PACIFIC GAS AND ELECTRIC COMPANY

2021 WILDFIRE MITIGATION PLAN REPORT

RULEMAKING 18-10-007

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PACIFIC GAS AND ELECTRIC COMPANY
2021 WILD FIRE MITIGATION PLAN REPORT

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PACIFIC GAS AND ELECTRIC COMPANY

2021 WILDFIRE MITIGATION PLAN

EXECUTIVE SUMMARY

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PACIFIC GAS AND ELECTRIC COMPANY
2021 WILDFIRE MITIGATION PLAN
EXECUTIVE SUMMARY

A. Introduction

Pacific Gas and Electric Company's (PG&E) 2021 Wildfire Mitigation Plan (WMP) continues many of the actions undertaken in our 2019 and 2020 WMPs, but also reflects an evolution to a more precise, technology-based approach to measure and mitigate wildfire risk, lessons learned implementing the 2020 WMP, and feedback received from the Wildfire Safety Division (WSD), PG&E's Federal Monitor, and many others as to areas that we can improve and gaps we should address. As the devastating 2020 fire season demonstrated, California's climate-driven wildfire risks are increasing annually, and only focused and sustained mitigation efforts will be effective at reducing the threat and impact of wildfires facing all Californians.

Our updated risk-modeling for the 2021 WMP benefits from both historical data (weather patterns, detailed information on previous ignitions, outages and other risk events, etc.) as well as state-of-the-art tools such as fire-spread technology that shows the locations where specific infrastructure failures can lead to ignitions that have the highest consequences for our communities. Leveraging this updated risk model and increased governance and oversight, going forward at least 80 percent of work performed in our key wildfire mitigation workstreams, System Hardening and Enhanced Vegetation Management (EVM), will be focused on assets in the top 20 percent of the highest risk circuit segments or in fire rebuild areas.

In addition, PG&E's 2021 WMP builds upon the successes and lessons learned in 2020, as well as the feedback we have received from the WSD and other stakeholders. Similar to previous WMPs, PG&E's 2021 WMP has three overarching goals: (1) reducing wildfire ignition risk, (2) enhancing wildfire risk situational awareness, and (3) reducing the impact of PSPS events. In 2020, we acknowledged shortcomings and gaps in several programs where improvement is needed, including risk targeting and quality management of vegetation management work and the prioritization and execution timing of system inspections. These gaps were often identified as a result of feedback and input from the WSD and the Federal Monitor. We have listened carefully to this feedback and focused on addressing these gaps in 2021. The 2021 WMP articulates how we are closing those gaps and applying those learnings to other wildfire risk mitigation activities.

In the remainder of this Executive Summary, we provide:

- Section B: An overview of PG&E's system and wildfire threats;
- Section C: A summary of outcomes from the 2020 WMP;
- Section D: An overview of risk modeling and prioritization tools;
- Section E: Identification of gaps and lessons learned in 2020;

- Section F: A table and summaries of PG&E's wildfire risk mitigation activities;
- Section G: A discussion of new technology and future improvements; and
- Section H: Conclusion.

B. PG&E's System and Wildfire Threat

Over half of PG&E's service territory lies in the High Fire Threat Districts (HFTD) Tiers 2 and 3 as identified by the California Public Utilities Commission (CPUC or Commission) in 2018.[1] The wildfire threat in these areas has increased significantly over the past decade. For example, the U.S. Forest Service estimates that 147 million trees died in California from drought and invasive beetles from 2010-2018, which is just one of the factors that has contributed to the significant increasing in the size of the HFTDs within PG&E's service territory. Unfortunately, 2020 was another unprecedented wildfire season with five of the six largest wildfires in California's history occurring in 2020, all in PG&E's service territory, including the first fire to ever impact over 1 million acres.[2] The unprecedented weather patterns, including late-summer dry lightning storms, that drove the 2020 wildfire season and continue to present significant wildfire risk and the need for PSPS events into January 2021 further indicate the unpredictable, dynamic, and growing nature of the wildfire risk we all face.

Approximately 5,500 line-miles of electric transmission and 25,500 line-miles of distribution assets lie within these HFTDs, roughly one-third of PG&E's total overhead assets. Many of these are long lines that serve low-density, non-urban customers and communities located within the "wildland-urban interface," who face an increased fire risk. Approximately 10 percent of PG&E's electric customers[3] reside within HFTD areas, and with population migration brought on by COVID-19 and other causes, the number of customers living in wildland-urban interfaces or HFTD areas may increase in coming years.

C. 2020 WMP Outcomes

To reduce wildfire risk in our service territory, PG&E successfully implemented our 2020 WMP and substantially completed, and in some cases exceeded, the 38 commitments made in that plan. Some of the 2020 WMP accomplishments in our largest wildfire-related programs include:

- System Hardening – Crews hardened 342 miles in HFTD areas, exceeding the 2020 WMP target of 221 miles;

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1 Available at www.cpuc.ca.gov/firethreatmaps.

2 Data from CAL FIRE as of 11/3/20: https://www.fire.ca.gov/media/4jandlhh/top20_acres.pdf

3 With a "customer" defined as an electric meter or service point, each of which generally represents at least one household or business.

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- EVM – Crews completed 1,878 miles in 2020, exceeding the target of 1,800 miles, including completing two-thirds of the work in the first half of 2020, before peak wildfire season;

- Smaller Public Safety Power Shutoff (PSPS) events – We took multiple actions that together made 2020 PSPS events 55 percent smaller than they would have been in 2019, which avoided a PSPS event for over 800,000 customers;

- Shorter PSPS events – Crews restored power more than 40 percent faster in 2020 after severe weather passed, as compared to 2019. On average in 2020, post-PSPS inspections were completed and power was restored for customers 10 hours after the weather cleared, as compared to 17 hours in 2019; and,

- Smarter PSPS events – Despite the challenges created by the COVID-19 pandemic, PG&E enhanced our partnership with communities and customers with better information before, during and after PSPS events. Due to various efforts, including adding staff to partner closely with Counties and Tribes and improving communication and data-sharing tools, the overwhelming feedback from Counties and Tribes was that their experience with 2020 PSPS events was improved. Similarly, our tools and resources provided to customers were substantially improved, especially for those customers who depend on power for medical or independent living needs, and Access and Functional Needs customers. We know that the hardship to customers impacted by PSPS is significant and there is still much room for improvement. But customers are seeing our progress. In a recent survey of over 1,000 business and residential customers impacted by PSPS events in 2020, 60% of the respondents said PG&E's handling of PSPS in 2020 was improved over 2019 (and only 10% expressing that it was worse).[4]

Beyond the largest wildfire-related programs, PG&E's 2020 WMP efforts delivered on nearly all of our commitments. Details of the 38 commitments from the 2020 WMP and performance are provided in Section 7.2.B of the 2021 WMP. We also identified gaps in 2020 that we are closing to improve our wildfire risk mitigation activities, as discussed in Section E below.

D. Updated Risk Models That Improve Quantification and Prioritization Tools

In PG&E's prior WMP submissions, we relied on the initial wildfire risk model developed in 2018 to prioritize circuit level where the highest wildfire risk existed, leveraging a relative risk ranking. In 2020, PG&E substantially upgraded this risk quantification toolset. All risk quantification is based on two components: risk event likelihood (*i.e.*, probability) and risk event consequence. For the 2021 Wildfire Distribution Risk Model, which was developed in 2020, PG&E upgraded both parts of that calculation. The risk event likelihood analysis has been advanced into a

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4 The remaining responses were 24% responding "about the same" and 6% being "unsure."

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more comprehensive assessment for two of the most significant utility-caused ignition drivers: vegetation contact and conductor failure. For the risk event consequence component of the model, PG&E now uses outputs from a Technosylva fire simulation model, which derives fire propagation and consequence outcomes based on available fuels, topography, and weather; as well as buildings and population locational data. The 2021 Wildfire Distribution Risk Model is being used to target and prioritize work in several of PG&E's largest wildfire risk mitigation programs including EVM, System Hardening, and Asset Inspections.

To ensure alignment, governance, accountability, and support of the implementation of PG&E's updated wildfire risk model, a new governance committee, the Wildfire Risk Governance Steering Committee or (WRGSC), was established in late 2020. This committee is chaired by PG&E's Chief Risk Officer and incorporates leaders from Electric Operations, Risk and Internal Audit, and other teams. Representatives from PG&E's Federal Monitor as well as the Operational Observers from the governor's office also participate these meetings. The WRGSC reviews and approves the workplans for the most critical wildfire risk mitigation programs to ensure they are in alignment with the new risk model and monitors regular reporting of work completed and quality results so that we are accountable and effective in reducing the most risk through these workstreams.

The updated 2021 Wildfire Distribution Risk Model has produced more comprehensive, updated results in terms of which assets and locations in our system are most appropriate to target for programs like System Hardening. As a result, we have shifted our project execution, in alignment with the risk model outcomes, so that some previously identified projects may no longer be executed and newly identified projects are being aggressively pursued to reduce risk as quickly as feasible.

PG&E has also expanded our programmatic- and portfolio-level risk assessments through the calculation of a Risk Spend Efficiency (RSE) for an increased number of programs and wildfire risk mitigation activities. In the 2021 WMP, PG&E has provided RSEs for more than 10 times as many initiatives as we were able to in the 2020 WMP. PG&E and other parties continue to refine these portfolio-level and programmatic risk assessments through PG&E's 2020 Risk Assessment Mitigation Phase (RAMP) Report and other risk-focused proceedings before the CPUC.

E. Gaps Identified, Lessons Learned and Actions to Resolve

1. Risk Prioritization of EVM Work

In 2020, PG&E and external parties including the Federal Monitor and the Governor's Operational Observers identified as a gap that the execution of EVM work was not aligned with our risk prioritization model. In some cases, and for several reasons including the longer cycle time associated with completing the more densely vegetated sections of our system, lower priority circuit segments were being completed before higher priority circuit segments. Parties recognized this was not intentional, but rather reflected gaps in our processes.

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For 2021, PG&E is resolving this gap through increased control and validation of the workplan. First, we have implemented the updated risk model described above and are targeting the highest risk circuit segments. Second, we have increased the controls around the actual circuit segments that will be completed. The newly formed WRGSC is responsible for approving the selection of EVM work locations using the new risk model that prioritizes high risk circuits/segments and monitoring regular reporting of work completed. Third, we have aligned our incentives on this work so that achieving target performance will require that 80 percent of the work completed over the next three years be performed on circuit segments that are among the top 20 percent highest risk. These same principles are being applied to the System Hardening program where the updated risk model is also being used to target the highest risk circuit segments and same incentive metric structure is being used. Through the improved risk prioritization, program controls, and metric updates, our investments will be maximized to reduce wildfire risk.

2. Quality of Vegetation Management Activities

The leading causes of CPUC reportable ignitions in HFTD areas are vegetation coming into contact with powerlines and equipment failure. Managing vegetation in proximity to powerlines is therefore one of the most important wildfire risk mitigation activities, but also one of the most challenging given the dynamic nature and volume of trees in PG&E's service territory. Our 2021 WMP builds in new actions to further improve the quality and consistency of our vegetation management work. For 2021, PG&E anticipates more than tripling our work verification workforce by adding more than 200 quality inspectors to increase our ability to verify that vegetation management was completed to meet or exceed state and federal standards. We will also be performing work verification (post-tree work inspections) on work performed in HFTDs, both for EVM and routine vegetation management programs. PG&E will be deploying ground-based LiDAR technology to capture objective snapshots of the condition of vegetation throughout HFTDs to further validate work completion and time-stamped conditions across our system. Finally, PG&E will be staffing a centralized team of arborists to investigate any concerns or findings raised by internal or external parties to ensure timely follow-up, appropriate resolution and adequate closure of any issues identified.

3. Prioritizing the scheduling and execution of system inspections in HFTD areas

The system inspection program is a critical aspect of PG&E's wildfire risk mitigation activities as it identifies potential issues on PG&E assets in HFTDs before they have a chance to fail. In 2020, however, PG&E did not properly manage and prioritize the execution of system inspections in the highest risk areas. In some cases, assets outside of HFTDs were inspected before higher wildfire risk assets had been completed.

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In 2021, PG&E is resolving this issue by applying the same updated risk model mentioned for EVM and system hardening to prioritize the system inspections workplan. We are committed to completing all planned inspections in HFTD areas before the late summer peak of wildfire season[5] and the WRGSC is also directing the establishment and execution of the system inspections workplan. Increased program oversight, focus on aligning to the risk prioritization, and earlier completion of inspections in HFTD areas will improve PG&E's system inspections in 2021.

The most severe equipment problems found through inspections are immediately repaired or made safe. Less severe problems are addressed within a risk-informed timeframe based on the severity of the identified issue and the potential consequences associated with a failure of that asset at that location.

4. Addressing WSD-Identified Action Items and Quality Performance

In response to our 2020 WMP, WSD identified a number of deficiencies that we addressed in a Remedial Compliance Plan submitted in July and in Quarterly Reports which we started submitting in September. Recently, after evaluating our Remedial Compliance Plan and First Quarterly Report, WSD identified a total of 123 Action Items for follow-up. This additional feedback has been helpful in shaping our 2021 WMP. The 2021 WMP addresses 38 of the 39 Actions Items that WSD identified after reviewing our Remedial Compliance Plan.[6] Our 2021 WMP also responds to the majority of the 84 Actions Items identified by WSD that related to the First Quarterly Report. Details on these Actions Items and where they are addressed in PG&E's 2021 WMP are provided in Section 4.6.

In addition to responding to the Action Items, in 2021 PG&E will continue to provide WSD with status updates on our WMP activities through both formal reports and informal engagement. Our status reporting to the WSD will include quality performance results for key initiatives as additional data and insight on the mitigation activities and initiatives being undertaken by PG&E.

F. Wildfire Risk Mitigation Activities

Table PG&E-ExecutiveSummary-1 below summarizes the progress on the major wildfire mitigation activities undertaken in 2020, and our targets for 2021. As noted in the introduction, PG&E's 2021 WMP is focused on three overarching goals: (1) reducing wildfire ignition risk; (2) enhancing wildfire risk situational awareness; and (3) reducing the impact of PSPS events for our customers and communities.

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5 Before July 31, with the exception of locations where an inspection was attempted but access restrictions, customer refusals, or other external factors prevented initial completion of the inspection (Can't Get In (CGI) locations).

6 The final Action from the Remedial Corrective Plan (Action PGE-35 (Class A)) is being completed in partnership with SCE and SDG&E and will be submitted by February 26th, after approval of WSD staff.

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Following Table PG&E-ExecutiveSummary-1, we address each of these three goals and provide an overview and context for the key initiatives that we are implementing to achieve them. PG&E's 2021 activities and initiatives are further described in more depth throughout the 2021 WMP, particularly in Section 7.

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TABLE PG&E-EXECUTIVESUMMARY-1
SUMMARY OF 2020 AND 2021 WILDFIRE MITIGATION ACTIVITIES

	PROGRAM	2020 PROGRESS*	2021 TARGETS*	2021 WMP SECTION REFERENCE
Reduce Wildfire Ignition Potential	Enhanced Veg Mgmt. (EVM)	1,878 line miles	1,800 high risk line miles	7.3.5
	Asset Inspections	Transmission – 100% of Tier 3 & Zone 1 and ~33% of Tier 2 structures	Transmission – 100% of Tier 3 & Zone 1 and ~33% of Tier 2 structures, plus additional higher risk structures by July 31[(a)]	7.3.4.2
		Distribution – 100% of Tier 3 & Zone 1 and ~33% of Tier 2	Distribution – 100% of Tier 3 & Zone 1 and ~33% of Tier 2, plus high consequence Tier 2 structures by July 31 [(a)]	7.3.4.1
		Substations – 100% of Tier 3 & Zone 1 and ~33% of Tier 2	Substations – 100% of Tier 3 & Zone 1 and ~33% of Tier 2 by July 31	7.3.4.15
	Miles Hardened	342 line miles	180 high risk miles	7.3.3.17
	Butte County Undergrounding	30 line miles	23 line miles	7.3.3.17
	Asset Replacement	643 non-exempt fuses replaced	1,200 non-exempt fuse replacements	7.3.3.7
	PSPS	Reduced catastrophic wildfire risk through 6 PSPS outages that were over 50% smaller and 40% shorter after the weather cleared than they would have been in 2019	Reduce catastrophic wildfire risk during severe weather conditions, including revising PSPS criteria to incorporate known risks, while continuing to take actions to reduce the impact of PSPS events on customers	8
Situational Awareness	Weather Stations	404 weather stations	300 weather stations to complete long-term goal of 1,300 total	7.3.2.1.3
	High-Def Cameras	216 high-def cameras	135 high-def cameras, in alignment with long-term goal of 600 total (90% visual coverage of HFTD areas) by the end of 2022	7.3.2.1.4

a) This timeline for the completion of asset inspections in HFTD areas excludes Can't Get In (CGI) locations where external factors including environmental restrictions, inability to access, or other issues prevent the scheduled inspection, which may then extend beyond July 31st.

* All data are for activities and assets within California Public Utilities Commission (CPUC or Commission)-designated HFTDs unless otherwise indicated; 2020 actual results and 2021 targets as of February 5, 2021.

TABLE PG&E-EXECUTIVE SUMMARY-1
SUMMARY OF 2020 AND 2021 WILDFIRE MITIGATION ACTIVITIES
(CONTINUED)

	PROGRAM	2020 PROGRESS*	2021 TARGETS*	2021 WMP SECTION REFERENCE
Reduce Impact of PSPS Events	Distribution Sectionalization	603 devices	250 devices	7.3.3.8.1
	Transmission Line Switching	54 switches	29 switches	7.3.3.8.2
	Distributed Generation and Microgrids	6 temporary microgrids (3 via pre-installed interconnection hubs) and 62 substations operationally ready to leverage temporary generation during PSPS events	Deploy 5 additional microgrids with pre-installed interconnection hubs and have Temporary Generation on standby to reduce impacts of PSPS events in 2021	7.3.3.11.1
	Community Resource Centers (CRC)	Had over 300 sites prepared to open as a CRC if called upon; activated 245 CRCs supporting ~50,000 customers	Partner with counties and tribes to improve targeting of CRCs and remain flexible to various regulations and conditions related to COVID	8.2.1
	Communication and Outreach	Shifted customer outreach to virtual in response to COVID, engaged with over 5,500 attendees to virtual open houses; partnered with over 250 Community Based Organizations (CBO) to support and communicate with customers	Deploy customer outreach, engagement and measures, including with in-language resources and further engagement with CBOs	7.3.9.2, 7.3.10.1, 8.4
	Community Partnership	Increased pre-season planning, pre-event communications and staffed up single points of contacts to keep communities prepared, engaged and informed for PSPS events	Grow partnerships with community organizations to further preparedness and execution of PSPS events	8.4

* All data are for activities and assets within CPUC-designated HFTDs unless otherwise indicated; 2020 actual results and 2021 targets as of February 5, 2021.

1. Reduce Wildfire Ignition Potential

Reducing the risk of catastrophic fires begins with understanding the causes of utility-related fire ignitions in PG&E's service territory. Over the past four years, approximately 35 percent of reportable ignitions in PG&E's HFTD areas have been caused by vegetation contact with electrical equipment and another 33 percent were caused by utility equipment failures; the remaining ignitions were caused by third-party actions, animals, and other causes. Historically, PG&E followed regulatory requirements and standard industry practices for Vegetation Management (VM) and equipment inspections and maintenance. However, the increased number of dead trees, drought, hotter temperatures and higher winds due to climate change have radically increased the risk of a significant wildfire in the event of an ignition. Therefore, as described below, PG&E is now going beyond existing compliance requirements to address the wildfire risk conditions that now face our service territory and the state at large.

a. Enhanced VM

Vegetation located in proximity to powerlines can cause a fire by contacting energized equipment. PG&E's routine VM program inspects all of our approximately 100,000 miles of overhead electric facilities at least annually[7] to identify and clear vegetation that might grow or fall into utility equipment to reduce the risk of contact and ignition. In addition to routine VM practices, PG&E's EVM Program inspected and further trimmed or removed vegetation on over 4,300 line-miles (~17 percent) of distribution lines within HFTDs between 2019 and 2020. In 2021, informed by updated risk modeling, we will deploy EVM on another 1,800 miles of distribution lines as part of our ongoing and multi-year effort to reduce the risk of vegetation contact incidents involving our electric distribution lines in HFTD areas.

b. Asset Inspection and Repair

In late 2018 and 2019, PG&E inspected all equipment within the HFTDs in our service territory to identify any structures or equipment that were damaged, degraded or could fail and potentially cause a fire. Beginning in 2020, PG&E began re-inspecting assets (transmission, substation and distribution) in HFTDs based on a risk-informed cycle with Tier 3 assets continuing to be inspected annually and Tier 2 assets inspected on a three-year cycle (i.e., 1/3 each year). That cycle will be continued in 2021 with some additional inspections being performed based on our updated risk modelling, for example in non-HFTD areas where risk modeling indicates elevated wildfire risk. Future year

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7 PG&E's planned routine inspection timeframe for all assets is November 15 of the prior year through November 15 of the current year (i.e. 11/15/20-11/15/21 for the 2021 plan year). However, delays including inaccessible facilities, sensitive environments or other limitations may delay some inspections for the current plan year by a few weeks, but still completing by the end of the calendar year (i.e. 12/31/21).

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inspection cycles may be further adjusted to align with updates in our understanding of the risks associated with local wildfire risk conditions, changing weather patterns, repairs, replacements, and information gathered via inspections. In 2021, PG&E is also adjusting our workplan to complete all inspections in HFTD areas before July 31[8] to identify and repair the most severe asset conditions that could contribute to a wildfire ignition before (9/1) the peak wildfire risk season.

c. System Hardening

System hardening entails replacing or eliminating existing distribution lines in HFTD areas and installing stronger and more resilient equipment. Hardening methods include replacing bare overhead conductor with covered conductor and installing stronger poles or converting the line from overhead to underground. Some lines can be eliminated entirely if customers or a community can be supplied through some other means, including permanent remote grids.

For 2021, PG&E is leveraging our updated wildfire risk model to target hardening 180 line miles through this resource intensive work in the highest risk locations. The outputs from the updated 2021 Wildfire Distribution Risk Model are materially different from the previous risk rankings, resulting in the pausing of some previously-planned projects, on circuit segments no longer assessed to be high risk, and the launching of new projects on circuit segments now identified as some of the highest risk. Because the standard cycle time (including scoping, design, permitting, and construction) for a system hardening project exceeds 12 months, pursuing only the projects in the highest risk reduction tranche results in the 2021 target miles of system hardening work being less than the mileage executed in 2020. Despite hardening fewer miles in 2021, we will be reducing more risk than if we had executed upon the prior 2021 workplan developed using the 2018 Wildfire Risk Model.[9] We will also be rebuilding our pipeline of projects identified, vetted, designed and permitted for future construction such that the pace of system hardening will increase substantially in 2022 to over 450 miles per year. Even with the shift in the risk model PG&E anticipates generally aligning with previously outlined system hardening goals for the three-year WMP timeframe (2020-2022). In the 2020 General Rate Case (GRC), PG&E targeted 1,021 miles of system hardening for this period and our updated plan forecasts completing 992 miles, within 3% of the original, GRC plan.

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8 This timeline for the completion of asset inspections in HFTD areas excludes Can't Get In (CGI) locations where external factors including environmental restrictions, inability to access, or other issues prevent the scheduled inspection, which may then extend beyond July 31st.

9 See Section 7.3.3.17 for discussion of the risk value of the planned 2021 system hardening project portfolio as compared to the prior work scope.

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Maximizing risk spend efficiency is built into the process for executing every system hardening project going forward. This process leverages extensive field assessment and engineering analysis to determine the best method to reduce wildfire risk and consequence for each specific power line segment and its geography. Engineering and field teams develop and analyze possible hardening solutions (i.e. undergrounding, asset removal, relocation, overhead hardening) for a high-risk priority circuit segment and the possible solutions are analyzed for risk spend efficiency[10] to determine the most prudent risk mitigation approach. The recommended approach then reviewed and approved by PG&E's WRGSC before we begin designing, permitting and constructing the approved hardening project.

In addition to the wholesale hardening of the highest priority circuit segments, PG&E is also continuing to replace specific, individual assets on other circuit segments to reduce wildfire risk including replacing non-exempt fuses and surge arrestors with CAL FIRE approved "exempt" equipment that is less likely to create a spark during operations. Additionally, PG&E will be integrating our approach to the replacement of these assets into a comprehensive Fire Risk Component Replacement program that leverages our most up to date wildfire risk model to identify and prioritize the individual asset replacements.

d. Public Safety Power Shutoffs

Significant wildfires are most likely to occur during critical fire weather conditions consisting of high winds, low humidity, and where there is a high level of dry fuel. Most of these severe fire weather conditions result in the National Weather Service issuing a Red Flag warning, often in the late summer or fall, for areas in the heavily forested foothills or mountains of Northern California, where many distribution and transmission assets are located. As a wildfire risk mitigation activity, PSPS events are a critical last resort when weather conditions are severe. The hundreds of locations where PG&E assets were damaged or hazards were identified during post-PSPS inspections validate the value and need for this tool to be available. However, these PSPS events create extraordinary disruption to the lives and businesses of impacted customers. After learning a number of difficult lessons during the 2019 PSPS season, in 2020 PG&E focused on making PSPS event smaller, shorter and smarter for our customers. Those efforts were successful, with 2020 events being 55 percent smaller and over 40 percent shorter once the severe weather passed. Further, 60 percent of impacted customers recently surveyed indicated that PG&E's handling of PSPS events was improved in 2020 over 2019. PG&E continues to focus in 2021 and beyond on reducing the risk of

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10 The RSE for each solution is performed by evaluating the risk reduction of each hardening approach against the net present value of the lifetime costs of that approach – including assessing ongoing vegetation management and maintenance costs.

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catastrophic wildfires while further minimizing the negative impact of PSPS events on the customers we serve.

2. Enhanced Wildfire Situational Awareness

PG&E is continuing to invest in tools, equipment, resources and a skilled workforce to improve our understanding of upcoming and real-time weather and fire conditions, so we can act proactively to reduce fire ignitions and mitigate the potential spread of a fire if one were to start.

a. Situational Awareness Tools

PG&E is installing a variety of weather and fire monitoring devices across HFTD areas. These monitoring devices allow early warning of high fire risk conditions and real-time identification of emerging wildfires, which in turn enable faster action by first responders and more proactive system operations to avert fire ignition and spread. PG&E is nearing the completion of long-term goals for the deployment of weather stations (1,300 by the end of 2021) and HD cameras (600 by the end of 2022). Therefore, while we plan to install hundreds of weather stations and high-definition cameras in 2021, the pace of installations is slower than in 2020 as we close in on these long-term goals and optimize the remaining installation to maximize the value of these assets. PG&E's situational awareness tools in the HFTD areas include:

- Weather stations – PG&E has installed 1,000 to date, which we understand to be the largest utility owned weather station network in the world, and we plan to add another 300 in 2021, completing the goal of 1,300, and approximately 1 weather station for every 20 distribution circuit miles in HFTD, by the end of 2021;

- High-definition cameras – PG&E has installed a total of 333 through the end of 2020 and expects to have a total of 468 cameras installed by the end of 2021; this pace supports having 600 cameras by the end of 2022 which will provide the targeted, approximately 90% visual coverage of all the HFTD areas in PG&E's service territory;

- Enhanced abnormal condition or wire-down detection tools; and

- Satellite fire-detection monitoring of PG&E service territory.

b. Wildfire Safety Operations Center and Meteorology

PG&E has established highly qualified, 24/7 meteorology operations and a Wildfire Safety Operations Center (WSOC). These two entities work hand-in-hand to support day-to-day gas and electric system

operations broadly as well as support emergency responses and preparation activities. These organizations have the tools, technology and analytical capabilities to forecast wildfire threat conditions, identify and track actual fires, and support rapid fire response.

PG&E's WSOC, in particular, plays a key role in addressing the challenges of climate-driven extreme weather events, in support of customer and community safety. The WSOC serves as a coordination, facilitation and communications hub for wildfire activities, including using weather data to monitor fire threats. In the event of a potential fire threat or an actual fire, the WSOC coordinates PG&E's response efforts with the appropriate operational personnel and local first responders or safety officials. The WSOC partners with geographically distributed teams of Public Safety Specialists (PSS) who have extensive public safety experience and are responsible for working with local PG&E responders and local agencies to safely respond to emergencies. In addition, the WSOC works with the Safety and Infrastructure Protection Team (SIPT) to support risk assessment, prevention activities (like the application of fire retardant on PG&E assets that may be at risk of ongoing fires) and mitigation.

PG&E's meteorology department integrates weather data from numerous internal and external sources, including a thousand of PG&E's own weather stations located in HFTDs. Over the last few years, PG&E's meteorology team has compiled one of the largest high-resolution climatological datasets in the utility industry: a 30-year, hourly, 2- kilometer (km) spatial resolution dataset consisting of weather, dead and live fuel moistures and fire weather assessments, to improve identification of high-risk weather patterns. In 2020, PG&E upgraded our weather condition forecasting and fire risk analysis toolset from forecasting at a 3 km by 3 km (9 square km) resolution of PG&E's entire HFTD area to an even tighter resolution of 2 km by 2 km (4 square km). This more than doubled the geographical precision and allowed PG&E to better determine which specific areas and lines are at severe wildfire risk, and which lines at less risk can be excluded from consideration for a potential PSPS.

3. Reduce Impact of PSPS

Learning from 2019, PG&E worked to make PSPS events smaller, shorter and smarter for our customers and communities in 2020. Those efforts were largely successful as the six PSPS events in 2020 were, in aggregate, 55 percent smaller than a PSPS event would have been in 2019 had the same weather patterns occurred. PG&E also succeeded in making PSPS events shorter as we reduced the average time to restore power once the severe weather cleared by more than 40 percent. Finally, feedback from community partners validated that our improved outreach, engagement and tools resulted in better communicated and better coordinated PSPS events in 2020. Despite the challenges of the COVID-19 pandemic, nearly 50,000 customers safely visited PG&E's Community Resource Centers during PSPS

events, over 30,000 food replacement packages were provided through partnerships with local food banks and nearly 5,000 batteries were distributed to at-risk customers.

PG&E continues our work to make future PSPS events smaller in scope, shorter in duration and smarter in performance while safeguarding customers and communities from wildfire risk during times of severe weather. One of the key patterns identified during the 2020 PSPS season is the recurrence of weather patterns that drive the need to de-energize the same customers repeatedly. These "repeat impact" areas represent a challenge as these are often very high-risk areas (e.g. HFTD Tier 3) that due to topography and weather patterns are repeatedly exposed to high wind, and therefore high wildfire hazard, conditions. PG&E is closely analyzing these repeat impact areas to identify actions that can be taken to minimize impacts and better support customers in these areas.

PG&E is continuing to make every effort to make future PSPS events less impactful on the customers and communities we serve while continuing to safeguard them from catastrophic wildfire risk during times of severe weather. PG&E is reviewing what conditions warrant taking a PSPS, in alignment with external feedback. Specifically, we are assessing how to incorporate the presence of known, high-risk vegetation conditions adjacent to powerlines into PSPS decision making. This assessment may result in PG&E executing PSPS in 2021 for powerlines where high priority vegetation tags[11] have been identified, including on lines that may not have met the 2020 PSPS event criteria. Following that activity over the next few months, PG&E will analyze the likely impact of that updated criteria in making PSPS events larger and compare that impact to the actions being taken to make PSPS events smaller. Given this ongoing analysis, we do not have specific 2021 PSPS targets, but are taking substantial actions to make PSPS events in 2021 smaller, shorter, and smarter.

At the time of this filing, there is significant outstanding uncertainty about the scope of PSPS in 2021 as a result of recent proposed conditions under consideration as it pertains to how we implement the PSPS program. This uncertainty impacts PG&E's ability to set specific targets around reducing the size and length of PSPS events in 2021. Notwithstanding this uncertainty and potential scope increase, PG&E's intent – as outlined throughout the PSPS portions of this 2021 WMP – is to reduce the impact of PSPS on our customers and communities wherever possible consistent with overall public safety. Throughout this document there are references to ongoing initiatives to make PSPS smaller and shorter and that work and intent will continue unabated. However, the ability to achieve overall reductions in PSPS size and duration across the 2021 fire season is uncertain at this time for the reasons outlined above, and should not be confused with the intent of or language

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11 PG&E has identified "high priority vegetation tags" as "Priority 1" and "Priority 2" tags where trained vegetation inspectors identify trees or limbs that currently present elevated risk and must be worked on an expedited basis (at least within 30 days).

describing these various initiatives to lessen the impact on customers by striving to make events "smaller" or "shorter."

a. Smaller: Reducing the Number of PSPS-Affected Customers

PG&E will use several methods to further reduce the number of customers impacted by PSPS events in 2021 and beyond. First, further investment in additional sectionalization devices will enable us to more precisely operate and control the grid to limit the size of the sections of our system that must be taken out of service in a PSPS event. In addition, PG&E will leverage distributed, temporary generation, in combination with switching and sectionalizing, to isolate and keep in service communities and critical facilities when the rest of the local area is shut down by a PSPS. In 2020, PG&E deployed hundreds of megawatts of temporary generation to support PSPS events, a scale not previously attempted. We learned a number of lessons from that and heard feedback from many parties, including the widespread interest in diversifying the power source for these temporary generators beyond diesel-powered, that we will be acting on in 2021 by seeking other generation sources.

b. Shorter: Reducing PSPS Duration

In addition to better situational awareness, PG&E has upgraded our operational resources to more quickly restore power after the severe weather has passed. In 2020, PG&E deployed more helicopters, which provide the fastest tool for inspecting and re-energizing powerlines, and fixed-wing aircraft equipped with cameras and infrared equipment that allowed us to inspect some assets at night. Through the deployment of these tools and operational improvements we reduced the restoration time after the weather cleared by more than 40 percent from an average of ~17 hours in 2019 to ~10 hours in 2020. These tools will continue to be deployed in 2021 alongside further operational improvements based on lessons learned in 2020, including the ability to better align inspection resources with likely upcoming all-clear weather declarations to speed the start of re-energization patrols and developing location-specific restoration strategies to reduce outage duration for repeat-impact customers who, due to topography or circuit length, consistently experience the longest restoration times. Even with improvements to restoration tools and processes, event size is a major driver of the time it takes to complete restoration. If changes to PSPS decision making criteria, such as inclusion of high-risk vegetation conditions, results in expanded events then restoration time would be impacted. PG&E will work to meet the CPUC requirement of all customers restored within 24 hours of the weather clearing; however, we do not have a specific target for an expected reduction in PSPS event duration in 2021. We are also working to reduce outage duration for customers who have consistently experienced the longest duration outages after "weather all clear" conditions.

c. Smarter: Better Community and Customer Awareness, Coordination and Support

In 2020, PG&E hired additional staff, implemented new tools, and broadly increased our communications and coordination with communities and customers in advance of and during PSPS events. We also expanded partnerships with over 200 CBOs with whom we collaborate to reach and engage with customers in multiple ways, including through in-language or local, community-level resources. PG&E will continue to build on these partnerships, grow our network of local resources and enhance our data tools to further improve the support we provide our customers and communities. Our efforts to make PSPS event smarter in 2021 will be guided by: outreach grounded in customer and stakeholder feedback, research and data; continued data collection for customer contacts and preferences (*e.g.*, language); refining communications for clarity and accessibility; continuing to develop partnerships; and monitoring and adjusting for the ongoing COVID-19 pandemic.

G. New Technology Deployments and Future Improvements

New technologies may meaningfully change the risk profile of operating our electric transmission and distribution systems in the high fire risk environments of Northern and Central California. Several system operations technologies that were initiated in 2020 are being further implemented and explored in 2021 and beyond. A selection of these technologies, which are discussed in more detail in Section 7 of the 2021 WMP, include:

- Rapid Earth Fault Current Limiter – technology that has the ability to automatically and rapidly reduce the flow of current and risk of ignition in single phase to ground faults.

- Distribution, Transmission, and Substation: Fire Action Schemes and Technology) – an internally developed PG&E technology pilot that aims to use fraction-of-a-second technologies to detect objects approaching energized power lines and respond quickly to shut off power before object impact.

- Continuous monitoring sensors – measure current in real-time and report events as they occur. These line sensors are next-generation fault indicators with additional functionality and communication capabilities.

- Data Management and Maturity – PG&E is working to operationalize a data analytics environment that integrates asset-related information from disparate data sources into a single environment, which can enable improved, data-driven approaches to wildfire risk mitigation.

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H. Conclusion

PG&E continues to grow and learn about wildfire risk itself, initiate actions that can best reduce that risk, and optimally targeting those actions. Although PG&E does not have a complete roadmap of all the actions and deliverables to reduce wildfire risk that will occur over the next 5 to 10 years; we have seen our wildfire risk mitigation approaches improve significantly in just the last two-plus years since the WMP process was launched. We are optimistic that improvements will continue as PG&E, our state, nation, communities, technology providers and others learn, adapt, develop and invent refinements, new tools and novel approaches. Going forward, as we learn of other improvement opportunities, we will similarly move rapidly to incorporate those learnings and optimize our efforts to reduce wildfire risk. There is much more work to do and we are committed taking those steps to significantly reduce wildfire risk and prevent catastrophic wildfires associated with utility equipment.

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SECTION 1

PERSONS RESPONSIBLE FOR EXECUTING THE WMP

1. Persons Responsible for Executing the Wildfire Mitigation Plan

Provide an accounting of the responsibilities of the responsible person(s) executing the plan, including:

1. *Executive level with overall responsibility*

2. *Program owners specific to each component of the plan*

Title, credentials and components of responsible must be released publicly, but other contact information may be provided in a redacted file attached to the WMP submission.

The following individuals have responsibilities for oversight, governance and execution of Pacific Gas and Electric Company's (PG&E) 2021 WMP. While hundreds of leaders, and thousands of employees and contractors, contribute to the WMP activities or have "ownership" or accountability for individual initiatives or other small portions of the WMP, we have identified below the centralized leaders who have general responsibility for the referenced sections of the 2021 WMP.

Executive-level owner with overall responsibility

Debbie Powell, Interim Head, Electric Operations

- E-mail: [redacted]
- Telephone number: [redacted]

Program Owners for Each Component of Plan:

TABLE PG&E-1-1: PROGRAM OWNERS FOR EACH COMPONENT OF PLAN

Section	Name	Title	[redacted]	Component
Section 1: Persons responsible for executing the plan	Debbie Powell	Interim Head, Electric Operations (EO)		General oversight and management of WMP Activities
Section 2: Adherence to statutory requirements	Matt Pender	Director, EO Regulatory Strategy & Community Wildfire Safety Program		
Section 3: Actuals and planned spending	Matt Pender	Director, EO Regulatory Strategy & Community Wildfire Safety Program		
Section 4: Lessons	Matt Pender	Director, EO Regulatory Strategy &		4.1 Lessons Learned; 4.6 – Past Deficiencies

Section	Name	Title	[redacted]	Component
learned and risk trends		Community Wildfire Safety Program		
	Paul McGregor	Director, EO Risk Management and Analytics		4.2, 4.3, 4.5 – Risk Understanding and Modeling
	Jadwindar Singh	Director, EO Asset Knowledge Management		4.4 – Research
Section 5: Inputs to the plan and directional vision	Matt Pender	Director, EO Regulatory Strategy & Community Wildfire Safety Program		Note: Operational teams support section 5.4 on skilled resource details
Section 6: Metrics and underlying data	Matt Pender	Director, EO Regulatory Strategy & Community Wildfire Safety Program		Note: Various specific teams support data collection
Section 7: Mitigation initiatives	Matt Pender	Director, EO Regulatory Strategy & Community Wildfire Safety Program		7.1.A-C; 7.2.A, B & D; 7.3.a and 7.3.b 7.3.10 - Stakeholder cooperation and community engagement
	Jadwindar Singh	Director, EO Asset Knowledge Management		7.1.D – New Technologies; 7.3. 7 - Data governance
	Mary Hvistendahl	Director, System Inspections		7.2.C ; 7.3. 4 - Asset management and inspections
	Paul McGregor	Director, EO Risk Management and Analytics		7.3. 1 - Risk assessment and mapping
	Rod Robinson	Sr. Director, Emergency Prep & Response		7.3.2 - Situational awareness and forecasting 7.3.6 - Grid operations and protocols 7.3.9 - Emergency planning and preparedness

Section	Name	Title	[redacted]	Component
	Mark Esguerra	Sr. Director, EO Asset Strategy		7.3.3 - Grid design and system hardening 7.3.2.8 – Resource allocation methodology
	Michael Ritter	Sr Director, Vegetation Management Ops		7.3.5 - Vegetation management and inspections
Section 8: Public Safety Power Shutoff	Mark Esguerra	Sr. Director, EO Asset Strategy		8.1 - Directional Vision for PSPS
	Roderick Robinson	Sr. Director, Emergency Prep & Response		8.2, 8.3 & 8.5
	David Schoenberg	Director, Customer Experience		8.4 Engaging Vulnerable Communities
Section 9: Appendix	Matt Pender	Director, EO Regulatory Strategy & Community Wildfire Safety Program		

1.1 Verification

Verification

Complete the following verification for the WMP submission:

(See Rule 1.11)

(Where Applicant is a Corporation)

I am an officer of the applicant corporation herein, and am authorized to make this verification on its behalf. The statements in the foregoing document are true of my own knowledge, except as to matters which are therein stated on information or belief, and as to those matters I believe them to be true.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on 2/4/2021 (Date) at Alamo (Name of city), California.

Debbie Powell, Interim Head, Electric Operations

1.2 Initial Explanatory Notes and Comments

In this section, PG&E provides some initial explanatory notes and comments that will assist readers when reviewing the 2021 WMP.

(a) Consistency with 2021 Wildfire Mitigation Plan Guidelines Template

On November 30, 2020, the California Public Utilities Commission (Commission) issued Resolution (Res.) WSD-011, Attachment 2.2 which was the 2021 Wildfire Mitigation Plan Guidelines Template (Guidelines). The Guidelines provided an outline for the 2021 WMP and tables for the utilities to complete as part of their submission. On January 21, 2021, WSD provided updates to the Guidelines and on January 25, 2021, WSD provide further updates to the Guidelines.

PG&E has attempted to the best of our ability to provide the information requested by the Commission and WSD in the time allotted and in the manner requested in the updated Guidelines. Due to the relatively condensed period between the issuances of Res.WSD-011 and the submission of the 2021 WMP, there may be some areas where PG&E is unable to provide the requested data. Where data is unavailable, we have noted this in our 2021 WMP.

(b) Narrative Subparts

Some sections in the 2021 WMP are quite lengthy. In order to assist the reader, PG&E has added lettered subparts in these sections (e.g., (a), (b), etc.).

(c) Responses to Class A and Class B Deficiency Action Items

On December 30, 2020, the WSD provided an evaluation of PG&E's Remedial Compliance Plan (submitted on July 27, 2020) that included 39 Action Items related to Class A deficiencies in the 2020 WMP that are to be included in the 2021 WMP. On January 8, 2020, WSD provided an evaluation of PG&E's First Quarterly Report (submitted September 9, 2020) that included an additional 84 Action Items related to Class B deficiencies in the 2020 WMP that are to be included in either the 2021 WMP or in a subsequent submission on February 26, 2021.

For ease of reference in the 2021 WMP, PG&E refers to the Remedial Compliance Plan action items as Action PGE-1 (Class A), Action PGE-2 (Class A), etc. PG&E's responses to the First Quarterly Report action items are referred to as Action PGE-1 (Class B), Action PGE-2 (Class B), etc.

PG&E is responding to all of the Class A action items in the 2021 WMP. Consistent with WSD's direction, for Class B action items, PG&E is addressing as many as possible in the 2021 WMP but for those action items that could not be addressed by February 5, 2021, an additional set of responses will be provided on February 26, 2021.

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In Section 4.6, PG&E has included tables indicating where in the 2021 WMP each Action Item is addressed. PG&E generally tried to address Action Items in the relevant section of the 2021 WMP, but in some cases, where an Action Item was not directly related to other sections of the 2021 WMP, the response was included in Sections 4.6.1 and 4.6.2.

Finally, Action PGE-25 (Class B) requests that PG&E "integrate discussion of long-term planning within the respective section of each individual initiative." In response to this Action Item, PG&E has included with each of the initiatives in Section 7.3 a discussion at the end of each initiative addressing long-term plans. PG&E understands that "long-term plans" refers to a 3 to 10 year time horizon.

(d) Data from Third Parties

The Guidelines direct the utilities to work with federal, state, and local agencies, stakeholders, and partners to collect or compile information that the utility has not collected and could not ascertain. While PG&E was able to obtain supplemental information from other entities such as California Department of Forestry and Fire Protection, we were not able to reach out to or obtain data from third parties in all situations.

(e) Formatting and Additional Tables and Figures

To provide context to help understand the tables and narrative, PG&E has included the instructions from the Guidelines in *italics* at the beginning of each section and table in the 2021 WMP.

PG&E is also providing additional tables to explain various additional data or calculations that PG&E performed to complete tables required in the Guidelines. PG&E has included only the required tables, not the PG&E-specific tables, in the excel files that it is posting with the 2021 WMP. The additional PG&E-specific tables are identified in the following format in the narrative:

TABLE PG&E-SECTION#-TABLE#.

Similarly, where PG&E has provided figures to supplement the narrative, these PG&E-specific figures are identified in the same format:

FIGURE PG&E-SECTION#-FIGURE#.

For example, the first figure in Section 2 of the WMP would be FIGURE PG&E-2-1.

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(f) Definition of Terms and Glossaries

Generally, PG&E relies upon the Glossary provided in the Guidelines as a reference source for terminology used in the tables. PG&E has included the Glossary from the Guidelines in our 2021 WMP.

Some terms used in PG&E's 2021 WMP are not defined in the Guidelines. PG&E has included an additional PG&E-specific glossary for ease of reference regarding these terms. The PG&E-Specific Glossary is included in Section 9 of the 2021 WMP as an appendix.

(g) Model Glossary

There are a number of models referred to and discussed throughout the 2021 WMP. In order to assist the reader, PG&E is including a glossary of models listing the various models referred to in the 2021 WMP with a brief description of each. The Model Glossary is included in Section 9 of the 2021 WMP as an appendix.

(h) Initiative v. Program

The 2021 WMP uses the terms "initiative" and "program" interchangeably to describe specific efforts that PG&E is making to reduce wildfire risk. PG&E has used the initiatives defined by WSD in the 2021 WMP, but also at points refers to programs, which may be one or more initiatives.

(i) 2020 RAMP Report

Throughout the 2021 WMP, we reference the 2020 RAMP Report. This is the report that PG&E submitted on June 20, 2020 in Application (A.) 20-06-012.[12]

(j) Definition of Transmission and Distribution

PG&E defines transmission voltage as being 60 kilovolt (kV) or above and has used this delineation for many years. Distribution is, therefore, defined as below 60 kV. Therefore, any references in the 2021 WMP to transmission refers to voltages at 60kV or above. Note that in some of the WSD-provided tables or definitions transmission has been defined as 65kV or above. PG&E is unable to re-orient our data systems to use 65kV as the delineation between distribution and transmission.

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12 The 2020 RAMP Report and other materials related to the RAMP proceeding are available at: https://apps.cpuc.ca.gov/apex/f?p=401:56:0::NO:RP,57,RIR:P5_PROCEEDING_SELECT:A2006012.

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(k) Ignition Data

The fire ignition data provided in the 2021 WMP, particularly Tables 7.1 and 7.2, is based on fire incident reports filed with the CPUC annually in accordance with D.14-02-015. The ignition data provided in these tables was pulled from PG&E's systems in mid-January 2021 and reflects preliminary data for two reasons. First, PG&E's final 2020 fire ignition report is due on April 1, 2021 and 2020 data will be further reviewed in advance of that filing. Second, in late 2020 PG&E self-identified a data omission regarding prior year's fire ignition data in the annual reports submitted and notified the CPUC of this issue on December 23, 2020. PG&E's investigation identified a relatively small population of distribution vegetation outage ignitions since 2017 that were excluded on the annual report due to a misidentification in a field-based documentation system. We are continuing to investigate other potential sources of fire ignition data that were omitted from our reports. We anticipate completing the investigation into the 2014-2019 data by the end of the first quarter of 2021. Based on the results of our investigation, we plan to submit amendments to our annual reports and provide a supplemental filing updating the ignition data in Tables 7.1 & 7.2. We will be revising our ignition data capture processes going forward to ensure accurate reporting in alignment with the results of our investigation.

For reference, while the investigation is underway the initial findings have shown that the number of missing incidents for each year and an amended annual total are as follows:

- o 2019 = 4 Missing Incidents, 467 Amended Total
- o 2018 = 5 Missing Incidents, 439 Amended Total
- o 2017 = 28 Missing Incidents, 529 Amended Total

(l) SmartMeter™ References

SmartMeter™ is a trademarked name and so references to SmartMeter™ in the 2021 WMP that inadvertently do not include the ™ should be considered to include the ™ in the SmartMeter name.

(m) Attachments

Throughout the 2021 WMP there are references to attachments that are applicable to specific sections and provide additional materials. For ease of reference, we are including below a list of the attachments. In the text of the 2021 WMP, we refer to the attachment name and number. In the list below, we have also added the designation "CONF" which indicates whether an attachment is confidential or not. PG&E will provide on our website a public version of each attachment unless the attachment is confidential in its entirety, in which case the attachment will not be provided on our website:

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- 2021WMP_Section 7.3_Atch01
- 2021WMP_Section 8.2.1_Atch01
- 2021WMP_Section 8.2.4_Atch01_CONF
- 2021WMP_ClassA_Action-PGE-3_Atch01
- 2021WMP_ClassA_Action-PGE-8_Atch01
- 2021WMP_ClassA_Action-PGE-12_Atch01
- 2021WMP_ClassA_Action-PGE-15_Atch01
- 2021WMP_ClassA_Action-PGE-15_Atch02
- 2021WMP_ClassA_Action-PGE-23_Atch01
- 2021WMP_ClassA_Action-PGE-23_Atch02
- 2021WMP_ClassA_Action-PGE-23_Atch03
- 2021WMP_ClassA_Action-PGE-24_Atch01_CONF
- 2021WMP_ClassA_Action-PGE-24_Atch02_CONF
- 2021WMP_ClassA_Action-PGE-24_Atch03
- 2021WMP_ClassA_Action-PGE-38_Atch01_CONF
- 2021WMP_ClassB_Action-PGE-3_Atch01
- 2021WMP_ClassB_Action-PGE-15_Atch01
- 2021WMP_ClassB_Action-PGE-20_Atch01
- 2021WMP_ClassB_Action-PGE-22_Atch01
- 2021WMP_ClassB_Action-PGE-35_Atch01
- 2021WMP_ClassB_Action-PGE-35_Atch02
- 2021WMP_ClassB_Action-PGE-43_Atch01_CONF
- 2021WMP_ClassB_Action-PGE-43_Atch02_CONF
- 2021WMP_ClassB_Action-PGE-47_Atch01_CONF
- 2021WMP_ClassB_Action-PGE-55_Atch01
- 2021WMP_ClassB_Action-PGE-55_Atch02
- 2021WMP_ClassB_Action-PGE-55_Atch03
- 2021WMP_ClassB_Action-PGE-55_Atch04
- 2021WMP_ClassB_Action-PGE-55_Atch05
- 2021WMP_ClassB_Action-PGE-55_Atch06
- Attachment 1 – All Data Tables Required by 2021 WMP Guidelines

PACIFIC GAS & ELECTRIC COMPANY

SECTION 2

ADHERENCE TO STATUTORY REQUIREMENTS

PGE-DIXIE-NDCAL-000004416

2. Adherence to Statutory Requirements

Section 2 comprises a "check list" of the CPUC Code Sec. 8386 (c) requirements and subparts. Each utility shall both affirm that the WMP addresses each requirement AND cite the Section or Page Number where it is more fully described (whether in Executive Summary or other section of the WMP).

Illustrative Table 2-1 check-list:

Requirement	Description	WMP Section/Page
2	The objectives of the plan	Section 4.1 pg. 13
10	Protocols for the de-energization of the electrical corporation's transmission infrastructure, etc.	Section 5 overview, pg. 30-31

Mark the following table with the location of each requirement. If requirement is located in multiple areas, mention all WMP sections and pages, separated by semi-colon (e.g., Section 5, pg. 30-32; Section 7, pg. 43)

TABLE PG&E-2-1: 2021 WMP COMPLIANCE WITH STATUTORY REQUIREMENTS[13]

Requirement	Description	WMP Section/Page
1	An accounting of the responsibilities of persons responsible for executing the plan	Section 1
2	The objectives of the plan	Goals: Section 5.1 (Goals) Objectives: Section 5.2
3	A description of the preventive strategies and programs to be adopted by the electrical corporation to minimize the risk of its electrical lines and equipment causing catastrophic wildfires, including consideration of dynamic climate change risks	Risk Strategies: Sections 4.2-4.3, 4.5, 7.1.A Climate Change Risks: Sections 4.2-4.2.1, 6.7, 7.3.1.2 Wildfire Mitigation Programs and Initiatives: Section 7.3 PSPS Strategies: Sections 8.2.1 to 8.2.2

13 PG&E has consulted with the Wildfire Safety Division (WSD) and WSD agreed that for purposes of this table, references to the 2021 WMP sections was sufficient, rather than sections and page numbers.

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TABLE PG&E-2-1: 2021 WMP COMPLIANCE WITH STATUTORY REQUIREMENTS (CONTINUED)

Requirement	Description	WMP Section/Page
4	A description of the metrics the electrical corporation plans to use to evaluate the plan's performance and the assumptions that underlie the use of those metrics	Model and metric calculations: Section 4.5.2; Performance Metrics: Sections 6.1 to 6.4; PSPS Metrics: Section 8.5
5	A discussion of how the application of previously identified metrics to previous plan performances has informed the plan	Section 4.1; Section 6.1-6.4; Section 8.5 (PSPS metrics)
6	Protocols for disabling reclosers and deenergizing portions of the electrical distribution system that consider the associated impacts on public safety. As part of these protocols, each electrical corporation shall include protocols related to mitigating the public safety impacts of disabling reclosers and deenergizing portions of the electrical distribution system that consider the impacts on all of the aspects listed in PU Code 8386c	Recloser Operations: Section 7.3.6.1 PSPS Protocols for De-energization: Sections 8.2.1 to 8.2.2
7	Appropriate and feasible procedures for notifying a customer who may be impacted by the deenergizing of electrical lines, including procedures for those customers receiving a medical baseline allowance as described in paragraph (6). The procedures shall direct notification to all public safety offices, critical first responders, health care facilities, and operators of telecommunications infrastructure with premises within the footprint of potential for a given deenergization event	Sections 7.3.9.3; 8.2.4; 8.4

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TABLE PG&E-2-1: 2021 WMP COMPLIANCE WITH STATUTORY REQUIREMENTS (CONTINUED)

Requirement	Description	WMP Section/Page
8	Plans for vegetation management	Sections 5.4.1 and 5.4.2, 7.3.5, 7.3.5.1 to 7.3.5.20
9	Plans for inspections of the electrical corporation's electrical infrastructure	Sections 5.4.3, 5.4.5, 7.2.C, 7.3.4, 7.3.4.1 to 7.3.4.15
10	Protocols for the deenergization of the electrical corporation's transmission infrastructure, for instances when the deenergization may impact customers who, or entities that, are dependent upon the infrastructure	Section 8.2.2
11	A list that identifies, describes, and prioritizes all wildfire risks, and drivers for those risks, throughout the electrical corporation's service territory, including all relevant wildfire risk and risk mitigation information that is part of the Safety Model Assessment Proceeding and the Risk Assessment Mitigation Phase (RAMP) filings	Sections 4.2 and 4.3
12	A description of how the plan accounts for the wildfire risk identified in the electrical corporation's RAMP	Sections 4.2 and 7.3.8.3
13	A description of the actions the electrical corporation will take to ensure its system will achieve the highest level of safety, reliability, and resiliency, and to ensure that its system is prepared for a major event, including hardening and modernizing its infrastructure with improved engineering, system design, standards, equipment, and facilities, such as undergrounding, insulation of distribution wires, and pole replacement	Section 5.4.4 and 7.3.3.1 to 7.3.3.17

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TABLE PG&E-2-1: 2021 WMP COMPLIANCE WITH STATUTORY REQUIREMENTS (CONTINUED)

Requirement	Description	WMP Section/Page
14	A description of where and how the electrical corporation considered undergrounding electrical distribution lines within those areas of its service territory identified to have the highest wildfire risk in a commission fire threat map	Section 7.3.3.16
15	A showing that the electrical corporation has an adequately sized and trained workforce to promptly restore service after a major event, taking into account employees of other utilities pursuant to mutual aid agreements and employees of entities that have entered into contracts with the electrical corporation	Workforce: Sections 7.3.9.1; 8.2.3 Mutual Assistance: Section 7.3.9.7 (mutual assistance)
16	Identification of any geographic area in the electrical corporation's service territory that is a higher wildfire threat than is currently identified in a commission fire threat map, and where the commission should consider expanding the high fire threat district based on new information or changes in the environment	Section 4.2.1
17	A methodology for identifying and presenting enterprise wide safety risk and wildfire-related risk that is consistent with the methodology used by other electrical corporations unless the commission determines otherwise	Sections 4.2 and 7.3.8.3
18	A description of how the plan is consistent with the electrical corporation's disaster and emergency preparedness plan prepared pursuant to Section 768.6, including plans to restore service and community outreach	Sections 7.3.9.2, 7.3.9.4 to 7.3.9.5
19	A statement of how the electrical corporation will restore service after a wildfire	Sections 7.3.9.5

TABLE PG&E-2-1: 2021 WMP COMPLIANCE WITH STATUTORY REQUIREMENTS (CONTINUED)

Requirement	Description	WMP Section/Page
20	Protocols for compliance with requirements adopted by the commission regarding activities to support customers during and after a wildfire, outage reporting, support for low-income customers, billing adjustments, deposit waivers, extended payment plans, suspension of disconnection and nonpayment fees, repair processing and timing, access to electrical corporation representatives, and emergency communications	Section 7.3.9.3
21	A description of the processes and procedures the electrical corporation will use to do the following: (A) Monitor and audit the implementation of the plan. (B) Identify any deficiencies in the plan or the plan's implementation and correct those deficiencies. (C) Monitor and audit the effectiveness of electrical line and equipment inspections, including inspections performed by contractors, carried out under the plan and other applicable statutes and commission rules.	Sections 4.6, 7.2, 7.2.A to 7.2.D
22	Cites "Any other information that the Wildfire Safety Division might require. While it is assumed such information will be incorporated into the WMP, substantive additions will be identified for easier reference.	Initiative/WMP Costs and Expense: Sections 3.1-3.2 and Table 12 Lessons Learned: Section 4.1 Research/Pilot projects: Sections 4.4, 7.1.D Workforce: Sections 5.4.1 to 5.4.4, 7.1.C Compliance with Decision 20-05-051: Section 8.1 (addressing short, medium and long-term actions each utility will take to reduce the impact of, and need for, de-energization events to mitigate wildfire risk).

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PACIFIC GAS & ELECTRIC COMPANY

SECTION 3

ACTUALS AND PLANNED SPENDING

FOR MITIGATION PLAN

PGE-DIXIE-NDCAL-000004422

3.1 Summary of WMP initiative expenditures

In the Table PG&E-3-1, summarize the projected costs (in thousands) per year over the three-year WMP cycle, including actual expenditures for years passed. In Table 3-2 break out projected costs per category of mitigations, over the three-year WMP cycle. The financials represented in the summary tables below equal the aggregate spending listed in the mitigations financial tables reported quarterly. Nothing in this document shall be construed as a statement that costs listed are approved or deemed reasonable if the WMP is approved, denied, or otherwise acted upon.

TABLE 3-1: SUMMARY OF WMP EXPENDITURES – TOTAL

	Spend in Thousands of Dollars
2020 WMP Planned	$4,829,752
2020 Actual	$4,862,464
Difference[(a)]	($32,712)
2021 Planned	$4,955,161
2022 Planned	$5,197,811
2020-22 Planned	$15,015,436

(a) Difference represents planned minus actual.

TABLE 3-2: SUMMARY OF WMP EXPENDITURES BY CATEGORY

WMP Category (Spend in $ Thousands)	2020 WMP Planned	2020 Actual	Difference[(a)]	2021 Planned	2022 Planned	2020-22 Planned (w/ 2020 Actual)
Risk and Mapping	$5,450	$6,300	($850)	$6,841	$7,067	$20,208
Situational Awareness	$36,020	$35,518	$502	$49,789	$63,434	$148,741
Grid Design and System Hardening	$2,624,433	$2,692,241	($67,808)	$2,698,098	$3,017,543	$8,407,881
Asset Management and Inspections	$379,534	$299,737	$79,797	$266,904	$241,097	$807,738
Vegetation Management	$1,454,522	$1,451,311	$3,211	$1,507,398	$1,450,157	$4,408,867
Grid Operations	$179,161	$182,984	($3,823)	$192,059	$180,468	$555,510
Data Governance	$90,975	$116,619	($25,644)	$147,362	$149,992	$413,974
Resource Allocation	$2,148	$6,591	($4,443)	$7,121	$7,179	$20,891
Emergency Planning	$25,107	$22,793	$2,314	$26,341	$27,356	$76,489
Stakeholder Cooperation and Community Engagement	$32,402	$48,371	($15,969)	$53,248	$53,519	$155,138
Total	$4,829,752	$4,862,464	($32,712)	$4,955,161	$5,197,811	$15,015,436

(a) Difference represents planned minus actual.

Pacific Gas and Electric Company (PG&E) provides above the information requested for Table PG&E-3-1 and Table PG&E-3-2. There are several important points to be aware of in the presentation of this information:

- Mitigation and control work has been included in this Wildfire Mitigation Plan (WMP) and these tables that spans multiple cost recovery mechanisms including the General Rate Case (GRC), Transmission Owner (TO) rate case at the Federal Energy Regulatory Commission (FERC), Catastrophic Event Memorandum Account (CEMA), Fire Risk Mitigation Memorandum Account (FRMMA), Wildfire Mitigation Plan Memorandum Account (WMPMA), and EPIC. Some of these costs have already been approved for inclusion in customer rates and some of these costs are still pending review or approval through open and transparent cost recovery proceedings;
- Financial figures have been mapped to each initiative and/or category based upon the activity being described in Section 7.3 of this document;
- While the primary work performed for wildfire risk mitigation is in the HFTD areas, some work and financial costs associated with Non-HFTD areas have been included in some of these the financial figures;
- The costs reflected are PG&E's best estimate of the costs for the proposed programs as of February 5, 2021. Further changes to 2021 budgets and work

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plans are possible and actual costs may vary substantially from these plans depending on actual work completion, conditions and requirements; and,

- For the "2020 WMP Planned" and "2020 Actual" columns, the population of work included in these financial data sets is aligned to the 2021 WMP scope and list of initiatives. Please note that due to changes in scope for some initiatives from the 2020 WMP to 2021 WMP (for example, PG&E has added/removed sub-initiatives or as indicated above, we are now referencing some Non-HFTD work and financials), we aligned the 2020 financial information with the 2021 scope to ensure consistency across the years of the table.

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3.2 Summary of ratepayer impact

Report the projected cost increase to ratepayers due to utility-ignited wildfires and wildfire mitigation activities engaged in each of the years below. Account for all expenditure incurred in that year due to utility-ignited wildfires/mitigation activities and provide methodology behind calculation below Table 3-3.

TABLE 3-3: WMP ELECTRICITY COST TO RATEPAYERS

	Annual performance – Actual					
Outcome metric name	**2016**	**2017**	**2018**	**2019**	**2020**	**Unit(s)**
Increase in electric costs to ratepayer due to utility-ignited wildfires (total)	$0	$0	$0	$0	$0	Dollar value of average monthly rate increase attributable to utility-ignited wildfires per year (e.g., $3/month on average across customers for utility-ignited wildfires occurring in 20XX)
Increase in electric costs to ratepayer due to wildfire mitigation activities (total)	$0	$0	$0	$0	$0.14	Dollar value of average monthly rate increase attributable to WMPs per year

Table 3-3 summarizes the ratepayer impact due to costs associated with utility-ignited wildfires and wildfire mitigation activities that were recovered in rates from 2016 through 2020. In this table, PG&E presents the average monthly bill impact for a typical bundled Non-California Alternate Rate for Energy (CARE) residential customer with an average monthly usage of 500 kilowatt (kWh). Below, PG&E provides an explanation concerning how the data in Table 3-3 was developed.

Ratepayer Impact Due to Utility-Ignited Wildfires:

For the five year period from 2016-2020, PG&E reviewed all wildfire response and recovery efforts where costs have been incurred and identified. There were ten (10) CPUC reportable utility-related fire ignitions in that population: (1) four ignitions were associated with October 2017 Northern California wildfires; (2) four ignitions were the 2017 Railroad Fire, 2018 Camp Fire, 2019 Camino Fire, and 2019 Bethel Island Fire; (3) one ignition was the Kincade Fire, which is reported in compliance with Decision (D.) 19-05-037;[14] and (4) one ignition was the Zogg Fire, which is reported in compliance with D.19-05-037.[15]

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14 PG&E's investigation into the cause of the Kincade Fire is ongoing. PG&E has included the Kincade Fire because CAL FIRE has announced its determination that PG&E's facilities caused the Kincade Fire.

15 PG&E's investigation into the cause of the Zogg Fire is ongoing. PG&E has included the Zogg Fire because CAL FIRE has collected PG&E equipment as part of its investigation.

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For the period of 2016-2020, PG&E incurred approximately $1.1 billion in expenditures associated with these ten utility-ignited wildfires. These costs were related to: (1) restoration activities during these catastrophic events, including repairing the damaged utility facilities and replacing equipment to restore service to customers; (2) temporary facilities set up due to the Camp Fire; and (3) the Butte rebuild effort such as permanent underground services and mobile home spaces. Excluding non-incremental overheads and Wildfire Order Instituting Investigation (OII) disallowances in accordance with D.20-05-019, the amount of incremental expenditures recorded through 2020 for these ten utility-related fire ignitions is $238 million. None of these costs are or have been reflected in customer rates to date. Specifically, for CPUC-jurisdictional rates, PG&E is currently seeking recovery of recorded costs incurred through 2019 for the Camino Fire and Bethel Island Fire in the Wildfire Mitigation and Catastrophic Events (WMCE) Application (A.20-09-019), which is pending CPUC approval. PG&E has not sought cost recovery for the remaining eight utility-ignited wildfires in any existing CPUC proceeding. For FERC-jurisdictional rates, PG&E has not yet sought cost recovery associated with the ten utility-ignited wildfires because of the lag in time associated with PG&E's Formula Rate.

To develop an estimate of ratepayer impact due to utility-ignited wildfires associated with the $238 million incremental expenditures incurred from 2016 through 2020, PG&E used a simplified calculation model by functional area to translate the expenditures to a revenue requirement. Cost of capital, depreciation, revenue fees and uncollectible, as well as taxes are factored in the revenue requirement calculation model through 2025. PG&E estimates a total revenue requirement of approximately $124 million associated with the $238 million incremental expenditures incurred through 2020. However, it is unclear precisely when these costs would be approved to go into rates, when cost recovery would begin, and how long the recovery period will be.

PG&E has made certain assumptions on the cost recovery periods in order to calculate future monthly bill impacts associated with utility-ignited wildfire costs occurring from 2016 through 2020. For costs contained in applications that have already been filed, PG&E has reflected the cost recovery periods proposed in those applications. For applications that have not yet been filed, PG&E has made assumptions concerning the recovery periods based on the expected timing of the applications. As a result, PG&E has estimated that the average monthly bill impact from utility-ignited wildfire costs occurring from 2016 through 2020 will be $0.98 in 2023, $1.11 in 2024, and $0.70 in 2025.[16] These bill impacts are not representative of the bill increases customers will experience when these costs are implemented in rates. Rather, these bill impacts represent the portion of the total bill that would be associated with utility-ignited wildfires. The actual change to bills in any future period will depend on the changes in the total authorized revenue requirement and electric sales at the time of implementation.

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16 Bill impacts represent the average monthly bill impact for a typical bundled Non-CARE residential customer with an average monthly usage of 500 kWh.

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Ratepayer impact due to wildfire mitigation activities:

PG&E incurred approximately $5.8 billion in expenditures associated with utility wildfire mitigation activities for the period of 2016-2020. These expenditures can be broadly categorized in three ways.

The first category, consisting of costs totaling approximately $2.0 billion, are related to the Risk Assessment and Mitigation Phase mitigation approved in the General Rate Case (GRC), which includes enhanced vegetation management, system hardening program, situational awareness and PSPS.

The second category, consisting of costs totaling $2.6 billion, are those booked to the wildfire mitigation memorandum accounts, which PG&E has conducted pursuant to our WMP. These costs include enhanced wildfire inspections, repair and replace, as well as microgrid programs.

The third category, consisting of costs totaling approximately $1.2 billion, are related to inspections of electric transmission facilities, system hardening, enhanced controls, and other programs designed to make PG&E's customers and the communities that we serve safer.

Excluding non-incremental overheads and Wildfire OII disallowances in accordance with D.20-05-019, the amount of incremental expenditures recorded through 2020 for wildfire mitigation activities is approximately $5.0 billion. The majority of these costs are not reflected in customer rates at this time. The specific wildfire mitigation activities included in existing rates are:

1) $13.8 million of capital expenditures forecast for electric distribution equipment replacement in 2019 for Tier 2 and 3 High Fire-Threat Districts in the 2017 GRC Decision (D.17-05-013); and

2) $15.9 million of O&M expense for network transmission related to the Wildfire Safety Inspections Program (WSIP), which was reflected in customer rates for rate year 2020. PG&E filed our twentieth Transmission Owner rate case at FERC in October 2018 in Docket No. ER19-13-000 (TO20). PG&E's TO20 rate filing was a Formula Rate. FERC accepted the filing, subject to hearing and refund, for rates to go into effect on May 1, 2019. PG&E filed a partial settlement in the TO20 proceeding on March 31, 2020 that was approved by FERC in August 2020. PG&E filed a settlement for all of the remaining issues on October 15, 2020. FERC approved the TO20 settlement on December 30, 2020. Under the Formula Rate model, the electric transmission O&M expense for the rates years 2019 and 2020 is based on 2017 and 2018 recorded costs, respectively. These amounts are then trued up for the 2019 and 2020 actuals in subsequent years through a true-up mechanism included in the Formula Rate. There is no O&M expense in 2017 (for the rate year 2019) specific to wildfire mitigation as specified in the WMP. In 2018 (for the rate year 2020), $15.9 million of O&M expense for WSIP was included in transmission rates. For electric transmission capital, PG&E did not forecast any WMP capital expenditure for the rate year 2019. In the rate year 2020, PG&E included $20.3 million of wildfire mitigation capital

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expenditure forecast. These costs were mainly related to repairs and replacements from WSIP.

To develop an estimate of the revenue requirement due to utility wildfire mitigation activities associated with the $5.0 billion of expenditures, PG&E has incorporated various decisions and applications as follows:

1) The 2020 GRC Decision (D.20-12-005), approved on December 3, 2020, adopted the Settlement Agreement amount of $405.9 million in expense and $603.3 million in capital expenditures for 2020 for the wildfire mitigation and vegetation management program. PG&E is authorized to establish balancing accounts to track these costs and amortize the 2020 authorized amounts in customer rates beginning March 2021 until December 2022. PG&E is also authorized to recover 2020 incremental spend up to the authorized cost cap of 115 percent for wildfire mitigation balancing account and 120 percent for vegetation management expense through a Tier 2 advice letter filing, which is expected to enter rates in 2021. Based on the preliminary year-end financial close for 2020, PG&E incurred $682.5 million in expense and $630.4 million in capital expenditures tracked in the wildfire mitigation and vegetation management balancing account. PG&E will seek recovery of incremental costs above the authorized cost cap in an application proceeding, the timing of which has not yet been determined. For the purpose of developing an estimate of ratepayer impact, PG&E assumes these costs once approved will enter rates beginning in 2023;

2) In the WMCE Application, PG&E seeks recovery of incremental recorded costs for wildfire mitigation activities incurred through December 2019 totaling $1.603 billion. Based on the scoping memo, a proposed decision for the WMCE Application is expected in September 2021. For the bill impact calculation, PG&E has reflected the Commission's decision of an interim rate relief of $447 million of revenue requirement, to be collected over a 17-month period from January 2021 to May 2022. PG&E assumes the remaining revenue requirement associated with these costs, once approved, will be collected in rates over a 12-month period from June 2022 to May 2023, consistent with the proposal in the WMCE application;

3) PG&E incurred $142 million of expenditures in 2020 associated with the Microgrids program tracked in the memorandum account per PSPS Resiliency Strategies and Microgrid OIR (R.19-09-009). These costs are related to the substation make-ready program, temporary generation program and community microgrid enablement program;

4) PG&E recorded $660 million of wildfire tree mortality expense incurred through 2020. PG&E seeks recovery of 2016-2019 tree mortality expense in the Catastrophic Event Memorandum Account (CEMA) Application (A.18-03-015), which is pending CPUC approval. The 2020 GRC Decision authorizes PG&E to include CEMA tree mortality expense in the approved vegetation management balancing account for cost recovery. PG&E will seek recovery of the 2020 CEMA tree mortality expense in an

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application proceeding. For the purpose of developing an estimate of ratepayer impact, PG&E assumes that the tree mortality costs for 2016-2019 once approved will enter rates beginning in 2022; and,

5) PG&E incurred approximately $779 million of expenditures, net of Wildfire OII disallowances, related to electric transmission wildfire mitigation activities. These costs will be recovered under the FERC Formula Rate mechanism.

In addition to the expenditures discussed above associated with utility-ignited wildfires and wildfire mitigation activities, PG&E incurred approximately $565 million of incremental insurance premiums recorded in the Wildfire Expense Memorandum Account (WEMA) between July 26, 2017 through December 31, 2019. Pursuant to D.18-06-029, PG&E is authorized to establish the WEMA to track and seek recovery of incremental insurance premiums effective July 26, 2017. The 2020 GRC Decision authorizes PG&E to recover $66.1 million of incremental insurance premium, which will enter rates beginning March 1, 2021 and ending December 31, 2022. PG&E seeks recovery of $498.7 million in revenue requirement through the WEMA application (A.20-02-004), which is pending approval from the CPUC. These costs are not associated with any specific wildfire event.

To develop an estimate of ratepayer impact, PG&E converted the expenditures to revenue requirement from various decisions and applications discussed above. PG&E has factored in cost of capital, depreciation, Assembly Bill 1054 equity rate base exclusion and other parameters in the revenue requirement calculation through 2025. PG&E estimates a total revenue requirement of approximately $3.6 billion associated with the $5.0 billion of wildfire mitigation expenditures incurred through 2020. However, it is unclear precisely when these costs would be approved to go into rates, when cost recovery would begin, and how long the recovery period will be.

As described above, PG&E has made certain assumptions on the cost recovery periods in order to calculate future monthly bill impacts associated with wildfire mitigation activities occurring from 2016 through 2020. For costs that have been approved to go into rates, PG&E has reflected the recovery period as outlined in the decision. For costs contained in applications that have already been filed, PG&E has reflected the cost recovery periods proposed in those applications. For applications that have not yet been filed, PG&E has made assumptions around the recovery periods based on the expected timing of the applications. As a result, PG&E has estimated that the average monthly bill impact from the resulting costs associated with wildfire mitigation activities occurring from 2016 through 2020 will be $9.16 in 2021, $15.04 in 2022, $9.62 in 2023, $2.93 in 2024, and $2.87 in 2025.[17] These bill impacts are not representative of the bill increases customers will experience when these costs are implemented in rates. Rather, these bill impacts represent the portion of the total bill that would be associated with wildfire mitigation activities. The actual change to bills in any future period will depend on the changes in the total authorized revenue requirement and electric sales at the time of implementation.

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17 Bill impacts represent the average monthly bill impact for a typical bundled Non-CARE residential customer with an average monthly usage of 500 kWh.

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PACIFIC GAS & ELECTRIC COMPANY

SECTION 4

LESSONS LEARNED AND RISK TRENDS

PGE-DIXIE-NDCAL-000004431

4.1 Lessons Learned: How Tracking Metrics on the 2020 Plan Has Informed the 2021 Plan

Describe how the utility's plan has evolved since the 2020 Wildfire Mitigation Plan (WMP) submission. Outline any major themes and lessons learned from the 2020 plan and subsequent implementation of the initiatives. In particular, focus on how utility performance against the metrics used has informed the utility's 2021 WMP.

Pacific Gas and Electric Company's (PG&E) wildfire mitigation strategy continues to be structured around three strategic imperatives: reducing wildfire ignition potential, enhancing situational awareness, and reducing the impact of Public Safety Power Shutoff (PSPS) events. The 2021 WMP focuses on further maturing these imperatives based on lessons learned from the implementation of our 2019 and 2020 WMP. As many of our wildfire risk mitigation programs are still evolving the use of metrics to determine effectiveness specific programs is just beginning and will improve as more data is gathered over time. While PG&E delivered on the programs included in the 2020 WMP, we also identified several gaps in our execution in 2020 and lessons learned that we are focused on resolving through our 2021 WMP and oversight of the workstreams in 2021. The primary gaps identified and lessons learned from 2020 include risk prioritization of Enhanced Vegetation Management (EVM) work, prioritizing the scheduling and execution of system inspections, and the quality of vegetation management activities, as discussed below. PG&E's 2021 WMP also presents a significant step forward in our risk modeling, due to both overall improvements in our toolset for analyzing risk and lessons learned from the past few years. Finally, we also continue to refine the delivery and execution of our PSPS program, particularly as it relates to partnering and communicating with the communities and customers impacted by PSPS events.

The remainder of this section includes the following subsections:

- Subsection (a): Lessons learned for EVM risk prioritization;
- Subsection (b): Lessons learned regarding system inspection prioritization and execution;
- Subsection (c): Lessons learned on vegetation management quality improvements;
- Subsection (d): Risk modeling improvements; and,
- Subsection (e): PSPS improvements.

(a) Enhanced Vegetation Management Risk Prioritization

In 2020, PG&E identified, and other external parties including the Federal Monitor provided feedback, that the execution of EVM work was not aligned with our risk prioritization model. In some cases, and for a number of reasons including the longer cycle time associated with completing the more densely vegetated sections of our system, lower priority circuit segments were being completed before higher priority circuit segments.

For 2021, PG&E is resolving this gap through increased control and validation of the workplan. First, we have implemented an updated risk model (described in Section 4.5.1) to inform the selection of which circuit segments to work in 2021. In 2021, we will prioritize and target the highest risk circuit segments and have increased the controls around the actual circuit segments that will be completed. The newly formed Wildfire Risk Governance Steering Committee (WRGSC, chaired by PG&E's Chief Risk Officer) is directly approving the selection of EVM work locations and monitoring regular reporting of work completed to ensure actual work is aligned with the planned risk reduction. Second, we have revised our internal incentive metric associated with EVM work to require that at least 80 percent of the work be performed in the top 20 percent of the risk ranking of circuit segments[1] otherwise the incentive metric will be assessed to be a 0. Through the improved risk prioritization, program controls and metric updates, our investments in EVM will help maximize wildfire risk reduction. This learning is also being applied to the System Hardening program where the updated risk model is also being used to target projects and the incentive metric structure has been set up the same way to require that 80 percent of the system hardening miles completed are in the top 20 percent of the risk ranking (or areas where assets must be rebuilt due to an actual wildfire).

(b) System Inspection Prioritization and Execution

By identifying potential issues on PG&E assets in High Fire Threat Districts (HFTD) before they have a chance to fail, the system inspection program is a critical aspect of PG&E's wildfire risk mitigation activities. However, in 2020, PG&E did not properly manage and prioritize the execution of system inspections in the highest risk areas. In some cases, assets outside of HFTDs were inspected before higher wildfire risk assets had been completed. In 2021, PG&E is resolving this issue by applying the same updated risk model mentioned for EVM and system hardening to prioritize and order the system inspections workplan. We are going to complete all inspections in HFTD areas before the late summer peak of wildfire season[2] and the WRGSC is also directing the establishment and execution of the system inspections workplan. Through the increased oversight, focus on aligning to the risk prioritization and earlier completion of inspections in HFTD areas, PG&E's critical system inspection program will provide increased wildfire risk mitigation value in 2021 and going forward.

(c) Vegetation Management Quality Improvements

Vegetation contacts with powerlines remain the leading cause of California Public Utilities Commission (CPUC or Commission) reportable ignitions in HFTD areas.

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1 The incentive metric for 2021-2023 not only measures the number of miles completed (1,800 miles per year) but also requires that 80% of the work completed over that three year period be in the top 20% of circuit segments on the risk buydown curve or be in areas impacted by actual wildfires. If less than 80% of the miles counted fit that criteria then the metric performance will be a 0, regardless of how many total miles were completed.

2 Before September 1, with the possible exception of locations where an inspection was attempted before September 1 but access restrictions, customer refusals or other external factors prevent initial completion of the inspection.

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Managing vegetation in proximity to powerlines is therefore one of the most important wildfire risk mitigation activities, but also one of the most challenging given the dynamic nature and volume of trees in PG&E's service territory. In 2020, we identified steps to further improve the quality and consistency of our vegetation management work.

For 2021, PG&E is deploying substantially increased resources to validate the quality of our vegetation management work and respond more quickly to any concerns raised, internally or externally about vegetation management work. PG&E anticipates more than tripling our work verification workforce by adding more than 200 inspectors to increase our ability to verify that vegetation management was completed to meet state and federal standards and PG&E's own expectations. We will also be performing work verification (post-tree work inspections) on 100 percent of work performed in HFTDs, both for EVM and routine vegetation management programs. PG&E will also be deploying technology to capture objective snapshots of the condition of vegetation throughout HFTDs through ground-based Light Detection and Ranging (LiDAR) to further validate work completion and time-stamped conditions across our system. Finally, PG&E will be staffing a centralized team of arborists to investigate any concerns or findings raised by internal or external parties to ensure timely follow-up, appropriate resolution and adequate closure of any issues identified. Together these efforts, along with ongoing improvements to processes and tools (like work tracking systems), will improve PG&E's vegetation management performance, quality and consistency in addressing vegetation, one of the most important and challenging wildfire risks facing PG&E's utility infrastructure.

(d) Risk Modeling Improvements

Implementing the 2021 Wildfire Distribution Risk Model, which is discussed in much more detail in Section 4.5.1 below, has allowed PG&E to advance our predictive analytics capabilities and practices. For example, the 2019-2020 Wildfire Risk Model used in the 2019 and 2020 WMPs deployed industry best practices around model performance metrics after the model was in use, as an after-the-fact quality check. The Equipment Probability of Ignition and Vegetation Probability of Ignition Models now used for the 2021 WMP use the same performance metrics in a proactive manner, to evaluate the accuracy of the model before it is deployed.

Another resource leveraged more fully during the development of the 2021 Wildfire Distribution Risk Model was benchmarking with risk modeling experts from peer utilities, particularly in California. Through regular, ongoing collaboration meetings experts from PG&E, San Diego Gas & Electric Company (SDG&E), Southern California Edison Company (SCE), Australian utilities and others have partnered to learn about each other practices, challenges and learnings.

The 2021 WMP includes risk models that provide a deeper granularity of risk analysis, for example, the 2020 WMP distribution line scoring of circuits and Circuit Protection Zones (CPZ) was heavily scrutinized, so for the 2021 WMP, PG&E has analyzed and made more uniform Circuit Segments to apply to models across the distribution system.

Data accuracy and data validation practices continue to improve. In 2020, we saw the first phase implementation of a data aggregation platform that forms a foundation for a

"single source" of data. This is a significant step in PG&E's efforts to mature these two foundational capabilities.

Finally, PG&E has received comments from both the Safety Policy Division (SPD) and parties in the 2020 Risk Assessment Mitigation Phase (RAMP) proceeding (Application 20-06-012) requesting PG&E to analyze PSPS consequences to customers at a more granular level than at an enterprise level risk. PG&E also understands that SDG&E through its Wildfire Next Generation System,[3] is evaluating PSPS consequences and considered customer impacts in its Risk Spend Efficiency (RSE) calculations for this WMP. PG&E supports these requests to analyze and model PSPS customer impacts and made an initial attempt at this evaluation in our first Quarterly Report in our response to Condition Guidance-1 examining customer reliability only, though we understand that additional consequences, such as safety and financial, are also of interest to stakeholders. PG&E intends to explore modeling these additional consequences. PG&E also supports SDG&E's effort to consider the reduction of PSPS consequences to customers in its mitigation RSE calculations for system hardening activities such as covered conductor deployment or undergrounding of overhead circuits in HFTD areas.

PG&E has constructed an initial PSPS consequence model at the enterprise level, and although our risk models are not yet evolved enough to assess PSPS consequence at a circuit or circuit segment level, we currently intend to develop this capability for use in the second half of 2021. PG&E expects to work collaboratively with the other California utilities to further advance this modeling.

(e) PSPS Program Improvements

While PG&E is committed to taking actions that further make PSPS events smaller, we will not deviate from the purpose of PSPS events, to prevent catastrophic wildfire ignitions during the most severe and highest risk wildfire conditions. Therefore, we are assessing what conditions not currently included in the scoping of PSPS events that may drive an expansion in the scope of 2021 PSPS events, in alignment with external feedback. Specifically, we are assessing how to incorporate the presence of known, high-risk vegetation conditions adjacent to powerlines into PSPS decision making. This assessment may result in PG&E executing PSPS in 2021 for powerlines where high priority vegetation tags[4] have been identified, including on lines that may not have met the 2020 PSPS event criteria. Following that activity over the next few months, PG&E will analyze the likely impact of that updated criteria in making PSPS events larger and compare that impact to the actions being taken to make PSPS events smaller. Given this ongoing analysis, we do not have specific 2021 PSPS targets, but are taking substantial actions to make PSPS events in 2021 smaller, shorter, and smarter.

In addition to the scope of PSPS events, PG&E is also working to improve customer resources and engagement before, during and after PSPS events. With two years of

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3 SDG&E WMP Quarterly Report, Guidance-1 and SDGE-3, September 9, 2020.

4 PG&E has identified "high priority vegetation tags" as "Priority 1" and "Priority 2" tags where trained vegetation inspectors identify trees or limbs that currently present elevated risk and must be worked on an expedited basis (at least within 30 days).

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experience with significant PSPS events, PG&E is further grounding our outreach, programs and services in customer and stakeholder feedback, research, and data to continuously improve. We will use this feedback and research to, among other things: continue to refine our Community Resource Center strategy working in close collaboration with our county, tribal and Community-Based Organization (CBO) partners, and enhance solutions for customers that are like to see "repeat impacts" due to multiple PSPS events. Another dimension where we will continue to use data to direct our activities is in the deployment of specialized material and resources. During the 2020 PSPS season, PG&E deployed a substantial amount of in-language material to provide accessible PSPS information for non-English speaking customers and communities. PG&E is continuing to gather data and feedback to assess how best to support customers with limited English proficiency. It may be that more material on PG&E's website is less valuable than continuing to strengthen our partnerships with CBOs who already have relationships with and support those customers and communities.

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4.2 Understanding Major Trends Impacting Ignition Probability and Wildfire Consequence

Describe how the utility assesses wildfire risk in terms of ignition probability and estimated wildfire consequence, including use of Multi-Attribute Risk Score (MARS) and Multi-Attribute Value Function (MAVF) as in the Safety Model and Assessment Proceeding (S-MAP)[11] and RAMP, highlighting changes since the 2020 WMP report. Include description of how the utility distinguishes between these risks and *the risks to safety and reliability. List and describe each "known local condition" that the utility monitors per General Order (GO) 95, Rule 31.1, including how the condition is monitored and evaluated.*

PG&E has substantially updated our wildfire risk modeling and risk assessment tools for this 2021 WMP. Section 4.5 provides an introduction and in-depth explanation of the updated models in use for 2021. This Section 4.2 follows the 2021 WMP template in explaining the use of established risk modeling tools (MAVF and MARS, defined below). Many readers may benefit by first reviewing Section 4.5 to understand PG&E's overall wildfire risk assessment and modeling approach for the 2021 WMP, before coming back to the detailed discussion in this section.

The remainder of this section includes the following subsections:

- Subsection (a): PG&E's use of MAVF to assess wildfire ignition probabilities and estimated consequences, and to translate these from natural units into a unitless risk score for MARS;
- Subsection (b): PG&E's wildfire risk assessment and bowtie analysis;
- Subsection (c): How PG&E distinguishes between wildfire risks and other safety and reliability risks;
- Subsection (d): A description describes of "known local conditions" as that term is used in General Order (GO) 95, Rule 31.1; and,
- Subsection (e): Responses to Actions identified in Wildfire Safety Division's (WSD) evaluation of PG&E's Remedial Compliance Plan (Actions PGE-3 (Class A), PGE-4 (Class A), and PGE-6 (Class A)) and in WSD's evaluation of PG&E's First Quarterly Report (Actions PGE-1 subpart 1(Class B), PGE-4 (Class B), PGE-5 (Class B), and PGE-15 (Class B)) that are related to the substance of this section.

(a) Use of MAVF and MARS

Pursuant to Decision (D.) 18-12-014, PG&E implemented the S-MAP Settlement Agreement in 2019, including the development of an MAVF and Risk Bowtie for Wildfire analysis. PG&E employs an MAVF to combine all potential consequences of the

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occurrence of a risk event and create a single measurement of value known internally as MARS.[5] An MAVF consists of the following components:

- Attributes
- Ranges
- Natural Units
- Weights
- Scaling Function

D.18-12-014 also provides six principles to use in determining the MAVF components: Attribute Hierarchies, Measured Observations, Comparison, Risk Assessment, Scaled Units, and Relative Importance.

The key components of the MAVF that PG&E used for assessing wildfire-related risks, and how they adhere to the principles, are shown Table PG&E-4.2-1 below and are described in the discussion following the table.

TABLE PG&E-4.2-1: KEY COMPONENTS OF MAVF

Attribute	Range	Natural Units	Weight	Scaling Function
Safety	0 - 100	Equivalent Fatalities (EF)/ event	50%	Non- Linear
Electric Reliability	0 – 4 Billion	Customer Minutes Interrupted (CMI)/ event	20%	Non- Linear
Gas Reliability	0 – 750,000	Customers affected/event	5%	Non- Linear
Financial[6]	0 - $5 Billion	$/event	25%	Non- Linear

- Ranges: Pursuant to D.18-12-014, the smallest observable value of an Attribute is the low end of the range, and the largest observable value is the high end of the range. PG&E interprets the largest observable value to be a reasonable value informed by historical events and plausible large-consequence scenarios. In PG&E's analysis and risk framework, event consequences are not capped at the high end of the range, but rather, the range is a specification required in the scaling function.
    - The high end of the Safety Attribute Range, set to 100, is an order-of- magnitude value informed by recent events.

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5 D.18-12-014, p. 17, 2018 S-MAP Revised Lexicon: *MAVF*.

6 Pursuant to D.18-12-014 and D.16-08-018, utility shareholders' financial interests are to be excluded from the General Rate Case (GRC) and RAMP risk evaluation and risk mitigation considerations.

- The high end of the Electric Reliability Range (4 Billion CMI) was based on the most severe reliability impact from a single event of 3.6 billion CMI from the October 26, 2019 PSPS event.
- The Gas Reliability high end is based on a scenario of an outage at a critical gas facility.
- The Financial Attribute's high end represents a financial loss commensurate with an Energy Crisis-type event.

- Natural Units: EF is defined as the sum of Public, Employee and Contractor Fatalities and Serious Injuries per event occurrence. Serious Injuries are defined as situations that require hospitalization of an individual pursuant to existing Federal and State reporting guidelines.[7] Fatalities and Serious Injuries are converted to EFs using the multiplicative factors 1.00 and 0.25, respectively. The conversion rate from Serious Injury to EF is based on information available from Federal sources.[8]

- Scaling Function: The Non-Linear Scaling Function is used to convert each Attribute from its Natural Unit to Scaled Units.[9] It consists of the following segments, with each segment intended to represent events that are either operational (i.e., encountered in the course of regular operations), critical or catastrophic.
  - For natural units from 0 to 1 percent of the Range (operational/moderate events): Linear function from 0 to 0.1 Scaled Units.
  - For natural units from 1 percent to 10 percent of the Range (critical events): Quadratic function from 0.1 to 5 Scaled Units.
  - For natural units from 10% to 100+% of the Range (catastrophic events): Linear function from 5 to 100 Scaled Units.

D.18-12-014 directs utilities to use Expected Value when calculating the Consequence of Risk Event (CoRE) and use the scaling function to capture aversion to extreme outcomes or indifference over a range of outcomes. Under PG&E's Non-Linear scaling

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7 Pipeline and Hazardous Materials Safety Administration (PHMSA) §191.3Definitions: Incident (see also: https://www.phmsa.dot.gov/data-and- statistics/pipeline/pipeline-facility-incident-report-criteria-history) and D.98-07-097 (Amended April 27, 2006), Findings of Fact 3 and Appendix B, Accident Report Requirements 3 (see also: https://www.cpuc.ca.gov/General.aspx?id=2090).

8 See "Treatment of the Values of Life and Injury in Economic Analysis," Table 2-3, Federal Aviation Administration (FAA) Office of Aviation Policy and Plans, Updated September 2016, (available at: https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/media/econ- value-section-2-tx-values.pdf).

9 D.18-12-014, pp. 17-18; 2018-S-MAP Revised Lexicon: Scaled Unit of an Attribute: a value that varies from 0 to 100.

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function, the risk score, as measured by Scaled Units, will be low for operational events, but increases exponentially as critical events approach catastrophic (but low probability) levels. Once catastrophic levels are attained the function assigns 10 times higher score for each potential increase in Natural Units when compared to operational events. This captures aversion to critical and catastrophic outcomes and gives higher priority to controls and mitigations that affect them.

When PG&E evaluates potential event consequences, it does not cap them at the Range high end per se, but pursuant to D.18-12-014,[10] PG&E places a ceiling of 100 on converted Scaled Units, i.e., if a modeled risk event's consequence in Natural Units goes above the Attribute Range, the converted Scaled Unit will be 100. This provides a way to compare the relative importance of different Attributes using Attribute Weights, consistent with the Relative Importance principle.[11] Also, by capping, PG&E recognizes that catastrophic risks must be mitigated, and it is immaterial to consider one risk to be "more" or "less" catastrophic than another (e.g., a financial loss of $5 billion or $5.2 billion) when evaluating alternatives.

Environmental consequences of an event are accounted for financially (i.e., as part of the Financial consequences) because there is a lack of commonly accepted ways to measure non-monetary environmental consequences. This makes the use of non-monetary environmental Attributes inconsistent with the principle of Measured Observations.

In PG&E's risk modeling, Attribute levels (e.g., the financial consequence of a risk event) are assumed to be uncertain and are represented by well-defined probability distributions. PG&E uses Monte-Carlo simulations of risk events based on these probability distributions to calculate MAVF consequence levels (in Scaled Units or MARS) and thus Risk Scores, consistent with the Risk Assessment principle.

Overall, the S-MAP conforming risk assessment has not changed substantially since the 2020 WMP. However, there have been a few important changes including:

- Fire Weather Warning nomenclature was changed to Red Flag Warning (RFW) for clarity; and,
- Tranches were updated to incorporate the 2021 Wildfire Distribution Risk Model to provide more granularity in the risk assessment

These changes are described in more detail in Subsection (b) below.

(b) Wildfire Risk Assessment and Bowtie Analysis

Consistent with D.18-12-014, PG&E assesses wildfire risk and estimated wildfire consequences in a bowtie analysis.

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10 *Id.*

11 D.18-12-014, Attachment A, Step 1A, No 7. MAVF Principle 6 –Relative Importance. Page A-6.

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FIGURE PG&E-4.2-1: WILDFIRE RISK "BOWTIE" ANALYSIS (PG&E SERVICE TERRITORY; OVERHEAD CIRCUITS - ALL VOLTAGE CLASSES)

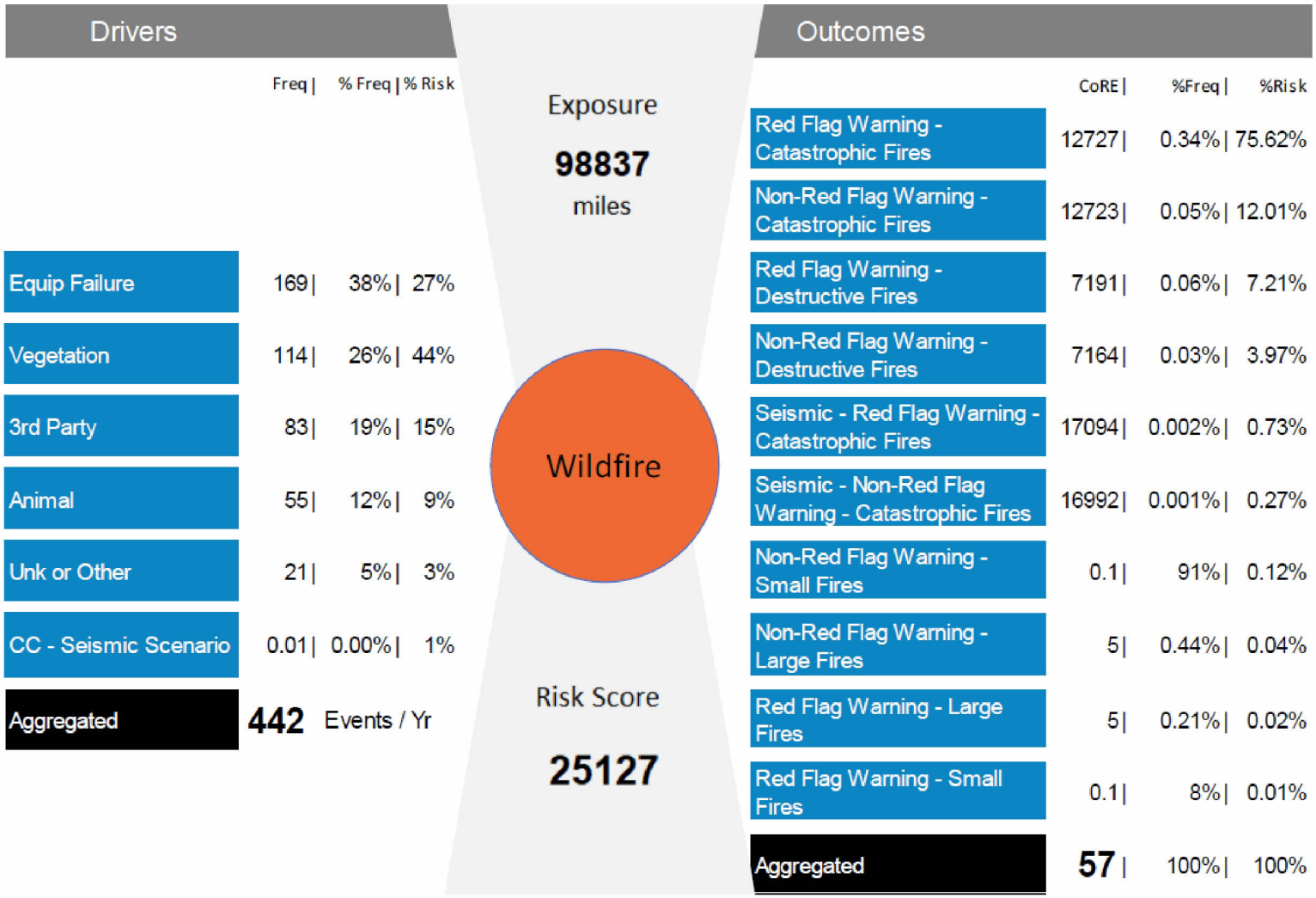


FIGURE PG&E-4.2-2: WILDFIRE RISK "BOWTIE" ANALYSIS (PG&E HFTD ONLY; DISTRIBUTION VOLTAGE OVERHEAD CIRCUITS)

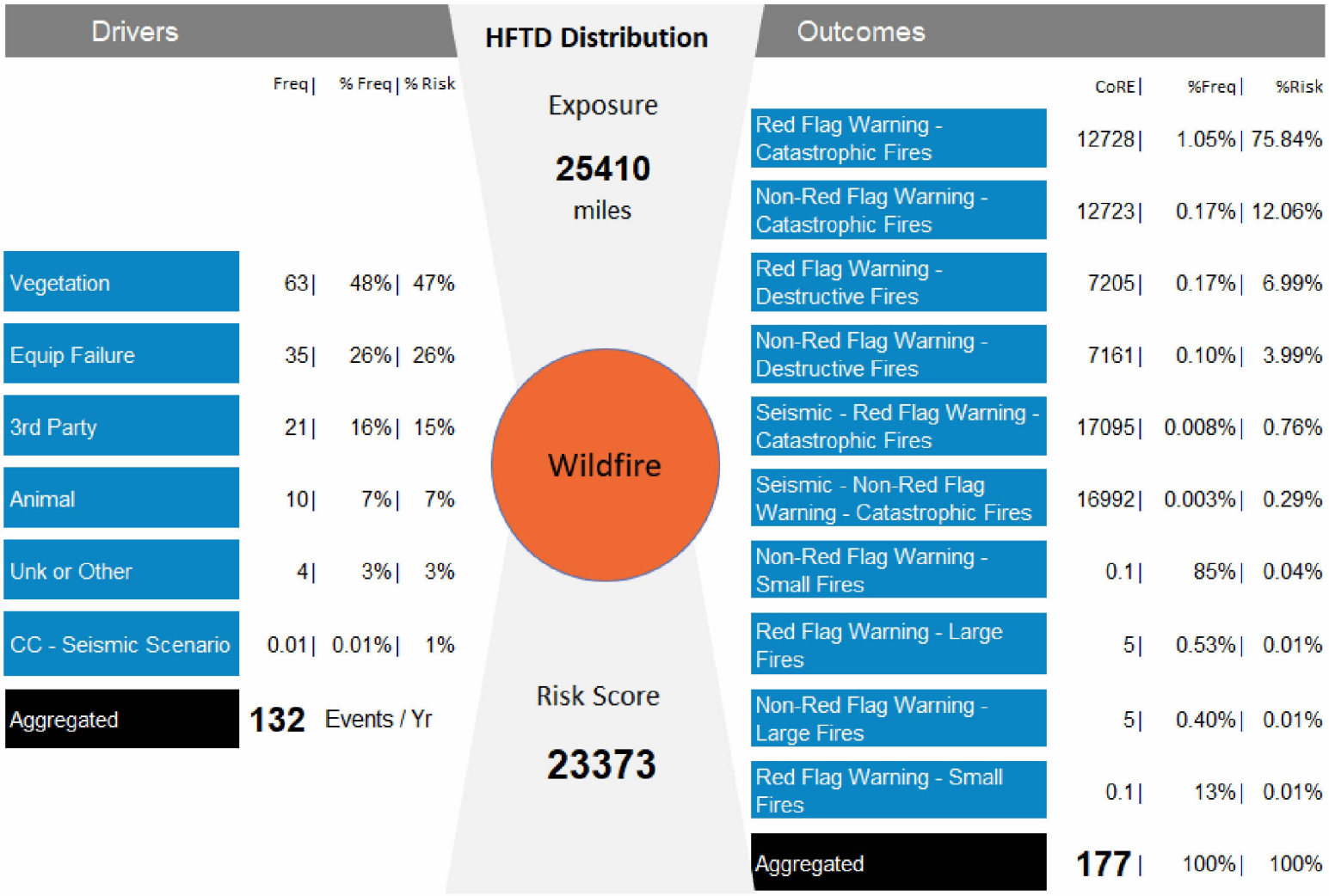
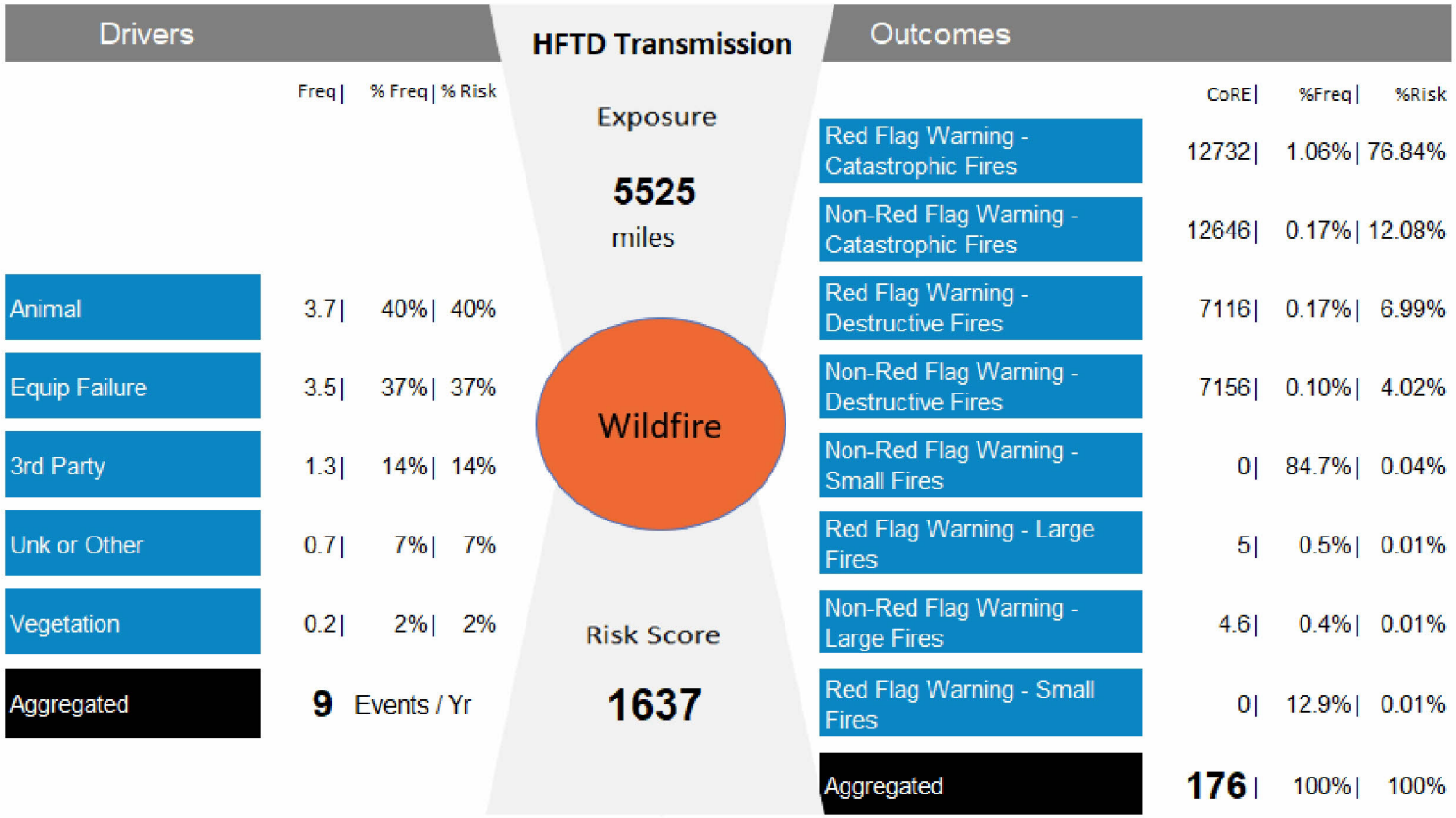


FIGURE PG&E-4.2-3: WILDFIRE RISK "BOWTIE" ANALYSIS (PG&E HFTD ONLY; TRANSMISSION VOLTAGE OVERHEAD CIRCUITS)



PG&E provides a summary below of the elements of the bowtie analyses in Figures PG&E-4.2-1, 4.2-2, and 4.2-3 above:

1. Drivers - Ignition Frequencies: Shown on the left of the visuals above, the current S-MAP conforming bowtie is derived from normalizing the ignitions by Transmission and Distribution overhead line miles of exposure reported annually to the CPUC. In accordance with D.14-02-015, PG&E annually reports to the CPUC fire incidents that may be associated with PG&E facilities and that meet the following conditions: (a) a self-propagating fire of material other than electrical and/or communication facilities; (b) the resulting fire traveled greater than one linear meter from the ignition point; and (c) PG&E has knowledge that the fire occurred. The S-MAP conforming model discussed in detail in PG&E's 2020 RAMP Report currently has ignitions reported to the CPUC for years 2015 through 2019. Though PG&E is still finalizing the 2020 reportable ignition data in preparation for our annual report, preliminary 2020 data is used in the model.[12]

2. Total Exposure: Shown in the center of the visuals above across all Tranches: 98,837 circuit miles of overhead Transmission and Distribution voltage conductor covering PG&E's service territory. Since the 2020 WMP and 2020 RAMP Report, PG&E has received feedback from WSD, Safety Policy Division (SPD), and various stakeholders that the level of tranching was not adequate to represent the risk profiles of PG&E's system. In response to this feedback, in the 2021 WMP, PG&E is introducing the 2021 Wildfire Distribution Risk Model, in combination of the requirements of S-MAP, to further delineate wildfire risk across PG&E's system at a more granular level, specifically with regard to electric distribution facilities. PG&E aggregated this circuit segments from the 2021 Wildfire Distribution Risk Model into circuit level granularity in HFTD areas. Aggregating to the circuit level better aligns with other construction, inspection, and maintenance programs across PG&E. In the cases of EVM and System Hardening, those major programs are assessed with even more granularity. Details regarding the 2021 Wildfire Distribution Risk Model are described in Section 4.5.1. PG&E is also currently developing a 2022 Wildfire Transmission Risk Model that will focus on electric transmission facilities.

3. Outcomes - Wildfire Consequences: There is a wide range of potential public safety risks resulting from a fire ignition associated with PG&E assets. In the overwhelming majority of cases, fire ignitions do not end up a large wildfire because they are extinguished quickly and/or do not propagate far. However, in some cases, ignitions can result in larger wildfires. PG&E uses fire incidents from

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12 PG&E's 2020 fire incident data will be submitted to the CPUC by April 1, 2021 per D.14-02-015. As such, PG&E's 2020 fire incident data report may contain data that has been revised from the data used in this risk analysis.

the California Department of Forestry and Fire Protection (CAL FIRE) database to estimate the safety and financial consequences of wildfire. For each fire incident, the CAL FIRE dataset provides the location, size, number of destroyed/damaged structures, and the number of fatalities/injuries. Reliability consequences are estimated by using distribution customer minutes for outages that were associated with CPUC reportable ignitions and known fires associated with those outages. PG&E is providing a more granular outcomes of consequences, as shown on the right side of the bowtie, on ignitions in terms of three variables:

a. The size/destructiveness of the fire that resulted from the ignition. PG&E's categorization of fire size is based on the following definitions:

- Catastrophic: A fire that destroys 100 or more structures and results in a serious injury and/or fatality.
- Destructive: A fire that destroys 100 or more structures but does not result in a serious injury or fatality.
- Large: A fire that burns 300 or more acres but does not meet the definition of a Destructive or Catastrophic fire.
- Small: A fire that burns fewer than 300 acres.

b. Whether the ignition took place on a day and in an area in which a RFW was in place or not. RFW is a forecast warning issued by the National Weather Service (NWS) in the United States to inform the public, firefighters, and land management agencies that conditions are ideal for wildland fire combustion and rapid spread.[13] The potential consequences of ignitions are higher when an RFW is in effect.[14]

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13 Precise temporal and spatial mapping analysis of RFW conditions is conducted by utilizing RFW GIS shapefiles from: https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml. (as of June 16, 2020).

In a February 19, 2020 letter to PG&E providing feedback on information that PG&E provided in workshops held on January 13, 2020 and February 4, 2020, TURN recommended that "for clarity" PG&E use "Fire Weather *Conditions* instead of *Warning*" when classifying outcomes. At the time of the workshop, PG&E used the term "Fire Weather Warning" to refer to elements of the NWS Red Flag Warning. PG&E's use of RFWs to categorize outcomes is appropriate because it is a simple, objective metric from a trusted third-party (NWS) that serves as a reasonable proxy for fire weather conditions.

14 PG&E's 2021 Wildfire Distribution Risk Model assumes that starting in 2023 the probability that an ignition occurs at a location and day that RFW is in effect will increase in 5-year increments based on the Cal-Adapt Wildfire Data.

c. For catastrophic fires, only, whether the catastrophic fire is associated with a seismic event.

(c) Wildfire Risk Assessment Compared With Other Safety and Reliability Risks

All Enterprise Risks on PG&E's Risk Register might have safety and reliability consequences. The consequences are modeled separately for each risk. In developing probabilities and consequences for wildfire risks, PG&E uses a mix of internal and external data to model wildfire drivers and consequences (safety and reliability impacts on the risk). Safety and Reliability consequences/attributes (per S-MAP terminology) are also modeled separately and combined into a risk score using the MAVF. PG&E's risk approach, including how wildfire risks and other non-wildfire safety and reliability risks are addressed, is discussed in more detail in Section 7.1.A.

(d) List and Description of "Known Local Conditions" as That Term is Used in GO 95, Rule 31.1

GO 95, Rule 31.1 directs PG&E to design, construct and maintain a facility in accordance with accepted good practice for the intended use and known local conditions. For the purposes of risk assessment, PG&E utilized HFTD and non-HFTD areas as its known local conditions. PG&E developed our S-MAP conforming bowtie for the wildfire risk by creating separate tranches for HFTD and non-HFTD areas. The higher risk scores and RSE values for mitigations in the HFTD areas enables a clear case for prioritization of wildfire mitigation initiatives in HFTD areas. For additional information on PG&E's evaluation of HFTD areas, including the development of our HFRA Map identifying risk areas beyond HFTDs, please see Section 4.2.1.

(e) Responses to RCP Actions

ACTION PGE-3 (Class A)

In its 2021 WMP update, PG&E shall describe how financial consequence and spend is weighted within the MAVF.

Response:

A summary of the weighting of financial consequences and spend is provided in Table PG&E-4.2-1 above. PG&E described how financial consequences and spend are weighted within MAVF in more detail in the 2020 RAMP Report, Chapter 3 Risk Modeling and Risk Spend Efficiency, page 3-4 through 3-18 (see Attachment 2021WMP_ClassA_Action-PGE-03_Atch01). An excerpt of the relevant portions from the 2020 RAMP Report, pp. 3-5 to 3-7 and 3-14 to 3-15, is provided below. The 2020 RAMP Report itself includes a much more detailed discussion of scaling, weighting and how the financial and spend consequence is factored into MAVF.

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Implementing MAVF Principle 1 – Attribute Hierarchy

Principle 1 requires that Utilities identify Attributes that are combined in a hierarchy such that the top level Attributes are categories and the lower level Attributes, or sub-Attributes, are observable and measurable.[15]

PG&E identified four Attributes: (1) Safety, (2) Electric Reliability, (3) Gas Reliability, and (4) Financial, each with one lower-level Attribute.

1) "Safety" has one lower-level observable and measurable attribute: EF.

2) "Electric Reliability" has one lower-level observable and measurable attribute: Customer Minutes Interrupted (CMI).

3) "Gas Reliability" has one lower-level observable and measurable attribute: Number of Customers Affected.

4) "Financial" has one lower-level attribute: U.S. Dollars. Pursuant to D.18-12-014 and D.16-08-018, shareholders' financial interests are excluded.[16]

Implementing MAVF Principle 2 – Measured Observations

MAVF Principle 2 requires that each lower-level Attribute have its own minimum and maximum range expressed in natural units that are observable during ordinary operations and as a CoRE.[17] Table PG&E-4.2-2 below summarizes PG&E's Attributes and associated ranges.

TABLE PG&E-4.2-2: STEP 1A, PRINCIPLE 2 – MEASURED OBSERVATIONS

Line No.	Attribute	Natural Unit of Attribute	Range
1	Safety	EFs	0 – 100
2	Electric Reliability	CMI	0 – 4 billion
3	Gas Reliability	Number of Customers Affected	0 – 750 thousand
4	Financial	Dollars	0 – 5 billion

The S-MAP Settlement Decision defines the low and high end of the Range of the Natural Unit to be a smallest and largest observable value from a risk event.[18] PG&E uses the term Upper Bound to denote the highest value in a Range. However, given the uncertainty in what the largest observable outcome of a risk event might be, PG&E

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15 D.18-12-014, Attachment A, p. A-5, No. 2.

16 D.18-12-014, p. 29, and D.16-08-018, p. 193, Conclusion of Law (COL) 37.

17 D.18-12-014, Attachment A, p. A-5, No. 3.

18 D.18-12-014, Attachment A, p. A-3.

defines the Ranges based on historical events and plausible high -consequence scenarios. PG&E defines each of the natural units of the Attribute as follows:

- An Equivalent Fatality is defined as the sum of Fatalities and Serious Injury Equivalents per event occurrence. Serious Injury is defined as an injury that requires in-patient hospitalization of an individual pursuant to existing Federal and State reporting guidelines.[19,20] Fatalities and Serious Injuries are converted to EFs using the factors shown in Table PG&E-4.2-3. The conversion rate from Serious Injury to EF is based on the disutility factors for Serious Injuries relative to Fatality available from Federal sources.[21] The Upper Bound of the Range for the Safety Attribute is based on EFs resulting from the Camp Fire rounded up to 100.

TABLE PG&E-4.2-3: EQUIVALENT FATALITY CONVERSION FACTORS SIMULATED FATALITY OR SERIOUS INJURY QUANTITIES

Line No.	Type	Equivalent Factor
1	Fatality	1.00
2	Serious Injury	0.25

- The Electric Reliability Upper Bound is based on the October 26-29, 2019 PSPS event consequence of approximately 3.6 billion CMI rounded up to 4 billion.
- The Gas Reliability Upper Bound is based on a scenario of an outage at a critical gas facility.
- The Upper Bound of the Financial Range represents a financial loss commensurate with a 2000-2001 Energy Crisis-type event. Costs related to recent wildfires were not used to set the Upper Bound because, pursuant to D.18-12-014, utility shareholders' financial interests are excluded from consideration.

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19 PHMSA § 191.3, Definitions: Incident. See also: <https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-facility-incident-report-criteria-history>, accessed June 25, 2020.

20 D.98-07-097, Appendix B, Accident Report Requirements, par. 3. See also, <https://www.cpuc.ca.gov/General.aspx?id=2090>, accessed June 22, 2020.

21 See FAA Office of Aviation Policy and Plans, Treatment of the Values of Life and Injury in Economic Analysis, p. 2-3, Table 2-3, Updated September 2016, accessed June 19, 2020, at: <https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/media/econ-value-section-2-tx-values.pdf>.

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Implementing MAVF Principle 6 – Relative Importance

MAVF Principle 6 states that each Attribute should be assigned a weight reflecting its importance relative to other Attributes defined in the MAVF.[22]

PG&E uses the Attribute Weights shown in Table PG&E-4.2-4.

TABLE PG&E-4.2-4: ATTRIBUTE WEIGHTS

Line No.	Attribute	Weight
1	Safety	50%
2	Electric Reliability	20%
3	Gas Reliability	5%
4	Financial	25%

PG&E assigned the Attribute Weights to reflect the relative importance of moving each Attribute from its least desirable level (i.e., Upper Bound) to its most desirable level (i.e., zero). For example, the Attribute Weights reflect PG&E's view that it is twice as valuable to move the Safety Attribute from 100 to 0 EFs as it is to move the Financial Attribute from $5 billion to $0. Assigning 50 percent weight to the Safety Attribute is in line with PG&E's emphasis on safety and is also consistent with the S-MAP Settlement Decision's requirement for a minimum 40 percent weighting for Safety.[23]

ACTION PGE-4 (Class A)

In its 2021 WMP update, PG&E shall submit a table describing its risk assessment techniques used for each initiative in the format used by SCE. [See SCE RCP at 9]

Response:

PG&E has included a table describing the risk assessment techniques used for each initiative into Table 12 in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx.

ACTION PGE-6 (Class A)

In its 2021 WMP update, PG&E shall provide a timeline that shows when it expects each individual *initiative in its WMP to be incorporated into its risk modeling.*

Response:

PG&E has included a timeline for incorporation of WMP initiatives into risk modeling for initiatives impacted by risk model located in Table 12 in Attachment 1 – All Data Tables

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22 D.18-12-014, Attachment A, p. A-6, No. 7.

23 D.18-12-014, p. 66, COL 5.

PGE-DIXIE-NDCAL-000004449

Required by 2021 WMP Guidelines.xlsx. Specifically, these are initiatives for which the proposed mitigations will be largely determined by insights from wildfire risk models.

ACTION PGE-1 (Class B):
1) further describe why either ignition risk and wildfire consequence risk is calculated instead of calculating both, and

2) provide an explanation for each initiative as to why it either reduces ignition risk or wildfire consequence risk, but not both.

Response:

1) For each initiative, PG&E identified if the activity reduces ignition risk or wildfire consequence risk. PG&E considers ignition risk as the likelihood of a risk event (LoRE) and wildfire consequence risk as the consequence of a risk event (CoRE). Once this is determined, the overall wildfire risk is calculated by multiplying LoRE x CoRE. For each initiative, PG&E takes the difference between the baseline wildfire risk and the mitigated wildfire risk to quantify the risk reduction.

2) Explanation for initiatives determining reduction in ignition risk or wildfire consequence risk will be provided in Feb. 26 submission.

ACTION PGE-4 (Class B)

1) Clarify what is meant by "the likelihood of a large 300-acre fire of exponentially spreading and becoming catastrophic or destructive is closer to 70 percent";
2) Provide the percentage of ignitions that lead to fires greater than 300-acres;
3) Explain why PG&E finds 300-acres to be of significant value;
4) Define what PG&E's understanding of "catastrophic" fire is in the context of less than 1 percent of ignitions leading to a catastrophic fire; and
5) Provide the percent of ignitions that lead to catastrophic fires during Red Flag Warning (RFW) conditions.

Response:

1. PG&E wrote in the First Quarterly Report that "the likelihood of a large 300-acre fire of exponentially spreading and becoming catastrophic or destructive is closer to 70 percent, especially during Red Flag Warning (RFW) conditions." This meant that during RFW conditions, there is approximately a 70 percent chance that a large wildfire (*i.e.*, 300 acres or greater) started with an ignition involving PG&E's electric equipments in an HFTD area results in destroying 100 or more structures.
2. Out of ignitions reviewed from 2015-2019 related to PG&E's electric equipment, the percentage of ignitions that lead to fires greater than 300 acres was 0.9 percent.
3. The Annual CALFIRE Redbook provides incident data for Large Fires 300 Acres and Greater. This data includes the number of structures destroyed and the number of fatalities. PG&E used this dataset to model the consequences of a large fire because this dataset includes more incidences of large fires (283 large fires for PG&E's Territory for 2015-2019) than wildfires caused by PG&E's

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ignitions. Thus, this became a natural breakpoint on analysis of consequence of an ignition.

4. For the purpose of risk analysis, PG&E defines "catastrophic fires" as fires 300 acres or greater that result in 100 or more structures destroyed and one or more fatalities.
5. Out of the 2,200 ignitions from 2015-2019 reviewed, there were 131 ignitions during RFW conditions, and 5 out of the 131 ignitions fell into this "catastrophic" category. Thus, the percent of ignitions that lead to catastrophic fires during RFW conditions was approximately 4 percent.

ACTION PGE-5 (Class B)

1) Provide in-depth explanations as to how a failure rate of 70 percent for Priority A tags, 50 percent for Priority B tags, and 1 percent for Priority E and F tags was calculated.

2) Provide an in-depth explanation as to how a power-line failure rate from vegetation of 70 percent was calculated.

3) Describe the SMEs used to determine such failure rates.

4) Implement industry standard and best practices into determining such failure rates, or describe how such have been implemented.

Response:

1. In order to estimate the benefits of performing a control that PG&E has historically undertaken (e.g., operations and maintenance), we proposed using the tag severity as a way to estimate the probability of a failure if left unaddressed.

   Given that, when an asset is identified with a Priority A tag, those tags are expected to be fixed immediately or at least made safe and a repair scheduled within 30 days. The expectation here is that if something is marked as a Priority A, it is unlikely to last through a Priority B tag, which is to be addressed within 90 days. Using that assumption, PG&E estimated that something that is tagged with Priority A is expected to fail between the duration of correction between an A and a B tag, or between 30-90 days. As such, a Priority A tag is estimated to fail within 60 days. To annualize this, PG&E estimates that there is a 1.0 – (60/365) = ~84 percent chance of failure. This was conservatively reduced to 70 percent after review with the PG&E team.

   When an asset is identified with a Priority B tag, those tags are expected to be fixed within 90 days. The expectation here is that if something is marked as a Priority B, it is unlikely to last through a Priority E tag, which is to be addressed within 1 year. Using that assumption, PG&E estimated that something that is tagged with Priority B is expected to fail between the duration of correction between an B and a E tag, or between 90-365 days. As such, a Priority B tag is estimated to fail within 227.5 days. To annualize this, PG&E estimates that there is a 1.0 – (227.5/365) = ~38 percent chance of failure. This was adjusted to 50 percent after review with the PG&E team.

When an asset is identified with a Priority E tag, those tags are expected to be fixed within 1 year. The expectation here is that if something is marked as a Priority E, it is unlikely to last through a Priority F tag, which is to be addressed within 5 year. Using that assumption, PG&E estimated that something that is tagged with Priority E is expected to fail between the duration of correction between an E and a F tag, or between 1-5 years. As such, a Priority E tag is estimated to fail within 2.5 years. However, at the time of the filing, because of the influx of Priority E and F tags identified on the system, and that assets in HFTD areas get inspected or re-assessed more frequently, PG&E set the probability to 1 percent to acknowledge the existence of the tags but not overstate their impacts, as those Priority E & F tags are monitored consistently.

2. We found it challenging to estimate what might occur if we were not performing controlled activities. Specifically with vegetation, PG&E performs maintenance on significant amounts of trees in our system territory, and still vegetation is the largest driver to ignitions in HFTD. With no basis for proving the counter-factual, PG&E used the same estimation as with assets and inspections to ensure consistency across how tags are utilized. In reviewing the 70 percent assumption, PG&E had to weigh how vegetation compared against asset failure. When assets fail, it can create sparks that could ignite. Similarly, unmaintained vegetation coming into contact with PG&E equipment provides fuel for ignitions to occur. PG&E did not have better data to challenge the 70 percent assumption to be higher or lower, and ultimately, maintained this for consistency.

3. SMEs used to approximate the failure rates include members of Risk Management, Asset Strategy, Inspection, and the Vegetation organization.

4. PG&E is engaged in various wildfire best practice forums to discuss ways to perform better estimations. PG&E continues to benchmark practices with other California utilities and is also engaged in working groups as part of the International Wildfire Risk Management Consortium.

ACTION PGE-15 (Class B)

1) Describe why it used a linear relationship between probability of fire type and time passed

2) Provide supporting materials showing a linear relationship.

Response:

1. PG&E used a linear relationship to be conservative as it relates to the probability of fire type to time passed. Because PG&E only had fire simulation data for 2-hour and 8-hour spread, despite expecting the relationship to be exponential, PG&E used a linear relationship as a conservative estimate as a stated assumption.

2. Attached is the 'Technosylva Fire Probability' dataset (See Attachment 2021WMP_ClassB_Action-PGE-15_Atch01), which includes the outputs of the probability of small, large, and destructive based on an 8 hour and 2 hour spread.

Summarized in a table is the probability of a small, large, and destructive probabilities between the 2 time frames.

PGE-DIXIE-NDCAL-000004453

4.2.A. Contribution of Weather to Ignition Probability and Estimated Wildfire Consequences

A) Describe how the utility monitors and accounts for the contribution of weather to ignition probability and estimated wildfire consequence in its decision-making, including describing any utility-generated Fire Potential Index or other measure (including input variables, equations, the scale or rating system, an explanation of how uncertainties are accounted for, an explanation of how this index is used to inform operational decisions, and an explanation of how trends in index ratings impact medium-term decisions such as maintenance and longer-term decisions such as capital investments, etc.).

This section describes the teams, tools and models PG&E has deployed to assess the contribution of weather to wildfire risk. In order to understand the real-time to short-term weather and fire risk (hour to week ahead), PG&E's meteorology department utilizes real-time weather station data and weather model data from multiple models. These weather model data are utilized to drive dead fuel moisture (DFM) and live fuel moisture (LFM) models, which ultimately feed together into PG&E's Fire Potential Index (Utility FPI or FPI) Model and Outage Producing Winds (OPW) Model to inform PSPS. For longer-term decisions such as grid-hardening, PG&E utilizes climatological weather datasets and fire spread simulations across a range of historical fire weather days to inform investment decisions where the risk is highest over the long-term.

PG&E's Meteorology team is comprised of 15 scientists, most with advanced degrees in scientific fields with diverse backgrounds in operational meteorology, utility meteorology, outage prediction, fire science, data science, cloud computing, atmospheric modeling, application development and data systems development. The team is comprised of alumni from the San Jose State University (SJSU) Fire Weather Research Laboratory (https://www.fireweather.org/), former wildland firefighters, former NWS forecasters, and Veterans of the Marine Corps and United States Air Force.

The remainder of this section includes the following subsections:

- Subsection (a): Weather considerations for PSPS events generally;
- Subsection (b): Operational weather forecasting models and climatological datasets informing PSPS;
- Subsection (c): The weather analysis contributing to PSPS events on the distribution system;
- Subsection (d): Determination of the minimum fire potential conditions;
- Subsection (e): Utility Fire Potential Index Model;
- Subsection (f): Outage Producing Winds Model;
- Subsection (g): Black swan conditions;
- Subsection (h): The weather analysis contributing to PSPS events on the transmission system;

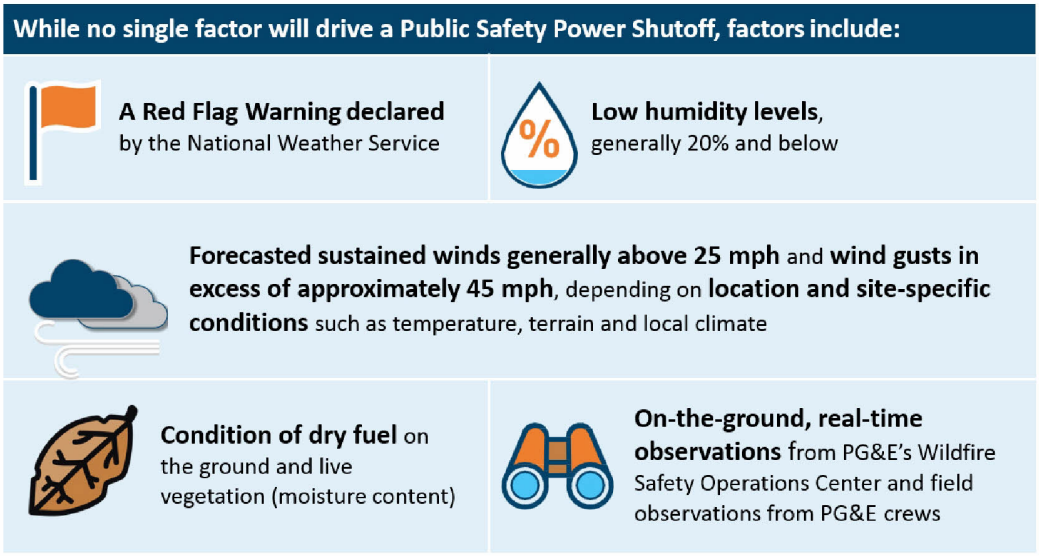
- Subsection (i): Development and use of climatology data;
- Subsection (j): Long-term risk assessment and weather input into models; and,
- Subsection (k): Responses to Actions identified in WSD's evaluation of PG&E's Remedial Compliance Plan (Action PGE-5 (Class A)).

(a) Weather Considerations for PSPS Events Generally

No single factor drives the determination that a PSPS is necessary, as each situation is dynamic and unique. The main drivers of PSPS are described below, but PG&E also carefully reviews external forecast information from the NWS (i.e., Red Flag Warnings), the Northern and Southern Geographic Area Coordination Centers (GACC) and the National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center to ultimately decide to de-energize portions of the grid for public safety. In the days leading up to a PSPS event, PG&E Meteorologists participate on interagency conference calls hosted by either the Northern or Southern CA GACC where NWS meteorologists and GACC meteorologists discuss their forecast of upcoming events. PG&E greatly appreciates this collaboration and the opportunity to coordinate with external and independent forecast agencies on upcoming risk periods.

The general conditions that are present during PSPS events are presented in Figure PG&E-4.2-4.

FIGURE PG&E-4.2-4: GENERAL PSPS CONDITIONS



As will be discussed in more detail below, PG&E's relies on our Large Fire Probability Models for distribution and transmission for every PSPS assessment. However, in addition to these models, PG&E carefully reviews an array of available data and federal forecast information to verify that multiple authorities recognize an upcoming or imminent period of risk:

- On-the-ground observations from field observers

- Red Flag Warnings from the NWS
- High Risk forecasts of Significant Fire Potential from the GACC
- Fire weather outlooks from the Storm Prediction Center (SPC), which is part of the NWS
- The California Weather Threat Briefing provided to California Office of Emergency Services (Cal OES) by the NWS Western Region, Regional Operations Center

(b) Operational Weather Forecast Models and Climatological Datasets Informing PSPS

Before discussing the methodology that PG&E utilizes for PSPS, it is important to have a better understanding of operational weather forecast models and climatological datasets. PG&E leverages multiple external and internal numerical weather models in each PSPS assessment. One of the primary drivers is output from the PG&E Operational Mesoscale Modeling System (POMMS), which is a version of the National Center for Atmospheric Research-Weather Research and Forecasting Model. This model provides weather forecast data (e.g., wind, temperature, relative humidity) at 2 x 2 km model resolution out 105 hours and is updated four times each day. This modeling framework provides forecast data for >45,000 model "grid points" across PG&E's service territory. These "grid-points" can be thought of like virtual weather stations where data can be extracted. PG&E also coupled Live Fuel and Dead Fuel Models into POMMS, to provide dead and live fuel moisture forecasts across the same 2 x 2 km model domain for PSPS assessments. A more detailed discussion of PG&E's numerical weather and fuels systems can be found in Section 7.3.2.

PG&E utilized the same weather model configuration to produce a 30-year, hour-by-hour historical weather and fuels climatology also at 2 x 2 km resolution. This climatology provides over 45,000 "grid points" in the same domain as the forecast model where historical data can be extracted each hour going back 30 years. This is a powerful dataset that was combined with historical outages and fires to better understand the meteorological and fuel moisture levels that contribute to large fires.

(c) Analysis of Weather Contribution for Distribution PSPS Events

PG&E evaluates the risk for a catastrophic fire caused by PG&E distribution equipment as the probability of an outage leading to an ignition combined with the consequence or growth potential of a resulting fire. There are three key inputs of PG&E's meteorological and fuels analysis to determine PSPS criteria on the distribution system:

- Minimum Fire Potential Conditions being met
- PG&E's Distribution Large Fire Probability Model (LFP_D) comprised of the following:
    - OPW Model
    - Utility FPI Model
- Distribution "Black Swan" criteria

The minimum Fire Potential Conditions are a weather and fuels filter based on relative humidity values and fuel moisture values that must be exceeded for PSPS to be

considered. These values were established from an examination of historical fire occurrence in PG&E's territory as well as information published by federal agencies regarding fire behavior and criteria used to issue warnings to the public. The exact criteria used in the minimum fire potential conditions are described later in this section.

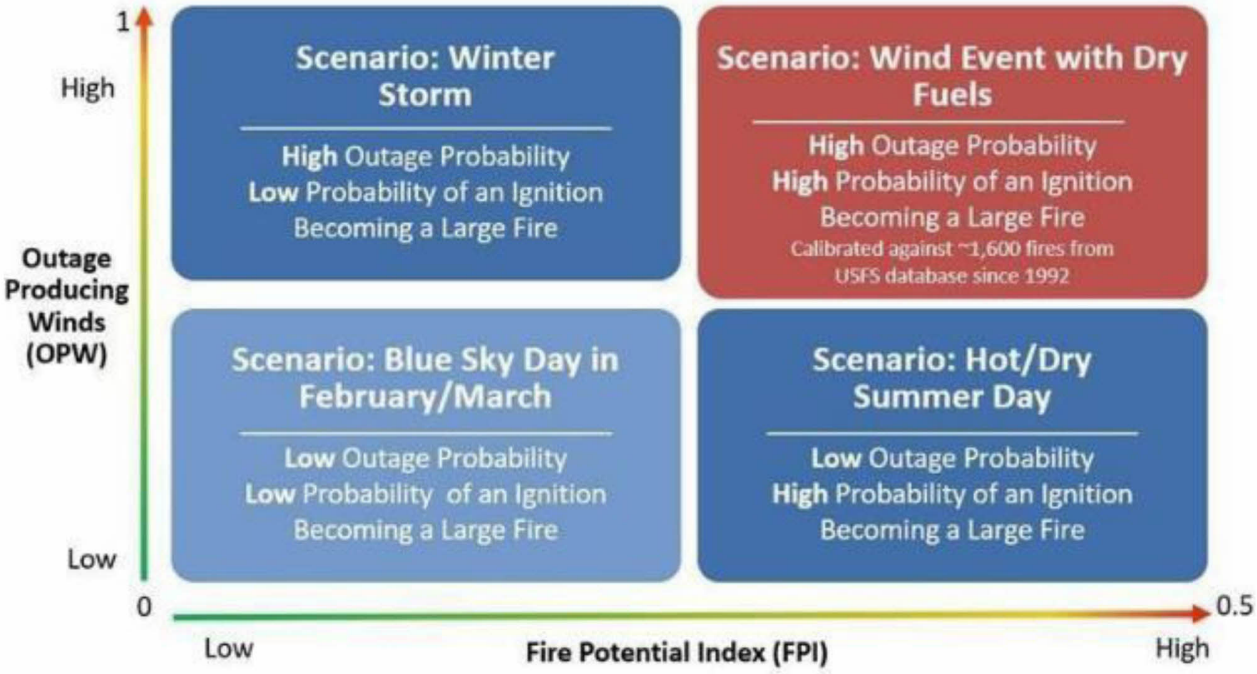
Once the minimum Fire Potential Conditions are met, PG&E then considers the output from the LFP_D Model on the distribution system. The LFP_D Model is a product of the OPW and Utility FPI Models, which are combined in both space and time. The LFP_D is given by the equation below.

$$LFP_D = OPW * FPI$$

The LFP_D Model provides hourly output for each grid cell in PG&E's weather model domain (>45,000 cells in the PG&E territory) and highlights locations that have concurrence of an increased probability for large fires and increased probability of wind-related outages on PG&E's distribution system. The LFP_D Model was backcast through PG&E's 30-year climatology to establish a guidance value for PSPS. The goal of this analysis was to ensure large fires of the past would have been identified by LFP_D Model while balancing customer impacts by limiting PSPS events to the extent possible. This involved evaluating the LFP_D for large wind-driven fires in the past to ensure events such as the 2017 Northern California Fires and 2018 Camp fire would be identified by the guidance, as well as determining the annual number and size of PSPS events that would have occurred in the past using the established guidance value.

Figure PG&E-4.2-5 below represents the conceptual risk framework of how OPW and Utility FPI Models are used to forecast PSPS events for distribution facilities. For example, PSPS is considered when there is concurrence of high FPI and high OPW in space and time, which represents locations that have a high wind-related outage probability and high probability of large fires.

FIGURE PG&E-4.2-5: FIRE RISK MODEL INTERACTION: OUTAGE PRODUCING WINDS AND FIRE POTENTIAL INDEX



In addition to LFP_D, PG&E also evaluates areas that meet our "Black Swan" criteria. These are areas that have a low likelihood of observing an outage, but critical conditions that may lead to explosive wildfire growth. The Black Swan criteria are described in more detail in Subsection (g) below.

(d) Minimum Fire Potential Conditions

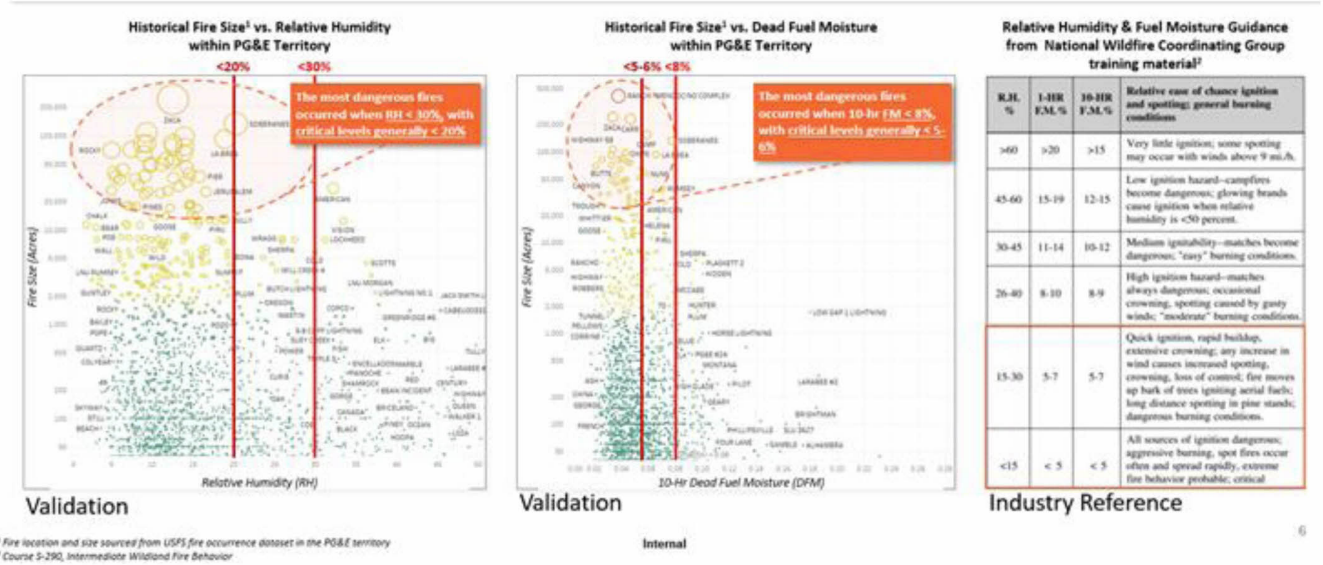
The first step in determining the scope of a PSPS event is evaluating the minimum Fire Potential Conditions in space and time. This serves as a weather and fuels filter based on relative humidity values and fuel moisture values that must be met for PSPS to be considered. The values utilized were established from an examination of historical fire occurrence in PG&E's territory in relation to the weather and fuel conditions during each fire, as well as Fire Danger information published by federal agencies.

PG&E first conducted a review of National Wildfire Coordinating Group (NWCG) training material and next completed an analysis of all large fires in the PG&E territory from 1992 - 2018 to determine the minimum fire potential conditions that must be met before PSPS is considered. The fire information was sourced from a United States Forest Service (USFS) fire occurrence database, while weather and fuels information were sourced from PG&E's 30-year climatology (discussed in more detail below).

Figure PG&E-4.2-6 below represents some of the agency training material and validation that was performed by PG&E. For each fire in the USFS database, the weather and fuel moisture data were extracted from PG&E's 30-year climatology in space and time. A review of past fires revealed, for example, that fires that eventually grow larger than 10,000 acres most often occur when Relative Humidity (RH) is less than 30 percent and the 10-hour DFM is less than 8 percent. This aligns with training

material in NWCG material offered in course S-290 (Intermediate Wildland Fire Behavior), where RH and DFM values above 25% and 8%, respectively, would produce "moderate" burning conditions whereas drier conditions would be more dangerous.

FIGURE PG&E-4.2-6: AGENCY TRAINING MATERIALS AND PG&E VALIDATION



Similar analyses were conducted on the 100 hour and 1,000-hour DFM time-lagged classes to determine when large fires most often occur. For example, there is very low historical precedence based on this analysis for large fires to occur when the 1000-hour DFM is greater than 14 percent.

Another important element considered in the minimum fire potential conditions is wind speeds. PG&E recognizes that PSPS events should not be conducted when gusty winds are not present even though the FPI may be high due to hot and very dry weather alone. To establish a minimum wind speed value, PG&E first reviewed RFW guidance from the NWS. A Red Flag Warning means warm temperatures, very low humidity, and stronger winds are expected to combine to produce an increased risk of fire danger. Many NWS offices have developed their own RFW criteria and most offices consider wind speed when issuing an RFW. Some NWS offices consider wind gusts over 35 mph, while others utilize a minimum sustained wind from 15-25 mph, while others use a matrix approach dependent on the combination of RH and wind speed.

The Northern CA GACC, a federal forecast agency, was also consulted about wind speed criteria used to generate high-risk forecasts for winds. High Risk Days are issued by the GACCs when fuel and weather conditions are predicted that historically have resulted in a significantly higher than normal chance for a new large fire or for significant growth on existing fires. Based on personal communications with GACC fire weather meteorologists, wind speed criteria generally range from 30-40 mph gusts depending on RH and fuel moisture values associated with an event.

The NOAA Storm Prediction Center is another federal forecast agency that generates fire weather outlooks (https://www.spc.noaa.gov/products/fire_wx/). The SPC is

responsible for forecasting meteorological conditions which, when combined with the antecedent fuel conditions, favor rapid growth and spread of a fire should an ignition occur.

The SPC issues three categorical risk areas to highlight fire weather threats in their fire weather outlooks: elevated, critical, or extremely critical for temperature, wind and RH. Two other forecast categories are also used to address dry thunderstorms.

The SPC guidance for critical areas is as follows:

- Dry Fuels
- Sustained winds 20 mph or greater
- Relative humidity at or below regional thresholds (<15% in CA)
- Temperatures at or above 50-60 degrees F, depending on the season
- Concurrency of the above criteria for 3 hours or more

The SPC extremely critical guidance contains more stringent criteria such as sustained wind speeds 30 mph and greater, for example.

To generally align with federal forecast agency forecasts of high fire risk, a forecast wind speed value of 20 mph sustained is utilized in the minimum fire potential conditions PG&E considers. A summary of minimum fire potential conditions is shown in Table PG&E-4.2-5 below. Identification of these conditions in space and time is the first step when determining a PSPS event. Additional outage potential, fire potential, and Black Swan criteria are then utilized to determine the ultimate scope of a PSPS event, which is discussed later in this section.

TABLE PG&E-4.2-5: MINIMUM FIRE POTENTIAL CONDITIONS

Logic	Variable	Sign	Value
&	Fire Potential Index (FPI)	>	0.2
&	Sustained Wind Speed mph	>	20
&	Dead Fuel Moisture (DFM) 10hr	<	8%
&	Dead Fuel Moisture (DFM) 100hr	<	10%
&	Dead Fuel Moisture (DFM) 1000hr	<	14%
&	Relative Humidity (RH)	<	30%

(e) The Utility Fire Potential Index

PG&E developed and calibrated the Utility FPI Model using our 30-year climatology dataset combined with a USFS fire occurrence dataset in the PG&E territory. The Utility FPI Model is considered in PG&E's models for potential distribution and transmission PSPS events and is also used to evaluate field work to help mitigate fire ignitions. The Utility FPI Model combines several factors including a fire weather index (wind, temperature, and humidity) with fuel moisture data (10-hour dead fuel moisture and live fuel moistures), and landcover type (grass, shrub/brush, or forest).

The Utility FPI Model is a logistic regression model and is related to the probability of a small fire becoming a large fire. The Utility FPI Model forecast describes the potential for fires to spread rated on a scale from "R1" (lowest) to "R5" (highest). The Utility FPI Model is run at 2 x 2 km resolution and provides hourly forecasts out four days. Fire Danger forecasts from the federal National Fire Danger Rating System available at WFAS.net, provide a day ahead forecast only; thus, the ability to model the FPI multiple days ahead allows PG&E to communicate the stakeholders and customers that a PSPS may be needed.

(f) The Outage Producing Winds Model

In 2020, PG&E revised our OPW Model. The revised version represents the next generation distribution outage model building on the 2019 OPW model. The OPW Model was built from the ground up and is focused on supporting mitigation of utility caused wildfire risk through PG&E's PSPS program and other wildfire risk mitigation programs.

The OPW Model is based on an analysis of windspeeds from PG&E's 30-year weather climatology and approximately 400,000 sustained and momentary outages occurring on distribution grid from 2008 to 2020. Damages and hazards from PG&E's 2019 PSPS events were also included in the training set. Excluded from the outage data are outages due to snow, rain and lightning, and outages due to non-weather driven major events such as fires and earthquakes.

The OPW Model forecasts the probability of unplanned outages associated with wind events occurring in PG&E's service area. The output of the OPW Model is a measure of the probability of an outage in specific parts of PG&E's service territory based on forecasted wind speed. The OPW Model is driven by PG&E's high-resolution weather modeling output, POMMS, at both 2 km and 3 km resolution. Outage producing winds are forecast four times per day with the hourly outage probabilities for each grid cell with a forecast horizon of 84 hours ahead for the 3 km resolution, and 105 hours ahead for 2 km resolution. These winds vary across PG&E's system based on differences in topography, vegetation and climatological weather exposure in different parts of PG&E's service territory.

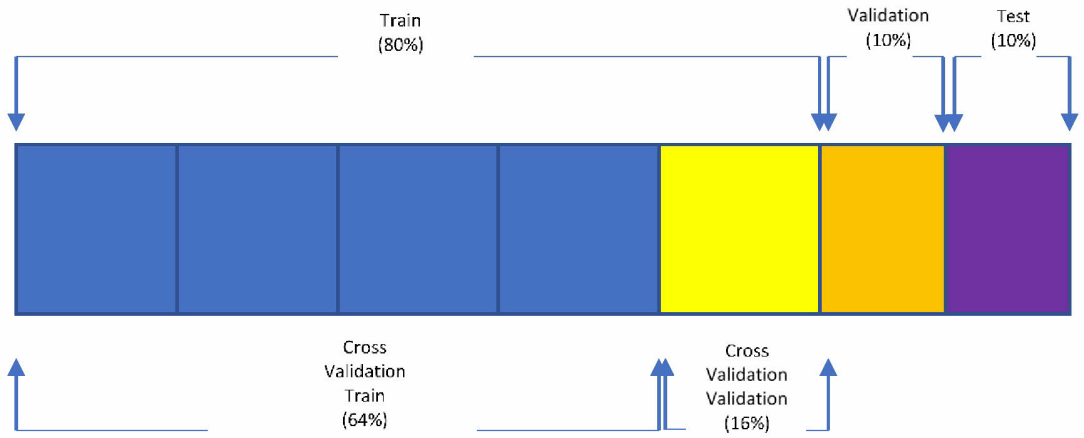
Outage nodes are created to relate historical outages to nodes, and then the nodes to POMMS grid cells. The geographic area of a node is as a function of distribution line mile density. Spatially contiguous nodes of similar line miles per node were created using a genetic growth algorithm. Approximately 23,000 logistic functions are fit for each of the node-cell pairs, to the observations of windspeeds in that cell, and whether an outage was observed on the node. The OPW of the node is then the mean of the OPW of the node-cell models for that node. This approach is referred to as Multiple Instance Learning in the literature and performs well where the labels of the grid cells (instances) is not well known, but the labels of the outage nodes (bags) is well known, while retaining information from the cells, i.e., the windspeeds. The outage-node-cell relation allows wind-outage relationships to be learned for localized areas, and outage probabilities to be compared across the territory.

Alternative OPW Model formulations were evaluated, including circuit level models, and circuit-cell level models. Due to the high variability of lengths of PG&E's approximately

3,300 circuits, these models were found to be less granular for the longer circuits which are spreading the weather information over too large of an area, and too small for the shorter circuits, with insufficient observation of outages to train the model.

There were between 27 to 1029 outages over the 13 years per node for training the model, with a mean of 261 outages per node. The nodes are an imbalanced classification problem, with a mean Positive Class Fraction of 0.25 percent.

FIGURE PG&E-4.2-7: TRAIN-VALIDATION-TEST SETS



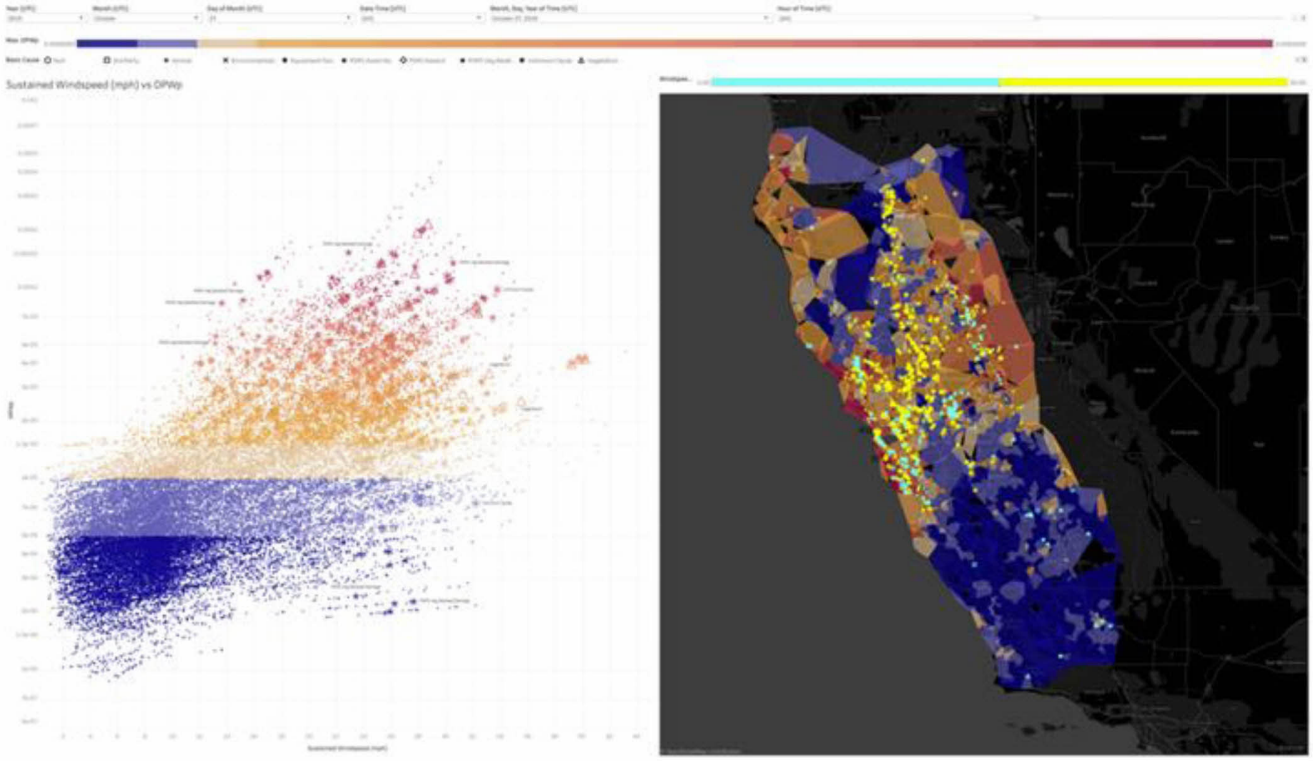
The statistical evaluation metrics of Average precision divided by Positive Class Fraction and Area under the Receiver Operating characteristic curve are calculated using the models training on the training sets and evaluated on the validation set as shown in Figure PG&E-4.2-7 above. The test split is withheld for potential future model selection. Average precision summarizes the precision-recall curve as the weighted mean of precisions achieved at each discrimination threshold with the increase in recall from the previous threshold used as the weight. Positive Class Fraction is the fraction of positive class labels out of all labels. Average precision divided by Positive Class Fraction, has an average across the nodes of 7.4. For reference, a naïve model will an Average Precision divided by Positive Class Fraction of 1. The Receiver Operating Characteristic (ROC) curve plots the true positive rate against the false positive rate for each discrimination threshold. The area under the ROC curve, has an average across the nodes of 0.57. For reference, a naïve model will have an area under the ROC curve of 0.5.

A positive correlation is observed between positive class fraction and model performance indicating greater imbalance nodes are more difficult to predict. Tier 2 and Tier 3 HFTDs observe stronger model performance with stronger relationships of outages to windspeeds given typically higher vegetation risk. The San Joaquin Valley Tier 1 area is of note with high class imbalance, weaker relations of outages to windspeeds, and thus weaker model performance.

In order to further evaluate model skill before operational implementation for PSPS, an interactive dashboard was created to visualize and analyze the actual outages versus

OPW hour-by-hour for over 300 high impact historical weather days for subject matter expert review. Operational meteorologists used the dashboard to evaluate model performance against key historical storm events by evaluating the timing of weather onset compared to modeled outage probability increases, and relative magnitude of outage probabilities against actual outage data. Figure PG&E-4.2-8 below represents a snapshot of the OPW dashboard.

FIGURE PG&E-4.2-8: SNAPSHOT OF OPW DASHBOARD



(g) Black Swan Conditions

In 2020, PG&E introduced an evaluation of Black Swan conditions to review low probability, high consequence events. The inclusion of Black Swan Guidance allows PG&E to identify lines that may show, for example, low wind-related outage probability but may experience conditions that have been present in some past, catastrophic fire incidents. This allows a pass at capturing outage and potential ignition events that are much rarer. These potential outage pathways include animal contacts, third party contacts, foreign debris contacting lines (e.g., metallic balloons), etc. A review of 2020 CPUC-reportable fire ignitions originating from PG&E assets showed that approximately one-third of ignitions were caused by third-party or animal contact with PG&E assets.

The guidance values utilized for Black Swan are presented in Table PG&E-4.2-6 below. If these conditions are forecast, the distribution line is considered for PSPS under Black Swan regardless of LFP_D. These utilize the same fuel dryness factors aside from the sustained wind speed, RH and FPI. The 30-mph sustained wind speed was chosen as it aligns with the SPC wind-speed classification of "Extremely-Critical" conditions

employed in their categorical risk assessment. In the future, PG&E may also consider fire spread consequence output as part of our Black Swan Guidance.

The SPC guidance for Extremely-Critical areas are as follows:

- Very Dry Fuels
- Sustained winds 30 mph or greater
- Relative humidity at or below 1/3 lower than regional thresholds
- Temperatures at or above 60-70 degrees F, depending on the season
- Concurrency of the above criteria for three hours or more

Table PG&E-4.2-6 below provides further information regarding the values for black swan conditions on PG&E's distribution system.

TABLE PG&E-4.2-6: PG&E DISTRIBUTION BLACK SWAN CONDITIONS

Logic	Variable	Sign	Value
&	Fire Potential Index (FPI)	>	0.3
&	Sustained Wind Speed mph	>	30
&	Dead Fuel Moisture (DFM) 10hr	<	8%
&	Dead Fuel Moisture (DFM) 100hr	<	10%
&	Dead Fuel Moisture (DFM) 1000hr	<	14%
&	Relative Humidity (RH)	<	20%

(h) Analysis of Weather Contribution for Transmission PSPS Events

There are three key inputs of PG&E's meteorological analysis to determine PSPS criteria on the Transmission system:

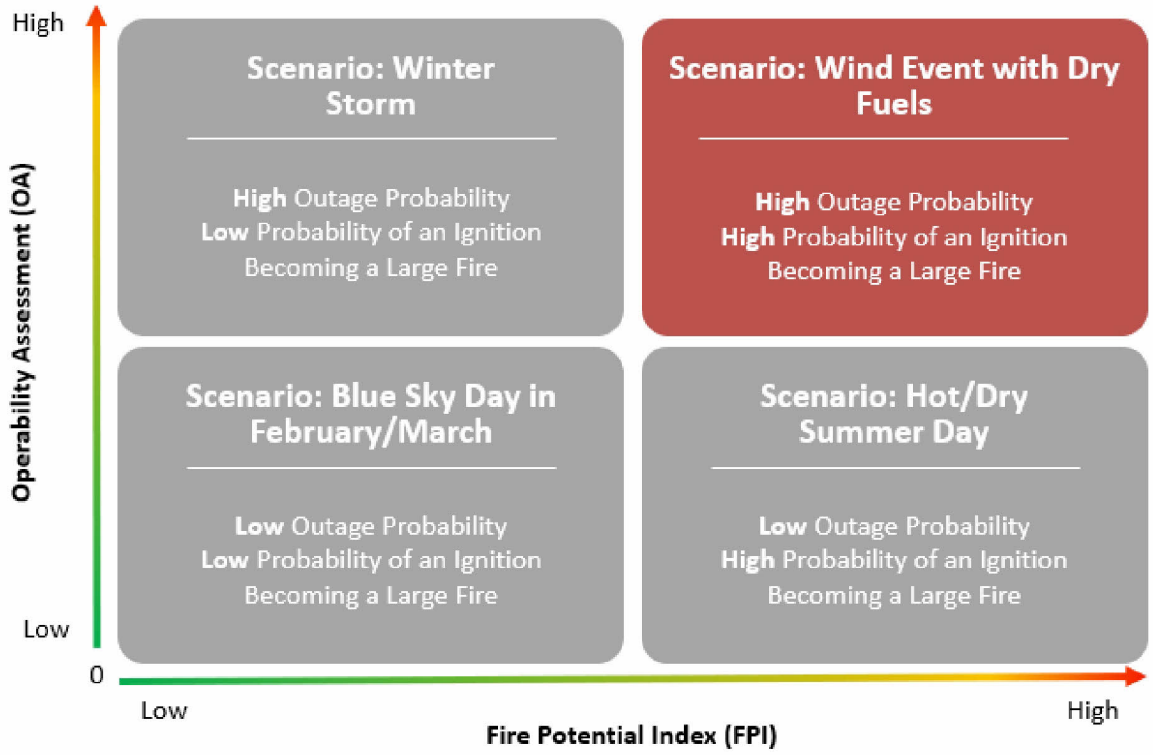
- Minimum Fire Potential Conditions
- PG&E's Transmission Large Fire Probability Model (LFP_T) comprised of the following:
  - Transmission Operability Assessment Model (OA Model)
  - Utility FPI Model
- Transmission "Black Swan" criteria

For transmission, the same general risk framework is utilized as is used for distribution (see Figure PG&E-4.2-9 below); however, the distribution OPW Model is replaced with the OA Model, which provides a forecasted probability of failure for each transmission structure. The OA Model and Utility FPI Model are combined in both space and time to form PG&E's Transmission Large Fire Probability model (LFP_T), which is presented below:

$$LFP_T = OA * FPI$$

Figure PG&E-4.2-9 below represents the conceptual risk framework of how the OA Model and the Utility FPI Model are used to forecast PSPS events for transmission facilities.

FIGURE PG&E-4.2-9: FIRE RISK MODEL INTERACTION: OPERABILITY ASSESSMENT AND FIRE POTENTIAL INDEX



PG&E partnered with a third party to develop the OA Model for transmission. This model combines historical wind speeds for each structure, historical outage activity, and the condition of assets based on inspection programs to help understand the wind-related failure probability of each structure. The OA Model can be driven with forecast wind speeds to output the probability of failure at the structure level each hour.

(i) PG&E's Development and Use of Climatology Data

Working with external experts, PG&E Meteorology improved our operational weather model and historical datasets in 2020 by increasing the model granularity from 3 x 3 km to 2 x 2 km, and creating a new 30-year weather, dead fuel and live fuel moisture climatology at 2 x 2 km resolution. This hourly climatology provides data from ~45,000 grid points across the PG&E territory. These grid points can be thought of like virtual weather stations where data can be extracted from each point for any hour over the past 30 years. The variables included in this climatology are weather outputs (wind speed, temperature, relative humidity, precipitation, etc.), dead fuel moisture for the 1-, 10, 100, 1000-hour dead fuels, and live fuel moisture for chamise and manzanita plant species.

This is a valuable and sizable dataset. For example, there are ~12 billion data points for a single variable (e.g., wind speed) available in the climatology (45,000 grid points * 30 years * 8,760 hours/year). The actual data size is much larger as PG&E's modeling domain extends well beyond the bounds of the PG&E territory. All told, the PG&E weather and fuels climatology contains more than 100 billion data points that can be extracted in space and time across the past 30 years in the PG&E territory.

In order to process these large datasets and run climatological analyses, dedicated infrastructure was built in the Amazon Web Services (AWS) cloud to store these datasets and spin up computational resources on-demand to perform numerous studies with these climatology datasets.

To build the OPW and Utility FPI Models, data were extracted from the climatology at the nearest virtual weather station (i.e., grid point) at the time the fire or outage incident occurred. This data was then used to develop the OPW and Utility FPI models. Once the models were developed, they are then operationalized in the forecast model to provide a 4-day look ahead at the weather, the probability of wind-caused outages, and the probability of large fires. When constructing models for PSPS, PG&E was able to reconstruct our LFP Models through the climatology so that large, catastrophic fires in the past would have been captured by the model, while also looking at the number of times per year and on average, customers would be impacted during a PSPS event.

With this climatology, other studies can be performed to determine where offshore winds events and PSPS events are most often expected to occur. These offshore wind events are commonly known as Diablo or Santa Ana wind events. The Diablo wind is a dry, northeast wind that occurs over northern California. These events are critical to consider as the vast majority of destructive fires in California history have occurred during dry, offshore wind events. Figure PG&E-4.2-10 below presents the average frequency of offshore (Diablo) wind events across the PG&E territory. For this analysis, a dry, Diablo wind event was defined as an event lasting at least 3 hours, having sustained winds >20 mph, wind direction from the north to northeast (offshore), and a FPI indicating dry conditions. This analysis shows the relative frequency of these events is higher in the North Bay Area and northern Sierra than in other portions of the PG&E territory. This study also revealed dry, offshore wind events are most common in Autumn, as expected. These patterns generally held true in 2019 and 2020 as the majority of PSPS events occurred during autumn across the northern half of PG&E's territory and impacted communities more often in these locations.[24]

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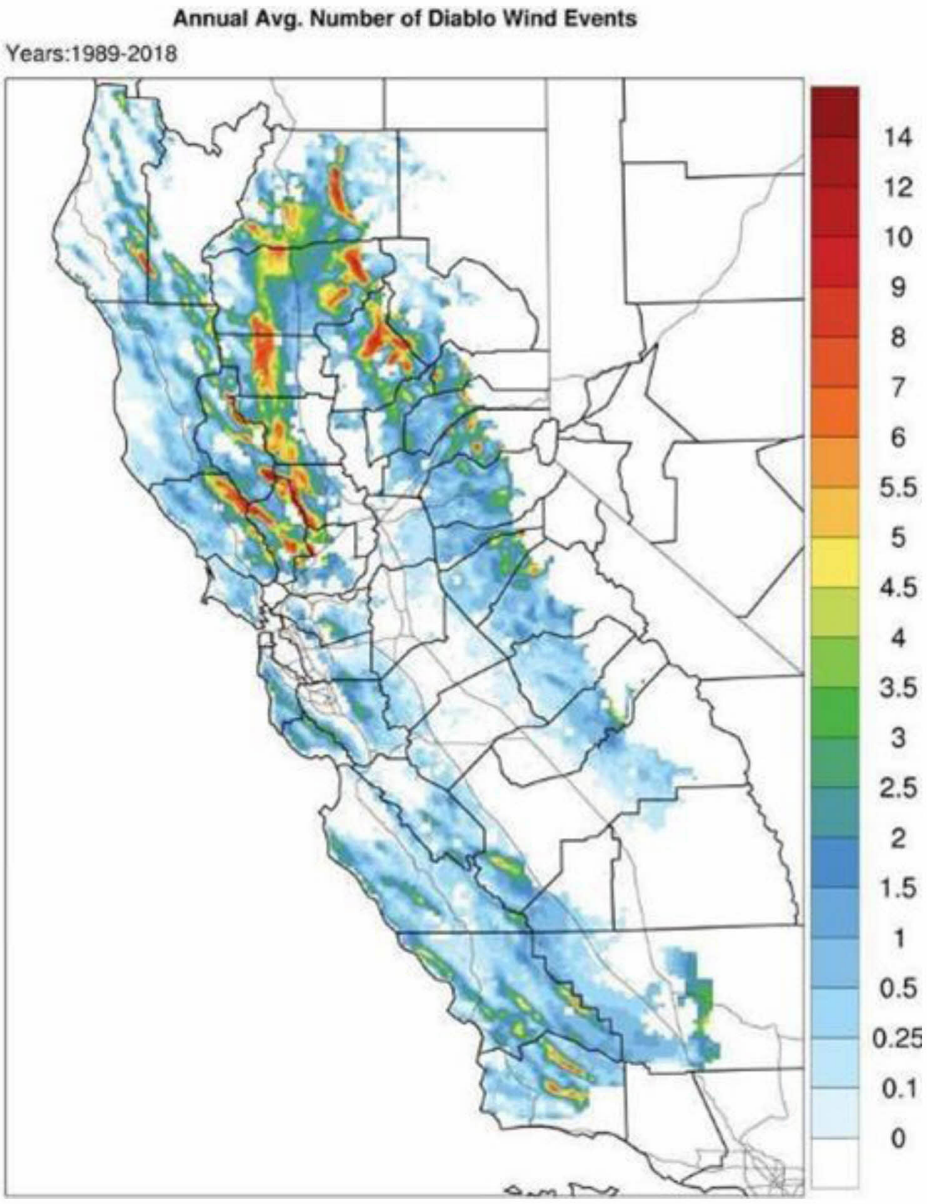
[24] PG&E is also working with Argonne National Laboratory to conduct a climate change modeling study to determine if the location and or frequency of Diablo wind events may change by mid-century. The results of this study are expected to be completed in 2021, but preliminary analysis reveals that the North Bay, Northern Sierra and Sacramento Valley will continue to be hot-spots for Diablo wind events.

FIGURE PG&E-4.2-10: 30-YEAR HISTORICAL ANNUAL AVERAGE OF "DIABLO WIND EVENTS" GEOGRAPHICALLY



(j) Long-Term Risk Assessments And Weather Input Into Models

Climatology data is also used to determine which circuits have the overall highest risk of large fires over the long-term. This is a separate assessment from PSPS, as large fires can and have occurred during low and moderate wind speeds and are mostly fuels or plume-dominated. A range of meteorological data sets are used as inputs to the ignition probability models described in Section 4.3. Table PG&E-4.2-7 below itemizes the meteorological data sets used in the 2021 Wildfire Distribution Risk Model as inputs to the Vegetation Probability of Ignition Model and the Equipment Probability of Ignition Model described in Section 4.3. In all cases these are historical data sets used as a proxy to represent forecasted future conditions.

TABLE PG&E-4.2-7: METEOROLOGICAL DATASETS USED IN 2021 WILDFIRE DISTRIBUTION RISK MODEL

Covariate	Category	Source	Spatial Resolution	Units	Descriptions
100-hour fuels	Meteorological data	gridMET	~4km	%	Unless otherwise noted, all GRIDMET data aggregated from 2014 to 2016. The dead fuel moisture data were obtained from GRIDMET, and the "100-hour-fuels" feature was included in the model. The exact GRIDMET variable use is known as fm-100 and is a standard fire modeling metric of fuel dryness for fuels about 1-3" in diameter - intermediate sized fuels.
1000-hour fuels	Meteorological data	gridMET	~4km	%	fm-1000, as defined above, but for 3-8" in diameter.
burn index	Meteorological data	gridMET	~4km		the US, the National Fire Danger Rating System (USNFDRS) Burning Index (BI)
energy release	Meteorological data	gridMET	~4km		USNFDRS Energy Release Component (ERC)
precipitation average	Meteorological data	gridMET	~4km	Mm	Daily precipitation average
specific humidity	Meteorological data	gridMET	~4km	kg/kg	Specific humidity
vapor pressure deficit avg	Meteorological data	gridMET	~4km	kPa	Measure how much water is in the air compared to how much it could hold at the given temperature. VPD drives evapotranspiration and is the mechanism for fuels drying out during fire season.
temperature max average	Meteorological data	gridMET	~4km	K	Average of daily maximum temperature in Kelvin (recall that it is sensed via satellite)
wind avg	Meteorological data	RTMA	~2.5km	m/s	Hourly average wind speed at 10m, averaged from 2016 to 2018
wind max	Meteorological data	RTMA	~2.5km	m/s	Annual 99th percentile hourly wind speed at 10m assessed over 2016 to 2018
windy summer day pct	Meteorological data	RTMA	~2.5km		The percentage of days with sustained hourly wind speeds over 15 mph
gusty summer day pct	Meteorological data	RTMA	~2.5km		The percentage of days with sustained hourly wind speeds over 20 mph

(k) Response to RCP Actions

ACTION PGE-5 (Class A):

In its 2021 WMP update, PG&E shall:

1) Refile the updated OPW and wind analysis data;

2) Provide detail on how it has verified the accuracy of its OPW model; and

3) How it accounts for less granularity in historic weather data due to fewer deployed weather stations.

Response:

Details regarding PG&E's updated OPW Model above addressing questions (1) and (2) are found in Section 4.2.A(f) above. Regarding question (3), PG&E uses the 30-year climatology of historic weather to train the OPW Model, which is on a 3 km and 2 km grid, and does not suffer from the challenge of lower weather station density in the past compared to now.

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4.2.B. Contribution of Fuel Conditions

B) Describe how the utility monitors and accounts for the contribution of fuel conditions to ignition probability and estimated wildfire consequence in its decision-making, including describing any proprietary fuel condition index (or other measures tracked), the outputs of said index or other measures, and the methodology used for projecting future fuel conditions. Include discussion of measurements and units for live fuel moisture content, dead fuel moisture content, density of each fuel type, and any other variables tracked. Describe the measures and thresholds the utility uses to determine extreme fuel conditions, including what fuel moisture measurements and threshold values the utility considers "extreme" and its strategy for how fuel conditions inform operational decision-making.

PG&E's Utility FPI Model, Dead Fuel Model, and Live Fuel Model are discussed in detail as part of our discussion of Advanced Weather Modeling in Section 7.3.2.1.2. In 2020, PG&E deployed a Dead Fuel Model on the cloud capable of predicting the moisture content of multiple DFM fuel classes (i.e., DFM 1hr, DFM 10hr, DFM 100hr, DFM 1000hr) at 2 x 2 km resolution. PG&E also deployed 2 x 2 km Live Fuel Model for Chamise as well as Manzanita plant species. These are machine-learning models developed using National Fuel Moisture Database (NFMDB) observations. In addition to creating new forecast models, PG&E created a 30-year climatology of DFM and LFM output at 2 x 2 km resolution as well. These historical datasets allow PG&E meteorologists and data scientists to evaluate the fuel conditions present during historical fires.

PG&E also created a new Live Fuel Model using remotely-sensed satellite data. The Live Fuel Model is trained on field observations. PG&E is taking steps to bolster these observations and to provide them to the public, to help validate existing models and enable more accurate models to be developed in the future as they can take advantage of many more observations. To this end, PG&E partnered with SJSU in 2019 and 2020 to sample LFM at multiple locations in the HFTD areas within the Bay Area and share that data broadly. In 2020, PG&E also established an internal LFM sampling program to complement samples collected by state and federal across Northern and Central CA. This network consists of 30 locations where plant species such as Chamise and Manzanita are sampled to measure the amount of fuel moisture in these plants throughout the seasonal cycle. Samples are collected in the field and shipped to PG&E's chemistry laboratory for processing. The results of all measurements are uploaded and made publicly available via the NFMDB. These observations are critical to train and validate high resolution live fuel moisture models and satellite-derived live fuel moisture products and will be helpful for PG&E and others to train the next generation of Live Fuel Model.

4.2.1 Service Territory Fire-Threat Evaluation and Ignition Risk Trends

Discuss fire-threat evaluation of the service territory to determine whether an expanded HFTD is warranted (i.e., beyond existing Tier 2 and Tier 3 areas). Include a discussion of any fire threat assessment of its service territory performed by the electrical corporation, highlighting any changes since the prior WMP report. In the event that the electrical corporation's assessment determines the fire threat rating for any part of its service territory is insufficient (i.e., the actual fire threat is greater than what is indicated in the CPUC Fire Threat Map and HFTD designations), the corporation shall identify those areas for consideration of HFTD modification, based on the new information or environmental changes. To the extent this identification relies upon a meteorological or climatological study, a thorough explanation and copy of the study shall be included.

List and describe any macro trends impacting ignition probability and estimated wildfire consequence within utility service territory, highlighting any changes since the 2020 WMP report:

1. *Change in ignition probability and estimated wildfire consequence due to climate change;*
2. *Change in ignition probability and estimated wildfire consequence due to relevant invasive species, such as bark beetles;*
3. *Change in ignition probability and estimated wildfire consequence due to other drivers of change in fuel density and moisture;*
4. *Population changes (including Access and Functional Needs population) that could be impacted by utility ignition;*
5. *Population changes in HFTD that could be impacted by utility ignition;*
6. *Population changes in WUI that could be impacted by utility ignition;*
7. *Utility infrastructure location in HFTD vs non-HFTD; and*
8. *Utility infrastructure location in urban vs rural vs highly rural areas.*

In this section, we describe the High Fire Risk Area (HFRA) Map that PG&E has developed. The HFRA Map is currently used in scoping PSPS events and may be used in the future for other purposes, such as prioritizing inspections and work. Subsection (a) describes PG&E's development of the HFRA Map.

This section also includes a list of macro trends impacting ignition probability and estimated wildfire consequences. This information is included in Subsection (b).

(a) Development of PG&E's High Fire Risk Area Map

In 2020, PG&E started the development of our territory wide HFRA Map which is a purpose-built map for use in scoping PSPS events. The HFRA Map considers catastrophic fire risk factors and utility infrastructure and was developed by considering incremental changes to the HFTD map boundaries to add areas where risk factors for

the potential of catastrophic fire from utility infrastructure ignition during offshore wind events is higher. In developing the HFRA Map, we aimed to accomplish the following:

1. Ensure all areas of catastrophic wildfire risk are fully captured in PG&E's PSPS program;

2. Identify areas that could be removed from the PSPS scope as they do not pose the risk of a catastrophic wildfire during offshore wind events;

3. Dedicate resources and processes that allow for on-going refinement of the HFRA Map accounting for changes in land use, climate, and PG&E's infrastructure while utilizing new modeling tools as they become available to inform catastrophic fire risk; and

4. Work with internal teams to ensure PSPS project workplans (e.g., system hardening, PSPS sectionalization) are informed by existing HFRA boundaries and capture/document recommendations for future review and refinement.

In the second quarter of 2020, we completed the first version of the HFRA Map which identified approximately 115 areas that are not included in HFTD areas to be included in our PSPS scope. These HFRA Map areas vary from small boundary adjustments (e.g., 0.25 acres) to larger areas (e.g., hundreds of square miles) where ignitions could lead to catastrophic fires during offshore wind events. Many of the larger areas do not contain high numbers of customers or PG&E assets as they are in rural, hard to access locations where a fire could grow and spread rapidly. Table PG&E-4.2-8 below provides a summary of the areas added to the HFRA Map that are in addition to HFTD areas.

TABLE PG&E-4.2-8: HIGH LEVEL SUMMARY OF ADDITIONS TO HFTD AREAS

Polygons Added	115
Customers added to PSPS Scope	3,000
Distribution Circuit Miles within polygons	620
Transmission Circuit Miles within polygons	230

A map of the added areas is provided below in Figure PG&E-4.2-11, which shows the HFTD map (Yellow and Red) with added HFRA Map areas in green. Figure PG&E-4.2-12 is more granular and shows how the HFRA Map identified a specific risk area outside a Tier 3 HFTD area. As well as expanding the PSPS Scope beyond the HFTD Map, PG&E is considering the removal of areas that are within the HFTD from PSPS scope and may do so in 2021.

FIGURE PG&E-4.2-11: HFTD AREAS WITH HFRA MAP ADDITIONS

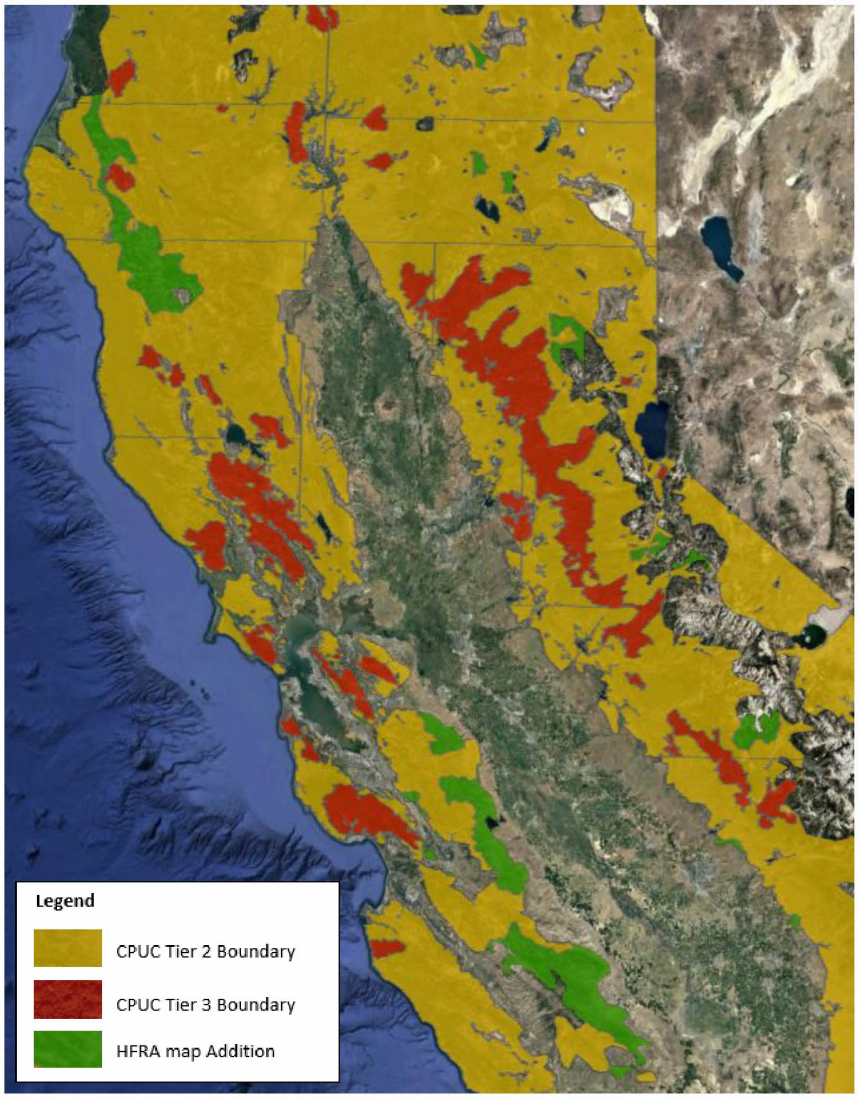

FIGURE PG&E-4.2-12: HFTD TIER 3 BOUNDARY WITH HFRA ADDITIONS

The HFRA Map was developed using the following process:

1. Areas were identified by subject matter experts familiar with local area and fire history for potential addition to the HFRA Map.

2. A centralized team reviewed all areas slated for addition utilizing PG&E's analytical datasets and tools while documenting the criteria (see below) as to why the areas should or should not be added.

3. The areas for addition were then reviewed by a third party for additional feedback. See Section 4.4.2 for further information on the HFRA Map external review.

The following criteria was considered and documented with regard to areas included in the HFRA Map:

1. Is the area consistent with surrounding HFTD areas?

2. Does the area have significant slope/potential for an uphill fire propagated by an offshore wind event?

3. Does the area have a high fuel load?

4. Is the area in proximity to wildland fuels?

5. Is there development in high risk land use areas?

6. Are there insufficient firebreaks given the exposure?

PG&E will continue to evaluate the inclusion of additional areas requiring wildfire reduction activity in future WMPs based upon information obtained during the implementation and evaluation of PG&E's annual plan. In addition, PG&E will continue to mature our tools to analyze wildfire risk using available data, climatology and fire spread modeling to inform potential adjustments to the HFTD areas. These analytics may lead to additional future recommendations.

(b) Macro Trends Impacting Ignition Probability and/or Wildfire Consequence

PG&E has identified the following macro-trends that may impact wildfire ignition probability and/or wildfire consequences:

TABLE PG&E-4.2-9: MACRO TRENDS IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCE

Rank	Macro trends	Comments
1	Change in ignition probability and estimated wildfire consequence due to climate change	Several key climate change trends are influencing variable periods of extreme wildfire risks in Northern California. These trends significantly increase wildfire ignition risks around utility networks. Warmer winters are causing increases in rainfall rather snow, resulting in a decrease to the snowpack. This reduces available water resources earlier in summer months, stressing vegetation and increasing available fuels. Compounding the shift from snow to rain are extended dry periods following summer months deeper into fall and early winter. Northeast winds are more common in fall and winter months in Northern California and if not accompanied by rainfall or other atmospheric moisture wildfire risks continue to increase despite the presence of lower temperatures. Ignitions that occur under these conditions can result in large conflagrating wildfires that can further promote risk associated with Northern California's abundant fuel and extreme terrain resulting in fires that develop their own devastating weather. ***Reference*:** OEHHA: https://oehha.ca.gov/epic/changes-climate/precipitation. "Extremely dry and extremely wet years have become more common in California. On average, the state receives 75 percent of its annual precipitation from November through March, with 50 percent occurring from December through February. As the winter months have become warmer in recent years, more precipitation has been falling as rain instead of snow over the watersheds that provide most of the state's water supplies." "The last decade also includes the driest consecutive four-year period, from 2012 to 2015." "Warming temperatures, declining snowpack, and earlier spring snowmelt runoff can create stresses on vegetation" ***Reference:*** National Geographic: https://www.nationalgeographic.com/science/2019/10/climate-change-california-power-outage/.

TABLE PG&E-4.2-9: MACRO TRENDS IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCE (CONTINUED)

Rank	Macro trends	Comments
2	Change in ignition probability and estimated wildfire consequence due to relevant invasive species, such as bark beetles	Invasive species create landscape level concerns that have significant potential to impact areas within and adjacent to utility rights-of-way (ROW). Effects can extend well beyond the ROW making effective mitigation challenging for utilities without more holistic engagement and support from surrounding landowners and stakeholders. Of concern to utilities are both invasive plant and insect species. Invasive insect species, such as bark beetles, can exacerbate forest health concerns and result in hazardous tree conditions that require repetitious monitoring and mitigation by utilities. Native insect species, under stressed environmental conditions – like drought, can impose the same impacts and challenges. Invasive plant species in California tend to thrive in disturbed environments, often displacing native species. There is evidence that these invasions can change and intensify fire regimes. Landscape disturbance can be presented following fires, as well as during ROW maintenance and enhancements. Regardless of disturbance origin utilities are continually compelled to perform additional monitoring and mitigation to identify and control detrimental impacts associated with invasive species. ***References:*** Emergency Proclamation – Office of Governor https://www.ca.gov/archive/gov39/2015/10/30/news19180/index.html. PNAS – Invasive grasses increase fire occurrence and frequency across US ecoregions. “Fire-prone invasive grasses create novel ecosystem threats by increasing fine-fuel loads and continuity, which can alter fire regimes.” “The existence of an invasive grass-fire cycle is well known, evidence of altered fire regimes is typically based on local scale studies or expert knowledge.” “As concern about US wildfires grows, accounting for fire-promoting invasive grasses will be imperative for effectively managing ecosystems.”

TABLE PG&E-4.2-9: MACRO TRENDS IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCE (CONTINUED)

Rank	Macro trends	Comments
3	Change in ignition probability and estimated wildfire consequence due to other drivers of change in fuel density and moisture	PG&E's service territory has experienced noteworthy changes in both fuel density and moisture over the last several decades. These trends significantly increase wildfire ignition risks around utility networks. Fuel density is increasing while available moisture in critical wildfire risk periods is decreasing. This has been accompanied by increases in large tree mortality and overall changes in forest structure. Contributing factors cover a wide range of influences, including but not limited to; climate change, land use patterns, fire suppression and variable forest management practices. Forests are becoming denser with decreased presence of large trees and significant tree mortality over the last decade. Lands that are left unmanaged are subject to increases in accumulated dead and downed fuels that can be annually influenced by surrounding finer, flashier fuels following periods of rain or snowfall. ***Reference:*** PNAS: https://www.pnas.org/content/112/5/1458. ***Reference:*** California Energy Commission: https://www.energy.ca.gov/sites/default/files/2019-07/Projections_CCCA4-CEC-2018-014.pdf.

TABLE PG&E-4.2-9: MACRO TRENDS IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCE (CONTINUED)

Rank	Macro trends	Comments
4	Population changes (including Access and Functional Needs population) that could be impacted by utility ignition	Population in California and PG&E's territory continue to show projections for growth in decades to come. A fair amount of this growth continues in lands previously undeveloped and bordering, or in, fire prone wildland areas. Many utility customers have left the urban environment in favor of more fire prone areas for reasons unassociated with the associated wildfire risk. Current estimates suggest that at least 25 percent of California's residents already reside in areas subject to significant wildfire risk. With projection of upward population trends continuing, it is likely that populations in the Wildland Urban Interface (WUI) and/or the HFTD areas will relatedly increase. These trends may be compounded by the societal impacts of Covid-19. Housing trends in 2020 indicated a shift associated with stay-a-home orders and increased capability to telecommute. These emerging trends have indicated a desire to relocate from urban communities to more rural communities, many within the HFTD areas. The lack of availability and affordability of housing in lower wildfire risk urban areas within the PG&E territory are also factors that many residents evaluate and that all stakeholders, including policymakers, must consider as we all move forward. A significant, but variable and uncertain, portion of the population increases in higher wildfire risk areas will include customer with supplemental access or other functional needs. Utilities (and other stakeholders) will need to continue to engage in programs and education campaigns that inform and prepare all customers to mitigate these growing risks. ***References:*** LCAU: https://lcau.mit.edu/project/cataloguing- interface-wildfire-and-urban-development-california. PPIC: https://www.ppic.org/content/pubs/report/R_116HJ3R.pdf. HBI: http://www.homebuyinginstitute.com/news/california-housing-predictions-for-2021/. CNBC: Warming climate, population sprawl threaten California's future with more destructive wildfires, https://www.cnbc.com/2019/11/09/why-californias-wildfires-are-going-to-get-worse.html.
5	Population changes in HFTD that could be impacted by utility ignition	See PG&E's response to Item #4. Given the overall area of the HFTD areas as a percentage of PG&E's service territory (over 50%), it is likely that population growth in the HFTD areas will not be an exception to anticipated trends. In fact population growth in HFTD areas may exceed, at least in some areas, population growth in non-HFTD areas.
6	Population changes in WUI that could be impacted by utility ignition	See PG&E's response to Item #4. Given the overall area of the WUI as a percentage of PG&E's service territory, it is likely that population growth in WUI will not be an exception to anticipated trends. The HFTD map was informed by WUI data and tremendous overlap between the two categories exists within PG&E service territory.

TABLE PG&E-4.2-9: MACRO TRENDS IGNITION PROBABILITY AND/OR WILDFIRE CONSEQUENCE (CONTINUED)

Rank	Macro trends	Comments
7	Utility infrastructure location in HFTD vs non-HFTD	PG&E anticipates limited net-addition of utility assets in the near future. Therefore the overall breakdown of assets between HFTD and non-HFTD areas is not expected to significantly evolve going forward. Nonetheless, the volume and location of utility infrastructure already in HFTD areas (~1/3rd of PG&E's overhead electric assets) presents a risk to be mitigated, which is the focus of this plan. When adding or replacing utility infrastructure, particularly in or near HFTD, siting decisions should complement other resiliency and hardening programs continually over the decades to come. Given the increased focus on upgrading, strengthening or replacing assets in HFTD, the location and characteristics of infrastructure in HFTD areas will see more significant changes as compared to Non-HFTD areas.
8	Utility infrastructure location in urban vs rural vs highly rural areas	See PG&E's response to Item #7. There is high correlation between the HFTD areas and rural/highly rural areas within PG&E's service territory. There is similar correlation between urban areas and non-HFTD areas. Therefore the trends impacting urban vs. rural are largely similar to those impacting HFTD vs. non-HFTD.

4.3 Change in Ignition Probability Drivers

Based on the implementation of the above wildfire mitigation initiatives, explain how the utility sees its ignition probability drivers evolving over the 3-year term of the WMP, highlighting any changes since the 2020 WMP report. Focus on ignition probability and estimated wildfire consequence reduction by ignition probability driver, detailed risk driver, and include a description of how the utility expects to see incidents evolve over the same period, both in total number (of occurrence of a given incident type, whether resulting in an ignition or not) and in likelihood of causing an ignition by type. Outline methodology for determining ignition probability from events, including data used to determine likelihood of ignition probability, such as past ignition events, number of risk events, and description of events (including vegetation and equipment condition).

For 2021, PG&E has updated the 2019-2020 Wildfire Model that was described in previous WMPs. The updated model is referred to as the 2021 Wildfire Distribution Risk Model because it addresses wildfire risks on PG&E's distribution system. PG&E is currently developing a 2022 Wildfire Transmission Risk Model for our transmission system and plans to have it completed in 2021 for use in informing and prioritizing work that will occur in 2022.

Consistent with past risk models, the risk scores in the 2021 Wildfire Distribution Risk Model are the product of the likelihood of an ignition event multiplied by the consequence of the event. For the 2021 Distribution Wildfire Risk Model, ignition probabilities were developed for the top risk drivers as outlined in the table below. The wildfire consequence values leveraged the Technosylva Fire Model and are calibrated to the system level wildfire MAVF risk scores reported in PG&E's 2020 RAMP Report. This section provides details on the ignition probabilities while a more detailed explanation of the 2021 Wildfire Distribution Risk Model is provided in Section 4.5.1.

Since the 2020 WMP, PG&E has adopted a consistent categorization of ignition probability drivers. PG&E's 2020 RAMP Report details the approach to ignition probability drivers. To create an accurate categorization of ignition drivers, a thorough analysis of historical data resulted in six (6) top level risk drivers and thirty-five (35) sub-drivers. The six (6) top level drivers for ignition are provided in Table PG&E-4.3-1.

TABLE PG&E-4.3-1: TOP LEVEL IGNITION DRIVERS

Ignition Probability Driver	Description	Detailed Risk Driver	How the Utility Expects to See Incidents Evolve Over the 3-year WMP Term
D1 – Equipment Failure	Events where failure of a PG&E asset such as a conductor, arrester, insulator, breaker, transformer, etc., caused a reportable ignition	Overall, the Equipment Failure risk driver accounts for 38% ignitions systemwide and 27% of ignitions in HFTD areas (26% for HFTD Distribution and 37% for HFTD Transmission). Conductor and splice/clamp/connector failures account for the majority of the equipment failure incidents.	Equipment and more specifically conductor caused wildfires are forecasted to decrease due to mitigation programs that are informed by the risk models described in this section.
D2 – Vegetation	Events where trees, tree limbs, and other vegetation came in contact with a PG&E asset, resulting in a reportable ignition	Overall, the Vegetation risk driver accounts for 26% of ignitions systemwide, 45% of ignitions in HFTD areas (48% for HFTD Distribution and 2% for HFTD Transmission).	Vegetation caused wildfires are forecasted to decrease due to mitigation programs that are informed by the risk models described in this section.
D3 – Third-Party Contact	Events where member(s) of the public or an object under their control come in contact with a PG&E asset, resulting in a reportable ignition. Examples of third-party contact include a vehicle hitting a distribution or transmission pole or a Mylar balloon hitting equipment or conductor.	The Third-Party Contact risk driver accounts for 19% of ignitions systemwide and 15% of ignitions in HFTD areas (16% for HFTD Distribution and 14% for HFTD Transmission).	No anticipated decrease in ignitions due to 3rd party contact. Programs designed to mitigate equipment and vegetation caused ignitions could potentially reduce the probability of third-party caused ignitions, but those programs have not been focused on locations with a high probability of such contact.

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TABLE PG&E-4.3-1: TOP LEVEL IGNITION DRIVERS (CONTINUED)

Ignition Probability Driver	Description	Detailed Risk Driver	How the Utility Expects to See Incidents Evolve Over the 3-year WMP Term
D4 – Animal	Events where animals such as birds or squirrels came in contact with a PG&E asset, resulting in a reportable ignition.	The Animal risk driver accounts for 12% of ignitions systemwide and 10% of ignitions in HFTD areas (7% for HFTD Distribution and 40% for HFTD Transmission).	No anticipated decrease in ignitions due to animal contact. Programs designed to mitigate equipment and vegetation caused ignitions could potentially reduce the probability of animal caused ignitions, but those programs have not been focused on locations with a high probability of animal contact.
D5 – Unknown or Other	Events associated with PG&E assets, which led a reportable ignition, where evidence of the root cause of the ignition was not available	The Unknown or Other risk driver accounts for 5% of ignitions systemwide and 4% of ignitions in HFTD areas (3% for HFTD Distribution and 7% for HFTD Transmission).	No anticipated decrease in ignitions due to unknown or other events. Programs designed to mitigate equipment and vegetation caused ignitions could potentially reduce the probability of unknown or other caused ignitions, but those programs have not been focused on locations with a high probability of this category of events.
D6 – Seismic Scenario (Cross-Cutting)	Failure events caused by seismic activity. This risk is described further in Chapter 20 of the 2020 RAMP Report.	The Seismic risk driver is estimated to account for <1% of ignitions.	No anticipated decrease in ignitions due to seismic events.

The focus on the risk modeling and the resulting mitigation initiatives is on the vegetation and equipment failure modes as they represent a high percentage of the overall ignitions by cause. Combined with the Wildfire Consequence Model described in Section 4.5.1, the mitigation initiatives are designed to reduce the ignitions in the highest wildfire risk areas. It is important to note that as PG&E is mitigating areas of highest risk, reportable ignitions may not show a demonstratable decrease. This is due to the fact that ignition probability and wildfire consequence are not highly correlated. That is to say that locations with a high probability of ignition caused by vegetation or equipment failures generally may not be locations with high wildfire consequence.

In the remainder of this section, PG&E describes our methodology for determining ignition probability, the Equipment Probability of Ignition Model, and the Vegetation Probability of Ignition Model.

(a) Methodology for Determining Ignition Probability From Events

In support of risk-based Electric Operations planning, PG&E has developed distribution[25] asset risk models designed to quantify wildfire risks from the distribution system at planning and situational awareness timescales, support risk-based decision making, and enable reporting of risk reduction activities to regulators and the public. To do this, PG&E characterizes wildfire risk as:

Risk = Ignition Probability x Wildfire Consequence.

Both the probability (also referred to as likelihood) and the consequences of an ignition are conditioned, to a degree, on the environmental factors (i.e, wind and gust speeds, temperature, vegetation structure, and topography) experienced by distribution assets, and their age and other physical characteristics.

To answer the question of *where* ignition events are likely to occur, we have estimated fire season ignition probabilities using maximum entropy models (MaxEnt) pioneered in the modeling of ecological ranges of species. These models are trained on ignition (or outage) locations and gridded spatial (raster) environmental and asset attribute data. The data can draw from a specific time period, but the model itself is dedicated to spatial, not temporal, patterns. The MaxEnt Model provides relative scores or, if properly calibrated, probabilities for fire-season ignitions per "pixel" of input data.

In order to more accurately assess and define risks, in 2020 PG&E:

1. Replaced the regression equipment ignition likelihood from prior models with the Equipment Probability of Ignition Model

2. Replaced the regression vegetation ignition likelihood from prior models with the Vegetation Probability of Ignition Model

By incorporating these new models into the 2021 Wildfire Distribution Risk Model, PG&E was able to:

- Incorporate additional variables in the models, increasing accuracy (tree types, wind scores, ground cover);
- Model ignitions directly by utilizing the MaxEnt Model as compared to modeling proxies in prior models; and,
- Reduce overfit by developing training and testing datasets for model development.

A wide range of input data sets were used in developing both the Vegetation Probability of Ignition and the Equipment Probability of Ignition Models. Table PG&E-4.3-2 summarizes the data developed to date for use in these models. A more detailed description of the Vegetation Probability of Ignition and the Equipment Probability of Ignition Models is provided after Table PG&E-4.3-2.

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25 PG&E defines voltages below 60 kV as distribution and voltages 60 kV and above as transmission.

TABLE PG&E-4.3-2: DATA USED TO DEVELOP PROBABILITY OF IGNITION MODELS

Data Set	Category	Source	Spatial resolution	Units	Descriptions
100-hour fuels	Meteorological data	gridMET	~4km	%	Unless otherwise noted, all GRIDMET data aggregated from 2014 to 2016. The dead fuel moisture data were obtained from GRIDMET, and the "100-hour-fuels" feature was included in the model. The exact GRIDMET variable use is known as fm-100, and is a standard fire modeling metric of fuel dryness for fuels about 1-3" in diameter - intermediate sized fuels.
1000-hour fuels	Meteorological data	gridMET	~4km	%	fm-1000, as defined above, but for 3-8" in diameter.
burn index	Meteorological data	gridMET	~4km		The US, the National Fire Danger Rating System (USNFDRS) Burning Index (BI)
energy release	Meteorological data	gridMET	~4km		USNFDRS Energy Release Component (ERC)
precipitation average	Meteorological data	gridMET	~4km	Mm	Daily precipitation average
specific humidity	Meteorological data	gridMET	~4km	kg/kg	Specific humidity
vapor pressure deficit avg	Meteorological data	gridMET	~4km	kPa	Measure how much water is in the air compared to how much it could hold at the given temperature. VPD drives evapotranspiration and is the mechanism for fuels drying out during fire season.
temperature max average	Meteorological data	gridMET	~4km	K	Average of daily maximum temperature in Kelvin (recall that it is sensed via satellite)
wind avg	Meteorological data	RTMA	~2.5km	m/s	Hourly average wind speed at 10m, averaged from 2016 to 2018
wind max	Meteorological data	RTMA	~2.5km	m/s	Annual 99th percentile hourly wind speed at 10m assessed over 2016 to 2018
windy summer day pct	Meteorological data	RTMA	~2.5km		The percentage of days with sustained hourly wind speeds over 15 mph
gusty summer day pct	Meteorological data	RTMA	~2.5km		The percentage of days with sustained hourly wind speeds over 20 mph

TABLE PG&E-4.3-2: DATA USED TO DEVELOP PROBABILITY OF IGNITION MODELS (CONTINUED)

Data Set	Category	Source	Spatial resolution	Units	Descriptions
tree height max	Tree data	Salo Sciences	100m		Tree height data were obtained from a third-party vendor, Salo, and the "tree-height-max" feature was developed by calculating the maximum tree height, in meters, for each 100m x 100m pixel area along the distribution grid, according to the processed satellite data provided by Salo. The satellite imagery was collected in November 2019.
tree height average	Tree data	Salo Sciences	100m		Same as above but taking the pixel average height.
impervious	Surface condition	NLCD	100m	%	NLCD imperviousness products represent urban impervious surfaces as a percentage of developed surface over every 30-meter pixel in the United States, scaled to 100m.
unburnable	Surface condition	LANDFIRE 2016 Surface Fuels Model	100m	%	The "un-burnable" feature is a land surface descriptor similar to imperviousness that includes surfaces that typically don't ignite when a spark occurs. The feature was derived from several land use types within the 2016 LANDFIRE surface fuel model (USGS, 2016) and is the percentage of the 100m x 100m pixel identified as un-burnable. The land use types considered "un-burnable" in the composite spatial layer include: urban, snow/ice, agriculture, water, and barren.
local topography	Surface condition	NED National Elevation Database	100m		The relative topography of the area was also used as a feature in the model. The topographic position index (TPI) was extracted from a USGS national elevation dataset (NED) at 100-meter resolution. The TPI compares the cell elevation to the mean elevation for the local neighboring area (positive values are above the mean and negative values are below the mean) (The Nature Conservancy).

TABLE PG&E-4.3-2: DATA USED TO DEVELOP PROBABILITY OF IGNITION MODELS (CONTINUED)

Data Set	Category	Source	Spatial resolution	Units	Descriptions
hftd	HFTD	CPUC	100m		Categorical variable that is 1 for non-HFTD locations, 2 for Tier 2 and 3 for Tier 3.
Age	Asset data	EDGIS Conductors	100m		The estimated conductor age (the "estimated-age") was calculated as the number of years since the installation year, as listed in ED-GIS. If the installation date was missing or invalid, then the estimated age in the STAR model dataset was used
Materials	Asset data	EDGIS Conductors	100m		The type of conductor material was split into one-hot encoded dummy variables, which identified conductor materials aluminum (Al), copper (Cu), and ACSR ("conductor-material-al," "conductor-material-cu," and "conductor-material-acsr," respectively) as binary model features.
Size	Asset data	EDGIS Conductors	100m		The conductor size dataset was split into one-hot encoded dummy variables, which identified conductor size 2, 4, and 6 ("conductor-size-2," "conductor-size-4," and "conductor-size-6," respectively) as binary model features. Lower numbers correspond with larger diameters.
Splice count	Asset data	EDGIS Conductors	100m		Splices were identified from the splices database table (Emili Scaief, 2020). In order to prevent splice locations from introducing bias to the model, only the Reliability Program splice records were used, which only included spans with more than three per phase.

TABLE PG&E-4.3-2: DATA USED TO DEVELOP PROBABILITY OF IGNITION MODELS (CONTINUED)

Data Set	Category	Source	Spatial resolution	Units	Descriptions
Coastal indicator	Asset data	EDGIS Conductors	100m		Coastal areas were identified using a binary feature in the model. Coastal areas within PG&E service territory were mapped internally in PG&E and conductors are tagged with a coastal indicator field in ED-GIS.

(b) Equipment Probability of Ignition Model

Ignition likelihood for equipment in 2021 was determined based on a probability analysis predicting ignitions in 100m x 100m pixels. The Equipment Probability of Ignition Model was trained on conductor failure related ignitions limited to fire season events and CPUC reportable ignitions from 2015 to 2018 and tested using the 2019 ignitions. The modeling technique used was a maximum entropy model. MaxEnt Model provides a way of estimating the relative occurrence rate given a fairly modest number of ignition locations the principle of maximum entropy states that the probability distribution which best represents the current state of knowledge is the one with the largest entropy, in the context of precisely stated prior data.

A range of variables were included in the initial modeling. These included meteorology data, PG&E asset data, and remote sensing data from government and private third parties. The most important variables for the Equipment Probability of Ignition Model are identified below in Table PG&E-4.3-3.

TABLE PG&E-4.3-3: VARIABLES IN EQUIPMENT PROBABILITY OF IGNITION MODEL

Variable	Permutation Importance
Non-burnable area	30.8
Daily precipitation, mean	29.8
Conductor material: ACSR	9.7
Estimated conductor age	8.9
Max tree height	4.3
Reliability Program splice	4.3
Vapor pressure deficit, mean	4.0
Conductor size: 2	3.4
Conductor size: 4	1.6
100-hour fuels, mean	1.1
Max temperature, mean	1.0
Wind speed, mean	0.9
Local topography	0.2
Conductor size: 6	0.1
Conductor material: Al	~0
Conductor material: Cu	~0

Using these variables, a probability of ignition was assigned for each 100m x 100m grid. These probabilities were indexed and calibrated to the total expected ignition frequency.

Given the amount of work required to develop new models, PG&E was only able to include in the Equipment Probability of Ignition Model used in the 2021 Wildfire Distribution Risk Model information regarding conductor failures. Updates to this model are planned on an annual basis. In 2021, we currently intend to include maintenance tag data and asset data in the Equipment Probability of Ignition Model and additional equipment failure models for poles and transformers. These additional equipment models will combine with an update to the conductor failure model to improve the predictive power of equipment caused ignition probabilities will be enhanced to better inform mitigation programs.

(c) Vegetation Probability of Ignition Model

Ignition likelihood for vegetation in 2021 was determined based on a probability analysis predicting ignitions in 100m x 100m pixels. The Vegetation Probability of Ignition Model was trained on vegetation ignitions limited to fires season evens and CPUC reportable ignitions from 2015 to 2018 and tested using the 2019 ignitions. This data set includes all vegetation related outages that resulted in an ignition. The modeling technique used was a maximum entropy model. The MaxEnt Model provides a way of estimating the relative occurrence rate given a fairly modest number of ignition locations. The principle of maximum entropy states that the probability distribution which best represents the current state of knowledge is the one with the largest entropy, in the context of precisely stated prior data.

Variables in the initial model included meteorology data, PG&E asset data, and remote sensing data from government and private third parties. The most important variables for the Vegetation Probability of Ignition Model are included below in Table PG&E-4.3-4.

TABLE PG&E-4.3-4: VARIABLES IN VEGETATION PROBABILITY OF IGNITION MODEL

Variable	Permutation Importance
tree-height-max	26.1
100-hour-fuels-avg	24.1
vapor-pressure-deficit-avg	21.6
gusty-summer-day-pct	6
Hftd	4.2
precipitation-avg	3.1
Impervious	2.8
specific-humidity-avg	2.4
burn-index-avg	2.3
wind-max	1.9
temperature-avg	1.6
windy-summer-day-pct	1
local-topography	0.8
tree-height-avg	0.8
1000-hour-fuels-avg	0.6
energy-release-avg	0.4

Using these variables, a probability of ignition was assigned for each 100m x 100m grid. These probabilities were indexed and calibrated to the total expected ignition frequency.

Updates to this model are planned on an annual basis. In 2021, PG&E currently intends to incorporate LiDAR informed tree species data so that the predictive power of vegetation caused ignition probabilities will be enhanced to better inform mitigation programs.

4.4 Research Proposals and Findings

Report all utility-sponsored research proposals, findings from ongoing studies and findings from studies completed in 2020 relevant to wildfire and PSPS mitigation.

4.4.1 Research Proposals

Report proposals for future utility-sponsored studies relevant to wildfire and PSPS mitigation. Organize proposals under the following structure:

1. ***Purpose of research** – Brief summary of context and goals of research;*

2. ***Relevant terms –** Definitions of relevant terms (e.g., defining "enhanced vegetation management" for research on* EVM*); and*

3. ***Data elements –** Details of data elements used for analysis, including scope and granularity of data in time and location (i.e., date range, reporting frequency and spatial granularity for each data element, see example table below).*

Example table reporting data elements

Data Element	*Collection Period*	*Collection Frequency*	*Spatial Granularity*	*Temporal Granularity*	*Comments*
Ignitions from contact with vegetation in non-enhanced vegetation areas	*2014 –2020+ (ongoing)*	*Per ignition*	*Lat/lon per ignition*	*Date, hour of ignition (estimated)*	–
Ignitions from contact with vegetation in enhanced vegetation areas	*2019 –2020+ (ongoing)*	*Per ignition*	*Lat/lon per ignition*	*Date, hour of ignition (estimated)*	–

4. ***Methodology** - Methodology for analysis, including list of analyses to perform; section shall include statistical models, equations, etc. behind analyses*

5. ***Timeline** - Project timeline and reporting frequency to WSD*

San Jose State University – Climatological Analysis

1. Purpose of Research

The purpose of the research is to better understand wildland fire behavior by studying fire-atmospheric interactions through partnership with the SJSU Fire Weather Research Lab. SJSU has established the largest academic Wildfire Interdisciplinary Research Center in the United States with five new tenure-track faculty members. SJSU will help PG&E analyze their 30-year 2 km x 2 km WRF model climatology to better understand the fire weather conditions associated with extreme wildfire and PSPSs. The analyses will be conducted by two tenure-track faculty, one post-doctoral scholar, and two graduate students.

2. *Relevant Terms*

WRF – Weather Research and Forecasting Model

3. *Data Elements*

TABLE PG&E-4.4-1: DATA ELEMENTS (SAN JOSE STATE UNIVERSITY – CLIMATOLOGICAL ANALYSIS)

Data Element	*Collection period*	*Collection frequency*	*Spatial granularity*	*Temporal granularity*	*Comments*
PG&E 30 year downscaled climatology	1990-2020 (modeled)	Modeled hourly weather data	2km x 2km grid	Hourly Data through the climatology	
PG&E Fire Occurrence Dataset	2003-2019	N/A	N/A	N/A	Dataset of fire ignitions in PG&E territory gathered from multiple sources

4. *Methodology*

a) Conduct analyses using PG&E's new 30-year climatology of 2 kilometer, hourly, WRF model output
   - This data shall allow for robust analyses on critical fire weather conditions using a combination of high spatiotemporal resolution and long duration data to investigate the following combined with fire occurrence datasets:
     - Climatology and decadal trends in fire weather and Diablo Wind events, or other Foehn wind events (type, intensity, duration, etc.).
     - A Diablo Wind metric shall be created and used to understand the climatology of events.
     - This metric shall be used to rank all Diablo Wind Events across the 30-year history based on strength, geographic extent, and duration.
     - Using PG&E's proprietary and public fire occurrence datasets to evaluate numerous fire weather indices to help determine which index is best correlated to daily fire growth.

b) Generation of grid point distributions, percentile data maps from the climatology data.
   - Map visualizations to be generated: 90th, 95th, 99th and Maximum (minimum) maps of:
     - Wind Speed
     - Wind Gust
     - Temperature
     - Relative humidity (minimum)
     - Dewpoint depression (minimum)
     - Precipitation
     - Diablo Fire Weather Index

- Grid point specific distributions shall be used by PG&E to put the forecast in perspective with the historical data

c) Covariation of fire weather mesoscale circulation patterns with the synoptic patterns and known modes of climate variability
d) High-resolution trends in existing fire-weather indices and local fire season duration to help determine annual average start and end time of fire season.
e) SJSU will interact regularly with the PG&E Meteorological staff and will provide regular online meetings on research progress.
f) SJSU shall conduct the proposed analyses and publish the results in peer-reviewed journals.

5. Timeline

As the project is still in its initial planning stages, no timeline has been set at this time.

Wildfire Mitigation Open Innovation Challenge

1. ***Purpose of Research***

PG&E has initiated an "Open Innovation Challenge" to identify novel technologies that could potentially reduce PG&E-caused wildfire risk. The search for innovations is global in reach and goes beyond the electric utility industry technology sector. PG&E hopes to identify one or more promising innovative technologies for use in a pilot project.

2. ***Relevant Terms***

No terms used herein require additional definition.

3. ***Data Elements***

No specific data elements for analysis are available at this time. See Methodology.

4. ***Methodology***

The open innovation challenge process started with a definition of problem statements, instead of pre-supposing potential solutions. These problem statements were created following a series of interviews conducted with internal and external subject matter experts on areas where innovations could potentially provide the greatest ignition risk reduction. The set of problem statements described the problem areas that PG&E would like solved or improved upon, without specifying any technology or techniques to solve the problems. As a result of this process, PG&E narrowed our focus for this challenge to the following four areas:

- Advancement of the state-of-the-art for "monitor & mitigate" technologies for real-time detection of faults and prevention of arcing, sparking, and other ignition events along transmission and distribution infrastructure

- Alternatives to current undergrounding methods, including level-grounding
- Reducing labor required for vegetation management
- Innovative heat-resistant materials

Using these problem statements, PG&E solicited innovators, entrepreneurs and startups to request that they apply if they have solutions for the defined problems. The solicitation was made through two methods: one being a research community network-driven effort and the other being an automated computer programmed Internet search method. For the research community network-driven method, PG&E reached out through known innovation networks, academic research partners, and other technology knowledge experts. For the second method, an automated computer programmed Internet search parsed technical journals, professional sites, startups sites, patent databases, and other publications across industries and disciplines to identify authors, institutes, and companies with relevant ideas or expertise. After compiling the potentially relevant resources, PG&E will create a ranked list of the top innovators in each challenge area for further solicitation including for referrals and submission of an application to this challenge. The resulting proposals will then be vetted, and winners selected with the desired result being technology pilots that lead to deployment.

5. ***Timeline***

In December 2020, PG&E announced this open innovation challenge, published the problem statements described in the Methodology section above, and set a submission deadline in January 2021. The solicitation and innovator communication phase are ongoing and scheduled to complete in February 2021. The ranking and final selection phase for each of the challenge areas is scheduled to conclude in March 2021. The final report will be completed by September 2021. Results are to be reported in the next annual update.

Cal Poly Wildland Urban Interface Fire Information Research and Education Institute

1. ***Purpose of Research***

The purpose of the newly formed Cal Poly Wildland Urban Interface Fire Information Research and Education Institute (FIRE Institute) is to make significant contributions to solving the WUI fire problem through integrated and applied research and education that innovates, informs policy, disseminates information, and educates students and professionals.

In 2021, PG&E is partnering with, and advising on the direction of research and associated activities by, the FIRE Institute as it embarks on the development of solutions for sustainable fire resilient communities and safer and more effective fire-preparedness and response operations through applied research and incorporation of technology.

2. ***Relevant Terms***

No terms used herein require additional definition.

3. ***Data Elements***

There are no specific data elements related to this effort at this time because PG&E's advisory role for the Institute's new research is in the beginning phase.

4. ***Methodology***

None currently as this research partnership is in its beginning phase.

5. ***Timeline***

Planned activities in 2021 include a symposium to engage stakeholders (private sector, utilities, government, regulatory bodies, academia), define research priorities, and identify policy recommendations. Specific PG&E-specific research workstreams are anticipated though not defined at this time.

We will report, in the next annual update, on our advisory role to the Institute, PG&E-relevant research direction and initiatives, as well as PG&E WMP-relevant results from this research collaboration.

Targeted Tree Species Study

1. ***Purpose of Research***

The purpose of PG&E's Targeted Tree Species Study is to identify species that are more likely to fail near PG&E facilities, thereby creating potential wildfire ignitions. PG&E will use the information obtained through the study to evaluate the performance of the species risk rating component of our Tree Assessment Tool (TAT). The study will involve an analysis of tree mortality rates related to precipitation. PG&E will also use the information obtained through the study to evaluate our scheduling for patrol cycles as part of our vegetation management responsibilities.

2. ***Relevant Terms***

Species Risk – What a particular tree species (in isolation of everything else) tells you about the likelihood of the tree failing or the likelihood of its failure relative to its frequency in the population.

Tree Assessment Tool or TAT – Tool that evaluates an individual tree's likelihood of failing and supplies instruction of whether to abate or not abate the tree.

Patrol Cycle – The span of time between inspections.

3. *Data Elements*

TABLE PG&E-4.4-2: DATA ELEMENTS (TARGETED TREE SPECIES STUDY)

Data Element	*Collection Period*	*Collection Frequency*	*Spatial Granularity*	*Temporal Granularity*	*Comments*
Ignitions from contact with vegetation	2008-2020+ (ongoing)	Per ignition	Circuit and/or Regional level	Date	–
Outages from contact with vegetation	2008-2020+ (ongoing)	Per outage	Circuit and/or Regional level	Date	
Trees assessed by TAT	March 2020+ (ongoing)	Per tree basis	Lat/Long per tree	Date	–
TBD					Per vendor input- vendor will extract and provide additional data

4. *Methodology*

- Vendor will identify the appropriate external data sources to study in conjunction with internal data provided by PG&E to develop and execute a targeted tree species study to quantify failure risk by species and region.
- Vendor will study tree mortality rates in conjunction with precipitation levels in order to evaluate patrol cycles within our service territory.
- Vendor will develop a working knowledge of the TAT and the species risk rating component currently in use.
- Vendor will evaluate the species risk component of the TAT currently in use for effectiveness, using available external data sources and data provided by PG&E.
- Vendor will evaluate the weighting of the risk component of the TAT using data provided by PG&E.
- Vendor will help set up a system for continuous monitoring of TAT for ongoing evaluation.

5. *Timeline*

The research is planned to be complete in Quarter 2 2022. PG&E plans to report on the status of this research in the next annual update.

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4.4.2 Research Findings

Report findings from ongoing and completed studies relevant to wildfire and PSPS mitigation. Organize findings reports under the following structure:

1. ***Purpose of research** – Brief summary of context and goals of research;*
2. ***Relevant terms –** Definitions of relevant terms (e.g., defining "enhanced vegetation management" for research on EVM);*
3. ***Data elements –** Details of data elements used for analysis, including scope and granularity of data in time and location (i.e., date range, reporting frequency and spatial granularity for each data element, see example table above);*
4. ***Methodology** – Methodology for analysis, including list of analyses to perform; section shall include statistical models, equations, etc. behind analyses;*
5. ***Timeline –** Project timeline and reporting frequency to WSD. Include any changes to timeline since last update;*
6. ***Results and discussion** – Findings and discussion based on findings, highlighting new results and changes to conclusions since last update; and*
7. ***Follow-up planned** – Follow up research or action planned as a result of the research.*

PG&E engineers and technical staff perform analysis and review of concepts, tools, and technologies as a normal and consistent part of business operations; however, those analyses and reviews are not often characterized as "Research Studies" in the same formal approach as the kind of academic research that this section is set up to discuss. PG&E conducts research through the EPIC program and findings for EPIC projects are published as part of the closeout documentation. The relationship of the EPIC research program with this WMP is described in Section 7.1.D.2. There are a number of wildfire mitigation-related EPIC projects included as part of this WMP; they are listed in Section 7.1.D. In addition, PG&E documents "lessons learned" on projects, including numerous non-EPIC projects included in this WMP, in various sections, including, but not limited to, Section 7.1.D. The following are specific academic research findings for completed studies relevant to wildfire and PSPS mitigation:

Independent, External Review of the Proposed 2020-21 HFRA Map for PSPS Scoping by the B. John Garrick Institute for Risk Sciences at UCLA (GIRS-RT)

1. ***Purpose of Research***

   The GIRS-RT provided an independent, external review of the proposed 2020-21 PG&E HFRA Map for PSPS. The HFRA map builds on the CPUC's HFTD Map developed in 2018. The HFRA map makes incremental changes to the HFTD map by adding regions where the risk of utility triggered catastrophic

wildfire from an offshore wind event is high and removing regions where it is not.

PG&E used this methodology review and polygon by polygon feedback to further inform the HFRA map development polygons.

2. Relevant Terms

High Fire Risk Area or HFRA - Mapping terminology that aligns with other California utilities use of maps supplemental to the HFTD Map. While the HFTD is a foundational tool to identify areas of elevated or extreme wildfire risk for utilities, it was not developed at the electric asset level and is not operationally informed for PSPS program scoping and execution. HFRA refinements may also serve to inform future adjustments or recommendations to improve the HFTD map.

Aspect – The direction the slope faces (north, east, south, west). The aspect determines the effect of solar heating, air temperature, and moisture. In the Northern Hemisphere, south facing slopes receive more solar heating which results in lower humidity, rapid moisture loss, and lighter fuels such as grasses. Seasonal directions of solar heating should be taken into consideration when analyzing a slope's aspect.

Slope – A ratio of rise over run. Another way to think of it is height over distance expressed as a percentage. Slopes can range from slight to steep but the influence on wildland fire is substantial. The steeper the slope the faster a fire moves uphill. Flames are closer to the fuel source, radiation heat increases the dehydration and preheats the vegetation, resulting in ignition sooner than on a slight slope or level ground.

Land Use – Evaluation of modification and maintenance activities to the natural wildland landscape. Land Use can change probability of fire ignition and fire behavior.

Fuel Loading – Fuel loading is reported in tons of fuel available per acre. The higher the fuel loading, the more heat that will be produced during a fire.

Fuel Position – Fuel position is based on relation to the ground. It can be defined by three types of fuels: subsurface fuels, surface fuels, and aerial fuels.

Fuel Continuity – The horizontal and vertical spacing of fuels. These are often referred to as continuous fuels or patchy fuels. The rate and direction of the fire is predictable with continuous fuels. Patchy fuels are difficult to calculate because the radiant heat may not be able to ignite the source.

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3. Data Elements

TABLE PG&E-4.4-3: DATA ELEMENTS (INDEPENDENT, EXTERNAL REVIEW OF THE PROPOSED 2021-21 HFRA MAP FOR PSPS SCOPING BY THE B. JOHN GARRICK INSTITUTE FOR RISK SCIENCES AT UCLA (GIRS-RT)

Data Element	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Comments
Aerial imagery	Varied	Varied	Varied	Varied	Utilization of readily available and current satellite imagery from Google Earth and ESRI to inform land use, fuels, and terrain at variable scale to inform wildfire ignition risks and potential fire behavior.
Topographic map layers	Varied	Varied	Varied	N/A	Utilized to evaluate the slope off the terrain in and adjacent to areas of the HFRA to inform potential for fire spread.
Fire perimeter history	Annual Ongoing MTBS and GeoMAC	Ongoing	Varied	Varied	Utilization of fire perimeter data to evaluate fire frequency/regimes, fire spread patterns and effectiveness of historical suppression efforts.
Fire spread modeling	N/A	Varied	N/A	Varied	The use of computational fire spread modeling to inform or support recommendations based on qualitative local knowledge and other analysis.
Qualitative historical local knowledge	N/A	N/A	N/A	N/A	Experience-based inputs and recommendations from PG&E Public Safety Specialists with fire response and experience in specific regions of PG&E service territory.
Field visits	N/A	N/A	N/A	N/A	As needed field verification for supplemental evaluation of actual current conditions.
Meteorology outputs	1989-2020 * modeled	N/A	2km x 2km grid	Hourly	Utilization of 30-year climatological re-analysis to inform anticipated exposures to electric assets and surrounding wildland fuels and terrain.

Data Element	Collection Period	Collection Frequency	Spatial Granularity	Temporal Granularity	Comments
Historical outage datasets	2009-2017	On-going	N/A	N/A	Datasets of outages that occurred during offshore wind events were used to inform polygon creation and by highlighting areas that typically experience outages during offshore wind events.

4. Methodology

After internal draft development of the HFRA Map, PG&E commissioned the GIRS-RT to review PG&E's HFRA Map development methodology and the polygons associated with the draft map. During this review, the GIRS-RT evaluated the criteria used to add or remove the areas to or from the HFTD Map. To supplement these criteria, the GIRS-RT accessed additional data sets to enable complementary, objective assessments for land use, fuel load and slope. The GIRS-RT also utilized fire history and perimeter data to check alignment of candidate regions with recent fires.

5. Timeline

This was a one-time review in 2020 of the proposed 2020-21 PG&E HFRA Map for scoping PSPS events and associated mitigation programs. PG&E may utilize the GIRS-RT for additional HFRA Map reviews going forward.

6. Results and Discussion

The GIRS-RT reviewed the polygons to the build the HFRA Map off of the existing HFTD map as well as the rationale used to make the case for each areas' addition or removal. The GIRS-ST agreed with PG&E's methodology and concurred with the majority of the polygons slated for the map. The GIRS-RT also recommended that some areas be expanded or shrunk based on their analysis. PG&E used this external analysis as a secondary check to confirm that the addition or removal rationale is correct and that the areas either pose or do not pose catastrophic wildfire risk.

7. Follow-up Planned

PG&E may further contract the GIRS-RT to review any additional areas slated for addition or removal to the HFRA Map that have not already been reviewed.

Continual Improvement within Enhanced Vegetation Management Program

1. Purpose of Research

The EVM program engaged with researchers at University of California Cooperative Extension and the University of California Berkeley to help evaluate the EVM procedural requirements for work execution that would help reduce wildfire risks. This research is part of continuous improvement efforts focused on long term analysis and strategy around the EVM program. PG&E worked with the engaged researchers to evaluate the methodology of targeting high risk tree species and trees exhibiting flawed branches for overhang zone clearing during EVM inspections. In addition, the parties evaluated potentially adjusting PG&E's minimum radial clearance requirements for trees whose trunks are within the defined minimum clearance zone.

2. Relevant Terms

EVM: Enhanced Vegetation Management; the PG&E program and effort to reduce vegetation-related risks to electric distribution facilities

3. Data Elements

TABLE PG&E-4.4-4: DATA ELEMENTS (CONTINUAL IMPROVEMENT WITHIN ENHANCED VEGETATION MANAGEMENT PROGRAMS)

Data Element	*Collection Period*	*Collection Frequency*	*Spatial Granularity*	*Temporal Granularity*	*Comments*
Outages from contact with vegetation	2008-2019	Per Outage	Regional	* From June-October/ Species-Redwood ** Species Redwood, Douglas Fir	This Data element was used for creating analysis reports regarding: – Fire risk ranking per region for targeting overhanging high risk species * Tree failure data for Redwoods ** Branch statistics for Redwoods and Douglas Fir to evaluate ignition ratings
Ignitions from contact with vegetation	All records up to 4/2019	Per Ignition	Regional	* From June-October/ Species-Redwood ** Species Redwood, Douglas Fir *** Month, Species-Redwoods	This Data element was used for creating analysis reports regarding: – Fire risk ranking per region for targeting overhanging high risk species * Tree failure data for Redwoods ** Branch statistics for Redwoods and Douglas Fir to evaluate ignition ratings *** Redwood ignitions based on acres burned
Species Composition	11/15/2016-11/15/2017	Per Tree	Regional/ and division	By project year	This Data element was used for creating analysis reports regarding: – Fire risk ranking per region for targeting overhanging high risk species – Tree failure data for Redwoods – Branch statistics for Redwoods and Douglas Fir – Redwood ignitions based on acres burned to evaluate ignition ratings
Acres Burned	2008-2019	Per Ignition	N/A	Month	This Data element was used for creating analysis reports regarding: Redwood ignitions based on acres burned

4. *Methodology*

The above data elements were used to create the analysis reports used in this review. PG&E had the researchers review the analysis reports to evaluate our methodology for calculating the fire risk ranking for different types of trees per region, as set forth below.

PG&E bases the overall species fire risk ranking per region for targeting overhanging high-risk tree species on the following data:

- Overall species risk formula adds outage score to 1.5 times the ignition score. This is to account for the inherently greater wildfire risk associated with ignitions compared to outages alone. 1.5 factor was evaluated and determined as part of this effort by both internal and external Subject Matter Experts.
- The Species list is limited to species that are related to >1 percent of a region's outages. This limit enables a focus on those species that are present and have had impacts in meaningful numbers in the region.

The parties also evaluated whether Redwoods and Douglas Fir should be excluded from target species lists based on the following data:

- Tree failure statistics from June to October
- Branch statistics to indicate low ignition ratings for both
- Ignitions based on acres burned and month of year

5. *Timeline*

This review was conducted in September and October 2020.

6. *Results and Discussion*

The research found that PG&E's fire risk ranking per species uses a sound methodology. The engaged researchers agreed that we should focus on tree species that have been observed to have a higher branch failure rate as part of our continuous improvement efforts. Redwoods and Douglas Firs were determined to not qualify as high risk tree species in any region based on this review. Lastly, the researchers also agreed that it may be appropriate to leave more healthy low risk tree species by adjusting PG&E's minimum radial clearance requirements for trees whose trunks are within the defined minimum clearance zone.

7. *Follow-up planned*

Results of this research may not result in any changes in 2021 but are part of long-term analysis for performing EVM in the most effective way possible.

Lab Testing to understand ignition behaviors associated with Electric and Magnetic field induction

1. *Purpose of Research*

To understand potential ignition risks associated with de-energized power lines with induced voltages and currents, a thorough literature search was performed both internally and with the help of a third party, the Electric Power Research Institute (EPRI), and no technical publications was found related to this scenario. To further explore this potential risk, lab testing was conducted to determine the fire ignition potential of induced voltages and currents at relatively low energy level associated with de-energized power lines in close proximity to other energized lines. Various scenarios were created in internal PG&E and external Powertech vendor labs in Canada to mimic the induction level currents and voltages and potential ignitions of a down conductor, with recognition of the varying factors in field conditions (i.e., ground resistivity).

2. *Relevant Terms*

GPR – Ground Potential Rise

3. *Data Elements*

TABLE PG&E-4.4-5: DATA ELEMENTS (LAB TESTING TO UNDERSTAND IGNITION BEHAVIORS ASSOCIATED WITH ELECTRIC AND MAGNETIC FIELD INDUCTION)

Data Element	*Collection period*	*Collection frequency*	*Spatial granularity*	*Temporal granularity*	*Comments*
Lab Testing to understand Induction driven Ignition	2020	N/A	N/A	August-Sept 2020	Lab data collected via testing

4. *Methodology*

Two types of current injection methodologies were used to perform the testing:

- Current injection via a ground rod.
- Current injection via a conductor resting on the surface of the ground.

Two types of fuel beds were used to represent flammable vegetation. The first type is a CAL FIRE-specified fuel bed per Section 9.1 of the Power Line Fire Prevention Field Guide used to qualify electrical equipment devices for exemption from Public Resource Code Section 4292. This fuel bed is an erosion control blanket, Excel S-22, manufactured by Western Excelsior Corporation, consisting of 12 mm (1/2 inch) thick layer of agriculture straw material. Four layers of the blanket were laid over the 44" x 44" area of compacted topsoil. The required moisture of the fuel bed is <5 percent, and this was achieved by using an environmental chamber to dry the blanket for

at least 48 hours prior to testing. The temperature of the environmental chamber was kept at approximately 100 ^{O}F.

The second type of fuel bed consisted of sod purchased at the local hardware store and naturally dried outdoor for five days.

PG&E Internal Lab Test Circuit: For internal testing, energizing the ground rod/conductor using a high potential test unit with a max current output of 70mA, a current was injected through the fuel bed and soil to the ground plane, which created a ground potential rise (GPR) and voltage gradient around the electrode.

Powertech's High Power Lab Test Circuit: For external testing, a high power lab set was used, which was connected to the BC Hydro's largest substation via a 230 kV transmission line. A step-down transformer can provide voltages up to 44 kV. The lab capacitor bank had a selection of capacitors to adjust the current within the desired range of 0.1 – 5 A to match as closely as possible the large source impedance of the real system in an induced voltage scenario.

5. Timeline

The testing was conducted in August and September 2020.

6. Results and Discussion

Empirical data collected through a total of 150 tests provided us with better insight into ignition behaviors at low power levels, with different voltage and current combinations. However, the testing did not provide clear thresholds of ignition. The research found that the cases where the conductor was on the ground (representing a fallen conductor due to high wind or tree impact), the conditions of the ground and contact material were the most influential factors for ignition. We also witnessed reduced probability of ignition at lower voltage and current combinations, as well as increased ground impedance. Additionally, it was observed that current was less likely to be established and sustained in dry hay with lower voltages due to high impedance.

7. Follow-up Planned

Based on the findings from the testing, it was determined that grounding and sectionalizing the de-energized lines, where feasible, to reduce induced voltages and currents may be the best way to minimize ignition risk. PG&E is working on determining the feasibility and PSPS procedural impact of this requirement and establishing revised guidance.

4.5 Model and Metric Calculation Methodologies

4.5.1 Additional Models for Ignition Probability, Wildfire and PSPS Risk

Report details on methodology used to calculate or model ignition probability, potential impact of ignitions and/or PSPS, including list of all input used in impact simulation; data selection *and treatment methodologies; assumptions, including Subject Matter Expert (SME) input; equation(s), functions, or other algorithms used to obtain output; output type(s), e.g., wind speed model; and comments.*

For each model, organize details under the following headings:

1. ***Purpose of model** – Brief summary of context and goals of model;*
2. ***Relevant terms –** Definitions of relevant terms (e.g., defining "enhanced vegetation management" for a model on vegetation-related ignitions);*
3. ***Data elements –** Details of data elements used for analysis, including scope and granularity of data in time and location (i.e., date range, reporting frequency and spatial granularity for each data element, see example table above);*
4. ***Methodology –** Methodology and assumptions for analysis, including Subject Matter Expert (SME) input; equation(s), functions, statistical models, or other algorithms used to obtain output;*
5. ***Timeline** – Model initiation and development progress over time. If updated in last WMP, provide update to changes since prior report; and*
6. ***Application and results** – Explain where the model has been applied, how it has informed decisions, and any metrics or information on model accuracy and effectiveness collected in the prior year.*

This section of the 2021 WMP addresses the information requested in the Guidelines, as well as the information requested in certain Action Items identified in WSD's evaluation of PG&E's Remedial Compliance Plan related to Class A Conditions and PG&E's First Quarterly Report related to Class B Conditions. The remainder of this section is organized as follows:

- Subsection (a): Introduction and summary table;
- Subsection (b): Overview of the 2021 Wildfire Distribution Risk Model and discussion of future models;
- Subsection (c): Developing a risk framework;
- Subsection (d): Modeling methodology for the 2021 Wildfire Distribution Risk Model;
- Subsection (e): Additional models developed and used for wildfire risk;

- Subsection (f): The Transmission Operability Assessment Model;
- Subsection (g): Validation of models and frequency of updates;
- Subsection (h): Models used for PSPS events; and,
- Subsection (i): Response to the following Action Items:
    - Class A: Action PGE-1, PGE-2, PGE-7, PGE-17, PGE-18, PGE-19, and PGE-20
    - Class B: Action PGE-31, PGE-37, PGE-38, PGE-39, PGE-40, PGE-41, PGE-42, PGE-52, PGE-53, and PGE-80.

(a) Introduction and Summary Table

PG&E's wildfire risk models produce a quantified risk value that is the product of two terms—the ignition probability and the wildfire consequence at each location. Consistent with this approach, this section discusses the probability and consequence portions of PG&E's wildfire risk models separately, as well as the resulting risk value. Table PG&E-4.5-1 below provides an overview of the wildfire risk models developed by PG&E, organized using the six headers requested by WSD, followed by a detailed narrative of the models and their uses and development.

TABLE PG&E-4.5-1: OVERVIEW OF PG&E RISK AND OPERATIONAL MODELS

#	Model Name	Purpose of Model	Relevant Terms	Data Elements	Methodology	Timeline	Application and Results
1	Enterprise Risk Model	To assess enterprise risks (including wildfire) using a common framework (i.e., risk bowtie and MAVF) and compare consequences using the MAVF scoring approach agreed to in the SMAP Settlement Agreement; and ultimately to develop RSEs at a portfolio/program level	Risk drivers, risk event, outcomes, consequence dimensions, MAVF	For wildfire: CPUC Reportable Ignitions, CalFire historical fire reports, Red Flag Warning days	Reference SMAP Settlement Agreement (D. 18-12-014)	RAMP Report filed every four years preceding the GRC submission by one year (i.e. 2020 RAMP and 2023 GRC – filed 2021)	For wildfire: results used to qualify pre and post mitigation risk score (for comparison to other enterprise risks).
2	2021 Wildfire Distribution Risk Model	Provide wildfire risk values for the distribution system to provide insights into the locations with high wildfire risk by risk driver to inform the development of mitigation programs	Vegetation Probability of Ignition Model (see row #3 below) Equipment Probability of Ignition Model (see row #4 below) Wildfire Consequence Model (see row #5 below)	Data elements listed below for the Vegetation POI, Equipment POI, and Wildfire Consequence Models. Definitions for circuit segments	Risk values are calculated for risk drivers (vegetation, equipment, etc.), at a 100-meter by 100-meter granularity and then aggregated up to circuit segments or circuits according to the need of the mitigation program. Risk is calculated as the product of ignition probability and wildfire consequence.	Initiated January 2020 and completed November 2020.	Used to provide insights for the System Hardening, EVM programs respectively.

TABLE PG&E-4.5-1: OVERVIEW OF PG&E RISK AND OPERATIONAL MODELS (CONTINUED)

#	Model Name	Purpose of Model	Relevant Terms	Data Elements	Methodology	Timeline	Application and Results
3	Vegetation Probability of Ignition Model	Provide annual ignition probability due to vegetation failures	MaxEnt – Short for Maximum Entropy. The name given to a family of models that seek to maximize the information entropy[26] (i.e., instead of the likelihood or some other optimization criteria) of the probability distribution associated with a given set of conditions – in this case, ignition probability, given environmental and asset characteristics. It can also be interpreted as finding the least unique distribution that fits the underlying data.	Environmental, Meteorological, and Asset data	MaxEnt algorithm to provide 100-meter by 100-meter pixel values along the Tier 2 and Tier 3 distribution lines.	Initiated January 2020 and completed November 2020	Not directly used to inform workplans. Input to the 2021 Wildfire Distribution Risk Model

26 Information entropy is the average level of uncertainty inherent in an outcome derived from a set of variables or covariates.

TABLE PG&E-4.5-1: OVERVIEW OF PG&E RISK AND OPERATIONAL MODELS (CONTINUED)

#	Model Name	Purpose of Model	Relevant Terms	Data Elements	Methodology	Timeline	Application and Results
4	Equipment Probability of Ignition Model	Provide annual ignition probability due to conductor failures	MaxEnt – Short for Maximum Entropy. The name given to a family of models that seek to maximize the information entropy (i.e. instead of the likelihood or some other optimization criteria) of the probability distribution associated with a given set of conditions – in this case, ignition probability, given environmental and asset characteristics. It can also be interpreted as finding the least unique distribution that fits the underlying data.	Environmental, Meteorological, and Asset data as described below	MaxEnt algorithm to provide 100-meter by 100-meter pixel values along the Tier 2 and Tier 3 distribution lines.	Initiated January 2020 and completed November 2020	Not directly used to inform workplans. Input to the 2021 Wildfire Distribution Risk Model.

TABLE PG&E-4.5-1: OVERVIEW OF PG&E RISK AND OPERATIONAL MODELS (CONTINUED)

#	Model Name	Purpose of Model	Relevant Terms	Data Elements	Methodology	Timeline	Application and Results
5	Wildfire Consequence Model	Quantify the locational fire impacts in terms of the MAVF framework	Technosylva – Fire simulation software whose outcomes are based on available fuels, topography, and weather; and structure and population data. Technosylva simulation outputs are used as the source of spatially resolved fire severity data that is the primary input into the spatial consequence calculations. FBI – Technosylva's Fire Behavior Index. A scale of 1-5 that captures fire severity as a function of flame length (intensity of burn) and rate of spread. FBI of 3 or greater is expected to require aggressive suppression.	Input data: meteorology, satellite derived fuels (100-hour and 1000-hour) For each 8-hour simulation the following output data was used to develop the consequence data set: Number of structures, acres burned, and Fire Behavior Index (FBI) which is a combination of Flame Length and Rate of Spread (ROS)	Technosylva model output combined to develop a destructive fire probability that is then calibrated to the system level MAVF score.	Initiated January 2020 and completed November 2020	Used to prioritize the Distribution Tier 2 triennial inspections cycle (Tier 3 inspections are conducted every year), and other maintenance programs. Also input to the 2021 Wildfire Distribution Risk Model.

TABLE PG&E-4.5-1: OVERVIEW OF PG&E RISK AND OPERATIONAL MODELS (CONTINUED)

#	Model Name	Purpose of Model	Relevant Terms	Data Elements	Methodology	Timeline	Application and Results
6	Vegetation Risk Model	Quantify wildfire risk due to vegetation failures to prioritize vegetation wildfire mitigation programs	MAVF risk value for each 100-meter pixel Mean MAVF risk value for each circuit segment or circuit segment.	Output in 100-meter pixels that are aggregated to the circuit segment level	Risk is calculated as the product of the ignition probability and wildfire consequence for each 100-meter pixel. Circuit Segment level risk scores are the mean of the pixel risk scores in that segment.	Initiated January 2020 and completed November 2020	Used to provide insights to the prioritization for the EVM program to improve focus on highest risk segments.
7	Conductor Risk Model	Quantify wildfire risk due to conductor equipment failures to prioritize system hardening and equipment replacement wildfire mitigation programs	MAVF risk value for each 100-meter pixel Mean MAVF risk value for each circuit segment or circuit segment.	Output in 100-meter pixels that are aggregated to the circuit segment level	Risk is calculated as the product of the ignition probability and wildfire consequence for each 100-meter pixel. Circuit Segment level risk scores are the mean of the pixel risk scores in that segment.	Initiated January 2020 and completed November 2020	Used to provide insights to the prioritization for the System Hardening program to improve focus on highest risk segments.

TABLE PG&E-4.5-1: OVERVIEW OF PG&E RISK AND OPERATIONAL MODELS (CONTINUED)

#	Model Name	Purpose of Model	Relevant Terms	Data Elements	Methodology	Timeline	Application and Results
8	Large Fire Probability Model (Distribution) or LFP_d Model	Identify and quantify areas of the PG&E territory where there is concurrence in space and time of high potential for large fires to occur and increase outage probabilities.	The model is comprised of the Fire Potential Index and the Outage Producing wind model, which seek to quantify the probability of an outage event and the probability of large fire occurrence.	Data output every 2 x 2 km	Based on PG&E's high-resolution weather, outage and fuels models forecast and historical data.	First version in use in 2018, continued operations and enhancements through 2020.	Risk model utilized for distribution PSPS events.
9	Large Fire Probability Model (Transmission) or LFP_T Model	Identify and quantify areas of the PG&E territory where there is concurrence in space and time of high potential for large fires to occur and increase failure probabilities.	The model is comprised of the Fire Potential Index and the Transmission Operability Assessment model, which seek to quantify the probability of an outage event and the probability of large fire occurrence.	Data output for each transmission structure	Based on PG&E's high-resolution weather, outage and fuels models forecast and historical data.	First version in use in 2020, continued operations and enhancements through 2021.	Risk model utilized for transmission PSPS events.
10	Dead Fuel Moisture Model	Model and forecast the relative amount of moisture in dead vegetation	Fuel moisture is a measure of the amount of water in a potential fuel source for fire. It is expressed as a percentage of water in the dry weight of that fuel.	2 x 2 km output of four DFM fuel classes. Data available in forecast as well as across 30- year climatology	DFM is forecast by the Nelson Dead Fuel Moisture model, which utilized by federal agencies to model DFM.	Initially developed in 2015, enhanced in 2020 to run at 2 x 2 km.	Input to the Fire Potential Index Model

TABLE PG&E-4.5-1: OVERVIEW OF PG&E RISK AND OPERATIONAL MODELS (CONTINUED)

#	Model Name	Purpose of Model	Relevant Terms	Data Elements	Methodology	Timeline	Application and Results
11	Live Fuel Moisture Model	Model and forecast the relative amount of moisture in live vegetation	Fuel moisture is a measure of the amount of water in a potential fuel source for fire. It is expressed as a percentage of water in the dry weight of that fuel. As opposed to dead fuels, live fuels are biologically active.	2 x 2 km output of LFM in Chamise and Manzanita species. Data available in forecast as well as across 30- year climatology	LFM is forecast by a machine-learning model that was trained on historical LFM observations and historical weather data.	Initially developed in 2015, enhanced in 2020 to run at 2 x 2 km.	Input to the Fire Potential Index Model
12	Transmission Operability Assessment Model or OA Model	Provides probability of failure of transmission line assets (at a structure level) in windy conditions	pf = probability of failure, Bayesian updating	Enhanced inspection condition scores, repair data, outage data, ETGIS data (age, environment), PLSCADD data (in progress), etc.	Probability is calculated based on an asset fragility curve that varies with windspeed. Asset failure curves are adjusted from "brand new" based on various factors such as inspection condition, age, environment and previous performance.	Initiated in 2019. Continually updated/enhanced with official version releases by May 31 of each fire season.	The OA Model is primarily used for PSPS events, but is also a factor incorporated into operational, maintenance, and investment decisions for the transmission system.

TABLE PG&E-4.5-1: OVERVIEW OF PG&E RISK AND OPERATIONAL MODELS (CONTINUED)

#	Model Name	Purpose of Model	Relevant Terms	Data Elements	Methodology	Timeline	Application and Results
13	Outage Producing Wind Model or OPW Model	Quantify and forecast the wind-related outage probability on the distribution system	The OPW model was built using historical weather compared sustained and momentary outages and is run at 2 x 2 km resolution. OPW is an input into the LFPd model.	2 x 2 km output of OPW in forecast and historical mode. Data available in forecast as well as across 30- year climatology	Wind speeds were first linked with over 400,000 historical sustained and distribution outages in space and time. The OPW model was then trained with this historical data for localized areas. OPW can be driven with forecasted wind speeds to determine areas that have an increased outage probability in the future.	Initially developed in 2019, enhanced in 2020 to run at 2 x 2 km. Future enhancements discussed in WMP.	OPW is a main input in the LFP_d Model. It is used to understand the probability of an outage event occurring hour-by-hour at 2 km resolution.

TABLE PG&E-4.5-1: OVERVIEW OF PG&E RISK AND OPERATIONAL MODELS (CONTINUED)

#	Model Name	Purpose of Model	Relevant Terms	Data Elements	Methodology	Timeline	Application and Results
14	Fire Potential Index Model or FPI Model of Utility FPI Model	Quantify and forecast the probability of large fires based on environmental and vegetation factors	FPI describes the probability fires growing large (>1000 acres). It combines weather (wind, RH, temperature), DFM, LFM, and land-classification.	2 x 2 km output of FPI in forecast and historical mode. Data available in forecast as well as across 30- year climatology	Weather, fuel moisture, and other environmental data were linked to a historical fire occurrence in space and time. The goal was to determine which factors and combination of factors yield the most predictive skill of probability of large fires. Over 4,000 FPI models were constructed by combining multiple indices and factors to ultimately determine the most predictive and operable FPI. The FPI is run in forecast model out several days to determine the hour-by-hour risk of large fires.	Initially developed in 2018, model enhancements made in 2019, and enhanced to run at 2 x 2 km resolution in 2020. Future enhancements discussed in WMP.	FPI is a main input in the LFPd and LFPt models. It is used to understand the probability of a large fire occurring hour-by-hour at 2 km resolution.

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(b) Overview of 2021 Wildfire Distribution Risk Model And Future Models

The 2021 Wildfire Distribution Risk Model supersedes the prior wildfire risk models used in the 2019 and 2020 WMPs, referred to as the 2019-2020 Wildfire Risk Model.[27] Key objectives for the 2021 Wildfire Distribution Risk Model are:

1. Provide situational awareness of risk;
2. Enable risk-informed decision making; and,
3. Enable PG&E to develop line-of-sight on risk reductions from wildfire risk mitigation initiatives.

Recognizing that risk-informed decision making is desired for both workplans developed on an annual basis and operational decisions, such as PSPS, PG&E has been developing models specific to the temporal needs of each model. There are primarily two forms of models that can be used to address wildfire risk. First, planning models support annual workplans and are based on either worst case conditions such as weather and fuels or cumulative probabilities of failure or ignition. The 2021 Wildfire Distribution Risk Model described below is a planning model for the Electric Distribution system. Second, operational models, such as those used for PSPS events utilize real-time weather, fuels data, and asset conditions as reflected by maintenance tags or recently completed asset hardening. The Large Fire Probability Model (Distribution) or LFP_D Model, described in Section 4.2.A, is an example of an operational model. Given the respective application of planning and operational models, planning models are updated on an annual cadence while operational models are updated as frequently as weekly during fire season.

The 2021 Wildfire Distribution Risk Model seeks to quantify the risk of wildfire represented by the probability of ignitions associated with electric grid infrastructure combined with the consequences if that ignition propagates into a wildfire. The 2021 Wildfire Distribution Risk Model is a set of models that represents failure modes, or risk drivers, underlying ignitions and the consequences of wildfire. These models comprise the components of the wildfire risk formula:

Wildfire Risk = Ignition Probability x Wildfire Consequence

The "Ignition Probability" portion of the 2021 Wildfire Distribution Risk Model is modeled according to the risk drivers identified in PG&E's 2020 RAMP Report for wildfire risk. From among these risk drivers, the 2021 Wildfire Distribution Risk Model developed probabilities for vegetation and equipment failure caused ignitions as they represent 38 percent and 26 percent systemwide of the grid related ignitions respectively. Within equipment failures, the 2021 Wildfire Distribution Risk Model has developed probabilities for conductor failures. As described in Section 4.3, future modeling efforts

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27 In the 2021 WMP, the naming convention used for models reflects the period of time the model was used to inform and prioritize planning. For example, the 2019-2020 Wildfire Risk Model was developed in 2018 but was used to inform planning in 2019 and 2020. The 2021 Wildfire Distribution Risk Model was developed in 2020 and is being used to inform planning in 2021.

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will add failure models for other drivers such as 3rd party contact and for electric grid equipment such as poles and transformers. The modeling framework established with this model will accommodate the future addition of such models.

The "Wildfire Consequence" portion of the 2021 Wildfire Distribution Risk Model focuses on impact measures such as acres, number of structures, and variables describing the nature of the fire such as flame length and rate of spread. The key improvement for the 2021 Wildfire Distribution Risk Model is tied to the advanced modeling capabilities of the Technosylva fire simulation tools. In the 2019-2020 Wildfire Risk Model, REAX Engineering provided simulations that relied heavily on the concentration of fuels to determine the potential for an ignition to propagate to a wildfire. While informative, the Technosylva simulation tool improves on this capability by modeling what fire science refers to as ladder fuels whereby an ignition will propagate from low fuels such as grass and brush to increasingly denser fuels leading to treetop, as well as updated ground fuels, buildings and population data layers. The result is a more accurate representation of the potential consequences of wildfire in the wildland urban interface and the broader Tier 2 and Tier 3 HFTD areas modeled. Future model versions will model the entire PG&E distribution system.

Bringing the improvements to the both the Ignition Probability and Wildfire Consequence portions of the model together, the 2021 Wildfire Distribution Risk Model now provides an improved measure of wildfire risk. The 2019-2020 Wildfire Risk Model provided a relativistic measure that was instructive for prioritizing circuits and circuit segments, but it did not allow for measuring the degree of risk between those segments. The 2021 Wildfire Distribution Risk Model provides this capability as the risk scores are absolute scaled units. Furthermore, these wildfire risk scores are calibrated to the system and tranche risk scores for wildfire risk event as described and modeled in PG&E's 2020 RAMP Report. As a result, risk values can now identify how much riskier a location is compared to another, risk can be more accurately compared across wildfire and PG&E's other risk events, and the actual value of risk reduction is now more easily computed.

Even as the predictive power of the 2021 Wildfire Distribution Risk Model has been greatly improved as compared to the 2019-2020 Wildfire Risk Model, PG&E is continuing to develop and refine our risk modeling. The 2021 Wildfire Distribution Risk Model has several limitations; it does not include transmission facilities, does not have the ability to compare wildfire risks for additional risk drivers as well as measuring the risk reduction for specific mitigations, and for equipment probability of ignition only includes conductors.

In 2021, PG&E intends to develop the 2022 Wildfire Distribution Risk Model which will include certain upgrades to the 2021 model and will include data on additional electrical equipment (e.g., poles). In 2021, PG&E is also working to develop a 2022 Wildfire Transmission Risk Model for our transmission facilities that will be similar to the 2021 Wildfire Distribution Risk Model. Finally, PG&E is also working on a Pilot Probabilistic Risk Assessment or "PRA." The PRA is still conceptual, but, if successfully developed, will integrate all models into a single electric system view of wildfire risk. PG&E is working to develop a reference model of the PRA in 2021 and potentially, depending on the effectiveness of the reference model, to use the PRA for planning in 2022.

(c) Developing a Risk Framework

To accomplish the improvements from the 2019-2020 Wildfire Risk Model to the 2021 Wildfire Distribution Risk Model, a systematic Risk Modeling Framework was used to develop the capabilities identified in the CPUC Utility Wildfire Mitigation Maturity Survey (Maturity Survey). This general framework is shown in Figure PG&E-4.5-1.

FIGURE PG&E-4.5-1: RISK MODELING FRAMEWORK

The specific risk model framework steps that resulted in the development of the 2021 Wildfire Distribution Risk Model include:

- **Scoping – defining the problem and desired outcomes.** Beginning with the Scoping step, the 2021 Wildfire Distribution Risk Model is tied to the wildfire risk bowtie and risk scores outlined by PG&E's Enterprise & Operational Risk Management (EORM) department in our 2020 RAMP Report. Examples include the development of risk scores calibrated to the system MAVF scores and modeling failure modes for the identified wildfire risk drivers. During the scoping step, key desired capabilities were identified tying to the Maturity Survey, such as the improved level of granularity, the ability to aggregate risk scores to different levels such as circuit segments, and the comparability of risk scores to facilitate the development of risk reduction and RSE values.

- **Data Intake – key data sets are identified and prepared for modeling**. For the 2021 Wildfire Distribution Risk Model, vegetation data, ignition data, and asset data were critical data sets that were identified and prepared in this step. As LiDAR data was not fully available at this stage, LiDAR informed satellite vegetation data was obtained by one of our project partners, Salo Sciences.

- **Risk ID – Failure Modes Effect Analysis (FMEA) and Exploratory Data Analysis (EDA) are employed to understand and identify the root cause**

and characteristics of the problem. From the identified risk drivers in the RAMP Wildfire Risk bowtie, vegetation and conductor equipment caused ignitions were investigated. Using a previously developed FMEA, EDA was conducted on the identified data sets in the Data Intake step. EDA begins the process of gaining insight from the data before the modeling begins. This includes understanding the accuracy of the data, patterns including outliers and anomalies, as well as interesting relationships between data sets.

- **Risk Assessment – development of the models and model features**. In this step, the model algorithm is selected and trained on the ignition data to provide spatial probabilities of ignition. The Wildfire Consequence Model data was also developed from the Technosylva simulation model. To quantify the predictive power of the model, precision assessments were developed. These metrics informed iterative adjustments that were subsequently made to improve predictive ability. The resulting MAVF risk scores were then calibrated, and validation exercises were held with the Vegetation Management and Distribution Asset Strategy teams that would use the models to inform their 2021 workplans. At this point the 2021 Wildfire Distribution Risk Model was reviewed and approved by the WRGSC which is led by the Chief Risk Officer and made up a cross-functional officer team.

- **Risk Management – insights from models are used to develop work plans.** The modeling insights are combined with project factors and variables not incorporated in the models. For example, species data was not fully incorporated in to the EVM Risk model. As a result, the Vegetation Management team applied species data as an overlay to the Vegetation Risk Model to produce the 2021 EVM workplan. With the Distribution Asset Strategy team, model data is combined with information on terrain, customers locations, and customer counts to identify the preferred mitigation alternative. Similar to the risk models, the resulting workplans are also reviewed and approved, as part of this step, by the WRGSC.

- **Risk Mitigation – monitors and reports the drawdown of risk as work is performed.** This is accomplished with the model as well as validating the model against actual system performance metrics. For example, ignition probability models are validated against actual annual ignitions to capture insights into future improvements. As modeling capabilities improve monitoring the risk drawdown can become a key operational metric.

(d) Modeling Methodology for the 2021 Wildfire Distribution Risk Model

The 2021 Wildfire Distribution Risk Model formulates risk in probabilistic terms in a manner that is similar to and compatible with the MAVF risk framework established by the CPUC. The fundamental concept is that the risk associated with an event, such as a fire ignition, can be expressed as the product of the probability of the event happening and the consequences if it does happen. The MAVF framework calls these the likelihood of risk event (LoRE) and the CoRE, respectively. In the 2021 Wildfire Distribution Risk Model, the notation P(ignition) for ignition probability and C(ignition) for the consequences of an ignition, is used, as shown below:

Risk = P(ignition) x C(ignition)

Below, PG&E describes in more detail how the 2021 Wildfire Distribution Risk Model addresses ignition probability and consequence.

Ignition Probabilities – Vegetation Probability of Ignition Model and Equipment Probability of Ignition Model. To answer the question of where ignition events are likely to occur, fire season ignition probabilities have been estimated using maximum entropy models (MaxEnt), which was pioneered in the modeling of ecological ranges of species. These models are trained on ignition (or outage) locations, gridded spatial environmental data, and asset attribute data. While the data can draw from a specific time period, the model itself is dedicated to spatial, not temporal, patterns. The MaxEnt model provides relative scores or, if properly calibrated, probabilities for fire-season ignitions per "pixel" of input data. MaxEnt models take the set of locations of ignitions under study and rasterized (i.e., pixelated) data on environmental conditions and asset attributes as explanatory covariates for all locations with grid infrastructure as inputs and output rasterized maps of ignition probabilities.

For the 2021 Wildfire Distribution Risk Model, the objective is to identify which environmental conditions and asset attributes (collectively called the model covariates) are more common among ignition locations than they are among all distribution grid locations. For example, tall trees are more common among vegetation caused ignition locations than they are among typical distribution grid locations. Metrics of vegetation dryness, HFTD tier assignments, conductor materials and size, and others, can all be checked for such patterns. The ratio of covariate value prevalence at ignition locations to their prevalence across all grid locations is called the relative occurrence rate. MaxEnt provides a way of estimating the relative occurrence rate given a fairly modest number of ignition locations. The way it does this is to fit a statistical distribution of covariate values for ignition locations that is consistent with the values at known ignition locations, but otherwise as similar as possible to the distribution of values found everywhere else along the distribution grid. The similarity criteria are enforced using a metric called the relative information entropy between the ignition locations and the distribution grid locations, where the larger that metric is, the more similar the two distributions are. For this reason, the overall approach is referred to as a maximum entropy or MaxEnt estimation of the relative occurrence rate. When multiplied by the fraction of all grid locations that experience ignitions annually, the relative occurrence rate is normalized into an estimate of the annual probability an ignition will occur for all values of the covariates. This can be used to forecast annual ignition probabilities based on the covariate values found at each distribution grid location.

MaxEnt models have been successfully applied in ecology to the problem of estimating a species' range (i.e., the physical extent of its suitable habitat), given a set of locations where members of that species have been observed and the corresponding environmental conditions at those locations and all candidate locations for the range. In that context, the model assigns a score to every location that captures how similar the conditions at that location are to the locations where the species was observed. There is a correspondence between MaxEnt applied to species observations and ranges and ignition locations and at-risk locations—looking for the "range" of grid-caused wildfires—the environmental conditions and asset attributes associated with elevated wildfire

probabilities. PG&E has applied MaxEnt methods to event occurrences and their proximate asset and environmental conditions contrasted with the background conditions everywhere else along the distribution grid to identify the locations most likely to experience similar events in the future.

PG&E developed two models regarding the probability of ignition related to specific risk drivers—the Vegetation Probability of Risk Model (Model #3 in Table PG&E-4.5-1 above) and the Equipment Probability of Ignition Model (Model #4 in Table PG&E-4.5-1 above). These models are further described in Section 4.3.

Ignition Consequences – Wildfire Consequence Model. PG&E uses MAVF to calculate the consequence of an event. The consequence attributes and their respective weights are:

1. Safety (50%)
2. Financial (25%)
3. Electric Reliability (20%)

Each outcome in the Wildfire Consequence Model (Model #5 in Table PG&E-4.5-1 above) is assigned a score for these three categories which is then aggregated to calculate the consequence score. The consequence values assigned to each simulated fire comes from these existing MAVF consequence scores. MAVF divides wildfire risk events into severity categories, modeling each category as a separate set of inputs (think tabulations/counts of historical ignitions that fit into each severity category) and consequence outcomes.

Historically, risk assessments using MAVF scoring have been performed at the enterprise-level without spatially explicit data or models. In other words, the risks are computed in terms of the expected count and severity of "risk events" but not at their specific locations. The purpose of the 2021 Wildfire Distribution Risk Model is to model the spatial variation in risk so that wildfire mitigation efforts can prioritize higher risk assets and locations for mitigation. This approach required new spatially explicit MAVF CoRE consequence metrics that are consistent with the enterprise-wide risk numbers. The development of spatial MAVF CoRE consequence metrics required mapping the characteristics of every "grid pixel" in the HFTD areas to the categories used to assign ignitions to tranches of consequence already in use in the MAVF framework. These categories include HFTD areas, red flag warning conditions, and fire severity. Technosylva fire simulations under extreme fire weather conditions were used to estimate the likelihood of ignitions growing into fires of Small, Large, Destructive, or Catastrophic extent. These characteristics were then used to lookup existing MAVF CoRE values for corresponding tranches and used to compute probability weighted averages of the consequence values for every grid location in the HFTDs areas.

(e) Additional Models Used for Wildfire Risk

In addition to the models described above, there are two additional models that PG&E developed to address wildfire risk. These are submodels that include components of the 2021 Wildfire Distribution Risk Model.

- **Vegetation Risk Model.** All vegetation-caused CPUC reportable fire season ignitions from 2015 to 2018 within the HFTD areas were used to model the risk

addressed by the EVM program. PG&E did not use 2019 ignition data initially because this data is being used to test and validate the predictive power of the model. A MaxEnt model was used to estimate spatial ignition probabilities based on those ignitions. This work was informed by data on vegetation, weather and other environmental conditions. The ignition probabilities were combined with the MAVF CoRE values from the spatial ignition consequence data set to produce 100m x 100m grid-pixel-level risk scores. The pixelated risks were aggregated within each circuit segment (also called Circuit Protection Zone or CPZ) in the HFTD areas to produce the risk summaries provided as inputs used to inform EVM planning and prioritization. The Vegetation Risk Model is Model #6 in Table PG&E-4.5-1 above.

- **Conductor Risk Model.** All conductor-involved CPUC reportable fire season ignitions from 2015 to 2018 (2019 was held back for testing predictive power) within the HFTDs were used to model the risk addressed by the System Hardening program.[28] A MaxEnt model was used to estimate spatial ignition probabilities based on those ignitions. The ignition probabilities were combined with the MAVF CoRE values from the spatial ignition consequence data set to produce 100m x 100m grid-pixel-level risk scores. This work was informed by data on conductor materials and size, proximity to the coast, and the location of splices. Prior work within PG&E informed our interest in these data fields. The pixelated risks were aggregated within each circuit segment in the HFTD areas to produce the risk summaries provided as inputs used to inform system hardening planning and prioritization. The Conductor Risk Model is Model #7 in Table PG&E-4.5-1 above.

(f) Transmission Operability Assessment Model

While the 2021 Wildfire Distribution Risk Model is focused on PG&E's electric distribution system, the Transmission Operability Assessment Model or OA Model works to mitigate the risk of wind-induced failures of transmission equipment that may result in an unintentional ignition. The OA Model is primarily used for PSPS events, but is also a factor incorporated into operational, maintenance, and investment decisions for the transmission system.

In 2019, PG&E developed the OA Model to assess the physical condition of overhead electrical transmission line assets. The OA Model provides for a data-driven, risk-based framework to inform both asset management and operability assessment decisions by incorporating elements of probabilistic-based engineering analyses commonly used in other risk-driven industries such as nuclear power generation. The OA Model computes an asset-based fragility (probability of failure due to wind gust speed) by quantitatively assessing the condition (or health) of transmission structures and components and accounting for known degradation mechanisms. This fragility, in turn, contributes to the quantification of risk due to environmental conditions associated with PSPS. When used in conjunction with Transmission Asset Management, the OA Model also provides

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28 Note that vegetation-caused conductor-involved ignitions were also modeled by the Vegetation Risk Model.

probabilistic-driven insight into the operation, maintenance, and investment strategy of transmission infrastructure.

PG&E is engaged with two ongoing modeling efforts regarding the data-driven, risk-informed decision making for management of PG&E's transmission system:

(1) Operation of the OA Model, which includes maintenance of existing data supplies to ensure daily relevance of the Model's outputs, and

(2) Use of Bayesian Updating (a data-driven, probability-based methodology) for in-flight improvement of wind-based asset strength estimation.

Both of these modeling efforts are described briefly below.

Operation of the OA Model: The key to understanding the OA Model is the concept of fragility. In short, fragility refers to the increasing probability of failure for increasing applied load. In the context of the OA Model, fragility is the conditional probability that an asset (tower, pole, conductor, anchor, etc.) will fail at a given wind speed. While wind speed is the intensity measure used to define fragility, the OA Model considers many damage mechanisms such as corrosion, fatigue, wear and decay that can lower the capacity of the asset to resist wind loads.

The OA Model is based on assigning a fragility curve to each asset to reflect its current health relative to a newly designed and constructed, but otherwise identical, asset. This is done by first presuming a fragility associated with a new, healthy asset, and then adjusting both the strength and uncertainty to reflect the observed condition, age, environment, and historical performance of the circuit in whole. Specifically, the median strength is adjusted based on asset inspection results, test and treat inspection findings (for wood poles only), and structural engineering analysis of the towers/poles, insulators, guys, foundations, anchors and conductors. The uncertainty is adjusted based on the asset age versus a notional design life, the aggressiveness of the asset environment with respect to corrosion and windiness, and the past performance of the circuit.

Fragility can be used to predict the risk that an asset (or set of assets) will underperform at a forecast wind speed. Alternately, if a risk tolerance is defined, the corresponding wind speed at which that tolerance is exceeded can be determined directly from the fragility as described earlier. The risk tolerance is an input to the OA Model, and is a function of many concerns outside the scope of the OA Model.

Bayesian Updating: Bayesian Updating is a methodology by which the wind-based asset strength estimation provided by the OA Model is continuously improved as additional outage data is received. In this manner, the OA Model works to maintain up-to-date relevancy by incorporating new data in the form of newly-reported failures and survivals of transmission assets subjected to windy conditions. Ongoing efforts to improve on the Bayesian Updating methodology have included:

- Vetting of historical outage data to identify, where missing, the cause category and location;

- Identifying the expected wind speed at the date, time, and location of the historical outage;

- Examining post-PSPS patrol data to identify transmission-specific damage, if any, that may have resulted in an outage if the transmission line were energized; and

- Working to establish a unified dataset from which all historical outage data can be referenced.

PG&E has learned a number of key lessons from nearly two years of operating the OA Model, including:

- Identifying and mitigating missing data: This most notably has occurred with the operation of Bayesian Updating. When outage data was missing or sparse (for example, location data was missing), it led to earlier indications that the outputs from Bayesian Updating may be disproportionately penalizing transmission assets due to limited data. Transmission OA subsequently engaged in an extensive effort to research, vet, and document historical outage data to improve the quality of this dataset for Bayesian Updating usage.

- Data visualization: As more data continues to be available, the computational demands on the OA Model have stressed earlier tools. To this end, the Transmission OA team built out and validated data processing, analysis, and visualization tools to provide a robust, reliable, and repeatable framework for operating, visualizing, and distributing OA Model data.

These lessons have been incorporated into the OA Model enhancements that are either in progress or under investigation, as described in the following paragraphs.

Enhancements to the OA Model that are in progress include:

- Incorporation of quantitative outputs for Tier 2 and Tier 3 HFTD transmission assets into the fragility calculations; and

- Integration of a refined corrosion data that incorporates additional variables (such as an asset's distance from a known pollution source) in the corrosion score computation.

PG&E is also looking into the following enhancements for the OA Model that include:

- Integrating the probability of a flashover into the existing OA Model framework;

- Conductor-specific refinements to the fragility computations of this asset class;

- Aggregation and incorporation of wood pole test and treat data; and

- Incorporation of component test data collected by PG&E as part of a larger testing program that PG&E with which PG&E has engaged to better define fragility curves for specific components.

(g) Validation and Frequency of Updates

As part of the Risk Assessment step in the Risk Modeling Framework, models are reviewed and validated. Validation is conducted on a number of Quality Assurance (QA) and Quality Control (QC) levels. Two QA methods are employed for validation. First, following good data science and software development practice, data scientists conduct code reviews on each other's work. Second, model runs include test automation code that checks model outputs to catch erroneous values. A number of QC steps are also employed both internal and external to PG&E. Within PG&E, the EORM team reviews the modeling methodology and results to provide feedback and signal its acceptance of the models for use in measuring risk. Next, PG&E groups that use the risk models to develop mitigation work plans test the model with their subject matter expertise. The PG&E Internal Audit group also has conducted in depth reviews of model methods, results and the application in developing mitigation workplans. Finally, PG&E uses outside expertise to review and validate model methods, code and model results. PG&E is currently contracted Energy and Environmental Economics, Inc. to perform a review and validation of the modeling methodology, code, model results and application to be completed in the spring 2021.

For transmission, the OA Model methodology is derived from the performance-based engineering framework supported by the Pacific Earthquake Engineering Research (PEER) program, which is a consortium of research and industry experts who have extensively published peer-reviewed technical papers related to this topic. PG&E subject matter experts reviewed the OA Model methodology in numerous meetings and workshops, where the nature, purpose, and preliminary outcomes of the model were discussed. An independent, external review was also performed by experts in probabilistic engineering analysis with the B. John Garrick Institute for Risk Sciences at UCLA.

Best practices from data science and software development were employed to integrate the OA Model methodology into Python and Power BI. These best practices included code peer review, automated scripts that compare the model outputs from two independent systems, and automated unit tests of the code for repeatable validation.

Updates and enhancements to the OA Model go through the same review and validation processes, with the additional step of PG&E's Transmission consultant preparing a delta study that identifies the impact of these updates or enhancements on the model outputs. OA Model documentation, including the technical basis of the methodology, is maintained by the Transmission OA team.

As we explained above in Section 4.5.1(b), planning models support annual workplans and are based on either worst case conditions such as weather and fuels or cumulative probabilities of failure or ignition. An example of a planning model is the 2021 Wildfire Distribution Risk Model. Operational models, such as those used for PSPS events utilize real-time weather, fuels data, and asset conditions as reflected by maintenance tags or recently completed asset hardening. An example of operational models are the Large Fire Probability Model (Distribution) and the Large Fire Probability Model (Transmission).

Given the respective application and use of planning and operational models, planning models are updated on an annual cadence while operational models are updated as frequently as weekly during fire season. While operational models benefit from the latest meteorology and asset data to inform event based decisions (e.g., PSPS), investment and planning models require less frequent updates. Planning models are used for annual planning decisions. However, as risk mitigations are completed through the year, planning models can be updated to measure the resulting risk reduction. The frequency of updates in planning models to reflect the completion of risk mitigations will occur on a quarterly basis beginning in 2021.

(h) Modeling for PSPS Events

The operational modeling used by PG&E to determine whether to initiate a PSPS event includes the Large Probability Fire Model (Distribution) and (Transmission), that includes the Utility FPI and OPW Models, as well as the OA Model described above in Section 4.5.1(f). The Large Probability Fire Model (Distribution) and (Transmission), Utility FPI, and OPW Models are also discussed in Sections 4.2.A.

PG&E has also modeled PSPS consequences to customers at a program level in terms of MAVF as discussed in Section 4.1(e); and is currently developing a more granular, circuit level model, to assess the impacts of PSPS denenergizations. PG&E currently plans to complete this analysis in collaboration with the WSD and the other California utilities by September 30, 2021.

(i) Response to RCP Actions

ACTION PGE-1 (Class A)

In its 2021 WMP update, PG&E shall elaborate on its risk modeling plans to explain:

a. *how it plans to use risk modeling to evaluate benefits for each individual initiative in its WMP;*
b. *PG&E shall also detail current capabilities, future capabilities, and how it intends to use future capabilities; and*
c. *the frequency of model updates.*

Response:

a. In Section 4.5.1(b) above, PG&E describes how the models that it has developed, including the 2021 Wildfire Distribution Risk Model, are used for distribution planning purposes generally. This information will assist in PG&E's general planning for initiatives. In Section 4.5.1(e), PG&E describes specifically how the Vegetation Risk Model and Conductor Risk Model inform our EVM and system hardening initiatives. In Section 4.5.1(f), PG&E describes how the Transmission OA Model helps inform transmission planning. With regards to other initiatives, in Section 4.5.1(b), PG&E describes our plans to develop additional modeling capabilities in 2021. These additional capabilities will help evaluate the benefits of additional WMP initiatives. Finally, PG&E addresses incorporating each initiative into our risk modeling in our response to Action PGE-6 (Class A) in Section 4.2 above.

b. The current and future capabilities of PG&E's models are described in Sections 4.5.1(b)-(g) above. Section 4.5.1(h) references other sections in the 2021 WMP that specifically describe the capabilities and future capabilities of models used for PSPS events.

c. The frequency of model updates is described in Section 4.5.1(g).

ACTION PGE-2 (Class A)

In its 2021 WMP update, regarding its vegetation probability model, PG&E shall:

1) *include fall-ins and other vegetation-related instances within its probabilistic outputs,*
2) *describe how non-vegetation related outputs are excluded, and*
3) *describe the frequency and manner in which updates are performed.*

Response:

1) and 2) For the Vegetation Probability of Ignition Model, only ignition events are predicted or *produced* as a probabilistic output. PG&E assumes that the term "output" in this Action Item refers to the ignition events used to train the model. In Section 4.3(c), PG&E outlines that all vegetation related ignition events were used to train the model. Ignition events without the mention of vegetation in the cause code were not included in the training set.

3) As a planning model used for the development of annual workplans, this model is updated annually. This update trains the model with an expanded set of event data that *includes* the addition of the latest year. As additional data sets are identified and made available and algorithm improvements are identified, they are also included in the annual update.

ACTION PGE-7 (Class A)

In its 2021 WMP update, PG&E shall specify intended benchmarks for risk modeling and provide clearer detail on who has peer validated the models and how the review has been incorporated, including, but not limited to, (a) qualifications and job titles of the "peers" who provided feedback in the Utility Analytics Institute Conference, (b) the input and validation provided by such peers, and (c) a description of how PG&E plans to or has incorporated such external peer review into its modeling efforts.

Response:

In Section 4.5.1(g), PG&E provides details on the QA and QC validation steps that are part of our risk model development. While PG&E did present the 2021 Wildfire Distribution Risk Model at the November 2020 Utility Analytics Institute Conference, due to the pandemic, the conference was remote and the presentations were pre-recorded. As such, no significant feedback was received and PG&E did not consider this presentation as part of the model validation process. As mentioned in Section 4.5.1(g), PG&E is contracting with Energy and Environmental Economics, Inc. to perform a

review and validation of the modeling methodology, code, model results and application to be completed in the Spring of 2021.

ACTION PGE-17 (Class A)

In its 2021 WMP update, PG&E shall discuss whether it intends to update its asset risk model daily outside of a PSPS event, giving reasons. PG&E shall also discuss when it intends to implement more frequent than annual updates for distribution asset risk models and the frequency of such updates.

Response: As we explained above in Section 4.5.1(b), planning models support annual workplans and are based on either worst case conditions such as weather and fuels or cumulative probabilities of failure or ignition based on historical analysis and asset attributes. An example of a planning model is the 2021 Wildfire Distribution Risk Model. On the other hand, operational models, such as those used for PSPS events utilize real-time weather, fuels data, and asset conditions as reflected by maintenance tags or recently completed asset hardening. Examples of operational models are the Large Fire Probability Model (Distribution) and the Large Fire Probability Model (Transmission).

Given the respective application and use of planning and operational models, planning models are updated on an annual cadence while operational models are updated as frequently as weekly during fire season. While operational models benefit from the latest meteorology and asset data to inform event based decisions (e.g., PSPS), investment and planning models require less frequent updates. Planning models are used for annual planning decisions. However, as risk mitigations are completed through the year, planning models can be updated to measure the resulting risk reduction. The frequency of updates in planning models to reflect the completion of risk mitigation work will occur on a quarterly basis beginning in 2021.

ACTION PGE-18 (Class A)

In its 2021 WMP update, PG&E shall: (1) discuss why it does not plan on using a similar methodology for its distribution asset risk model as compared to its transmission risk model, and (2) explain why it does not plan on updating the distribution model weekly, similar to the frequency used for updating its transmission model.

Response:

1) As outlined in Sections 4.5.1(b) – (e), the 2021 Wildfire Distribution Risk Model employs a machine learning approach to develop an ignition probability. In Section 4.5.1(f), PG&E explains that the OA Model employs a fragility approach where the relationship between ignition probability and force (primarily via wind speed) is characterized by a curve. Given the scope, design and function of the transmission system, the fragility approach is an effective methodology. Specifically, for steel structures the characteristic strength curve is informative as the age, location, and load on the steel structure are available and the variation in steel characteristics are more narrow than wood. Alternatively, the scarcity of transmission ignition events (at approximately 10 per year for transmission versus approximately 100 for distribution) makes a machine learning approach for transmission more challenging. Due to the much wider scope, design, and

function of the distribution system, ignition event counts are higher which provides more data for the development of machine learning models. As data collection improves, machine learning models could become more effective for the development of transmission risk models and with improved distribution system data, the fragility approach could prove instructive for the development of distribution risk models

2) In Section 4.5.1(g), PG&E outlines the update frequency for planning models used for annual work plans and for operational models used for events such as PSPS. As discussed in that section, the OA Model is primarily used to inform PSPS decisions and thus is updated more frequently, often weekly during PSPS events. The OA Model is used as an input to annual planning, but this is not the primary purpose of the model. The Distribution Planning models, such as the 2021 Wildfire Distribution Risk Model, are not used for PSPS decisions but instead are used to target mitigations and estimate risk reduction for work planning such as system hardening and EVM. Since work planning is done primarily on an annual cycle, these models do not need to be updated as frequently. However, as PG&E explained in Section 4.5.1(g), we will update our planning models quarterly in 2021 to reflect completed risk mitigation work.

ACTION PGE-19 (Class A)

In its 2021 WMP update, PG&E shall provide an interim solution for more frequent than annual updates of distribution asset conditions in its risk model

Response:

In Section 4.5.1(g), PG&E outlines the update frequency for planning models used for annual work plans such as the 2021 Wildfire Distribution Risk Model and for operational models such as the Transmission Operating Assessment Model used for events such as PSPS. For planning models specifically, PG&E indicated that as risk mitigations are completed through the year, planning models can be updated to measure the resulting risk reduction. The frequency of updates in planning models to reflect the completion of risk mitigation work will occur on a quarterly basis beginning in 2021.

ACTION PGE-20 (Class A)

In its 2021 WMP update, PG&E shall: (1) provide sufficient reasoning for the current lack of distribution asset health updates within its risk modeling, (2) explain why more frequent distribution asset health updates are not possible at this time, (3) provide a concrete timeline outlining each step in PG&E's process to updating each risk model, and (4) define the frequency of risk model updates in the interim before the 2022/2023 standardization with an explanation as to if and why PG&E finds that frequency sufficient.

Response:

1) The 2021 Wildfire Distribution Risk Model currently includes updated asset data as compared to prior risk models discussed in the 2019 and 2020 WMPs. PG&E plans to update the 2021 Wildfire Distribution Risk Model on a quarterly basis as mitigation field

work is completed, as described in Section 4.5.1(g). The OA Model is updated weekly with the status of maintenance tags and this cadence switches to daily during PSPS events. PG&E also summarizes these points in our responses to Action PGE-17 (Class A) and Action PGE-18 (Class A). In addition, asset health updates from inspections and maintenance tags will also be part of the updates that will be incorporated into the 2022 Wildfire Distribution Risk Model.

2) In Section 4.5.1(g), PG&E explains the basis for the update frequency for planning models used for annual work plans and for operational models used for events such as PSPS. PG&E also summarizes these points in our responses to Action PGE-17 (Class A) and Action PGE-18 (Class A).

3) In Q1 of 2021, the asset health data from maintenance inspections will be integrated into the 2021 Wildfire Distribution Risk Model. In Q2 2021, the 2021 Wildfire Distribution Risk Model will then augment the OPW Model in determining the Large Fire Probability for use in deenergization decisions during PSPS events. With these two steps, distribution asset health is scheduled to be integrated into the OPW Model for the 2021 fire season and to follow a similar update cadence to the Transmission asset health data.

4) PG&E's objective is to update planning models on an annual basis for the development of workplans, and on a quarterly basis for tracking risk reduction following mitigation work completed in the field. Operational models are generally updated on a weekly basis switching to daily updates during PSPS events.

ACTION PGE-31 (Class B)

1) *Describe how it has calculated overall wildfire risk in a similar manner as the 5,500 miles for system hardening to identify the most high-risk circuits,*

2) *Provide the locations via GIS files on such high-risk circuits,*

3) *Provide the percentage of the 5,500 miles fall under the total identified high-risk circuits,*

4) *Describe how the determination of high-risk circuits was used to prioritize WMP initiatives, and*

5) *Explain how PG&E's risk modeling considers a range of potential mitigation types, rather than assuming system hardening is the appropriate mitigation.*

Response:

1) In a recognition of the continually changing effects of climate, PG&E is no longer setting an end point to the System Hardening Program. For more detail concerning the 5,500 miles of system hardening, see the response to Action PGE-3 (Class B) in Section 7.3.3.17.1.

2) PG&E has provided a map of wildfire risk by circuit segment in Section 7.3.7.4.

3) In a recognition of the continually changing effects of climate, PG&E is no longer setting an end point to the System Hardening Program. For more detail concerning the 5,500 miles of system hardening, see the response to Action PGE-3 (Class B) in Section 7.3.3.17.1.

4) The development of the system hardening WMP initiative looked to the ignition probability and wildfire risk values of circuit segments using the 2021 Wildfire Distribution Risk Model for insights which are combined with additional information not included in the model to determine if the proposed mitigation will be effective in reducing risk in that location.

5) At this time the 2021 Wildfire Distribution Risk Model does not provide risk reduction values that are specific by mitigation type. As described in Section 7.3.3.17.1, the System Hardening Program considers a range of alternatives such as undergrounding, installing covered conductor, and even remote grid to customize the improvements to the circuit segment. The capability to provide risk reduction scores for each mitigation type will be added as part of the 2022 Wildfire Distribution Risk Model..

ACTION PGE-37 (Class B)

1) Provide the age score used for each conductor installation year, and

2) Explain how it calculates the age score input for Sub-Model #1 when it has not provided complete conductor age information to the WSD in its GIS data submissions to date.

Response:

The estimated conductor age (the "estimated-age") was calculated as the number of years since the *installation* year, as listed in EDGIS. If the installation date was missing or invalid, then the estimated age in the STAR model dataset was used (as extracted from the primary conductor dataset in the Foundry platform). The installation date was determined to be invalid if:

1. It fell within the 1986 to 1990 time period, an unreliable default value in the dataset,

2. It was greater than the current date, or

3. It was less than 1901.

The STAR model estimated the conductor age using the average age of the poles associated with *the* conductor or, if pole age could not be calculated, the average age of the conductors in the service territory (PG&E Digital Catalyst, 2019).

ACTION PGE-38 (Class B)

1) Provide an update to the status of integrating any new inputs into its risk modeling, and

2) Describe how such new inputs have been integrated into its risk modeling.

Response:

Please see Sections 4.3(b) and 4.3(c) for a description of new risk model inputs, as well as Section 4.5.1 which provides an overview of updates to our risk modeling.

ACTION PGE-39 (Class B)

1) Provide the timeline in detail for when it plans to include all outstanding inputs, broken down by each input.

Response:

The timeline for the planned inclusion of data set or inputs are outlined in the Table PG&E-4.5-2 below:

TABLE PG&E-4.5-2: TIMELINE FOR RISK MODELING INPUTS

Input Data Set	Anticipated Benefit	Need for Inclusion	Inclusion Challenge Preventing Inclusion Already	Timeline
LiDAR tree species data	Specific tree species detail in risk scores	VM mitigations can be customized to tree species.	LiDAR collection completion and data processing were completed by the end of 2020.	Q2 2021
LiDAR asset data	Improved accuracy of asset locations	LiDAR data provides a more accurate lat/long of assets.	LiDAR collection completion and data processing were completed by the end of 2020.	Q2 2021
Maintenance Tags	Improved data asset condition	Improved ability to prioritize tags	Connecting asset level data to model whose granularity is not yet at the asset level.	Q2 2021
Inspection Results	Improved data asset condition	Improved ability to prioritize tags	Connecting asset level data to model whose granularity is not yet at the asset level.	Q2 2021
Pole loading	Support development of pole failure model	Need to add pole failures to the conductor risk model to better model distribution equipment modeling	O-calc data base project is still in progress	Q2 2022

ACTION PGE-40 (Class B)

1) Describe in detail how each of the currently outstanding inputs will contribute to PG&E's modeling efforts;

2) Describe how PG&E determined the need to include each of these inputs; and

3) Further explain why each of these inputs were not already included within modeling efforts.

Response:

Please see the Table PG&E-4.5-2 above.

ACTION PGE-41 (Class B)

1) Explain how egress *is weighted against other factors during risk modeling and selection of initiatives.*

Response:

A general egress model was included in previous wildfire risk models used in the 2019 and 2020 WMP. In 2020, PG&E worked with Santa Cruz County to complete a detailed egress study for Santa Cruz County. The results for the individual Census Defined Places in Santa Cruz County were compared to the evacuation times from the general egress model. As a result of inconsistency between the detailed study results with the general egress model, PG&E is undertaking the development of a new egress model with expected completion in 2022. In the interim, egress is not part of the 2021 Wildfire Distribution Risk Model.

ACTION PGE-42 (Class B)

1) Provide a quantitative description of how egress score is calculated and incorporated into its prioritization calculations, particularly in comparison to the other factors;

2) Explain how it factors in identification of wooden poles near evacuation routes. If such information is not currently factored in, explain why, and ensure that wooden poles are included as a factor for calculating egress in its 2021 WMP Update; and

3) Provide an example showing the calculation of egress assessment.

Response:

As discussed in the response to Action PGE-41 (Class B), egress is not part of the 2021 Wildfire Distribution Risk Model.

ACTION PGE-52 (Class B):

1) explain how the models in Table 7 assess the potential between risk levels on safety and reliability for the purposes of classifying priority levels in accordance with Rule 18.

Response:

Table 7 in the First Quarterly Report provided a timeline for asset management and inspections maturity. Table 7 did not include any models but only referred to moving "towards risk informed inspection protocols. The models described in the 2021 WMP can be used for mitigations such as the System Harding Program and priority of inspections. The classification of priority levels for conditions identified in inspections, as described in GO 95 Rule 18, are solely determined by the field assessment of the

inspection team, in accordance with their safety severity and location within the HFTD tiers, not by risk models.

ACTION PGE-53 (Class B)

1) Create a framework for the maturation of risk modeling outlining each step, including a timeline for completion and progress updates; and

2) Expand on the details of each step.

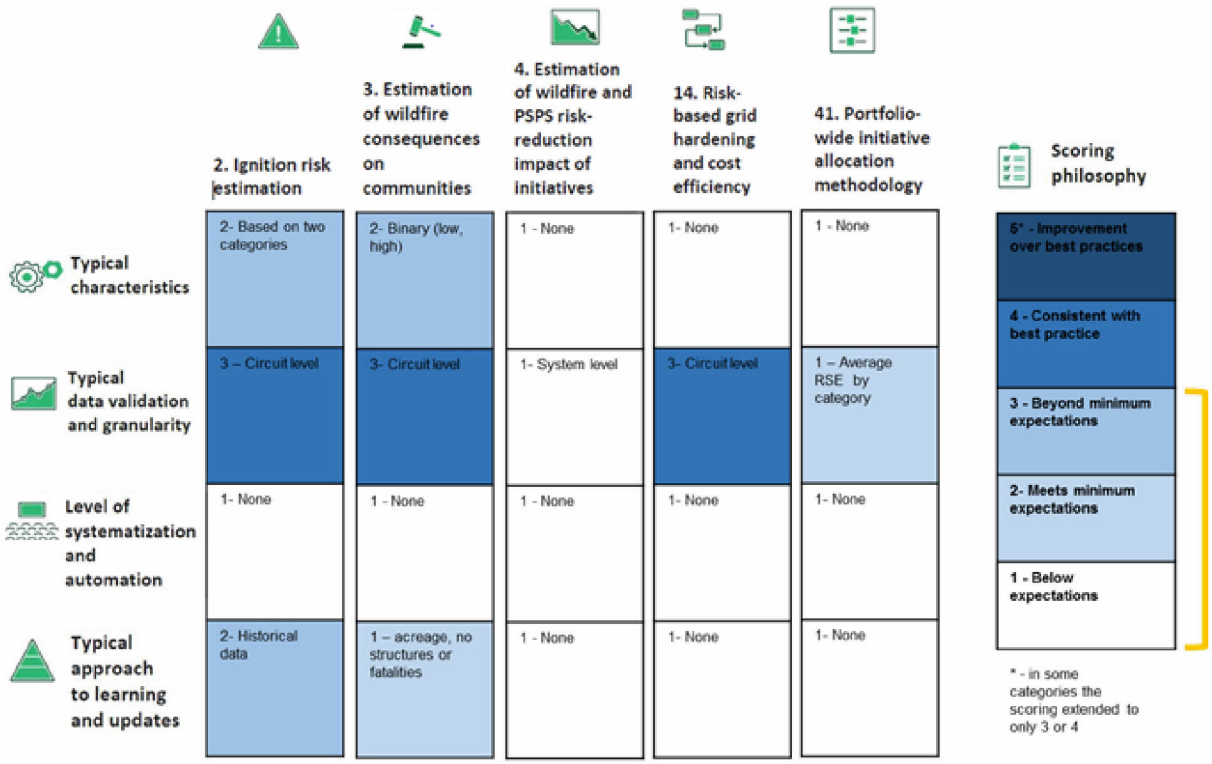
Response:

PG&E's risk modeling objectives are to develop models that: (1) provide situational awareness of risk; (2) enable risk-informed decision making; and (3) enable PG&E to develop line-of-sight on risk reductions from wildfire risk mitigation initiatives. Following the risk framework outlined in Section 4.5.1(c) and shown in Figure PG&E-4.5-2, as modeling capabilities are improved from relative risk models at the circuit level with system level risk reduction and RSE capabilities to automated quantitative risk models that include risk reduction and RSE evaluations all at the asset level, these improvements will register across the capabilities and categories of the Maturity Survey.

Figure PG&E-4.5-2 below outlines PG&E risk modeling capabilities across the Maturity Survey categories today and Figure PG&E-4.5-3 shows the planned progress over the next three years from 2021 to 2023.

PGE-DIXIE-NDCAL-000004534

FIGURE PG&E-4.5-2: PG&E RISK MODELING CAPABILITIES IN THE MATURITY SURVEY (CURRENT STATE)



The planned improvement for each of the five risk modeling categories shown above are discussed in more detail here:

Ignition Risk Estimation – As detailed in Section 4.5.1, ignition probability capabilities have improved to produce a quantitative value based on individual failure modes within each risk driver. Currently, vegetation and conductor equipment failures are modeled at a 100 meter x 100 meter granularity. From this base level output, circuit segment and circuit level outputs are produced. Our next model iterations will add failure models for poles and transformers followed by third party and animal risk drivers. As more risk drivers and failure modes are added to the ignition models the model output will approach an asset level of granularity. At the same time, model code will stabilize to the point where automated, productionalized code will be updated with refreshed data.

Estimation of Wildfire Consequences on Communities – Wildfire consequence capabilities have improved with the use of the Technosylva wildfire spread modeling. Current wildfire consequence data is now based on a range of fire science and meteorological data to produce community impacts data such as acres burned and impacted structures. These are produced at a 200 meter granularity along electrical lines and area aggregated up to the circuit segment, circuit level and higher levels for use with the ignition probability models. As our ignition models improve to the asset level, the consequence data PG&E is working closely with Technosylva to improve the accuracy of the wildfire consequence modeling by comparing model capabilities to match actual fires as they occur. Future improvements include the further automated

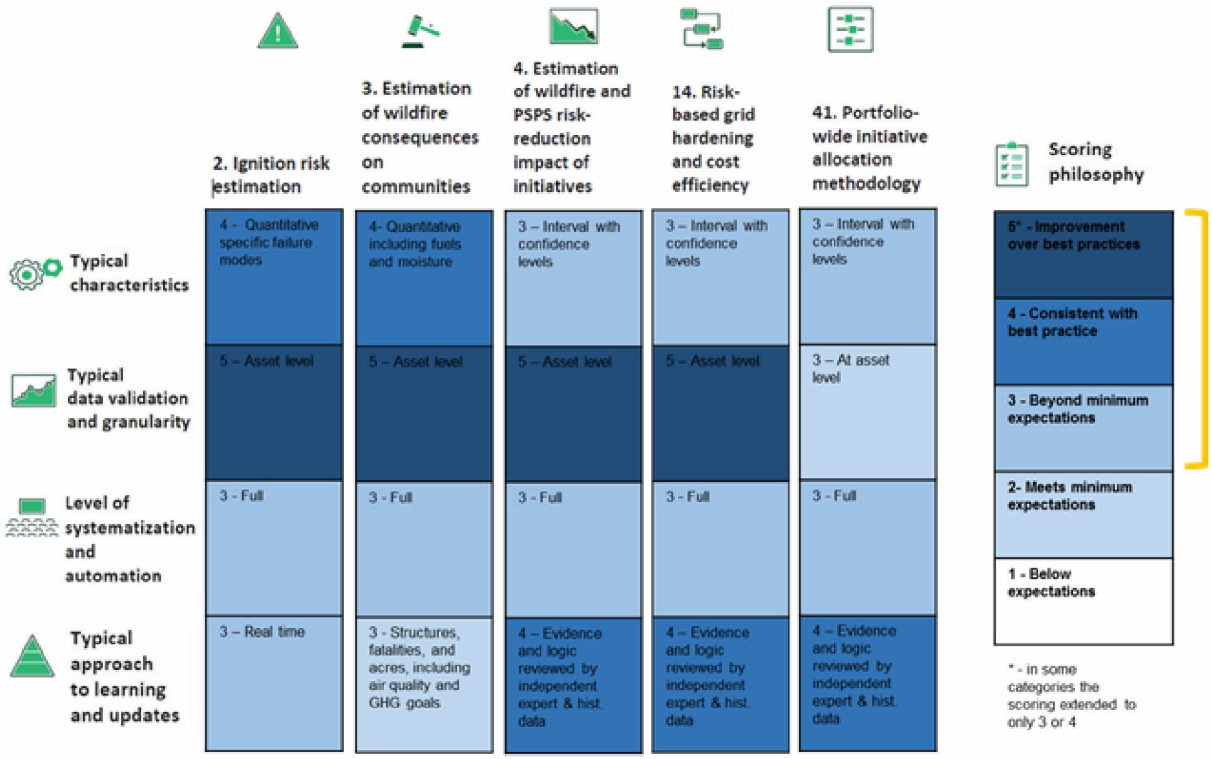
integration of Technosylva model features with ignition probability models to product wildfire risk values.

Estimation of Wildfire and PSPS Risk-Reduction Impact of Initiatives – Currently, risk reduction values for mitigations are estimated at the system level. With the development of the 2022 Wildfire Distribution Risk Model, the risk model output will include risk scores for circuit segments as they do in the 2021 Wildfire Distribution Risk Model, and risk reduction estimates for mitigation alternatives. This feature will next be automated into the model code to enable the development of portfolio scenarios. The first set of risk reduction values for mitigations will be based on subject matter expertise until sufficient operational data from mitigation technologies are obtained that statistical models can be developed.

Risk-based Grid Hardening and Cost Efficiency – With the addition of risk reduction values for mitigations the development of more granular risk spend efficiency values will follow.

Portfolio-wide Initiative Allocation Methodology – As mentioned, automating the model code with the risk reduction feature will enable the development of portfolio scenarios.

FIGURE PG&E-4.5-3 PG&E: RISK MODELING CAPABILITIES IN THE MATURITY SURVEY (FUTURE STATE ~2023)



ACTION PGE-80 (Class B)

1) Provide a framework or outline of the modeling efforts underway to integrate system hardening and VM, and

2) Describe the initiatives it is taking in order to integrate the two moving forward.

Response:

The 2022 Wildfire Distribution Risk Model aims to add two new features that will improve the maturity of PG&E risk modeling (as described in Action PGE-53 (Class B)) which will improve the coordination of mitigation efforts such as system hardening and VM. The 2022 Wildfire Distribution Risk Model will allow for the development of a composite ignition probability and risk value at each point along the grid. From this composite value the portion of the ignition probability and risk due to different risk drivers such as vegetation or equipment will be available. Building on these features, the development of reduction scores for mitigation alternatives will then allow for the estimation of risk reduction along a circuit by mitigation. These features will allow for work plan development that can identify a balanced mix of mitigations to address the risk profile of the circuit location.

4.5.2 Calculation of Key Metrics

Report details on the calculation of the metrics below. For each metric, a standard definition is provided with statute cited where relevant. The utility must follow the definition provided and detail the procedure they used to calculate the metric values aligned with these definitions. Utilities must cite all data sources used in calculating the metrics below.

1. ***Red Flag Warning overhead circuit mile days –*** *Detail the steps to calculate the annual number of red flag warning (RFW) overhead (OH) circuit mile days. Calculated as the number of overhead circuit miles that were under an RFW multiplied by the number of days those miles were under said RFW. Refer to Red Flag Warnings as issued by the National Weather Service (NWS). For historical NWS data, refer to the Iowa State University Iowa archive of NWS watch/warnings. Detail the steps used to determine if a circuit mile was under a Red Flag Warning, providing an example of how the RFW OH circuit mile days were calculated for a Red Flag Warning that occurred within utility territory over the last five years.*

   RFWs are issued by the NWS in defined fire zones (https://www.weather.gov/gis/FireZones). These zones are different from the typical NWS public forecast zones. Because the fire zones are used by the NWS for issuing RFWs, the PG&E overhead circuit miles were calculated by the PG&E GIS team for each of the NWS fire zone polygons that intersect and are within the PG&E territory. Then, RFW days for each year and/or quarter were calculated for each fire zone. A RFW day is defined as the number of days that a RFW was valid from issue date to expiration date. For example, if a RFW lasted for 12 hours before expiring, then it will be equal to 0.5 RFW days. Finally, the RFW overhead circuit mile days were calculated by multiplying the RFW days and the overhead miles for each NWS fire zone. All RFW overhead circuit mile days were summed up across the NWS fire zones to give the total RFW overhead circuit mile days. RFW archived data shapefiles were downloaded from the Iowa State University's public archived NWS Watch/Warning website (https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml).

2. ***High Wind Warning overhead circuit mile days*** *– Detail the steps used to calculate the annual number of High Wind Warning (HWW) overhead circuit mile days. Calculated as the number of overhead circuit miles that were under an HWW multiplied by the number of days those miles were under said HWW. Refer to High Wind Warnings as issued by the National Weather Service (NWS). For historical NWS data, refer to the Iowa State University Iowa archive of NWS watch/warnings.7 Detail the steps used to determine if an overhead circuit mile was under a High Wind Warning, providing an example of how the OH HWW circuit mile days were calculated for a High Wind Warning that occurred within utility territory over the last five years.*

   HWWs are issued by the NWS in defined NWS public forecast zones (https://www.weather.gov/gis/PublicZones), which are different from the NWS fire zones. The PG&E GIS team calculated the overhead circuit miles for all

NWS public forecast zones that are within and intersect the PG&E territory. Then, HWW days were calculated for all the same NWS public forecast zones. A High Wind Warning Day is defined as the number of days that a High Wind Warning was valid from issue date to expiration date within an NWS public zone. For example, if a HWW was valid for six hours within a public zone, then the number of HWW days for that zone is equal to 0.25 days. Finally, the HWW overhead circuit mile days were calculated by multiplying the RFW days and overhead miles for each NWS public zone. All HWW overhead circuit mile days were summed up across the NWS public zones to give the total HWW overhead circuit mile days. HWW archived data shapefiles were downloaded from the Iowa State University's public archived NWS Watch/Warning website (https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml).

3. ***Access and Functional Needs population*** – *Detail the steps to calculate the annual number of customers that are considered part of the Access and Functional Needs (AFN) population. Defined in Government Code § 8593.3 and D.19-05-042 as individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking,*[29] *older adults, children, people living in institutionalized settings, or those who are low income, homeless, or transportation disadvantaged, including, but not limited to, those who are dependent on public transit or those who are pregnant*

   PG&E follows the four step process as delineated below to calculate the annual number of customers that are considered part of the AFN population.

   Step 1: Collect data from the following categories that apply to the CPUC's AFN definition for which data is available in PG&E databases:

   1) Customers enrolled in the Medical Baseline program;

      - Data source: Medical baseline enrollment data

   2) Customers enrolled in California Alternative Rates for Energy (CARE) program or Family Electric Rate Assistance (FERA) program;

      - Data source: CARE or FERA enrollment data

[29] Guidance on calculating number of households with limited or no English proficiency can be found in D.20-04-003.

3) Customers that self-identify to receive an in-person visit before disconnection for non-payment (e.g., vulnerable);[30]

   - Data source: self-identification to receive in-person visit before disconnection for non-payment enrollment data

4) Customers that self-identify as having a person with a disability in the household (e.g., "disabled");[31]

   - Data source: self-identification as having a person with a disability in the household enrollment data

5) Customers who self-select to receive utility communications in non-standard format (e.g., in braille or large print)

   - Data source: self-selection to receive utility communications in non-standard data enrollment data

6) Customers who indicate a non-English language preference.

   - Data source: Non-English language preference enrollment data

Step 2: Calculate the number of customers in each of the six categories above and add them together.

Step 3: Calculate the number of customers appearing in more than one of the above six categories.

Step 4: Subtract the result of Step 3 from the result of Step 2 to arrive at the total annual number of customers that are considered part of the AFN populations.

4. ***Wildlife Urban Interface*** *– Detail the steps to calculate the annual number of circuit miles and customers in Wildland Urban Interface (WUI) territory. WUI is defined as the area where houses exist at more than one housing unit per 40 acres and (1) wildland vegetation covers more than 50 percent of the land area (intermix WUI) or (2) wildland vegetation covers less than 50 percent of the land area, but a large area (over 1,235 acres) covered with more than*

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30 In accordance with D.12-03-054, customers that are not enrolled or qualify for the Medical Baseline Program can "certify that they have a serious illness or condition that could become life threatening if service is disconnected." PG&E uses this designation to make an in-person visit prior to disconnection. This designation remains on their account temporarily for 90 days, and can be extended to 12 months if the customers submits an application. The customer characteristic, vulnerable senior, is no longer included in the Disconnect OIR based on D.20-06-003, p. 14, and therefore not included in this metric.

31 Customers can self-identify with PG&E that they have a person in the household with a disability. This customer designation currently has no end date. In accordance with D.12-03-054, customers who have previously been identified as disabled and who have identified a preferred form of communication, the utility shall provide all information concerning the risk of disconnection in the customer's preferred format (e.g. phone, text, email, TDD/TTY).

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75 percent wildland vegetation is within 1.5 mi (interface WUI) (Radeloff et al., 2005).

PG&E identifies WUI areas within our service territory based upon data provided by the University of Wisconsin-Madison SILVIS Lab, available here: http://silvis.forest.wisc.edu/data/wui-change/, which shows the WUI areas within California as of 2010.

5. ***Urban, rural and highly rural*** *– Detail the steps for calculating the number of customers and circuit miles in utility territory that are in highly rural, rural, and urban regions for each year. Use the following definitions for classifying an area highly rural/rural/urban (also referenced in glossary):*

   - *Highly rural – In accordance with 38 CFR 17.701, "highly rural" shall be defined as those areas with a population of less than 7 persons per square mile as determined by the United States Bureau of the Census. For the purposes of the WMP, "area" shall be defined as census tracts.*

   - *Rural – In accordance with GO 165, "rural" shall be defined as those areas with a population of less than 1,000 persons per square mile as determined by the United States Bureau of the Census. For the purposes of the WMP, "area" shall be defined as census tracts.*

   - *Urban – In accordance with GO 165, "urban" shall be defined as those areas with a population of more than 1,000 persons per square mile as determined by the United States Bureau of the Census. For the purposes of the WMP, "area" shall be defined as census tracts.*

   Population density numbers are calculated using the American Community Survey (ACS) 1-year estimates on population density by census tract for each corresponding year (2016 ACS 1-year estimate for 2016 metrics, 2017 ACS 1-year estimate for 2017 metrics, etc.). For years with no ACS 1-year estimate available, we use the 1-year estimate immediately before the missing year (e.g., use 2019 estimate if 2020 estimate is not yet published).

4.6 Progress Reporting on Past Deficiencies

Report progress on all deficiencies provided in the 2020 WMP relevant to the utility. This includes deficiencies in Resolution WSD-002.

Summarize how the utility has responded and addressed the conditions in the table below. Reference documents that serve as part of the utility's response (e.g., submitted in the utility's Remedial Compliance Plan, location in 2021 WMP update, etc.). Note action taken by the WSD for Class A and B deficiencies (e.g. response found sufficient, response found insufficient and further action required, etc.).

In this section, PG&E lists the deficiencies identified by WSD for our 2020 WMP. For ease of reference, PG&E is providing separate tables for the Class A, Class B and Class C deficiencies identified in Resolutions WSD-002 and WSD-003. For referenced documents, PG&E is using the following terminology:

- **RCP** – The Remedial Compliance Plan submitted by PG&E on July 27, 2020.
- **First Quarterly Report** – the Quarterly Report submitted by PG&E on September 9, 2020 for the period May to July 2020.
- **Second Quarterly Report** – the Quarterly Report submitted by PG&E on December 9, 2020 for the period July to September 2020.
- **Third Quarterly Report** – the Quarterly Report submitted by PG&E on February 5, 2021, concurrent with the filing of the 2021 WMP, for the period October to December 2020.

On December 30, 2020, WSD provided a Notice of Non-Compliance regarding PG&E's RCP and additional action items for the Class A deficiencies addressed in the RCP. On January 8, 2021, WSD provided a Notice of Non-Compliance regarding PG&E's First Quarterly Report and additional action items for certain of the Class B conditions addressed in that report.

Below, in Table PG&E-4.6-1 for Class A action items and Table PG&E-4.6.2 for Class B action items, we have made each action item a separate row. In some cases, there are multiple action items for a single Class A or Class B deficiency, so this deficiency is repeated in each row with the separate action item.

Table PG&E-4.6-3 includes the Class C deficiencies identified by WSD.

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TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-3	Lack of risk modeling to inform decision-making	PG&E is providing a discussion concerning our risk modeling approach, addressing each of the subparts of Action PGE-1	RCP, pp. 1-12 2021 WMP, Section 4.5.1	**Insufficient** **Action PGE-1 (Class A):** In its 2021 WMP update, PG&E shall elaborate on its risk modeling plans to explain: a. How it plans to use risk modeling to evaluate benefits for each individual initiative in its WMP; b. PG&E shall also detail current capabilities, future capabilities, and how it intends to use future capabilities; and c. The frequency of model updates.
Guidance-3	Lack of risk modeling to inform decision-making	PG&E is providing a discussion concerning our vegetation probability model modeling approach, addressing each of the subparts of Action PGE-2	RCP, pp. 1-12 2021 WMP, Section 4.5.1	**Insufficient** **ACTION PGE-2 (Class A):** In its 2021 WMP update, regarding its vegetation probability model, PG&E shall: 1) include fall-ins and other vegetation-related instances within its probabilistic outputs; 2) describe how non-vegetation related outputs are excluded; and 3) describe the frequency and manner in which updates are performed.
Guidance-3	Lack of risk modeling to inform decision-making	PG&E is providing a discussion concerning the weighting of financial consequence and spend in our MAVF.	RCP, pp. 1-12 2021 WMP, Section 4.2	**Insufficient** **ACTION PGE-3 (Class A):** In its 2021 WMP update, PG&E shall describe how financial consequence and spend is weighted within the MAVF.
Guidance-3	Lack of risk modeling to inform decision-making	PG&E is providing a table describing our risk assessment techniques in the format used by SCE.	RCP, pp. 1-12 2021 WMP, Section 4.2	**Insufficient** **ACTION PGE-4 (Class A):** In its 2021 WMP update, PG&E shall submit a table describing its risk assessment techniques used for each initiative in the format used by Southern California Edison (SCE). [See SCE RCP at 9].

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TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-3	Lack of risk modeling to inform decision-making	PG&E is providing our updated OPW and wind data analysis and information concerning verification and granularity.	RCP, pp. 1-12 2021 WMP, Section 4.2.A	**Insufficient** **ACTION PGE-5 (Class A):** In its 2021 WMP update, PG&E shall: 1) refile the updated OPW and wind analysis data, 2) provide detail on how it has verified the accuracy of its OPW model and 3) how it accounts for less granularity in historic weather data due to fewer deployed weather stations.
Guidance-3	Lack of risk modeling to inform decision-making	PG&E is providing a timeline of when it expects each initiative will be incorporated into our risk modeling.	RCP, pp. 1-12 2021 WMP, Section 4.2	**Insufficient** **ACTION PGE-6 (Class A):** In its 2021 WMP update, PG&E shall provide a timeline that shows when it expects each individual initiative in its WMP to be incorporated into its risk modeling.
Guidance-3	Lack of risk modeling to inform decision-making	PG&E is providing a discussion of benchmarks and peer validation for risk modeling.	RCP, pp. 1-12 2021 WMP, Section 4.5.1	**Insufficient** **ACTION PGE-7 (Class A):** In its 2021 WMP update, PG&E shall specify intended benchmarks for risk modeling and provide clearer detail on who has peer validated the models and how the review has been incorporated, including, but not limited to, a) qualifications and job titles of the "peers" who provided feedback in the Utility Analytics Institute Conference, b) the input and validation provided by such peers, and c) a description of how PG&E plans to or has incorporated such external peer review into its modeling efforts.

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TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-1	PG&E groups initiatives into programs and does not provide granular initiative detail	PG&E has addressed this action item in Section 4.6.2, Table 12 in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx, and Attachment 2021WMP_Class A_Action-PGE-8_Atch01.	RCP, pp. 13-19 First Quarterly Report, pp. 90-96 2021 WMP, Section 4.6.1 2021 WMP, Table 12 in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. Attachment 2021WMP_Class A_Action-PGE-8_Atch01	**Insufficient** **ACTION PGE-8 (Class A):** In its 2021 WMP update, PG&E shall: 1) update Tables 21-30 to reflect a quantitative value to accurately reflect risk reduction effectiveness instead of the current qualitative descriptions 2) provide a column describing the program under which initiative falls, and 3) provide the difference between the actual and forecasted amounts in comparison to the 2020 WMP Section 5.3 tables.

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TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-1	PG&E groups initiatives into programs and does not provide granular initiative detail	PG&E is providing the information requested regarding the Inspect App.	RCP, pp. 13-19 First Quarterly Report, pp. 90-96 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-9 (CLASS A):** In its 2021 WMP update, PG&E shall: 1) provide the month for implementation of the Inspect App broken down between all patrol and inspection programs, as well as between distribution and transmission programs if such differ, 2) provide an explanation for any delays in implementing the Inspect App for certain programs, and 3) explain what qualifies the process to be "stabilized" for utilization on inspection type identification.
PGE-3	High incidence of conductor failure	PG&E is providing an analysis of our internal reports regarding it investigation of primary wire down events.	RCP, pp. 20-27 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-10 (CLASS A):** In its 2021 WMP update, PG&E shall: 1) provide its analysis and any internal report(s) completed in regards to PG&E's internal investigation(s) on primary wire down events from conductor or splice failure, [As stated in Footnote 1 of PGE RCP on p. 21, PG&E can provide the substantial amount of data collected to run analysis, but WSD is more interested in the numerical conclusions drawn from the analysis (such as calculated failure rates for all conductor materials analyzed, failure rate by material per overhead circuit mile, failure rate of ASCR inside corrosion zones vs. outside, etc.) and any internal reports completed based on the analysis. The full data set is not necessary at this time]. 2) provide a summary of any conclusions or findings drawn relating to splice failure. 3) report on its evaluation of historical meteorology data versus distribution wires-down outage data.

TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-3	High incidence of conductor failure	PG&E is providing a discussion regarding Major Event Days and the information requested in the subparts of Action PGE-11.	RCP, pp. 20-27 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-11 (CLASS):** In its 2021 WMP update, PG&E shall elaborate on its MEDs by: 1) describing what PG&E uses as its Major Event Day identification threshold value (TMED), 2) providing the percentage of data not included in analysis due to MED data exclusion, both in terms of number of days and number of wire-down instances, and 3) explaining how PG&E intends to improve and expand MED reporting and why current circumstances allow for expanded MED reporting when the past did not.
PGE-3	High incidence of conductor failure	PG&E is providing a graph similar to Figure 10 for all weather metrics and sub-categories	RCP, pp. 20-27 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-12 (CLASS A):** In its 2021 WMP update, PG&E shall provide a graph similar to Figure 10 (PG&E RCP @ 25) which includes all weather metrics and sub-categories described in Section (3) (PG&E RCP @ 24) (e.g., Gray Sky, Storm Day, Northeast Wind).
PGE-3	High incidence of conductor failure	PG&E is providing a discussion regarding performing an analysis of the correlation between wind speeds and wire down events.	RCP, pp. 20-27 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-13 (CLASS A):** In its 2021 WMP update, PG&E shall: 1) describe when it intends to perform an analysis on the correlation between wind speed and wire down events; 2) explain why it has not performed such an analysis yet; and 3) upon completion of this analysis, provide the percentage of outages and wire down events caused by conductor failure due to wind.

TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-3	High incidence of conductor failure	PG&E is providing a description of our prioritization for aluminum conductor replacements	RCP, pp. 20-27 2021 WMP, Section 7.3.3.3	**Insufficient** **ACTION PGE-14 (CLASS A):** In its 2021 WMP update, PG&E shall: 1) provide an explanation as to how it is prioritizing replacing aluminum conductors in areas that overlap both corrosion zones and the HFTD, 2) if PG&E is not prioritizing aluminum conductors located in overlapping corrosion zones and HFTDs, explain why, and 3) explain whether any higher priority is given to aluminum conductor within corrosion zones outside of HFTDs.
PGE-3	High incidence of conductor failure	PG&E is re-submitting Attachments 3 and 4 in Excel format with the additional requested columns	RCP, pp. 20-27 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-15 (CLASS A):** In its 2021 WMP update, PG&E shall resubmit its RCP Attachments 3 and 4 in Excel format with the following additional columns: 1) region number 1-4 (as outlined in the National Electric Energy Testing, Research and Applications Center (NEETRAC) report); 2) corrosion area ranking (e.g., moderate, severe); 3) conductor material; and 4) number of splices along replaced portion. PG&E shall also provide similar tables for 2021 and 2022.

TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-3	High incidence of conductor failure	PG&E is providing a discussion of how hardened circuits will be reflected in future PSPS events	RCP, pp. 20-27 2021 WMP, Section 8.1	**Insufficient** **ACTION PGE-16 (CLASS A):** In its 2021 WMP update, PG&E shall: 1) provide the timeline for which it expects "hardened" circuits to be "reflected" in future PSPS events; 2) define what "hardened" circuits consists of; 3) explain how "hardened" circuits will be "reflected" in future PSPS events (i.e., scope, location, thresholds for initiating); 4) explain how long it takes to perform the analysis to determine the impact of "hardened" circuits on PSPS; and 5) explain the factors that PG&E is monitoring and analyzing to determine the impact of "hardened" circuits on PSPS.
PGE-8	Annual risk ranking is quickly out of date	PG&E is providing a discussion of risk model updating, including the frequency of updates	RCP, pp. 28-32 2021 WMP, Section 4.5.1	**Insufficient** **ACTION PGE-17 (CLASS A):** In its 2021 WMP update, PG&E shall discuss whether it intends to update its asset risk model daily outside of a PSPS event, giving reasons. PG&E shall also discuss when it intends to implement more frequent than annual updates for distribution asset risk models and the frequency of such updates.
PGE-8	Annual risk ranking is quickly out of date	PG&E is providing a discussion of our distribution and transmission modeling, and the frequency of updating	RCP, pp. 28-32 2021 WMP, Section 4.5.1	**Insufficient** **ACTION PGE-18 (CLASS A):** In its 2021 WMP update, PG&E shall: 1) discuss why it does not plan on using a similar methodology for its distribution asset risk model as compared to its transmission risk model, and 2) explain why it does not plan on updating the distribution model weekly, similar to the frequency used for updating its transmission model.

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TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-8	Annual risk ranking is quickly out of date	PG&E is addressing the frequency of updating the condition of distribution assets in our risk model	RCP, pp. 28-32 2021 WMP, Section 4.5.1	**Insufficient** **ACTION PGE-19 (CLASS A):** In its 2021 WMP update, PG&E shall provide an interim solution for more frequent than annual updates of distribution asset conditions in its risk model
PGE-8	Annual risk ranking is quickly out of date	PG&E is providing a discussion of distribution asset health updates in our risk model	RCP, pp. 28-32 2021 WMP, Section 4.5.1	**Insufficient** **ACTION PGE-20 (CLASS A):** In its 2021 WMP update, PG&E shall: 1) provide sufficient reasoning for the current lack of distribution asset health updates within its risk modeling, 2) explain why more frequent distribution asset health updates are not possible at this time, 3) provide a concrete timeline outlining each step in PG&E's process to updating each risk model, and 4) define the frequency of risk model updates in the interim before the 2022/2023 standardization with an explanation as to if and why PG&E finds that frequency sufficient.
PGE-15	It is unclear how PG&E classifies findings as the appropriate level	PG&E is providing the percentage of tag reprioritization information requested	RCP, pp. 33-42 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-21 (CLASS A):** In its 2021 WMP update, PG&E shall provide the percentage of priority "E" and "F" findings that were reprioritized to "A" or "B" from the 2019 to the 2020 inspection cycles within HFTDs.
PGE-15	It is unclear how PG&E classifies findings as the appropriate level	PG&E is providing an explanation regarding the use of 2013-2018 ignition data	RCP, pp. 33-42 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-22 (CLASS A):** In its 2021 WMP update, PG&E shall explain why it uses 2013-2018 ignition frequency for transmission and 2014-2019 for distribution when determining prioritization. [From page 35 of our RCP.]

TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-15	It is unclear how PG&E classifies findings as the appropriate level	PG&E is providing a description of RSE calculations and the tables requested in Action PGE-23	RCP, pp. 33-42 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-23 (CLASS A):** In its 2021 WMP update, PG&E shall: 1) explain how it determined the Risk Reduction and RSE values provided in Table 5 and provide an explanation of all inputs, relative weight of inputs, and list all algorithms used; 2) reproduce Table 5 with each column normalized per overhead circuit mile; and 3) submit an additional table for numbers in HFTD only and per circuit mile within HFTD.
PGE-15	It is unclear how PG&E classifies findings as the appropriate level	PG&E is providing a description of our preselected priority options	RCP, pp. 33-42 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-24 (CLASS A):** In its 2021 WMP update, PG&E shall provide all preselected priority options available within its inspections mobile application or any references available to properly classify field conditions.
PGE-15	It is unclear how PG&E classifies findings as the appropriate level	PG&E is providing a breakdown of enhanced inspection costs	RCP, pp. 33-42 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-25 (CLASS A):** In its 2021 WMP update, PG&E shall break down the additional costs of enhanced inspections compared to routine inspections.
PGE-15	It is unclear how PG&E classifies findings as the appropriate level	PG&E is providing a discussion of how our enhanced inspection and routine inspection programs are being addressed	RCP, pp. 33-42 2021 WMP, Section 7.3.4	**Insufficient** **ACTION PGE-26 (CLASS A):** In its 2021 WMP update, PG&E shall explain whether and where enhanced inspections have replaced or been merged with routine inspections. PG&E shall also describe the areas outside of the HFTD that have had routine inspections replaced by enhanced inspections.

TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-15	It is unclear how PG&E classifies findings as the appropriate level	PG&E is providing an update of Tables 6 and 7	RCP, pp. 33-42 2021 WMP, Table 1 (Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx) – metrics with "grid conditions findings from inspection"	**Insufficient** **ACTION PGE-27 (CLASS A):** In its 2021 WMP update, PG&E shall update Tables 6 and 7 to include Tag Find Rate per circuit mile inspected instead of per pole/structure inspected.
PGE-25	Lack of details to address personnel shortages	PG&E is providing a discussion of how it identifies effective contract employees	RCP, pp. 43-48 2021 WMP, Section 5.4.2	**Insufficient** **ACTION PGE-28 (CLASS A):** In its 2021 WMP update, PG&E shall describe its process for identifying the most effective contract employees.
PGE-25	Lack of details to address personnel shortages	PG&E is providing a discussion of how it is working with other utilities on resources	RCP, pp. 43-48 2021 WMP, Section 5.4.2	**Insufficient** **ACTION PGE-29 (CLASS A):** In its 2021 WMP update, PG&E shall provide further explanation on how it is working with other utilities to ensure that it is not limiting other utilities' resources.
PGE-25	Lack of details to address personnel shortages	PG&E is providing a discussion of the increase in our external VM workforce	RCP, pp. 43-48 2021 WMP, Section 5.4.2	**Insufficient** **ACTION PGE-30 (CLASS A):** In its 2021 WMP update, PG&E shall describe the increase in external VM workforce from 2018 to 2020.

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TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-25	Lack of details to address personnel shortages	PG&E is providing a discussion of the VM information requested in Action PGE-31	RCP, pp. 43-48 2021 WMP, Section 5.4.1	**Insufficient** **ACTION PGE-31 (CLASS A):** In its 2021 WMP update, PG&E shall: 1) describe how long it takes to complete tree crew training, 2) describe the type of certification earned upon the completion of pre-inspector training, 3) elaborate on how PG&E supports obtaining an International Society of Arboriculture (ISA) certification, 4) provide the number and percentage of contracted versus internal pre-inspectors and describe whether contracted pre-inspectors undergo the same training as internal pre-inspectors, 5) describe how PG&E ensures proper certification of contracted pre-inspectors, and 6) explain how it ensures proper training is completed by subcontractors.

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TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-25	Lack of details to address personnel shortages	PG&E is providing a discussion of how it prioritizes work based on labor constraints.	RCP, pp. 43-48 2021 WMP, Section 5.4.2	**Insufficient** **ACTION PGE-32 (CLASS A):** In its 2021 WMP update, PG&E shall describe how it prioritizes work based on labor constraints. Specifically, PG&E shall discuss whether it has reduced the scope of VM work due to labor constraints and, if so, explain the analysis to support that decision-making, including risk assessment and prioritization.
PGE-26	Effectiveness of increased vegetation clearances	PG&E is providing a description of how it intends to analyze and use vegetation clearance data and analyze data regarding EVM effectiveness.	RCP, pp. 49-53 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-33 (CLASS A):** In its 2021 WMP update, PG&E shall 1) provide a detailed plan for how it intends to analyze and use extended vegetation clearance data specifically, including specific statistical methods it intends to use and how it will control for environmental variables (e.g., wind, soil, elevation, species), and 2) provide a plan on how PG&E will continue analyzing and collecting data relating to measuring EVM effectiveness.
PGE-26	Effectiveness of increased vegetation clearances	PG&E is providing an explanation of how it calculated effectiveness for certain sub-drivers.	RCP, pp. 49-53 2021 WMP, Section 4.6.1	**Insufficient** **ACTION PGE-34 (CLASS A):** In its 2021 WMP update, PG&E shall explain how it calculated the effectiveness for each sub-driver shown in Table 8 and include all inputs and algorithm(s) used.
PGE-26	Effectiveness of increased vegetation clearances	PG&E is working with SCE and SDG&E to develop a plan for the items requested in Action PGE-35. This information will be provided in the 2/26 filing.	RCP, pp. 49-53 2/26 submission	**Insufficient** **ACTION PGE-35 (CLASS A):** In its 2021 WMP update, PG&E along with SCE and SDG&E shall submit a joint, unified plan that reflects collaborative efforts and contains uniform definitions, methodology, timeline, data standards, and assumptions.

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TABLE PG&E-4.6-1: LIST OF CLASS A DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-27	Public safety partner coordination	PG&E is providing a description of how it chooses PSPS Advisory Committee representatives.	RCP, pp. 54-64 2021 WMP, Section 7.3.10.1	**Insufficient** **ACTION PGE-36 (CLASS A):** In its 2021 WMP update, PG&E shall describe how it vets and chooses PSPS Advisory Committee representatives.
PGE-27	Public safety partner coordination	PG&E is providing a discussion of how it intends to communicate with the counties identified.	RCP, pp. 54-64 2021 WMP, Section 7.3.10.1	**Insufficient** **ACTION PGE-37 (CLASS A):** In its 2021 WMP update, PG&E shall explain how it intends to remedy the lack of communication with the three counties that declined to meet for the Wildfire Safety Working Sessions.
PGE-27	Public safety partner coordination	PG&E is providing the requested list of contacts.	RCP, pp. 54-64 2021 WMP, Section 7.3.10.1	**Insufficient** **ACTION PGE-38 (CLASS A):** In its 2021 WMP update, PG&E shall provide a list of every PG&E contact and their counterparts and the cities, counties, tribal governments, and first responder entities and description of their interaction.
PGE-27	Public safety partner coordination	PG&E is providing a discussion of how it intends to approach PSPS meetings to provide adequate communication.	RCP, pp. 54-64 2021 WMP, Section 7.3.10.1	**Insufficient** **ACTION PGE-39 (CLASS A):** In its 2021 WMP update, PG&E shall explain how it intends to remedy any planned meetings that were not completed and ensure adequate communication is maintained when meetings are not held.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-1	Lack of risk RSE Information	PG&E provides a description of how both ignition risk and wildfire consequence risk are used in calculation	First Quarterly Report, pp. 1-14 Subpart 1 – 2021 WMP Section 4.2 Subpart 2 - 2/26 submission	**Insufficient** **ACTION PGE-1 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) further describe why either ignition risk and wildfire consequence risk is calculated instead of calculating both, and 2) provide an explanation for each initiative as to why it either reduces ignition risk or wildfire consequence risk, but not both.
Guidance-1	Lack of risk RSE Information	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 1-14 2/26 submission	**Insufficient** **ACTION PGE-2 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide an RSE calculation for fuel and slash management, and 2) provide a description of how this value was calculated.
Guidance-1	Lack of risk RSE Information	PG&E clarified the scope of the System Hardening project and provided more details and updates related to the project. PG&E also attached data tables to clarify the assumptions and figures.	First Quarterly Report, pp. 1-14 2021 WMP Section 7.3.3	Insufficient **ACTION PGE-3 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain why only hardening efforts are identified within a higher risk tranche as a solution for the 7,100 miles scoped for system hardening, and no other initiatives are viable as a solution, 2) define what hardening consists of in regards to the 7,100 miles identified to be hardened, 3) provide the supporting materials and calculations showing that assets in the 7,100 is 2.75 more likely to fail, including all conclusions as to the reason why the failure rate is higher, 4) the location of the 7,100 miles, and 5) the explanation of the overlap and increase for these 7,100 and the 5,500 discussed in PGE-5 identified for hardening.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-1	Lack of risk RSE Information	PG&E has provided definitions and data around large catastrophic fires greater than 300 acres, including those during RFW conditions	First Quarterly Report, pp. 1-14 2021 WMP Section 4.2	**Insufficient** **ACTION PGE-4 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) clarify what is meant by "the likelihood of a large 300-acre fire of exponentially spreading and becoming catastrophic or destructive is closer to 70 percent,"13 2) provide the percentage of ignitions that lead to fires greater than 300-acres, 3) explain why PG&E finds 300-acres to be of significant value, 4) define what PG&E's understanding of "catastrophic" fire is in the context of less than 1 percent of ignitions leading to a catastrophic fire, 5) provide the percent of ignitions that lead to catastrophic fires during Red Flag Warning (RFW) conditions.
Guidance-1	Lack of risk RSE Information	PG&E has explained how the failure rates for various tags have been calculated along with power-line failure rate. PG&E has also provided details of the team of SMEs responsible to determine such failure rates. Finally PG&E has explained how collaboration between various IOUs are being used to fine tune the model.	First Quarterly Report, pp. 1-14 2021 WMP Section 4.2	**Insufficient** **ACTION PGE-5 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide in-depth explanations as to how a failure rate of 70 percent for Priority A tags, 50 percent for Priority B tags, and 1 percent for Priority E and F tags was calculated, 2) provide an in-depth explanation as to how a power-line failure rate from vegetation of 70 percent was calculated, 3) describe the SMEs used to determine such failure rates, and 4) implement industry standard and best practices into determining such failure rates, or describe how such have been implemented..
Guidance-2	Lack of alternatives analysis for chosen initiatives	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 15-24 2/26 submission	**Insufficient** **ACTION PGE-6 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide an explanation of what "limited alternatives considered" consists of for all initiatives in which PG&E provided such explanation in Table 1, 2) use the terminology of "no alternatives considered" if "limited" does not include anything substantive, and 3) reevaluate all initiatives with "limited" or no alternatives considered to include actual alternatives analysis.

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-2	Lack of alternatives analysis for chosen initiatives	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 15-24 2/26 submission	**Insufficient** **ACTION PGE-7 (CLASS B):** In its 2021 WMP Update, PG&E shall provide a table similar to Table 1 evaluating how initiatives interact with one another as alternatives when deciding implementation.
Guidance-2	Lack of alternatives analysis for chosen initiatives	PG&E explains the pilot of the use of fire retardant	First Quarterly Report, pp. 15-24 2021 WMP Section 7.3.3.5	**Insufficient** **ACTION PGE-8 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) discuss how PG&E is piloting the use of fire retardant, including how PG&E is choosing areas to undergo the pilot, 2) discuss how long it takes to deploy fire retardant, including when such a decision would be made, 3) describe the environmental permitting process needed for deployment of fire retardant, and 4) explain what continuing "to explore the potential of this 'fail safe' alternative"14 consists of.
Guidance-2	Lack of alternatives analysis for chosen initiatives	PG&E clarifies that the System Hardening Hybrid Program was being considered as an alternative program in 2020 and is not implemented	First Quarterly Report, pp. 15-24 2021 WMP Section 7.3.3.17.1	**Insufficient** **ACTION PGE-9 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide details on the System Hardening Hybrid Program, particularly when comparing it to covered conductor and the standard system hardening projects discussed within the WMP, 2) when comparing the system hardening hybrid to standard hardening, provide the risk reduction per mile implemented, 3) provide the locations in which the system hardening hybrid has been deployed and piloted, including an explanation of the rationale and any supporting calculations to determine the use of the hybrid over standard hardening approach in those areas, and 4) provide the locations in which the system hardening hybrid is planned to be deployed, including an explanation of the rationale and any supporting calculations to determine the use of the hybrid over standard hardening approach in those areas.

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-2	Lack of alternatives analysis for chosen initiatives	PG&E clarifies that the Wildfire Targeted System Upgrades were being considered as an alternative program in 2020 and are not implemented	First Quarterly Report, pp. 15-24 2021 WMP Section 7.3.3.17.1	**Insufficient** **ACTION PGE-10 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide details on the Wildfire Targeted System Upgrades, particularly when comparing it to covered conductor and other system hardening projects discussed within the WMP, 2) when comparing the Wildfire Targeted System Upgrades to covered conductor, provide the risk reduction per mile implemented; 3) provide the locations in which Wildfire Targeted System Upgrades have been deployed and piloted, including an explanation as to the reasoning and any supporting calculations to determine the use of upgrades in those areas, and 4) provide the locations in which the upgrades are planned to be deployed, including an explanation as to the reasoning and any supporting calculations to determine the use of upgrades in those areas.
Guidance-4	Lack of discussion of PSPS impacts	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 25-27 2/26 submission	**Insufficient** **ACTION PGE-11 (CLASS B):** In its 2021 WMP Update, PG&E shall provide quantitative values for all initiatives for all subparts included in Condition Guidance-4.
Guidance-4	Lack of discussion of PSPS impacts	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 25-27 2/26 submission	**Insufficient** **ACTION PGE-12 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) analyze how initiatives will impact subparts (i), (ii), and (iii) based on "protection zone," and 2) define what PSPS area was used for such analysis.

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-4	Lack of discussion of PSPS impacts	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 25-27 2/26 submission	**Insufficient** **ACTION PGE-13 (CLASS B):** In its 2021 WMP Update, PG&E shall reevaluate all initiatives for reduction in PSPS duration, including any indirect impacts.
Guidance-4	Lack of discussion of PSPS impacts	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 25-27 2/26 submission	**Insufficient** **ACTION PGE-14 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) reevaluate all initiatives and state if they directly support the "Evolution of the PSPS Program" (as outlined on p. 4-24 of the 2020 WMP), and 2) if so, expand on how the initiative directly supports the "Evolution of the PSPS Program."
Guidance-5	Aggregation of initiatives into programs	PG&E explains that the linear relationship is assumed based on conservative estimates and includes the Technosylva Fire Probability Dataset	First Quarterly Report, pp. 28-31 2021 WMP Section 4.2	**Sufficient** **ACTION PGE-15 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) describe why it used a linear relationship between probability of fire type and time passed, and 2) provide supporting materials showing a linear relationship.
Guidance-5	Aggregation of initiatives into programs	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 28-31 2/26 submission	**Sufficient** **ACTION PGE-16 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) list all initiatives in which it is developing a quantitative threshold, 2) provide a timeline and status update for when it intends to develop such quantitative evaluations for each initiative, and 3) explain what sort of SME expertise is being used for the development of each quantitative value.
Guidance-6	Failure to disaggregate WMP initiatives from standard operations	Not Applicable	First Quarterly Report, pp. 32-35	**Sufficient**

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-7	Lack of detail of effectiveness of enhanced inspection programs	PG&E defines what is meant by Asset Improvement Opportunities and explains how enhanced inspections allow for "building for the future" and system trending for these opportunities	First Quarterly Report, pp. 36-39 2021 WMP Section 7.3.4.2	**Insufficient** **ACTION PGE-17 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) define "asset investment opportunities" and, 2) explain how these opportunities benefit from enhanced inspections.
Guidance-9	Insufficient discussion of pilot programs	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 40-43 Second Quarterly Report, pp. 1-6 2/26 submission	**Insufficient** **ACTION PGE-18 (CLASS B):** In its 2021 WMP Update, PG&E shall provide a refiling of Attachment 1 from its QR filing that includes a column with quantitative values for both performance and risk reduction.
Guidance-10	Data issues - general	Not Applicable	First Quarterly Report, pp. 44-48 Second Quarterly Report, pp. 7-15	WSD has indicated that this deficiency is being addressed separately.
Guidance-11	Lack of detail on plans to address personnel shortage	PG&E explains that Qualified Electrical Worker Journeyman Lineman can be either promoted from within or hired from outside, in each of which cases there are minimum qualifications and/ or apprenticeship requirements to be fulfilled	First Quarterly Report, pp. 49-58 2021 WMP Section 5.4.3	**Insufficient** **ACTION PGE-19 (CLASS B):** In its 2021 WMP Update, PG&E shall differentiate and describe the differences between the hiring and training process of an outside hire compared to an internal promotion or reassignment.
Guidance-11	Lack of detail on plans to address personnel shortage	PG&E explains the details of training related to the System Inspections Program QCR position and further describes additional training/ certifications for contracted positions as well	First Quarterly Report, pp. 49-58 2021 WMP Section 5.4.3	**Insufficient** **ACTION PGE-20 (CLASS B):** In its 2021 WMP Update, PG&E shall provide the details regarding the internal training course required in order to qualify for a System Inspections Program QCR position, including: a) a description of the materials it covers, b) components of the course (such as WBT, OJT,22 etc.), and c) the length of time it takes to complete each component of the course.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-11	Lack of detail on plans to address personnel shortage	PG&E explains contractual terms that expect the contracted QEWs to be trained by the vendor	First Quarterly Report, pp. 49-58 2021 WMP Section 5.4.3	**Insufficient** **ACTION PGE-21 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain why Journeyman Lineman trainings are not provided to contracted QCR inspectors, and 2) describe any assessment taken to demonstrate qualifications of Journeyman Lineman regarding "routine job knowledge," or explain why PG&E does not find it necessary, if one is not required.
Guidance-11	Lack of detail on plans to address personnel shortage	PG&E has provided the performance scorecard in Attachment 2021WMP_ClassB_Action-PGE-22_Atch01	First Quarterly Report, pp. 49-58 Attachment 2021WMP_Class B_Action-PGE-22_Atch01	**Insufficient** **ACTION PGE-22 (CLASS B):** In its 2021 WMP Update, PG&E shall develop and present a performance scorecard for vegetation management contractors similar to the scorecard used to evaluate the performance of construction contractors.
Guidance-11	Lack of detail on plans to address personnel shortage	PG&E explains current multi-day program orientation training and plans to improve worker qualification	First Quarterly Report, pp. 49-58 2021 WMP Section 5.4.3	**Insufficient** **ACTION PGE-23 (CLASS B):** In its 2021 WMP Update, PG&E shall implement an assessment for all external recruits in order to ensure proper training levels are met.
Guidance-12	Lack of detail on long-term planning	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 59-89 2/26 submission	**Sufficient** **ACTION PGE-24 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) define what "continue" or "increase" means for each instance it is used from Tables 4 to 13, and 2) either a) implement quantitative benchmarks that are reasonable and achievable for each such instance, or b) explain how it intends to track progress of each instance if a quantitative benchmark is not provided.

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-12	Lack of detail on long-term planning	PG&E has included a section on long term planning under each initiative (after 5) Future Improvements to Initiative)	First Quarterly Report, pp. 59-89 2021 WMP Section 7 under each initiative	**Sufficient** **ACTION PGE-25 (CLASS B):** In its 2021 WMP Update, PG&E shall integrate discussion on long-term planning within the respective section of each individual initiative.
PGE-2	Equipment failure	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 97-107 2/26 submission	**Insufficient** **ACTION PGE-26 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain why equipment failure is used as the current default for ignition cause, 2) provide the percentage of ignitions from 2016 to 2020 that are inaccurately characterized as equipment failure causes, 3) describe how PG&E checks for accuracy of ignition cause determinations currently, including any supporting documentation and procedures, 4) explain how PG&E plans to change the inaccurately documented ignition cause of "equipment failure" moving forward, including changes in procedures, training of first responders, and QA/QC checks for accuracy, 5) explain how PG&E plans on remedying inaccurately documented past ignition causes (include all relevant plans, if they differ from the plan for more accurate documentation in the future), and 6) provide a timeline for when PG&E intends to complete these improvements.
PGE-2	Equipment failure	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 97-107 2/26 submission	**Insufficient** **ACTION PGE-27 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the percentage and overhead circuit mileage of small copper conductor replacement projects that fall within HFTD areas, 2) explain how PG&E is prioritizing small copper replacement projects, and 3) explain any parallel upgrades (pole replacements, crossarm repairs, etc.) PG&E is performing that are compatible with small copper conductor replacements, including how such are prioritized.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-2	Equipment failure	PG&E explains how data from a consortium of utilities are used to benchmark across a variety of topics and metrics	First Quarterly Report, pp. 97-107 2021 WMP Section or 4.6.2	**Insufficient** **ACTION PGE-28 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide a list of the electrical corporations PG&E has worked with so far regarding identification of high equipment failure rates, and 2) explain how PG&E is working with each of the other utilities regarding data comparisons.
PGE-2	Equipment failure	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 97-107 2/26 submission	**Insufficient** **ACTION PGE-29 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) indicate which subset of outages in Table 17 it considers to be near-miss ignition events, 2) explain what each subcategory of "Unknown" or "Other" consists of in Tables 16 and 17 of PG&E's QR, and 3) explain in more detail all "Unknown" and "Other" values, including what is included within those values.
PGE-5	Use of relative risk scoring method	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 108-112 2/26 submission	**Insufficient** **ACTION PGE-30 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide a list of all changes to equipment as described in PG&E's QR response that would cause GIS data to no longer accurately reflect the original location of the 600 miles missing from the GIS data, 2) describe why the "start and end point" of circuit segments would no longer exist within the GIS data, broken down by percentage of cause (e.g., conductor replacement, full equipment replacements, facility removals), and 3) explain whether PG&E has completely replaced or hardened these 600 miles of its distribution system and thus no longer considers them part of the highest priority circuit segments, or if not, explain the cause of the missing information.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-5	Use of relative risk scoring method	PG&E has provided rationale and data supporting the questions in this action	First Quarterly Report, pp. 108-112 2021 WMP Section 4.5.1	**Insufficient** **ACTION PGE-31 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) describe how it has calculated overall wildfire risk in a similar manner as the 5,500 miles for system hardening to identify the most high-risk circuits, 2) provide the locations via GIS files on such high-risk circuits, 3) provide the percentage of the 5,500 miles fall under the total identified high-risk circuits, 4) describe how the determination of high-risk circuits was used to prioritize WMP initiatives, and 5) explain how PG&E's risk modeling considers a range of potential mitigation types, rather than assuming system hardening is the appropriate mitigation.
PGE-5	Use of relative risk scoring method	PG&E explains how the system hardening initiatives will be prioritized in the future	First Quarterly Report, pp. 108-112 2021 WMP Section 7.3.3.17.1	**Insufficient** **ACTION PGE-32 (CLASS B):** In its 2021 WMP Update, PG&E shall explain how the system hardening initiatives provided in this response are prioritized in comparison to one another.
PGE-5	Use of relative risk scoring method	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 108-112 2/26 submission	**Insufficient** **ACTION PGE-33 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the number of circuit miles and percentage of the 5,500 identified miles each of the targeted approaches consist of, and 2) provide the GIS file for the locations of each targeted approach.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-5	Use of relative risk scoring method	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 108-112 2/26 submission	**Insufficient** **ACTION PGE-34 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the number and percentage of circuit miles out of the 5,500 miles in which EVM work is being completed, 2) provide the location of such miles via GIS, 3) provide the number and miles in which the high risk circuits identified with the Distribution EVM model overlap with the 5,500 miles, and 4) provide the location of the circuit miles in GIS and in accordance with data attributes and metadata specified in the WSD's GIS data reporting requirements.
PGE-5	Use of relative risk scoring method	PG&E explains the assumptions around the RSE increase	First Quarterly Report, pp. 108-112 2021 WMP Section 7.3.3.17.1	**Insufficient** **ACTION PGE-35 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) describe the reason behind the increase in RSE for system hardening between 2020-2022 and 2023-2026, and 2) provide the calculations used to determine the RSEs for both date ranges.
PGE-5	Use of relative risk scoring method	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 108-112 2/26 submission	**Insufficient** **ACTION PGE-36 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain how and why the 1,060 miles were prioritized, and 2) provide the location of the 1,060 circuit miles via GIS.
PGE-6	Discrepancy between ignition reduction projections	N/A	First Quarterly Report, pp. 113-117	**Sufficient**

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-7	Line risk scoring sufficiently incorporates all risks that cause ignition and PSPS	PG&E explains the definition of conductor age/ estimated age used in the EDGIS	First Quarterly Report, pp. 118-122 2021 WMP Section 4.5.1	**Insufficient** **ACTION PGE-37 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the age score used for each conductor installation year, and 2) explain how it calculates the age score input for Sub-Model #1 when it has not provided complete conductor age information to the WSD in its GIS data submissions to date.
PGE-7	Line risk scoring sufficiently incorporates all risks that cause ignition and PSPS	PG&E explains the integration of new inputs into our risk modeling	First Quarterly Report, pp. 118-122 2021 WMP Section 4.5.1 Section 4.3 (b) Section 4.3 (c)	**Insufficient** **ACTION PGE-38 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide an update to the status of integrating any new inputs into its risk modeling, and 2) describe how such new inputs have been integrated into its risk modeling.
PGE-7	Line risk scoring sufficiently incorporates all risks that cause ignition and PSPS	PG&E provides a timeline and rationale of including new data inputs into the risk modeling	First Quarterly Report, pp. 118-122 2021 WMP Section 4.5.1	**Insufficient** **ACTION PGE-39 (CLASS B):** In its 2021 WMP Update, PG&E shall provide the timeline in detail for when it plans to include all outstanding inputs, broken down by each input.
PGE-7	Line risk scoring sufficiently incorporates all risks that cause ignition and PSPS	Same as above (Action PGE-39 Class B)	First Quarterly Report, pp. 118-122 2021 WMP Section 4.5.1	**Insufficient** **ACTION PGE-40 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) describe in detail how each of the currently outstanding inputs will contribute to PG&E's modeling efforts, 2) describe how PG&E determined the need to include each of these inputs, and 3) further explain why each of these inputs were not already included within modeling efforts.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-9	Weighing egress as a risk factor	PG&E explains how egress is no longer factors into the risk modeling	First Quarterly Report, pp. 123-124 2021 WMP Section 4.5.1	**Insufficient** **ACTION PGE-41 (CLASS B):** In its 2021 WMP Update, PG&E shall explain how egress is weighted against other factors during risk modeling and selection of initiatives.
PGE-9	Weighing egress as a risk factor	Same as above (Action 41 Class B)	First Quarterly Report, pp. 123-124 2021 WMP Section 4.5.1	**Insufficient** **ACTION PGE-42 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide a quantitative description of how egress score is calculated and incorporated into its prioritization calculations, particularly in comparison to the other factors, 2) explain how it factors in identification of wooden poles near evacuation routes. If such information is not currently factored in, explain why, and ensure that wooden poles are included as a factor for calculating egress in its 2021 WMP Update, and 3) provide an example showing the calculation of egress assessment.
PGE-10	Sufficient weather station coverage	PG&E provided an updated description of our weather station coverage.	First Quarterly Report, pp. 125-127 2021 WMP Section 7.3.2.1.3	**Insufficient** **ACTION PGE-43:** In its 2021 WMP Update, PG&E shall: 1) provide the locations via GIS of the 111 stations awaiting installation, and 2) explain how PG&E chose these 111 locations.
PGE-10	Sufficient weather station coverage	PG&E provided an updated description of our weather station coverage including benefits of weather stations far from PG&E assets	First Quarterly Report, pp. 125-127 2021 WMP Section 7.3.2.1.3	**Insufficient** **ACTION PGE-44 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain why it finds installation of weather stations far from PG&E electrical assets to be necessary, and 2) explain how installation of such weather stations will augment its situational awareness.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-10	Sufficient weather station coverage	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 125-127 2/26 submission	**Insufficient** **ACTION PGE-45 (CLASS B):** In its 2021 WMP Update, PG&E shall provide the internal cost/benefit analysis being conducted in the interim while a program is being developed.
PGE-11	Additional relevant reports	PG&E provided the reports and documents requested by this deficiency.	First Quarterly Report, pp. 128-135 Second Quarterly Report, pp. 16-18	**Sufficient**
PGE-12	Fuse replacement program planned to take 7 years	PG&E further clarified the scope of the fuse replacement program in 2021	First Quarterly Report, pp. 136-138 2021 WMP Section 7.3.3.7	**Insufficient** **ACTION PGE-46 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain whether it is increasing the scope of fuse replacements and, if so, why, 2) explain whether the replacement of the originally identified fuses (i.e., 625 per year) are being prioritized before replacement of those in the increased scope (i.e., 1,200 per year), and 3) describe how prioritization has changed since the initial scope in 2019.
PGE-12	Fuse replacement program planned to take 7 years	Attachment provided with GIS locations	First Quarterly Report, pp. 136-138 See attachment: 2021WMP_Class B_Action-PGE-47_Atch01	**Insufficient** **ACTION PGE-47 (CLASS B):** In its 2021 WMP Update, PG&E shall provide the locations via GIS of the fuses that have already been replaced.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-12	Fuse replacement program planned to take 7 years	PG&E provides a cost benefit analysis of fuse replacements	First Quarterly Report, pp. 136-138 2021 WMP Section 7.3.3.7	**Insufficient** **ACTION PGE-48 (CLASS B):** In its 2021 WMP Update, PG&E shall provide the cost/benefit analysis performed regarding fuse replacements, including the calculation of reduction of VM costs per fuse replaced.
PGE-13	Factors limiting microgrid deployment	PG&E details the use of microgrid sites/ backup sites during 2020 PSPS event	First Quarterly Report, pp. 139-145 2021 WMP Section 7.3.3.11.1	**Insufficient** **ACTION PGE-49 (CLASS B):** In its 2021 WMP Update, PG&E shall provide additional information about its specific backup generation sites, including a) the number of times used and b) challenges faced with the completion of this project and its operation.
PGE-13	Factors limiting microgrid deployment	PG&E describes the rationale for deploying microgrid sites	First Quarterly Report, pp. 139-145 2021 WMP Section 7.3.3.11.1	**Insufficient** **ACTION PGE-50 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the cost/benefit analysis completed for microgrids as a mitigation, and 2) define what is meant by a "bridge" solution and "other solutions" and 3) include a timeline for how long an interim "bridge" solution would be in place.
PGE-13	Factors limiting microgrid deployment	PG&E describes the microgrid initiative in detail	First Quarterly Report, pp. 139-145 2021 WMP Section 7.3.3.17.5	**Insufficient** **ACTION PGE-51 (CLASS B):** In its 2021 WMP Update, PG&E shall expand on the remote grid initiative in detail and explain the feasibility of it.
PGE-14	Level 3 findings	*PG&E explains how the models in Table 7 assess the potential between risk levels on safety and reliability*	First Quarterly Report, pp. 146-151 2021 WMP Section 4.5.1	**Insufficient** **ACTION PGE-52 (CLASS B):** In its 2021 WMP Update, PG&E shall explain how the models in Table 7 assess the potential between risk levels on safety and reliability for the purposes of classifying priority levels in accordance with Rule 18.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-14	Level 3 findings	PG&E outlines risk modeling capabilities across the Maturity Survey categories today and shows the planned progress over the next three years from 2021 to 2023	First Quarterly Report, pp. 146-151 2021 WMP Section 4.5.1	**Insufficient** **ACTION PGE-53 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) create a framework for the maturation of risk modeling outlining each step, including a timeline for completion and progress updates, and 2) Expand on the details of each step.
PGE-17	Inspections using infrared technology	PG&E provides clarification on the IR findings	First Quarterly Report, pp. 152-154 2021 WMP Section 7.3.4.4	**Insufficient** **ACTION PGE-54 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the source that states 70 percent of IR findings are not identified visually, and 2) provide the percentage of PG&E findings via IR that were not identified during prior visual inspections.
PGE-17	Inspections using infrared technology	PG&E provides a discussion on risk reduction and cost savings of our infrared inspections	First Quarterly Report, pp. 152-154 2021 WMP Section 7.3.4.4	**Insufficient** **ACTION PGE-55 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the expected risk reduction for using IR inspections, as well as all inputs and algorithms used for the calculation, and 2) provide the estimated cost savings, both overall and per Overhead (OH) circuit mile, that IR inspections provide.
PGE-17	Inspections using infrared technology	PG&E provides clarification the splice count using infrared inspections	First Quarterly Report, pp. 152-154 2021 WMP Section 7.3.4.4	**Insufficient** **ACTION PGE-56 (CLASS B):** In its 2021 WMP Update, PG&E shall explain why IR inspections are used to determine splice count, and why it does not currently retain that information otherwise.
PGE-18	Hazard tree analysis focus on at-risk trees	PG&E provides a clarification on prioritization in the hazard tree program	First Quarterly Report, pp. 155-161 2021 WMP Section 7.3.5.15	**Insufficient** **ACTION PGE-57 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain the prioritization of hazard tree work in relation to the highest risk areas, and 2) prioritization of work relative to TAT scoring.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-18	Hazard tree analysis focus on at-risk trees	PG&E clarifies that while it does not have a top 10 list for at-risk species, it maintains a list of highest estimated overall EVM risk per region	First Quarterly Report, pp. 155-161 2021 WMP Section 7.3.5.15	**Insufficient** **ACTION PGE-58 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the top 10 at-risk EVM species categorized by geographical area,31 and 2) provide a list of vegetation work prescribed based on specific tree species, if such exists and differs from at-risk identification.
PGE-18	Hazard tree analysis focus on at-risk trees	PG&E provides data on the green hazard tree program.	First Quarterly Report, pp. 155-161 2021 WMP Section 7.3.5.15	**Insufficient** **ACTION PGE-59 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the percentage of trees within PG&E's inventory that are classified as a "Green Hazard Tree," and 2) provide the percentage of both "Green Hazard Trees" worked and removed in relation to a) identified "Green Hazard Trees," b) total tree inventory, c) work performed on tree inventory, and d) total tree removals.
PGE-19	Low pass rate on EVM QA	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 162-167 2/26 submission	**Insufficient** **ACTION PGE-60 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) describe what WV consists of when comparing the 2019 audit to the 2020 audit, and 2) provide all criteria for both the 2019 and 2020 pass rates.
PGE-19	Low pass rate on EVM QA	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 162-167 2/26 submission	**Insufficient** **ACTION PGE-61 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) define what "Pass w/Observations" consists of, including all supporting procedures and criteria, and 2) provide a list of the observations made that "Pass w/ Observations" consists of from Table 21.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-19	Low pass rate on EVM QA	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 162-167 2/26 submission	**Insufficient** **ACTION PGE-62 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide details on specific capabilities being implemented to improve inspection pass rates, 2) the cost increase or savings of each capability, and 3) the timeline for implementation of each capability, including past dates for any already implemented.
PGE-19	Low pass rate on EVM QA	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 162-167 2/26 submission	**Insufficient** **ACTION PGE-63 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the 2019 and 2020 monthly passing rate both in miles and percent, including the breakdown between "Pass" and "Pass w/Observation," 2) explain whether criteria for pass rate changed, along with the month in which new criteria was utilized, and 3) continue providing monthly results in PG&E's future WMP and QR filings.
PGE-20	Redistributing resources to focus on transmission clearances	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 168-170 2/26 submission	**Insufficient** **ACTION PGE-64 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain where the numbers in Table 22 originated and why they differ from Table 11-2, 2) provide a revision of Table 22 showing only transmission-related ignitions caused by vegetation contact, and 3) include an additional row showing transmission-related ignitions caused by vegetation contact that led to fires greater than 500-acres.
PGE-20	Redistributing resources to focus on transmission clearances	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 168-170 2/26 submission	**Insufficient** **ACTION PGE-65 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) include an estimated change from 2019 to 2020 in personnel hours for a) distribution EVM work and b) TVM work, and 2) provide the targeted miles for 2019 and 2020 of TVM.

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-21	Describe why additional programs for transmission clearances are necessary	PG&E provides further clarification and data associated with TVM	First Quarterly Report, pp. 171-174 2021 WMP Section 8.2.2	**Insufficient** **ACTION PGE-66 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the percent reduction to transmission de-energization during PSPS events associated with TVM, including a description and supporting data of how such was calculated, 2) describe how PG&E factors in areas that have not undergone TVM when determining transmission de-energization during PSPS events, including all supporting procedures and models used, and 3) describe all instances in which a transmission line stayed energized due to TVM being completed, where it otherwise would have been subject to PSPS.
PGE-21	Describe why additional programs for transmission clearances are necessary	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 171-174 2/26 submission	**Insufficient** **ACTION PGE-67 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the number of OH circuit miles tested in the transmission ROW Expansion Program, 2) break down the number of vegetation-caused outages per year for the ten years prior to the 2017 ROW expansion pilot, 3) provide the number of vegetation-caused outages along the circuit miles demonstrating the ROW Expansion Program pilot in the ten years prior to the pilot, and 4) provide data on any ignition(s) that have occurred in areas that have undergone TVM outside of the pilot.
PGE-21	Describe why additional programs for transmission clearances are necessary	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 171-174 2/26 submission	**Insufficient** **ACTION PGE-68 (CLASS B):** In its 2021 WMP Update, PG&E shall explain the resource shift from distribution EVM to TVM with the support of quantitative data and figures demonstrating increased effectiveness for decreasing catastrophic wildfire risk.

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-21	Describe why additional programs for transmission clearances are necessary	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 171-174 2/26 submission	**Insufficient** **ACTION PGE-69 (CLASS B):** In its 2021 WMP Update, PG&E shall provide the percentage of all VM resources (labor, costs, etc.) being allocated to TVM.
PGE-21	Describe why additional programs for transmission clearances are necessary	PG&E provides clarity on resource allocation and circuit miles related to transmission ROW	First Quarterly Report, pp. 171-174 2021 WMP Section 7.3.5.3	**Insufficient** **ACTION PGE-70 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the resource allocation in terms of percentage between transmission ROW expansion and PSPS risk tree work, and 2) provide the number of circuit miles completed in 2020 for transmission ROW expansion and PSPS risk-tree work, respectively.
PGE-21	Describe why additional programs for transmission clearances are necessary	PG&E provides clarification and calculation around "veg point"	First Quarterly Report, pp. 171-174 2021 WMP Section 4.6.2	**Insufficient** **ACTION PGE-71 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) define what a "veg point" is, and 2) discuss how 3.82 "veg points" was calculated for use when determining distribution EVM reallocation.
PGE-22	Vegetation Management inspectors lacking proper certification	PG&E provides the score to pass pre-inspector assessment	First Quarterly Report, pp. 175-178 Second Quarterly Report, pp. 19-22 2021 WMP Section 7.3.5.14	**Insufficient** **ACTION PGE-72 (CLASS B):** In its 2021 WMP Update, PG&E shall provide the pass-rate and identify the score required to pass the Pre-Inspector assessment.

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-22	Vegetation Management inspectors lacking proper certification	PG&E provides the processes around ensuring professionals having ISA certification carry out the work	First Quarterly Report, pp. 175-178 Second Quarterly Report, pp. 19-22 2021 WMP Section 7.3.5.14	**Insufficient** **ACTION PGE-73 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain whether and how it ensures that pre-inspection work not completed by an ISA certified pre-inspector is verified by an ISA certified arborist during the WV process, 2) furnish any supporting procedures and documents demonstrating that VM work is checked by an ISA certified arborist at some point in the process, and 3) clarify if PG&E's understanding of "vast majority" of work professionals having ISA certification correlates to the "50 percent" of the WV Team being ISA Certified Arborists, mentioned earlier within its response to the "Work Verification" explanation of this section.
PGE-22	Vegetation Management inspectors lacking proper certification	PG&E further clarifies verification and improvement of TAT	First Quarterly Report, pp. 175-178 Second Quarterly Report, pp. 19-22 2021 WMP Section 7.3.5.15	**Insufficient** **ACTION PGE-74 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain how it verifies and improves the TAT, 2) provide the timeline/frequency of verification and improvements, and 3) provide a list of SMEs that contributed to and "endorsed"40 the TAT.
PGE-22	Vegetation Management inspectors lacking proper certification	PG&E provides explanation on certification for pre-inspectors	First Quarterly Report, pp. 175-178 Second Quarterly Report, pp. 19-22 2021 WMP Section 7.3.5.14	**Insufficient** **ACTION PGE-75 (CLASS B):** In its 2021 WMP Update, PG&E shall explain the resources and processes it provides to employees to support ISA certification of its pre-inspectors.

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-22	Vegetation Management inspectors lacking proper certification	PG&E provides clarification on the Work Verification process	First Quarterly Report, pp. 175-178 Second Quarterly Report, pp. 19-22 2021 WMP Section 7.3.5.13	**Insufficient** **ACTION PGE-76 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain what the verification process entails for the 100 percent of EVM work being checked, including the length of time it takes the WV process to be completed per circuit mile, and 2) explain why it finds it necessary to increase the WV process for Routine Maintenance from 10 percent to 25 percent.
PGE-23	Vegetation waste and fuel management process	PG&E provides more information on the USD pilot program	First Quarterly Report, pp. 179-189 Second Quarterly Report, pp. 23-33 2021 WMP Section 7.3.5.3	**Insufficient** **ACTION PGE-77 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide the percentage and number of OH circuit miles that underwent the Transmission UDS pilot program, including the Transmission UDS and ROW Expansion overlap, for both completed and scheduled work, and 2) explain how it determines UDS is beneficial on top of TVM, and how the benefits between the two differ.
PGE-23	Vegetation waste and fuel management process	PG&E provides more information on the USD pilot program	First Quarterly Report, pp. 179-189 Second Quarterly Report, pp. 23-33 2021 WMP Section 7.3.5.2	**Insufficient** **ACTION PGE-78 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) describe whether it has evaluated implementing UDS for distribution ROW, and either a) provide locations where UDS for distribution ROW is being implemented or planned to be implemented, or b) explain why PG&E is not utilizing UDS for distribution ROW vegetation maintenance.

TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-23	Vegetation waste and fuel management process	PG&E explains that the effectiveness assessment will be dependent on the pilot UDS program	First Quarterly Report, pp. 179-189 Second Quarterly Report, pp. 23-33 2021 WMP Section 7.3.5.15	**Insufficient** **ACTION PGE-79 (CLASS B):** In its 2021 WMP Update, PG&E shall provide quantitative determinations of effectiveness for its fuel management efforts broken down by geographical area,42 demonstrating how PG&E tracks effectiveness when optimizing its processes based on geography.
PGE-24	Improving prioritization	PG&E explains the plan to integrate system hardening and VM efforts	First Quarterly Report, pp. 190-196 2021 WMP Section 4.5.1	**Insufficient** **ACTION PGE-80 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) provide a framework or outline of the modeling efforts underway to integrate system hardening and VM, and 2) describe the initiatives it is taking in order to integrate the two moving forward.
PGE-24	Improving prioritization	PG&E explains that the new strategies outlined in First Quarterly Report will allow for retroactive data integration	First Quarterly Report, pp. 190-196 2021 WMP Section 7.3.7.1	**Insufficient** **ACTION PGE-81 (CLASS B):** In its 2021 WMP Update, PG&E shall: 1) explain whether these developments are solely for newly collected data or if these developments allow retroactive data integration for previously collected data, and 2) if they do not allow for previous data usage, explain a) why PG&E does not have such capability and b) why PG&E deems its plan to be sufficient.
PGE-24	Improving prioritization	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 190-196 2/26 submission	**Insufficient** **ACTION PGE-82 (CLASS B):** In its 2021 WMP Update, PG&E shall provide an update and explanation as to how its hardening initiatives have directly impacted its threshold values for initiating de-energization events, giving a) particular locations and b) quantitative data showing such changes.

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TABLE PG&E-4.6-2: LIST OF CLASS B DEFICIENCIES FOR 2020 WMP (CONTINUED)

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
PGE-24	Improving prioritization	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 190-196 2/26 submission	**Insufficient** **ACTION PGE-83 (CLASS B):** In its 2021 WMP Update, PG&E shall provide the calculations used to determine the percent outage reduction of the five categories (all, high, medium, low, and none) presented on page 194 of PG&E's QR.
PGE-28	Justification and detail for PG&E's self-assessed stakeholder engagement capabilities	PG&E provided a description of our approaches for coordinating and collaborating with communities for wildfire mitigation and PSPS.	First Quarterly Report, pp. 197-215 Second Quarterly Report, pp. 34-64	**Sufficient**
PGE-29	Cooperation and sharing of best practices	This information will be provided in the 2/26 filing	First Quarterly Report, pp. 216-219 2/26 submission	**Sufficient** **ACTION PGE-84:** In its 2021 WMP Update, PG&E shall incorporate lessons learned from the 2020 WMP filing into its discussion of each initiatives.

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TABLE PG&E-4.6-3: LIST OF CLASS C DEFICIENCIES FOR 2020 WMP

Deficiency Number	Deficiency Title	Utility Response (Brief Summary)	Referenced Documents	WSD Action
Guidance-8	Equivocating language and failure to commit	PG&E was mindful to not include ambiguous, diluting or equivocating language in the 2021 WMP and sought to include specific objectives, details and commitments throughout the 2021 WMP, where possible. However, as PG&E has noted in several portions of our WMP, our understanding of the effects of climate change, wildfire risks and the best mitigation approaches are evolving fields with new information and learnings every year. Therefore, some of the words noted in this deficiency, like "assess," "evaluate" and "evolve" are included in some portions of the 2021 WMP as these words properly articulate a planned action and/or stage of development or maturity for some of PG&E's efforts. Particularly as it relates to long-term planning, PG&E believes that we would be imprudent if we were not continually assessing, evaluating and evolving our wildfire mitigation efforts to make improvements. These descriptions are provided only where they are applicable to fully communicate the plans we currently have and how they may change as we learn more.	2021 WMP (throughout)	WSD has not yet acted on this deficiency.
PGE-4	Capacitor bank failure	PG&E is providing a description of the mitigation measures being undertaken to reduce capacitor bank failures. Those measures are described in more detail in Section 7.3.3.1.	2021 WMP, Section 7.3.3.1	WSD has not yet acted on this deficiency.
PGE-16	PG&E's recordkeeping	PG&E describes the challenges and limitations of working with paper records. PG&E also notes areas where it has shifted to electronic records.	2021 WMP, Section 7.3.7.1	WSD has not yet acted on this deficiency.

4.6.1 Responses to WSD Actions for Class A Remedial Compliance Plan (RCP) Conditions

As referenced in the Table PG&E-4.6-1 above, PG&E has included responses to the WSD Actions for the Class A RCP conditions in various sections within the 2021 WMP that are related to that Action. For Actions in which the response does not fit in with a specific WMP section, PG&E is providing the response below.

ACTION PGE-8 (Class A)

In its 2021 WMP update, PG&E shall:

1) *Update Tables 21-30 to reflect a quantitative value to accurately reflect risk reduction effectiveness instead of the current qualitative descriptions*

2) *Provide a column describing the program under which each initiative falls, and*

3) *Provide the difference between the actual and forecasted amounts in comparison to the 2020 WMP Section 5.3 tables.*

Response:

1) PG&E has provided a column in Table 12 (Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx) with a quantitative value to reflect risk reduction effectiveness. Due to scope changes from 2020 WMP to 2021 WMP (for example, PG&E has added/removed sub-initiatives for the 2021 WMP), the risk reduction evaluation assumptions are based on the 2021 WMP scope for each initiative.

   All initiatives have been categorized into Mitigations, Controls and Foundational Activity. PG&E has calculated risk reduction effectiveness values for these initiatives except where relevant data is not available. Typical examples of initiatives where relevant data are not available are:

   a. Foundational activities – such as data governance initiatives
   b. Pilot programs in early stages, where data to evaluate risk reduction has not been sufficiently gathered, and
   c. Complementary activities – where the initiative cost is difficult to separate from the costs of another initiative. In this case, the response points to the initiative it is complementary to.

   For further details of the quantitative analysis, please refer to the package of workpapers in Attachment 2021WMP_Section7.3_Atch01.

2) The 2021 WMP template for Table 12, provided in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx, included a column entitled "If spend not disaggregated by category, note spend category or mark general operations". In the cases where PG&E is unable to disaggregate financial information for one of these "child" initiatives this column specifies which "parent" initiative that "child" falls under. The responses in this column may provide the primary information requested by this action item. However, PG&E has also provided an additional column

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describing the "Program" under which each initiative falls in Table 12 in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. The "Program" as captured in this column represents the fundamental business process under which this initiative is performed, in many cases these "Program" labels are similar to the Capability Categories that align with the Utility Wildfire Mitigation Maturity Model. As there have been some minor changes in the initiatives from our 2020 WMP to the 2021 WMP (for example, PG&E has added or removed some sub-initiatives for 2021), all data in Table 12, including the program categorization is based on the 2021 WMP scope for each initiative.

3) PG&E has provided the difference between the actual and forecasted amount for 2020 in Attachment 2021WMP_ClassA_Action-PGE-8_Atch01.xlsx. The numbers in this attachment are based on the scope and financial assumptions used for the PG&E's First Quarterly Report (submitted September 9, 2020).

   The 2020 numbers in Attachment 2021WMP_ClassA_Action-PGE-8_Atch01.xlsx will be different from the 2020 numbers provided in Section 3.1 (Tables 3-1 and 3-2) and Table 12 (Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx) due to scope changes from 2020 WMP to 2021 WMP (for example, PG&E has added/removed sub-initiatives for the 2021 WMP or as per the 2021 WSD guidelines, we are now including Non-HFTD spend).

ACTION PGE-9 (Class A)

In its 2021 WMP update, PG&E shall:

1) *Provide the month for implementation of the Inspect App broken down between all patrol and inspection programs, as well as between distribution and transmission programs if such differ,*

2) *Provide an explanation for any delays in implementing the Inspect App for certain programs, and*

3) *Explain what qualifies the process to be "stabilized" for utilization on inspection type identification*

Response:

1) Inspect App implementation:

   a. Distribution Detailed OH Inspections pilot deployed in January 2020

   b. Transmission Detailed OH Inspections pilot deployed in March 2020

   c. Inspect App for documentation of Transmission and Distribution Patrols has not yet been developed or deployed

2) In August of 2016, a custom-developed, native iOS mobile application, *Asset Inspection* was deployed to the electric compliance organization. The features in the application were part of a minimum viable product that was used in conjunction with a paper process to facilitate the documentation of any minor work or corrective

issues found during a detailed inspection process. The initiative was a multi-year effort to create an enterprise mobile solution and align the preventative maintenance processes between gas and electric operations. The electric patrol and inspection process during this timeframe only required documentation and photos if an issue was identified and follow-on work was required.

In March 2018, the *Asset Inspection* application was updated to incorporate a new, more robust mapping interface with improved functionality that included Gas Distribution, Gas Transmission, Electric Distribution and Electric Transmission assets. *Asset Inspection* was re-branded as *Inspect* and was deployed to the Gas Leak Survey organization. In August 2018, the new electric version of *Inspect* was completed and deployed to Electric Compliance, replacing the previous *Asset Inspection* version. The functionality was still limited to access to maps, documentation and photos of corrective issues and integration to our system of record, SAP. The next iteration of the application was going to incorporate patrol documentation until the change was made in November 2018 to collect an inspection checklist for every detailed inspection as directed by the Wildfire Safety Inspection Program.

In 2019, the majority of the year was spent revising, refining and aligning the checklist questions for distribution, transmission and substation. Due to the revisions being made throughout the year to align with the System Inspection Program regulatory oversight, the decision was made not to incorporate the checklist into the *Inspect* application yet, instead a separate low code/no code forms application called Pronto Forms was developed to facilitate frequent changes. The inspection questions were moved into the *Inspect* application in 2020 which eliminated the use of Pronto Forms for detailed OH inspection documentation

3) A "stabilized" process is defined as the ability to accomplish the end to end process for detailed overhead inspections, using technology to document the details and collect photos of an overhead inspection digitally with an integrated submission directly into our system of record and associated compliance reporting.

ACTION PGE-10 (Class A)

In its 2021 WMP *update, PG&E shall:*

1) *Provide its analysis and any internal report(s) completed in regards to PG&E's internal* investigation*(s) on primary wire down events from conductor or splice failure, [As stated in Footnote 1 of PGE RCP on p. 21, PG&E can provide the substantial amount of data collected to run analysis, but WSD is more interested in the numerical conclusions drawn from the analysis (such as calculated failure rates for all conductor materials analyzed, failure rate by material per overhead circuit mile, failure rate of ASCR inside corrosion zones vs. outside, etc.) and any internal reports completed based on the analysis. The full data set is not necessary at this time.]*

2) *Provide a summary of any conclusions or findings drawn relating to splice failure*

3) *Report on its evaluation of historical meteorology data versus distribution wires-down outage data.*

PGE-DIXIE-NDCAL-000004583

Response:

1) PG&E's internal investigation on wires down events resulting from conductor or splice failure focuses on Basic Cause, main equipment involved, and the equipment condition. The Engineer Investigation Wires Down Database focuses on equipment failure caused wire down outages on non-Major Event Day (MED) where the equipment involved is either the overhead conductor or Splice/Connector. From here, the database tracks asset information such as involved conductor size/type, exact fault location (lat/long), known splices, and environmental information such as corrosion zone, snow loading, and HFTD. These attributes and factors are used to determine conductor replacement project justification and priority, as well as to determine failure trends of types of conductors and environmental factors that may increase asset health deterioration.

   Our numerical conclusions are based on the fact that PG&E has done analysis on conductor rates by size/type normalized by quantity in the PG&E system. Figures PG&E-4.6-1 and 4.6-2 below, which were previously provided in PG&E's RCP, were developed from the Engineer Investigation Wires Down Database collected data indicating that small copper wire has a higher rate of failure system wide, in addition to 4 Aluminum Conductor Steel-Reinforced (ACSR) conductor. In an effort to reduce outages due to conductor failure, PG&E standards were updated in 2015 to reduce conductor size options on new construction, using larger more resilient conductor as well as reduce inventory requirements for multiple conductor sizes.

FIGURE PG&E-4.6-1: CONDUCTOR ANNUAL WIRE-DOWN RATE

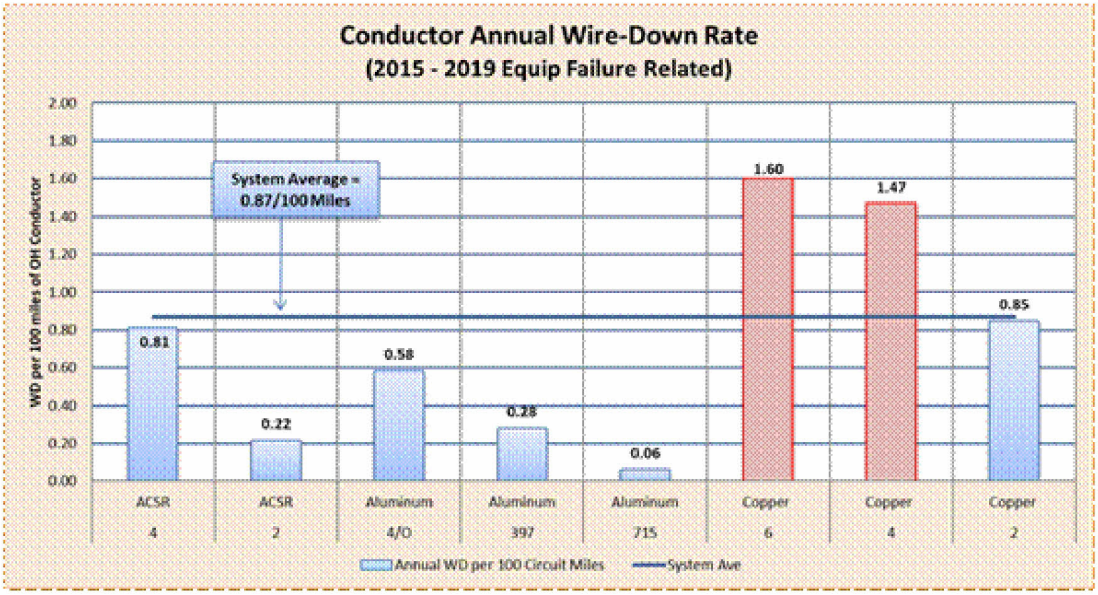
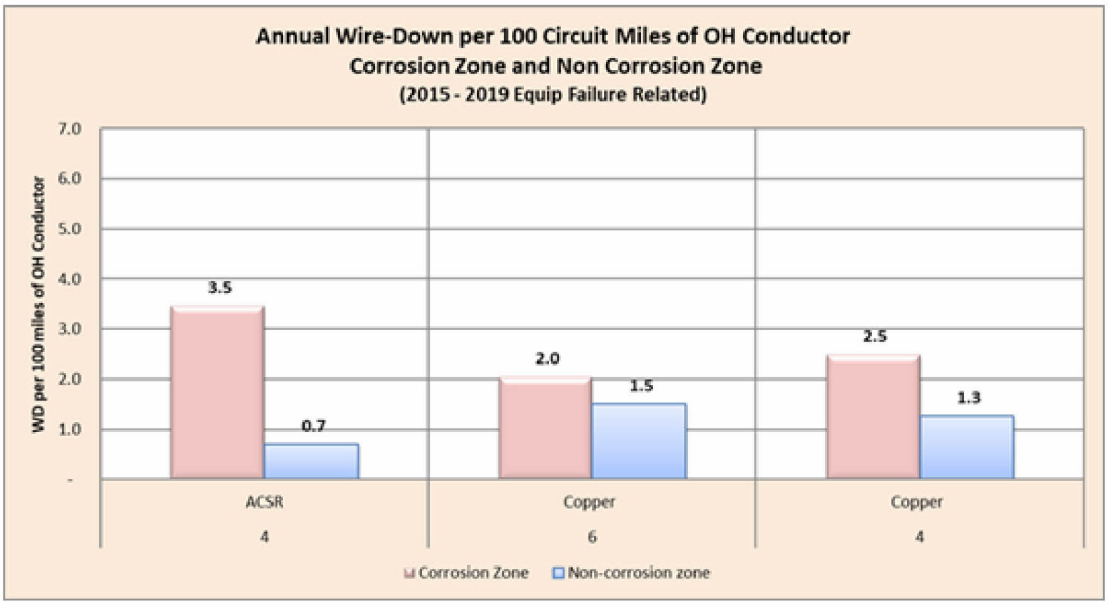


FIGURE PG&E-4.6-2: ANNUAL WIRE-DOWN RATE PER CIRCUIT MILE



2) Splice quantity within a span was identified as the highest impact variable to predict future wires down. Starting in 2021, PG&E is initiating efforts to collect more information from the field in order to develop more insights regarding asset failures. One effort will pilot extracting sections of span(s) that have failed to do testing on the conductor and the splices involved.

3) The below graph shows the equipment (Overhead Conductor and Splice) failure wires down rates on Blue Sky Days vs Grey Sky/Storm day (specifically with Northeast Wind, Northwest Wind, and Winter Storm influence) vs Major Event Days. The Blue Sky wire down trend is showing a steady/decreasing rate.

TABLE PG&E-4.6-4: DISTRIBUTION WIRES DOWN EVENTS DUE TO EQUIPMENT (OVERHEAD CONDUCTOR AND SPLICE FAILURES)

	Distribution Wires Down Events				Days Per Year				Wires Down/Day			
	2017	2018	2019	2020	2017	2018	2019	2020	2017	2018	2019	2020
Blue Sky Day	488	499	385	422	262	304	247	279	1.9	1.6	1.6	1.5
***Grey Sky/Storm**	152	148	130	76	35	34	35	23	4.3	4.4	3.7	3.3
Major Event Days	514	17	231	23	26	2	11	1	19.8	8.5	21.0	23.0

*Northeast Wind, Northwest Wind, and Winter Storm only

ACTION PGE-11 (Class A)

In its 2021 WMP update, PG&E shall elaborate on its MEDs by:

1) describing what PG&E uses as its Major Event Day identification threshold value (TMED),

2) providing the percentage of data not included in analysis due to MED data exclusion, both in terms of number of days and number of wire-down instances, and
3) explaining how PG&E intends to improve and expand MED reporting and why current circumstances allow for expanded MED reporting when the past did not

Response:

1) The MED threshold is calculated each year using the methodology prescribed in the industry-wide Standard IEEE 1366-2012 titled "IEEE Guide for Electric Power Distribution Reliability Indices." This threshold represents a daily System Average Interruption Duration Index (SAIDI) value and any day with outages that exceed this daily threshold is classified as an MED. The historical MED threshold values from 2015 to 2020 vary by year and are provided in the table below:

TABLE PG&E-4.6-5: HISTORICAL SAIDI MED THRESHOLD VALUES

Year	2015	2016	2017	2018	2019	2020
SAIDI MED Threshold (TMED)	2.186	1.879	1.463	1.847	1.935	2.941

2) The referenced analysis consisted of distribution wire down events caused by equipment (overhead conductor and splice) failures. Days not classified as MEDs are referred to Non-MEDs and PG&E also classifies the Non-MEDs into Blue Sky, Gray Sky, and Storms days. The table below shows and compares the corresponding wire down events that occur on MEDs versus those that occurred on Non-MEDs.

TABLE PG&E-4.6-6 DISTRIBUTION WIRE DOWN EVENTS ON MEDs VERSUS NON-MEDs

All Days	2015	2016	2017	2018	2019	2020
Number of Distribution Wire Down Events						
Events on Non-MEDs	633	714	739	695	662	615
Events on MEDs	126	69	533	37	354	84
Events on MEDs as a Percent of Total	16.6%	8.8%	41.9%	5.1%	34.8%	12.0%
Number of Days						
Non-MEDs	355	363	335	358	334	352
MEDs	10	3	30	7	31	14
MEDs as a Percent of Total	2.7%	0.8%	8.2%	1.9%	8.5%	3.8%

3) Although PG&E recognizes that external factors such as weather and wind will tend to stress the electric system and increase the number of wire down events experienced, PG&E's analysis of wire down events that occur on Blue Sky (non-weather related events) is intended to provide a base line of the system health. PG&E's focus on Non-MEDs was to help gauge the historical trends and to prioritize/optimize the benefits of future asset replacement or circuit reconstruction projects. PG&E had, and still has, the data related to wire down events on MEDs to perform analysis and reviews to inform maintenance or operational decisions. Although the impact to PG&E's system varies significantly based on the weather and winds experienced across our very large service

territory on MEDs, we are working to better understand how the system responds to wind events, including MEDs. Some improvements being incorporated into wire down event tracking include reporting and recording damage during PSPS events which includes wire on ground conditions (even if de-energized). This documentation, including information about the cause and the extent of damage, is used to determine trends and analyze system performance during severe wind events that drive PSPS events. Further, the control center is strengthening outage reporting and data accuracy details through change management and training. Specifically for equipment failure wires down, multiple datasets, including the outage report and the SAP repair notification, are reviewed for outage cause accuracy and equipment failure details. As such, PG&E has improved and expanded our analysis and reporting of wire down events to include the impacts during wind-related MEDs, which is covered in Action Item PGE-12 (Class A) below.

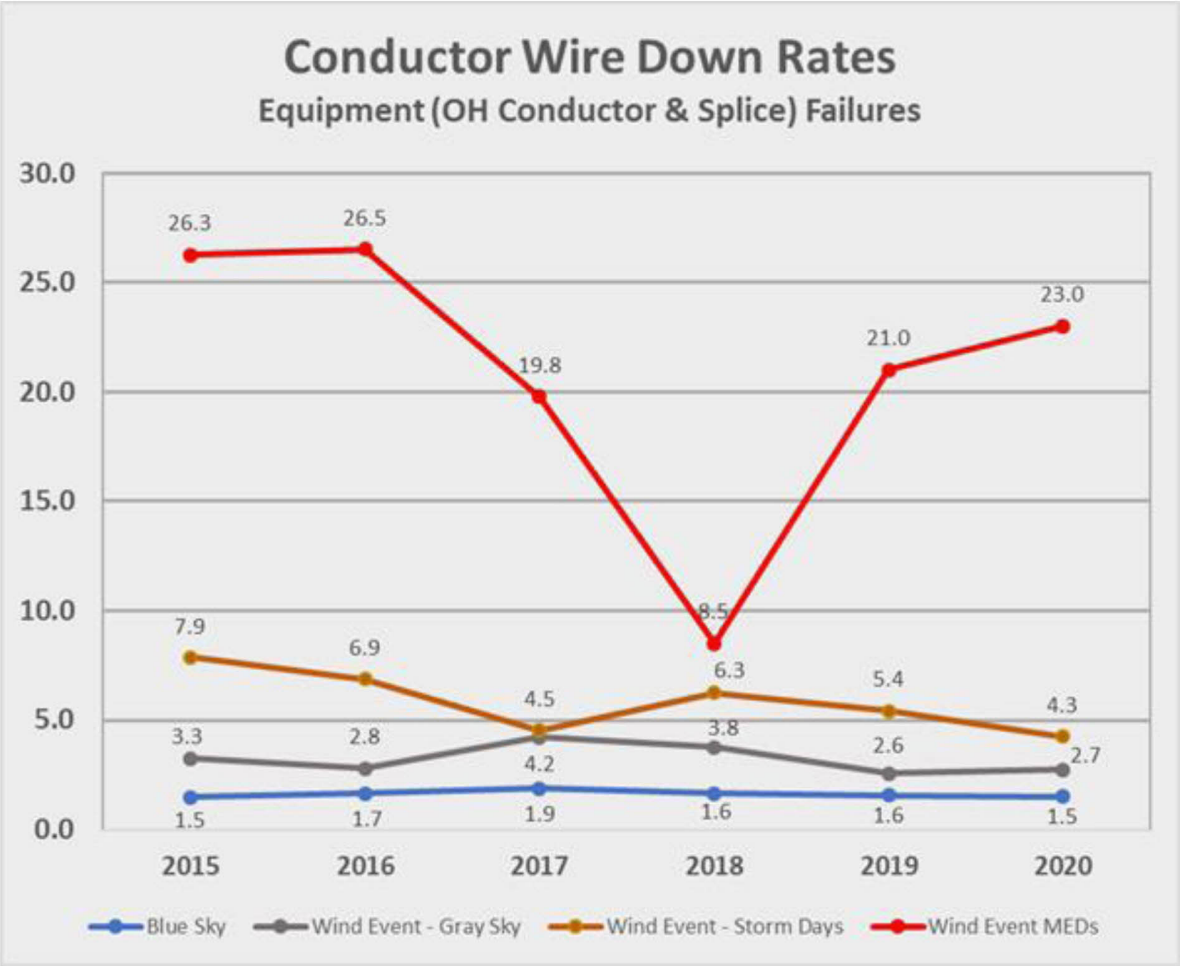
ACTION PGE-12 (Class A)

In its 2021 WMP update, PG&E shall provide a graph similar to Figure 10 (PG&E RCP @ 25) which includes all weather *metrics and sub-categories described in Section (3) (PG&E RCP @ 24) (e.g. Gray Sky, Storm Day, Northeast Wind)*

Response:

Figure PG&E-4.6-3 below provides updated distribution wire down information from 2015 to 2020 similar to the information previously contained in Figure 10 of PG&E's RCP. For further comparison purposes, the Gray Sky and Storm Days have been separated in this graph and the graph includes the corresponding average number of wire-down events per day experienced on MEDs. The data supporting this graph and an alternate view breaking wire down events down for identified wind patterns (*i.e.*, Winter Storm, Northeast Wind, and Northwest Wind) is provided in 2021WMP_ClassA_Action-PGE-12_Atch01.xlsx.

FIGURE PG&E-4.6-3: CONDUCTOR WIRE DOWN RATES FROM 2015-2020



ACTION PGE-13 (Class A)

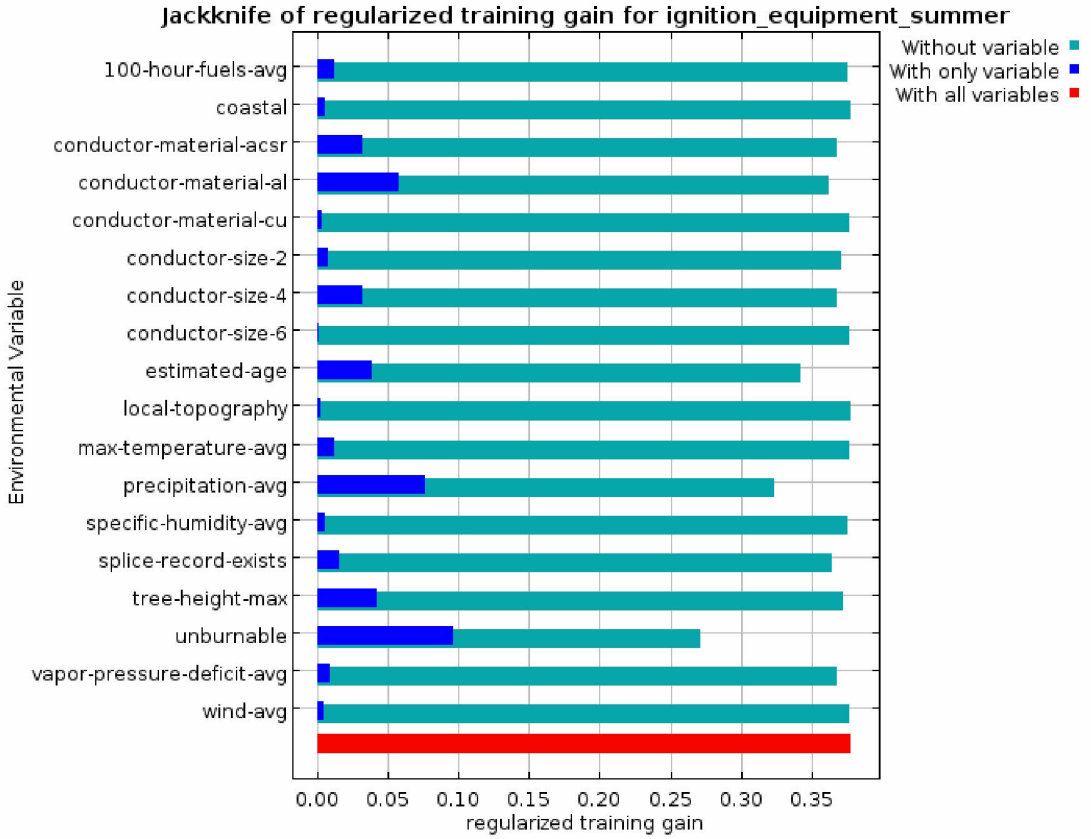
In its 2021 WMP update, PG&E shall:

1) describe when it intends to perform an analysis on the correlation between wind speed and wire down events,
2) explain why it has not performed such an analysis yet, and
3) upon completion of this analysis, provide the percentage of outages and wire down events caused by conductor failure due to wind.

Response:

Wind speed is one of many variables that influences failures and wire down events. However, wind speed alone is not the only factor that needs to be considered in wire down events. When developing the 2021 Wildfire Distribution Risk Model, wind speed was considered as a variable impacting ignition, and it was determined, as can be seen in the output below, that average wind speed (the last row in Figure PG&E-4.6-4 below) has a marginal effect on the probability of ignition.

FIGURE PG&E-4.6-4: JACKKNIFE ANALYSIS OF REGULARIZED TRAINING GAIN FOR IGNITION MODEL



Given these results, PG&E decided to use an ignition model as it is better equipped and more relevant for decision making rather than developing a specific analysis that attempts to solely correlate wind speed to wires down. Moreover, there is not a single relation between average wind speeds and wire down events, as the wind speed

required for an outage varies across PG&E's system based on differences in topology, vegetation and climatological weather exposure.

ACTION PGE-15 (Class A)

In its 2021 WMP update, PG&E shall resubmit its RCP Attachments 3 and 4 in Excel format with the following additional columns

1) region number 1-4 (as outlined in the National Electric Energy Testing, Research and Applications Center (NEETRAC) report),
2) corrosion area ranking (e.g., moderate, severe),
3) conductor material, and
4) number of splices along replaced portion. PG&E shall also provide similar tables for 2021 and 2022.

Response:

PG&E is resubmitting RCP Attachments 3 and 4 as the Files "2021WMP_ClassA_Action-PGE-15_Atch01" and "2021WMP_ClassA_Action-PGE-15_Atch02" respectively.

PG&E is not able to provide all of the information for_Atch01 regarding the MWC 08W (HFTD). The information requested is not actively maintained in a centralized database, thus, we are not able to provide this information. In addition, PG&E notes that this information is not the driver of the decision of this program as the information does not impact how PG&E manages these assets. Instead, MWC 08W (HFTD) relies on the 2021 Wildfire Distribution Risk Model in decision making.

ACTION PGE-21 (Class A)

In its 2021 WMP update, PG&E shall provide the percentage of priority "E" and "F" findings that were reprioritized to "A" or "B" from the 2019 to the 2020 inspection cycles within HFTDs.

Response:

There was a small percentage of open "E" and "F" priority corrective notifications (e.g., EC or LC "tags") that have changed to an "A" or "B" priority rating during the performance of Field Safety Reassessments (FSR) in 2020. The following table summarizes the change in Tags that has occurred:

TABLE PG&E-4.6-7: PERCENTAGE OF TAGS ESCALATED TO PRIORITY A AND B

EC/LC	Total FSRs completed YTD	Total Escalated to Priority A	% Escalated to Priority A	Total Escalated to Priority B	% Escalated to Priority B
EC - Distribution	182,764	103	0.056%	3,991	2%
LC - Transmission	11,906	12	0.10%	168	1%

ACTION PGE-22 (Class A)

In its 2021 WMP update, PG&E shall explain why it uses 2013-2018 ignition frequency for transmission and 2014-2019 for distribution when determining prioritization.

Response:

This historical asset ignition frequency data referenced on pages 35-36 of PG&E's RCP was used to determine tag prioritization and was based on PG&E's Wildfire Safety Inspection Program (WSIP) Compliance Plan and Interim Controls (Interim Controls) drafted in August 2019. For Tag Risk Scoring, PG&E considered five components: asset failure ignition risk, historical asset ignition frequency, likelihood of wildfire spread and consequence score, egress score and time-dependent. As noted, historical asset ignition frequency was different between Distribution and Transmission. Because the Interim Controls were drafted in mid-2019, and given to the infrequency and lack of data points for Transmission for the partial year, we did not include partial 2019 data into our scoring for Transmission at the time. For Distribution, because there was more data to consider, the partial year was included.

ACTION PGE-23 (Class A)

In its 2021 WMP update*, PG&E shall:*

1) explain how it determined the Risk Reduction and RSE values provided in Table 5 and provide an explanation of all inputs, relative weight of inputs, and list all algorithms used,
2) reproduce Table 5 with each column normalized per overhead circuit mile, and
3) submit an additional table for numbers in HFTD only and per circuit mile within HFTD.

Response:

1. Risk Reduction and RSE values are calculated using the SMAP conforming Enterprise Risk Model. Details of the methodologies and algorithms on how this is calculated are provided in the 2020 RAMP Report Chapter 3, see Attachment 2021WMP_ClassA_Action-PGE-03_Atch01. In addition, PG&E includes 2 additional files that include the calculation and inputs to this calculation of RSE, see Attachments 2021WMP_ClassA_Action-PGE-23_Atch02 and 2021WMP_ClassA_Action-PGE-23_Atch03.

2. Below is Table-5 normalized per overhead circuit mile. Circuit miles for routine inspection were based on a 5 year cycle of ~80,710 distribution and ~18,125 transmission miles, divided evenly across the 5 years. Circuit miles files for WSIP inspection are based on the entire ~25,410 distribution and ~5,525 transmission HFTD miles. Normalization of Overhead Circuit Mile was performed by dividing the Ignitions Prevented, Risk Reduction, and Cost by the number of overhead circuit miles. RSE is agnostic to circuit miles, as it is already a ratio of risk reduction divided by cost. Incremental benefit is not normalized per overhead circuit mile, as the number of miles performed is different between routine and WSIP inspections.

Original Table-5

Inspection Type	Ignitions Prevented	Risk Reduction	Cost ($000)	RSE
2018 Routine Inspection – Dist.	21.7	1,095	$12,063	~90.7
2019 WSIP – Dist.	91	15,825	$149,263	~106.0
Incremental Benefit – Dist	**69.3**	**14,452**	**$137,200**	**~105.3**
2018 Routine Inspection – Trans	8.3	945	$8,537	~110.7
2019 WSIP – Trans.	102	18,116	$67,601	~268.0
Incremental Benefit – Trans	**93.7**	**17,171**	**$59,064**	**~290.7**

Table-5 Normalized Per Overhead Circuit Mile

Inspection Type	Circuit Miles	Ignitions Prevented	Risk Reduction	Cost ($000)	RSE
2018 Routine Inspection – Dist.	16,142	0.0013	0.0678	$0.75	~90.7
2019 WSIP – Dist.	25,410	0.0036	0.6228	$5.87	~106.0
Incremental Benefit – Dist		**N/A**	**N/A**	**N/A**	**N/A**
2018 Routine Inspection – Trans	3,625	0.0023	0.2607	$2.36	~110.7
2019 WSIP – Trans.	5,525	0.0185	3.2789	$12.24	~268.0
Incremental Benefit – Trans		**N/A**	**N/A**	**N/A**	**N/A**

3. Below is the Table-5 with HFTD miles only. Please note WSIP figures did not change, as WSIP was meant to be performed in HFTD only in 2019.

Table-5 HFTD Only

Inspection Type	Ignitions Prevented	Risk Reduction	Cost ($000)	RSE
2018 Routine Inspection – Dist.	6.3	1,051	$3,798	~276.7
2019 WSIP – Dist.	91	15,825	$149,263	~106.0
Incremental Benefit – Dist	**84.7**	**14,774**	**$125,465**	**~117.8**
2018 Routine Inspection – Trans	5.3	913	$2,602	~351.1
2019 WSIP – Trans.	102	18,116	$67,601	~268.0
Incremental Benefit – Trans	96.7	17,203	$64,999	~264.7

Inspection Type	Circuit Miles	Ignitions Prevented	Risk Reduction	Cost ($000)	RSE

2018 Routine Inspection – Dist.	5,082	0.0012	0.2068	$0.75	~276.7
2019 WSIP – Dist.	25,410	0.0036	0.6228	$5.87	~106.0
Incremental Benefit – Dist		**N/A**	**N/A**	**N/A**	**N/A**
2018 Routine Inspection – Trans	1,105	0.0048	0.8262	$2.36	~351.1
2019 WSIP – Trans.	5,525	0.0185	3.2789	$12.24	~268.0
Incremental Benefit – Trans		**N/A**	**N/A**	**N/A**	**N/A**

ACTION PGE-24 (Class A)

In its 2021 WMP update*, PG&E shall provide all preselected priority options available within its inspections mobile application or any references available to properly classify field conditions.*

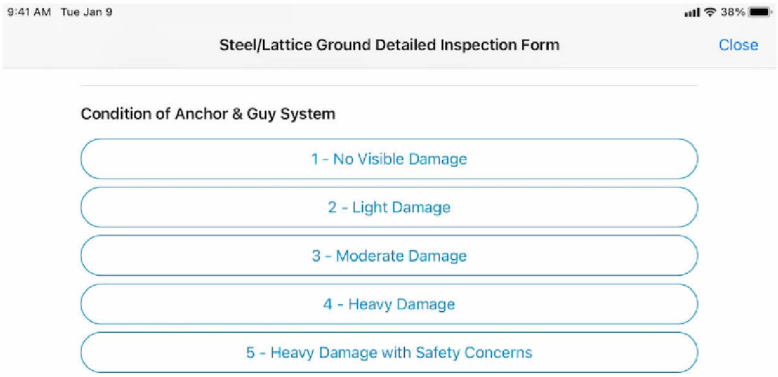
Response:

Please see the preselected priority options available within the Inspect App and references to classify field conditions below:

(1) Screen shots of Inspect App showing the condition assessment codes and notification priority codes (T&D)

These are summary condition assessment codes related to the inspector evaluation of the item being inspected on the structure and documented against the completed inspection record for the asset. These codes are coupled with any corrective notifications also documented at the structure being inspected.

FIGURE PG&E-4.6-5: EXAMPLE - INSPECT APP



These are the corrective notification priority codes for distribution and transmission. A recommended priority is pre-selected in the mobile application, based on the selections made in "Facility," "Damage" and "Action" sections. This priority can be over-ridden if the priority is "higher" than recommended based on the opinion of the inspector or as determined by field conditions. This priority may also be over-ridden during review of the field finding by the Central Inspection Review Team (CIRT).

FIGURE PG&E-4.6-6: EXAMPLE - TRANSMISSION INSPECT APP

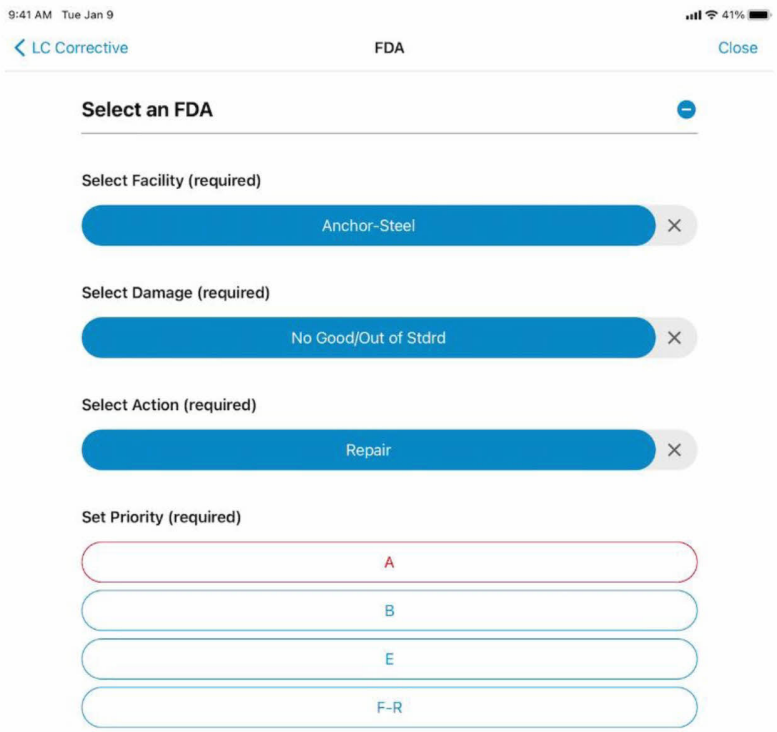
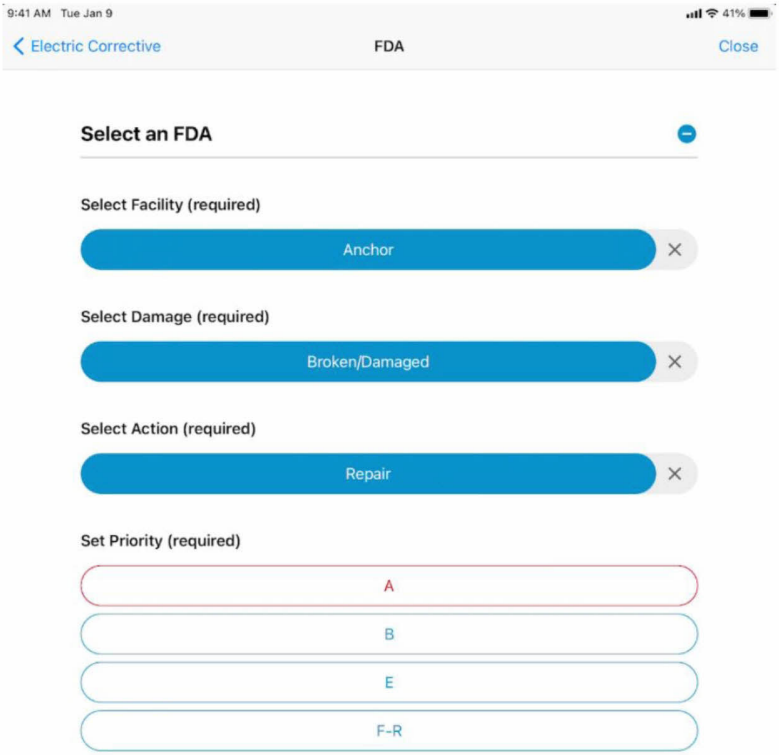


FIGURE PG&E-4.6-7: EXAMPLE - DISTRIBUTION INSPECT APP



(2) Priority Chart from TD-2305M Electric Distribution Preventive Maintenance Manual (EDPM_04012016, PDF Page 189), see Attachment 2021WMP_ClassA_Action-PGE-24_Atch01:

FIGURE PG&E-4.6-8: PRIORITY CHART FROM TD-2305M

Degree of Importance	Probability of Facility Failure	Impact of Failure and/or Exposure
Priority A Emergency	• A structure has already failed • Equipment has significant damage • The condition results in significant exposure to the general public	• Failure or exposure may lead to serious injuries • Failure has caused outages to customers • Requires immediate response or stand-by
Priority B Urgent 0-3 Months	• A structure has already failed • Equipment has significant damage • The condition may result in significant exposure to the general public • The condition can be "made safe", but requires permanent repair within 3 months	• Failure or exposure may lead to serious injuries, significant outages • Failure or exposure will result in an imminent reliability concern • Failure or exposure is a safety issue with significant impact • Does NOT require immediate response or stand-by
Priority E 3-12 Months	• A structure has already failed, but damage is such that repair is not required in the next 3 months • High likelihood that structure or equipment will fail in the next 12 months • The condition does not result in significant exposure to the general public	• Failure or exposure will not lead to serious injuries • Failure will result in an outage(s) • Failure or exposure is a safety issue with impact to PG&E operations and customers
Low No EC Required	• The condition is not structural • There is a low likelihood of failure • The condition does not have a significant impact to structural integrity • The condition is not likely to fail within 12 months	• There is little potential for injury or impact on reliability • Work procedures mitigate safety concerns • Failure or exposure does not present a significant impact to PG&E operations and customers
Priority F Regulatory (As identified on the back of the EC Work Form)	• N/A • Regulatory Facility/Damage/Action (FDAs) must be identified	• N/A • Regulatory Facility/Damage/Action (FDAs) must be identified

(3) Priority Table from TD-1001M Electric Transmission Preventive Maintenance Manual (ETPM_08312020_Rev 5, PDF page 21), see Attachment 2021WMP_ClassA_Action-PGE-24_Atch02:

FIGURE PG&E-4.6-9: PRIORITY TABLE FROM TD-1001M

Table 3 lists the priority codes and the associated time frames for typical response/repair action.

Table 3. Priority Codes

Priority Code[1]	Priority Description
A[2]	The condition is urgent and requires **immediate** response and continued action until the condition is repaired or no longer presents a potential hazard. SAP due date will be 30 days to allow time for post-construction processes and notification close-out.
B[3]	Corrective action is required within **3 months** from the date the condition is identified. The condition must be reported to the transmission line supervisor as soon as practical.
E	Corrective action is required within **12 months** from the date the condition is identified ***EXCEPT FOR ITEMS WITHIN HFTD TIER 3 ARE REQUIRED WITHIN 6 MONTHS.***[4].
F	Corrective action is recommended within **24 months** from the date the condition is identified, (due beyond 12 months, not to exceed 24 months). ***EXCEPT FOR ITEMS WITHIN HFTD TIER 3 ARE REQUIRED WITHIN 6 MONTHS AND WITHIN HFTD TIER 2 ARE REQUIRED WITHIN 12 MONTHS.***[5]

[1] Refer to 2.3.5.2, "Priority Code Due Dates for High Fire Risk Conditions within HFTDs" and 2.3.5.3, "Priority Code Due Dates for Non-Fire Risk Conditions within HFTDs."
[2] QCRs must report immediately any "Priority Code A" abnormal condition to the transmission line supervisor, and the transmission supervisor or QCR contacts GCC.
[3] In addition, QCRs must report any "Priority Code B" condition to the transmission line supervisor as soon as practical, to ensure that correction occurs within the appropriate time.
[4] If the condition in the HFTD Tier 3 does NOT create a fire risk (non-threatening) the corrective action is required within 12 months.
[5] If the condition in the HFTD Tier 3 OR Tier 2 does NOT create a fire risk (non-threatening) the corrective action is required within 24 months.

(4) TD-2305M-JA02 Electric Dist Overhead Inspection Job Aid, see Attachment 2021WMP_ClassA_Action-PGE-24_Atch03.

ACTION PGE-25 (Class A)

In its 2021 WMP update, PG&E shall break down the additional costs of enhanced inspections compared to routine inspections.

Response:

In 2019, PG&E's WSIP significantly changed the volume of assets inspected each year, condensed the timeline for HFTD inspection units, increased complexity of asset data/information captured, expanded quality oversight protocols, extended training time, all of which increased the need for external labor. These factors linked to creating more structure and consistency in the inspections programs also contributed to higher costs for enhanced inspections compared with prior compliance inspections of similar assets.

As explained in the introduction to Section 7.3.4, PG&E plans to complete the HFTD inspection units earlier in the annual cycle, and for 2021 is targeting completion of those

units by end of July 2021. Due to annual refreshment of the technology, checklist, and training, inspection cycles typically commence at the close of first quarter and therefore are constrained to under six months for execution. Due to the shortened HFTD inspection window, and increased volume in 2019 as compared to prior compliance cycles, WSIP and the new System Inspections department have required more than the historic complement of internal inspection personnel. For WSIP 2019, contractors completed nearly all the inspections, and in 2020 contractors represented more than three-quarters of detailed overhead inspections. In 2021, PG&E expects contractors to account for over half of the inspection workforce. Contracted personnel generally cost more per labor hour than comparable internal labor. In 2021, PG&E will again rely heavily on contracted labor for inspectors, supplementing the approximately 130 distribution, transmission towermen and troublemen personnel. PG&E continues to work to recruit and retain permanent full time Inspectors, adding eight headcount to the distribution department within System Inspections in 2020.

As to the additional data recorded, enhanced inspections document more photographs, more inspector annotation, and record checklist item responses, compared to the historic reporting which generally captured completion of inspection, and little more detail. The time required to accurately document each checklist answer digitally versus exception-only data entry also drives up the time required to complete each field inspection. PG&E estimates the time required to physically complete the incremental recordkeeping at each asset is increased two to four times, depending upon asset type.

Finally, the additional quality reviews and orientation durations imposed since 2019 also add cost to the program. For 2020 and 2021, inspectors from outside PG&E will receive three days of training, and internal inspectors will receive two days of refresher training. Both the cost of training delivery and personnel wages are captured in the cost of enhanced inspections. Costs from quality oversight arise from additional skilled and qualified labor that perform field validation and desk-based reviews of inspection findings prior to creating corrective work. Additionally, new personnel were hired to provide baseline staffing for an internal program quality oversight function. In prior practice, inspection supervisors provided the primary quality check in-cycle. The costs associated with this expanded onboarding process and centralized review team are allocated across all units completed in the year.

The drivers of increased costs between the baseline GO 165 programs and the enhanced inspections programs were:

- Incremental labor cost due to percentage of inspection units completed by contract vendor
- Incremental labor cost due to compressed execution schedule (increased overtime)
- Incremental time required to document a unit of inspection (checklist, photos, data corrections)
- Incremental administrative oversight of inspection quality (CIRT and QA/QC costs)
- Adjusted field execution that varied from established historical operational routes and patterns

An overview of the historic and forecast unit costs for routine and enhanced inspections is provided in Table-PG&E-4.6-8 below. Routine unit costs for pre-WSIP (i.e, before enhanced) inspections for transmission and distribution are included in the column for 2018. The columns for 2019 and 2020 reflect actual unit costs that include enhanced inspections. The column for 2021 reflects a forecast of unit.

TABLE PG&E-4.6-8: HISTORIC AND FORECAST UNIT COSTS FOR ROUTINE AND ENHANCED INSPECTIONS

	Fiscal year	2018 Pre-WSIP	2019 WSIP	2020	2021 forecast
	MAT	Unit Cost $	Unit Cost $	Unit Cost $	Unit Cost $
Distribution Overhead Detailed Inspections	BFB	24	296	136	120
Transmission Tower Climbing Inspections	BFT	1,541	473	1,031	1,031
Transmission Overhead Detailed Inspections	BFZ	113	638	654	654

ACTION PGE-33 (Class A)

In its 2021 WMP update, PG&E shall

1) provide a detailed plan for how it intends to analyze and use extended vegetation clearance data specifically, including specific statistical methods it intends to use and how it will control for environmental variables (e.g., wind, soil, elevation, species), and 2) provide a plan on how PG&E will continue analyzing and collecting data relating to measuring EVM effectiveness.

Response:

For this analysis, PG&E will calculate the following: past outages/ignitions where distance from tree to conductor was estimated to be 12 feet or less at the time of the outage/ignition as a proportion of total outages/ignitions. The resulting value will be considered as the population of outages/ignitions that will be reduced as a result of expanding clearance to 12 feet. The 12 foot expanded clearance will be obtained regardless of environmental conditions (e.g., wind, soil, elevation, species).

PG&E will update the outage/ignition data periodically to evaluate the effectiveness of the extended vegetation clearance. In addition, PG&E will analyze outage/ignition rates pre- and post-EVM treatment to track overall EVM effectiveness.

ACTION PGE-34 (Class A)

In its 2021 WMP update, PG&E shall explain how it calculated the effectiveness for each sub-driver shown in Table 8 and include all inputs and algorithm(s) used.

PGE-DIXIE-NDCAL-000004599

Response:

We evaluated the specific EVM scope of work intended to address each subdriver listed in Table 8 and combined this information with field experience regarding outages/ignitions to estimate the potential effectiveness of our proposed EVM work addressing each subdriver. The percentage effectiveness estimates were not based on specific algorithms.

4.6.2 Responses to WSD Actions for Class B Conditions

As referenced in the Table PG&E-4.6-2 above, PG&E has included responses to the WSD Actions for the Class B conditions in various sections within the WMP that are related to that Action. For Actions in which the response does not fit in with a specific WMP section, PG&E is providing the response below.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E has incorporated discussions around long term planning under each initiative after 5) Future Improvements to initiative in Section 7.3. PG&E recognizes that we must improve our long-term planning capabilities. PG&E has learned a tremendous amount from all of our wildfire mitigation activities in 2018, 2019 and 2020, but we also recognize that it is imperative to shift from operating on a year-to-year basis to grounding our WMP effort into longer-term vision while continuing to maintain a flexible program (PG&E further discusses this consideration in Section 5.2).

PG&E is establishing certain considerations that underlie our long-term planning efforts. More specifically, utility budget and planning cycles (e.g., unit planning) is done on a three-year cycle, which is in line with industry practice. In addition, the goals detailed in Tables 4 through 13 from the First Quarterly Report are not firm commitments but rather aspirational capabilities. PG&E will certainly work towards maturing the capabilities, but it also must maintain the right to pivot to higher priority needs based on future events as they unfold (e.g., wildfire risk is dynamic, and PG&E continues to adapt and evolve as it learns more).

ACTION PGE-28 (Class B)

1) Provide a list of the electrical corporations PG&E has worked with so far regarding identification of high equipment failure rates
2) Explain how PG&E is working with each of the other utilities regarding data comparisons.

Response:

PG&E participates in various benchmarking studies and industry working groups to benchmark Electric Operations. One of them is managed by First Quartile Consulting where a consortium of 21 utilities (listed below) benchmark across a variety of topics and metrics on an annual basis, including outages and events due to equipment failures. Data analysis includes comparing common reliability metrics, such as SAIDI and System Average Interruption Frequency Index (SAIFI), as well as diving into specific sources that drive outages/equipment failure (e.g., equipment, weather, trees, etc.). As PG&E learns practices, metrics and processes from utilities that are in the top quartile, it will share them with the relevant departments throughout our enterprise for continuous improvement.

PG&E's Electric Operations organization established a dedicated team to focus on benchmarking activities starting in Quarter 3 2020. For future benchmarking efforts, the team plans to continue using learnings from previous years benchmarks and discussions to inform additional survey/benchmarking opportunities in order to evaluate equipment failure rates on an even more granular level.

TABLE PG&E-4.6-9: CONSORTIUM OF UTILITIES

Utility Name	
Arizona Public Service	Oncor Electric Delivery
Abu Dhabi Distribution Co	Portland General Electric
Austin Energy	PSE&G
CenterPoint Energy	PSEG Long Island
CPS Energy	Southern California Edison
Entergy	TECO Energy
Exelon	Tucson Electric Power
Hydro One	UES Electric
Hydro-Quebec	Alabama Power*
Lower Colorado River Authority	Tennessee Valley Authority*
Omaha Public Power District	
*Transmission only	

ACTION PGE-71 (Class B)

1) define what a "veg point" is, and 2) discuss how 3.82 "veg points" was calculated for use when determining distribution EVM reallocation.

Response:

1. A Vegetation Point, or "veg point," is a single tree identified and listed in the Collector application for the EVM program.

2. The 3.82 veg point metric was not used to determine distribution EVM reallocation. PG&E did not shift personnel hours for distribution EVM and TVM work. The performance metric provided above was derived exclusively for ROW Expansion. We do not currently track the number of veg points completed per Full-Time Equivalent employee per weekly mile for EVM.

PACIFIC GAS & ELECTRIC COMPANY

SECTION 5

INPUTS TO THE PLAN AND DIRECTIONAL VISION FOR WMP

PGE-DIXIE-NDCAL-000004603

5. Inputs to the Plan and Directional Vision for Wildfire Risk Exposure

5.1 Goal of the Wildfire Mitigation Plan

The goal of the WMP is shared across WSD and all utilities: Documented reductions in the number of ignitions caused by utility actions or equipment and minimization of the societal consequences (with specific consideration to the impact on Access and Functional Needs populations and marginalized communities) of both wildfires and the mitigations employed to reduce them, including PSPS.

In the following sub-sections report utility-specific objectives and program targets towards the WMP goal. No utility response required for Section 5.1.

5.2 The Objectives of the Plan

Objectives are unique to each utility and reflect the 1, 3, and 10-Year projections of progress towards the WMP goal. Objectives are determined by the portfolio of mitigation strategies proposed in the WMP. The objectives of the plan shall, at a minimum, be consistent with the requirements of California Public Utilities Code §8386(a) –

Each electrical corporation shall construct, maintain, and operate its electrical lines and equipment in a manner that will minimize the risk of catastrophic wildfire posed by those electrical lines and equipment.

Describe utility WMP objectives, categorized by each of the following timeframes, highlighting changes since the prior WMP report:

1. *Before the next Annual WMP Update (by Feb 2022)*
2. *Within the next 3 years (2020-2022)*
3. *Within the next 10 years – long-term planning beyond the 3-year cycle*

Pacific Gas and Electric Company's (PG&E) overall objective for our 2021 Wildfire Mitigation Plan (WMP) remains unchanged from our 2020 WMP objective. Consistent with the statutory goal stated above, we seek to reduce the risk and consequences of wildfires associated with utility electrical equipment, thereby avoiding catastrophic wildfires across central and northern California. our wildfire mitigation strategy is structured around three strategic imperatives: (1) reducing wildfire ignition potential, (2) reducing wildfire spread through enhanced situational awareness, and (3) reducing the impact of Public Safety Power Shutoff (PSPS) events. Figure PG&E-5.2-1 below shows the key elements of our wildfire mitigation strategy.

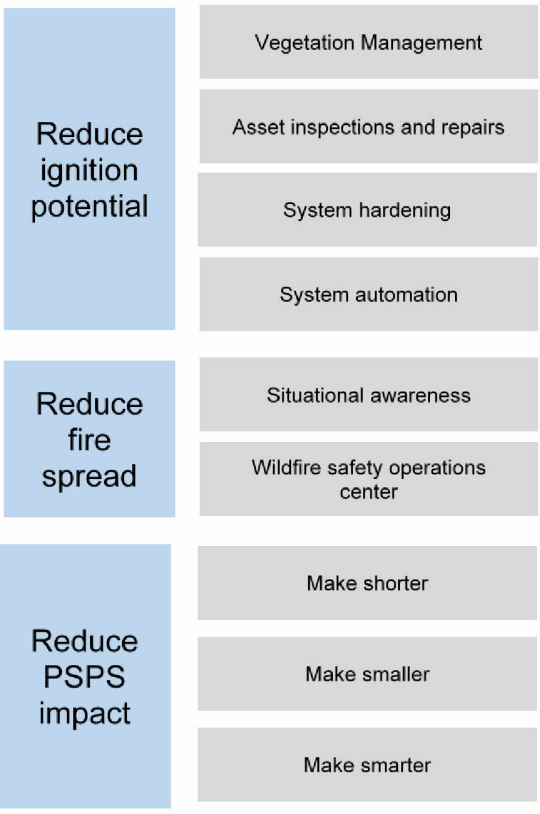
Reducing ignition potential is critically important because minimizing ignition risk inherently reduces the potential for fire to spread as well as the need for PSPS events. The imperative to reduce ignition potential is supported by first understanding the causes of utility-related fire ignitions. Vegetation is responsible for approximately half of utility-related ignitions in High Fire Threat District (HFTD) areas, with equipment failure representing roughly another third. Accordingly, reducing ignition potential is implemented at a tactical level by major initiatives that include vegetation management, inspections and repairs of electric facilities, a system hardening program that upgrades transmission and distribution assets, and a system automation program that enhances

visibility into and control of the system. During high-risk weather periods, PSPS is also used in a targeted manner to reduce ignition risk on parts of the infrastructure that have not been hardened.

Reducing fire spread is supported by improving situational awareness through monitoring of high-risk fire areas, enabling earlier detection and warning of wildfires, and more effective response by fire crews. Limiting fire spread is also supported by the our Wildfire Safety Operations Center (WSOC), a physical facility serving as the central wildfire-related information hub for us. WSOC monitors, assesses, and directs specific wildfire prevention and response efforts. WSOC monitors for fire ignitions in real time, leveraging our weather information, wildfire camera data, and publicly available weather information, as well as first responder and local and state data. WSOC compiles, interprets, and distributes this information across the company and to emergency response organizations to support limiting the spread of wildfires.

We recognize the significant disruption that PSPS causes for our customers, and uses PSPS only as a tool of last resort for wildfire mitigation. In the short, mid, and long-term, PG&E strives to continue making PSPS events shorter, smaller, and smarter. The intent of "shorter" is to reduce the outage time after the weather "All Clear," and "smaller" refers to reducing the number of customers impacted by each event given the event's weather footprint. The "smarter" objective is to reduce the impact to customers and communities that are de-energized, along with executing PSPS with excellence, keeping in mind lessons learned. The "smaller, shorter, smarter" PSPS efforts are described in more detail in Section 8.1.

FIGURE PG&E-5.2-1: KEY ELEMENTS OF PG&E's WILDFIRE MITIGATION STRATEGY



In 2020, we made significant progress on all three of our strategic imperatives. Key examples include: to reduce ignition potential, we hardened 342 miles of distribution circuits, completed 1,878 miles of Enhanced Vegetation Management (EVM), and inspected 100 percent of transmission and distribution circuits in HFTD Tier 3. To reduce fire spread through increased situational awareness, we installed over 200 cameras and 400 weather stations in 2020. We also significantly reduced our PSPS impact relative to 2019. Through a number of tool and process improvements, combined with a suite of mitigation initiatives, we reduced the number of customers impacted by PSPS by over 50 percent, relative to the number of customers that would have been impacted under the 2019 PSPS program.

Long-Term WMP Planning

Continued progress in our ability to reduce ignition potential, reduce fire spread, and reduce PSPS impact will require us to develop additional capabilities. The Wildfire Safety Division's (WSD) Utility Wildfire Mitigation Maturity Model (WMM) provides a list of 52 capabilities across 10 categories that are critical for wildfire risk reduction. While hawse have made significant strides in our wildfire mitigation program these last two years, we still have work to do to further advance in many of these capabilities.

We have learned a tremendous amount from our wildfire mitigation activities in 2018, 2019 and 2020. We faced a steep learning curve with respect to developing wildfire mitigation capabilities and purposely designed our WMP program to be nimble and

flexible so that it could pivot quickly to address emerging concerns, take advantage of new technologies, and quickly incorporate lessons learned. The focus on the past few years has been on aggressively pursuing opportunities that are identified and ensuring that our work plans remain prioritized based on risk and accounts for what we observed in the previous fire season.

While we have made significant strides in our wildfire mitigation capabilities, we recognize that we have largely been operating on a year-to-year basis with respect to planning for our many WMP initiatives. We now need to ground our entire WMP effort on longer-term planning while continuing to maintain a program that can adjust quickly to learnings. The deficiency that we received from the WSD on the 2020 WMP on Condition Guidance-12 with respect to lack of long-term planning underscores this point. We realize that we need to move to a WMP program that utilizes longer-term benchmarks and goals within the limitations of the shorter utility planning and funding cycles. We will need to take more of a portfolio view, maturing the way that we use data and initiative-specific Risk Spend Efficiencies (RSE) to prioritize across different efforts.

We initiated this longer-term planning effort when it responded to Condition Guidance-12 as part of our First Quarterly Report, submitted on September 9, 2020. In this response, we identified and distinguished the underlying attributes that enable the WMM capabilities.[32] In the long-term, we seek to prioritize those attributes with respect to their impact on the WMP capabilities, prioritize our portfolio of initiatives and programs relative to their ability to support the attributes, and identify the actions to improve performance of the initiatives. This process, along with the full list of capabilities that we envision developing over the near, mid, and long-term time horizons, is described in more detail in our First Quarterly Report.[33]

However, as we described in our response to Condition Guidance-12, it is difficult to commit to a specific set of plan elements beyond a horizon of three to five years for a number of reasons. Long-term planning and forecasting is challenging due to the many changes in wildfire risk understanding, energy technologies, economics, customer, societal preferences, climate change, and institutional and political direction in California and the broader U.S. Furthermore, our distribution business operates on 4-year financial planning cycles through the General Rate Case (GRC) process, with specific work plans developed annually. Our work plan, budget and funding processes are generally aligned to these shorter annual or 4-year cycles.

Sometimes even making one-, two- or three-year goals is challenging given the dynamic nature of wildfire risk. For example, the unprecedented size and destruction from the 2020 August lightning fires caused shifts in our system hardening portfolio, creating a new focus on fire rebuilds across our system. New work replaced some of what we originally envisioned completing. Retaining the ability to quickly pivot investment decisions will be essential for us to successfully navigate ever-evolving risks and opportunities.

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32 First Quarterly Report, pp. 59-65.

33 First Quarterly Report, pp. 59-89.

PGE-DIXIE-NDCAL-000004607

The early maturity level of our WMP program also makes setting longer-term goals challenging. Our various models and risk assessments underlying key WMP programs such as EVM, inspections, and PSPS mitigation efforts are still improving by leaps and bounds each year, driving not only changes to our work plans, but also creating limitations in terms of forecasting long-term wildfire mitigation needs. Even forecasting the quantity of work that needs to be accomplished is challenging when our understanding of what constitutes a high-risk location continues to evolve.

The role of the newly created Wildfire Risk Governance Forum is to ensure that our work plan and annual goals remain prioritized despite changing models. While the learning curve remains steep, our plans are very likely to change and evolve as we develop a deeper understanding of the nature of the wildfire risk and the most effective mitigations together with the California Public Utilities Commission (CPUC) and other stakeholders.

Finally, while we are deeply committed to the goal of reducing the risk of catastrophic wildfires, it cannot be our only goal. While safety remains our first priority, we have been asked by our customers and the State of California to reimagine and build the electric grid of the future as a secure, resilient, reliable, affordable, and integrated platform that enables continued gains for clean-energy technologies and California's economy. This grid of the future can leverage low-carbon resources, high levels of energy efficiency and demand flexibility, electrification, and advanced energy storage. It will provide customers maximum flexibility, more choices in how they use energy, and ultimately increased value from their utility grid in a dynamic energy future. We need to account for these broader goals when considering how to reduce the risk and consequences of wildfires associated with utility electrical equipment.

We are committed to improving our long-term WMP planning despite these challenges. A long-term plan is essential because it provides a trajectory to attaining the capabilities we need to reduce wildfire risk. We consider the items under our 1-year goals section below to be our WMP commitments. The goals and capabilities described in the Quarterly Report as well as in the Long-Term WMP Objectives and in the 3- and 10-year list of goals below are based on our best available knowledge today. While we are working toward these milestones, our plans and capabilities may need to change in response to unknown future events and circumstances. We look forward to working with the CPUC to find the right balance between longer-term plans and short-term requirements and actions.

Long-Term WMP Objectives

In principle, we expect that our 3- and 10-year WMP objectives will remain the same as the objectives for the 2021 WMP: to reduce ignition risk, prevent fire spread, and reduce PSPS impact.

In the three year time frame, we anticipate continued progress on all three of our WMP objectives, but our overall capabilities will still be relatively immature. We indicated in the First Quarterly Report that we will still be in the foundational, early maturity phase for all but two of the ten Maturity Model categories within these three years. Accordingly, we will be heavily focused on solidifying the quantitative framework underlying our entire WMP program, including PSPS. In particular, we will develop how

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we use RSEs to shape the portfolio and aggressively adjust our risk models to pinpoint the riskiest locations in our system. While these foundational activities are taking place, we will largely continue to maintain the suite of mitigations proposed in this WMP.

Within three years, we hope to reach a mid-maturity level with respect to the following two Maturity Model categories: Situational Awareness and Forecasting and Emergency Preparedness and Response. This mid-maturity level indicates that these capabilities and their implementation will have surpassed a foundational level and reached a point where they are being refined and advanced.

In the area of Situational Awareness and Forecasting, our camera and weather station deployment programs will be largely complete, significantly reducing the chance of a large fire becoming catastrophic. In the area of emergency planning and response, we anticipate making significant progress. This program, together with our public safety partners, supports the goal of limiting and slowing the rate of fire spread once a fire begins. In the three year time frame, in addition to taking a leading role in integrating our wildfire plan with the plans of other stakeholders, the emergency planning and preparedness team will have evolved the company's wildfire plan to incorporate confounding and simultaneous disasters. We will also have developed a utility standard for after-action reviews and procedures.

In the ten-year time frame, all of our WMP initiatives will no longer be in their foundational phases, but will have advanced significantly towards maturity. We expects that we will be close to achieving our "target" or "vision" wildfire mitigation capabilities in all ten areas of the WMM.

With respect to Grid Design and System Hardening, this accomplishment means that we will have transformed our transmission and distribution systems to account for wildfire risk while continuing to support other objectives, including maintaining overall reliability and advancing grid capabilities to integrate Distributed Energy Resources and support decarbonization goals. We will have adequately mitigated the riskiest areas in our system through various mitigations, including but not limited to system hardening, undergrounding, line sensing, or emerging technologies. In the select instances when these mitigations still are not enough to protect our customers, we will continue to use PSPS in a very limited and surgical fashion to eliminate wildfire risk, while working to minimize the impacts to our customers.

With the maturation of risk models and quantitative frameworks underlying the WMP, we anticipate having a portfolio in the ten-year time frame that is significantly more optimized than today. Through our programs and pilots, we will have identified the most effective tools to prevent wildfire ignition and spread in our service territory and to reduce the impacts of PSPS. While the work will never be complete as long as wildfire risks remain, we may be able to begin envisioning what initiatives might comprise part of a steady-state set of wildfire mitigation activities.

Below, we list our 1-,3-, and 10-year objectives for wildfire mitigation and map them, where appropriate, to the specific capability categories described in WSD's WMM. Additional goals specifically related to reducing the PSPS impact are discussed in Section 8.1.

1. *Before the next Annual WMP Update*

The 53 commitments we are focused on delivering for 2021 (by the next annual update) are outlined in Table PG&E-5.2-1, including those that are targeted to be completed earlier than the next annual update:

TABLE PG&E-5.2-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Risk Assessment and Mapping	A.01	7.3.1.5	Match drop simulations (24 additional hours of forecast data)	Enhance the wildfire spread project in 2021 by expanding the forecast horizon from three to four days.	12/31/2021
Risk Assessment and Mapping	A.02	7.3.1.5	Match drop simulations (update fuel model layers)	Update the fuel model layers on annual basis (Technosylva).	12/31/2021
Risk Assessment and Mapping	A.03	7.3.1.3	Re-Train Vegetation and Equipment Probability of Ignition Models	PG&E's Vegetation Probability of Ignition and Equipment Probability of Ignition Models will see more improvements with another year of data (2020) incorporated.	12/31/2021
Risk Assessment and Mapping	A.04	7.3.1.1 / 4.5.1	Risk Mapping Improvements (Transmission)	Improve Transmission Risk Modeling to provide more standardized wildfire risk mapping/ranking between the various controls and mitigations.	12/31/2021
Risk Assessment and Mapping	A.05	7.3.1.1 / 7.3.1.4	Risk Mapping Improvements (Distribution)	Improve Distribution Risk Modeling to include: 1) ability to compare wildfire risks for different risk drivers, 2) ability to measure the risk reduction of specific mitigations, 3) add wildfire risk values for distribution line locations beyond the HFTD and High Fire Risk Areas (HFRA) areas to include all of PG&E's distribution lines.	12/31/2021
Risk Assessment and Mapping	A.06	4.5.1 / 4.1	Model PSPS customer impacts at circuit level	Develop a more granular, circuit level model, to assess PSPS customer impacts.	9/30/2021
Situational Awareness and Forecasting	B.01	7.3.2.1.1	Numerical Weather Prediction	Make enhancements to numerical weather prediction program.	12/31/2021

PGE-DIXIE-NDCAL-000004610

TABLE PG&E-5.2-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Situational Awareness and Forecasting	B.02	7.3.2.1.2	Enhancements to Fuel Moisture Sampling and Modeling efforts	Expand the historical Dead Fuel Moisture (DFM) and LFM Live Fuel Moisture (LFM) climatology at 2 x 2 km resolution to back-fill all of 2020.	6/1/2021
Situational Awareness and Forecasting	B.03	7.3.2.1.2	Enhancements to Fuel Moisture Forecasting	Evaluate extending the deterministic DFM and LFM forecast to provide another 24 hours of forecast data.	6/1/2021
Situational Awareness and Forecasting	B.04	7.3.2.1.3	Enhancements to Weather Station Project (Installations and Optimization)	Install or optimize the location of 300 weather stations throughout PG&E's territory.	12/31/2021
Situational Awareness and Forecasting	B.05	7.3.2.1.3	Enhancements to Weather Station Project (Wind Gust Model)	Develop a weather-station specific wind gust model based on machine-learning or statistical techniques.	12/31/2021
Situational Awareness and Forecasting	B.06	7.3.2.1.6	Medium- to Seasonal-Range Diablo Wind Forecasting	Develop and deploy a seasonal Diablo wind event forecasting system to obtain longer lead-times of upcoming Diablo wind events.	12/31/2021
Situational Awareness and Forecasting	B.07	7.3.2.1.6	Information Sharing	Make adjustments to the public 7 day forecast to provide more granularity and clarity around the potential for a PSPS event.	6/1/2021
Situational Awareness and Forecasting	B.08	7.3.2.2.2	SmartMeters ™ - Partial Voltage Detection	Implement expanded coverage of Partial Voltage Detection capabilities to the three phase meters by end of June 2021.	6/30/2021
Situational Awareness and Forecasting	B.09	7.3.2.2.4	Sensor IQ Pilot Deployment	Deploy Sensor IQ (SIQ) functionality on all planned SmartMeters™ (500,000) by 12/31/2021.	12/31/2021
Situational Awareness and Forecasting	B.10	7.3.2.2.6	Distribution Arcing Fault Signature Library	Complete a 6-month minimum analytic stage capturing all events on the installed circuit to inform the Distribution Arcing Fault Signature Library project.	12/31/2021

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TABLE PG&E-5.2-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Situational Awareness and Forecasting	B.11	7.3.2.4	Enhancements to Fire Potential Index (FPI) Model	Enhance the FPI Model by September 1, 2021 using additional data and an enhanced fire occurrence dataset. PG&E also plans to incorporate the new Technosylva fuel mapping layer into FPI calculations if it provides more predictive skill of large fires.	9/1/2021
Situational Awareness and Forecasting	B.12	7.3.2.5	Safety and Infrastructure Protection Team (SIPT) Staffing	Maintain SIPT staffing levels to support fire prevention and mitigation activities.	12/31/2021
Situational Awareness and Forecasting	B.13	7.3.2.6	Enhancements to Outage Producing Wind (OPW) Model	Recalibrate the OPW Model using the 2 km climatology that will be extended to capture all events in 2020, including sustained and momentary outages, as well as damages found in PSPS events of 2020.	9/1/2021
Situational Awareness and Forecasting	B.14	7.3.2.7	Wildfire Safety Operations Center (WSOC) - Procedure Update	Update WSOC Procedural Documentation to include expansion of WSOC for All Hazards.	12/31/2021
Situational Awareness and Forecasting	B.15	7.3.2.7	Wildfire Safety Operations Center (WSOC) - Expand Active Incidents Visibility	Expand current Active Incidents Dashboard for additional stability, incorporate new data streams and expand the number of viewers.	10/1/2021
Situational Awareness and Forecasting	B.16	7.3.2.1.4	HD Cameras	Install an additional 135 cameras.	12/31/2021

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TABLE PG&E-5.2-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Grid Design and System Hardening	C.01	7.3.3.8.3	Assess Motorized Switch Operator (MSO) switches	Assess various alternatives to address the ignition risk associated with MSO switches. Explore several pilot options to inform the best alternatives and select the appropriate corrective action for MSO's for the next WMP update.	12/31/2021
Grid Design and System Hardening	C.02	7.3.3.11.1 C	Generation for PSPS Mitigation (Temporary Distribution Microgrids)	Develop at least 5 additional distribution microgrid Pre-installed Interconnection Hubs (PIH).	12/31/2021
Grid Design and System Hardening	C.03	7.3.3.11.1 B	Generation for PSPS Mitigation (Substation Distribution Microgrids)	Prepare at least 8 substations to receive temporary generation for 2021 PSPS mitigation.	8/1/2021
Grid Design and System Hardening	C.04	7.3.3.11.3	Emergency Back-up Generation – PG&E Service Centers & Materials Distribution Centers	Equip at least 23 PG&E Service Centers & Materials Distribution Centers to receive permanent or temporary generation.	12/31/2021
Grid Design and System Hardening	C.05	7.3.3.17.5	Remote Grid	Begin operations of the first Remote Grid site by the end of 2021.	12/31/2021
Grid Design and System Hardening	C.06	7.3.3.8.1	Distribution Sectionalizing (automated devices)	Install at least 250 more distribution sectionalizing devices integrating learnings from 2020 PSPS events, 10-year historical look-back of previous severe weather events, and feedback from county leaders and critical customers.	12/31/2021
Grid Design and System Hardening	C.07	7.3.3.8.2	Transmission Switches	Install 29 SCADA transmission switches to provide switching flexibility and sectionalization for PSPS events.	9/1/2021
Grid Design and System Hardening	C.08	7.3.3.9.1	Distribution line legacy 4C controllers	Replace all remaining (~84) distribution line legacy 4C controllers that are in Tier 2 and Tier 3 HFTD areas.	12/31/2021
Grid Design and System Hardening	C.09	7.3.3.9.2	Fuse Savers (Single phase reclosers)	Install 70 sets of single phase reclosers.	12/31/2021

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TABLE PG&E-5.2-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Grid Design and System Hardening	C.10	7.3.3.17.4	Rapid Earth Fault Current Limiter (REFCL) Pilot	PG&E plans to have the final results from this pilot project by September 2021 to inform the long term REFCL strategy.	9/1/2021
Grid Design and System Hardening	C.11	7.3.3.7	Expulsion Fuse Replacement (non-exempt equipment)	Replace approximately 1,200 fuses/cutouts, and other non-exempt equipment identified on poles in Tier 2 and Tier 3 HFTD areas.	12/31/2021
Grid Design and System Hardening	C.12	7.3.3.17.3	Surge Arrester Replacements	Replace at least 15,000 of the remaining 21,400 Tier 2 and Tier 3 non-exempt surge arresters.	12/31/2021
Grid Design and System Hardening	C.13	7.3.3.17.1	System Hardening (line miles)	Harden 180 highest risk miles.	12/31/2021
Grid Design and System Hardening	C.14	7.3.3.17.6	Butte County Rebuild	Underground 23 miles.	12/31/2021
Grid Design and System Hardening	C.15	7.3.3.17.2	System Hardening - Transmission Conductor	Replace approximately 92 miles of conductor on lines traversing HFTD, including associated asset hardware.	12/31/2021
Asset Management and Inspections	D.01	7.3.4.1	Distribution HFTD Inspections (poles)	Complete enhanced detailed inspections of overhead distribution assets in the following recurrence intervals: (1) Tier 3 and Zone 1 – annually; and (2) Tier 2 – every three years. Inspections will be completed by July 31, 2021, barring exceptions due to physical conditions or landholder refusals which delay or hinder PG&E access to facilities.	7/31/2021
Asset Management and Inspections	D.02	7.3.4.15	Substation HFTD Inspections (substations)	Complete supplemental ground and aerial inspections of 100 substations: 42 in HFTD Tier 3, 38 in HFTD Tier 2; and 20 in substations adjacent to Tier 2 and 3 HFTD areas.	7/31/2021

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TABLE PG&E-5.2-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Asset Management and Inspections	D.03	7.3.4.2	Transmission HFTD Inspections (structures)	Completed detailed enhanced inspections and some form of aerial assessment (helicopter, drone, aerial lift, climbing) on the following recurrence intervals: (1) Tier 3 and Zone 1– annually; and (2) Tier 2 – every three years. Inspections will be completed by July 31, 2021, barring exceptions due to physical conditions or landholder refusals which delay or hinder PG&E access to facilities.	7/31/2021
Asset Management and Inspections	D.04	7.3.4.5	Infrared Inspections of Transmission Electric Lines and Equipment	Conduct Infrared inspections on 100% of transmission circuits in Tier 3 HFTD areas, 33% of transmission circuits in Tier 2 HFTD areas, and 20% of transmission circuits in non-HFTD areas plus additional annually inspected lines. Planned scope of Transmission Infrared Inspections in 2021 is approximately 8,000 miles.	12/31/2021
Vegetation Management and Inspections	E.01	7.3.5.15	EVM (line miles)	Complete 1,800 circuit miles and mitigate approximately 190,000 trees.	12/31/2021
Vegetation Management and Inspections	E.02	7.3.5.1	VM Community and Environmental Engagement	Expansion of the month ahead workplan reports to the Regional Water Quality Control Board Representatives.	12/31/2021
Vegetation Management and Inspections	E.03	7.3.5.3	VM Transmission Right of Way Expansion	Perform Transmission ROW expansion on approximately 200 miles within HFTD areas.	12/31/2021
Data Governance	G.01	4.4.1	Research Proposals (Open Innovation Challenge)	Initiate an “Open Innovation Challenge” to identify novel technologies that could potentially reduce PG&E-caused wildfire risk.	9/1/2021
Data Governance	G.02	4.4.1	Cal Poly Wildland Urban Interface (WUI) Fire Information Research and Education (FIRE) Institute	Partner with, and advise on the direction of research and associated activities of the FIRE Institute.	12/31/2021

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TABLE PG&E-5.2-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Emergency Planning and Preparedness	I.01	7.3.9.1	Staffing to Support Service Restoration	Hire approximately 40 Linemen and 100 Apprentices.	12/31/2021
Emergency Planning and Preparedness	I.02	7.3.9.1	Trained Workforce for Service Restoration	All required personnel complete identified trainings to improve PSPS event execution (including SEMS, Access and Functional Needs and other critical training).	12/31/2021
Stakeholder Cooperation and Community Engagement	J.01	7.3.10.1 / 8.4	Community Based Organizations (CBOs) Coordination	Partner with CBOs in targeted communities to increase their capacity to serve AFN communities, such as medically sensitive customers, low-income, limited- English speaking and tribal customers.	12/31/2021
Stakeholder Cooperation and Community Engagement	J.02	7.3.9.2 / 7.3.10.1	Community Engagement	Engage community stakeholders through offering: Wildfire Safety Working Sessions, workshops that review PG&E's PSPS Policies and Procedures document, listening sessions, and Energy and Communications Providers Coordination Group meetings.	2/1/2022
Stakeholder Cooperation and Community Engagement	J.03	7.3.9.2 / 7.3.10.1	Customer and Community Outreach	Continue to enhance communications and engagement efforts with a focus on wildfire safety and preparedness for PSPS events - including Webinars/Community Meetings, Direct-to-Customer Outreach, developing and delivering informational video resources.	12/31/2021
Protocols on Public Safety Power Shutoff	K.01	8.4 / 8.2.4	Customer and Agency Outreach During PSPS Events	Improve Customer and Agency Outreach During PSPS Events by: developing opt-in address alerts, conducting new message testing, promoting enrollment, hosting briefings, hosting cooperator calls.	12/31/2021
Protocols on Public Safety Power Shutoff	K.02	8.2.1	Mitigate Impacts on De-Energized Customers	Work with partner organizations to provide outreach and support to vulnerable customers through programs such as the Disability Disaster Access and Resources Program (DDAR) and the Portable Battery Program (PBP).	12/31/2021

2. *Within the next 3 years*

Over the next three years, we have identified the following focus areas to help accelerate our maturity in key capabilities. We will continue to explore innovative ways to significantly help meet our core WMP objective of reducing fire risk, fire spread, or PSPS impact. A more detailed view of the capabilities expected to be developed over the next in the short, mid, and long-term planning horizons can be found in our Quarterly Report.

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- **Situational Awareness and Forecasting:** Deploy cameras to cover approximately 90 percent of the high fire-risk areas.

- **Emergency Planning and Preparedness:** Evolve wildfire plan to incorporate confounding and simultaneous disasters.

- **Asset Management and Inspections:** Mature in the use of risk-informed inspection protocols and recurrence intervals.

- **Risk Assessment and Mapping:** Increase granularity of ignition risk reduction to below the circuit level, including integration of fire spread consequences.

- **Grid Design and System Hardening:** Further develop and operationalize additional risk mitigation approaches including remote grids, microgrids and the Fire Risk Component Replacement program.

- **Vegetation Management and Inspections:** Increase fuel reduction programs and assess the benefits of these efforts.

3. *Within the next 10 years – long-term planning beyond the 3-year cycle*

Across the longer-term, 10-year planning horizon, We will focus on broadening and deepening our WMP efforts, by maturing across WMM capabilities to make our overall program more robust, while extending particularly effective programs to further protect our customers and communities.

- **Performance Assessment:** Track and assess performance of implemented wildfire risk and PSPS impact mitigation activities over an extended period of time to validate effectiveness. Based on observed performance, continue using, modifying, and improving elements of wildfire mitigation programs.

- **Weather Forecasting:** Achieve and maintain state of the art geographic granularity of weather prediction. Incorporate external sources and partner with academic institutions to support achieving the desired level of automation, forecasting granularity and forecasting accuracy.

- **Risk Modeling:** Full automation of current risk level, reduction, and RSE tools, including leveraging real time data and specific asset failure modes as modeling inputs.

- **Grid Design and System Hardening:** Harden our highest risk distribution circuits in HFTD areas and eliminate all non-exempt equipment in HFTD areas. Deploy remote grids, microgrids and back-up power solutions where appropriate and in partnership with our communities and customers.

- **Vegetation Management and Inspections:** Extend EVM to most distribution line miles in Tier 2 and Tier 3 HFTDs.

- **Asset Inspections:** Increase our ability to identify asset problems before they result in failure by gaining a deeper insight into asset condition through advanced technologies, data management, and analytical capabilities.

- **System Operations:** Further target smaller and less frequent PSPS events through better system resiliency, grid configuration (including sectionalization) and dynamic risk and weather modeling.

- **Data Governance:** Refine analytics operating model to further develop high-quality predictive and prescriptive analytics for risk informed decision making. Develop data access Application Programming Interfaces (APIs) to enable increased partnerships and transparency with researchers, regulators, and state and local governments.

Together with the long-term vision presented in the First Quarterly Report, these goals serve as a guiding roadmap for PG&E. They represent our current state of knowledge and understanding about wildfire risk and associated mitigation programs. As technology and policy continue to evolve, and our own understanding and risk management practices improves, the specific goals and wildfire mitigation approaches PG&E adopts will likely evolve as well. We will stay connected to industry innovations in wildfire risk reduction, grid hardening, and related fields through our memberships in Electric Power Research Institute (EPRI), International Wildfire Risk Mitigation Consortium (IWRMC), and other peer groups. These relationships will continue to support our ability to identify and incorporate promising innovations into our wildfire mitigation programs.

5.3 Plan program targets

Program targets are quantifiable measurements of activity identified in WMPs and subsequent updates used to show progress towards reaching the objectives, such as number of trees trimmed, or miles of power lines hardened.

List and describe all program targets the electrical corporation uses to track utility WMP implementation and utility performance over the last five years. For all program targets, list the 2019 and 2020 performance, a numeric target value that is the projected target for end of year 2021 and 2022, units on the metrics reported, the assumptions that underlie the use of those metrics, update frequency, and how the performance reported could be validated by third parties outside the utility, such as analysts or academic researchers. Identified metrics must be of enough detail and scope to effectively inform the performance (i.e., reduction in ignition probability or wildfire consequence) of each targeted preventive strategy and program.

The commitments outlined in our 2021 WMP include both quantitative and qualitative targets. For the purposes of this section of the WMP, Table 5.3-1 reflects a summary of all quantitative targets that involve work being performed on assets (i.e., inspections, repairs, replacements, new installations). For a complete list of all qualitative and quantitative 2021 WMP Commitments please refer to Section 5.2. Note that all 2020 data shown is as of February 5, 2021 and some data, including 2020 actual performance, is preliminary and subject to potential revisions. Additionally, 2022 Targets are forecasted based on currently available data and are subject to change based on learnings in 2021.

TABLE 5.3-1: LIST AND DESCRIPTION OF PROGRAM TARGETS, LAST 5 YEARS

Program Target	2019 Performance	2020 Performance	Projected Target by end of 2021	Projected Target by end of 2022[33]	Units	Underlying Assumptions	Update Frequency	Third-Party Validation
B.04 - 7.3.2.1.3 - Enhancements to Weather Station Project (Installations and Optimization)	426	404	300	TBD	# of weather stations installed	Between 2018 and end of 2021, we will have installed over 1300 weather stations, meeting the original scope of the program to have approximately one weather station for every 20 distribution circuit miles in HFTD. Beyond 2021, in collaboration with external partners, we will assess the need to install additional weather stations as well as optimize the locations of existing stations.	Annual	SAP Work Orders
B.16 - 7.3.2.1.4 - HD Cameras	75	216	135	132	# of HD Cameras Installed	By end of 2022 will have met original goal of having 600 cameras and 90% visual coverage of HFTD areas. Cameras considered operational when they successfully begin providing images to Alertwildfire.org (available to the public as well)	Annual	SAP Work Orders
C.02 - 7.3.3.11.1C - Generation for PSPS Mitigation (Temporary Distribution Microgrids)	1 [+3 temporary configurations]	3 (2 additional) [+3 temporary configurations]	8 (5 additional)	15 (7 additional)	Cumulative # of Distribution Temporary Microgrids (PIH) operationally ready to receive temporary generation	Primary unit of measure reflects cumulative PIHs available and ready to operate for PSPS events.	Annual	SAP Work Orders
C.03 - 7.3.3.11.1B - Generation for PSPS Mitigation (Substation Distribution Microgrids)	0	60	8	8	# of substations operationally ready as a temporary microgrid	Substation microgrid program began in 2020.In 2020, there were two additional substation solutions at Calistoga and Placerville that are categorized under the Temporary Distribution Microgrids immediately above (section 7.3.3.11.1C) that also utilized substation temp gen equipment, bringing the total count of substations equipped to accept generation to 62.	Annual	SAP Work Orders

TABLE 5.3-1: LIST AND DESCRIPTION OF PROGRAM TARGETS, LAST 5 YEARS (CONTINUED)

Program Target	2019 Performance	2020 Performance	Projected Target by end of 2021	Projected Target by end of 2022[33]	Units	Underlying Assumptions	Update Frequency	Third-Party Validation
C.04 - 7.3.3.11.3 - Emergency Back-up Generation – PG&E Service Centers & Materials Distribution Centers	0	0	23	72	# of locations equipped to receive permanent or temporary generation (Operational)	New initiative started in 2021	Annual	SAP Work Orders
C.05 - 7.3.3.17.5 - Remote Grid	0	0	1	20	# of Remote Grid sites operational	This was a new Technology initiative that started in 2020	Annual	Final Completion Certificate of the Purchase and Sale Agreement for Standalone Power System
C.06 - 7.3.3.8.1 - Distribution Sectionalizing (automated devices)	228	603	250	100	# of new installations of Automated Sectionalizing Devices (SCADA Commissioned)	Devices located on lines traversing into Tier 2 and Tier 3 HFTD boundaries	Annual	PSPS 2020 Commissioned Completions
C.07 - 7.3.3.8.2 - Transmission Switches	0 (For PSPS mitigation)	54	29	65	# of switches installed to mitigate PSPS impacts		Annual	SCADA Wave and PSPS Master Data
C.08 - 7.3.3.9.1 - Distribution line legacy 4C controllers	0	20	~84 (100% of remaining devices in Tier 2 and 3 HFTD)	0	# of distribution line Legacy 4C Controllers replaced with SCADA enabled reclosers in HFTD areas	Approximately 50 4C reclosers were replaced by other programs leaving 84 in 2021 to complete all devices	Annual	SAP Work Orders

TABLE 5.3-1: LIST AND DESCRIPTION OF PROGRAM TARGETS, LAST 5 YEARS (CONTINUED)

Program Target	2019 Performance	2020 Performance	Projected Target by end of 2021	Projected Target by end of 2022[33]	Units	Underlying Assumptions	Update Frequency	Third-Party Validation
C.09 - 7.3.3.9.2 - Fuse Savers (Single phase reclosers)	0	0	70	70	# of single phase reclosers sets installed (SCADA Commissioned)	PG&E piloted these devices in 2018-2019 to determine if they work as designed. In 2020, the devices were used for the Distribution Line Sectionalizing (123 locations). For 2021 and 2022, FuseSaver devices will be deployed to mitigate risk from back-feed conditions on long tap lines (70 locations annually). The FuseSaver and similar devices have multiple applications and can be used to open all phases whether it's for PSPS sectionalizing (under MAT 49H) or for mitigating back-feed conditions (under MAT 49T).	Annual	SAP Work Orders
C.11 - 7.3.3.7 - Expulsion Fuse Replacement (non-exempt equipment)	708	643	1,200	1,200	# of Expulsion Non-Exempt Fuses replaced in Tier 2 and Tier 3 HFTD		Annual	IA 2020 Final Review
C.12 - 7.3.3.17.3 - Surge Arrester Replacements	4,602	10,263	at least 15,000 of the remaining 21,400 in HFTD	TBD (may include remainder HFTD units plus some non-HFTD units)	# of Non-Exempt Surge Arresters replaced (in Tier 2 and Tier 3 HFTD through 2021)	In 2017, the Program started replacement of the existing surge arresters with new arresters identified as exempt by CAL FIRE 2022 Target will be dependent on actual performance in 2021. Any Tier 3 and Tier 2 HFTD units not completed in 2021 are planned to be completed in 2022, plus potential expansion into non-HFTD replacements	Annual	SA 2020 Locations Verified
C.13 - 7.3.3.17.1 - System Hardening (line miles)	171	342	180	470	# of line miles hardened in Tier 2, Tier 3 HFTD or fire Rebuild areas		Annual	IA 2020 Final Review

TABLE 5.3-1: LIST AND DESCRIPTION OF PROGRAM TARGETS, LAST 5 YEARS (CONTINUED)

Program Target	2019 Performance	2020 Performance	Projected Target by end of 2021	Projected Target by end of 2022[33]	Units	Underlying Assumptions	Update Frequency	Third-Party Validation
C.14 - 7.3.3.17.6 - Butte County Rebuild	0	30	23	23	# of miles hardened via undergrounding within Butte county	During the first year 2019 Actuals were incorporated in the System Hardening Program immediately above	Annual	Butte WMP Reportable Miles - 2020 Final
C.15 - 7.3.3.17.2 - System Hardening - Transmission Conductor	40	103	92	111	# of transmission line conductor miles hardened	Some of the mileage may not be in HFTD as some transmission lines traverse both HFTD and non-HFTD areas. Only electric transmission capital project greater than $1M are in scope. Smaller span reconductoring via maintenance tags is not counted in this overall mileage. 2021 target is adjusted from the original STAR filing to account for potential execution risks.	Annual	STAR Project Data Spreadsheet
D.01 - 7.3.4.1 - Distribution HFTD Inspections (poles)	694,250	100% of Tier 3 & Zone 1 and 33% of Tier 2 (339,728)	100% of Tier 3 & Zone 1 and 33% of Tier 2, plus high consequence Tier 2 structures (~402K)	100% of Tier 3 & Zone 1 and 33% of Tier 2, plus high consequence Tier 2 structures (~395K)	# of overhead distribution structures Inspected in HFTD and Buffer Zone "Zone 1"	For WSIP in 2019 we counted the number of inspections, while 2020 and beyond measure the number of poles inspected	Annual	Inspection Records (SAP)
D.02 - 7.3.4.15 - Substation HFTD Inspections (substations)	222	100% of Tier 3 & Zone 1 and 33% of Tier 2 (99)	100% of Tier 3 & Zone 1 and 33% of Tier 2 (100)	100% of Tier 3 & Zone 1 and 33% of Tier 2 (100)	# of substations inspected in Tier 3 and Tier 2 HFTD and adjacent Tier 3 and Tier 2 HFTD.	For WSIP in 2019 we counted the number of inspections, while 2020 and beyond measure the number of substations inspected	Annual	Inspection Records (SAP)
D.03 - 7.3.4.2 - Transmission HFTD Inspections (structures)	49,715	100% of Tier 3 & Zone 1 and 33% of Tier 2 (26,282)	100% of Tier 3 & Zone 1 and 33% of Tier 2 (24,092)	100% of Tier 3 & Zone 1 and 33% of Tier 2 (24,092)	# of structures inspected Tier 2 and Tier 3 HFTD	For WSIP in 2019 we counted the number of inspections, while 2020 and beyond measure the number of structures inspected	Annual	Inspection Records (SAP)

TABLE 5.3-1: LIST AND DESCRIPTION OF PROGRAM TARGETS, LAST 5 YEARS (CONTINUED)

Program Target	2019 Performance	2020 Performance	Projected Target by end of 2021	Projected Target by end of 2022[33]	Units	Underlying Assumptions	Update Frequency	Third-Party Validation
D.04 - 7.3.4.5 - Infrared Inspections of Transmission Electric Lines and Equipment	~4,354 HFTD Tier 3, 2 and Zone 1 [~9,905 system wide]	~2,676 HFTD Tier 3, 2 and Zone 1 [~5,250 system wide]	~2,844 HFTD Tier 3, 2 and Zone 1 [~7,761 system wide]	~2,844 HFTD Tier 3, 2 and Zone 1 [~7,761 system wide]	# of circuit miles infrared inspected in HFTD [total systemwide # of circuit miles infrared inspected]	Primary unit of measure for the 2021 commitment is HFTD miles (Tier 3, 2 and Zone 1) [Secondary unit of measure reflects all miles, including non-HFTD and ties to the financial data in Table 12] Note: Infrared inspections are dependent on loads. If load does not materialize, infrared inspection cannot be performed (it would not be effective). For 2022, infrared effectiveness will be evaluated prior to continuing or changing the re-inspection cycles set in 2021 scope.	Annual	Inspection Records (SAP)
E.01 - 7.3.5.15 - EVM (line miles)	2,498	1,878	1,800	1,800	# Line miles completed and verified in HFTD		Annual	EVM Work Verification Report
E.03 - 7.3.5.3 - VM Transmission Right of Way Expansion	198	207	200	125	# of miles of Transmission ROW expanded in HFTD		Annual	Project Team spreadsheets

5.4 Planning for Workforce and Other Limited Resources

Report on worker qualifications and training practices regarding wildfire and PSPS mitigation for workers in the following target roles:

1. *Vegetation inspections*
2. *Vegetation management projects*
3. *Asset inspections*
4. *Grid hardening*
5. *Risk event inspection*

For each of the target roles listed above:

1. *List all worker titles relevant to target role (target roles listed above)*
2. *For each worker title, list and explain minimum qualifications with an emphasis on qualifications relevant to wildfire and PSPS mitigation. Note if the job requirements include the following:*
   a. *Going beyond a basic knowledge of GO 95 requirements to perform relevant types of inspections or activities in the target role*
   b. *Being a "Qualified Electrical Worker" (QEW) and define what certifications, qualifications, experience, etc. is required to be a QEW for the target role for the utility.*
   c. *Include special certification requirements such as being an International Society of Arboriculture (ISA) Certified Arborist with specialty certification as a Utility Specialist*
3. *Report percentage of Full Time Employees (FTEs) in target role with specific job title*
4. *Provide a summarized report detailing the overall percentage of FTEs with qualifications listed in (2) for each of the target roles.*
5. *Report plans to improve qualifications of workers relevant to wildfire and PSPS mitigation. Utilities will explain how they are developing more robust outreach and onboarding training programs for new electric workers to identify hazards that could ignite wildfires.*

For consistency and clarity in responding to the five Items of information identified for the target roles, we have created a summation table to address Items 1 through 4. These items are referenced at the top of each table. Note that the Item 3 percentages include all listed active roles in 2020 and Item 4 percentages are based only on the roles with "High Interest" qualifications from Question 2 such as QEWs. Both Items 3 and 4 percentage totals sum to 100 percent representing the distribution of those resources across the different worker titles. Item 5 (plans to improve qualifications) is included in the narrative following each table.

5.4.1 Target role: Vegetation Inspections

TABLE PG&E-5.4-1: TARGET ROLE: VEGETATION INSPECTIONS

(1)	(2a.b.c)	(1)	(3)	(4)
Contractor Titles	Minimum Qualifications*	Qualifications Relevant to Wildfire and PSPS Mitigation	FTE % by Target Role	FTE % by High Interest Qualification
Vegetation Control (VC) Technician (Crew and PI)	N/A	VC position that carries out physical pole clearing work and pre-inspection	10%	
Vegetation Management (VM) Consulting Utility Forester	N/A	VM Patroller (AKA Pre-Inspector or PI) under Routine, Defined scope or CEMA etc.	75%	
VM Estimating Arborist (EA)	N/A	VM position that does EA work as a primary function	4%	
VM Senior Consulting Utility Forester	N/A	VM position that supervises a group of Pre-Inspectors	5%	
Right of Way (ROW) Pre-inspector	N/A	ROW enhancement, lays out individual projects	2%	
ROW Consulting Utility Forester	N/A	ROW field inspector	3%	
ROW Senior Consulting Utility Forester	N/A	ROW position that supervises a group of ROW Consulting Utility Foresters	2%	
			100%	

* Note: The Minimum Qualification only listed the qualifications outlined in part 2 (a, b, and c), the other qualifications for these positions are listed in the "Qualification Summary" section below.

Minimum Qualifications:

The Vegetation Management Inspection (VMI) roles do not require any of the three minimum qualifications (Qualified Electrical Worker (QEW), special certifications, advanced knowledge of General Order (GO) 95). Some VM project inspectors are certified arborists, but it is not a requirement for these roles.

PG&E uses the completion of training to ensure minimum qualifications are met before contractors can gain access to databases that are required to perform work in the field. Only after successfully completing specific training related to certain positions will the user be allowed access to the PG&E databases. Training requirements specific to the employee or contractor role are summarized below.

Qualification Summary:

- VC workers must complete VEGM -0302 PI Basics Structured Learning Path (SLP) described in the chart below
- ROW Pre-Inspectors, Consulting Utility Foresters and Senior Consulting Utility Foresters must complete the PI Basics SLP.
- Anyone working for EVM must also complete VEGM-0410 before receiving access. This course provides an overview of EVM procedures and the scope of work.

SLP class summary of qualifications:

TABLE PG&E-5.4-2: SLP CLASS SUMMARY OF QUALIFICATIONS

Course Number	Course Name	Description
VEGM-0101WBT	Introduction to Pre-Inspection Basics	Electrical equipment basics, the VM patrol process, tree work, and customer relations.
VEGM-0102WBT	Mapping Patrol Line Segments	How to identify patrol line segments on the index map.
VEGM-0103WBT	Pre-Inspection Tools and Practices	Tools and procedures pre-inspectors must follow during vegetation management work activities.
VEGM-0104WBT	Tree Assessment Tool (TAT)	How to use the Tree Assessment Tool (TAT)
VEGM-0105WBT	Tree Strike Potential	Strike potential decision process and data entry into the mobile device.
VEGM-0106WBT	Major Woody Stem Exemption	Major woody stem exemption decision process.
VEGM-0107WBT	Tree Growth Potential	Tree growth potential decision process and data entry into the mobile device.
VEGM-0108WBT	Abnormal Field Conditions Reporting	Identify abnormal field conditions during VM work activities.
VEGM-0109WBT	Assess Treatment of Re-sprouting Stumps	How to identify and treat re-sprouting stumps.
VEGM-0110WBT	Skills Assessment for Pre-Inspectors	Final skill assessment that will test key subjects from past vegetation management training.

Plans to Improve Worker Qualifications:

Broadly, we are supporting the further development of certifications within the VM industry in alignment with utility VM laws and regulations (including in specific states). In 2021, we will expand on the success of the 2020 rollout of the PI basics SLP. We will be clarifying and defining internal training that must be completed to ensure understanding of key concepts as well as developing new training where gaps are identified.

We will continue to work with our internal environmental partners to ensure that the identified environmental training for 2021 fulfill all our internal and external commitments. We are developing new training courses to support changes, such as Assessing Burned Redwoods in response to the 2020 fires and focusing training on Priority Tags in response to procedural changes. In all

cases our training will be developed with and managed through the PG&E Academy to ensure proper development and learner completion tracking.

ACTION PGE-31 (Class A):

In its 2021 WMP update, PG&E shall: (1) describe how long it takes to complete tree crew training, (2) describe the type of certification earned upon the completion of pre-inspector training, (3) elaborate on how PG&E supports obtaining an International Society of Arboriculture (ISA) certification, (4) provide the number and percentage of contracted versus internal pre-inspectors and describe whether contracted pre-inspectors undergo the same training as internal pre-inspectors, (5) describe how PG&E ensures proper certification of contracted pre-inspectors, and (6) explain how it ensures proper training is completed by subcontractors.

1) Tree crew training is continuous to ensure individuals are always improving upon and gaining new skills. However, prior to performing working on PG&E's behalf, all vegetation management contractors or employees must complete PG&E's SLP Program. The SLP consists of a phased approach that can take up to 12 months to complete a full comprehensive training for pre-Inspectors and tree crews. Once the initial SLP is completed, a second SLP opens to track progress quarterly for the first year.

2) Upon completing the courses associated with the SLP, specifically VEGM-0110 (Skills Assessment for pre-inspectors) pre-inspectors receive credit for completing the course, no official certification is provided. However, completion of the course allows for 6 credit hours to be applied towards Continuing Education units to the ISA if a student is ISA certified.

3) In our effort to encourage employees and contractors to seek ISA certification, PG&E adds training courses that are eligible for Continuing Education hours that can be used towards ISA certification renewals. Certification is currently not a requirement for pre-inspectors. For pre-inspectors to become certified, they require a certain level of experience and on-the-job training. For example, to become an ISA Certified Arborist, you must be trained and knowledgeable in all aspects of arboriculture and meet a minimum qualification of having three or more years of on the job experience. With that, PG&E has taken the approach of developing Tree Crew and Inspector Training programs to support a steady pipeline of qualified personnel who may later join our contract or internal VM workforce. PG&E's PI basics SLP and related training courses provide contractors with an opportunity to earn continuing education credit that can be used towards obtaining certification. Our partnership with Butte College allows us to provide employees and contractors with a direct path of obtaining certification.

4) While PG&E has started employing internal pre-inspectors, they comprise less than 1 percent of the VM workforce. Training requirements are the same for both internal and contracted pre-inspectors.

5) Certification is currently not a requirement for pre-inspectors. PG&E uses the method of on the job training to ensure pre-inspectors are professionally trained. Every training that a pre-inspector takes is managed by the Learning Academy within PG&E. (Please see the comprehensive list of training requirements above in Table PG&E-5.4-2 in Section 5.4.1)

6) To confirm subcontractors are following proper training protocols, PG&E has the prime contractor sign affidavits for each subcontractor as part of PG&E's approval process for the use of the subcontractor. Pre-inspectors and other related VM personnel, including subcontractors, are not granted access to PG&E systems until training is completed. Course completion is documented and retained in PG&E's System of Record. (See Section 5.4.1 Target Role Vegetation Inspections)

5.4.2 Target role: Vegetation Management Projects

TABLE PG&E-5.4-3: TARGET ROLE: VEGETATION MANAGEMENT PROJECTS

(1)	(2a.b.c)	(1)	(3)	(4)
Contractor Titles	Minimum Qualifications	Qualifications relevant to wildfire and PSPS mitigation	FTE % by Target Role	FTE % by High Interest Qualification
VM Project Coordinator	N/A	VM position that oversees a project - not a Pre-Inspector	16%	
VC Project Coordinator	N/A	VC Project Coordinator	11%	
VM Project Manager	N/A	VM position that oversees and is responsible for an entire project	26%	
ROW Project Manager	N/A	ROW position that oversees several enhancement projects	47%	
			100%	

Minimum Qualifications:

Similar to Vegetation Management Inspection roles mentioned in Section 5.4.1 (Target Role: Vegetation Management Inspection) VM project roles do not require any of the three minimum qualifications (QEW, special certifications, advance knowledge of GO 95).

PG&E uses the completion of training to ensure minimum qualifications are met before contractors can gain access to databases that are required to perform work in the field. Employees and contractors in VM project roles are required to complete SLP training as outlined in Section 5.4.1. The SLP requires the completion of a comprehensive training program that includes web-based training (WBT), scenario-based skills assessments, on the job training (OJT), and mentoring relationships with experienced Pre-Inspectors.

Plans to improve worker qualifications:

Please refer to Section 5.4.1 for details on how VM is working to improve worker qualifications for both the Vegetation Inspection and Vegetation Management Projects.

In this section PG&E also addresses Actions PGE-28 (Class A), PGE 29 (Class A), PGE 30 (Class A) and PGE-32 (Class A).

ACTION PGE-28 (Class A)

In its 2021 WMP *update, PG&E shall describe its process for identifying the most effective contract employees.*

***Response*:**

VM works with our Contract Management department to engage with contract vendors to recruit appropriate personnel to support our VM programs across our service territory, including CEMA (Catastrophic Event Memorandum Account) inspections, EVM inspections, routine inspections, and emergency work. In order to identify the most effective contract vendors, we verify that the vendor performs the appropriate scope of work identified, and we validate the vendors' safety presence in the industry. We evaluate the safety present by reviewing Key Performance Indicators like Serious Injury and Fatality actual counts, at fault Dig-ins, injuries, motor vehicle incidents, work procedure errors, work procedure violations, line strikes, timely notifications, and cause evaluations. Additionally, PG&E assures our vendors follow Occupational Safety and Health Administration (OSHA) qualified electrical worker 1910.269 and California Code of Regulations, Title 8 Section 2950.

ACTION PGE-29 (Class A)

In its 2021 WMP update, PG&E shall provide *further explanation on how it is working with other utilities to ensure that it is not limiting other utilities' resources.*

Response:

The market for vegetation contractors is an open and competitive market. In support of that open market, PG&E does not coordinate with other utilities on the hiring, sharing or balancing of vegetation contractors. PG&E understands that coordination of resource levels or contracting approaches potentially affecting the free market would be prohibited by antitrust laws. So while PG&E meets regularly with other utilities such as Southern California Edison Company (SCE) and San Diego Gas & Electric Company (SDG&E) to discuss VM safety practices, industry news and best practices, we do not coordinate on resource sharing or contracting plans and details.

ACTION PGE-30 (Class A)

In its 2021 WMP update, PG&E shall describe the increase in external VM workforce from 2018 to 2020.

Response:

Since 2018, the VM workforce has increased our external VM workforce by more than 100 percent. The VM workforce has added 4,000+ tree crew workers, and 1,000+pre-inspectors through the end of 2020. In implementing our incremental Vegetation Management work in 2018 (the Fuel Reduction Program, Accelerated Wildfire Risk Reduction activities, and EVM Program), we

knew that our then-existing contractor workforce was not large enough to address the volume of work required to address trees in HFTD areas with the potential to strike PG&E overhead lines. Accordingly, we have made a concerted effort to significantly increase our external VM workforce to address our wildfire prevention measures.

ACTION PGE-32 (Class A)

In its 2021 WMP update, PG&E shall describe how it prioritizes work based on labor constraints. Specifically, PG&E shall discuss whether it has reduced the scope of VM work due to labor constraints and, if so, explain the analysis to support that decision-making, including risk assessment and prioritization.

Response:

In 2020, labor constraints did not force any scope changes. If we were to have a labor constraint, we would prioritize by risk with high priority tags, wildfire mitigation work and routine work in HFTD taking precedence over lower-priority activities. As needed we review the scope of work identified in HFTD and prioritize that work accordingly. We use approaches such as inspections and risk assessments to determine the needed tree work and priorities in HFTDs.

5.4.3 Target role: Asset Inspections

TABLE PG&E-5.4-4: TARGET ROLE: ASSET INSPECTIONS INTERNAL ROLES

(1)	(2a.b.c)	(1)	(3)	(4)
PG&E Titles	Minimum Qualifications	Qualifications relevant to wildfire and PSPS mitigation	FTE % by Target Role	FTE % by High Interest Qualification
Compliance Inspector	QEW	Journeyman Linemen (International Brotherhood of Electrical Workers (IBEW)), QEW (distribution only)	73%	81%
Compliance Inspector – Underground	QEW	Journeyman Linemen (IBEW), QEW (distribution only)	2%	2%
Transmission Troubleman	QEW	Journeyman Linemen (IBEW) QEW (transmission OH only)	15%	17%
Transmission Towerman	QP	Journeyman Towerman (IBEW) QP (structural climbing assessments only), Qualified Persons but are not journeyman linemen classifications	10%	
Inspection Review Specialist, Senior	QEW	See Job Family (QEW or Engineer), new role starting in 2021		
Inspection Review Specialist, Expert	QEW	See Job Family (QEW or Engineer), new role starting in 2021		
			100%	100%

TABLE PG&E-5.4-5: TARGET ROLE: ASSET INSPECTIONS EXTERNAL ROLES

(1)	(2a.b.c)	(1)	(3)	(4)
Contractor Titles	Minimum Qualifications	Qualifications relevant to wildfire and PSPS mitigation	FTE % by Target Role	FTE % by High Interest Qualification
CONT – Aerial Inspection Review (AIR) Inspector		Journeyman Lineman, or Engineer	16%	
CONT – AIR SME		Journeyman Lineman, or Engineer	3%	
CONT – Compliance Inspector (Canus)	QEW	Journeyman Linemen (IBEW), QEW	11%	14%
CONT – Compliance General Foreman	QEW	Journeyman Linemen (IBEW), QEW	1%	2%
CONT – Compliance Foreman	QEW	Journeyman Linemen (IBEW), QEW	1%	1%
CONT – Compliance Inspector	QEW	Journeyman Linemen (IBEW), QEW	66%	81%
Hiring Hall Compliance Inspector	QEW	Journeyman Linemen (IBEW), QEW	1%	2%
			100%	100%

In this section PG&E also addresses Actions PGE-19 (Class B), PGE 20 (Class B), PGE-21 (Class B) and PGE-23 (Class B)

ACTION PGE-19 (Class B)

PG&E shall differentiate and describe the differences between the hiring and training process of an outside hire compared to an internal promotion or reassignment.

Response:

There are two ways to become a full-time employee QEW Journeyman Lineman at PG&E.

- Internal and external candidates can apply to join PG&E as an apprentice lineman. Selection requires successfully completing a comprehensive assessment process. Promotion to journeyman requires completion of a multi-year apprentice training and assessment program.
- Certified Journeymen from other utilities can apply for a Journeyman position at PG&E:

- The process to qualify as a PG&E Journeyman includes the following steps: 1) On-line application, 2) A Certification Review confirming the candidate has completed a valid apprenticeship and maintains Journeyman qualifications, 3) Successfully passing the Journeyman Lineman Knowledge Assessment, a proctored web-based assessment, 4) Completing the Journeyman Lineman Assessment Program which includes a full day's physical assessment conducted on-site at PG&E, 5) Interviews with PG&E Supervisors and/or Superintendents, and 6) Completing a successful background investigation, including DOT drug test.

Journeyman Linemen candidates for Qualified Company Representative (QCR) Inspector roles must complete the same requirements as listed above and the PG&E orientation and coursework for Inspectors as outlined in the training-related response. Regular status journeymen employees who bid into the System Inspections department, or are externally hired into the department, must complete pre-employment testing, multi-day orientation to inspection work, and participate in knowledge checks within the training material. They must also complete OJT support once they join System Inspections.

Minimum QCR Inspector Qualifications:

PG&E separates out the minimum requirements for personnel performing inspections aligned with our Local IBEW 1 Collective Bargaining Agreement (CBA) based on the type (electrical, structural) and voltage (transmission, distribution) of the assets being evaluated. The minimum position qualification for detailed transmission or distribution overhead (or underground) electrical inspections is that of a Journeyman Lineman, who are QEWs. Cal OSHA Title 8 regulations and the Department of Industrial Relations defines a QEW as a "qualified person who by reason of a minimum of two years of training and experience with high-voltage circuits and equipment and who has demonstrated by performance familiarity with the work to be performed and the hazards involved." In some instances, work can be performed or supported by various non-QEW roles, but the work is always performed under the direction of a QEW. Minimum qualifications required for structural climbing assessments of transmission overhead tower structures are Journeymen Towermen, who are trained in the construction and assessment of structural integrity. Apprentice Towermen may support such climbing assessments but must be under the direction of a Journeyman. Journeymen Towermen are considered Qualified Persons (QP) and QCR but these are not QEW classifications per PG&E's Local 1245 CBA. Therefore, the assessments completed by Towermen focus on the structural soundness of the towers and foundations, aligned with their training and experience. Evaluation of aerial imagery is completed by AIR+ Inspection Review Specialists or contractors who hold either engineering credentials or QEW status. PG&E's contractual terms also reference the Local 1245 CBA agreement, which spells out the universal requirements for each union classification. The Statement of Work (SOW) for inspection contractors states that only Journeymen Linemen and Foremen are qualified to perform detailed inspections, and QEWs or engineers are permitted to assess aerial imagery for the purpose of asset inspections.

Upon hire, or upon execution of a contract SOW to complete electric asset inspections (detailed overhead inspections), the journeyman (or engineering) credentials of the worker are confirmed. Contracted personnel must also complete ISNetworld (third-party online portal) registration and intake training prior to arrival and onboarding into the inspection program. Upon acceptance of worker eligibility and ISN credentials, personnel who will complete electric asset inspections are provided a multi-day orientation

on the expectations, guidelines, and tools relevant for the work. Inspection personnel, whether contracted or employees, must complete this training before being released to on-the-job orientation and oversight. PG&E employees in inspection roles are also provided annual refresher training to update them on any changes to guidelines, tools, and processes.

ACTION PGE-20 (Class B)

1) Provide the details regarding the internal training course required in order to qualify for a System Inspections Program QCR position, including:

a) a description of the materials it covers
b) components of the course (such as WBT, OJT, etc.)
c) the length of time it takes to complete each component of the course.

Response:

System Inspections requires inspectors who act as QCRs to complete training beyond the Journeyman Lineman certification. This additional training is both instructor-led and web-based (see Table PG&E-5.4-7):

- Orientation to inspection work: For PG&E QEWs, this is multi-day new employee training focused upon System Inspections requirements.
  - For QEWs that will be assigned Distribution Inspection work, this is a two-day course explaining PG&E's Electric Distribution Procedure Manual (EDPM), related Job Aids, and Technology training.
  - For QEWs and QCRs assigned to Transmission Inspection work, this is a three-day course explaining PG&E's Electric Transmission Procedure Manual (ETPM) and related Job Aids. Technology training is introduced at a later time.
- For Contracted QEWs for Distribution and Transmission work, this is a three-day course explaining PG&E field processes, either the EDPM or ETPM manuals, related Job Aids, and technology training. Refresher training for System Inspections' internal, regular status QCR Inspectors is provided annually. It may be shorter and supplemented by web-based training.

Contracted QEWs who have successfully completed a valid apprenticeship program to become journeymen, must complete a series of safety trainings courses on ISNetworld platform and attend PG&E's 3-day (8 hours a day) orientation and training for all personnel who conduct detailed inspections (QCR). The orientation and training include the following:

- Contractor Pre-Arrival Training (See Table PG&E-5.4-6)
  - ISNetworld (ISN) safety training completed per Utility Standard SAFE-1003S and TD-1952P-01. Course completion is validated by both the Vendor and PG&E prior to the contractor conducting field inspections.
  - ISN safety training may be validated in the field by scanning ISN contractor badge.
- PG&E-provided Training:

- Electric Distribution and Electric Transmission: 3-day (8 hours a day), and OJT up to 2 days.
- Substation: 2-day classroom and 1-day OJT (8 hours a day).
- For further details, see Table PG&E-5.4-7

TABLE PG&E-5.4-6: SYSTEM INSPECTIONS SCOPE OF WORK

Scope of Work	Definition
Inspector Qualifications	QEW who are well-qualified, having the qualities and capabilities required by law and training to efficiently and effectively perform this Work. Subcontractor shall have the same safety and training requirements as those of the Contractors.
Pre-Work before Deployment	**ISNetworld Training:** Trainings complete per SAFE-1003S and TD-1952P-01. Badge issued by employer. **PG&E Training:** Distribution and Transmission: 3-days at PG&E facility (remote due to COVID-19). Substation: 2-day orientation (remote due to COVID-19) and 1-day On the Job training.
Technology	Inspectors must be prepared to work in remote setting with appropriate technology (paperless process - iPad).
Crew size	Ground inspections: single-man crew. Climbing inspections: three-man crew, with four-man crew, max.

TABLE PG&E-5.4-7: SYSTEM INSPECTIONS SAFETY AND COMPLIANCE TRAINING

Training Delivery	Distribution	Duration
ISNetworld	Corporate Contractor Safety Orientation, SAFE0101	40 min
	SAFE-1503WBT, Fire Danger Precautions	60 min
	SAFE-4513WBT, Electric Operations Safety Foundations for Contractors	150 min
Administered by Vendor	N/A	
PG&E My Learning	CORP-9044WBT: Records & Info Management	45 min
	ISEC-9020WBT: Security & Privacy Awareness	45 min
Training Delivery	**Transmission**	**Duration**
ISNetworld	Corporate Contractor Safety Orientation, SAFE0101	40 min
	SAFE-1503WBT, Fire Danger Precautions	60 min

	SAFE-4514WBT, T-Line Contractor Safety Orientation	150 min
Administered by Vendor	N/A	
PG&E My Learning	CORP-9044WBT: Records & Info Management	45 min
	ISEC-9020WBT: Security & Privacy Awareness	45 min
Training Delivery	**Substation**	**Duration**
ISNetworld	Corporate Contractor Safety Orientation, SAFE0101	40 min
	SAFE-1503WBT, Fire Danger Precautions	60 min
Administered by Vendor	Substation Safety Field Orientation (SSFO) 2020-2021	
PG&E My Learning	PSOS-2500WBT: MAD/ARC for Substations (35 minutes)	35 min
	SAFE-1505WBT: Arc-Flash Hazard Control Basics (30 minutes)	30 min
	CORP-9044WBT: Records & Info Management	45 min
	ISEC-9020WBT: Security & Privacy Awareness	45 min

Because PG&E's Journeymen Towermen perform structural construction, maintenance, and assessment on a regular basis as part of their normal work duties, the QCR training is a refresher training. Towerman training has emphasis on new or updated PG&E processes, standards, and procedures, including technology that is used while performing field inspections on Tower assets. Training duration is approximately 4 1/2 hours and is currently provided remotely due to COVID19 social distancing protocols. Materials covered in the training are summarized in Attachment 2021WMP_ClassB_Action-PGE-20_Atch01.docx.

ACTION PGE-21 (Class B)

1) Explain why Journeyman Lineman trainings are not provided to contracted QCR inspectors
2) Describe any assessment taken to demonstrate qualifications of Journeyman Lineman regarding "routine job knowledge," or explain why PG&E does not find it necessary, if one is not required.

Response:

1) PG&E has established relationships with multiple vendors to ensure that we have a sufficient number of externally recruited QEWs to act in the capacity of QCRs. Only qualified IBEW Journeymen Linemen and Foremen with active union memberships will perform inspections upon completion of inspection-related orientation. Miscellaneous Equipment Operators (MEO), groundmen, towermen, construction managers, and inspection review specialists are not acceptable substitutes but may be used to support the safety of climbing inspection activities.

PG&E's contracts with third-party vendors require the vendors to provide resources with the knowledge and abilities required, to complete the tasked assigned based on their training and experience. The underlying competency for completing inspections at PG&E is currently a Journeyman Lineman QEW. Therefore, individuals who complete a state Joint Apprentice and Training Committee-sanctioned apprenticeship program that is endorsed by IBEW are considered eligible to be oriented for inspection work. PG&E may seek to validate a person's Journeyman Lineman QEW status, but PG&E does not undertake to provide the multi-year apprenticeship training to vendor-provided Journeyman Lineman QEW personnel. Further, it is the responsibility of the IBEW, and the third-party entity, to train their resources. Generally, it is not appropriate for PG&E to administer the training to third-party resources.

2) For externally contracted inspectors, PG&E confirms their Journeyman Lineman credential in coordination with IBEW Local 1245.To further validate the contractors' skillset, PG&E may further seek evidence of the Journeyman Lineman certificate. PG&E has also developed an Intake Form for contractors to self-identify as a QEW which triggers validation of IBEW labor qualifications. PG&E performs a monthly audit of submitted Intake Forms ensuring all forms are fully completed, and in turn takes a 10% sample of monthly onboarded personnel to validate qualifications via receipt of scans of the official journeyman credential.

As indicated above, partner vendors provide qualified personnel who possess required credential qualifications, as stated in the inspection program contract with PG&E as follows:

> "Contractor shall provide only Qualified Electrical Workers ("QEW") (per Title 29, Code of Federal Regulations (CFR), Part 1910, Subpart S), along with Journeyman Lineman (hereinafter, "Inspector") who are well-qualified, having the qualities and capabilities required by law and training to efficiently and effectively perform this Work."

PG&E requires these personnel to complete online training and pre-qualification tasks (e.g., ISN) aligned to the Contractor Safety Standard (SAFE-3001S) and program guidelines prior to receiving inspection program orientation. Additionally, during the multi-day inspection program orientation, Knowledge Checks are taken to test for understanding of the curriculum. While pre-arrival knowledge examinations are being considered for 2022, PG&E does not currently require, nor provide, pre-employment screenings for externally contracted QEW inspectors. Upon commencement of inspections, worker performance is monitored to enable on the job corrective feedback.

Outlier reports are produced and monitored by the asset inspections program quality department. The department flags personnel for additional attention and intervention when their inspection productivity, corrective notification find rate, and accuracy are reported above or below the average range of their peers. The performance monitoring flags personnel for intervention by field leaders, up to and including release from inspection work responsibilities.

ACTION PGE-23 (Class B)

1) Implement an assessment for all external recruits in order to ensure proper training levels are met.

Response:

Current Multi-Day Inspection Program Orientation:

Prior to COVID-19, Electric Distribution's Compliance required a Knowledge Assessment at the end of the New Inspector Training session that required a pass/fail grade in three allotted attempts. Failure to pass the course meant the lineman was released from duty as an Inspector. A passing grade advanced the lineman to his/her direct supervisor for execution of inspection duties as a QCR. This pass/fail requirement applied to internal QEWs who bid into the QCR Compliance Inspector role as permanent regular-status employees. Contracted personnel were not used to perform asset inspections prior to Wildfire Safety Inspection Program (WSIP) in 2019.

During COVID-19, in order to practice social distancing, the New Inspector Training classes are being held virtually, using Cisco WebEx or Microsoft Teams. Many in these remote learning classes are in different locations to promote a safe learning environment during the COVID-19 pandemic. This remote learning environment imposes new logistical restrictions for maintaining the integrity of pass/fail Knowledge Assessments. However, students are still required to pass the New Inspector Training course that requires a pass/fail grade in three allotted attempts prior to acting as QCRs for inspection tasks. Students who fail to pass the course will not obtain credit for the course and an alert is provided to their assigned supervisor to take corrective action.

The 2020 and 2021 Distribution and Transmission New Inspector Orientation courses contain Knowledge Checks at the end of each training topic or section. Knowledge Checks are provided within the training material at the end of chapter in the form of multiple choice or true/false questions. These are exercises designed to invite participation amongst remote learners and to highlight key learning content. This practice allows for team learning events, while recognizing the logistical challenges for maintaining integrity of a pass/fail post-training assessment in a remote learning and virtual environment. Therefore, a QEW's full attendance in the multi-day orientation and participation in Knowledge Checks are currently required to receive credit and be admitted to perform inspection tasks.

The day after the remote class ends, Inspectors are exposed to unstructured OJT to ensure they have understood the training material. Newly trained Inspectors meet with leaders (Supervisors or Inspection Review Specialists) in the field to discuss work and the training they just received. OJT is a key transition from classroom learning to field learning. It is designed to support (a) compliance with PG&E's field safety protocols, (b) open communication between the assigned supervisor and Inspector to

promote clarification of requirements and to provide the Inspector with opportunities to ask questions in furtherance of their training comprehension, and (c) verification that the Inspector is equipped with usable technology required to perform field inspections.

In 2021, a new Transmission-focused WBT that includes information on the ETPM and related Job Aids will be assigned to internal and external QCRs who perform transmission asset inspections. The ETPM WBT includes pass/fail course Knowledge Assessments comprised of 5 to 10 questions with multiple choice or true/false answers. Students are required to pass Knowledge Assessments to successfully complete the course, even if it takes multiple attempts. Students who fail the Knowledge Assessments will not obtain credit for the course and an alert is provided to their assigned supervisor on the training-timeliness dashboard for supervisor action.

Plans to Improve Worker Qualifications:

PG&E has historically used an in-person proctored pass/fail Knowledge Assessment practice for employee distribution Inspectors aligned with the Local 1245 CBA. Collaborating with IBEW and internal training experts, PG&E intends to re-deploy the distribution pass/fail individual assessments in PG&E's remote learning and virtual environment. This will involve additional testing technologies to maintain the integrity of the test without physical on-site test proctoring. PG&E also plans to improve Inspector qualifications via the deployment of an additional pass/fail Knowledge Assessment at the conclusion of the initial multi-day Inspector Orientation training for Transmission or Substation Asset Inspectors.

Upon this expansion to Substation and Transmission, internal and external QEW personnel who seek to perform inspection work will then be required to successfully complete the relevant Knowledge Assessment or be disallowed from performing inspection tasks. This expansion of best practice will require a joint agreement with our Local IBEW partner and the support of a certified psychometrician to ensure the tests are valid and suited to the intended purpose. PG&E intends to expand these pass/fail Inspector training assessments more broadly in 2022, via remote learning or proctored delivery, COVID-19 restrictions permitting.

Other enhancements under development in 2021 include targeted refresher content related to areas of Inspector underperformance as determined by the inspection program quality teams. Inspectors whose work quality is found to be consistently poor are provided feedback and, in some cases, barred from returning to the asset inspection function in the future. In 2020, PG&E released at least one contract Inspector for quality performance issues and pursued similar remedial action against internal Inspectors.

5.4.4 Target Role: Grid Hardening

Grid hardening projects are generally assigned to either contract or internal crews for the duration of the project construction. Therefore two tables have been provided below reflecting the resource composition for contracted grid hardening jobs as compared to internally resourced projects.

TABLE PG&E-5.4-8: CONTRACTED GRID HARDENING PROJECTS

(1)	(2a.b.c)	(1)	(3)	(4)
Contractor Titles	Minimum Qualifications	Qualifications Relevant to Wildfire and PSPS Mitigation	FTE % by Target Role	FTE % by High Interest Qualification
Lineman	QEW	Contractor company is responsible for the qualifications of their employees. Multiple PG&E departments perform safety observations of contractors and perform quality audits of completed work. Contractors should have ISN badges that are confirmed by EH&S organization during site visits.	61%	82%
Apprentice Lineman			8%	
Foreman	QEW		14%	18%
Groundman			14%	
General Forman			3%	
			100%	100%

TABLE PG&E-5.4-9: INTERNALLY RESOURCED GRID HARDENING PROJECTS

(1)	(2a.b.c)	(1)	(3)	(4)
PG&E Titles	Minimum Qualifications	Qualifications Relevant to Wildfire and PSPS Mitigation	FTE % by Target Role	FTE % by High Interest Qualification
Lineman	QEW	Required Training see below minimum qualifications and list of specific trainings	23%	60%
Apprentice Lineman			31%	
Foreman	QEW		15%	40%
Utility Worker			15%	
Miscellaneous Equipment Operator			15%	
			100%	100%

Minimum Qualifications:

In order to perform this work, at least one worker on site must be a QEW. Cal OSHA Title 8 regulations/ Dept. of Industrial Relations defines a Qualified Electrical Worker as a "qualified person who by reason of a minimum of two years of training and experience with high-voltage circuits and equipment and who has demonstrated by performance familiarity with the work to be

performed and the hazards involved." In some instances, work can be performed by various non-QEWs roles, but the work is always performed under the direction of a QEW. For internal PG&E positions, the "Groundman" role could include Utility worker, Ground Worker, T&D Assistant or Electric Line Assistant.

Plans to Improve Worker Qualifications:

No material improvements have been identified at this time. Enhancements to training will be implemented based on changes to processes and procedures or in response to any lessons learned or identified gaps. New or modified training, as needed, will be developed and delivered to personnel to drive a safe and competent workforce.

Related Qualifications For This Resource Group:

PG&E has a PSPS training program for QEW workers focused on inspecting, patrolling and reporting findings related to wildfire mitigation. That qualification training summary includes:

PSOS-0414 Transmission Inspections—Overhead
The purpose of this training is to ensure that all personnel responsible for patrol, inspection, and maintenance of the overhead, underground, and tower electric transmission line systems have a thorough understanding of how to apply general inspection and patrol procedures of electric transmission facilities. This training course focuses on the overhead portion of the ETPM Manual.

Upon completion of this course you will be able to: Identify and document abnormal conditions and prioritized the corrective actions required; Describe and comply with the following patrol and inspection procedures: Overhead, Infrared (IR), and Corrective Maintenance.

PSOS-0415 Transmission Inspections—Underground
The purpose of this training is to ensure that all personnel responsible for patrol, inspection, and maintenance of the overhead, underground, and tower electric transmission line systems have a thorough understanding of how to apply general inspection and patrol procedures of electric transmission facilities. This training course focuses on the underground sections of the ETPM Manual.

Upon completion of this course you will be able to: Identify and document abnormal conditions and prioritized the corrective actions required; Describe and comply with the following patrol and inspection procedures: Underground, IR, and maintenance

PSOS-0416 Transmission Inspections—Towerman
The purpose of this training is to ensure that all personnel responsible for patrol, inspection, and maintenance of the overhead, underground, and tower electric transmission line systems have a thorough understanding of how to apply general inspection and patrol procedures of electric transmission facilities. This training course focuses on the tower sections of the ETPM Manual.

Upon completion of this course you will be able to: Identify and document abnormal conditions and prioritized the corrective actions required; Describe and comply with the following patrol and inspection procedures: Tower and Maintenance.

SAFE-0256 Aerial Patrol

ILT: This course prepares patrolmen and pilots to work together as a team so they can avoid hazards while patrolling in the utility environment. Course participants will learn how to: (1) Prepare for the patrol prior to taking flight; (2) Establish roles and responsibilities within the crew; (3) Apply crew resource management behaviors; (4) Implement safe patrol techniques; (5) Identify and call out hazards; (6) Respond in emergency situations; and (7) Identify lessons learned during the post-flight debrief.

5.4.5 Target Role: Risk Event Inspections

TABLE PG&E-5.4-10: TARGET ROLE: RISK EVENT INSPECTIONS

(1)	(2a.b.c)	(2)	(3)	(4)
PG&E Titles	Minimum Qualifications	Qualifications Relevant to Wildfire and PSPS Mitigation	FTE % by Target Role	FTE % by High Interest Qualification
Troublemen	QEW	While these roles do not have certifications directly related to Wildfire and PSPS mitigation, these roles and their work is important to the ongoing, safe operation of PG&E equipment throughout our Service Area, including to mitigate wildfire risks.	86%	98%
Cablemen	QEW		1%	2%
Distribution Line Technicians			12%	
			100%	100%

Minimum Qualifications:

In order to perform this work, a worker needs to be a QEW. Cal OSHA Title 8 regulations/ Dept. of Industrial Relations defines a Qualified Electrical Worker as a "qualified person who by reason of a minimum of two years of training and experience with high-voltage circuits and equipment and who has demonstrated by performance familiarity with the work to be performed and the hazards involved." In some instances, work can be performed by various non-QEWs roles, but the work is always performed under the direction of a QEW.

Plans to Improve Worker Qualifications:

No material improvements have been identified at this time. Enhancements to training will be implemented based on changes to processes and procedures or in response to any lessons learned or identified gaps. New or modified training, as needed, will be developed and delivered to personnel to drive a safe and competent workforce.

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SECTION 6

PERFORMANCE METRICS AND UNDERLYING DATA

PGE-DIXIE-NDCAL-000004646

6. Performance metrics and underlying data

Instructions: Section to be populated from Quarterly Reports. Tables to be populated are listed below for reference.

NOTE: Report updates to projected metrics that are now actuals (e.g., projected 2020 spend will be replaced with actual unless otherwise noted). If an actual is substantially different from the projected (>10% difference), highlight the corresponding metric in light green.

In alignment with the "Note" provided in the WSD template, PG&E has worked to compare data where projected 2020 data was provided in the 2020 WMP to the 2020 actual results provided as part of the 2021 WMP in the tables within Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In particular on Table 10 and Table 12 PG&E has highlighted cells in light green in which the actual results differ by more than 10% from the previously reported, projected 2020 numbers.

6.1 Recent Performance on Progress Metrics, last 5 years Instructions for Table 1

In the attached spreadsheet document, report performance on the following metrics within the utility's service territory over the past five years as needed to correct previously-reported data. Where the utility does not collect its own data on a given metric, the utility shall work with the relevant state agencies to collect the relevant information for its service territory, and clearly identify the owner and dataset used to provide the response in the "Comments" column.

Pacific Gas and Electric Company (PG&E) has enclosed the Table 1 data in the Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E is providing the following comments below on the Table 1 data.

Comments for Table 1:

Item 1. Description – Grid Condition Findings From Inspection – Distribution:

- Level 1 findings are defined as Priority A tags. Level 2 findings are defined as Priority B and E tags. Level 3 findings are defined as priority F and H tags.
- PG&E does not track inspection data by circuit mile. Circuit miles shown are estimated based as a fraction of total circuit mileage and are assumed proportional to the percentage of structures inspected for each inspection category.

Item 1. Description – Grid Condition Findings From Inspection – Transmission:

- Findings by inspection/patrol type are not available before 2019; all findings were assigned to Detailed Inspections.
- Level 1 findings are defined as Priority A tags. Level 2 findings are defined as Priority B and E tags. Level 3 findings are defined as priority F tags.
- PG&E does not track inspection data by circuit mile. If a structure/circuit was patrolled multiple times in a year, mileage is only counted once for that year. Fraction of total mileage was assumed proportional to the percentage of structures inspected.

Item 2. Description – Vegetation Clearance Findings From Inspection:

- The number of spans inspected with noncompliant clearance is based on applicable rules and regulations at the time of inspection.
- PG&E does not track the precise data requested as PG&E's vegetation management data is generally tracked by tree. Therefore, the closest available data has been provided with an estimated translation to the "Percentage of right-of-way with noncompliant clearance" data that was requested. PG&E vegetation management pre-inspectors identify a tree that is currently violating minimum clearance distances, or may violate minimum clearance in the near future, with a special designation of being a Hazard Notification (HN). Not all HNs represent actively non-compliant trees, as in many cases the tree is currently compliant but may be at risk of violating minimum clearances before the normal tree work cycle

can be completed. Nonetheless, HNs are the best estimate PG&E has for the number of trees that were identified as being inside or near the minimum clearance requirements and have been provided above as the "Trees identified as being currently, or at risk in the near future, of being out of compliance" data.

- This estimate for the number of electric overhead spans has been determined by assuming an average span length (distance between poles) of 275 feet.

Item 3. Description – Community Outreach Metrics: # Customers in an Evacuation Zone for Utility-Ignited Wildfire; # Customers Notified of Evacuation Orders:

- PG&E does not issue wildfire evacuation notices to customers and does not maintain metrics on the number of customers in an evacuation zone or the number of customers notified of evacuation orders. In an effort to gather this data, PG&E's Public Safety Specialists reached out to safety personnel from 38 counties to determine if any evacuation data was available for the utility-ignited wildfires as defined in Table 2. Most replies from county personnel indicated that the requested data was not available. PG&E did receive data from 3 counties for the following incidents which are included in Table 1: 2018: Nimshew, Camp, 2019: Kincade, and 2020: Drum, as well as an unnamed incident in Santa Barbara County. PG&E cannot determine if this data is complete or accurate. Data for the Kincade fire includes the total number of phone calls, text messages, and emails sent. Santa Barbara county provided information on the number of residents notified but did not provide the number of residents in the evacuation zone. The percentage of customers notified was calculated based upon the numbers provided. No utility-ignited wildfires occurred in Quarter 1 2020.

Item 4. Assumptions for Inspection Data in 1.a,1.b,1.c

- See note below regarding Table 8 (historical grid data unavailable for 2014-2018); circuit mileage is assumed to be the same as our 2019 data for 2015-2018 for the purposes of Table 1
- Mileage was extrapolated using approximate unit counts of historical detailed inspection & Pole Test & Treat data & relative circuit mileage in High Fire Threat District (HFTD) and Non-HFTD

6.2 Recent Performance on Outcome Metrics, Annual and Normalized for Weather, Last 5 Years

Instructions for Table 2:

In the attached spreadsheet document, report performance on the following metrics within the utility's service territory over the past five years as needed to correct previously-reported data. Where the utility does not collect its own data on a given metric, the utility shall work with the relevant state agencies to collect the relevant information for its service territory, and clearly identify the owner and dataset used to provide the response in "Comments" column.

Provide a list of all types of findings and number of findings per type, in total and in number of findings per circuit mile.

PG&E has enclosed the Table 2 data in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E is providing the following comments below on the Table 2 data.

Comments for Table 2:

The data in Table 2 is derived from ignitions that are linked to a wildfire, which is defined as a fire greater than 10 acres in size.

- **Items 3.a (Fatalities due to utility-ignited wildfire [total]) and 3.b (Injuries due to utility-ignited wildfire (total)):** PG&E provides in the attached data table 2015 through 2019 for wildfires that the California Department of Forestry and Fire protection (CAL FIRE) concluded were caused by PG&E equipment.
- **Item 4a (Value of assets destroyed by utility-ignited wildfire [total]):** PG&E provides in the attached data table all 2015-2020 wildfires that involve disputes regarding destroyed assets that have settled. These settlements are lump sum settlements that do not break out the settlement dollars by damage category. In addition, the settlements reached related to the 2017 North Bay Fires and the 2018 Camp Fire (other than the settlement with the cities and counties) do not break out the settlement dollars by fire. Any attempt to break out the dollars by fire and/or damage category would be speculative. The settlements are totaled based on the year of the fire. The one exception is the 2018 Camp Fire which is reported with the 2017 North Bay Fires for the reasons described above. The chart does not include 2015-2020 wildfires that have not settled, which remain under investigation and/or civil discovery on causation issues, damages issues, or both.
- **Item 5b (Critical infrastructure damaged/destroyed by utility-ignited wildfire [total]):** 'Critical infrastructure' is defined in accordance with the definition adopted in Decision (D.) 19-05-042 and modified in D.20-05-051. The number of critical infrastructure damaged/destroyed reflects the count of unique Service Point ID's (meters) for red-tagged structures defined as critical infrastructure at the time of the wildfire.
- **Item 7a-d (Number of utility wildfire ignitions):** The 2015 through 2018 ignition data is primarily based on fire incident reports filed with the California Public

Utilities Commission (CPUC or Commission) annually in accordance with D.14-02-015. These reports include fire incidents that may be associated with PG&E facilities and meet the following conditions: (1) a self-propagating fire of material other than electrical and/or communication facilities (2) the resulting fire traveled greater than one linear meter from the ignition point, and (3) PG&E has knowledge that the fire occurred. Where not already included as part of the CPUC fire incidents report data, PG&E also included data for 2015 through 2018 wildfires that CAL FIRE concluded were caused by PG&E equipment. As of the time of the 2021 WMP submission, 2020 ignition data is being reviewed by PG&E in preparation for our 2020 fire incident that will be submitted by April 1, 2021 pursuant to D.14-02-015. The 2020 data in this table is preliminary and may be revised by the time that report is submitted.

2019 and 2020 include data related to the Kincade and Zogg Fires, respectively, which is reported in compliance with D.19-05-037. PG&E's investigation into the cause of the Kincade Fire and Zogg Fire is ongoing. PG&E has included information related to the Kincade Fire in this table because CAL FIRE has announced its determination that PG&E's facilities caused the Kincade Fire and has included information related to the Zogg Fire because CAL FIRE has collected PG&E equipment as a part of its investigation.

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6.3 Description of Additional Metrics

Instructions for Table 3:

In addition to the metrics specified above, list and describe all other metrics the utility uses to evaluate wildfire mitigation performance, the utility's performance on those metrics over the last five years, the units reported, the assumptions that underlie the use of those metrics, and how the performance reported could be validated by third parties outside the utility, such as analysts or academic researchers. Identified metrics must be of enough detail and scope to effectively inform the performance (i.e., reduction in ignition probability or wildfire consequence) of each preventive strategy and program.

PG&E provided several metrics in the 2020 WMP for this section. With the update of the WMP template, all of these metrics were incorporated and included in other parts of the 2021 WMP. PG&E has no new or additional metrics to include to evaluate wildfire mitigation that are not already captured in other sections of the 2021 WMP. However, PG&E may analyze and look to reuse these metrics in ways not documented in the WMP as we continue to mature our data sets and modeling.

6.4 Detailed Information Supporting Outcome Metrics

Instructions for Table 4:

Enclose detailed information as requested for the metrics below. In the attached spreadsheet document, report numbers of fatalities attributed to any utility wildfire mitigation initiatives, as listed in the utility's previous or current WMP filings or otherwise, according to the type of activity in column one, and by the victim's relationship to the utility (i.e., full-time employee, contractor, of member of the general public), for each of the last five years as needed to correct previously-reported data. For fatalities caused by initiatives beyond these categories, add rows to specify accordingly. The relationship to the utility statuses of full-time employee, contractor, and member of public are mutually exclusive, such that no individual can be counted in more than one category, nor can any individual fatality be attributed to more than one initiative.

PG&E has enclosed the Table 4 data in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E is providing the following comments below on the Table 4 data.

Comments for Table 4:

1. Data for "Member of public" was derived from review of PG&E's "Riskmaster" database, which tracks third party claims.
2. PG&E's Community Wildfire Safety Program (CWSP), under which PG&E tracks our wildfire mitigation activities, was developed in 2018, with the above activities implemented in late 2018. Therefore, the "Year 2018" data above represents data from late 2018.

Instructions for Table 5:

In the attached spreadsheet document, report numbers of OSHA-reportable injuries attributed to any utility wildfire mitigation initiatives, as listed in the utility's previous or current WMP filings or otherwise, according to the type of activity in column one, and by the victim's relationship to the utility (i.e., full-time employee, contractor, of member of the general public), for each of the last five years as needed to correct previously-reported data. For members of the public, all injuries that meet OSHA-reportable standards of severity (i.e., injury or illness resulting in loss of consciousness or requiring medical treatment beyond first aid) shall be included, even if those incidents are not reported to OSHA due to the identity of the victims.

For OSHA-reportable injuries caused by initiatives beyond these categories, add rows to specify accordingly. The victim identities listed are mutually exclusive, such that no individual victim can be counted as more than one identity, nor can any individual OSHA-reportable injury be attributed to more than one activity.

PG&E has enclosed Table 5 data in Attachment 1 – All Data Tables Required by WMP 2021 Guidelines.xlsx. In addition, PG&E is providing *the* following comments below on the Table 5 data.

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Comments for Table 5:

1. PG&E does not generally and centrally track Occupational Safety and Health Administration (OSHA) reportable incidents for contractors. Contractors are responsible for complying with OSHA reportable notification requirements. The data in Table 6 reflects all OSHA recordables, including any reportable incidents, that PG&E tracks for internal purposes.
2. Data for "Member of public" was derived from review of PG&E's "Riskmaster" database, which tracks third party claims.
3. PG&E's CWSP, under which PG&E tracks our wildfire mitigation activities, was developed in 2018, with the above activities implemented in late 2018. Therefore, the "Year 2018" data above represents data from late 2018.

6.5 Mapping Recent, Modelled, And Baseline Conditions

Underlying data for recent conditions (over the last five years) of the utility service territory in a downloadable shapefile GIS format, following the schema provided in the spatial reporting schema attachment. All data is reported quarterly, this is a placeholder for quarterly spatial data.

The underlying data for recent conditions (over the last five years) of the utility service territory is enclosed with the Geographic Information System (GIS) Data Standards. Please see PG&E's Quarterly Report (Condition Guidance-10) for additional discussion on the GIS data provided.

6.6 Recent Weather Patterns, Last 5 Years

Instructions for Table 6:

In the attached spreadsheet document, report weather measurements based upon the duration and scope of NWS Red Flag Warnings, High wind warnings and upon proprietary Fire Potential Index (or other similar fire risk potential measure if used) for each year. Calculate and report 5-year historical average as needed to correct previously-reported data.

PG&E has enclosed the Table 6 data in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E is providing the following comments below on the Table 6 data.

Comments for Table 6:

Table 6 shows the trends of National Weather Service (NWS) issued Red Flag Warnings (RFWs) and High Wind Warnings (HWWs) over the last 5 years impacting PG&E circuits across the territory through the metrics RFW Circuit Mile Days and HWW Circuit Mile Days. NWS RFWs are a proxy for high fire danger conditions, while HWWs are issued for solely high wind threats, regardless of humidity values and fire danger. These values have changed from previous reports, which calculated RFW Day Circuit miles based on Fire Index Areas. For these metrics, circuit miles are now calculated by the NWS RFW and HWW polygons to give a more accurate and precise values for RFW Circuit Mile Days and HWW Circuit Mile Days.

6.7 Recent and Projected Drivers of Ignition Probability

Instructions for Table 7:

In the attached spreadsheet document, report recent drivers of ignition probability according to whether or not risk events of that type are tracked, the number of incidents per year (e.g., all instances of animal contact regardless of whether they caused an outage, an ignition, or neither), the rate at which those incidents (e.g., object contact, equipment failure, etc.) cause an ignition in the column, and the number of ignitions that those incidents caused by category, for each of last five years as needed to correct previously-reported data.

Calculate and include 5-year historical averages. This requirement applies to all utilities, not only those required to submit annual ignition data. Any utility that does not have complete 2020 ignition data compiled by the WMP deadline shall indicate in the 2020 columns that said information is incomplete.

Comment related to ignition data for Tables 7.1 and 7.2:

The fire ignition data provided in Tables 7.1 and 7.2 is based on fire incident reports filed with the CPUC annually in accordance with D.14-02-015. The ignition data provided in these tables was pulled from PG&E's systems in mid-January 2021 and reflects preliminary data for two reasons: first, PG&E's final 2020 fire ignition report is due on April 1, 2021 and 2020 data will be further reviewed in advance of that filing. Second, in late 2020 PG&E self-identified a data omission regarding prior year's fire ignition data in the annual reports submitted, and notified the CPUC of this issue on December 23, 2020. PG&E's investigation identified a relatively small population of distribution vegetation outage ignitions since 2017 that were excluded on the annual report due to a misidentification in a field-based documentation system. We are continuing to investigate other potential sources of fire ignition data that were omitted from our reports. We anticipate completing the investigation into the 2014-2019 data by the end of the first quarter of 2021. Based on the results of our investigation, we plan to submit amendments to our annual reports and provide a supplemental filing updating the ignition data in Tables 7.1 and 7.2. We will be revising our ignition data capture processes going forward to ensure accurate reporting in alignment with the results of our investigation.

For reference, while the investigation is underway the initial findings have shown that the number of missing incidents for each year and an amended annual total are as follows:

o 2019 = 4 Missing Incidents, 467 Amended Total

o 2018 = 5 Missing Incidents, 439 Amended Total

o 2017 = 28 Missing Incidents, 529 Amended Total

The ignition data (in accordance with D.14-02-015) includes fire incidents that may be associated with PG&E facilities and meet the following conditions:

1. A self-propagating fire of material other than electrical and/or communication facilities

2. The resulting fire traveled greater than one linear meter from the ignition point, and

3. PG&E has knowledge that the fire occurred. At the time of this report, 2020 ignition data is being reviewed by PG&E in preparation for its 2020 fire incident report that will be submitted by April 1, 2021 per D.14-02-015. The data in this table is preliminary and may be revised by the time that report is submitted. The following comments should be noted regarding the ignition data:

- The note regarding the subcategories "Conductor failure — wires down" and "Wire- to-wire contact/contamination" for the outage data also applies to the ignition driver data. As a result, data is not input into these fields in Table 7.

- The note regarding the categories "Fuse failure – all" and the "Fuse failure-conventional blown fuse" for the outage data also applies to the ignition data.

In Table 7.2, columns under the category 'Projected ignitions by HFTD Tier' depict the projections of ignition frequency in the respective, future years. Projected ignitions have been forecasted in alignment with PG&E's 2020 RAMP Report.

Table 7.1: Key recent and projected drivers of ignition probability, last five years and projections – reference only, fill out attached spreadsheet to correct prior reports

PG&E has enclosed the Table 7.1 data in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E is providing the following comments below for Table 7.1:

Comments for Table 7.1: Key Recent and Projected Drivers of Ignition Probability, Last 5 Years (Distribution System):

To the extent available, PG&E's Integrated Logging Information System – Operations Data Base (ILIS-ODB) was used to provide the level of detail contained in Table 7.1 (Distribution) that includes both sustained and momentary outages experienced on our distribution system. When reviewing this data, the following should be noted:

- Based on PG&E's standard definition, a distribution wire down event results in a reportable outage event and occurs when a normally energized electric primary distribution conductor is broken, or stays intact, and falls from its intended position to rest on the ground or a foreign object. PG&E used this standard definition in this year's report and thus it does not include any secondary related wire down events. However, it should also be noted that any primary or secondary wire down condition that resulted in an outage event is also reported in the distribution outage results.

- In our 2020 WMP, PG&E utilized a different data extraction method attempting to identify a larger number of distribution wire down event conditions. However, it was subsequently determined this method resulted in an erroneously higher number of distribution wire down events due to various data issues such as momentary outages resulting from the same wire down event/condition that was also reported as a sustained outage.

- For sub-cause category 2.a."Connector damage or failure – Distribution," it was assumed that the word "Connector" was meant to indicate "Conductor" since connector damage would typically be reported as splice damage.

- For sub-cause category 8.a. "Unknown – Distribution," this generally does not apply to distribution wire down events.

- PG&E was unsure what was intended by the use of the term "Fuse damage or failure" because when a fuse isolates a fault condition, it will become permanently damaged and by design will no longer conduct electricity. For this subcategory, PG&E has interpreted it as only those outage events when a fuse was reported as the actual failed equipment.

- PG&E does not have an outage cause classification that specifically matches the terms, "Tap damage or failure – Distribution" and "Tie wire damage or failure – Distribution" and thus did not use these categories in this report.

- For "Wire-to-wire contact/Contamination," PG&E typically does not use this term for distribution wire down events. In addition, PG&E typically uses contamination more as a condition of the equipment and not normally as a basic cause. For this category under the Distribution outages, PG&E assumed this cause refers to a Basic Cause of "Unknown" and a Fault Type of "Line to Line."

- For "Contamination – Distribution," PG&E uses contamination more as a condition of the equipment and not as a basic cause. As such, PG&E does not have an outage classification that matches this term.

- For "Unknown – Distribution" outages, this category omits outages reported with a Basic Cause of "Unknown" and a Fault Type of "Line to Line" covered as "Wire-to-wire contact/Contamination" outages noted in the above bullet item.

- Due to their relatively small contribution, the Commission does not require transformer-only outages be reported in the annual electric system reliability metrics. However, transformer-only outages are reported within PG&E's Field Automation System (FAS) and most were also reported in PG&E's ILIS-ODB outage data base. PG&E is including these transformer-only outages in the WMP reporting to reflect the full picture of outage incidents which could have represented ignition potential. PG&E also further enhanced our reporting process/controls in September 2020 to ensure future transformer-only outages are fully reported in our ILIS-ODB outage data base and is working to improve outage cause reporting.

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- In Table 7.1 (Distribution), columns under the category 'Projected risk events' depict the projections in the respective years. Projections are based on forecasts submitted in the 2020 RAMP Report.

Comments for Table 7.1: Key Recent and Projected Drivers of Ignition Probability, Last 5 Years (Transmission System):

PG&E's Transmission Operations Tracking & Logging (TOTL) application was used as the primary data source for Table 7.1 (Transmission) which includes unplanned outages experienced on the transmission (i.e., >50 kV) system. Unplanned outages include those due to an "automatic" operation (i.e., the transmission line relayed automatically by a protective device (typically a circuit breaker) and either automatically tested OK, tested no good, or was set up not to test (e.g., automatics disabled or cut out for wildfire risk mitigation)). Unplanned outages also include those where the line was manually removed from service by Operations on an "emergency" basis, usually to repair or replace an imminent failure of an asset. Such emergency forced outages (EFOs) are taken without securing approval from the California Independent System Operator (CAISO). Planned or "scheduled" outages are not included. Scheduled outages differ from EFOs in that PG&E garnered CAISO approval prior to the line being removed from service.

Based on PG&E's standard definition, a transmission wire down event (similar to distribution) results in a reportable outage event (note: customers may or may not have been de-energized) and occurs when a normally energized electric transmission conductor fails in service and falls from its intended position to rest on the ground or a foreign object.

- Sub-cause category 10.a. "Connector damage or failure – Transmission," PG&E assumed that the word "Connector" was meant to indicate "Conductor" since connector damage would be reported separately in 10.b..

- Sub-cause category 10.f. "Tap damage or failure – Transmission," PG&E does not have an outage cause classification that specifically matches such.

- Sub-cause category 10.g. "Tie wire damage or failure – Transmission" does not exist in PG&E outage reporting.

- Sub-cause category 11.a. and 27.a. "Wire-to-wire contact/Contamination-Transmission" does not exist in PG&E transmission outage reporting and therefore has no data entries.

- Unlike distribution outage reporting, cause category "Contamination – Transmission" is tracked and reported accordingly.

- Every effort is made to minimize the number of outages assigned a cause category "Unknown – Transmission" for automatic type outages. At least one and sometimes more patrols are conducted after the outage to determine cause and certainly to find and correct any damaged equipment, usually with the help of fault location data provided by System Protection to help focus on the failure point. It's also important to note that any outage due to animal contact is one where the

patrol found a carcass to support the cause of animal, otherwise the choice "Unknown" is used.

- Sub-cause category 26.c. "Fuse damage or failure" has no meaning for unplanned transmission outages.

- Sub-cause category 26.h. "Crossarm damage or failure – Transmission" is not separately reported but included as part of reporting in the Sub-cause category "Pole damage or failure – Transmission," if applicable.

- Sub-cause category 26.j. "Recloser damage or failure – Transmission" represents outages where a circuit breaker failed in service and let to an outage. PG&E has very few traditional reclosers in our Transmission system.

- Sub-cause category 26.l. "Sectionalizer damage or failure – Transmission" has no entries; rather, transmission lines are sectionalized using line switches, hence such failures are captured in cause Category 26.e. "Switch damage or failure-Transmission."

- In Table 7.1 (Transmission), columns under the category 'Projected risk events' depict the projections in the respective years. Projections are based on forecasts submitted in the 2020 RAMP Report.

Table 7.2: Key recent and projected drivers of ignition probability by HFTD status, last 5 years and projections

PG&E has enclosed the Table 7.2 data in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E has provided comments on ignition data above.

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6.8 Baseline State of Equipment and Wildfire and PSPS Event Risk Reduction Plans

6.8.1 Current Baseline State of Service Territory and Utility Equipment

Instructions *for Table 8:*

In the attached spreadsheet document, provide summary data for the current baseline state of HFTD and non-HFTD service territory in terms of circuit miles; overhead transmission lines, overhead distribution lines, substations, weather stations, and critical facilities located within *the territory; and customers by type, located in urban versus* rural *versus highly rural areas and including the subset within the Wildland-Urban Interface (WUI) as needed to correct previously- reported data.*

The totals of the cells for each category of information (e.g., "circuit miles (including WUI and non-WUI)" would be equal to the overall service territory total (e.g., total circuit miles). For example, the total of number of customers in urban, rural, and highly rural areas of HFTD *plus those in urban, rural, and highly rural areas of non-HFTD would equal the total number of customers of the entire service territory. Table 8:* State of service territory and utility equipment – reference only, fill out attached spreadsheet to correct prior reports

PG&E has enclosed the Table 8 data in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E is providing the following comments below for the Table 8 data.

Comments for Table 8:

Table 8 seeks information regarding the current baseline state of HFTD and non-HFTD service territory, as located in urban versus rural versus highly rural areas, including a subset with the Wildland-Urban Interface (WUI). The WUI is defined as areas where homes are built near or among lands prone to wildland fires. PG&E identifies WUI areas within PG&E's service territory based upon data provided by the University of Wisconsin-Madison SILVIS Lab, available here: http://silvis.forest.wisc.edu/data/wui-change/, shows the WUI areas within California as of 2010.

Note that in Table 8 data for 2015-2018 has not been provided for two reasons: (1) PG&E planned and executed a multi-year project starting in 2013 that included converting legacy sources of electric facility information into a single enterprise GIS database. The conversion started in 2014 and was completed in 2018. This conversion was executed, reviewed, and accepted in phases for the entire PG&E service territory during these project years. There is no historical database of the electric facilities during the requested years from 2015 to 2018 that would contain a complete and accurate inventory of all the electric facilities metrics requested in Table 8. (2) PG&E's GIS system is a dynamic 'real-time' system that reflects the current assets in PG&E's service territory, when old assets are removed or replaced they are removed from the GIS system. Therefore, snapshots of asset information at prior points in history, before the WMP process began in 2019, are not available.

6.8.2 Additions, Removal, and Upgrade of Utility Equipment by End of 3-Year Plan Term

Instructions for Table 9:

In the attached spreadsheet document, input summary information of plans and actuals for additions or removals of utility equipment as needed to correct previously-reported data. Report net additions using positive numbers and net removals and undergrounding using negative numbers for circuit miles and numbers of substations. Report changes planned or actualized for that year – for example, if 10 net overhead circuit miles were added in 2020, then report "10" for 20212020. If 20 net overhead circuit miles are planned for addition by 2022, with 15 being added by 2021 and five more added by 2022, then report "15" for 2022 and "5" for 2021. Do not report cumulative change across years. In this case, do not report "20" for 2022, but instead the number planned to be added for just that year, which is "5."

PG&E has enclosed the Table 9 data in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E is *providing* the following comments below for the Table 9 data.

Comments for Table 9:

The data presented in Table 9 are based on the best knowledge and data that is available as of January 2021. As better data becomes available, this will be updated in the quarterly updates. For transmission overhead line additions and removals for 2021 and 2022, project prioritization and timing have yet to be fully determined or mapped. The data presented for 2021 Distribution removals/additions represents the work for removal of idle facilities. There are many other reasons that conductor may be added or removed. For weather station additions and removals for 2022, project prioritization and timing have yet to be fully determined or mapped. The 2020 Actual data was derived by subtracting the 2019 data from the 2020 data in Table 8, and reflects the total net change in *the* system year-over-year as shown in the GIS system. The same layers used in Table 8 have been used to determine Population Density, HFTD, and WUI.

Instructions for Table 10:

Referring to the program targets discussed above, report plans and actuals for hardening upgrades in detail in the attached spreadsheet document. Report in terms of number of circuit miles or stations to be upgraded for each year, assuming complete implementation of wildfire mitigation activities, for HFTD and non-HFTD service territory for circuit miles of overhead transmission lines, circuit miles of overhead distribution lines, circuit miles of overhead transmission lines located in Wildland-Urban Interface (WUI), circuit miles of overhead distribution lines in WUI, number of substations, number of substations in WUI, number of weather stations and number of weather stations in WUI as needed to correct previously-reported data.

If updating previously-reported data, separately include a list of the hardening initiatives included in the calculations for the table.

PG&E *has* enclosed the Table 10 data in the Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E is providing the following comments below for the Table 10 data.

Comments for Table 10:

The data presented in Table 10 are based on the best knowledge that PG&E has as of January 2021. As better data becomes available, this will be updated in the quarterly updates. PG&E reconductored 50.66 miles of transmission conductor across our service territory in 2020. The data on the location of these jobs is locked in as-built sketches that would need to be digitized.

PG&E does not upgrade weather stations.

PG&E is in the process of re-planning Distribution system hardening for 2021 and 2022. The underlying risk model is being updated as well. Because of this, the 2022 planning is not yet complete, and we will need to update the 2021 mileage when the re-planning is complete.

PG&E does not have a regular system hardening program for transmission conductor. There will be upgrades during 2021 and 2022 to the transmission lines in the normal course of PG&E's business.

The same layers used in Table 8 have been used to determine Population Density, HFTD, and WUI.

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PACIFIC GAS & ELECTRIC COMPANY

SECTION 7

MITIGATION INITIATIVES

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7. Mitigation Initiatives

7.1 Wildfire Mitigation Strategy

Describe organization-wide wildfire mitigation strategy and goals for each of the following time periods, highlighting changes since the prior Wildfire Mitigation Plan (WMP) Report:

1. *By June 1 of current year*
2. *By Sept 1 of current year*
3 *Before the next Annual WMP Update*
4. *Within the next 3 years*
5. *Within the next 10 years*

Pacific Gas and Electric Company's (PG&E) wildfire mitigation strategy focuses on three areas for the purposes of preventing catastrophic wildfires associated with electrical equipment: (1) reducing wildfire ignition risk, (2) enhanced wildfire risk situational awareness and (3) reducing the impact of Public Safety Power Shutoff (PSPS) events for our customers and communities. In alignment and support of these focus areas, we are working with regulators, communities, other utilities, and industry experts to get a better understanding of the wildfire problem and ways to address and limit wildfire risk. As an update to our 2020 WMP, the 2021 WMP reflects largely the same programs to reduce wildfire risk. However, as discussed in other sections of the 2021 WMP, including Section 4.1 on lessons learned, in 2020 we identified gaps in several programs where improvement is needed. These gaps are being addressed as part of the 2021 WMP. In addition, the scope of some programs is changing based on PG&E's 2021 Wildfire Distribution Risk Model and other risk modeling. For example, the number of miles targeted for system hardening in 2021 have been reduced as compared to 2020 based on the prioritization informed by these models.

Within the next year:

The 53 commitments we are focused on delivering for 2021 (by the next annual update) are outlined in Table PG&E-7.1-1, including those that are targeted to be completed earlier than the next annual update:

TABLE PG&E-7.1-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Risk Assessment and Mapping	A.01	7.3.1.5	Match drop simulations (24 additional hours of forecast data)	Enhance the wildfire spread project in 2021 by expanding the forecast horizon from three to four days.	12/31/2021
Risk Assessment and Mapping	A.02	7.3.1.5	Match drop simulations (update fuel model layers)	Update the fuel model layers on annual basis (Technosylva).	12/31/2021
Risk Assessment and Mapping	A.03	7.3.1.3	Re-Train Vegetation and Equipment Probability of Ignition Models	PG&E's Vegetation Probability of Ignition and Equipment Probability of Ignition Models will see more improvements with another year of data (2020) incorporated.	12/31/2021
Risk Assessment and Mapping	A.04	7.3.1.1/ 4.5.1	Risk Mapping Improvements (Transmission)	Improve Transmission Risk Modeling to provide more standardized wildfire risk mapping/ranking between the various controls and mitigations.	12/31/2021
Risk Assessment and Mapping	A.05	7.3.1.1/ 7.3.1.4	Risk Mapping Improvements (Distribution)	Improve Distribution Risk Modeling to include: 1) ability to compare wildfire risks for different risk drivers, 2) ability to measure the risk reduction of specific mitigations, 3) add wildfire risk values for distribution line locations beyond the HFTD and High Fire Risk Areas (HFRA) areas to include all of PG&E's distribution lines.	12/31/2021
Risk Assessment and Mapping	A.06	4.5.1/4.1	Model PSPS customer impacts at circuit level	Develop a more granular, circuit level model, to assess PSPS customer impacts.	9/30/2021
Situational Awareness and Forecasting	B.01	7.3.2.1.1	Numerical Weather Prediction	Make enhancements to numerical weather prediction program.	12/31/2021

TABLE PG&E-7.1-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Situational Awareness and Forecasting	B.02	7.3.2.1.2	Enhancements to Fuel Moisture Sampling and Modeling efforts	Expand the historical Dead Fuel Moisture (DFM) and LFM Live Fuel Moisture (LFM) climatology at 2 x 2 km resolution to back-fill all of 2020.	6/1/2021
Situational Awareness and Forecasting	B.03	7.3.2.1.2	Enhancements to Fuel Moisture Forecasting	Evaluate extending the deterministic DFM and LFM forecast to provide another 24 hours of forecast data.	6/1/2021
Situational Awareness and Forecasting	B.04	7.3.2.1.3	Enhancements to Weather Station Project (Installations and Optimization)	Install or optimize the location of 300 weather stations throughout PG&E's territory.	12/31/2021
Situational Awareness and Forecasting	B.05	7.3.2.1.3	Enhancements to Weather Station Project (Wind Gust Model)	Develop a weather-station specific wind gust model based on machine-learning or statistical techniques.	12/31/2021
Situational Awareness and Forecasting	B.06	7.3.2.1.6	Medium- to Seasonal-Range Diablo Wind Forecasting	Develop and deploy a seasonal Diablo wind event forecasting system to obtain longer lead-times of upcoming Diablo wind events.	12/31/2021
Situational Awareness and Forecasting	B.07	7.3.2.1.6	Information Sharing	Make adjustments to the public 7 day forecast to provide more granularity and clarity around the potential for a PSPS event.	6/1/2021
Situational Awareness and Forecasting	B.08	7.3.2.2.2	SmartMeters™ - Partial Voltage Detection	Implement expanded coverage of Partial Voltage Detection capabilities to the three phase meters by end of June 2021.	6/30/2021
Situational Awareness and Forecasting	B.09	7.3.2.2.4	Sensor IQ Pilot Deployment	Deploy Sensor IQ (SIQ) functionality on all planned SmartMeters™ (500,000) by 12/31/2021.	12/31/2021
Situational Awareness and Forecasting	B.10	7.3.2.2.6	Distribution Arcing Fault Signature Library	Complete a 6-month minimum analytic stage capturing all events on the installed circuit to inform the Distribution Arcing Fault Signature Library project.	12/31/2021

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TABLE PG&E-7.1-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Situational Awareness and Forecasting	B.11	7.3.2.4	Enhancements to Fire Potential Index (FPI) Model	Enhance the FPI Model by September 1, 2021 using additional data and an enhanced fire occurrence dataset. PG&E also plans to incorporate the new Technosylva fuel mapping layer into FPI calculations if it provides more predictive skill of large fires.	9/1/2021
Situational Awareness and Forecasting	B.12	7.3.2.5	Safety and Infrastructure Protection Team (SIPT) Staffing	Maintain SIPT staffing levels to support fire prevention and mitigation activities.	12/31/2021
Situational Awareness and Forecasting	B.13	7.3.2.6	Enhancements to Outage Producing Wind (OPW) Model	Recalibrate the OPW Model using the 2 km climatology that will be extended to capture all events in 2020, including sustained and momentary outages, as well as damages found in PSPS events of 2020.	9/1/2021
Situational Awareness and Forecasting	B.14	7.3.2.7	Wildfire Safety Operations Center (WSOC) - Procedure Update	Update WSOC Procedural Documentation to include expansion of WSOC for All Hazards.	12/31/2021
Situational Awareness and Forecasting	B.15	7.3.2.7	Wildfire Safety Operations Center (WSOC) - Expand Active Incidents Visibility	Expand current Active Incidents Dashboard for additional stability, incorporate new data streams and expand the number of viewers.	10/1/2021
Situational Awareness and Forecasting	B.16	7.3.2.1.4	HD Cameras	Install an additional 135 cameras.	12/31/2021

TABLE PG&E-7.1-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Grid Design and System Hardening	C.01	7.3.3.8.3	Assess Motorized Switch Operator (MSO) switches	Assess various alternatives to address the ignition risk associated with MSO switches. Explore several pilot options to inform the best alternatives and select the appropriate corrective action for MSO's for the next WMP update.	12/31/2021
Grid Design and System Hardening	C.02	7.3.3.11.1 C	Generation for PSPS Mitigation (Temporary Distribution Microgrids)	Develop at least 5 additional distribution microgrid Pre-installed Interconnection Hubs (PIH).	12/31/2021
Grid Design and System Hardening	C.03	7.3.3.11.1 B	Generation for PSPS Mitigation (Substation Distribution Microgrids)	Prepare at least 8 substations to receive temporary generation for 2021 PSPS mitigation.	8/1/2021
Grid Design and System Hardening	C.04	7.3.3.11.3	Emergency Back-up Generation – PG&E Service Centers & Materials Distribution Centers	Equip at least 23 PG&E Service Centers & Materials Distribution Centers to receive permanent or temporary generation.	12/31/2021
Grid Design and System Hardening	C.05	7.3.3.17.5	Remote Grid	Begin operations of the first Remote Grid site by the end of 2021.	12/31/2021
Grid Design and System Hardening	C.06	7.3.3.8.1	Distribution Sectionalizing (automated devices)	Install at least 250 more distribution sectionalizing devices integrating learnings from 2020 PSPS events, 10-year historical look-back of previous severe weather events, and feedback from county leaders and critical customers.	12/31/2021
Grid Design and System Hardening	C.07	7.3.3.8.2	Transmission Switches	Install 29 SCADA transmission switches to provide switching flexibility and sectionalization for PSPS events.	9/1/2021
Grid Design and System Hardening	C.08	7.3.3.9.1	Distribution line legacy 4C controllers	Replace all remaining (~84) distribution line legacy 4C controllers that are in Tier 2 and Tier 3 HFTD areas.	12/31/2021
Grid Design and System Hardening	C.09	7.3.3.9.2	Fuse Savers (Single phase reclosers)	Install 70 sets of single phase reclosers.	12/31/2021

TABLE PG&E-7.1-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Grid Design and System Hardening	C.10	7.3.3.17.4	Rapid Earth Fault Current Limiter (REFCL) Pilot	PG&E plans to have the final results from this pilot project by September 2021 to inform the long term REFCL strategy.	9/1/2021
Grid Design and System Hardening	C.11	7.3.3.7	Expulsion Fuse Replacement (non-exempt equipment)	Replace approximately 1,200 fuses/cutouts, and other non-exempt equipment identified on poles in Tier 2 and Tier 3 HFTD areas.	12/31/2021
Grid Design and System Hardening	C.12	7.3.3.17.3	Surge Arrester Replacements	Replace at least 15,000 of the remaining 21,400 Tier 2 and Tier 3 non-exempt surge arresters.	12/31/2021
Grid Design and System Hardening	C.13	7.3.3.17.1	System Hardening (line miles)	Harden 180 highest risk miles.	12/31/2021
Grid Design and System Hardening	C.14	7.3.3.17.6	Butte County Rebuild	Underground 23 miles.	12/31/2021
Grid Design and System Hardening	C.15	7.3.3.17.2	System Hardening - Transmission Conductor	Replace approximately 92 miles of conductor on lines traversing HFTD, including associated asset hardware.	12/31/2021
Asset Management and Inspections	D.01	7.3.4.1	Distribution HFTD Inspections (poles)	Complete enhanced detailed inspections of overhead distribution assets in the following recurrence intervals: (1) Tier 3 and Zone 1 – annually; and (2) Tier 2 – every three years. Inspections will be completed by July 31, 2021, barring exceptions due to physical conditions or landholder refusals which delay or hinder PG&E access to facilities.	7/31/2021
Asset Management and Inspections	D.02	7.3.4.15	Substation HFTD Inspections (substations)	Complete supplemental ground and aerial inspections of 100 substations: 42 in HFTD Tier 3, 38 in HFTD Tier 2; and 20 in substations adjacent to Tier 2 and 3 HFTD areas.	7/31/2021

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TABLE PG&E-7.1-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Asset Management and Inspections	D.03	7.3.4.2	Transmission HFTD Inspections (structures)	Completed detailed enhanced inspections and some form of aerial assessment (helicopter, drone, aerial lift, climbing) on the following recurrence intervals: (1) Tier 3 and Zone 1– annually; and (2) Tier 2 – every three years. Inspections will be completed by July 31, 2021, barring exceptions due to physical conditions or landholder refusals which delay or hinder PG&E access to facilities.	7/31/2021
Asset Management and Inspections	D.04	7.3.4.5	Infrared Inspections of Transmission Electric Lines and Equipment	Conduct Infrared inspections on 100% of transmission circuits in Tier 3 HFTD areas, 33% of transmission circuits in Tier 2 HFTD areas, and 20% of transmission circuits in non-HFTD areas plus additional annually inspected lines. Planned scope of Transmission Infrared Inspections in 2021 is approximately 8,000 miles.	12/31/2021
Vegetation Management and Inspections	E.01	7.3.5.15	EVM (line miles)	Complete 1,800 circuit miles and mitigate approximately 190,000 trees.	12/31/2021
Vegetation Management and Inspections	E.02	7.3.5.1	VM Community and Environmental Engagement	Expansion of the month ahead workplan reports to the Regional Water Quality Control Board Representatives.	12/31/2021
Vegetation Management and Inspections	E.03	7.3.5.3	VM Transmission Right of Way Expansion	Perform Transmission ROW expansion on approximately 200 miles within HFTD areas.	12/31/2021
Data Governance	G.01	4.4.1	Research Proposals (Open Innovation Challenge)	Initiate an “Open Innovation Challenge” to identify novel technologies that could potentially reduce PG&E-caused wildfire risk.	9/1/2021
Data Governance	G.02	4.4.1	Cal Poly Wildland Urban Interface (WUI) Fire Information Research and Education (FIRE) Institute	Partner with, and advise on the direction of research and associated activities of the FIRE Institute.	12/31/2021

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TABLE PG&E-7.1-1: 2021 WMP COMMITMENTS DUE BY NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Emergency Planning and Preparedness	I.01	7.3.9.1	Staffing to Support Service Restoration	Hire approximately 40 Linemen and 100 Apprentices.	12/31/2021
Emergency Planning and Preparedness	I.02	7.3.9.1	Trained Workforce for Service Restoration	All required personnel complete identified trainings to improve PSPS event execution (including SEMS, Access and Functional Needs and other critical training).	12/31/2021
Stakeholder Cooperation and Community Engagement	J.01	7.3.10.1/ 8.4	Community Based Organizations (CBOs) Coordination	Partner with CBOs in targeted communities to increase their capacity to serve AFN communities, such as medically sensitive customers, low-income, limited- English speaking and tribal customers.	12/31/2021
Stakeholder Cooperation and Community Engagement	J.02	7.3.9.2/ 7.3.10.1	Community Engagement	Engage community stakeholders through offering: Wildfire Safety Working Sessions, workshops that review PG&E's PSPS Policies and Procedures document, listening sessions, and Energy and Communications Providers Coordination Group meetings.	2/1/2022
Stakeholder Cooperation and Community Engagement	J.03	7.3.9.2/ 7.3.10.1	Customer and Community Outreach	Continue to enhance communications and engagement efforts with a focus on wildfire safety and preparedness for PSPS events - including Webinars/Community Meetings, Direct-to-Customer Outreach, developing and delivering informational video resources.	12/31/2021
Protocols on Public Safety Power Shutoff	K.01	8.4/8.2.4	Customer and Agency Outreach During PSPS Events	Improve Customer and Agency Outreach During PSPS Events by: developing opt-in address alerts, conducting new message testing, promoting enrollment, hosting briefings, hosting cooperator calls.	12/31/2021
Protocols on Public Safety Power Shutoff	K.02	8.2.1	Mitigate Impacts on De-Energized Customers	Work with partner organizations to provide outreach and support to vulnerable customers through programs such as the Disability Disaster Access and Resources Program (DDAR) and the Portable Battery Program (PBP).	12/31/2021

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Within three years:

Beyond the current three-year WMP period (which concludes at the end of 2022), PG&E's focus areas are anticipated to remain the same: (1) reducing wildfire ignition risk, (2) enhanced wildfire risk situational awareness; and (3) reducing the impact of PSPS events. However, ongoing learning and analysis will inevitably result in changes in some of the tactics, initiatives, or programs within these focus areas. As one example, PG&E has established specific situational awareness targets by the end of the current WMP period including having one weather stations for approximately every twenty circuit miles in HFTD areas and having ninety percent visual coverage of the HFTD areas with High-Definition Cameras. After those goals are accomplished, PG&E will analyze what further situational awareness enhancements will add value in supporting the complementary focus areas of reducing wildfire risk and reducing PSPS impacts. Some examples of what solutions could be identified as adding value may include deploying more devices, exploring different sensing devices, or integrating new software or technologies to leverage existing sensing data.

In addition to the analysis and adjustments that we already know will be necessary, given the volume of learnings and adjustments made during the first two years of the WMP process, PG&E will learn more which will shape our long-term plans for the three and ten year time horizons by undertaking the following.

- Incorporate future climate change information into risk models and increase the granularity of ignition risk reduction modeling to below the circuit level, including integration of fire spread consequences. Future improvements to PG&E's risk models are discussed in more detail in Section 4.5.1.

- Continue to drive PSPS events to be smaller, shorter and smarter based on further improved tools, processes and understanding of wildfire risk and weather patterns.

- Identify, implement, evaluate and test new technologies and tools to bolster operational capabilities, increase the flexibility of the grid and enable greater system resiliency. Develop and implement new wildfire mitigation programs using promising new technologies and tools. (See Section 7.1.D below for some of the technologies currently being explored.)

- Pursue California-based training programs to increase the population of trained Pre-Inspectors and tree crew personnel.

- Test and pilot clean temporary generation technologies in controlled and field environments.

- Work towards integration of an Enterprise Data Management Program, to maximize the availability and usability of wildfire-relevant datasets for further analysis and decision-making.

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Within ten years:

PG&E's grid architecture, lines, equipment, and processes will change over the next 10 years to support our objectives. PG&E's long-term WMP effort seeks to optimally reduce wildfire risk and the impact of PSPS events, while supporting other objectives, including maintaining overall reliability, improving resiliency, and advancing grid capabilities to integrate distributed energy resources and support decarbonization goals. Many regulatory, technological, and customer-related factors that will impact these other objectives are unclear, and the appropriate, precise architecture of the grid in 10 years is uncertain. However, PG&E's long-term plan will make significant progress on risk mitigation activities like Enhanced Vegetation Management, System Hardening, Fire Risk Component Replacements, and grid operational technologies and tools.

Progress on the three WMP areas of focus described above also aligns with the WSD's Wildfire Mitigation Maturity Model, which defines 52 capabilities across 10 categories. The capabilities are themselves enabled by essential functional attributes that are often common across multiple capabilities. Key capabilities, resources and tools we anticipate developing over the 3 and 10-year time horizons (that run beyond the 2021 WMP period) include the following.

- Track and assess performance of implemented wildfire risk mitigation activities over an extended period of time to validate effectiveness. Based on observed performance, continue, modify and improve elements of wildfire mitigation programs for as long as these measures are cost-effective in reducing the risk (frequency, scope and consequences) of wildfires, given the evolving threat of climate change in California.
- Develop "real-time" risk models that incorporate condition of assets, environmental factors, weather conditions, and potential fire spread.
- Full-scale implementation and operations of remote grids based upon site selection framework; construct permanent generation solutions at relevant substations.
- Incorporate improving research, information, data, technologies and other tools into wildfire risk reduction efforts including PSPS targeting and minimization activities.
- Incorporate technology such as integrated communications and data sharing platforms to support better partnership with fire suppression and first responder agencies.
- Gain deeper insight into asset condition through advanced technologies, data management, and analytical capabilities; increase ability to identify asset problems before they result in failure.
- Develop data access Application Programming Interfaces to enable increased partnerships and transparency with researchers, regulators, and state and local governments; establish and enforce comprehensive governance patterns for the collection and storage of new data; refine analytics operating model and organization structure to further develop high-quality predictive and prescriptive analytics for risk informed decision making.

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7.1.A. PG&E's Approach to Managing Wildfire Risk

A. *Discuss the utility's approach to determining how to manage wildfire risk (in terms of ignition probability and estimated wildfire consequence) as distinct from managing risks to safety and/or reliability. Describe how this determination is made both for (1) the types of activities needed and (2) the extent of those activities needed to mitigate these two different groups of risks. Describe to what degree the activities needed to manage wildfire risk may be incremental to those needed to address safety and/or reliability risks.*

In this section, PG&E addresses how wildfire risks are evaluated and managed differently than other public safety (non-wildfire) and reliability risks.

PG&E uses the Safety Model Assessment Proceeding (SMAP) principles to implement the methodologies adopted in the SMAP Settlement which was approved by the Commission in Decision (D.) 18-12-014. Our risk management program enables PG&E to: (1) identify those risks that could lead to catastrophic safety consequences, (2) implement the actions that have the highest and most cost-effective potential to reduce risk, and (3) transparently monitor and report results.

Through the SMAP process, PG&E developed the Corporate Risk Register, presenting each risk event with definitions, risk bowtie analyses, and data. For each risk on the Corporate Risk Register, PG&E assessed the likelihood of a risk event, and the consequence of a risk event (CoRE) attributed to Safety, Reliability and Financial. In combination, PG&E calculates the level of risk through the Multi-Attribute Value Function framework to calculate a Multi-Attribute Risk Score. This, in total, allows PG&E to assess the level of risk and the level of risk reduction between Wildfire and other risks that focus other safety and/or reliability risks. Given the vast difference in risk scores between Wildfire and other risks, mitigation programs that mitigate ignition or wildfire consequence show significantly higher risk reduction than non-wildfire mitigation programs. Figure PG&E-7.1-1 below presents how Wildfire compares to other enterprise risks, like Failure of Electric Distribution Overhead Assets.

FIGURE PG&E 7.1-1: 2023 BASELINE RISK RANKING (2020 RAMP REPORT)[1]

			2023 Baseline Score	
Rank	LOB	Safety Risks	Safety Risk Score	Multi-Attribute Risk Score
1	EO	Wildfire	9,856	25,127
2	SHED	Third Party Safety Incident	887	944
3	GO	Loss of Containment on Gas Transmission Pipeline	128	281
4	SHED	Contractor Safety Incident	94	94
5	SHED	Employee Safety Incident	86	90
6	GO	Loss of Containment on Gas Distribution Main or Service	72	99
7	SS	Real Estate and Facilities Failure	69	97
8	PGEN	Large Uncontrolled Water Release (Dam Failure)	41	70
9	EO	Failure of Electric Distribution Overhead Assets	18	525
10	SHED	Motor Vehicle Safety Incident	16	17
11	EO	Failure of Electric Distribution Network Assets	6	7
12	GO	Large Overpressure Event Downstream of Gas M&C Facility	5	13

After performing the risk analysis on the Wildfire risk, PG&E focuses on understanding each mitigation programs' benefit in managing and mitigating that risk, either by reducing the likelihood of occurrence or by reducing the consequences of an event. This is detailed in Table 12 in "Attachment 1 – All Tables Required by 2021 WMP Guidelines.xlsx" for the initiatives assessed. PG&E's risk assessment process to identify the top drivers of Wildfire risk are detailed in Section 4.2.

As described in the 2020 RAMP Report, over 99 percent of PG&E's wildfire risk is located in the HFTD Tier 3 and Tier 2 areas, despite only accounting for approximately 30 percent of risk events (ignitions). The largest drivers of wildfire risk are vegetation contact and conductor failure. As such, PG&E developed two probability of ignition models, together with a fire consequence model, collectively called the 2021 Wildfire Distribution Risk Model, that helped delineate wildfire risk within HFTD areas at a circuit segment level. Details of the model are provided in Section 4.5.1.

1 Figure PG&E-7.1-1 is based on post-2020 RAMP CPUC workshop, as shown on July 30, 2020.

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7.1.B. Major Investments and Implementation of Wildfire Mitigation Initiatives

B. Include a summary of what major investments and implementation of wildfire mitigation initiatives achieved over the past year, any lessons learned, any changed circumstances for the 2020 WMP term (i.e., 2020-2022), and any corresponding adjustment in priorities for the upcoming plan term. Organize summaries of initiatives by the wildfire mitigation categories listed in Section 7.3.

PG&E's 2021 WMP builds upon the successes achieved and lessons learned in 2020. Similar to the 2019 and 2020 WMPs, PG&E's 2021 WMP has three overarching goals: (1) reducing wildfire ignition risk, (2) enhancing wildfire risk situational awareness, and (3) reducing the impact of PSPS events. In alignment with those goals, our major investments for 2021 and 2022 remain very similar to those outlined in the 2020 WMP. The broader population of major investments are captured in the list of commitments being made in this WMP which is provided above in Section 7.1 and organized by the wildfire mitigation categories. In Table PG&E-7.1-2 below the major unitized commitments are provided, including the volume of work completed in 2020.

The primary update and adjustment to PG&E's wildfire risk mitigation efforts in 2021 is in the updated risk modeling and prioritization leveraged to inform the targeting of those investments, as discussed in Section 4. PG&E has updated our wildfire risk assessment capabilities to a more precise, technology-based approach to measure and mitigate wildfire risk. Our updated risk-modeling for the 2021 WMP benefits from both historical data (weather patterns, detailed information on previous ignitions, outages and other risk events, etc.) as well as state-of-the-art tools such as fire-spread technology that shows the locations where infrastructure failures could lead to ignitions that cause the most catastrophic fires. Leveraging this new risk model, going forward at least 80 percent of our largest wildfire mitigation investments, System Hardening and Enhanced Vegetation Management, will be performed in the top 20 percent of the highest risk circuit segments or in fire rebuild areas. This will be executed within the governance of our newly formed Wildfire Risk Governance Steering Committee which has direct oversight over key WMP workstreams.

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TABLE PG&E-7.1-2: SUMMARY OF 2020 AND 2021 WILDFIRE MITIGATION ACTIVITIES

	PROGRAM	2020 PROGRESS*	2021 TARGETS*	2021 WMP SECTION REFERENCE
Reduce Wildfire Ignition Potential	Enhanced Veg Mgmt. (EVM)	1,878 line miles	1,800 high risk line miles	7.3.5
	Asset Inspections	Transmission – 100% of Tier 3 & Zone 1 and 33% of Tier 2 structures	Transmission – 100% of Tier 3 & Zone 1 and 33% of Tier 2 structures, plus additional higher risk structures by July 31[(a)]	7.3.4.2
		Distribution – 100% of Tier 3 & Zone 1 and 33% of Tier 2	Distribution – 100% of Tier 3 & Zone 1 and 33% of Tier 2, plus high consequence Tier 2 structures by July 31 [(a)]	7.3.4.1
		Substations – 100% of Tier 3 & Zone 1 and 33% of Tier 2	Substations – 100% of Tier 3 & Zone 1 and 33% of Tier 2 by July 31	7.3.4.15
	Miles Hardened	342 line miles	180 high risk miles	7.3.3.17
	Butte County Undergrounding	30 line miles	23 line miles	7.3.3.17
	Asset Replacement	643 non-exempt fuses replaced	1,200 non-exempt fuse replacements	7.3.3.7
	Public Safety Power Shutoff (PSPS)	Reduced catastrophic wildfire risk through 6 PSPS outages that were over 50% smaller and 40% shorter after the weather cleared than they would have been in 2019	Reduce catastrophic wildfire risk during severe weather conditions, including revising PSPS criteria to incorporate known risks, while continuing to take actions to reduce the impact of PSPS events on customers	8
Situational Awareness	Weather Stations	404 weather stations	300 weather stations to complete long-term goal of 1,300 total	7.3.2.1.3
	High-Def Cameras	216 high-def cameras	135 high-def cameras, in alignment with long-term goal of 600 total (90% visual coverage of HFTD areas) by the end of 2022	7.3.2.1.4

(a) This timeline for the completion of asset inspections in HFTD areas excludes Can't Get In (CGI) locations where external factors including environmental restrictions, inability to access, or other issues prevent the scheduled inspection, which may then extend b eyond July 31st.

* All data are for activities and assets within California Public Utilities Commission (CPUC or Commission)-designated HFTDs unless otherwise indicated; 2020 actual results and 2021 targets as of February 5, 2021.

TABLE PG&E 7.1-2: SUMMARY OF 2020 AND 2021 WILDFIRE MITIGATION ACTIVITIES (CONTINUED)

	PROGRAM	2020 PROGRESS*	2021 TARGETS*	2021 WMP SECTION REFERENCE
Reduce Impact of PSPS Events	Distribution Sectionalization	603 devices	250 devices	7.3.3.8.1
	Transmission Line Switching	54 switches	29 switches	7.3.3.8.2
	Distributed Generation and Microgrids	6 temporary microgrids (3 via pre-installed interconnection hubs) and 62 substations operationally ready to leverage temporary generation during PSPS events	Deploy 5 additional microgrids with pre-installed interconnection hubs and have Temporary Generation on standby to reduce impacts of PSPS events in 2021	7.3.3.11.1
	Community Resource Centers (CRC)	Had over 300 sites prepared to open as a CRC if called upon, activated 245 CRCs supporting ~50,000 customers	Partner with counties to improve targeting of CRCs and remain flexible to various regulations and conditions related to COVID	8.2.1
	Communication and Outreach	Shifted customer outreach to virtual in response to COVID, engaged with over 5,500 attendees to virtual open houses; partnered with over 250 Community Based Organizations (CBOs) to support and communicate with customers	Deploy customer outreach, engagement and measures, including with in-language resources and further engagement with CBOs	7.3.9.2, 7.3.10.1, 8.4
	Community Partnership	Increased pre-season planning, pre-event communications and staffed up single points of contacts to keep communities prepared, engaged and informed for PSPS events	Grow partnerships with community organizations to further preparedness and execution of PSPS events	8.4

* All data are for activities and assets within CPUC-designated HFTDs unless otherwise indicated; 2020 actual results and 2021 targets as of February 5, 2021.

7.1.C. Challenges Associated With Limited Resources

C. List and describe all challenges associated with limited resources and how these challenges are expected to evolve over the next 3 years.

Limited resources are a significant execution risk facing WMP implementation. PG&E learned a number of lessons from the execution of our first WMP in 2019 when some one-time activities (like the Wildfire Safety Inspection Program) and a ramp-up of new efforts created a significant peak of work to be performed over a limited window of time. We found that there is limited ability to rapidly scale up skilled resources to support such a peak in a short amount of time. PG&E successfully incorporated the lessons learned from that experience by executing a more sustainable and even workplan in 2020 to deliver on our 2020 WMP commitments without significant swings in our workforce. We maintained and supported a stable workforce to deliver on our 2020 WMP plans despite the logistical challenges created by the COVID-19 pandemic. PG&E is planning a similarly stable and sustainable workplan in 2021 and anticipates managing the needed workforce accordingly.

As workload volumes in some key areas, including System Hardening, grow in 2022 and beyond, we will closely monitor available resource levels in order to complete our wildfire mitigation work. At the same time, we recognize that resource limitations will likely remain a challenge in areas like vegetation management given the volume of work to be performed and the need for skilled and experienced individuals to address the inherent hazards of the job. In addition, recently revised regulations like Senate Bill 247 may influence changes in the available vegetation management companies and employees in California. It is difficult to forecast how the labor market and resource capacity/availability within California and the Western United States will change over the next several years given the increased wildfire risk experienced in the Pacific Northwest over the last few years. It is likely that the demand for trained resources will increase. Further, the ongoing COVID-19 pandemic creates uncertainty related to the availability of contract resources who often travel across states or regions throughout the year. Overall, PG&E appreciates that getting additional, talented individuals into critical positions now and providing them with experience and training will provide significant benefits in the future. Therefore, PG&E is working with community colleges and the IBEW to establish training programs to increase the size of our skilled workforce, most notably in vegetation management. PG&E also continues to focus on hiring additional qualified employees to support our wildfire risk mitigation workload over the long-term.

Beyond the in-field deployment of wildfire risk mitigation activities, PG&E is closely monitoring resource limitations related to key "support" functions as well. A primary example is Geographic Information System (GIS) resources. There are a limited number of these highly skilled, and often very experienced, employees or contractors who can quickly and efficiently navigate utility GIS systems and gather/integrate data from these systems. In light of the GIS data reporting requirements that have substantially increased and evolved over the past six months, PG&E is assessing if it has, or can acquire, enough qualified,

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efficient GIS resources to support the critical needs of (1) ongoing operations, (2) system improvements and enhancements to support more efficient operations, and (3) data reporting requirements and submissions. PG&E is also assessing the necessary and appropriate staffing levels for GIS resources as compared to other resources we have available.

PG&E is continually monitoring our resource levels to ensure that we have the resources we need to perform, and support, critical wildfire risk mitigation work. Over the next three years, we anticipate that the COVID-19 pandemic, public health requirements, and other regulations will continue to impact the vegetation management and overall resource availability. We will adapt to those, and other, impacts as we strive to mitigate wildfire risk.

7.1.D. New or Emerging Technologies

D. Outline how the utility expects new technologies and innovations to impact the utility's strategy and implementation approach over the next 3 years, including the utility's program for integrating new technologies into the utility's grid. Include utility research listed above in Section 4.4.

In this section, PG&E addresses new and emerging technologies.

7.1.D.1 Impact on Strategies

PG&E actively explores new or emerging technologies that can mitigate wildfire risk and associated potential impact on public safety. Section 7.1.D details technology-driven innovations focused on wildfire mitigation consistent with the following definitions:

- *New: Technologies or analytical methods enabled through technology that were new to PG&E after the release of its 2019 WMP (i.e., February 6, 2019), exclusive of 'emerging' technologies*
- *Emerging: Pre-commercial technologies or analytical methods, including Technology Demonstration & Deployment projects*[2]

These technologies or analytical methods hold significant promise to advance PG&E's wildfire risk mitigation, bolster operational capabilities, increase the flexibility of the grid, and allow for greater system resiliency. Capabilities targeted through new or emerging technologies include, but are not limited to:

- Situational awareness and forecasting: New or emerging technologies can enable more accurate forecasting and identification of environmental events and operating conditions that pose a risk to the grid so that critical issues may be dealt with as quickly as possible to avoid the risk of catastrophic wildfires.
- Grid design and hardening: New or emerging technologies can enable innovative system hardening techniques (e.g. new grid topologies or new resilience and PSPS avoidance technologies or techniques) to mitigate the risk of fire ignition and potential impacts on public safety.
- Asset management and inspections: New or emerging technologies can enable automated and improved methods to identify asset or system issues so that high risk items can be addressed prior to failure.
- Vegetation management and inspections: New or emerging technologies

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2 The Technology Demonstration and Deployment demonstration project definition was approved by the CPUC in D.12-05-037, p.37: "The installation and operation of pre-commercial technologies at a scale sufficiently large and in conditions sufficiently reflective of anticipated actual operating environments, to enable the financial community to effectively appraise the operational and performance characteristics of a given technology and the financial risks it presents."

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can enable more timely and accurate insights on vegetation health, density and proximity to assets allowing PG&E to implement risk-based vegetation management work practices to further ensure high risk areas are efficiently addressed.

- Asset Analytics and Grid Monitoring: New or emerging technologies can leverage data to enable greater insights on asset health to optimize system maintenance and implement proactive measures to reduce the risk of asset failure.

- Foundational Enablement: New or emerging technologies, including grid communication tools and control networks, can enable greater exchange of information required to provide real or near-real time operational visibility across the grid for enhanced decision-making. These foundational items can also increase the flexibility of the grid, providing fundamental capabilities to advance system resiliency.

The projects included in this section are arranged according to these targeted capability areas above and are referred to as Program Areas in the project reports below.

The impacts of new or emerging technologies on utility strategy will vary by project. Information on the strategic enablement of these technologies is detailed further in Sections 7.1.D.2 and 7.1.D.3 below. The scope and implementation of these projects are subject to change due to the evolving nature of technology and business needs. There will likely be technologies that develop or mature over the reporting timeframe (2021-2023) which PG&E may pursue that are not described in Section 7.1.D.3. Projects that newly meet the inclusion criteria after the filing of the 2021 WMP update will be added to the Condition Guidance-9 quarterly reports.

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7.1.D.2. Implementation Approach and Integration of New or Emerging Technologies

The projects included in this Section 7.1.D are managed as a portfolio of wildfire mitigation-related new or emerging technology projects. Currently eight of the projects in this portfolio are also administered under PG&E's Electric Program Investment Charge (EPIC) Program.

The EPIC program, established in 2011 by the CPUC in D.11-12-035, provides PG&E with an opportunity to demonstrate the value of emerging technologies that could advance a broad array of objectives including wildfire safety, grid safety, resiliency and reliability as well as customer enablement, and integration of renewable and distributed energy resources. The CPUC has established rules that guide the EPIC program through its various rulings within the program docket. PG&E administers the EPIC program to comply with the CPUC rules and effective use of the program funding. In selecting emerging technologies for demonstration, we assess criteria that may inform project value and successful implementation, including: (i) alignment to key program objectives, (ii) technology novelty, (iii) technology readiness, (iv) sponsorship and clear path to production, (v) obstacles to implementation, and (vi) potential benefits at demonstration and full deployment stages. PG&E also assesses alignment to utility strategic priorities and customer needs to ensure that technologies, if successfully demonstrated, will enable PG&E (and potentially other utilities) to better serve its customers and deliver on program objectives, including enhancements to safety and grid resiliency.

EPIC demonstration projects aid in identifying key requirements and insights to inform broader deployment in a manner that strategically aligns the integration of technologies with existing operations. Given the rapidly evolving energy landscape and the impact of climate change in California, the continuation of technology innovation programs like EPIC is critical to the continued advancements of grid capabilities to enable advancements on safety and resiliency.

Consistent with CPUC guidance, PG&E has relied primarily upon the EPIC program to demonstrate emerging technologies to improve our ability to mitigate wildfire risk, although the wildfire mitigation new or emerging technology portfolio, as reported on in this section, also includes new technology projects that are not pre-commercial in nature. These projects are funded and managed separately from the EPIC portfolio according to standard (non-EPIC) business planning processes.

The EPIC 3 Program cycle now underway is the final triennial cycle in the current EPIC program. The CPUC is currently contemplating in the EPIC successor program proceeding, Rulemaking 19-10-005, whether the investor-owned utilities (IOU) will continue to administer their respective portions of the EPIC Program to develop capabilities that reduce wildfire risk and address other critical California objectives.

PG&E will continue to seek funding and authorization to pursue demonstration

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projects for new and emerging technology related to wildfire mitigation through the EPIC Successor Program (if authorized), through our 2023 General Rate Case request (if the CPUC does not authorize continued IOU administration of the EPIC program), or through other funding mechanisms.

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7.1.D.3. New or Emerging Technologies – Project Details

This section provides an overview of 18 mitigations that leverage new or emerging technologies, including 16 projects that were previously included in Section 5.1.D New or Emerging Technologies in the 2020 WMP. On June 11, 2020, the CPUC issued Resolution WSD-003 approving the Wildfire Safety Division's recommendation for a Conditional Approval of PG&E's 2020 WMP. In the Conditional Approval recommendation, the WSD identified in Condition Guidance-9 that PG&E had an "insufficient discussion of pilot programs" and recommended quarterly reporting on these projects. As this was identified as a deficiency of the 2020 WMP, these projects are reported herein according to the Condition Guidance-9 reporting criteria, in addition to being reported in the ongoing quarterly reports.

In addition to the New or Emerging criteria (listed in Section 7.1.D.1) for inclusion in this section, the project must also at least be in the Planning phase (as described below) with an approved business case and a planned budget. Projects that newly meet the inclusion criteria after the filing of the 2021 WMP will be added to PG&E's next quarterly report.

The portfolio of projects addressed in this section begins with the projects included in the 2020 WMP, and accounts for the removal of projects that have been closed and the addition of newly launched projects.

The following projects included in the New or Emerging Technology section of the 2020 WMP have been removed from the New or Emerging Technology section of the 2021 WMP. The first four projects below are either now in production or in the process of entering production and continue to be included in other sections of the 2021 WMP. The last project has completed and is not planned to be taken to production. They are:

- *5.1.D.3.1 Wildfire Spread Models. The wildfire spread model is now in production with over 70 million virtual fires simulated by the technology each day every 200m along PG&E's overhead assets in the HFTDs.*

- *5.1.D.3.2 Satellite Fire Detection. The data and workflows of this project are now in production and are providing detection of potential wildfire conditions to inform operational response. In addition, PG&E also sends automated email fire alerts to various partners and has developed a public facing web page where these detections are available.*

- *5.1.D.3.3 Weather Model and Fire Potential Index – Model Expansions. The 2 km model pipeline of weather, fuels, OPW model, and FPI are now in production in the external cloud environment. These models and tools inform daily fire danger risk, Public Safety Power Shutoff decision-making frameworks, and outage potentials which can be modeled through PG&E's Storm Outage Prediction Project Model.*

- *5.1.D.3.19 EPIC 2.34: Predictive Risk Identification with Radio Frequency Added to Line Sensors (Distribution Fault Anticipation Technology). The technology demonstration project was completed. For more information*

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on how this project is continuing into production and wider deployment, see Section 7.3.2.2.3 Distribution Fault Anticipation Technology and Early Fault Detection.

- *5.1.D.3.11 Ultrasonic Technology. This project was removed because Ultrasonic Technology (UT) defect detection was found to be unreliable at this time. Additional project details from the last project quarterly report prior to removal can be found in the 2020 WMP Conditional Approval Guidance Item 9 Second Quarterly report available from the CPUC website.*

For the 2021 WMP, PG&E has newly included the EPIC 3.41: Drone Enablement and Operational Use and EPIC 3.43: Momentary Outage Information projects in this section.

Below are four EPIC projects that PG&E may pursue to demonstrate additional wildfire risk reduction capabilities, subject to CPUC approval of Advice Letter 6043-E to conduct these proposed projects as part of the current EPIC 3 investment cycle:

- *Project 44 – Advanced Transformer Protection: Demonstrate and evaluate the use of negative sequence transformer differential protection to provide high sensitivity fault detection and prevent transformer winding failures.*

- *Project 45 – Automated Fire Detection from Wildfire Alert Cameras: Demonstrate an automated fire detection model using machine learning, computer vison, or Artificial Intelligence (AI) techniques that accurately detects fires based on visual and infrared camera data streams; optimize for automated fire detection alerts.*

- *Project 46 – Advanced Electric Inspection Tools – Wood Poles: Demonstrate and evaluate the use of a nondestructive examination method (Radiography Testing) to detect flaws and prevent potential failures on electric distribution wood poles.*

- *Project 47 – Operational Vegetation Management Efficiency Through Novel Onsite Equipment: Demonstrate new technologies and onsite processes that can materially lower vegetation management costs by (a) small scale mobile torrefaction, and (b) wood baling technologies.*

The New or Emerging Technology projects included in this 2021 WMP are summarized in Table PG&E-7.1-3. Comprehensive details of each of the projects follow this table.

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TABLE PG&E-7.1-3: NEW OR EMERGING TECHNOLOGIES

Section	Project Name	Program Area	Approximate 2021 Project Financial Forecast ($K)[(a)]
7.1.D.3.1	SmartMeters™ Partial Voltage Detection	Situational Awareness & Forecasting	$331
7.1.D.3.2	Line Sensor Devices	Situational Awareness & Forecasting	$6,420
7.1.D.3.3	EPIC 3.15: Proactive Wires Down Mitigation Demonstration Project (Rapid Earth Fault Current Limiter)	Grid Design & System Hardening	$3,030
7.1.D.3.4	Distribution, Transmission, and Substation: Fire Action Schemes and Technology (DTS-FAST)	Grid Design & System Hardening	$30,000
7.1.D.3.5	Remote Grid	Grid Design & System Hardening	$1,382
7.1.D.3.6	EPIC 3.11: Multi-Use Microgrid	Grid Design & System Hardening	$1,440
7.1.D.3.7	Enhanced Asset Inspections – Drone/AI (Sherlock Suite)	Asset Management and Inspections	$7,753

(a) Financial forecasts for emerging technology assessment or deployment projects are highly tentative as uncertainty regarding costs and functionality is very high for new technologies. The forecast shown reflects project costs only (not production costs if the results of the project lead to production), are estimates as of January 2021, and are subject to change, including but not limited to the fact that several of the project estimates remain to be discussed at this time. Costs beyond 2021 have not yet been defined given this level of uncertainty.

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TABLE PG&E-7.1-3: NEW OR EMERGING TECHNOLOGIES (CONTINUED)

Section	Project Name	Program Area	Approximate 2021 Project Financial Forecast ($K)[a]
7.1.D.3.8	Below Ground Inspection of Steel Structures (Steel Transmission Structure Corrosion Assessment and Mitigation Pilot)	Asset Management and Inspections	TBD
7.1.D.3.9	EPIC 3.41: Drone Enablement	Asset Management and Inspections	$1,583
7.1.D.3.10	Mobile LiDAR for Vegetation Management	Vegetation Management and Inspections	TBD
7.1.D.3.11	EPIC 3.13: Transformer Monitoring via Field Area Network (FAN)	Asset Analytics & Grid Monitoring	$1,267
7.1.D.3.12	EPIC 3.20: Maintenance Analytics	Asset Analytics & Grid Monitoring	$541
7.1.D.3.13	EPIC 3.32: System Harmonics for Power Quality Investigation	Asset Analytics & Grid Monitoring	$761
7.1.D.3.14	Sensor IQ	Asset Analytics & Grid Monitoring	$533
7.1.D.3.15	EPIC 3.43: Momentary Outage Information	Asset Analytics & Grid Monitoring	$1,358
7.1.D.3.16	Wind Loading Assessments	Asset Analytics & Grid Monitoring	$1,715
7.1.D.3.17	EPIC 3.03: Advanced Distribution Energy Resource Management System	Foundational	$1,496
7.1.D.3.18	Advanced Distribution Management System (ADMS)	Foundational	$1,000[b]

(a) Financial forecasts for emerging technology assessment or deployment projects are highly tentative as uncertainty regarding costs and functionality is very high for new technologies. The forecast shown reflects project costs only (not production costs if the results of the project lead to production), are estimates as of January 2021, and are subject to change, including but not limited to the fact that several of the project estimates remain TBD at this time. Costs beyond 2021 have not yet been defined given this level of uncertainty.

(b) This figure represents the portion of this project related to wildfire mitigation.

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In accordance with Condition Guidance-9, the standardized project information is provided in the following format arranged according to the five Condition Items noted in that deficiency, with expansion by PG&E into multiple targeted, detailed responses:

Condition Item (i): All pilot programs or demonstrations identified in WMP.	
The projects are summarized in the table above and the following is the template for the detailed reporting that is provided for each project, below.	
Information Type	*Description*
(i).A: Project Type	Either New Technology (Commercially Available Offering) or Emerging (Pre-commercial) Technology according to the definition provided in Section 7.1.D.1 above.
(i).B: Additional References in the 2021 WMP	Other sections where this project is also significantly detailed within the WMP.
(i).C: Section in the 2020 WMP	If applicable, the section number of this project in the New or Emerging Technologies section of the 2020 WMP.
(i).D: Project Objective and Summary	A summary of the project, including its wildfire mitigation-related objective and an indication of whether the project is progressing toward broader adoption, if known. For many new or emerging technology projects, it is not clear until late in the project lifecycle whether the results indicate that the technology is appropriate to be broadly adopted.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	PG&E is providing one or more UWMMM Categories and Capabilities potentially impacted, where anticipated. Due to the nature of new and emerging technology project developments, these potential Categories and Capabilities are subject to change.

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<table>
<tr><td colspan="2">Condition Item (ii): Status of the pilot, including where pilots have been initiated and whether the pilot is progressing toward broader adoption.</td></tr>
<tr><td>Information Type</td><td>Description</td></tr>
<tr><td>(ii).A: Project Phase</td><td>The project phase is reported according to the following definitions:
<table>
<tr><td>Project Phase</td><td>Definition</td></tr>
<tr><td>Initiation</td><td>Project purpose and benefits defined
Initial scope, schedule, budget
Sponsor, stakeholders, project team defined</td></tr>
<tr><td>Planning</td><td>Business case including refined scope, schedule, budget and approvals
Benchmarking for non-duplication, lessons learned, and industry best practices</td></tr>
<tr><td>Design/ Engineering</td><td>Detailed design, technical requirements, coordination
Contracting</td></tr>
<tr><td>Staging</td><td>Review and confirmation of project alignment with purpose, benefits, scope, budget, schedule
Key success factors defined</td></tr>
<tr><td>Build/Test</td><td>Build, test and demonstration
Evaluation to defined metrics</td></tr>
<tr><td>Closeout</td><td>Path to production revised
Lessons learned documented
Decommissioning completed
Final report</td></tr>
<tr><td>Continuous Improvement</td><td>Optional phase that some projects progress to when there is project-related continuous improvement activity post Closeout.</td></tr>
</table></td></tr>
<tr><td>(ii).B: Project Status</td><td>A summary of the current state of the project, with activity indicative of whether the project is progressing toward broader adoption. For many new or emerging technology projects, it is not clear until late in the project lifecycle whether the results indicate that the technology is appropriate to be broadly adopted.</td></tr>
<tr><td>(ii).C: Project Location</td><td>For field-based projects the general location is provided. For software or analytics-only projects, the area the project applies to is provided, such as to High Fire Threat Districts (HFTD) or systemwide.</td></tr>
</table>

Condition Item (iii): Results of the pilot, including quantitative performance metrics and quantitative risk reduction benefits.	
Information Type	*Description*
(iii).A: Results to Date	Results of pilot projects are provided through Q4 2020. Project results for prior quarters are included, either labeled by quarter or as Prior Results that may extend to the origin of the project. Results for pilot projects in phases preceding the Closeout phase, as defined in (ii).A, are preliminary and subject to change.
(iii).B: Lessons Learned	Lessons learned for pilot projects are technological learnings, findings, and key takeaways to inform a path to production. Lessons learned can also be barriers, issues, risk, or obstacles that if not solved could jeopardize the path to production. Lessons learned provided for projects in phases preceding the Closeout phase, as defined in (ii).A, are preliminary and subject to change.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field for each project listed in this section in the supplemental filing to be filed no later than February 26, 2021. Quantitative performance metrics are provided, as they are known, and used in the evaluation of a technology including for whether a technology is effective and progressing toward broader adoption. PG&E acknowledges the need for, and value of, establishing quantitative performance metrics at the beginning of a project, and is continuing to improve these quantitative performance metrics for all of the projects included in this section.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field for each project listed in this section in the supplemental filing to be filed no later than February 26, 2021. Quantitative risk reduction benefits that may result from adoption of the technology are provided, as they become better understood. Especially for the pre-commercial technology projects that are a part of this new or emerging technology portfolio, there is inherent uncertainty in the assumptions and estimates that are developed to create the quantitative risk reduction benefit. PG&E acknowledges the need for, and value of, establishing anticipated quantitative risk reduction benefits at the beginning of a project, and is continuing to improve these quantitative risk reduction benefits for all of the projects included in this section.

Condition Item (iv): How the electrical corporation remedies ignitions or faults revealed during the pilot on a schedule that promptly mitigates the risk of such ignition or fault and incorporates such mitigation into its operational practices.	
Information Type	*Description*
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	If the project, in any phase, identifies a potential ignition or fault risk condition (e.g., an in-field asset condition or configuration issue, or a vegetation issue), the potential condition is reported and validated against current PG&E preventive and corrective maintenance guidelines and treated in accordance. In addition, a general statement of such activity is provided in this response.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	Typically, methods to incorporate ignition or fault risk mitigation findings into operational practices are revealed toward the end of the projects as part of the lessons learned and other recommendations in the Closeout documentation. However, if PG&E identifies such risk mitigation methods to inform proposed changes to operational practices, including prior to the conclusion of the project, they will be included in this response.

Condition Item (v): A proposal for how to expand use of the technology if it reduces ignition risk materially.	
Information Type	*Description*
(v).A: 'End Product' at 'Full Deployment' and Location	For this response PG&E is providing the anticipated use of the technology, including anticipated locations, should the technology be proven to be successful and subsequently put into production. Given that the projects are in varying phases of development and precommercial technologies are inherently uncertain, this response is based upon our current understanding of the technology and its applicability to PG&E operations, and subject to change. Early stage projects may not have a clear strategy for the 'end product' at 'full deployment', while others such as those in the Continuous Improvement phase may have already been deployed.

Forward-looking statements detailed through this section, including but not limited to project next steps, expected results, and potential quantitative risk reduction benefits, are subject to change due to the evolving nature of technology and drivers of system and public safety risk.

The projects described below are organized by Program Areas.

Program Area: **Situational Awareness and Forecasting – New or Emerging Technologies**

PG&E is deploying a set of complementary tools to better assess and more accurately locate, often in near real time, environmental events and grid conditions that pose a danger to the grid so that critical issues may be dealt with as quickly as possible to avoid the risk of catastrophic wildfires. Below are potential mitigations leveraging new or emerging technologies; for additional information please see Section 7.3.2.

7.1.D.3.1 SmartMeter™ Partial Voltage Detection

(i).A: Project Type	Emerging (Pre-commercial) Technology
(i).B: Additional References in the 2021 WMP	This project is described in Section 7.3.2.2.2: Situational awareness and forecasting - SmartMeter™ Partial Voltage Detection (Formerly Known as Enhanced Wires Down Detection)
(i).C: 2020 WMP Section	5.1.D.3.4
(i).D: Project Objective and Summary	PG&E's EPIC 1.14: Next Generation SmartMeter™ Telecom Network Functionalities project demonstrated that the SmartMeter™ Telecommunications Network (SMN) can support a variety of both present and future smart grid applications and devices, including using multiple types of outage reporting data from the SmartMeter™ network to better identify and differentiate wire down type outages and share information with distribution management systems more effectively. The SmartMeter™ Partial Voltage Detection (formerly known as Enhanced Wires Down Detection) project builds on this work to assess the ability to use SmartMeter™ technology to locate and identify partial voltage conditions to enable faster response to grid issues. A partial voltage condition can indicate the occurrence of a potentially hazardous distribution grid condition, including hazards that can contribute to wildfire risk. PG&E has enabled Single-Phase SmartMeter™ to send real-time alarms to the Distribution Management System under partial voltage conditions (25-75 percent of nominal voltage). Prior to implementation, SmartMeter™ electric meters could only provide real-time alarms for the outage state. For Three-Wire distribution systems, the partial voltage condition indicates one phase feeding the transformer has low voltage or no voltage. This enhanced situational awareness can help detect and locate the area boundaries between meters encountering normal voltage and those encountering partial voltage. This allows operators to detect and locate partial voltage line sections more quickly to enable faster response to potential wires down, open jumpers, or loss of phase(s) due to unganged fuse operation. Phase 1 partial voltage detection technology has proven successful on 3-Wire distribution systems where transformers are connected line-to-line, and loss of phase results in a partial voltage condition whereby the communication card can detect and then send alerts to the Distribution Management System (DMS) during the event. Phase 1 of this project completed in 2019 included implementation on 4.5 million single phase SmartMeter™ electric meters covering 25,597 line miles of Tier 2 and Tier 3 HFTD areas. Phase 2 of this project is underway. It applies to ~365K 3-phase SmartMeter™ electric meters and relies upon the implementation of firmware detection of partial voltage conditions. The Phase 2 technology is intended to alert on partial voltage conditions on 4-Wire systems where transformers are connected line-to-neutral.

(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	F. Grid operations and protocols: 27. Protective equipment and device settings
(ii).A: Project Phase	Phase 1: Closeout (~4.5 million single-phase meters have been in production since 2019). Phase 2: Design/Engineering (~365K three-phase meters in scope).
(ii).B: Project Status	Phase 1 is in production and has been deployed to ~4.5M meters. Phase 2 is in a development phase with the intent of deployment to 365K meters in Tier 2 and Tier 3 HFTDs by the end of Q2 2021, though this deployment intent is at risk due to a vendor product issue that is currently being assessed.
(ii).C: Project Location	Phase 1: Tier 2 & 3 HFTDs were initially targeted; now deployed system-wide. Phase 2: Targeting system-wide deployments.
(iii).A: Results to Date	Q3 2020/Q4 2020 Phase 2 Project Results: - Meter firmware vendor contract finalized. - Design of Distribution Management System (DMS) data presentation for operator use. - SmartMeter™ firmware functionality testing complete - SmartMeter™ firmware deployment planning complete
(iii).B: Lessons Learned	- In Phase 1, it was discovered that some abnormal SmartMeter™ electric meter conditions (e.g. failed power supply) can produce false positive partial voltage alerts. PG&E had to address these false positives by applying filtering strategies to prevent presentation to operators through the Distribution Management System (DMS).
(iii).C: Quantitative Performance Metrics	Per “Action PGE-18 (Class B)” in Section 5.1.7 of the “Wildfire Safety Division Evaluation of Pacific Gas and Electric Company’s First Quarterly Report” dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. – Ability to detect open jumpers, partial operation of unganged fuses, and wire down events (proven for 3-Wire systems in Phase 1; to be validated for 4-Wire systems in Phase 2). – Ability to incorporate partial voltage detection functionality into the DMS and operational processes.
(iii).D: Quantitative Risk Reduction Benefits	Per “Action PGE-18 (Class B)” in Section 5.1.7 of the “Wildfire Safety Division Evaluation of Pacific Gas and Electric Company’s First Quarterly Report” dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. - Improved visibility to distribution operators and dispatchers through DMS and Outage Management Tool (OMT) of situations where there is a possible partial voltage and/or wire down condition. - Improved locational identification of partial voltage outages to the DMS and OMT, and ultimately enabling more timely resolution of these issues, which can result in lower risk of wildfire ignition and/or spread.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	Phase 1 - Currently in production. Phase 2 - None at this time.

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(iv).B: Methods to Incorporate Project Findings Into Operational Practices	The methodology is to display filtered partial voltage alerts on transformers in DMS maps, which allows operators to be alerted of partial voltage conditions and visualize the boundaries between full voltage, partial voltage and complete outage sections of the distribution system. Integration into the Outage Management Tool will summarize SmartMeter™ partial voltage alert counts in an informational table presentation for current outages. The enhanced situational awareness can help operators detect and locate partial voltage line sections more quickly to enable faster response to potential wires down, open jumpers, or loss of phase(s) due to unganged fuse operation.
(v).A: 'End Product' at 'Full Deployment' and Location	The end product is that the partial voltage detection firmware will be deployed to all compatible PG&E SmartMeter™ electric meters system-wide, with system optimization completed, and functionality integrated into the Distribution Management System and Outage Management Tool, as described in (iv).B above.

7.1.D.3.2 Line Sensor Devices

(i).A: Project Type	New Technology (Commercially Available Offering)
(i).B: Additional References in the 2021 WMP	Section 7.3.2.2.5: Situational Awareness & Forecasting – Line Sensor Devices
(i).C: 2020 WMP Section	5.1.D.3.5
(i).D: Project Objective and Summary	Line Sensors are primary conductor-mounted devices that continuously measure current in real-time and report events as they occur, and in some cases the current waveform of grid disturbances. These line sensors are next-generation fault indicators with additional functionality and communication capabilities. Line Sensor technology can reduce wildfire risk and improve public safety by continuous monitoring of the grid, performing analytics on captured line disturbance data, identifying potential hazards, and when necessary dispatching field operations to proactively patrol, maintain, and repair discovered field conditions or assets on the verge of failure.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	F. Grid operations and protocols: 27. Protective equipment and device settings
(ii).A: Project Phase	Build/Test
(ii).B: Project Status	Line sensors have been deployed on 60 feeders covering a total of 4,898 circuit miles in Tier 2 & 3 HFTDs. On a daily basis, the data from these sensors are being used to investigate the source of unknown cause outages.
(ii).C: Project Location	Tier 2 & 3 HFTD in the North Bay, Sonoma, North Valley, Humboldt, Yosemite, and Sierra divisions.

(iii).A: Results to Date	Q3 2020/Q4 2020 - Developed line risk evaluations based on line sensor and other data for select HFTD circuits to calculate location of potential issues. Informed field operations for further inspection/assessment/maintenance. - Continued device deployment to circuits in HFTDs in the Humboldt, Stockton, Yosemite, and Sierra divisions. - Improved analytics methods and automation.
(iii).B: Lessons Learned	- When combined with other data sources, line sensor devices contribute valuable data to enable proactive condition detection. - Inputs from other sensors and systems as well as analytics are required to improve accuracy and results.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. - Effectiveness in detecting incipient faults with a low level of false positives.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Line sensors are being used to identify unresolved outage sources such as suspected momentary vegetation contact or other outages that generate momentary or sustained outages where a problem is not found during patrol. By using the line sensor data, we can use the improved locational information and fault type to generate more specific investigation patrol information. By addressing these outage types more proactively, we can resolve many of the conditions prior to fire season and high fire threat days.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	When a suspected high-risk condition is found by the Line Sensor Device team, the local restoration team is alerted and dispatched to patrol and rectify the situation as needed.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	PG&E is using data provided by line sensor technologies to bolster asset health and performance through a three-step process: (i) Collecting line sensor data attributes on disturbances to create a database of disturbance signatures for disturbance evaluations; (ii) Detecting disturbance information from Tier 2 and Tier 3 HFTDs and matching the captured disturbance data against the signature database to determine if a distribution line risk is likely to materialize as a hazard; (iii) Matching line sensor data attributes on line risks in a manner in which they can be evaluated in the distribution network model software to estimate the location of the line risk for proactive field patrol, inspection, and repair, if necessary, before failure to reduce risk and improve system safety.
(v).A: 'End Product' at 'Full Deployment' and Location	This product is one component of a set of grid sensor technologies (as described in 7.3.2.2 Continuous Monitoring Sensors) that, as a set, are optimized to support and complement each other. This product would be deployed to circuits in Tier 2 & 3 HFTDs and would be integrated into Distribution Control Center, Maintenance, and Field Operations functions to support faster fault identification (including location data) for proactive maintenance prior to high fire risk periods.

Program Area: **Grid Design and System Hardening—New or Emerging Technologies**

PG&E is reducing the risk of fire ignition and potential impacts on public safety through the adoption of system hardening methods enabled through innovative technologies (e.g. new grid topologies or new resilience and PSPS avoidance technologies or techniques). Mitigations leveraging new or emerging technologies include the following:

7.1.D.3.3 EPIC 3.15: Proactive Wires Down Mitigation Demonstration Project (Rapid Earth Fault Current Limiter)

(i).A: Project Type	Emerging (Pre-commercial) Technology
(i).B: Additional References in the 2021 WMP	7.3.3.17.4
(i).C: 2020 WMP Section	5.1.D.3.6
(i).D: Project Objective and Summary	The EPIC 3.15 Proactive Wires Down Mitigation demonstration project seeks the ability to automatically and rapidly reduce the flow of current and risk of ignition in single phase to ground faults through the use of Rapid Earth Fault Current Limiter (REFCL). REFCL works by moving the neutral line to the faulted phase during a fault, which significantly reduces the energy available for the fault. This significantly lowers the energy for single line to ground faults by reducing the potential for arcing and fire ignitions, as well as better detection of high impedance faults and wire-on-ground conditions. REFCL technology is applicable to three-wire unit-grounded circuits, which make up the majority of PG&E's distribution circuits within HFTDs.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	C. Grid design and system hardening: 14. Risk-based grid hardening and cost efficiency 15. Grid design and asset innovation
(ii).A: Project Phase	Design/Engineering
(ii).B: Project Status	All of the REFCL system equipment has been installed and initially tested. Further commissioning of the system is ongoing (as of late January) and a comprehensive testing program will begin in March 2021, with the project completed by July 2021. Based on feedback from Australian utilities who have leveraged this technology, ongoing observation and adjustment of various system parameters may be needed to "fine-tune" the REFCL system going forward. Evaluation of additional substations for suitability of REFCL installations has begun but is pending results and learnings of the Calistoga pilot project before design or field work starts on additional sites.
(ii).C: Project Location	Substation in a Tier 3 HFTD in the North Bay.

(iii).A: Results to Date	Q4 2020 - Completed substation construction and all the distribution field installations in Q4 2020.
(iii).B: Lessons Learned	- The Ground Fault Neutralizer (GFN) adds on another layer of system protection with greater sensitivity to ground faults than traditional system protection schemes commonly used in the USA which utilize solid grounding. In digital simulation testing, the GFN showed the capability to detect high impedance ground faults upwards of 16K ohms, which is in the typical range for vegetation contact faults. The GFN also shows promise of detecting reverse earth faults resulting from specific wires-down situations, which are especially challenging to detect and pose a public safety risk. – A key lesson learned is the need for balancing the line to ground capacitance of each phase on the distribution circuits where a GFN is deployed. A detailed review was performed in the project and it highlighted the need for capacitive balance units to have precise control over the balancing and achieve the greatest fault sensitivity. Group tapping for line voltage regulators was also determined to be required, so a new multiphase regulator controller was tested and verified for this function.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. – Performance as compared to fault response time performance standards – Faulted conductor voltage < 1,900 V within 85 ms – Faulted conductor voltage < 750 V within 500 ms – Faulted conductor voltage < 250 V within 2,000 ms - Identifying faulted circuit
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. REFCL may be able to reduce the likelihood of ignitions for certain types of single line to ground faults. This reduction in ignition likelihood would reduce the wildfire risks for those lines that have REFCL installed.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	The GFN will be operational in the North Bay substation to add another layer of system protection to the two connected distribution circuits. If a ground fault is detected, the GFN will autonomously mitigate the fault current and identify which circuit the fault is on. Pre-defined criteria will determine how the fault is cleared, whether through recloser tripping or cutover to solid grounding depending on ambient conditions. The plan for additional production implementations of the technology is in development.

(iv).B: Methods to Incorporate Project Findings Into Operational Practices	A Substation Earth Fault Management relay interface controller is currently in development and is needed to integrate the GFN into operational practices and the SCADA system. Operators will have visibility into the status of the GFN and make control decisions if a fault is detected. Training sessions with operations personnel are being scheduled showing how the REFCL technology works and the associated controls.
(v).A: 'End Product' at 'Full Deployment' and Location	- The end product is that the REFCL system would be deployed to substations in Tier 2 and 3 HFTDs, including substation components (arc suppression coil, GFN control cabinet, residual current compensator, and potentially upgraded CTs and relays) and field work (capacitive balancing, upgraded line reclosers, and upgrades to regulators, capacitor banks, and insulation levels as needed). - Capacitive operational analysis incorporated into planning and analysis of planned and unplanned outages. - Annual training for field personnel who would interact with the system, distribution operations, and distribution engineering. - Annual testing of circuit and REFCL system to check reliability/sensitivity of REFCL system operations and insulation tests to detect equipment that is overly stressed and likely to fail during REFCL operation.

7.1.D.3.4 Distribution, Transmission, and Substation: Fire Action Schemes and Technology

1. Note: Due to the sensitive nature of the experimental, proprietary technology, PG&E is unable to disclose extensive details about the DTS-FAST pilot project in public filings. Upon request, PG&E can provide further information under confidentiality protections.

(i).A: Project Type	Emerging (Pre-commercial) Technology
(i).B: Additional References in the 2021 WMP	8.1
(i).C: 2020 WMP Section	5.1.D.3.7
(i).D: Project Objective and Summary	DTS-FAST is an internal PG&E development and is currently in pilot phase. This technology pilot aims to use fraction-of-a-second technologies to detect objects approaching energized power lines and respond quickly to shut off power before object impact. PG&E is implementing a pilot to engineer, construct, install and monitor a new technology on a PG&E transmission circuit to assess the technology's efficacy at mitigating PG&E's wildfire and safety risks. Next steps and potential operationalization of this technology is dependent on an assessment of pilot findings.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	C. Grid design and system hardening: 12. Grid design for minimizing ignition risk 15. Grid design and asset innovation

(ii).A: Project Phase	Build/Test
(ii).B: Project Status	Pilot construction on a 115 kilovolt (kV) transmission circuit is 70 percent completed.
(ii).C: Project Location	Proof of concept completed at San Ramon, CA. Pilot being constructed on a 115kV transmission circuit.
(iii).A: Results to Date	Q3 2020/Q4 2020 - Engineering and construction details completed for pilot on 115kV transmission circuit.
(iii).B: Lessons Learned	- Proof of concept model was tested and retested to confirm the technology, as designed, would meet the detection, speed and signal confirmation requirements for subsequent testing through a pilot.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. - Ability to provide real-time signals from field demonstrating detection and/or non-detection. - All equipment with DTS-FAST must withstand harsh environmental conditions and remain operable. - Displays representing field conditions must accurately reflect equipment-health conditions between the field and points monitored. - The location and type of equipment failure must be detected at high level of accuracy. - Visual cameras must work under high voltage and high EMF conditions. - DTS-FAST must detect failure conditions in scope for project.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Wildfire risk reduction benefits, as described in (i).D above, are dependent upon assessment of pilot findings.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	- Assess optimal locations for technology implementation. - Engage technology vendors for hardware needs. - Secure resourcing required for targeted implementation, including mitigation strategy for potential COVID-19 impacts.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	- Leverage pilot findings for operational implementation. - Monitor new installations and assess success criteria to ensure technology is working optimally. - Assess impacts on asset inspections enabled through real time sensor data. - Assess impacts on ability to reduce PSPS events and expedite restoration times.

(v).A: ‘End Product’ at ‘Full Deployment’ and Location	Full deployment plans will be dependent on findings of pilot. If successful, PG&E will consider a targeted approach to post-pilot implementation to help ensure high impact areas are first addressed, taking into account risk-based and feasibility assessments.

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7.1.D.3.5 Remote Grid

(i).A: Project Type	New Technology (Commercially Available Offering)
(i).B: Additional References in the 2021 WMP	7.3.3.17.5
(i).C: 2020 WMP Section	5.1.D.3.8
(i).D: Project Objective and Summary	A "Remote Grid" is a new concept for utility service using standalone, decentralized energy sources and utility infrastructure for continuous, permanent energy delivery in lieu of traditional wires to small loads in remote locations at the edges of the distribution system. In many circumstances, the feeders serving these remote locations traverse through HFTDs areas. If these long feeders were removed and the customers served from a local and decentralized energy source, the resulting reduction in overhead lines could reduce fire ignition risk as an alternative to or in conjunction with system hardening. In addition to reducing wildfire risk, Remote Grid could be a cost-effective solution against expense and capital costs for the rebuild of fire-damaged infrastructure or for HFTD hardening infrastructure jobs to meet new HFTD build standards. PG&E's Remote Grid Initiative will validate and develop Remote Grid solutions as standard offerings such that they can be considered alongside or as an alternative to other service arrangements and/or wildfire risk mitigation activities such as system hardening. The findings of other pilot or demonstration projects, including EPIC 3.03: Advanced Distribution Energy Resource Management System, which looks to develop increased situational awareness and control capabilities of DERs, will help to support the deployment of remote grid configurations.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	C. Grid design and system hardening: 12. Grid design for minimizing ignition risk 13. Grid design for resiliency and minimizing PSPS 14. Risk-based grid hardening and cost efficiency
(ii).A: Project Phase	Build/Test
(ii).B: Project Status	The projects are advancing through scoping, assessment, contracting, design, and permitting activities, building understanding of the many aspects required for a successful Remote Grid. The three leading projects (some comprising five remote grid sites) are in the permitting and construction stages. Initial projects have been delayed due to unforeseen permitting delays due to presence of threatened species. Additional sites under consideration are undergoing detailed feasibility assessment to address constructability and customer acceptance before down selecting to a complete set of initial projects.
(ii).C: Project Location	Three initial remote grid projects (some comprising multiple remote grid sites) are in Mariposa and San Luis Obispo counties. Additional projects in HFTDs in El Dorado, Madera, Fresno, Tulare, Santa Barbara, Yuba, and Sierra counties are currently being assessed.

(iii).A: Results to Date	Q2 2020 - Completed field site visits to identify additional projects to pursue for concept validation. - Completed first broad RFP solicitation which was received by more than 20 technology integration and construction vendors, delivering initial validation of commercial availability. Q3 2020 - Developed and awarded major update of contract, including updated technical specification. - Documented detailed protocol to identify and evaluate potential projects. Q4 2020 - Negotiated & executed a turnkey Purchase and Sale Agreement and a 10-year full-wrap Maintenance Agreement, forming a reusable template for future Standalone Power System procurements. - Drafted terms of service into a form of Supplemental Provisions to the Electric Rules, as a tariffed form agreement. - The majority of customers engaged to date have voiced positive initial interest in pursuit of service conversion from overhead line to a Remote Grid. - Filed the proposed form of Supplemental Provisions Agreement with the CPUC in Advice 6017-E[(a)] on December 15, 2020. - Benchmarking with other utilities shows a point of validation in the advanced program now operational under Horizon Power in Western Australia. In California, Liberty Utilities has procured first Standalone Power System for a similar application.
(iii).B: Lessons Learned	- PG&E identified the technology combination of Solar Photovoltaic Generation and Battery Energy Storage with supplemental Propane Generators as the most cost effective, reliable, and cleanest solution for initial Remote Grid sites. - PG&E found there was sufficient initial vendor interest and availability to engage in contracting to deploy systems with specifications and terms responsive to PG&E's requirements. - A number of site-specific conditions can reduce individual project feasibility or delay implementation. Examples include: customer acceptance, physical space constraints, shading and other constructability related considerations such as grading and geological conditions, permitting challenges such as presence of threatened species, cultural heritage, or adjacency to scenic highway.

(a) See Advice 6017-E "Remote Grid Standalone Power System Supplemental Provisions Agreement" https://www.pge.com/tariffs/assets/pdf/adviceletter/ELEC_6017-E.pdf.

(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. The project success criterion is the establishment of proof that a complete Remote Grid system can be installed and operated at an economically viable price point while meeting safety, performance, and reliability requirements. Potential metrics include: - Cost of deployed stand-alone power system and forecasted future expense compared to the cost of other wildfire risk mitigations considered (e.g. undergrounding, overhead hardening). - Number of overhead line miles removed. -Stand-alone power system reliability (i.e. uptime). - CO_2 Emissions from Standalone Power Systems - Project cycle time duration (deployment speed from start to finish).
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. The anticipated benefit of Remote Grid is to reduce the wildfire ignition risks related to overhead distribution infrastructure. Remote Grid may be able to cost-effectively substitute for other options in an eventual volume of locations which could make a meaningful impact to the overall cost and risk reduction of the larger System Hardening portfolio. The more cost effective the solution turns out to be, the more locations it may reach, and the greater the benefit to the combined portfolio.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	The initial projects under way in 2020 are positioned as fully featured, long-term asset deployments with performance and reliability targets that will result in these projects eliminating segments of overhead line exposure. When these projects go online, an immediate ignition risk reduction can be realized upon de-energization of the infrastructure they replace.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	Standardization of to-be-proven Remote Grid site assessment and deployment processes, technical specifications, vendor contract templates, identification of qualified providers, and operational protocols (e.g. outage detection and response coordination) are needed to enable more rapid deployment of potential future Remote Grids. Further validation of the actual costs and lead time to deliver utility-grade performance and reliability will enable understanding of how widespread the benefits of this approach may be, relative to the occurrence of the requisite grid topology existing on the PG&E distribution system today. For instance, it is more likely that a Remote Grid would be appropriate at the end of an overhead distribution feeder with small numbers of customers.
(v).A: 'End Product' at 'Full Deployment' and Location	If this project is determined to be successful, the Remote Grid concept would be developed as a standard service offering and considered alongside other risk mitigations, such as overhead hardening and undergrounding, and deployed wherever it is cost effective and feasible. Possible appropriate deployment locations would be at the ends of overhead distribution feeders that serve small numbers of customers in HFTDs.

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7.1.D.3.6 EPIC 3.11: Multi-Use Microgrid

(i).A: Project Type	Emerging (Pre-commercial) Technology
(i).B: Additional References in the 2021 WMP	
(i).C: 2020 WMP Section	5.1.D.3.9
(i).D: Project Objective and Summary	The EPIC 3.11: Multi-Use Microgrid demonstration project develops and tests the technology, processes, and business models needed to deploy and operate multi-customer microgrids that are integrating third party-owned renewable energy generation assets to power the microgrid on a section of PG&E's distribution system. This includes the design and development of control specifications and SCADA integrations to maintain visibility and operational control of the microgrid in grid-connected and islanded modes. The findings of this project will help support microgrid growth to further resiliency and enhanced customer choice.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	C. Grid design and system hardening: 13. Grid design for resiliency and minimizing PSPS
(ii).A: Project Phase	Build/Test
(ii).B: Project Status	Functional design specification for the microgrid controller and the end to end integration network architecture and security approach have been finalized. Operational decisions for the microgrid including for communication and hardware fail-safes were evaluated in order to prepare the microgrid for integration at the Distribution Control Center. This specification along with the completed Concept of Operations (CONOPs) documentation is now being used to complete PG&E's advanced microgrid testbed. This pilot is progressing towards broader adoption, including creating standards and tariffs that would be needed to enable PG&E to partner with third parties (such as communities) and deploy microgrids.
(ii).C: Project Location	McKinleyville (Humboldt County). The project, the Redwood Coast Airport Microgrid, serves the Arcata-Eureka Airport business community incorporating 18 PG&E and Redwood Coast Energy Authority customers, including critical facilities such as the airport and a United States Coast Guard station.
(iii).A: Results to Date	Prior Results - Provided key feedback to microgrid controller manufacturers to inform the development of the Functional Design Specification document - Developed guideline questions for future microgrid controller testing beyond this project in order to support standardization. Q3 2020 - Started SCADA design (in progress) - Refined Functional Design Specification. - Completed communication and hardware fail-safes decisions Q4 2020 - Configuration of information points list and human-machine interface - Controller Test Plan aligned with third-party manufacturer - Utilized lessons learned from this project to publish a Community Microgrid Technical Best Practices Guide

(iii).B: Lessons Learned	- In order to ensure reliability and mitigate customer power loss, circuits should be designed to allow microgrid mode transitions to be seamless. - Verify prior to system design that preferred communication systems, such as the FAN, are available - Ensure clear designation and separation of stakeholder responsibilities, particularly between the utility and the microgrid generation owner/operator. - Defining if microgrid will be allowed to operate under certain fail-safe conditions requires strong operator buy-in and participatory planning. The process used for this project can serve as a useful guide for future microgrid deployment. - Because each microgrid configuration is unique it may not be possible to fully standardize and streamline processes and technology to be applicable for all microgrids. Future frameworks will need to be flexible to accommodate unique project needs. - Future project economics will likely differ significantly from the EPIC-funded Redwood Coast Airport Microgrid project and could be a major barrier to future scalability of multi-customer microgrids.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. The pilot and broader deployment success criteria are: - Successful operation of the project's multi-customer microgrid (the Redwood Coast Airport Microgrid) to satisfy community demand for enhanced resilience including seamless transitions between normal grid-connected and islanded modes of operation. - Validation that this multi-use microgrid model is replicable, scalable, and can inform the design of other multi-customer microgrids.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. This project's wildfire risk reduction benefit is related to its replicability of future microgrids in HFTDs. The processes, standards, and tariffs developed and tested out in this project will directly inform the development of other microgrid supporting programs such as the Community Microgrid Enablement Program. Overall, Microgrids reduce the impact of PSPS by providing power to safe-to-energize regions during wildfire threats.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	- Controller testing in PG&E's Microgrid Test Bed is being designed to be replicable and scalable to a wide range of microgrid controllers. This will facilitate the deployment of control schemes for future microgrid sites.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	- This project is designing the microgrid to be visible and controllable from the PG&E control center. Its operational guidebook will be the basis for integrating future microgrids of this kind into the control center operations. - A microgrid operating agreement is being developed and will form the basis of similar agreements for future community microgrids.
(v).A: 'End Product' at 'Full Deployment' and Location	Full deployment for this project is a permanent and in-field microgrid at Arcata-Eureka Airport, with visibility and control from PG&E control center. The formalization and documentation of a repeatable process will enable a streamlined approach to deploying additional Multi-Use Microgrids as appropriate in HFTDs.

Program Area: Asset Management and Inspections—New or Emerging Technologies

PG&E is developing new inspection tools and methods to quickly identify issues and proactively manage asset and system maintenance. This in turn reduces the risk of asset failure and potential impacts on our customers. PG&E is leveraging existing technologies, including remote sensing technologies such as LiDAR data and drone imagery capture[3], to accurately identify risks, including encroachment clearance and vegetation health. Combined with machine learning software, remote sensing data are being evaluated to identify dead or dying trees that could pose wildfire hazards or contribute to a wires-down situation. Mitigations leveraging new or untested technologies include the following:

7.1.D.3.7 Enhanced Asset Inspections—Drone/AI (Sherlock Suite)

(i).A: Project Type	New Technology (Not Widely Commercialized)
(i).B: Additional References in the 2021 WMP	
(i).C: 2020 WMP Section	5.1.D.3.10
(i).D: Project Objective and Summary	In 2019, PG&E collected more than 2.5 million high-resolution images (up to 100 megapixel) of our Electric Transmission assets through drones, helicopters, and other means of data capture as part of our enhanced inspection program (WSIP), and has collected an additional 2.5 million images in 2020 as a part of the aerial inspection program. This imagery, when labeled appropriately, can be used to train computer vision models to identify specific components, and in some cases, evaluate the condition of those components. To address this, PG&E is developing an application, Sherlock, to bolster its data visualization capabilities. Sherlock is a web application that allows inspectors to view photographs of assets along with associated data. Sherlock allows for remote access to data captured through drone/helicopter images and enables a review of said data to ensure that only corrected data is viewed by inspectors, reducing the time from flight to inspection. In addition, inspectors can markup issues within the inspection profile of the application, which generates the necessary documentation from the application itself, ensuring auditability and data quality. This documentation provides PG&E with increased data management, reporting, and audit capabilities. The markups from Sherlock feed into computer vision models. Computer vision models are being trained to classify photos, identify asset components, and search for potential issues in an automated fashion. Models within the inspection flow are currently being used to flag select images (e.g. overview, right of way, asset tag) for inspectors. Inspectors can label data and provide

[3] Future drone technology adoptions are dependent upon FAA regulations for Line of Sight requirements. If exceptions are granted to these requirements, PG&E will have the opportunity to consider new or untested drone technology use cases such as: (i) extended line of sight operations for greater crew efficiency; (ii) autonomous flight paths to expedite drone inspections; (iii) new charging methods that leverage existing asset infrastructure to minimize charging time and increase flight time.; and (iv) new data processing techniques that minimize data hand off processes by capturing and processing data in-air, allowing for greater in-air operation.

	feedback on the predictions which improves the models over time while reducing the inspection time and increasing inspection quality. Further, building and improving these models provides opportunities to use computer vision to flag images for review before humans see them, for prioritizing assets/lines for inspection, for identifying asset inventory, and as inputs to models that predict future asset failure.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	D. Asset management and inspections: 16. Asset inventory and condition assessments 18. Asset inspection effectiveness 20. Quality Assurance/Quality Control (QA/QC) for asset management
(ii).A: Project Phase	Build/Test
(ii).B: Project Status	The Sherlock Suite now includes six different profiles for different types of users across the aerial inspection program, in addition to a number of object detection and image classification models. Four AI models are currently in production, classifying images of “standard items” to reduce overall inspection time. Additionally, seven manual processes have been completely automated since the beginning of this project, and the teams are working to further automate manual steps so that inspectors can focus on looking for potential issues on assets.
(ii).C: Project Location	Systemwide Applications

(iii).A: Results to Date	Q2 2020 The following items were delivered: - Remote image load (cloud to cloud). - Image quality assurance capabilities. - Near real-time tracking of remote inspections within Sherlock. - Created a model to classify images of the top of a structure. - Improved data pipeline, and improved application security. - C-hook detection capabilities. Q3 2020 - Ability to view completed inspections and potential emergency tags in the post-Inspection quality check profile - Line level reporting and prioritization. - Standardization of items predictions (level 1 automation). - Development of multi component detection capabilities. - Development of bird nest detection. - Development of C-hook wear classification. Q4 2020 - Ability for post inspection QC with automated tracking within Sherlock - Inspection form built within Sherlock, writing to system of record directly - Bird nests flagged for inspectors using AI - Ability to add new AI models to detect potential failures to the inspector profile - Ability to run AI models at scale against millions of images in a cost-effective manner - Ability for pre-inspection QA to occur within Sherlock - Development of insulator detection, damaged cross-arm detection AI models
(iii).B: Lessons Learned	Research shows that introducing AI can affect behavior. For example, introducing automation, if not done carefully, can lead to human error due to fatigue or complacency. We are consistently measuring behavior to ensure safety of the inspection processes. As a result of this learning, we are starting our AI deployments with standard items, such as images of asset tags, overview image, access path, etc. before deploying failure detection models into production.
(iii).C: Quantitative Performance Metrics	Per “Action PGE-18 (Class B)” in Section 5.1.7 of the “Wildfire Safety Division Evaluation of Pacific Gas and Electric Company’s First Quarterly Report” dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. - Reduction in time from imagery capture to inspection – started tracking in Q2 2020 - Reduction to imagery inspection times (cumulative) – tracking since 2019 - Upgrade/downgrade rate improvements (inspection quality) – anticipated by Q1 2021
(iii).D: Quantitative Risk Reduction Benefits	Per “Action PGE-18 (Class B)” in Section 5.1.7 of the “Wildfire Safety Division Evaluation of Pacific Gas and Electric Company’s First Quarterly Report” dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Wildfire risk reduction benefits are anticipated though are not proven at this time.

(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	This technology is already in use by remote inspectors. Models within the inspection flow are currently being used to flag select images (e.g. overview, right of way, asset tag) for inspectors, to help focus inspection efforts on potential ignition risks.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	See reporting input (iv).A.
(v).A: 'End Product' at 'Full Deployment' and Location	Sherlock is in production and being used by different user groups across the transmission aerial inspection process. We continue to release new features on a regular basis. Future state developments include additional remote inspection processes for transmission, distribution, and substation. Potential capabilities to further enable inspectors, supervisors include: (i) data and imagery quality checks and assurance, (ii) data and imagery quality assurance, and (iii) artificial intelligence enabled search functionalities. Advanced deployments of computer vision models could allow auto-filling inspection forms, automatic flagging of asset issues, and flagging of image quality issues. Additionally, instrumentation to measure inspection quality throughout the process, as well as writing back to source systems (e.g. SAP, GIS), may be considered.

7.1.D.3.8 Below Ground Inspection of Steel Structures (Steel Transmission Structure Corrosion Assessment and Mitigation Pilot)

(i).A: Project Type	New Technology (Commercially Available Offering)
(i).B: Additional References in the 2021 WMP	7.3.4.10
(i).C: 2020 WMP Section	5.1.D.3.12
(i).D: Project Objective and Summary	PG&E is implementing a pilot that will regularly inspect steel assets below groundline to detect steel corrosion and concrete degradation that may compromise structural integrity, with the goal of reducing risk of steel assets in the transmission steel structures. To inspect below ground, the foundations/footings of steel towers and poles are excavated and evaluated for structural integrity, including measuring steel member material section loss and collecting environmental and soil data (soil resistivity, pH, structure to soil potential/DC voltage, reduction-oxidation reaction). Repairs and mitigations would then be prioritized, based on the field evaluations and soil samples, in combination with other evaluations of tower/structure and overhead assets.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	D. Asset management and inspections: 16. Asset inventory and condition assessments
(ii).A: Project Phase	Planning
(ii).B: Project Status	We continue to evaluate potential contractors prior to finalizing contracts.
(ii).C: Project Location	Approximately 1000 locations throughout the PG&E service territory, including in HFTDs, are planned.

(iii).A: Results to Date	Prior Results - Data analysis and project definition. - Structure selection and reaching out to contractors. - Designing the Field Experimentation through a selection of measurements that will provide PG&E the answers sought. Q3 2020/Q4 2020 - Project scope finalized - Structures for testing identified - Field operations processes and methods for project implementation documented.
(iii).B: Lessons Learned	None to date.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. - We anticipate the following performance metrics: - Assessing ~1000 transmission structure footings. - Documentation of data inputs including soil resistivity, depth of water table, drainage conditions - to contribute to asset health assessment. - Ability to apply analytics from data collected for insights to inform cathodic protection preventative maintenance programs - Ability to apply advanced analytics to the data will improve risk assessment of structures. - Post project closeout, comparison of below ground corrosion with above ground conditions to evaluate for potential correlations.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. This pilot aims to provide data as to the Asset Health of the below ground foundation of selected steel structures. The knowledge gathered will help the Asset Management and Civil Engineering teams identify required intervention (repair/replace recommendation) and provide a measure of structural design performance over the asset's service life to reduce the risk of structure failure and reduce the probability of an associated wires-down event that could cause wildfire ignition.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	If the project proves successful, it will provide high quality data inputs that can be used to inform asset maintenance decision-making. PG&E will assess findings and identify next steps based on findings of the project, including an assessment of the accuracy of estimating below ground corrosion based on above ground conditions.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	- Data can be integrated into asset management data models to help prioritize asset maintenance practices based on risk assessments. - Depending on findings of below ground corrosion conditions, PG&E may consider deploying cathodic protection to better protect from corrosion impacts. The pilot would help dictate where cathodic protection would be most impactful.
(v).A: 'End Product' at 'Full Deployment' and Location	- Broader implementation of below ground inspection of steel structures - Data integrated into asset management data models to help prioritize asset maintenance practices based on risk assessments - Depending on findings of below ground corrosion conditions, PG&E may consider deploying cathodic protection to better protect from corrosion impact.

7.1.D.3.9 EPIC 3.41 – Drone Enablement

(i).A: Project Type	New Technology (Not Widely Commercialized)
(i).B: Additional References in the 2021 WMP	
(i).C: 2020 WMP Section	This project was mentioned at the end of Section 5.1.D.3 New or Emerging Technologies – Project Summaries as a project that PG&E may pursue within EPIC.
(i).D: Project Objective and Summary	This project proposes to test the following two hypotheses: 1. Transmission Line & Substation Inspections: Automated and Beyond Visual Line of Sight (BVLOS) drone flight operations can offer a more accurate, safe and more efficient alternative to Transmission Line & Substation asset inspection than today's manual drone operations. 2. Distribution Alert Verification: Automated and BVLOS drone operations can provide a fast, safe and effective solution for field-validating the range of alerts that will be produced through the predictive sensors that are planned to be deployed across the distribution system.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	D. Asset management and inspections: 16. Asset Inventory and condition assessments 17. Asset inspection cycle 18. Asset inspection effectiveness 19. Asset maintenance and repair
(ii).A: Project Phase	Design/Engineer
(ii).B: Project Status	The project was officially launched in August 2020. The internal project team has been staffed, and the team has partnered with an external expert of drone technology and the FAA regulatory requirements and process to provide critical support during the Design/Engineering phase of the project. The team has developed a preliminary project plan and has begun to document the details of each planned use case. These use cases will be translated into a Concept of Operations (CONOPS) document and then translated into technical requirements for the upcoming Request for Proposals (RFP) to identify a drone vendor partner. The team has also begun preliminary coordination with the FAA.
(ii).C: Project Location	Project location is TBD. The team is actively working with the consultant on site selection parameters that will both support the project's objectives and meet FAA requirements for BVLOS operations.
(iii).A: Results to Date	Q3 2020 - Business Plan approved Q4 2020 - Expert drone consultant onboarded - Project schedule established - Use case questionnaire form completed (transmission, substation & distribution) for CONOPS development - Slide deck for discussion with FAA drafted - Initial RFP invitee list drafted
(iii).B: Lessons Learned	None to date.

(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Transmission & Substation Inspections: - Number of automated flight plan proposals approved - Number of automated flights conducted within Visual Line of Sight (VLOS) - Number of automated flights conducted BVLOS - percent reduction in time of automated inspection compared to equivalent manual inspection - Quality of data captured compared to data captured manually - Number of automated drone operations with flight issues/violations - Number of automated drone operations without flight issues/violations - Maximum uninterrupted drone flight time for drones equipped with in-flight battery recharging subsystem - Maximum non-stop flying range for drones equipped with in-flight battery recharging subsystem Distribution Alert Verification: - Number of automated flight plan proposals approved - Number of automated flights conducted within VLOS - Number of automated flights conducted BVLOS - percent reduction in time of automated alert verification compared to equivalent physical employee verification - Number of field validations that find asset issues requiring remediation - Maximum uninterrupted drone flight time for drones equipped with in-flight battery recharging subsystem - Maximum non-stop flying range for drones equipped with in-flight battery recharging subsystem Relevant CPUC-approved metrics: - Maintain / Reduce operations and maintenance costs - Criteria air pollution emission reductions - Public safety improvement and hazard exposure reduction - Utility worker safety improvement and hazard exposure reduction
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Using automated drone dispatch and data capture to investigate alerts generated by sensors in the distribution system has the potential to improve the efficiency and effectiveness of proactive asset health monitoring in HFTDs.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	TBD
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	TBD

(v).A: 'End Product' at 'Full Deployment' and Location	1. Transmission & Substation Inspections: Scaled up version of the solution at the end of the EPIC project to extend to the broader set of Transmission lines and substations in HFTDs. Ability to collect imagery data utilizing an autonomous UAV for detailed inspections on all assets within scope. 2. Distribution Alert Verification: Scaled up version of the solution at the end of the EPIC project to extend to the broader set of distribution assets in HFTDs. Improved integration between sensor alert system and drone system, with automated sharing of geospatially referenced alerts. Command and control application to monitor and track health and status of the fleet of drones and suggest which drone to deploy for inspection or field validation based on location, range, charge level, weather and other relevant factors. Potentially also a consolidated physical mission control center within a Distribution Control Center for operational management and situational awareness of the fleet of drones. Interfaces between the drone system and additional field sensor alert systems would be created (beyond the specific field sensors being used in this project; for instance, some combination of sensors from the Line Sensor, Enhanced Fault Detection, or Distribution Fault Anticipation projects).

Program Area: **Vegetation Management and Inspections—New or Emerging Technologies**

PG&E is using a variety of technologies to improve our vegetation management practices. For instance, physical ground inspections are being augmented by the capture of LiDAR and related, remote sensing, data that can be thoroughly and consistently analyzed to take measurements, reveal patterns and identify risks. Vegetation Management has benefited from improved intelligence regarding vegetation density and can leverage this data to strategically deploy resources where vegetation is near electrical assets.

Mitigations leveraging new or emerging technologies include the following:

7.1.D.3.10 Mobile LiDAR for Vegetation Management

(i).A: Project Type	New Technology (Commercially Available Offering)
(i).B: Additional References in the 2021 WMP	7.3.5.7
(i).C: 2020 WMP Section	5.1.D.3.13 (In the 2020 WMP, titled as "Mobile LiDAR for Distribution Inspections")
(i).D: Project Objective and Summary	This project seeks to validate that high-resolution data captured with vehicle and backpack-mounted Light Detection and Ranging (LiDAR) and imagery units can help reduce fire risk and improve compliance of PG&E's Vegetation Management (VM) process. The 2020 Pilot focused on one 84-mile circuit to evaluate the benefits and risk spend efficiency of LiDAR to the Planning, Pre-Inspection, Work Verification, and Documentation phases of the end-to-end VM radial clearing process.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	E. Vegetation management and inspections: 22. Vegetation inspection cycle 23. Vegetation inspection effectiveness 24. Vegetation grow-in mitigation 26. QA/QC for vegetation management
(ii).A: Project Phase	2019 Pilot: Closeout 2020 Pilot: Closeout 2021 Pilot: Planning
(ii).B: Project Status	Q4 2020: Closeout of 2020 Pilot Preparations are underway for an enhanced Mobile LIDAR collection effort in 2021.
(ii).C: Project Location	2019 Pilot: ~18K miles driven in Tier 2 & 3 HFTDs. 2020 Pilot: 84 driven miles along a circuit in Placer and Nevada counties. 2021 Pilot: TBD
(iii).A: Results to Date	Prior Results – See (iii).B Lessons Learned below. Q3 2020 / Q4 2020 – Collected and analyzed Pre- and Post-Work measurements. – Performed field check of preliminary 2019 radial clearing results, and assigning toward remediation when appropriate. – Determined the percent of circuits measurable from a road with sufficient quality in Tier 2 & 3 HFTDs.

(iii).B: Lessons Learned	From the 2019 Pilot PG&E learned that Mobile LiDAR is capable of measuring radial clearances and clearances to sky, and: – Initiated operationalization of results into vegetation management (VM) processes. – Derived cost and data analysis cycle time performance measures for both vehicle and backpack-mounted sensors. In addition, PG&E has learned: – To reduce false positives, point cloud analysis teams need an accurate inventory of primary conductor assets (e.g. the teams need to be able to exclude secondary conductors and telecommunications cables). – Mobile LiDAR can help improve asset locational data accuracy. – Field teams could benefit from integrated access to geospatial data in their mobile applications. – No public receptivity issues found with the car-based mobile LiDAR inspections. – Post-work scan results can support work verification and cycle time planning. From the 2020 Pilot, PG&E learned that the LiDAR data acquisition and processing can occur within 27 days, a period sufficient for VM operational workflow cycle times.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. - Demonstration of the efficacy of Mobile LiDAR measured by comparing false positive and false negative percentages of the radial clearances obtained from analyzing the LiDAR point clouds. - Scan analysis cycle time
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Mobile LiDAR provides a systematic way to identify radial clearance issues and potential grow-ins along road adjacent lines during the moment of data capture. This can create baseline observations for work verification to identify remaining clearance issues that may become grow-ins before the next cycle. Mobile LiDAR cannot identify hazard trees or replace the current inspection operations.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	When the Mobile LiDAR inspections process identifies a radial clearance issue in a region selected for scanning, the local Vegetation Management field operations team is informed and provided the data. Local operations will then consider the finding in context of their operations and then mitigate the identified clearance issue within the requisite timeframe.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	We will evaluate the stepwise integration of the methods described in (iv).A into VM operational workflows for road-side distribution corridors in HFTDs.
(v).A: 'End Product' at 'Full Deployment' and Location	The potential end product is the integration of Mobile LiDAR data outputs into select phases of the vegetation management radial clearing process in HFTD for road-side distribution corridors. Potential VM processes impacted include work verification and documentation.

Program Area: Asset Analytics & Grid Monitoring—New or Emerging Technologies

PG&E is assessing new methods to optimize asset maintenance practices. Unanticipated failure of electric assets due to wear and tear can lead to customer service outages and, in the worst case, fire ignition. Proactive management of asset health can reduce this risk and enhance system resiliency. PG&E is researching new or emerging technologies, such as enhanced sensor technologies that enable real-time system monitoring and situational awareness and developing analytic strategies to coordinate data received from multiple sources (e.g., SCADA, SmartMeter™ electric meters, primary line sensors, and emerging sensor technologies). Mitigations leveraging new or emerging technologies include the following:

7.1.D.3.11 EPIC 3.13: Transformer Monitoring via Field Area Network

(i).A: Project Type	Emerging (Pre-commercial) Technology
(i).B: Additional References in the 2021 WMP	
(i).C: 2020 WMP Section	5.1.D.3.14
(i).D: Project Objective and Summary	As service transformers reach the end of their usable life or overload, they begin to heat up, leading to potential safety and asset risks. Currently, identification of transformer temperature change and potential associated risks poses challenges and requires regular checks from PG&E field teams. The EPIC 3.13: Transformer Monitoring via Field Area Network demonstration project aims to increase the visibility of transformer health through the design and build of an overhead service transformer temperature sensor, a Temperature Alarm Device (TAD), supplemented by analytical models that analyze temperature data. The project will test the hypothesis that monitoring the external temperature of the tank of an overhead transformer can help in predicting and preventing imminent failure that could pose a wildfire ignition risk as well as impact safety and resiliency.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	C. Grid design and system hardening: 12. Grid design for minimizing ignition risk D. Asset management and inspections: 19. Asset Maintenance and Repair G. Data governance: 33. Data collection and curation
(ii).A: Project Phase	Planning
(ii).B: Project Status	The team is evaluating TAD costs provided by vendors, obtaining site licenses to access vendors' servers to obtain TAD data, and preparing to compare data from the two TAD vendors.
(ii).C: Project Location	Initial planned locations are in the San Jose area.

(iii).A: Results to Date	Q3 2020 - Business plan approved for project implementation. - RFP executed for external TAD vendor involvement. - Construction contract executed. Q4 2020 - Business plan approved for project implementation. - External TAD vendors selected for demonstration project
(iii).B: Lessons Learned	None to date.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Project is in the planning phase therefore performance metrics are not known.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. If the project hypothesis is proven, the wildfire risk reduction benefit would be the prediction and prevention of imminent failure of an overhead transformer that could pose a wildfire ignition risk as well as impact safety and resiliency.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	If the TAD effectively helps in the detection of imminent failure of overhead transformers, PG&E will be able to proactively replace transformers by dispatching field crews, thereby preventing failure, potential ignition risks, and associated outages.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	If the TAD technology is proven to be effective, (i) the communication system used by the TADs would need to be operationalized, (ii) the data would need to be integrated with our production databases, and (iii) the data would need to be combined with other data streams in an enterprise data analytics platform to provide a more holistic understanding of asset health.
(v).A: 'End Product' at 'Full Deployment' and Location	TADs would be installed on existing overhead transformers, prioritized first in Tier 3 HFTDs followed by Tier 2 HFTDs. Deployment in other locations will be subject to available funding.

7.1.D.3.12 EPIC 3.20: Maintenance Analytics

(i).A: Project Type	Emerging (Pre-commercial) Technology
(i).B: Additional References in the 2021 WMP	
(i).C: 2020 WMP Section	5.1.D.3.15
(i).D: Project Objective and Summary	The EPIC 3.20: Data Analytics for Predictive Maintenance project aims to develop analytical models using machine learning based on existing PG&E data sets (including SmartMeter™ electric meter connectivity, geolocational assets, and weather data) to predict electric distribution equipment failures so that corrective action can be taken before failure occurs. The project's current focus is on distribution transformers.

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(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	D. Asset management and inspections: 19. Asset maintenance and repair
(ii).A: Project Phase	Build/Test
(ii).B: Project Status	In Q4 2020 the team completed the first phase of the project which was focused on exploring voltage failures and anomalies while working with the Power Quality group. In coordination with the Asset Health and Performance Center, the second phase of the project is focused on ignition risks and catastrophic failures associated with failing equipment such as overloaded or near-failure transformers, stressed or near-failure cables, or primary side loose neutrals as well as from vegetation contact or other intermittent faults with overhead equipment.
(ii).C: Project Location	Algorithm testing and verification is ongoing throughout the PG&E service territory.
(iii).A: Results to Date	Q2 2020 - Added heuristic to identify fuse failures. - The best prediction model had 87 percent precision when making predictions on a set of 300 failures. Q3 2020 - Field validation of predicted failing transformers (in progress) - Through iterative development, the best model has improved and now has 98 percent precision for predicted failures. Q4 2020 - Failure model minimum viable product (MVP) is in progress - Submitted change request to expand scope. The expansion of scope will hone project focus on identifying transformer failures with high ignition risk and identifying grid event behavior which may indicate vegetation contact or other faults on overhead equipment. Distribution transformers are among the assets whose failures pose the highest ignition risk.
(iii).B: Lessons Learned	- Occurrences of poor data quality must be addressed to ensure prediction accuracy.
(iii).C: Quantitative Performance Metrics	Per “Action PGE-18 (Class B)” in Section 5.1.7 of the “Wildfire Safety Division Evaluation of Pacific Gas and Electric Company’s First Quarterly Report” dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. - Accuracy in the prediction of transformer failures - Ability to supplement or automate the manual inspection process for transformer failures (degree to which the project automates or supplements the existing process)
(iii).D: Quantitative Risk Reduction Benefits	Per “Action PGE-18 (Class B)” in Section 5.1.7 of the “Wildfire Safety Division Evaluation of Pacific Gas and Electric Company’s First Quarterly Report” dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Distribution transformers are one of the assets that pose the highest wildfire risk. The second phase of EPIC 3.20 will prioritize exploring overloading transformer failure and catastrophic failures to mitigate wildfire risk. The anticipated risk reduction benefits would be decreasing the frequency of wildfires caused by these failures.

(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	If the model predicts a failed or failing asset, a troubleman could be alerted based on model findings and dispatched to inspect the asset and perform maintenance or replace the asset as needed.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	The EPIC 3.20 analytics model will be integrated into the Asset Health and Performance Center asset monitoring workflow by using machine learning and automating the troubleshooting process of signal anomalies. When a failure is predicted, the asset will be flagged for review. Depending on findings of the review, PG&E may dispatch crews to inspect perform maintenance on, or replace the asset as needed.
(v).A: 'End Product' at 'Full Deployment' and Location	The end product will be an analytical model fully integrated into the Asset Health and Performance Center's distribution grid monitoring and analytics platform. This would include integration of workflows to proactively address and track outcomes from issues identified by the analytic model. The model will enable informed decisions made by the Power Quality and Asset Health & Performance teams through the entire service territory.

7.1.D.3.13 EPIC 3.32: System Harmonics for Power Quality Investigation

(i).A: Project Type	Emerging (Pre-commercial) Technology
(i).B: Additional References in the 2021 WMP	
(i).C: 2020 WMP Section	5.1.D.3.16
(i).D: Project Objective and Summary	The EPIC 3.32: System Harmonics for Power Quality Investigation demonstration project explores the use of next generation metering technology harmonics data to help automate the detection, investigation, and resolution of harmonics issues. Excessive harmonics have been shown to reduce utility equipment life, can cause premature equipment failure due to the potential to overheat, and can interfere with the operation of protection devices. Harmonics data from next generation metering technology can enable power quality engineers to monitor harmonics levels on the circuits and proactively address harmonics issues before they create a negative impact on PG&E and customers' equipment, mitigating the chances of equipment failure to have adverse effects or safety impacts.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	C. Grid design and system hardening: 12. Grid design for minimizing ignition risk 14. Risk-based grid hardening and cost efficiency
(ii).A: Project Phase	Design/Engineering
(ii).B: Project Status	Team has issued a Purchase Order (PO) to meter hardware vendor. Expected lead time for the meters is 12-16 weeks. Team plans to identify meter locations and install meters in Q1 2021.
(ii).C: Project Location	Three phase commercial/industrial customer locations with a high number of DER/Solar PV and agriculture customers in the Central Valley region.
(iii).A: Results to Date	Q3 2020 - Finalized field installation plan including meter installation locations.

	- Completed RFP and selected meter hardware that met the requirements to provide the necessary harmonics data Q4 2020 - Issued PO to meter hardware vendor. - Kick-off project with Information Technology (IT).
(iii).B: Lessons Learned	Meter procurement took longer than expected due to contractual issues between the vendor and PG&E legal teams. We should connect the vendor legal team and PG&E teams together sooner next time. PG&E awarded the contract to the vendor's distributor instead.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. CPUC-approved EPIC performance metrics are potential areas for measurement of success: - Reductions in outage numbers, frequency, and duration. - Reduction in number of customer voltage complaints related to harmonics issues. - Increased use of cost-effective digital information and control technology to improve reliability, security, and efficiency of the electric grid. - Reduction in truck roll out to install additional portable monitors. - Reduction in turnaround time for resolving customer voltage complaints related to harmonics issues. - Reduction in downtime for customer equipment, which currently may be weeks or months.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Anticipated wildfire risk reduction benefits are described as part of answer (iv).A.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	The plan is to validate locations with high levels of harmonics and determine if there is a harmonics-associated ignition risk to the transformers, cap banks, and fuses in the location. If a suspected ignition risk is found, the plan is to take action using existing operational processes.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	The plan is to use next generation metering technology to monitor and collect harmonics data on our electric distribution system for operationalizing harmonics-associated risk reductions.
(v).A: 'End Product' at 'Full Deployment' and Location	The end product is an analytics tool with the ability to monitor for, and enable proactive mitigation of, harmonics-related issues at approximately 3,000 large commercial customers throughout the service territory.

7.1.D.3.14 Sensor IQ

(i).A: Project Type	New Technology (Commercially Available Offering)
(i).B: Additional References in the 2021 WMP	7.3.2.2.4

(i).C: 2020 WMP Section	5.1.D.3.17
(i).D: Project Objective and Summary	Sensor IQ is a SmartMeter™ software application that enables SmartMeter™ electric meters to collect data at a higher frequency and deliver alarms such as high/low voltage outside configurable thresholds without disruption to normal billing data collection. This pilot enables and collects high frequency SmartMeter™ data; analytics using this data will only be performed through other projects. PG&E has a license to pilot Sensor IQ through October 2021 and will collect voltage, current, and power factor data every five minutes from meters included in this pilot. The purpose of this Sensor IQ project is to collect the needed data to be analyzed through other exploratory use cases to evaluate if the high frequency data supports 1) improved meter phase identification, as this information is needed by the EPIC 3.15: Proactive Wires Down Mitigation Demonstration Project (Rapid Earth Fault Current Limiter), which requires feeder phasing to determine the line-earth capacitive imbalance; and 2) EPIC 3.43: Momentary Outage Information, which seeks to use near real time meter data, including the data provided through Sensor IQ, to develop algorithms that can potentially identify the sources of momentary outages or other anomalies to create predictive maintenance strategies and processes; 3) other predictive grid monitoring and maintenance approaches for potential wildfire risk reduction methods through incipient fault detection as well as improvement of the ability to find faults in wires-down analytics.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	C. Grid design and system hardening: 12. Grid design for minimizing ignition risk 14. Risk-based grid hardening and cost efficiency
(ii).A: Project Phase	Build/Test
(ii).B: Project Status	Project is in process of development, deployment and validation with the plan of full deployment to ~500K meters in Tier 2 & Tier 3 HFTDs by the end of 2021.
(ii).C: Project Location	~500K SmartMeter™ electric meters located in Tier 2 & Tier 3 HFTDs.
(iii).A: Results to Date	Q3 2020/Q4 2020 - Data collection profiles, alarm thresholds and configurations have been developed for various meter types. - Sensor IQ has been deployed in the meter test environment to validate developed Data Collection Profiles.
(iii).B: Lessons Learned	- High frequency SmartMeter™ data alone was not enough to detect issues accurately. Analytics support is necessary to make the data provided by this project useful. Therefore, PG&E plans to direct this project's data, when available, into the EPIC 3.20: Maintenance Analytics, and EPIC 3.43: Momentary Outage Information projects to use their analytical components for meters in Tier 2 & 3 HFTDs. See the EPIC 3.20 and 3.43 project descriptions in this report for more information.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021.

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	- The ability to reliably collect high frequency data and events on meters which can be used for detecting unexpected conditions or improving analytical models. Example metrics are provided under item (iii).D: Quantitative Risk Reduction Benefits.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Sensor IQ is foundational in collecting the data that could be used with advanced analytics to uncover incipient conditions detectable by our existing population of SmartMeter™ electric meters. The analytics of the high frequency SmartMeter™ events and alarms may provide early warning of degrading distribution conditions that are not detectable by other existing sensors. These early detected conditions will permit the prompt and proactive correction of conditions prior to fire season or high fire threat days.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	If this project is found to benefit early identification of wildfire risks, the analytics developed in companion projects can be automated and integrated into existing preventative monitoring schemes.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	Automate the ingestion of Sensor IQ data into a data platform and apply analytical methods to assess events for indications of incipient conditions. Integrate data and analytics into existing or newly developed workflows for detection and resolution of incipient grid conditions that could create wildfire risk. Move the project to a production IT environment. The software contract for this pilot would be extended for deployment and converted to a full license.
(v).A: 'End Product' at 'Full Deployment' and Location	If effective, this product would be deployed in all circuits in Tier 2 & 3 HFTDs and integrated into standard distribution operation functions. It could also be extended to systemwide deployment to all compatible SmartMeter™ electric meters with an additional per-meter software license.

7.1.D.3.15 EPIC 3.43: Momentary Outage Information

(i).A: Project Type	Emerging (Pre-commercial) Technology
(i).B: Additional References in the 2021 WMP	7.3.2.2.4
(i).C: 2020 WMP Section	N/A
(i).D: Project Objective and Summary	PG&E has deployed over 5 million SmartMeters™ that provide alarm traps related to the meter's health and status during abnormal system conditions, such as outages, broad detection of sag and swell events, voltage deviations, intermittent power "blinks", or other anomalies as reported by the SmartMeter™ technology. This project proposes to leverage SmartMeter™ data through Sensor IQ as described in Section 7.1.D.14 above for more granular and real-time data streams that include high frequency voltage, current, power factor, and temperature, and real time notifications voltage variations or temperature alarms that can be used to develop algorithms that can potentially identify the sources of momentary outages/voltage excursions to create predictive maintenance strategies and processes. An objective is to determine if AMI momentary events ("blinks") and trap alarms correlate and can be used to identify specific

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	equipment shortcomings such as transformer failure, cracked insulator, loose neutrals, and/or vegetation contact, thereby leading to preventative maintenance practices that could also help reduce wildfire ignition risk. A second initiative is underway to add field insight from two additional sources of information: a new generation smart meter/grid edge sensor, and a behind-the-meter electrical condition detection sensor. The use of a new generation of meter potentially offers measurement and analysis of various primary and secondary issues including but not necessarily limited to loose neutrals, failing service transformers, failing splices, and vegetation contact, while the behind-the-meter electrical condition detection sensor provides an independent view of similar potential issues, but from the customer side of the meter.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	D. Asset management and inspections 16. Asset inventory and condition assessments
(ii).A: Project Phase	Design/Engineer
(ii).B: Project Status	The first part of the project is waiting for deployment of Sensor IQ to commence data collection and analytic development. The second part of the project, related to the new generation meter and behind-the-meter electrical condition detection sensor, is being initiated. Vendors have been selected and contract negotiations are expected to complete in Q1 2021.
(ii).C: Project Location	The Sensor IQ-based analysis is applicable to the entire PG&E electric distribution service territory served by SmartMeters™ but is now focused on meters in Tier 2 & Tier 3 HFTDs. The new generation meter and behind-the-meter electrical condition detection sensor are being piloted in a few Tier 2 & Tier 3 HFTDs.
(iii).A: Results to Date	Q4 2020 For the first part of the project: - Defined data points and data frequency requirements to perform analytics work to potentially identify equipment failures for enhanced preventative maintenance practices that focus on replacement before failure. - Developed IT framework (solutions blueprint) to ingest and provide data for analytics work. For the second part of the project: - Vendors and installation locations have been selected. - Two additional potentially useful data sources have been identified: new generation SmartMeter™ technology, and in-home electrical fire sensing. Analysis of project scope and cost changes to accommodate these data sources has been initiated.
(iii).B: Lessons Learned	None to date
(iii).C: Quantitative Performance Metrics	Per “Action PGE-18 (Class B)” in Section 5.1.7 of the “Wildfire Safety Division Evaluation of Pacific Gas and Electric Company’s First Quarterly Report” dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Performance will be initially measured based on the progress the development team can demonstrate towards validating or invalidating the project’s hypothesis. The initial performance metrics are:

	Number of asset failure use cases for which models are developed and tested Number of failure models for which predictive models are developed and tested Area Under the Precision/Recall Curve (AUC) for each Model developed (if appropriate) Top AUC achieved for each asset type (if appropriate) Net operational cost benefit assessment for the best model developed for each use case Number of field verification exercises completed Time required to ingest new data, update model (if appropriate), run model, and have insights ingested into business processes If a successful approach is developed, additional metrics focused on comparing the performance of current processes to the performance of the new analytical approach will be used.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Wildfire risk reduction benefits are anticipated as described in the second paragraph of answer (i).D.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	None to date.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	For the first part of the project: If the predictive models using Sensor IQ data are found to be successful, the next phase of development would be to move the analytical model to full production. Operational actions potentially include more precisely targeted PSPS events, more precisely targeted vegetation management, optimized truck rolls, or temporarily reconfiguring distribution system topology. Additionally, improved maintenance planning and optimized capital allocations are likely benefits of more precisely understanding equipment condition. For the second part of the project: If the technologies (the new generation meter and the behind-the-meter electrical condition detection sensor) are found to be successful in identifying incipient issues the more effective version will be assessed for larger deployment.
(v).A: 'End Product' at 'Full Deployment' and Location	If the first part of the project is more successful in its predictions, full deployment would include Sensor IQ aggregation/analysis on SmartMeters™ in Tier 2 & Tier 3 HFTDs and/or on select SmartMeters™ throughout the system, to be determined. If the second part of the project is more successful in its predictions, select or all SmartMeter™ would need to be upgraded to the new generation, or the behind-the-meter electrical condition detection sensor would need to be installed in select or all customer premises. Regardless of which part of the project is deployed, it would also include: Verified predictive analytics developed through application of data analytics platform toolsets and methods

	Multiple algorithms for determining equipment failure or underperformance risk in key categories (transformers, cabling, insulators, etc.) Integration of data streams and alerts into operational tools Ongoing tuning of algorithms and analytics using data analytics platform capabilities

7.1.D.3.16 Wind Loading Assessments

(i).A: Project Type	Emerging (Pre-commercial) Technology
(i).B: Additional References in the 2021 WMP	7.3.3.13
(i).C: 2020 WMP Section	5.1.D.3.18
(i).D: Project Objective and Summary	Excessive wind loads on PG&E's distribution poles may cause asset failure that in turn increases wildfire ignition risk. This project will reduce risk by providing asset intelligence to identify locations that require corrective actions driven by pole safety factors or limitations for wind speeds. The project will leverage existing Light Detection and Ranging (LiDAR) data from VM efforts to geo-correct pole locations. Objectives of this project include a greater understanding of failure modes, establishment of a common repository of data gathered, and effectively updating workflows of key asset systems to align with new data strategies. Wind loading segmentation will be performed to identify the wind loading of each asset on a support structure with the objective of integrating findings into risk models.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	A. Risk assessment and mapping 2. Ignition risk estimation D. Asset management and inspections 16. Asset inventory and condition assessments
(ii).A: Project Phase	Build/Test
(ii).B: Project Status	– Deployed the Wind Loading Assessment application to an initial group of 62 Distribution estimators
(ii).C: Project Location	PG&E service territory (PG&E owned distribution poles)
(iii).A: Results to Date	Q4 2020 – Upgraded the foundational modeling software to handle "tree poles" and crossarm framing automation. – Implemented a Citrix version of Wind Loading that allowed PG&E to switch to a less expensive third party Desk Top Review (pole loading review) vendor. – Consolidated all Distribution wind loading data onto a PG&E platform. – Completed the initial deployment stage of the project, with 62 (of 800) Distribution estimators using the new application.
(iii).B: Lessons Learned	– Data integration into external cloud environment has the potential to provide significant benefit by enabling greater data access and data sharing capabilities with external partners. – Data sharing through the external environment requires new methods for cybersecurity when sharing data externally. – LiDAR holds potential in enabling PG&E to geo-correct pole configurations and arrangements in an automated fashion, which will be further explored through this project.

(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. – Ability to perform pole geo-correction based on LiDAR data. – Integration of data into external cloud environment for greater data accessibility. – Accuracy of data for pole loading calculations.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. The anticipated wildfire risk reduction benefit is reduction of asset failures and associated wildfire risk due to excessive wind loads on PG&E's distribution poles and lines.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	– Integrate data provided through wind loading assessment for failure mode insights to inform manual inspection cycles (integration would occur through a separate project). – Pole geo-corrections will assist field crews in identifying correct pole locations in the field.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	– Data provided through this project can provide insights for proactive asset management practices (e.g. integrate results into distribution risk model).
(v).A: 'End Product' at 'Full Deployment' and Location	– Wind loading segmentation analysis will be performed to identify the wind loading of each asset, e.g., a conductor, on a support structure and integrate findings into appropriate systems. This will provide asset intelligence to identify locations that require corrective actions driven by pole safety factors or limitations for wind speeds, or to assess the safety factor of distribution poles as part of the preparation to exit a PSPS event. In addition, geo-corrections to pole locations can be determined based on LiDAR data.

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Program Area: **Foundational—New or Emerging Technologies**

Foundational new or emerging technologies, including grid communication tools and control networks, can enable greater exchange of information required to provide real or near– real time operational visibility across the grid for enhanced decision-making including for PSPS events. These foundational items can also increase the flexibility of the grid, providing fundamental capabilities to advance system resiliency.

7.1.D.3.17 EPIC 3.03: Advanced Distribution Energy Resource Management System

(i).A: Project Type	Emerging (Pre– commercial) Technology
(i).B: Additional References in the 2021 WMP	
(i).C: 2020 WMP Section	5.1.D.3.20
(i).D: Project Objective and Summary	The EPIC 3.03: Advanced Distributed Energy Resource Management System (DERMS) demonstration project seeks to design, procure, and deploy a prototype enterprise DERMS providing foundational operational capabilities which will support situational intelligence and broader wildfire mitigation efforts including remote grids, microgrids, and other Distribution Investment Deferral Framework (DIDF) opportunities (i.e. Non Wires Alternatives). This project includes the development of a cost-effective solution for providing advanced situational awareness and control capabilities for operators to manage Distributed Energy Resources (DER), dispatch DER registration data requests and monitor smart inverter-based DERs. As part of the effort to lower the cost of telemetry for interconnected DER assets, PG&E is engaging with vendors that would eventually produce PG&E-certified site gateways. Additionally, the project is engaging with potential DER aggregator partners to evaluate feasibility of integrating with the PG&E DER headend server as an alternative to the site gateway approach. Anticipated benefits of this project once deployed at scale include: (1) increased situational awareness of DER grid impacts which could allow for greater operational flexibility to safely reconfigure the grid during PSPS; (2) decreased time to de-energize remote grid locations by utilizing the remote disconnect feature of DERMS for remote grids during PSPS events; and (3) potential reduction in the number of customers impacted from PSPS events through microgrid technologies. We note that this project's technology is foundational; actual reduction is dependent on broader microgrid implementations.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	C. Grid Design and System Hardening: 12: Grid design for minimizing ignition risk 13. Grid design for resiliency and minimizing PSPS
(ii).A: Project Phase	Build/Test
(ii).B: Project Status	– Factory acceptance testing for the gateway device to be installed at the first pilot site at Blue Lake Rancheria has been completed. Installation of headend server at PG&E has been completed. - Installation of the gateway device at the pilot site is scheduled for early 2021. The field deployment has experienced delays because the pilot site is involved in COVID-19 response with the recent surge in cases.

	– Third-party site gateway vendors have begun interoperability testing with the headend server.
(ii).C: Project Location	Blue Lake Rancheria (BLR), Blue Lake, CA (Humboldt County). The BLR is a 100 acre tribal reservation and State-designated Disadvantaged Community (DAC).
(iii).A: Results to Date	– Completed design and installation of an IEEE 2030.5 DER Headend Server (CSIP certification pending) – Initial gateway buildout at the Blue Lake Rancheria site to test telemetry and control (in progress). – To build a market for remote site gateway devices for DER developers, PG&E selected two vendors for development of additional third-party remote site gateways meeting PG&E standards and requirements. This also set up a pathway for future vendors to develop their own remote site gateways.
(iii).B: Lessons Learned	– Technology ecosystem for DER integration utilizing the IEEE 2030.5 protocol is still rapidly evolving and is not yet "plug and play." Further interoperability testing and industry collaboration is required. – Technology architectures for integrating critical operational systems with 3rd party owned devices needs multiple levels of cybersecurity.
(iii).C: Quantitative Performance Metrics	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. – Proven ability of telemetry and control of DERs through a communications link with at least two DER sites and/or DER aggregators. – Cost effectiveness meet or exceed CPUC telemetry requirements at each site or aggregator. – Increased visibility of DERs on the grid and their utilization for microgrids, remote grids, and PG&E Control Centers. – Integration with other grid advancement programs and systems to enable scaled up deployment after EPIC project completion.
(iii).D: Quantitative Risk Reduction Benefits	Per "Action PGE-18 (Class B)" in Section 5.1.7 of the "Wildfire Safety Division Evaluation of Pacific Gas and Electric Company's First Quarterly Report" dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. Again, we note that this project's technology once deployed at scale will provide foundational capabilities for visibility and control rather than direct wildfire risk reduction benefits. Anticipated wildfire risk reduction benefits are described as part of answer (i).D.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	This project will demonstrate capabilities to: – Enhance situational awareness and DER control capabilities for distribution operators to support grid needs as part of wildfire mitigation related initiatives. – Enable PG&E to dispatch registration data requests to verify compliance of Smart Inverters with Rule 21 curve settings and monitor Smart Inverter-based DERs to maintain safe and reliable grid operations during PSPS and normal grid conditions.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	The DERMS would be integrated into the distribution system operators' systems and processes as described in (iv).A. The project team is also coordinating with the ADMS team (see Section 7.1.D.3.18 below) for future integration to optimize DER utilization and system-wide grid services.
(v).A: 'End Product' at 'Full Deployment' and Location	The end product is a fully integrated enterprise DER Headend that can scale to accommodate the growth of managed DERs over time. The headend server will

	be located at PG&E and the remote site gateways will be located at customer DER sites.

7.1.D.3.18 Advanced Distribution Management System (ADMS)

(i).A: Project Type	New Technology (Commercially Available Offering)
(i).B: Additional References in the 2021 WMP	8.1
(i).C: 2020 WMP Section	5.1.D.3.21
(i).D: Project Objective and Summary	PG&E is undertaking the first component of a multi-year effort to implement an Advanced Distribution Management System (ADMS) which will, when fully deployed, integrate into a single platform several of the current mission critical distribution control center applications (Distribution Supervisory, Control and Data Acquisition (DSCADA) software, Demand Management System (DMS), and Outage Management System (OMS)) that are currently spread across multiple platforms. The ADMS will become part of the core distribution operations technology tools that enable the visibility, control, forecasting, and analysis of a more dynamic grid. ADMS impacts grid resiliency through: (i) facilitation of DER integration; (ii) switching operation enablement during PSPS events by providing more timely and accurate data to operators; (iii) identification of devices within fire areas to allow operators to disable reclosing relays when weather and conditions pose significant risk to the system.
(i).E: Utility Wildfire Mitigation Maturity Model (UWMMM) Categories & Capabilities Potentially Impacted	F. Grid operations and protocols 27. Protective equipment and device settings 28. Incorporating ignition risk factors in grid control
(ii).A: Project Phase	Multiple (phase varies with functionality considered)
(ii).B: Project Status	Software is under development.
(ii).C: Project Location	Applicable to the entire PG&E electric distribution service territory
(iii).A: Results to Date	Q3 2020/Q4 2020 - Performing software build for wildfire mitigation functionality
(iii).B: Lessons Learned	- None to date
(iii).C: Quantitative Performance Metrics	Per “Action PGE-18 (Class B)” in Section 5.1.7 of the “Wildfire Safety Division Evaluation of Pacific Gas and Electric Company’s First Quarterly Report” dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021. - ADMS ability to identify automatic reclosing devices (e.g. Line Reclosers, Trip Savers, Fuse Savers) within fire areas and present the potentially impacted areas to operators for verification (to inform reclosing relay disablement) - Improvement of the situational awareness of operators through compilation of switching operation data sources into a single platform.
(iii).D: Quantitative Risk Reduction Benefits	Per “Action PGE-18 (Class B)” in Section 5.1.7 of the “Wildfire Safety Division Evaluation of Pacific Gas and Electric Company’s First Quarterly Report” dated January 8, 2021, PG&E will be updating this field in the supplemental filing to be filed no later than February 26, 2021.

	Wildfire risk reduction benefits are anticipated as described in the second paragraph of answer (i).D.
(iv).A: Ignition or Fault Risk Reduction Project Findings That Inform Current Operational Practices	- PG&E is taking a phased approach to ADMS implementation to ensure that foundational capabilities are first established. - Operator training simulator is planned for SCADA system and reclosing relay capabilities will help train operators on ADMS functionality to ensure timely adoption of ADMS platform.
(iv).B: Methods to Incorporate Project Findings Into Operational Practices	ADMS is a platform used for distribution operations. Operators will require training on the system and former systems will need to be sunset in a methodical manner that minimizes disruption to ongoing operations. Change management practices focused on people, process, and technology will be employed to ensure value streams from ADMS implementation are captured.
(v).A: 'End Product' at 'Full Deployment' and Location	Multi-year ADMS deployment will integrate several mission critical distribution control center applications that are currently spread across multiple platforms. This technology will enable the visibility, control, forecasting and analysis required from a more dynamic grid. When fully deployed, the ADMS platform will bring the capabilities of today's Distribution Supervisory, Control and Data Acquisition (D-SCADA) software, DMS, and Outage Management System (OMS) into a single platform. Integrating these systems into a single, more efficient platform will reduce the potential for operator error, improve cybersecurity risk controls, and enable PG&E to run a new suite of advanced applications that enhance current capabilities associated with safety and resiliency, while responding to future needs associated with the growth of DERs and complexities from wildfire risk.

7.2 Wildfire Mitigation Plan (WMP) Implementation

Describe the processes and procedures the electrical corporation will use to do all the following:

7.2.A Monitor and Audit WMP Implementation

A. Monitor and audit the implementation of the plan. Include what is being audited, who conducts the audits, what type of data is being collected, and how the data undergoes quality assurance and quality control.

PG&E monitors and regularly reviews the implementation of the 2021 WMP as it is being implemented. The effort to monitor and audit 2021 WMP implementation is supported by the WMP implementation teams, the Community Wildfire Safety Program (CWSP) Program Management Office (PMO), Electric Operations' Quality Team and PG&E's Internal Audit (IA) organization. PG&E has developed programmatic quality and monitoring processes and protocols for many of the individual programs within the WMP.

PG&E's CWSP PMO is responsible for monitoring the overall progress of the WMP workstreams and the quality of the WMP work at the program level. The PMO produces progress tracking and status updates via a weekly dashboard. The PMO also produces both a monthly status update and a comprehensive quarterly WMP report. The PMO provides on-going oversight and direction to the WMP program leaders. In addition, the status and tracking reports provide PG&E leadership, and ultimately the board of directors, visibility into the different elements of the WMP and gives them the information they need to monitor and, when needed, make adjustments to the program. PG&E has provided these reports and dashboards to WSD in our response to Condition PGE-11 for the 2020 WMP.

At the individual WMP program level, PG&E has developed quality monitoring and audit plans tailored to each program. For example, the WMP quality monitoring and audit programs developed for the System Hardening and Enhanced Vegetation Management programs including 100 percent work verification. For both of these key WMP programs no miles are recorded as complete in either program until they have been fully verified to be complete. The operating LOB generally validates that the work conducted is accurate and complete while the program data verification is validated by PG&E's QA or IA teams. The LOB that validates that the work is accurate and complete has the expertise to identify any technical issues. The IA teams have expertise in designing data validation and quality monitoring programs. Taken together, the quality monitoring and auditing program that PG&E implements validates both the physical completion of work and the quality of the program data.

In addition to the processes outlined above, PG&E also provides implementation information to parties in CPUC proceedings and has a number of external parties that are monitoring our wildfire mitigation activities. PG&E regularly provides updates and information requested to the following:

- Federal Monitor: PG&E's Federal Monitor has been given responsibility to review PG&E's wildfire mitigation efforts and compliance activities.

- Independent Safety Evaluators: In compliance with the Wildfire OII, starting in 2021 and conducted annually for three years, Independent Safety Evaluators working at the direction of the Safety Enforcement Division (SED) will audit and review financial data related to PG&E's Wildfire Safety Plans. Safety Evaluators are separate and distinct from Independent Evaluators provided for in Public Utilities Code § 8386.3(c). The Safety Evaluator audit reports shall be provided to the Director of SED and served on the service list for I.19-06-015.

- WSD: In 2020, WSD's compliance branch has engaged with PG&E on a bi-weekly audit of our system hardening projects, PSPS sectionalizing device installation, and EVM projects. Every two weeks, PG&E sends a list of these projects to the WSD for audit.

- Independent Evaluator: Starting in 2021, an Independent Evaluator will review PG&E's compliance with the WMP, as provided in Public Utilities Code § 8386.3(c).

- AB 1054 Quarterly Advice Letters: WMP implementation progress updates are one of the components contained in this quarterly filing requirement that is provided to the CPUC and parties.

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7.2.B WMP Deficiencies

B. Identify any deficiencies in the plan or the plan's implementation and correct those deficiencies.

PG&E continuously tracks WMP implementation during the year through tracking reports and quality reviews to assess both the progress and quality of the WMP work completed and to identify any program deficiencies. As discussed in the Section 7.2.A, PG&E's CWSP PMO is primarily responsible for monitoring the individual WMP programs in order to identify any potential deficiencies in the plan or the plan's implementation. The CWSP PMO provides PG&E's senior leaders regular WMP reports to evaluate and identify potential deficiencies. Any deficiencies identified at any level are reported to the PMO and the PMO is ultimately responsible for correcting those deficiencies and ensuring completion of the WMP.

As part of the "Conditional Approval" of PG&E's 2020 WMP, issued by the CPUC on June 11, 2020, there were a number of identified "deficiencies" that PG&E has been working to resolve through several follow-up filings including the Remedial Corrective Plan submitted on July 27, 2020 and Quarterly Reports submitted on September 9, 2020 and December 9, 2020. PG&E recently received feedback on those submissions including additional "actions" that are being incorporated into the 2021 WMP or provided as part of a supplemental filing by February 26, 2021. The details of those WSD-identified "deficiencies" and follow-up "actions" are included in a Section 4.6 and are not being repeated here.

Looking back to the implementation of PG&E's 2020 WMP, we successfully implemented and substantially completed the 38 commitments made in that plan. In many cases, we were able to exceed our 2020 WMP targets. In particular, while PSPS events remain a significant disruption for those customers who are impacted, PG&E delivered a substantially better PSPS experience in 2020 for both community partners and customers. Key examples of some of the most impactful WMP activities PG&E delivered in 2020 include:

- System Hardening – Crews hardened 342 miles in HFTD areas exceeding the 2020 WMP target of 221 miles;
- Enhanced Vegetation Management – Crews completed 1,878 miles in 2020, exceeding the target of 1,800 miles, including completing two-thirds of the work in the first half of 2020, before peak wildfire season;
- Smaller PSPS events – We targeted making 2020 PSPS events impact one-third less customers than they would have in 2019 and the multiple actions we took were successful in making the 2020 PSPS events 55 percent smaller, which avoided a PSPS event for over 800,000 customers;
- Shorter PSPS events – PG&E restored power more than 40 percent faster in 2020 after the severe weather passed, as compared to 2019. On

average post-PSPS inspections were completed and power was restored for customers 10 hours after the weather cleared in 2020, as compared to 17 hours in 2019; and,

- Smarter PSPS events – Despite the challenges created by the COVID 19 pandemic, PG&E enhanced our partnership with communities and customers with better information before, during and after PSPS events. Due to various efforts, including adding staff to partner closely with Counties and Tribes and improving communication and data-sharing tools, the overwhelming feedback from Counties and Tribes was that their experience with 2020 PSPS events was improved. Similarly, our tools and resources provided to customers were substantially improved, especially for those customers who depend on power for medical or independent living needs, and Access and Functional Needs customers. We know that the hardship to customers impacted by PSPS is significant and there is still much room for improvement. But customers are seeing our progress. In a recent survey of over 1,000 business and residential customers impacted by PSPS events in 2020, 60% of the respondents said PG&E's handling of PSPS in 2020 was improved over 2019 (and only 10% expressing that it was worse).

Beyond these largest wildfire-related programs, PG&E's 2020 WMP efforts delivered on nearly all of our commitments. The full list of 2020 commitments and performance against them is provided in Table PG&E-7.2-1 below. Of the 38 total commitments outlined in the 2020 WMP, 34 were completed or exceeded. The remaining four are:

- Two new technology implementation efforts ran into software / firmware challenges and Change Orders were filed with and approved by the CPUC for both. The Change Order revising the implementation timeline for the Sensor IQ project (referenced in Section 7.3.2.2.4 of this plan) was approved January 5, 2021. The Change Order filed in December for the Partial Voltage Detection project (referenced in Section 7.3.2.2.2 of this plan) was approved January 28, 2021.

- The Remote Grid new technology deployment effort (referenced in Section 7.3.3.17.5) was substantially completed in 2020. The primary objectives of learning through the deployment of actual projects was completed. Five Remote Grid sites are currently in the advanced stages of deployment, and forecast to be operationalized in 2021, although construction of these projects has been delayed, primarily by challenging permitting constraints associated with sensitive species.

- The PSPS restoration initiative was also substantially completed. Aerial assets acquired as planned and overall customer average restoration time after the severe weather passed was improved by more than 40 percent. One goal within this initiative was to restore power to 98 percent of customers within 12 daylight hours after the severe weather passed, which was nearly achieved with 95.5 percent performance. The primary driver of falling short of the 98 percent performance was that heavy smoke (due to

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pre-existing wildfires from the August lightning fire complexes) during the first PSPS event of 2020 on September 7th limited visibility such that only 28 of 60 helicopters were able to fly. This forced shifting of planned aerial inspections to need to be executed by slower, ground-based inspections which ultimately drove 91 percent performance for that event.

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TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
B.1 Upgraded POMMS Model to 2km	Increase POMMS model resolution to 2 km, increase model lead time to ~96 hours, deploy 0.67 km forecasts on demand, and deploy a high-resolution model ensemble package with 8 model members at 2 km resolution	PG&E's 2KM model is run 4 times per day. On-demand simulations and vendor-hosted training have been completed. The 8-member model ensemble is also being produced and delivered to PG&E daily
B.2 NOAA-20 Satellite Data	Add NOAA–20 data including Visible Infrared Imaging Radiometer Suite (VIIRS) into the suite of fire detection tools	PG&E has incorporated NOAA-20 data into the existing fire detection workflow
B.3 Wind Event Forecasting Tool (Diablo)	Develop and deploy a (2 to 4 week) Diablo wind event forecasting system based on statistical, machine learning and/or artificial intelligence techniques	An internal long-range diablo wind forecast was created internally by Meteorology. This was done after analysis of teleconnections against Diablo winds revealed that the Madden-Julian Oscillation could be used to indicate the potential for an increased or decreased risk of diablo winds. This forecast is now produced twice a week.

(a) Color code legend: Blue Fill = Commitment is completed; Green Fill= Commitment is on target; Amber Fill = ~one month or less behind plan/"At Risk" or "Substantially Complete, if after due date"; Red = >one month behind plan / "High Risk" or "Commitment Missed, if after due date."

TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
B.4 Wildfire Spread Model – Operational Impacts	PG&E will evaluate incorporating the fire spread model consequence into decision support frameworks including PSPS	Phase 2: Implementation of territory-wide fire risk, probabilistic fire spread modeling, improved urban encroachment into WUI areas and improved fire spotting algorithm was all completed in May 2020. Phase 3: CalFire validated this technology in 2019 with a pilot project and is likely to move forward with state-wide fire spread solution; improvements with Technosylva scoped for 2020. PG&E has evaluated and sees value in incorporating fire spread outputs directly into PSPS decision making going forward
B.5 Live Fuel Moisture (LFM) Sampling	Conduct LFM sampling utilizing Safety and Infrastructure Protection Team (SIPT) resources. Targeting samples from 10 locations by 06/01, and 15 additional sites by 9/01 for a 2020 total of 25	As of the end of September 25 sites (not counting two sites that were established but lost due to wildfire damage) are actively being sampled by SIPT crews. Sampling will be done on the 1st and 15th of each month going forward.
B.6 Re-calibrate the OPW and FPI models	Reproduce 30-year weather and fuel moisture climatology at the same 2 km resolution and model configuration as the enhanced operational POMMS model. Re-calibrate the OPW and FPI models using the new 2 km historical dataset	The 30-year climatology production of weather, DFM and LFM was entirely completed by 10/1.

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TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
B.7 SmartMeters™ - Partial Voltage Detection	Deploy 365,000 Three-Phase Smart Meters™ and extend the partial voltage detection enhancement to 3-phase Smart Meters™ and 4-Wire Distribution systems	Technical issues identified in November drove delays in product deployment. Change Order was submitted on 12/11/20 informing CPUC change in deployment timing and was approved on 1/28/21. Received a proposed firmware fix at the beginning of February 2021, PG&E will test the new firmware and deploy firmware to field meters upon successful certification. PG&E expects to have Partial Voltage Implementation in place on Three Phase meters in June 2021.
B.8 Smart Meters™ – Sensor IQ Pilot Deployment	Deploy Sensor IQ pilot to 500K Smart Meters™ covering ~25,597 distribution line miles in HFTD and customize reads and alarms to identify service transformer failures	Vendor product issue & technology constraints in current datacenter necessitated change in deployment timing. A Change Order submitted to WSD on 9/11 was approved 1/5/21. Deployment of Sensor IQ profiles to field meters began in January 2021. PG&E plans to complete the full program scope of 500K meters in 2021.

(a) Color code legend: Blue Fill = Commitment is completed; Green Fill= Commitment is on target; Amber Fill = ~one month or less behind plan/"At Risk" or "Substantially Complete, if after due date"; Red = >one month behind plan / "High Risk" or "Commitment Missed, if after due date."

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TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
B.9 High-Definition Cameras Deployment	Deploy an additional 200 cameras by December 31, 2020	216 cameras were installed, 16 units ahead of the target.
B.10 Weather Stations	Install 400 weather stations in 2020	404 stations were installed, 4 units ahead of the target of 400
C.1 SCADA Transmission Switching (switches)	Install 23 SCADA transmission switches to provide switching flexibility and sectionalizing for PSPS events	54 SCADA Switches installed in 2020; 39 by 9/1 exceeding the 9/1 target of 23 to support 2020 PSPS events
C.2 Distribution Segmentation **(automated devices)**	Enhance distribution segmentation by adding 592 automated sectionalizing devices by 9/1/20	603 devices commissioned by 9/1, exceeding the target of 592
C.3 Remote grids	Deploy 4-8 initial sites to validate use cases, design standards, deployment processes and commercial arrangements and deliver recommendations for scale-up	Commitment substantially complete. The primary objectives of learning through the deployment of actual projects have been completed. Five Remote Grid sites are currently in the advanced stages of deployment, with the first forecast to be operationalized in 2021, primarily delayed by challenging permitting constraints associated with sensitive species.

(a) Color code legend: Blue Fill = Commitment is completed; Green Fill= Commitment is on target; Amber Fill = ~one month or less behind plan/"At Risk" or "Substantially Complete, if after due date"; Red = >one month behind plan / "High Risk" or "Commitment Missed, if after due date."

TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
C.4 Transmission Line Evaluation for PSPS Scoping	Evaluate all 552 transmission lines in HFTD areas to determine which lines can potentially be removed from future PSPS Event scope	Evaluation of all 552 Transmission lines was completed in Q1
C.5 System Hardening (SCADA enabled circuit breakers)	Enable SCADA capability on the remaining circuit breakers within HFTD (excluding 4kV).	All of the remaining distribution circuit breakers in HFTD area have been enabled with SCADA as planned.
C.6 System Protection (surge arresters)	Replace 8,850 non-exempt surge arresters with exempt surge arresters in Tier 2 and Tier 3 HFTD areas in 2020	10,263 non-exempt surge arresters were replaced (Installed and QA verified) in Tier 2 and Tier 3 HFTD areas in 2020.
C.7 System Protection deploy DCD (reclosers)	Based on High Impedance Fault Detection pilot results, deploy newer protection capabilities Downed Conductor Detection (DCD) to 100 reclosers in Tier 2 & 3 HFTD	PG&E had 126 reclosers within Tier 2 & 3 fire areas with DCD enabled to alarm for a wire down condition by the end of June, exceeding the target of 100.
C.8 Rapid Earth Fault Current Limiter (REFCL) Pilot	REFCL demonstrations are planned to begin in 2020 on operational assets to test its capabilities.	All pieces of the REFCL system have been installed (construction completed for both all substation and distribution line equipment) to support in-field testing and evaluation of the REFCL Technology.

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TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
C.9 System Hardening Criteria Refinement (Dist.)	Refining Criteria for Hardened Distribution Facilities During Potential PSPS Events Includes, simulate OH performance using Finite Elements Analysis (FEA)	Calibration of the criteria with PSPS tools is complete. The criteria were applied during the 10/25 PSPS event, to simulate the application of the criteria for the future descoping of a segment of the Oakland K 1102 circuit.
C.10 System Hardening **(line miles)**	System Hardening; 221 miles in 2020 (excludes Butte County Rebuild see C.11)	342 miles completed
C.11 Butte County Rebuild **(UG de-energized miles**	Butte County Rebuild; 20 miles in 2020 (noted as tracking separately from other 221 miles)	Completed 21.3 WMP miles, exceeding the 20-mile target
C.12 Expulsion Fuse Replacement (non-exempt equipment)	Enhance distribution segmentation strategies by adding 592 automated sectionalizing devices by 09/01/20	643 Non-Exempt Fuses replaced in 2020
D.1 Ultrasonic Inspections Pilot	Commence a pilot of Ultrasonic technology in both transmission and distribution	PG&E ATS Team completed the pilot, produced summary conclusions, and received and review a 3rd party vendor validation report

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TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
D.2 Distribution HFTD Inspections (poles)	Perform detailed overhead inspections on 100 percent of HFTD Tier 3, and 33 percent of HFTD Tier 2 Distribution assets	Completed all targeted inspections, 100 percent of Tier 3 and 33 percent of Tier 2, with 339,728 distribution structures inspected in 2020.
D.3 Transmission HFTD Inspections (structures)	Perform detailed overhead inspections on 100 percent of HFTD Tier 3, and 33 percent of HFTD Tier 2 Transmission assets	Completed all targeted inspections, 100 percent of Tier 3 and 33 percent of Tier 2, with 26,282 transmission structures inspected in 2020.
D.4 Substation HFTD Inspections (substations)	Inspections once annually for all HFTD Tier 3 stations, on a three-year cycle for stations in HFTD Tier 2	Completed all targeted inspections, 99 substations inspected in 2020.
E.1 EVM (line miles)	In 2020, complete and validate an additional 1,800 EVM circuit miles on distribution lines in HFTD areas	1,878-line miles completed and validated, exceeding the 1,800-line mile target..
F.1 SIPT Crews and Engines Resourcing	Increase staffing to budgeted level of 98 STIP crew members and place 40 Engines, and maintain SIPT Viewer daily usage rate of 90 percent	PG&E exceeded targets with 42 engine trucks operational, 102 STIP crew members staffed and a STIP Viewer daily usage at the end of May of 91 percent support SIPT in 2020

(a) Color code legend: Blue Fill = Commitment is completed; Green Fill= Commitment is on target; Amber Fill = ~one month or less behind plan/"At Risk" or "Substantially Complete, if after due date"; Red = >one month behind plan / "High Risk" or "Commitment Missed, if after due date."

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TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
F.2 Protocols for PSPS Re-Energization[1]	Update standard (TD-1464B-002) to include lessons learned from 2019 PSPS events and latest meteorology inputs, update the existing DCC Operator training materials to incorporate revisions to the standard, and confirm that required PG&E personnel complete annual TD-1464S training.	Completed all phases: (1) standard updated, (2) DCC operator training materials finalized and released in June, (3) all DCC operators completed training, and (4) all needed employees (over 10,000) completed TD-1464S training.
F.3 Removal of TripSaver Auto-Reclosing Functionality	Permanently remove the automatic reclosing functionality of the remaining TripSavers serving the Tier 2 and Tier 3 HFTD areas	All 273 devices in scope were either replaced or had auto-reclosing functionality removed prior to June 1, 2020
I.1 Emergency Preparation & Restoration[1]	Finalize TD-1464B-002, perform field and classroom exercises, and conduct classroom / web-based training to prepare utility personnel to restore services after emergencies	Completed all phases: (1) standard updated, (2) performed field and classroom exercises, and (3) training completed as of 10/3

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TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
I.2 PSPS - Service Restoration	PG&E has adopted a new goal of conducting safety patrols and restoring service to 98 percent of PSPS-affected customers within 12 daylight hours of the weather "all-clear" declaration.	Commitment substantially complete for the year. Aerial assets acquired as planned. Total average restoration time after the "all-clear" reduced by more than 40% from 2019. Goal of 98 percent restoration within 12 daylight hours nearly achieved with 96% performance. Driver of performance was (1) heavy smoke during the first PSPS event of 2020 (9/7) such that only 28 of 60 helicopters were able to fly, driving ~91 percent performance for that event; and (2) the 10/25 PSPS event taxed restoration teams due to its geographic breadth, driving 96 percent performance for that event.
I.3 PSPS Customer Impact Mitigation	Mitigate PSPS customer impacts by using 1) advanced meteorology tools to forecast wildfire risk conditions, 2) apply improved analysis on system facing high fire risk, and 3) improving switching / sectionalizing, to affect smaller portions of the grid.	All three phases completed: (1) completed in alignment with commitments B.1 "Upgraded POMMS Model" and B.2 "NOAA-20 Satellite Data" meteorology forecasting tools. (2) Completed and improved analysis was utilized in the approved 2020 guidance for T&D PSPS decision making. (3) Switching / sectionalizing goals completed as of 9/1/20 with 603 distribution sectionalizing devices and 36 transmission switches completed, exceeding targets.

(a) Color code legend: Blue Fill = Commitment is completed; Green Fill= Commitment is on target; Amber Fill = ~one month or less behind plan/"At Risk" or "Substantially Complete, if after due date"; Red = >one month behind plan / "High Risk" or "Commitment Missed, if after due date."

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TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
I.4 Community Based Organizations (CBOs) Coordination	PG&E will enhance coordination with Community Based Organizations (CBOs) and multi-cultural media partners that have existing relationships and serve disadvantaged and/or hard to reach communities to provide in-language / translated education	PG&E conducted outreach to 264 CBOs and 38 multicultural media organizations that serve various groups within the AFN community to share information about PSPS preparedness. Overall a total of 250 CBOs and 36 multicultural media organizations agreed to share PG&E awareness & preparedness messages with their consumers / network before and / or during PSPS events as applicable.
I.5 CERP (Update and Publish)	Update and publish the Company Emergency Response Plan (CERP)	2020 CERP updated and published with final 2020 revisions completed and published in October.
I.6 Microgrids for PSPS Mitigation **(operationalized units)**	Mitigate the customer impacts of PSPS through permanent and temporary front-of-the-meter microgrid solutions	Target achieved through multiple microgrid tools available to support PSPS event mitigation: 1) 392 MWs of temporary generation reserved and available to be deployed to mid-feeder microgrids or substations that are safe to energize during 2020 PSPS events 2) 6 temporary microgrids operational for 2020 PSPS events 3) 60 substation sites made Operationally Ready or ready to receive temporary generation and energize safely within 48 hours of need to deploy prior to a PSPS event

(a) Color code legend: Blue Fill = Commitment is completed; Green Fill= Commitment is on target; Amber Fill = ~one month or less behind plan/"At Risk" or "Substantially Complete, if after due date"; Red = >one month behind plan / "High Risk" or "Commitment Missed, if after due date."

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TABLE PG&E-7.2-1: 2020 WMP COMMITMENTS AND PERFORMANCE (CONTINUED)

2020 Commitments[(a)]	WMP Commitment	Summary of 2020 Performance
I.7 PSPS - 24/7 Information Updates	Mitigating Impacts on De-energized Customers during PSPS through 24/7 Information Updates. PG&E's website and call center allow customers 24/7 access	De-energized Customers during PSPS received 24/7 Information Updates and had uninterrupted access to website and call center information.
I.8 CRC Mitigate PSPS Customer Impacts	Mitigating Impacts on De-energized Customers during PSPS through Community Resource Centers (CRCs)	PG&E had 362 event-ready outdoor and indoor CRC sites available to support PSPS events as needed in 2020.

(a) Color code legend: Blue Fill = Commitment is completed; Green Fill= Commitment is on target; Amber Fill = ~one month or less behind plan/"At Risk" or "Substantially Complete, if after due date"; Red = >one month behind plan / "High Risk" or "Commitment Missed, if after due date."

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7.2.C Monitor and Audit Inspection Effectiveness

C. Monitor and audit the effectiveness of inspections, including inspections performed by contractors, carried out under the plan and other applicable statutes and commission rules.

To monitor and audit the effectiveness of inspections carried out under the 2021 WMP and other applicable statutes and CPUC rules, PG&E uses a combination of processes, tools and other control points intended to quickly identify anomalies in inspection and/or patrol results. Once identified, our programs are designed to address the gap, determine the root cause and pursue improvement opportunities.

In 2020, PG&E began staffing an inspection Process Quality function responsible for establishing and monitoring process control measures and notifying responsible parties to take corrective measures when predefined inspection quality standards are not achieved. The Process Quality group exists within System Inspections, operating alongside IA and Electric QA. To drive intra-departmental consistency, the Process Quality department is formally documenting governing processes to guide ongoing quality assurance, quality control, and quality verification as it relates to the inspection and patrol tasks.

PG&E continues to migrate inspection and patrol recordkeeping to digital tools and technology. As results and data are recorded electronically at the time of the inspection, opportunities for analyzing inspection quality are expanded and accelerated. Using digital records, the Process Quality teams can begin to identify potential outliers and identify areas where additional audits or re-inspection may be required. For example, flagging inspection personnel whose local productivity far outpaces their peers, or whose field issue find rates fall statistically below peers. Using such targeted metrics, PG&E can better identify the need for process improvements, additional training or supervision, and other corrective actions. Such inspection process control metrics remain under development and are expected to expand in 2021.

In addition, field work and inspections are audited by the Federal Monitor and WSD, as described in more detail in Section 7.2.A above.

Additional information regarding monitoring and auditing of inspections is provided in Section 7.3.4.14.

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7.2.D Report in a format that matches across WMPs, Quarterly Reports, Quarterly Advice Letters, and annual compliance assessment

D. Ensure that across audits, initiatives, monitoring, and identifying deficiencies, the utility will report in a format that matches across WMPs, Quarterly Reports, Quarterly Advice Letters[4], and annual compliance assessment.

Like other California utilities, PG&E is required to provide information regarding our wildfire risk mitigation activities in a variety of reports and forms. Each of those documents, including this one, generally have a prescribed format, information and set of objectives and metrics defined by the regulator and/or requestor. Several of those reporting forums are identified in the prompt to this question. PG&E agrees that it is in everyone's best interest to standardize and streamline these documents and reports to minimize duplication and confusion while maximizing the investment of time from all parties in developing, reviewing and responding to the valuable content of these discussions. PG&E is working to align our reporting and communication about WMP activities across these various reporting forums and will continue to do so. PG&E's CWSP PMO is the primary department that facilitates and responds to all wildfire mitigation related questions and reports and provides a level of consistency and continuity between document through its leadership. PG&E looks forward to partnering with the WSD and other parties on continuing to streamline the templates, formats, requirements and timeframes of all of wildfire mitigation related filings for the benefit of all parties.

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4 General Rule for filing Advice Letters are available in General Order 96-B: https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M023/K381/23381302.PDF.

7.3 Detailed Wildfire Mitigation Programs

In this section, describe how the utility's specific programs and initiatives plan to execute the strategy set out in Section 7.1. The specific programs and initiatives are divided into 10 categories, with each providing a space for a narrative description of the utility's initiatives and a summary table for numeric input in the subsequent tables in this section. The initiatives are organized by the following categories provided in this section:

1. *Risk assessment and mapping*
2. *Situational awareness and forecasting*
3. *Grid design and system hardening*
4. *Asset management and inspections*
5. *Vegetation management and inspections*
6. *Grid operations and protocols*
7. *Data governance*
8. *Resource allocation methodology*
9. *Emergency planning and preparedness*
10. *Stakeholder cooperation and community engagement*

7.3.a Financial Data on Mitigation Activities, By Category

In the following Section (7.3.2) is a list of potential wildfire and Public Safety Power Shutoff (PSPS) mitigation activities which fit under the 10 categories listed above. While it is not necessary to have initiatives within all activities, all mitigation initiatives will fit into one or more of the activities listed below. Financial information—including actual / projected spend, spend per line- miles treated, and risk-spend-efficiency for activity by HFTD tier (all regions, non- High Fire Threat District (HFTD), HFTD Tier 2, HFTD Tier 3) for all HFTD tiers which the activity has been or plans to be applied—is reported in the attached file quarterly. Report any updates to the financial data in the spreadsheet attached in Table 12.

Financial spend information:

PG&E has included the requested financial spend information for each initiative in Table 12 in "Attachment 1 – All Tables Required by 2021 WMP Guidelines.xlsx". With regard to financial information, 2020 actual costs and 2021-2022 forecasts are provided. These forecasts are subject to changes as a result of operational and regulatory events. For example, as PG&E continues to gain experience implementing initiatives, the forecasts of cost may need to be updated. Forecasts are also subject to regulatory outcomes, including CPUC approval of the scope or timing of a specific initiative. With regard to plans and information for the number of units that will be installed for

certain initiatives, these are also subject to change. Actual unit installation and operation can be impacted by delays due to permitting, weather or access, laboravailability, and availability of equipment. PG&E expects that the actual unit numbers will change from forecasts, especially for future years such as 2022.

In addition, PG&E is providing the following explanation regarding the financial spend information provided:

- Mitigation and control work has been included in this Wildfire Mitigation Plan (WMP) and these tables that spans multiple cost recovery mechanisms including the General Rate Case (GRC), Transmission Owner (TO) rate case at the Federal Energy Regulatory Commission (FERC), Catastrophic Event Memorandum Account (CEMA), Fire Risk Mitigation Memorandum Account (FRMMA), Wildfire Mitigation Plan Memorandum Account (WMPMA), and EPIC. Some of these costs have already been approved for inclusion in customer rates and some of these costs are still pending review or approval through open and transparent cost recovery proceedings;
- Financial figures have been mapped to each initiative and/or category based upon the activity being described in Section 7.3 of this document;
- While the primary work performed for wildfire risk mitigation is in the HFTD areas, some work and financial costs associated with Non-HFTD areas have been included in some of these the financial figures;
- The costs reflected are PG&E's best estimate of the costs for the proposed programs as of February 5, 2021. Further changes to 2021 budgets and work plans are possible and actual costs may vary substantially from these plans depending on actual work completion, conditions and requirements; and,
- For the "2020 Actual" and "2020 Projected" columns in Table 12, the population of work included in these financial data sets is aligned to the 2021 WMP scope and list of initiatives. Please note that due to changes in scope for some initiatives from the 2020 WMP to 2021 WMP (for example, PG&E has added/removed sub-initiatives or as indicated above, we are now referencing some Non-HFTD work and financials), we aligned the 2020 financial information with the 2021 scope to ensure consistency across the years of the table.

Line Miles Treated and Transmission Voltage Definition:

The 2021 WMP Tables include data on the number of "line miles treated" for each initiative. This data has been provided, including being estimated, wherever possible, however there are a few limitations that should be understood for these figures.

First, a number of programs are not primarily defined by line miles but are defined by a number of assets (like the number of structures inspected each year, etc.). In these cases, PG&E made high level assumptions to estimate the approximate number of line miles that could be considered "treated" by such asset-based activities. As a result of these assumptions and estimates, the actual number of miles "treated" by these activities may not end up matching with the forecasts provided.

Second, activities at PG&E substations in HFTDs have been generally assigned as treating zero-line miles, since these activities primarily only impact assets within the substation itself and may or may not have material benefit to the circuit / line miles beyond the substation. The same is true for several programs where assets at just one particular point on the grid are being addressed.

Finally, throughout this WMP, PG&E references Transmission assets and programs. PG&E defines transmission voltage (for this and other regulatory filings) as being 60kV or above, PG&E notes this because in some of the initiative definitions the WMP Guidelines provided referenced transmission as being "at or above 65kV." PG&E is unable to reconfigure all of its data to align with a cut-off of 65kV instead of the historically used 60kV and therefore, when PG&E references transmission that is reflective of assets operating at or above 60kV.

Year Initiated

Table 12 (Attachment 1 – All Tables Required by 2021 WMP Guidelines.xlsx) includes a column labeled "Year Initiated" for each of the initiatives. A number of the "initiatives" identified in the WMP templates include activities and programs that have been underway for a very long time, including routine vegetation management, asset inspections and forecasting a fire potential index. It would be difficult or impossible to pinpoint precisely when PG&E began some of these activities which stretch back decades. Therefore, PG&E has populated this column with either "<2018" for initiatives that were started before the current period of dedicated wildfire mitigation activities began in 2018 and has provided specific years for initiatives that were undertaken since the formation of PG&E's Community Wildfire Safety Program in 2018.

Regulations

Table 12 ("Attachment 1 – All Tables Required by 2021 WMP Guidelines.xlsx) includes a column labeled "Current compliance status – In / exceeding with regulations." For purposes of this column and the adjacent column regarding rules, PG&E has interpreted the term "regulations" to mean CPUC General Orders and federal or state laws. Therefore we have not included as "regulations" directives and decisions from the CPUC and potentially others that provide guidance or compliance expectations for some of the WMP initiatives.

7.3.b Detailed Information on Mitigation Initiatives By Category and Activity

Report detailed information for each initiative activity in which spending was above $0 over the course of the current WMP cycle (2020-2022). For each activity, organize details under the following headings:

1. *Risk to be mitigated/problem to be addressed*
2. *Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives*
3. *Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")*
4. *Progress on initiative (amount spent, regions covered) and plans for next year*
5. *Future improvements to initiative*

Mitigation initiatives:

In Section 7.3.b, PG&E presents a description of our programs for 124 initiatives across the 10 categories listed above. The financial spend information for 2020-2022 and Risk Spend Efficiencies (RSE) calculations for each initiative can be found in Table 12 in Attachment 1 – All Tables Required by 2021 WMP Guidelines.xlsx. Detailed workpapers for the RSE calculations can be found in Attachment 2021WMP_Section7.3_Atch01. PG&E provides the following clarifications on the some of the questions included in the guidelines for the Section 7.3.2 wildfire mitigation initiatives.

- *Question 2: Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives*

  For each of the initiatives, we have provided an explanation as to why we engaged in this activity. However, in terms of "the risk informed analysis of empirical (or projected) impact of initiative in comparison to alternatives," PG&E includes references to risk informed analysis in the response as applicable. Since our 2020 WMP filing, PG&E has made progress to increase the number of RSE calculations performed from 4 to 61. While PG&E needs to do more in evaluating how RSE scores can be leveraged into our strategic planning process for work prioritization and comparison of alternatives, in the near-term, PG&E is focused on refining on RSE modelling and increasing the number of RSE calculations across the initiatives. We have not performed a quantitative alternatives analysis on every initiative, some of which are very foundational and fundamental, like benchmarking with other utilities. At a minimum PG&E has considered not performing this initiative as a primary alternative, but in most all cases has at least subjectively evaluated that the benefits of performing the initiative outweigh the costs.

- *Question 4: Progress on initiative (amount spent, regions covered) and plans for next year and Question 5: Future improvements to initiative*

  To address the "amount spent, regions covered" in Question 4, PG&E is capturing this information in Table 12 in Attachment 1 – All Tables Required by 2021 WMP Guidelines.xlsx, which includes the financials and regions covered for each initiative, split out by Non-HFTD, Zone 1, Tier 2, and Tier 3. There are instances in which financial spend information is included in the response to Question 4 for a specific initiative to provide additional insights or context, but largely the financial data has been reserved for the corresponding portion of Table 12.

  The second part of Question 4 ("plans for next year") and Question 5 are asking for similar information. Therefore, for a number of initiatives, PG&E has combined our answers to address both Question 4 and 5. Furthermore, for some initiatives, PG&E does not yet have specific future plans or improvements defined. Certain initiatives are piloting new programs and therefore lessons learned have not been realized yet to inform future strategic plans. In other cases, as improvement opportunities come up, PG&E may implement these improvements rather than planning these improvements as future improvements. These are some of the cases where PG&E describes our future plans as reliant on further evaluation or assessment to determine the path forward. These labels are intended to accurately portray the next steps for these initiatives and reflect the current level of maturity for some of these programs.

Risk Quantification:

With regard to risk information, the initiatives in this section have been categorized into Mitigations, Controls, and Foundational Activity. These categories are defined as follows and the columns in Table 12 (see Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx) are populated accordingly:

Mitigations: Specific additional or enhancement programs, beyond compliance, with specific start and end dates and a project budget, or an additional proposed activity not previously identified. PG&E has calculated RSEs for these initiatives except where relevant data is not available. This could be because the initiative is a Pilot or otherwise does not capture data found usable for RSE calculation. For mitigations with RSEs, PG&E has provided data for columns 'Primary driver targeted', 'Secondary driver targeted, 'Estimated RSE in non-HFTD region', 'Estimated RSE in HFTD Zone 1', 'Estimated RSE in HFTD Tier 2' and 'Estimated RSE in HFTD Tier 3' at the initiative level to the best of our ability.

Controls: Safety and compliance programs already in place. These activities are performed at a standard level every year to ensure that our electric system assets remain in a suitable condition. In the case of controls, it is difficult to determine the wildfire risk level absent of performing the control, for several reasons:

- *PG&E has been performing this work for so long that it is challenging to estimate the counter-factual (consequences of number of equipment*

failures, outages and ignitions) that might occur if PG&E were not performing these routine control activities

- *Some level of this work is required by regulation and good utility practice, it is difficult to zero-base budget, benchmark against peer utilities, or otherwise determine the appropriate minimum level of effort and investment for these activities*

- *PG&E has been tracking program inputs (work hours and resources) and outputs (trees trimmed, inspections performed, circuit miles replaced) as broad programmatic activities, rather than in more granular terms.*

PG&E has calculated RSEs for these initiatives except where relevant data is not available. For controls with RSEs, PG&E has provided data for columns 'Primary driver targeted', 'Secondary driver targeted, 'Estimated RSE in non-HFTD region', "Estimated RSE in HFTD Zone 1', 'Estimated RSE in HFTD Tier 2" and 'Estimated RSE in HFTD Tier 3' at the initiative level to the best of our ability.

Foundational Activity: Enablers to mitigations or controls. They are work needed to implement mitigations or information that would be used to better inform the execution of a control (i.e., investments in Information Technology infrastructure or data gathering). Foundational activities generally do not result in stand-alone risk reduction. As a result, foundational initiatives do not have associated risk drivers or RSE values.

PG&E has not calculated RSEs for the majority of these initiatives; however, we have presented RSEs for some foundational initiatives in order to elicit feedback about our approach.

For the majority of Foundational Initiatives, PG&E has not provided data for columns "Primary driver targeted", "Secondary driver targeted, "Estimated RSE in non-HFTD region", "Estimated RSE in HFTD Zone 1", "Estimated RSE in HFTD Tier 2" and "Estimated RSE in HFTD Tier 3" and has indicated N/A-Foundational. For the foundational initiatives where RSEs are calculated, these columns have been populated.

Finally, accurately and meaningfully measuring risk is challenging, and while PG&E has made every effort to provide the data requested, we encourage the Commission, the WSD, and stakeholders to continue to facilitate a collaborative discussion on how to most reasonably quantify these programs.

7.3.1 Risk Assessment and Mapping

7.3.1.1 A Summarized Risk Map Showing the Overall Ignition Probability and Estimated Wildfire Consequence Along Electric Lines and Equipment

Wildfire Safety Division (WSD) Initiative Definition: *Development and use of tools and processes to develop and update risk map and simulations and to estimate risk reduction potential of initiatives for a given portion of the grid (or more granularly, e.g., circuit, span, or asset). May include verification efforts, independent assessment by experts, and updates.*

1) Risk to be mitigated/problem to be addressed:

Risk maps and tools can be useful for identifying the potential risk reduction associated with initiatives for specific geographic areas or portions of the electrical grid. This can help focus initiatives on the areas where the potential risk reduction is the greatest.

For our electric distribution system, Pacific Gas and Electric Company (PG&E) has created distribution mapping capabilities though our 2021 Wildfire Distribution Risk Model for our System Hardening and Enhanced Vegetation Management (EVM) programs that combine ignition probability and wildfire consequences to estimate the baseline risk and risk reduction potential of these initiatives.

For our electric transmission system, PG&E can produce various maps by asset, but none offer a fully comprehensive risk view of ignition probability and wildfire consequences for transmission lines. PG&E does have modeling capabilities for transmission facilities, but these capabilities do not yet include multiple consequences (e.g., public safety, wildfire, environment, etc.) and multiple failure modes (e.g., wind, third party, asset failure, etc.). PG&E does have a full asset failure probability model for windy conditions (*i.e.*, the Transmission Operability Assessment Model or "OA Model"), which it is combining with the wildfire consequence model. PG&E intends to develop additional risk mapping capabilities and tools for transmission assets in 2021, as described below in response to Question #5 regarding future improvements.

2) Initiative selection ("why" engage in activity): – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

Risk ranking using a risk map allows for prioritization within system-wide workplans and potential areas of risk. For example, it allows inspections to be focused more frequently in riskier areas, repairs to be completed in order of highest risk (rather than first in, first out) while maintaining compliance with GO-95, controls and mitigations to be deployed in rank order to address riskiest segments first, as well as capital upgrades and replacements to be prioritized based on risk.

3) Region prioritization ("where" to engage activity): – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

Risk modeling and mapping has been focused on High Fire Threat District (HFTD) Tier 3 and Tier 2 areas, which allows PG&E to focus areas that have a pre-determined higher fire risk by geographical location. However, since risk within these tiers is not uniform, tools like the 2021 Wildfire Distribution Risk Model allow PG&E to identify pockets of higher relative risk withing the tiers and to target these localized areas for the most effective mitigation programs.

4) Progress on initiative (amount spent, regions covered) and plans for next year

Distribution risk models have evolved in the approach to modeling ignition probability, with more sophisticated modeling techniques implemented than in previous years such as machine learning. PG&E's risk modeling approach for distribution lines is described in detail in Sections 4.3 and 4.5.1. PG&E's risk models and existing modeling approach for the transmission system, including the OA Model, are described in more detail in Sections 4.2.A and 4.5.1.

5) Future improvements to initiative

Distribution: In June 2021, PG&E intends to focus on understanding and better quantifying risk reduction of implemented mitigations on the distribution system and refining the 2021 Wildfire Distribution Risk Model. Refinements will include the added ability to compare wildfire risks for different risk drivers as well as measuring the risk reduction of specific mitigations. These refinements in 2021 will be represented in the 2022 Wildfire Distribution Risk Model.

Transmission: In 2021, the Technosylva wildfire consequence information will be combined with the OA Model asset failure probability information to provide more standardized wildfire risk mapping/ranking between the various voltage classes.

For both distribution and transmission voltage classes, the key to future modeling improvements will be the understanding of how various mitigations (regardless of primary driver) reduce wildfire risk in a quantitative measure. Ideally, the combined impact of multiple mitigations and/or controls should be understood to provide for efficient work planning.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E's long-term plan for developing and using risk modelling and mapping to estimate the risk reduction potential of initiatives centers around refining data inputs, creating more integrated models, and improving granularity in model outputs. Steady improvement in these areas will serve to better localize areas and more effectively target mitigations that reduce the risk of grid related ignitions. With more data being captured internally as well by outside parties, PG&E will continue to evaluate these vast amounts of available data to increase the granularity and performance of our models. Following the risk framework outlined in Section 4.5.1(c), as modeling capabilities are

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improved from relative risk models at the circuit level with system level risk reduction and Risk Spend Efficiencies (RSE), to automated and quantitative risk models that include risk reduction and RSE evaluations all at the asset level, these improvements over the next three years will place PG&E at a steady state where improvement will focus on continually improving the data and granularity of the risk models for improved decision making. PG&E expects to reach a semi-automated level to update risk mapping by 2026, where risk reduction is shown as field work is completed and verified.

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7.3.1.2 Climate-Driven Risk Map and Modelling Based on Various Relevant Weather Scenarios

WSD Initiative Definition: *Development and use of tools and processes to estimate incremental risk of foreseeable climate scenarios, such as drought, across a given portion of the grid (or more granularly, e.g., circuit, span, or asset). May include verification efforts, independent assessment by experts, and updates.*

1) Risk to be mitigated / problem to be addressed:

Changes in climate can have significant impacts on the risks associated with electrical facilities, as well as the effectiveness of wildfire mitigations and initiatives. To address this risk effectively, it is important to develop tools to consider changes in future operating conditions as a result of climate change. PG&E has used and/or developed the following two resources for climate-informed risk mapping and modeling:

- 30-Year Historical Climatology Model: A 30-year historical climatology analysis to help prioritize near-term (zero to five years) wildfire mitigation measures based on historical weather patterns.

- Long-Term Climate Projections: California Public Utilities Commission (CPUC)-approved forward-looking climate data from California's Fourth Climate Change Assessment to consider long-term trends in risk due to climate change.

In addition to these resources, PG&E's Climate Resilience Team specifically evaluated whether the High Fire Risk Area (HFRA) Map (described in Section 4.2.1) that is used to inform some near-term Wildfire Mitigation Plan (WMP) initiatives is consistent with projected increases in wildfire risk due to climate change. PG&E found that the HFRA Map is consistent with expected wildfire risk intensification and spread patterns as a result of climate change, increasing the likelihood that WMP investments guided by the HFRA Map are prudent from both a near-term and long-term perspective.

Finally, PG&E has also initiated research on a study known as the Long-Term Grid Architecture Study to determine the longer-term impacts on grid architecture from various external factors including, but not limited to:

- Climate Change
    - Agricultural changes and impacts on load
    - Wildfire threat
    - Rising sea levels
- Population Migrations
    - Urbanization (e.g., inability to acquire fire insurance in rural areas)
    - Ruralization (e.g., increase in cost of living for urban landscapes)
- Technology

- Reduction in costs for current generation/storage technologies
- Introduction/maturation of newer generation/storage technologies
- Increase in electric vehicle quantity and capability

- Policy Changes

  - Senate Bill 100 – 100% renewable energy by 2045
  - Executive Order N-79-20 – 100% new vehicles to be zero-emissions

The Long-Term Grid Architecture Study aims to identify how these externalities will impact load and capabilities in ascertaining what a theoretical green-field optimal grid design should look like to safely and reliably provide electricity to customers in a 30-year lookahead. In support of this study, PG&E is undertaking an Electric Program Investment Charge project, 3.10 - Grid Scenario Engine, that will investigate whether a grid architecture can be automatically modeled based upon a variety of inputs that can help inform the longer-term grid architecture study.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

The 30-Year Historical Climatology Model was developed to help PG&E determine where wildfire and related contributing weather events are most likely to occur in the near-term, which supports planning and prioritization of near-term mitigation activities. PG&E uses CPUC-endorsed climate projections from the Fourth California Climate Change Assessment for an increasing number of applications as climate change is expected to alter operating conditions in unprecedented ways. We have used climate data to validate the use of the HFRA Map in wildfire mitigation planning and decision-making.

It is important to note that while climate change has and will continue to contribute to the increased risk of wildfire in California, considering future trends in wildfire risk may or may not be warranted for every wildfire mitigation initiative depending on the nature and timeframe of the work in question.

The Long-Term Grid Architecture study may allow PG&E to understand what potential grid architectures need to be applied in a targeted fashion throughout our service territory based upon the many external factors that may affect our ability to safely and reliably serve electricity to our customers. This can help inform PG&E on what longer-term decisions may be required to transition between grid architectures, and what policies may need to be enacted in order to support the transition.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk").

The analyses described above are intended to allow PG&E to focus on where there will be potential climate change impacts, and to evaluate our mitigations and initiatives based on these potential impacts. The 30-Year Historical Climatology Model helps us predict and prepare for wildfire risk events and indicates where

these events are most likely to occur. The Long-Term Climate Projections can help validate geographic prioritization of work given future expected conditions. The HFRA Map evaluates areas outside of HFTD areas for potential higher wildfire risk. Finally, the Long-Term Grid Architecture Study will be localized based upon local load profiles and external risk factors that can be generated based upon a variety of assumptions. An attempt to utilize these profiles in identifying the best-fit grid architecture will be studied and has the potential to inform future grid planning.

4) Progress on initiative (amount spent, regions covered) and plans for next year

PG&E will refresh any relevant forward-looking wildfire risk analysis once new relevant climate projections become available, such as with the release of California's Fifth Climate Change Assessment.

The Long-Term Grid Architecture Study is in the very beginning stages of conceptualization and planning, and therefore current plans and spend amounts forecasted for this effort are still unknown. It is anticipated that this work will occur in phases, with various parallel initiatives that may branch out from this work which can be defined in future WMPs.

5) Future improvements to initiative:

As new climate modeling and research becomes available, for example upon release of California's Fifth Climate Change Assessment, PG&E will evaluate whether near-term mitigation action and long-term planning is consistent with expected changes in wildfire risk due to climate change.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

30-year climatology model

We plan to continue building our high resolution weather and fuels climatology every year. This climatology is used to better understand the environmental conditions that lead to outages and large fires; thus, we expect the climatology dataset to continue to grow over the next ten years. At some point in the future, we may decide to make the operational weather model more granular, and at that time, it would require re-running the historical climatology at the new granular configuration. At this time, however, there are no plans in place to make the operational weather model or climatology more granular.

General usage of forward-looking climate data

The use of long-term climate data to inform decision-making is primarily driven by

PG&E's Climate Resilience Team.[1] The Climate Resilience Team provides input into WMP as requested and appropriate depending on the evolving efforts of the CWSP. It is important to note that operational risk models and mitigations often are focused on a one-to-five year time horizon, while climate projections are most useful for understanding trends on a decadal scale. Misapplication of climate data may result in overprediction of future conditions, skewed results, and misinformed decision-making.

Long-Term Grid Architecture study

As the Long-Term Grid Architecture study is intended to identify potential grid architecture changes over a longer time horizon. It is anticipated that any changes to the expense and capital investments required to meet recommendations that come from this study would occur in the 3-10 year window or even beyond. However, as the study is currently in the beginning stages, no findings have yet been determined.

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1 More information about the previous and planned activities of the Climate Resilience Team, which include many foundational work activities designed to integrate climate data into PG&E decision-making in appropriate cases, can be found in PG&E's 2020 Risk Assessment and Mitigation Phase Report (Chapter 20, Attachment A, Section A-4).

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7.3.1.3. Ignition Probability Mapping Showing the Probability of Ignition Along the Electric Lines and Equipment

WSD Initiative Definition: *Development and use of tools and processes to assess the risk of ignition across regions of the grid (or more granularly, e.g., circuits, spans, or assets).*

1) ***Risk to be mitigated / problem to be addressed:***

Ignition probability models, in conjunction with the wildfire consequence modeling from Technosylva , is used to determine and identify wildfire risk at specific grid locations within the HFTD Tiers 3 and 2. Since wildfire risk is not uniform across HFTDs, these models produce information that can also be used to identify which locations should be prioritized for specific initiatives and wildfire mitigations.

2) ***Initiative selection ("why" engage in activity): – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

The ignition probability associated with distribution and transmission lines is a critical component to addressing and mitigating wildfire risk. While PG&E's mapping effort to date related to electric distribution facilities has been focused on risk where probability and consequences are combined, PG&E now has the capability to create a stand-alone ignition probability map. PG&E has developed a Vegetation Probability of Ignition Model and an Equipment Probability of Ignition Model. These models are described in more detail in Section 4.3 and PG&E's risk modeling in general is described in Section 4.5.1.

For transmission lines, predicted asset failure during windy conditions is modeled using the OA Model. Although this is not a direct ignition probability analysis for transmission lines, the asset failures modeled have the potential to cause an ignition. The OA Model is described in more detail in Section 4.5.1.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

The ignition probability data provides information that helps identify and delineate areas of increased probability of ignition. Once these areas are identified, PG&E can better plan and coordinate mitigation activities in those areas.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

2020 activities focused on the development of PG&E's Vegetation Probability of Ignition and Equipment Probability of Ignition Models are described in detail in Section 4.3. Plans for 2021 include the refinement of these models, as well as development of new transmission models to support the 2022 Wildfire Distribution Risk Model and 2022 Wildfire Transmission Risk Model, are described in Section 4.5.1.

5) Future improvements to initiative:

In 2021, PG&E's Vegetation Probability of Ignition and Equipment Probability of Ignition Models will see more improvements with another year of data (2020) to be incorporated.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

The same long-term plan as discussed in Section 7.3.1.1 is applicable to this initiative because ignition probability modeling is a key component of PG&E's wildfire risk modeling.

7.3.1.4 Initiative Mapping and Estimation of Wildfire and PSPS Risk-Reduction Impact

WSD Initiative Definition: *Development of a tool to estimate the risk reduction efficacy (for both wildfire and Public Safety Power Shutoff (PSPS) risk) and risk-spend efficiency of various initiatives.*

1) Risk to be mitigated / problem to be addressed:

PG&E has developed models that can be used to determine the risk consequence for wildfire risk and to assess the consequences of PSPS deenergization to mitigate wildfire risk. While PG&E has developed tools to assess the risk reduction effectiveness of wildfire mitigation initiatives, as well as the RSE of proposed initiatives, tools to assess the effectiveness of PSPS consequence reduction at a circuit segment level are still in development as discussed in Section 4.1(e).

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

For wildfire mitigation programs and initiatives, such as System Hardening or EVM, PG&E has developed the 2021 Wildfire Distribution Risk Model, which is described in detail in Section 4.5.1. PG&E is currently working on developing a 2022 Wildfire Distribution Risk Model which will provide the capability to compare wildfire risks for additional risk drivers as well as measuring the risk reduction for specific mitigation. As failure models for conductors, vegetation, poles, and other risk drivers are added to the 2022 Wildfire Distribution Risk Model, subject matter expertise can be developed to estimate the impact of the mitigation in reducing the ignition probability or the wildfire consequence portion of the wildfire risk at a given location. These general risk reduction values can be combined with general or specific cost estimates to determine the RSE for a given mitigation option at a given location. RSE values can provide valuable insights for improved risk informed decision making and program development. The 2022 Wildfire Distribution Risk Model will add the ability to estimate the reduction in the ignition probability due to a new or hardened conductor. This will provide improved insights for aligning the right mitigation for locations on the distribution grid.

For PSPS consequence estimation, since these models are in their infancy, PG&E expects to work collaboratively with the other California IOUs to further advance this modeling through the WMP process and ongoing PSPS OIR and SMAP II proceedings.

For PSPS operational events, PG&E uses weather, fuel moisture, and Outage Producing Wind and Utility Fire Potential Index (FPI) Models which inform the decision as to whether a PSPS deenergization is necessary. These models are described in more detail in Section 4.2.A. These high-resolution historical datasets and forecasts are utilized in outage potential and fire potential index models, which are the main inputs into the framework PG&E utilizes to make the decision to execute a PSPS event.

For RSE scores for initiatives in the 2021 WMP, PG&E used our Enterprise Risk

Model, as described in more detail in Section 7.1.A.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The prioritization and location of EVM and System Hardening initiatives is informed by the 2021 Wildfire Distribution Risk Model for the distribution system. For PSPS operational decisions, PG&E does not prioritize by region as we use forecasts from models for the whole service territory and consider the appropriate scope for PSPS events.

4) Progress on initiative (amount spent, regions covered) and plans for next year

The progress and development of PG&E's risk modeling is described in detail in Sections 4.3 and 4.5.1. The 2022 Wildfire Distribution Risk Model, expected to be finalized in 2021, will also add ignition risk capabilities for distribution assets such as poles and transformers. In addition, PG&E intends to expand our wildfire consequence mapping to additional areas beyond the HFTD, known as the HFRA, as discussed in Section 4.2.1.

5) Future improvements to initiative

Future improvements to wildfire mitigation and PSPS risk models are described in Sections 4.2.A, 4.3, and 4.5.1.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E's long-term plan for developing and using risk modelling and mapping to assess the consequences of wildfire risk and PSPS deenergization as well as the effectiveness of mitigation programs is discussed in Sections 4.1, 4.2A, 4.3, and 4.5.1. Improvements to be implemented in the next 2 years will focus on building on our capabilities of the 2021 Wildfire Distribution Risk Model by the modeling of risk drivers, improving the granularity of the model results, and providing risk reduction values for mitigation alternatives. For PSPS consequence assessment, since our risk models are not yet evolved enough to assess PSPS consequence at a circuit segment level, we intend to develop this capability collaboratively with the other California IOUs and with the guidance of the WSD through the WMP process and ongoing PSPS OIR and SMAP II proceedings.

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7.3.1.5 Match Drop Simulations Showing the Potential Wildfire Consequence of Ignitions That Occur Along the Electric Lines and Equipment

WSD Initiative Definition: *Development and use of tools and processes to assess the impact of potential ignition and risk to communities (e.g., in terms of potential fatalities, structures burned, monetary damages, area burned, impact on air quality and greenhouse gas, or GHG, reduction goals, etc.).*

1) Risk to be mitigated / problem to be addressed:

In addition to determining whether an ignition is likely to occur or not, it is also critical to understand the impact and potential consequences of an ignition. Some ignitions may have minimal impact on the surrounding area and communities, while other ignitions could create significant risks including loss of life and property damage, as well as other wildfire related impacts such as air quality impacts. Tools and models can be developed to analyze these potential ignition impacts.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

PG&E has undertaken the development of tools and models to better understand the impact of ignitions on surrounding areas and communities. In late 2019 and 2020, PG&E partnered with an external expert, Technosylva, in the wildfire modeling field to test and deploy cloud-based wildfire spread model capabilities to better understand the technology and to test integration into current decision support framework, such as PSPS. Each day, PG&E delivers our high-resolution 2 x 2 Kilometer (km) weather and fuels model data sets to Technosylva, which performs over 100 million fire spread simulations every three hours out 3 days. These simulations provide fire spread outputs (e.g., potential number of acres burned, and population impacted) and can be visualized per overhead circuit in forecast mode to determine the highest risk circuits every 3 hours. In Figures PG&E-7.3.1-1 and PG&E-7.3.1-2 below, PG&E provides an example output from the fire spread model application and example output from the fire spread model application.

PG&E also has the ability, through a Technosylva application called Wildfire Analyst Enterprise (WFA), to simulate fires on-demand. This involves selecting a location on a map, the start time of ignition and the simulation duration in hours. The Technosylva wildfire spread model uses the dynamic weather forecast of wind and fuel moisture to model how the wildfire may spread. This model framework and technology is also being utilized by other Investor-Owned Utilities in California, as well as California Department of Forestry and Fire Protection (CAL FIRE). This technology allows PG&E to forecast ~100 million virtual fires daily across the PG&E territory in forecast mode, simulate fires on demand as they start, simulate hypothetical fires based on PSPS damage and hazard reports, as well as simulate fires in past weather scenarios.

Finally, PG&E has also developed a Wildfire Consequence Model using the Technosylva fire simulations. This model, in combination with wildfire ignition probability models described above, are used in the 2021 Wildfire Distribution Risk

Model for producing Multi-Attribute Value Function (MAVF)-calibrated risk scores. These scores can then be used to inform initiatives such as EVM and System Hardening.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The Technosylva wildfire spread model results are available across all HFTD areas and the HFRA areas identified by PG&E.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2020, PG&E and Technosylva made considerable improvements to the Technosylva wildfire spread model, which are outlined below.

1. Detailed Fuels Mapping for PG&E Service Territory

    - The fuel model map utilized in the fire spread model was significantly enhanced to fix known issues in the United States Forest Service LANDFIRE dataset; provide more granularity in the Wildland Urban Interface; and include recent fire scars through 2020.

2. Updated Weather Forecast 2km Data Integration

    - The PG&E Operational Mesoscale Modeling System (POMMS) 2 km weather forecast data was fully integrated into the wildfire spread model.

3. Territory wide risk

    - Another mode was developed to evaluate the fire risk not just as it pertains to PG&E's assets but the risk across the entire footprint of PG&E's territory.

4. Woody and Herbaceous Live Fuel Moisture (LFM) Remote Sensing Methods Analysis and Integration

    - Technosylva developed and integrated new LFM models that simulate the moisture available in the LFM woody and herbaceous fuels.

5. Climatological Risk Assessment

    - Technosylva completed a historical analysis from 2000 – 2019 and simulated over a billion fires over the worst >450 fire risk days. This analysis will help inform where the highest risk areas are across PG&E's service territory.

6. Integration with PG&E Fire Detection and Alert System

- Data generated from PG&E's fire detection and alert system are delivered to Technosylva via an API and are now integrated into WFA. These detections are being shared with multiple parties including CAL FIRE and the utilities that also use WFA in California.

7. Integration with PG&E Amazon Web Services (AWS) cloud

- Results from each Technosylva simulation are available on the PG&E cloud. This allows PG&E scientists to evaluate the results of every single simulation out of the millions produced daily.

5) Future improvements to initiative:

In 2021, PG&E will continue to evaluate and test a methodology to incorporate fire spread model outputs into PSPS decision making and expand the forecast horizon from three to four days. We will also work with Technosylva to update the fuel model layers on an annual basis. This includes modeling new vegetation growth in recently burned areas as well as accounting for recent fire disturbances.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E plans to evaluate developments in fire spread simulation technology that occur during the next 3 to 10 years. The technology used PG&E, described above, will likely updated with incremental improvements made by external vendors such as Technosylva and experts. We will also continue to evaluate how we use the output of these simulations internally. Improvements may include updates to fuel layer mapping, fuel moisture models, and risk outputs.

FIGURE PG&E-7.3.1-1: EXAMPLE OUTPUT FROM THE FIRE SPREAD MODEL APPLICATION – COLOR CODING REPRESENTS THE MAXIMUM FIRE SIZE SIMULATED FROM EACH OVERHEAD CIRCUIT

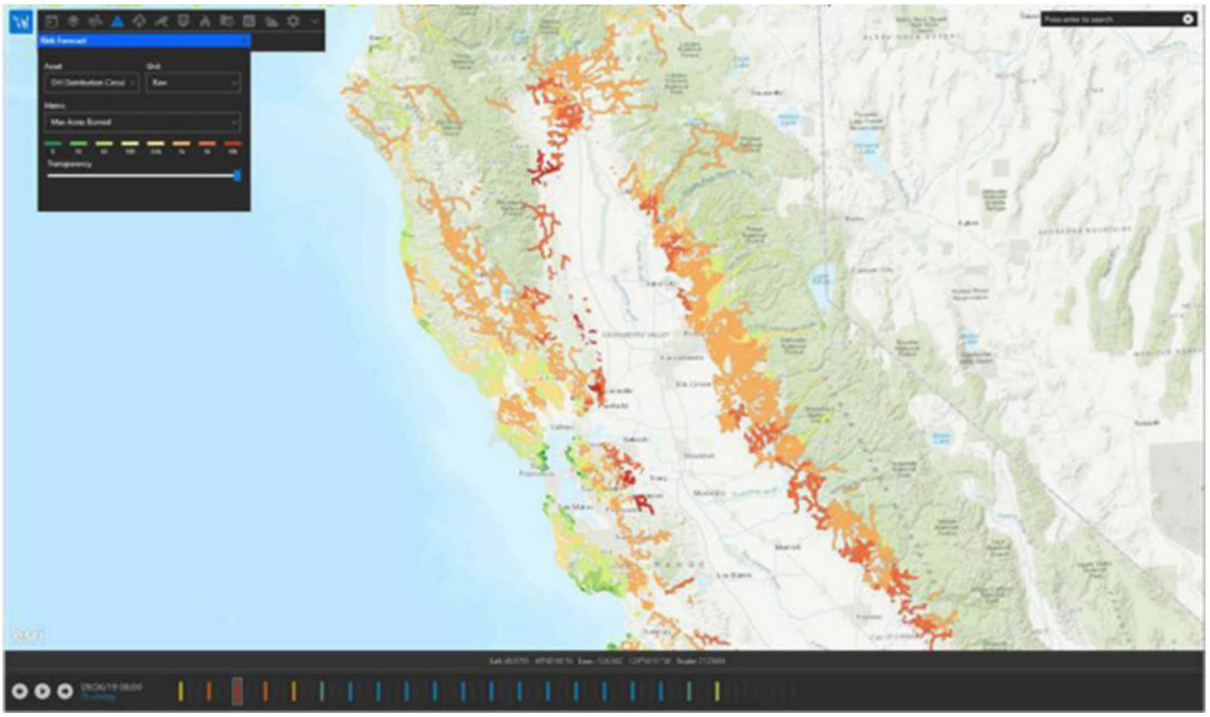
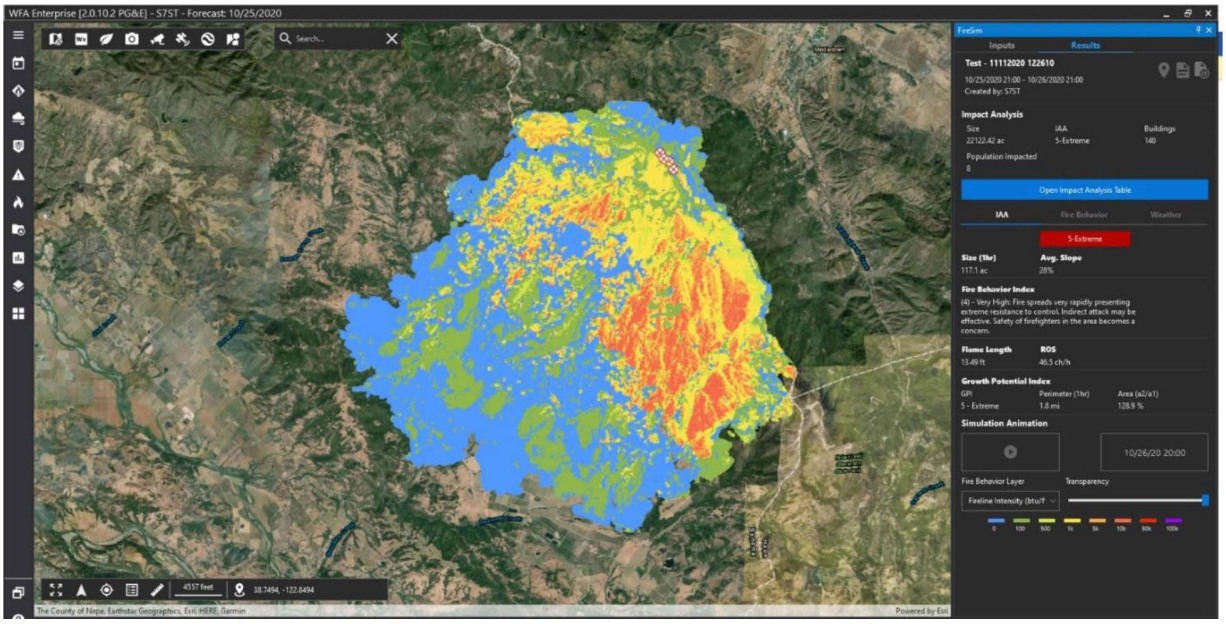


FIGURE PG&E-7.3.1-2: EXAMPLE OUTPUT FROM THE FIRE SPREAD MODEL APPLICATION



7.3.1.6 Weather-Driven Risk Map and Modelling Based on Various Relevant Weather Scenarios

WSD Initiative Definition: *A definition was not provided for this initiative in the WSD guidelines and templates. PG&E has provided a narrative to cover the scope of this initiative.*

1) Risk to be mitigated/problem to be addressed:

To gain better understanding of historical events as well as situational awareness of forecasted and real-time weather events, PG&E needs the ability to display weather model and risk information for model and data interpretation by subject matter experts.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives

PG&E has developed numerous historical, real-time and forecast weather-driven risk maps and visualizations that help inform operational decisions, including:

- Weather model data output visualizations from PG&E high resolution weather model, POMMS at 2 x 2 km resolution.
- Dead and Live Fuel Moisture model data available at 2 x 2 km resolution.
- The Fire Potential Index internal web application, which shows the R1 to R5 FPI index rating for geographic area.
- Weather model data output visualizations from external models including:
    - European Centre for Medium-Range Weather Forecasts
    - Global Forecast System
    - North American Mesoscale Model
    - High Resolution Rapid Refresh
    - Desert Research Institute California and Nevada Smoke and Air Committee Weather Research and Forecast model
- North American Regional Reanalysis (NARR) weather plots from 1995 – 2020 accessible every 3 hours to visualize historic storms.
- Real-time weather station data from over 1000 PG&E, National Weather Service (NWS) and Remote Automatic Weather Stations (RAWS) weather stations:
    - External visualizations from the National Oceanic and Atmospheric Administration-NWS Weather and Hazards Data Viewer and Mesowest
    - Internal Fosberg Fire Weather Index (FFWI) Page that shows the live FFWI for weather stations
- Visualizations of PG&E's Large Fire Probability (LFP) Models in Tableau and ArcGIS Pro.
- Visualizations from Technosylva Wildfire Analyst software, which display wildfire spread consequence metrics.

- Near real-time lightning detection data from the PG&E Lightning Detection Network.
- GOES-West satellite views that show visible and infrared satellite data.

PG&E's weather modeling and risk mapping is described in more detail in Section 4.2.A.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

There is no regional prioritization associated with this work. Weather maps and models are created for the entire PG&E service territory.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2020, PG&E deployed the latest version of our operational weather model, POMMS at 2 x 2 km resolution. This was built to be processed entirely on the AWS cloud. To that end, PG&E developed a model output visualization page where operational meteorologists can review forecast model data from each of the 4 model runs daily. These include maps of temperature, relative humidity, dewpoint, wind speed, winds gusts, precipitation, etc. Visualizations of Dead Fuel Moisture and LFM are available as well.

In 2020, PG&E also completed a 30-year historical weather and fuels climatology at 2 x 2 km resolution as well. This data was processed hour-by-hour by grid point to develop distribution functions that are used to put the forecast in perspective by translating forecasted wind speeds into percentiles based on these unique distributions.

PG&E also routinely updates our NARR archive maps once they become available from NCAR. These maps assist with storm forecasting as similar historical storm events can be studied in detail, as the impacts are known quantities, and compared against a forecasted event. This technique is called analog forecasting.

In 2020, PG&E also built visualizations of our LFP in Tableau and ArcGIS Pro. This allows operational meteorologists to visualize the LFP output across the entire PG&E territory.

5) Future improvements to initiative:

PG&E will continue to leverage our current weather driven risk maps and modeling data to inform wildfire mitigation activities.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E will continue to enhance our capabilities to visualize forecast and historical data over the long term. This includes creating interactive map displays where forecast data can be integrated with an interactive map platform as well as standard meteorological plots created using Python. We also plan to migrate our visualization platforms to the AWS cloud for scalability and redundancy. The risk maps are critical for our meteorologists to interpret and communicate the weather-related risks to internal and external stakeholders.

7.3.2 Situational Awareness and Forecasting

7.3.2.1 Advanced Weather and Fire Potential Forecasting and Monitoring

Wildfire Safety Division (WSD) Initiative Definition: *Purchase, installation, maintenance, and operation of weather stations. Collection, recording, and analysis of weather data from weather stations and from external sources.*

For this initiative, Pacific Gas and Electric Company (PG&E or the Company) has several sub-initiatives including:

- 7.3.2.1.1: Numerical Weather Prediction
- 7.3.2.1.2: Fuel Moisture Sampling and Modeling
- 7.3.2.1.3: Weather Stations
- 7.3.2.1.4: Wildfire Cameras
- 7.3.2.1.5: Fire Detection & Alerting
- 7.3.2.1.6: Other Meteorology Tools and Upgrades

Overview:

PG&E's Meteorology and Fire Science team is comprised of 15 scientists, most with advanced degrees in scientific fields with diverse backgrounds in operational meteorology, utility meteorology, outage prediction, fire science, data science, cloud computing, atmospheric modeling, application development and data systems development. The team is comprised of alumni from the San Jose State University (SJSU) Fire Weather Research Laboratory (https://www.fireweather.org/), former wildland firefighters, former National Weather Service (NWS) forecasters and Veterans of the Marine Corps and United States Air Force. The team is well positioned to advance operational meteorology and operational decision making at PG&E to reduce wildfire risk.

The meteorology team also partners and collaborates with external experts and companies versed in numerical weather prediction, satellite technology and wildfire spread modeling. The team's responsibilities include monitoring and forecasting weather for utility operations, as well as maintaining, developing and deploying meteorological and decision support models for utility operations. Each day, PG&E Meteorology ingests and processes multiple terabytes of weather intelligence utilizing PG&E on-premise data centers and cloud computing.

PG&E utilizes public and proprietary state-of-the-art weather forecast model data and operates an in-house, high-resolution meteorological modeling system to forecast weather conditions, outage potential, and fire potential. PG&E also has a robust history of weather data including over 500,000 images from the North American Regional Reanalysis (NARR), as well as a high-resolution (2 x 2 kilometer (km)) 30-year, hourly climatology of weather and fuels data. These historical datasets are utilized to train outage and fire potential models as well as to put forecasts into perspective. PG&E also leverages publicly available forecast information from government agencies

such as the NWS, Geographic Area Coordination Centers - Predictive Services, the National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center and coordinates directly with meteorologists from these agencies on daily interagency conference calls when there is an increased fire potential. PG&E acquires and processes public and proprietary weather data daily from several sources including, but not limited to:

- European Centre for Medium-Range Weather Forecasts (ECMWF)
- The ECMWF Ensemble Prediction System (EPS)
- Global Forecast System (GFS)
- Global Ensemble Forecast System (GEFS)
- Canadian Meteorological Centre Global Model
- North American Mesoscale Model
- High Resolution Rapid Refresh
- High Resolution Ensemble Forecast model suite
- NanoWeather Uncoupled Surface Layer model
- Clean Power Research, LLC solar irradiance model
- Desert Research Institute California and Nevada Smoke and Air Committee Weather Research and Forecast (WRF) model
- PG&E's 2 x 2 km WRF model; the PG&E Operational Mesoscale Modeling System (POMMS)
- National Center for Environmental Prediction (NCEP) Real-Time (RT) Mesoscale Analysis
- Satellite and Fire Detection data from Geostationary Operational Environmental Satellite (GOES)-16, GOES-17, Moderate Resolution Imaging Spectroradiometer (MODIS)-AQUA, MODIS- TERRA, Suomi National Polar-orbiting Partnership (NPP), and NOAA-20
- NOAA Radar data
- Upper air observations from NOAA soundings and various wind profilers
- Lightning Data from the TOA Systems, Inc. Global Lightning Network
- RT weather station data from over 1000 PG&E, NWS and Remote Automatic Weather Stations (RAWS) weather stations

PG&E first deployed the high resolution in-house mesoscale forecast model, POMMS, in November of 2014 and continues to improve and build upon the model framework to generate short to medium-term weather, outage, and fire potential forecasts across the PG&E service territory. POMMS is a high-resolution weather forecasting model that generates important fire weather parameters including wind speed, temperature, relative humidity (RH), and precipitation. Outputs from POMMS are used as inputs to the National Fire Danger Rating System (NFDRS), the Nelson Dead Fuel Moisture (DFM) model, and a proprietary Live Fuel Moisture (LFM) model to derive key fire danger indicators such as 1hr, 10hr, 100hr, 1000hr DFM, LFM.

In late 2018 to 2019, PG&E successfully completed one of the largest known high-resolution climatological datasets in the utility industry: a 30-yr, hourly, 3 km spatial resolution dataset consisting of weather, dead and LFMs, NFDRS outputs, and fire weather derivative products such as the Fosberg Fire Weather Index (FFWI). The quantity of data generated at the near-surface

was near 80 billion datapoints. With this robust weather and fire parameter dataset, PG&E Meteorology sought to develop outage and fire potential models in 2019 utilizing best-practices deployed in the utility industry, fire science and data science communities.

In late 2019 to 2020, PG&E embarked on an intensive effort to improve the POMMS model by increasing the resolution from 3 km to 2 km as well as increasing the output accuracy. The 2020 goal was to deploy a more accurate and granular high-resolution model to reduce customer impacts due to Public Safety Power Shutoff (PSPS) in 2020. To achieve this goal, numerical weather prediction experts in PG&E partnered with two external experts in numerical weather prediction: DTN, a company that specializes in subscription-based services for the analysis and delivery of real-time weather, agricultural, energy, and commodity market information, and Atmospheric Data Solutions. Over the course of half a year, nearly 20 different model configurations were tested by internal and external experts to determine the optimal weather model configuration that would be deployed. This included extensive back-testing and validation of past PSPS events to fine-tune model parameterization and physics options to achieve the most accurate model possible for deployment. After the optimal model was recommended and agreed upon by internal and external experts, it was deployed in 2020 and utilized during all 2020 PSPS events. In addition, a new 30-year climatology was produced using this new model configuration at 2 km resolution.

In 2020, PG&E also deployed a 2 km EPS based on the optimal model configuration aforementioned. The PG&E Operational Mesoscale Modeling System Ensemble Prediction System (POMMS-EPS) is comprised of a total of eight ensemble members. Six members are perturbed stochastically in order to better understand forecast uncertainty. Two members were set aside for longer-term testing and validation with the goal on informing the next generation of the POMMS model. With these members, PG&E meteorology will be able to test if other model configurations or initializing the POMMS model with ECMWF, for example, provides more accurate results. With these investments in numerical weather prediction, PG&E is positioned to keep pace with industry improvements in weather prediction.

In 2020, PG&E surpassed 1,000 weather stations installed, which is one of the largest utility-owned and operated weather station networks in the world. Each weather station deployed records and reports meteorological data every 10 minutes and all data is made publicly available. This data can be accessed in real time through the NWS weather and hazards data viewer, Mesowest, the NCEP Meteorological Assimilation Data Ingest System (MADIS), or at www.pge.com/weather. In 2019 and 2020, PG&E meteorologists met with representatives from NWS, California Department of Forestry and Fire Protection (CAL FIRE), United States Forest Service (USFS) and others to coordinate on where deployment of weather stations would be useful to not only PG&E, but to other agencies and the public. In 2021 and beyond, PG&E plans to expand and optimize this network and work with external stakeholders to improve meteorological measurements throughout California.

In 2020, PG&E established a LFM sampling program to complement samples collected by state and federal agencies on the state of live fuels across California. This network consists of 30 locations where plant species such as Chamise and Manzanita are sampled to measure the amount of fuel moisture in these plants throughout the seasonal cycle. These measurements are made publicly available via the National Fuel Moisture Database (NFMDB). These observations are critical to train high resolution LFM models and satellite-derived LFM products.

PG&E also developed and deployed a state-of-the-art satellite fire detection system in 2019 that used remote sensing data from five geostationary and polar-orbiting spacecraft to detect fires. In 2020, this program was expanded to include a newly launched polar-orbiting satellite, NOAA-20, to bolster the program. PG&E has partnered with the Space Science and Engineering Center (SSEC) from the University of Wisconsin, which provides PG&E with a customized, granular feed of fire detections from the next-generation GOES satellites. PG&E also obtains polar-orbiting satellite fire detection data from NASA. PG&E developed a proprietary application and algorithms in-house to consolidate fire detections as they arrive from several satellites and disseminate alerts via internal and external web applications and email. The web application allows PG&E's analysts in the Wildfire Safety Operations Center (WSOC), meteorologists and others to track fire detections in near-real time, evaluate the intensity of fires via the Fire Radiative Power (FRP) outputs, as well as track the general spread of fires. This system is used in concert with the weather station network described above, the expansive high-resolution camera network deployed in PG&E's territory, and several other sources. PG&E is committed to share this data with all interested stake holders. The external application available to the public is found here: https://pgefdp.lovelytics.info/pge_fire_app/.

In addition, PG&E is sharing this data with Technosylva, who has developed wildfire spread risk models and applications. This application is used by other California utilities and CAL FIRE, and PG&E has allowed all stakeholders access to this fire detection data through Technosylva's Wildfire Spread Analyst application. PG&E is also interested in receiving fire detection data available from Fire Guard, which is a produced by the California National Guard but has so far been unable to gain access to this data.

7.3.2.1.1 Numerical Weather Prediction

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

High resolution weather models are used by PG&E and other California utilities to forecast the weather and critical components such as temperature, wind speed and RH. These models were developed and configured to provide the most accurate output possible for the PG&E territory to date. External high-resolution models available to the public, such as the High-Resolution Rapid Refresh model, do not provide enough lead time or are not as granular (i.e., have coarser resolution). This program is a core and foundational component of PG&E's ability to forecast and execute a PSPS event to ultimately reduce the risk of catastrophic wildfire, while giving the public and stakeholders as much lead time as possible. The weather model output is also used by dead and LFM models and also is used in fire spread simulations.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PG&E Meteorology remains committed to advancing and improving our weather prediction capabilities beyond what is publicly available. This generally involves using state-of-the-science weather forecast models, such as the WRF model and determining which model configuration performs best for the PG&E service territory. With more accurate weather model data with a forecast horizon, PG&E will be able to mitigate catastrophic wildfire risk through PSPS while limiting the scope of PSPS events.

PG&E has rigorously tested and deployed high-resolution models and built high-resolution historical datasets. These high-resolution historical datasets and forecasts drive outage potential and Fire Potential Index (FPI) Models, which are the main inputs into the framework PG&E utilizes to make the difficult decision to execute a PSPS event.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E's weather modeling work is not limited to a particular region. The weather model provides output every 2 x 2 km across the PG&E system territory.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

PG&E first deployed the POMMS in 2014, upgraded the system to POMMS 2.0 in 2018 and upgraded again to the third version of the model called POMMS V3.0 in 2020. The improvements in 2020 led to more targeted PSPS events. More

advancements can be expected in the future as the state of weather modeling improves.

The 2020 POMMS V3.0 prediction suite is comprised of the following:

- A deterministic 2 x 2 km weather model (The WRF Model) that provides weather forecasts (e.g., wind, temperature, RH) out 105 hours. This model is run four times per day.
- A 2 x 2 km EPS run twice per day. The POMMS-EPS is comprised of eight ensemble members.
- Experimental 0.67 x 0.67 km forecasts that can be run on-demand during high risk events.
- A historical climatology that contains 30 years (1989 – 2020) of hourly weather data at 2 x 2 km resolution. This climatology was built using the same model configuration as used in forecast model.
- A 30-year climatology of DFM and LFM from multiple plant species at 2 x 2 km resolution.
- The POMMS V3.0 suite is entirely run and processed using the Amazon Web Services (AWS) cloud.

POMMS V3.0 was operationally deployed after significant validation and testing by PG&E and external numerical weather prediction experts DTN and Atmospheric Data Solutions. Nearly 20 different model configurations were run on a variety of test cases covering high wind and precipitation events. Model output from each case were validated against the hundreds of weather stations now available in the PG&E territory, including the hundreds of stations PG&E has deployed since 2018. The ultimate goal was to find the optimal model configuration that produced the most accurate simulations over a range of high-impact events for a range of meteorological parameters.

The model configuration deployed at 2 km resolution was recommend by both external partners and was approved by PG&E Meteorology. The WRF model version 4.1.2 (released July 12, 2019) was selected for POMMS V3.0. Key features added or made default in version 4 of WRF include a hybrid vertical coordinate and a moist potential temperature prognostic variable. A nested grid configuration of 18-, 6-, 2-, and 0.67-km grids are utilized. The vertical grid has 51 levels and a 20 hPa top. Adaptive time stepping is used for computational efficiency and the model was configured to run in the AWS cloud across different AWS regions for redundancy.

The WRF forecasts are initialized using ¼° output from the National Centers for Environmental Prediction (NCEP) - GFS model data as well as 1/12° Sea Surface Temperature analyses. Data assimilation (3DVAR) is applied on the outer grid. Data available for assimilation are taken from MADIS and include conventional surface and upper-air observations, as well as aircraft data and satellite-derived winds. As the NCEP-GFS forecast model is a single point of failure, PG&E and external experts developed the ability to initialize POMMS with ECMWF in case of a Federal/NCEP data outage.

PG&E has also developed an EPS based on POMMS V3.0. Eight forecast ensemble members are run at 2 km resolution to better evaluate forecast uncertainty

and to test additional model configurations to potentially inform future enhancements. Six of the members are stochastically perturbed with the following techniques available in WRF.

- Stochastically perturbed physics tendencies
- Stochastic kinetic-energy backscatter scheme
- Stochastically perturbed parameter scheme

The remaining two ensemble members are being used to test alternate configurations, such as alternate physical parameterizations (e.g., alternate Planetary Boundary Layer scheme) or forcing the model with different initial conditions (e.g., ECMWF forecast data).

In addition to upgrading to POMMS V3.0, PG&E enhanced our use of cloud computing architecture in 2020 to run and process the vast quantities of weather data (multiple terabytes) consumed and produced each day. This provides a flexible and cost-efficient environment and was chosen over utilizing on-premise High-Performance Computing Clusters or super computers. In the AWS cloud, weather and fuels forecasts are processed and stored in PostgreSQL databases and have been dynamically linked to ArcGIS Pro. This allows PG&E meteorologists to visualize the hour-by-hour forecast data with respect to PG&E's assets. Standard meteorological plots are also created and available via AWS web instances for evaluation by PG&E meteorologists.

Figure PG&E-7.3.2-1 below shows some simplified model output from the POMMS-EPS. The image represents forecasts of the pressure difference or gradient between Redding, California and Sacramento, California from the deterministic POMMS V3.0 output, as well as all eight ensemble members and the ensemble mean.

FIGURE PG&E-7.3.2-1: SIMPLIFIED MODEL OUTPUT FROM POMMS-EPS

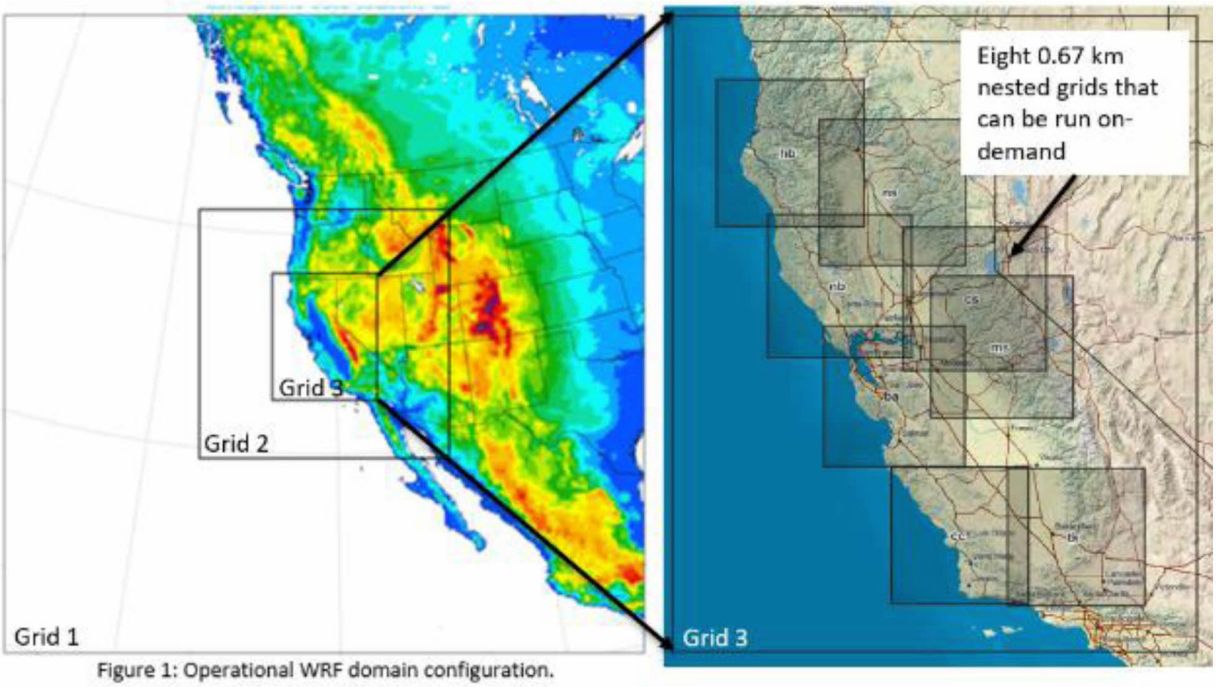
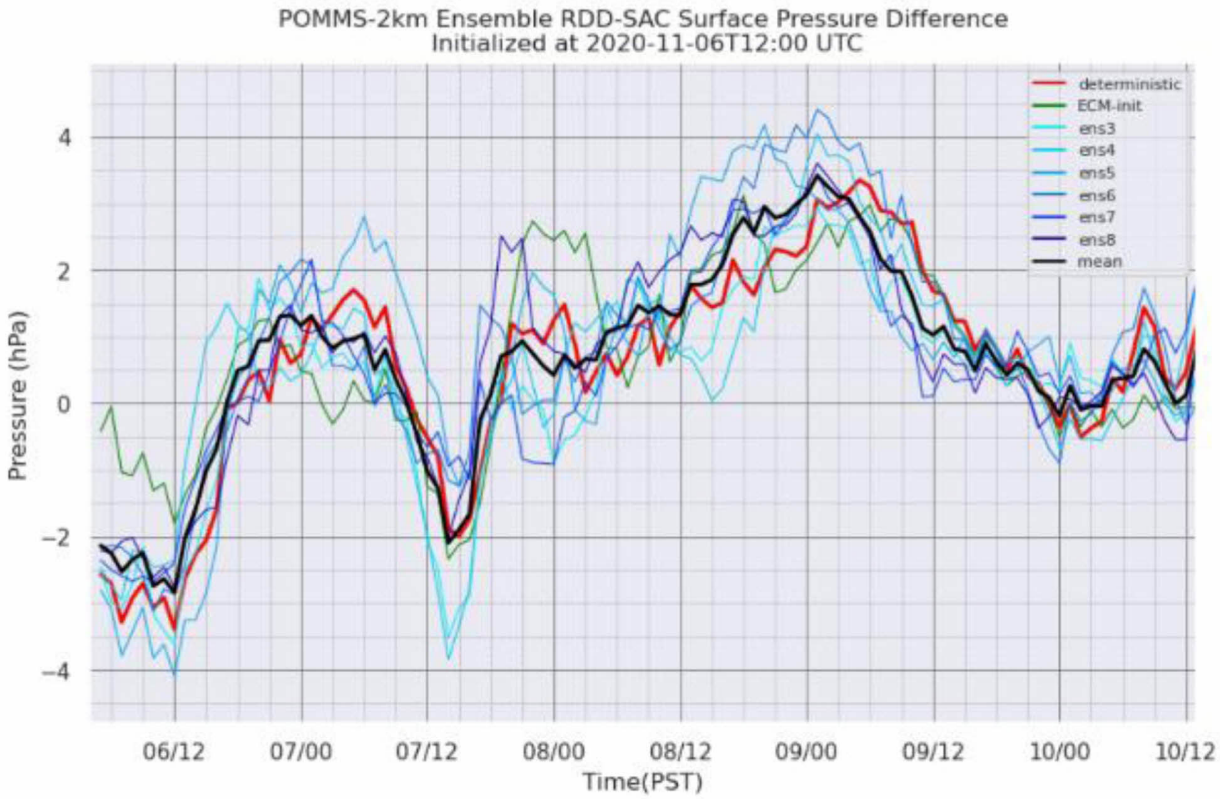


Figure 1: Operational WRF domain configuration.

FIGURE PG&E-7.3.2-2: EXAMPLE POMMS ENSEMBLE PREDICTION SYSTEM OUTPUT



5) Future improvements to initiative:

In 2021, PG&E plans to achieve the following to enhance our numerical weather prediction program:

- Expand the historical weather climatology at 2 x 2 km resolution to back-fill all of 2020. This will allow PG&E meteorologists and data scientists to study the outage and fire events of 2020 using this consistent set of climatology data.
- Explore a methodology to back-fill the climatological data each quarter moving forward.
- Evaluate extending the deterministic forecast to provide another 24 hours of forecast data (from 105 hours currently to 129 hours).
- Evaluate if the POMMS-EPS ensemble mean is more or less accurate than the deterministic POMMS model.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As numerical weather prediction is core and central to the PSPS program, PG&E will continue leveraging high resolution weather model data to inform operational decisions for the foreseeable future. PG&E plans to continue working with external numerical weather model experts to evaluate model physics, configurations, and resolutions that can improve the overall model fidelity.

Meteorological models are expected to improve in the future, and PG&E plans to evaluate and incorporate the latest weather model improvements that can increase forecast accuracy. This includes upgrading to newer version of the WRF Model in the future and producing more granular forecasts if greater accuracy can be achieved. Ensemble weather prediction is also being evaluated and can be expanded to provide a wider range of outcomes and probabilistic forecasts. This program is expected to continue through the next ten years at this time.

7.3.2.1.2 Fuel Moisture Sampling and Modeling

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated / problem to be addressed:

The moisture content in living and dead vegetation is a critical component of PG&E's FPI and the NFDRS used by state and federal fire agencies. Other California utilities are engaged in modeling the state of live and dead fuels to better understand when large fires are possible. PG&E Meteorology remains committed to advancing models utilized to simulate fuel moistures in dead and living vegetation, called DFM and LFM.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

The DFM and LFM forecasts are inputs into PG&E's FPI Model, which is a core component of PSPS assessments. Working with external experts, these models were enhanced to provide hourly output across PG&E's entire modeling domain at 2 x 2 km resolution to provide more granular output and a longer lead time than is publicly available. This gives PG&E the ability to assess the potential for PSPS events with a longer lead time leading to more advanced noticed of potential PSPS events.

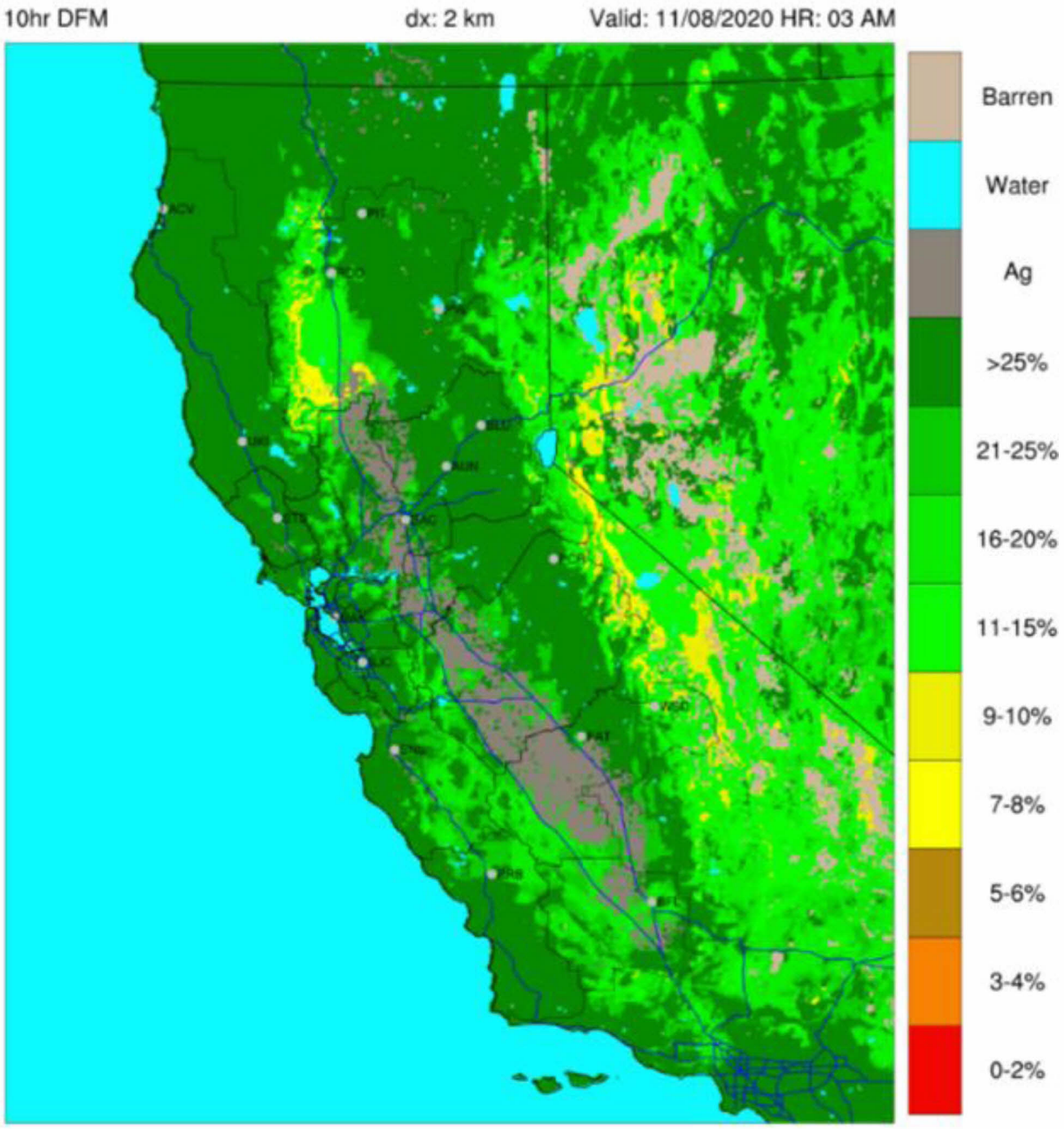
3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

There is no regional prioritization regarding this work. The fuel models provide output across the entire PG&E territory.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

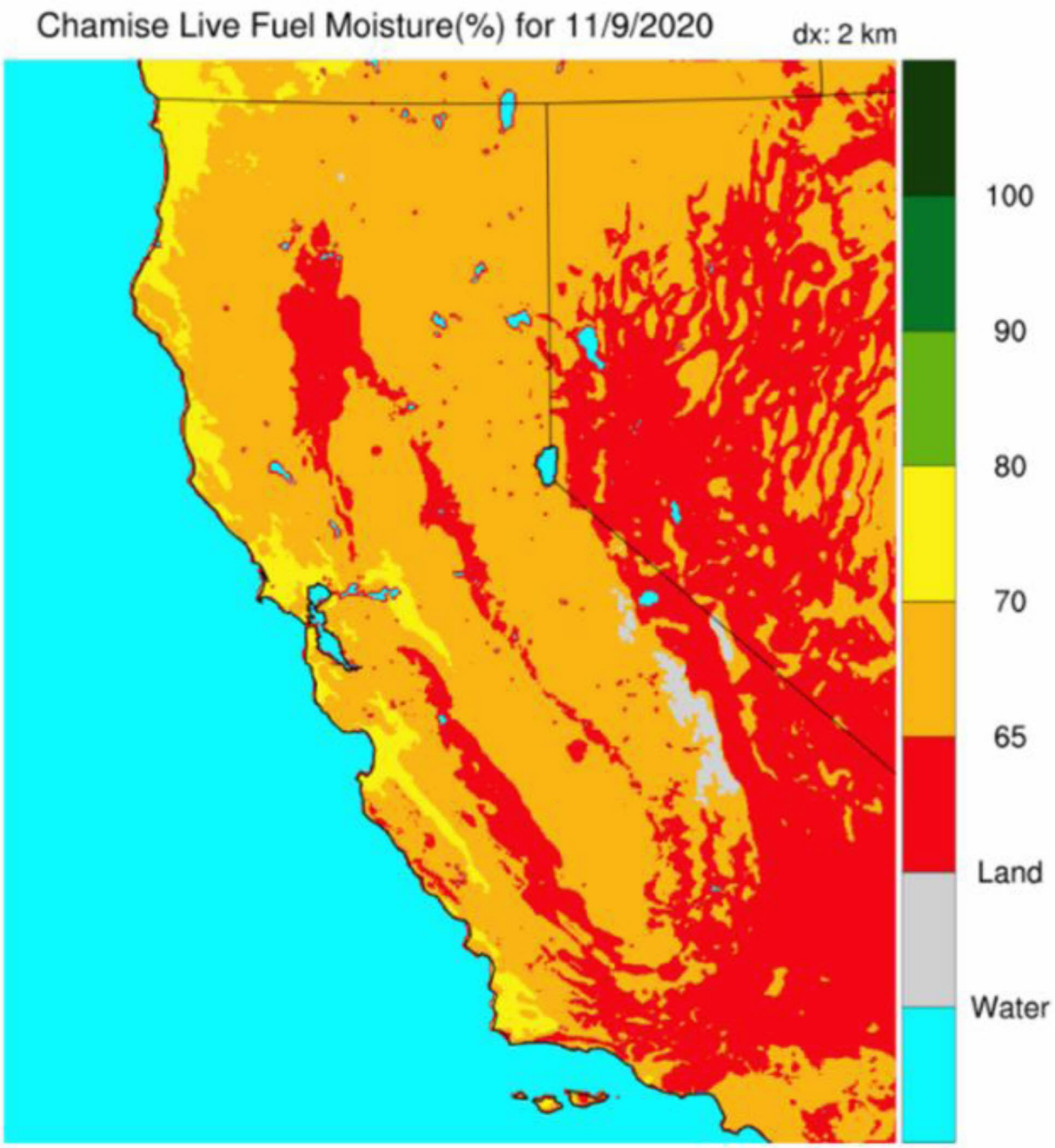
In 2020, PG&E partnered with Atmospheric Data Solutions and Technosylva to develop the next generation of LFM and DFM Models deployed at PG&E. In 2020, PG&E deployed a DFM Model on the PG&E-AWS cloud capable of predicting the moisture content of multiple DFM fuel classes (i.e., DFM 1hr, DFM 10hr, DFM 100hr, DFM 1000hr) at 2 x 2 km resolution. The DFM Model PG&E deployed is a customized version of the Nelson DFM model utilized in the NFDRS 2016 model version. Figure PG&E-7.3.2-3 below is an example hour output from the DFM 10hr fuel class is presented. These models provide hourly DFM forecasts for the four aforementioned DFM classes up to four days in advance.

FIGURE PG&E-7.3.2-3: HOUR OUTPUT FOR 10-HOUR DFM MODEL



PG&E also deployed 2 x 2 km LFM models for Chamise as well as Manzanita plant species. These are machine-learning models developed by ADS using NFMDB observations. Figure PG&E-7.3.2-4 below is an example hour output from the LFM Chamise model is presented.

FIGURE PG&E-7.3.2-4: HOUR OUTPUT FROM LFM MODEL

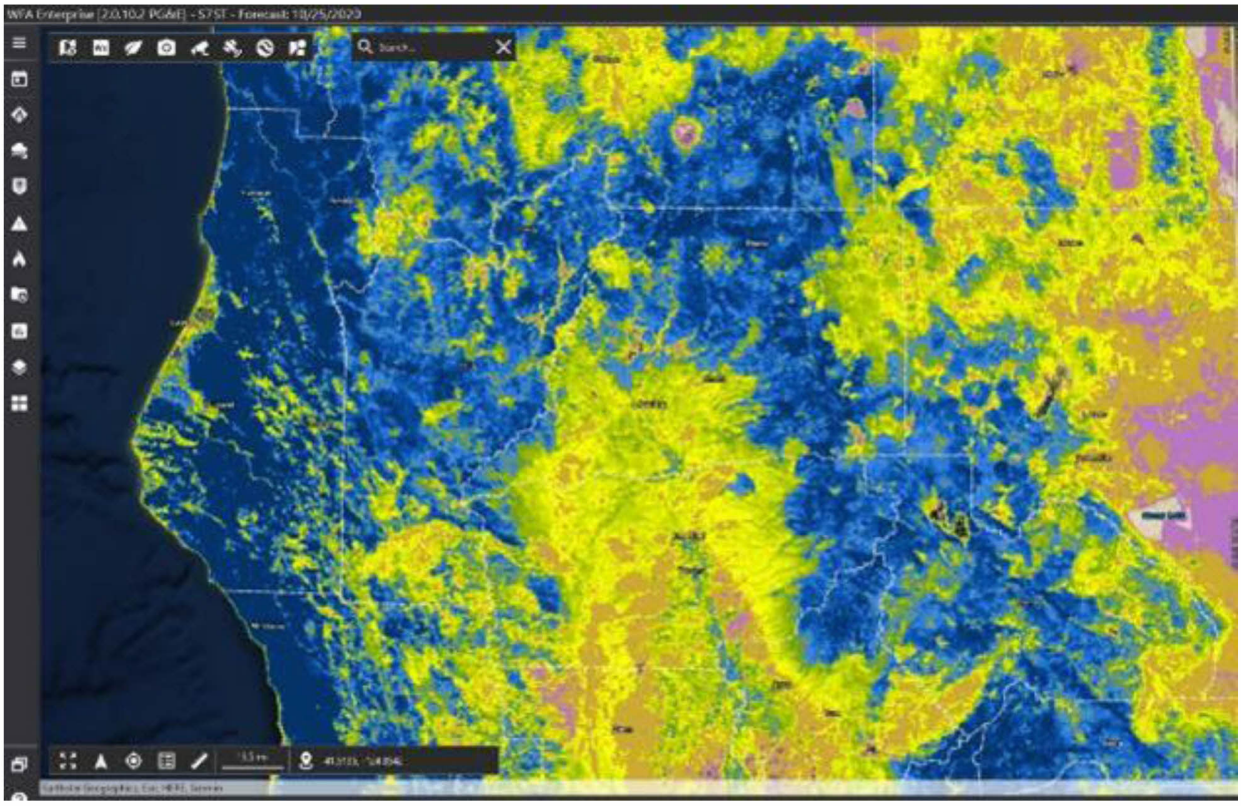


In addition to creating new forecast models, PG&E created a 30-year climatology of DFM and LFM output at 2 x 2 km resolution as well. These robust historical datasets allow PG&E meteorologists and data scientists to evaluate the dead and LFM conditions present during historical fires.

PG&E also sought to create new LFM models using remotely sensed satellite data. To this end, PG&E partnered with Technosylva to deploy LFM woody and LFM herbaceous fuel models that take advantage of recent Moderate Resolution

Imaging Spectroradiometer (MODIS) satellite measurements and indices such as the Normalized Difference Vegetation Index (NDVI). Figure PG&E-7.3.2-5 below is an example NDVI output is presented. These models were built using machine learning techniques and were trained against NFMDB observations.

FIGURE PG&E-7.3.2-5: EXAMPLE OF NORMALIZED DIFFERENCE VEGETATION INDEX OUTPUT



LFM models developed and deployed are trained on field observations. PG&E is taking steps to bolster these observations and to provide them to the public, to help validate existing models and enable more accurate models to be developed in the future, as they can take advantage of many more observations. To this end, PG&E partnered with SJSU in 2019 and 2020 to sample LFM at multiple locations in the High Fire Threat District (HFTD) within the Bay Area. Data collected from SJSU is available here: https://www.fireweather.org/fuel-moisture and also published to the NFMDB.

In 2020, PG&E also established an internal LFM sampling program to complement samples collected by state and federal across Northern and Central California. As of January 1, 2020, this network consists of 30 locations where plant species, such as Chamise and Manzanita, are sampled to measure the amount of fuel moisture in these plants throughout the seasonal cycle. Site locations are selected and scouted by PG&E meteorologists as well as Safety and Infrastructure Protection Teams (SIPT) personnel. The samples are collected in the field and shipped to PG&E's chemistry laboratory for processing. The results of all measurements are uploaded and made publicly available via

the NFMDB. These observations are critical to train and validate high-resolution LFM models and satellite-derived LFM products and will be helpful for PG&E and others to train the next generation of LFM models.

5) Future improvements to initiative:

In 2021, PG&E plans to achieve the following to enhance our Fuel Moisture Sampling and Modeling efforts:

- Expand the historical DFM and LFM climatology at 2 x 2 km resolution to back-fill all of 2020. This will allow PG&E meteorologists and data scientists to study the fire events of 2020 using this consistent set of climatology data.
- Evaluate extending the deterministic DFM and LFM forecast to provide another 24 hours of forecast data for more advanced warning of potential PSPS conditions.
- Continue the LFM sampling program in 2021 by continuing to measure LFM at 30 locations across PG&E's territory to bolster situational awareness and build historical datasets for model calibration.
- Evaluate sampling DFM as observations of DFM 100hr and DFM 1000hr fuels are currently sparse.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As fuel moisture sampling and prediction is core and central to the PSPS program, PG&E will continue leveraging high resolution fuel moisture models to inform operational decisions such as PSPS for the foreseeable future. PG&E plans to continue working with external experts to evaluate and operationalize new methodologies and models that may contribute to the overall model fidelity and accuracy. This program is expected to continue through the next ten years at this time.

7.3.2.1.3 Weather Stations

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

This section includes a description of weather stations and addresses Actions PGE-43 (Class B) and PGE-44 (Class B)

1) Risk to be mitigated/problem to be addressed:

There is high wildfire risk across many remote areas within PG&E's 70,000 square mile service territory. California contains thousands of microclimates in which wind patterns differ based on location and topography (e.g., on top of a ridge, in a canyon, or on a valley floor). As weather events unfold, such as in Diablo wind events, the complex dynamics of wind and terrain alignment as well as boundary layer height may result in downslope windstorms where wind speeds accelerate down mountain ranges and topographic features. Although there are hundreds of RAWS and NWS Weather Stations in remote areas of California, there are many locations where micro-scale effects can occur. These effects should be monitored.

By installing an expansive network of weather stations that cover some of these remote areas, we are able to enhance our real time situational awareness of conditions in these locations during critical fire weather events and also begin building a historical climatology in places where we never had verified observations before.

This historical data is also used to enhance predictive capabilities by using historical observations to test new weather model forecast configurations for enhanced accuracy. Installing such an expansive network across even the most remote portions of the territory's high fire threat areas increases real time situational awareness (in locations where it previously lacked) and mitigates wildfire risk by allowing us to better monitor conditions and respond in RT. It also allows us to use these observations to enhance predictive modeling to better forecast high risk wildfire conditions in the future and better prepare and respond to these events with as much time and confidence as possible.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Data from weather stations installed in PG&E's service area are used to help forecast and monitor for high fire-risk weather conditions. This data helps inform implementation of additional precautionary measures such as PSPS.

Starting in 2018, PG&E began building our utility weather station network to provide more real time weather intelligence across the PG&E service area. As of January 1, 2021, PG&E operates, maintains and calibrates more than 1,000 weather stations in the PG&E service area. This robust weather station network is used to obtain RT, local weather information to facilitate operational decision-making and support safe operation of facilities. Weather station data is also used to validate model forecasts and to test new high-resolution model configurations. The weather

stations record wind speed, temperature and humidity, which are the three most important fire weather parameters.

In 2018 and into 2019, PG&E developed an internal web application that presents real time weather station data from multiple networks (PG&E, NWS, RAWS) and color codes the observation based on the FFWI being observed. The FFWI is an index that uses wind speed, temperature and RH to capture the fire weather conditions being observed.

Meteorologists can interact with the data and view data from individual stations or click on a Fire Index Area (FIA) to see a summary of conditions from each weather station in the FIA over the past 24 hours. PG&E also developed the PG&E Wind Alert System (PWAS) that displays and disseminates alerts when real time data collected from PG&E, RAWS, and NWS weather station approach or exceed defined wind thresholds. The internal web application allows users to define the areas(s) where alerts are received.

In Figures PG&E-7.3.2-6, PG&E-7.3.2-7, and PG&E-7.3.2-8 below, PG&E provides: (1) a photograph of a weather station; (2) real time weather station data from multiple networks; and (3) a snapshot of PG&E's Wind Alert System that displays and also disseminates alerts when wind speeds exceed thresholds.

FIGURE PG&E-7.3.2-6: PG&E WEATHER STATION AND ASSOCIATED INSTALLATION DETAIL

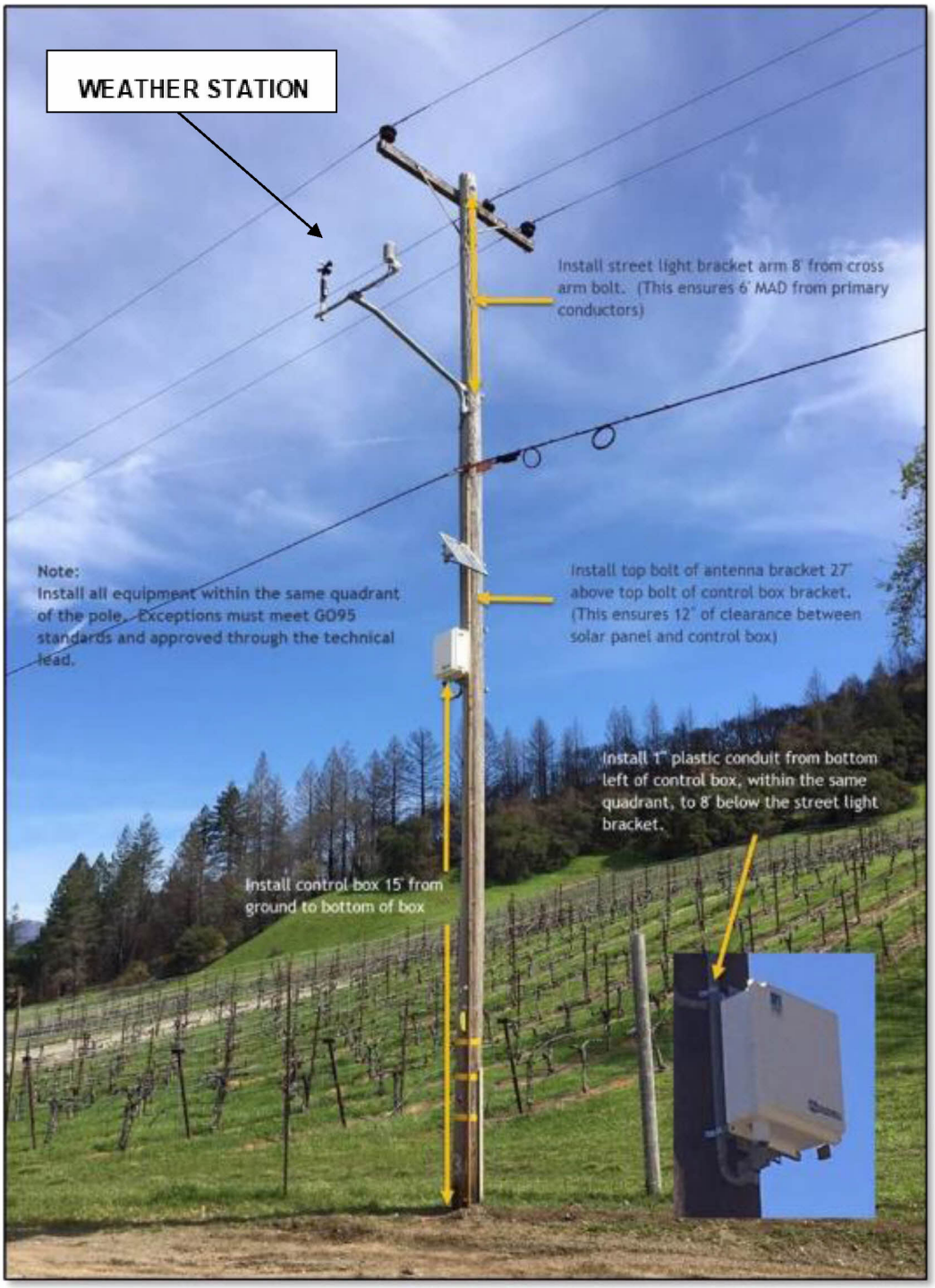


FIGURE PG&E-7.3.2-7: INTERNAL WEB APPLICATION DEVELOPED BY PG&E THAT SHOW REAL TIME WEATHER STATION DATA FROM MULTIPLE NETWORKS (PG&E, NWS, RAWS)

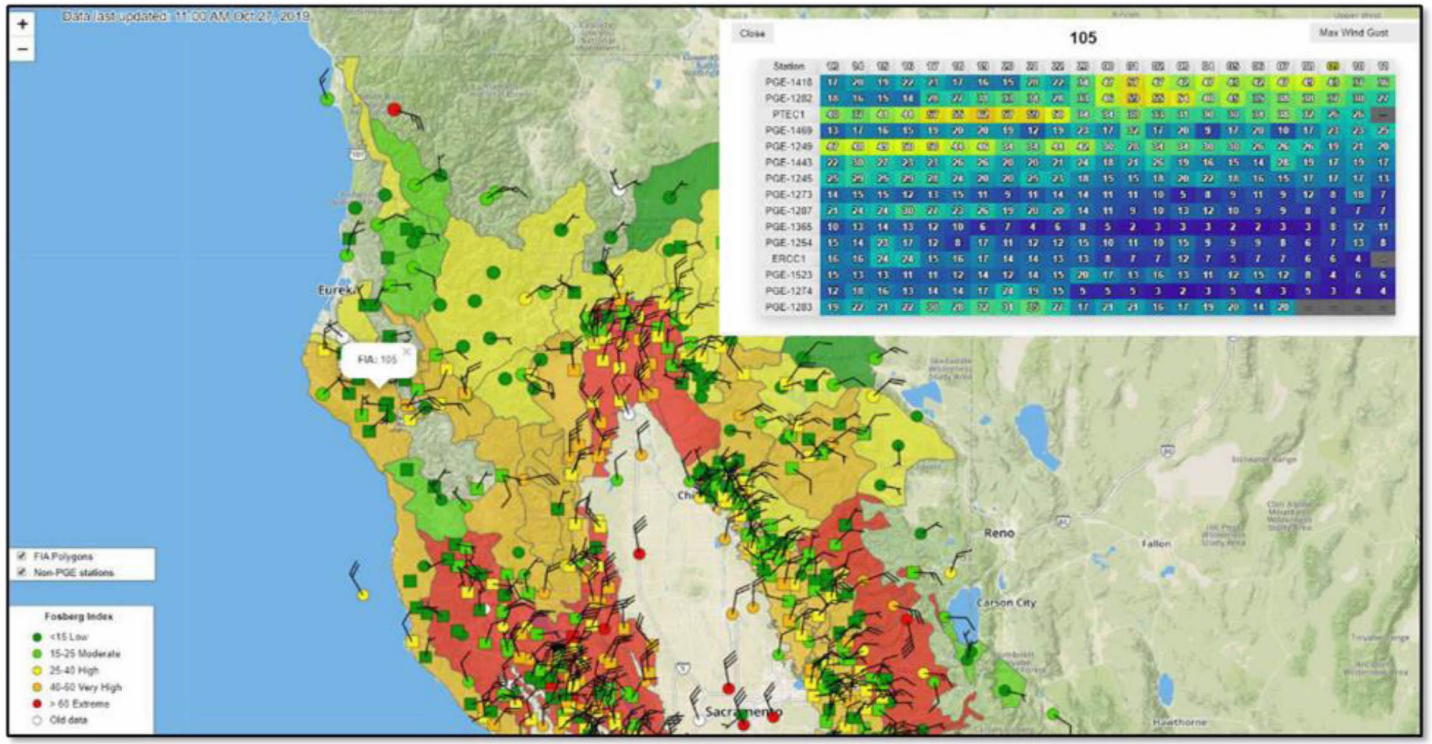
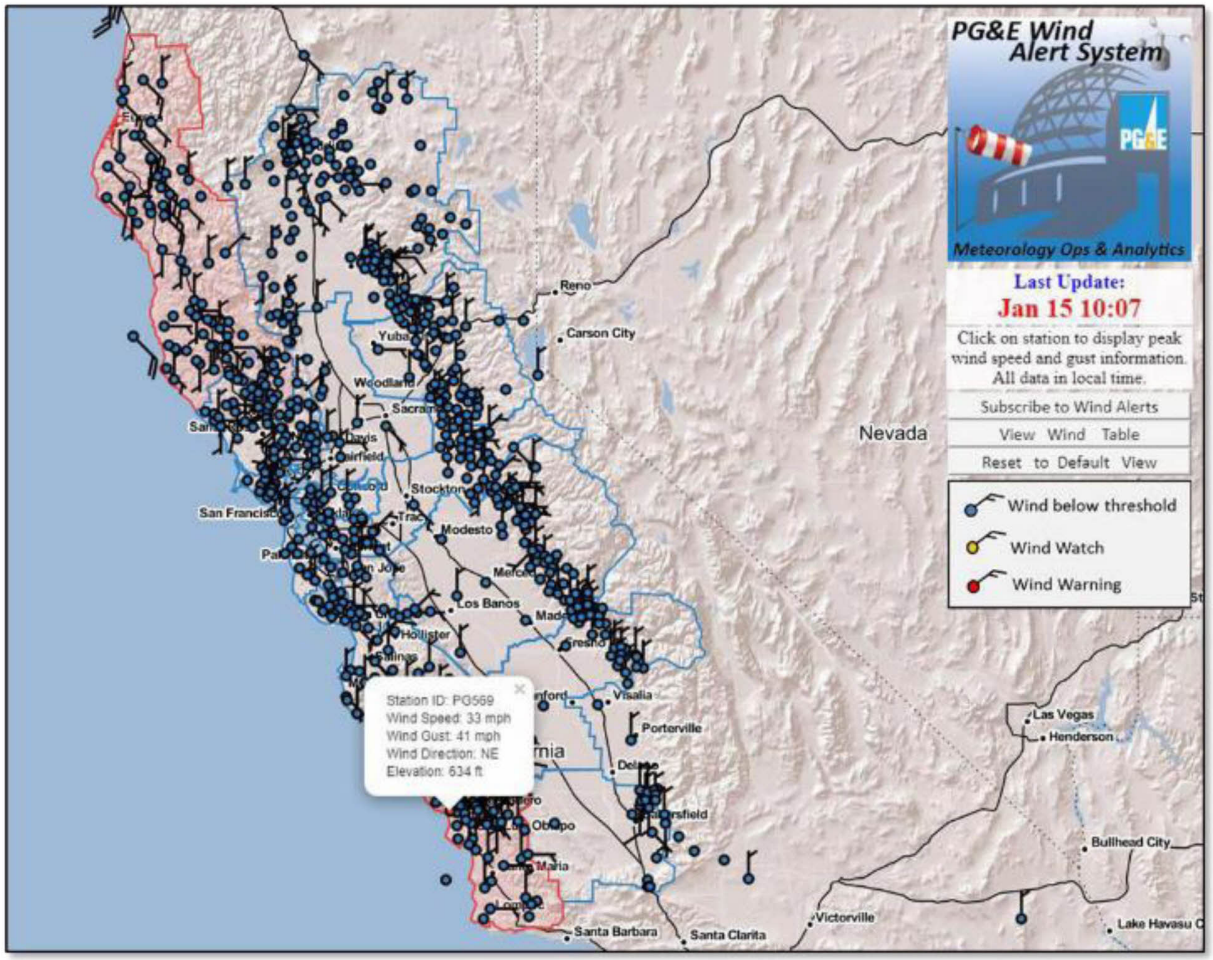


FIGURE PG&E-7.3.2-8: THE PWAS THAT DISPLAYS AND ALSO DISSEMINATES ALERTS WHEN WIND SPEEDS EXCEED THRESHOLDS – USERS CAN CUSTOMIZE ALERTS TO ONLY RECEIVE ALERTS FOR THE AREA(S) NEEDED



3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E has dedicated a meteorologist, who formerly worked at the NWS, to lead the station siting effort of each weather station. At a high level, this involves selecting optimal locations where weather stations can be installed on PG&E poles and towers. Next, pole and tower loading calculations are performed to ensure the pole/tower can adequately handle the additional forces a weather station installation will produce. Site visits are then conducted, and pictures are taken to ensure adequate wind fetch. Finally, the weather station is installed once final signoff is provided by the PG&E meteorologist weather station lead.

PG&E has worked and will continue to collaborate extensively with external agencies such as the NWS, CAL FIRE, Bureau of Land Management and the USFS to gain input on where additional weather stations would be valuable. Our goal is to build a weather station network that will not only help PG&E mitigate wildfire risk but assist other federal and state agencies to gain superior situational awareness in localized areas.

4) Progress on initiative (amount spent, regions covered) and plans for next year

From 2018 to 2020, PG&E has aggressively installed weather stations and as of 12/31/2020 installed and in operating more than 1,000 weather stations. These weather stations report data publicly every 10 minutes on fire weather conditions: wind, temperature and RH. The live and historical data from these stations are available for anyone to download via Mesowest or the NWS Weather and Hazards Viewer.

5) Future improvements to initiative

In order to enhance our Weather Station Project, PG&E plans to install or optimize the location of 300 additional weather stations throughout our service territory. We will also begin development of a weather-station specific wind gust model based on machine-learning or statistical techniques. Lastly, we will continue to work with local, state and federal stakeholders to optimize PG&E's weather station network for external uses.

Beyond 2021, we will assess the need to install additional weather stations as well as optimize the location of existing stations. Each weather station will require maintenance and calibration as stations are physical devices in the field.

ACTION PGE-25 (Class B)

1) Integrate discussion *on long term planning within the respective section of each individual initiative.*

Response:

The long-term plan of the weather station project will be to operate, maintain and optimize the weather station network. This network is a crucial component of the PSPS and situational awareness program and will continue for the next ten years and beyond.

The stations will need to be maintained as they are physical devices in the field exposed to environmental hazards. This includes replacing data loggers, anemometers, solar panels, batteries, and other equipment as required. Each year, the stations will be physically visited and calibrated to ensure data accuracy. In addition, PG&E will reserve the option to install a nominal number of additional weather stations and/or relocate stations to new locations if needed. PG&E is committed to making all the data collected from these important weather stations publicly available moving into the future.

ACTION PGE-43 (Class B)

1) Provide the locations via Geographic Information System (GIS) of the 111 stations awaiting installation, and
2) Explain how PG&E chose these 111 locations.

Response:

1) PG&E's process for tracking weather stations awaiting installation involves manually updating a spreadsheet to continuously add and remove weather stations from the listing. As such, PG&E could not recreate the listing of 111 weather stations that were awaiting installation at the time the First Quarterly Report was submitted. However, the current data indicates that PG&E has 127 stations awaiting installation in federal forest lands (see Attachment 2021WMP_ClassB_Action-PGE-43_Atch01.csv for a list of these weather stations pending installation with details of their latitudes and longitudes, as well as Attachment 2021WMP_ClassB_Action-PGE-43_Atch01.kmz for details of their locations via GIS). The number of weather stations pending installation fluctuates primarily due to new sites being identified, permitting issues, or other construction-related issues.

2) Station siting is performed by the Meteorology Department using Google Earth. On rare occasions the decision is made based on an in-person site visit. Initially, PG&E chose to site these weather stations on PG&E's distribution assets. We then moved to leverage transmission asset infrastructure. At the end of 2020, PG&E transitioned to installing additional weather stations on third-party lands where there are no utility assets. To do this, we mount a stand-alone pole to house each station. Weather stations are sited in mostly Tier 2 and Tier 3 HFTDs. Locations must be bucket truck accessible for installation, ongoing maintenance, and calibration of the station units. The locations are chosen based on accessibility and location from a meteorological standpoint in order to obtain critical fire weather observations at sites with the greatest exposure to offshore Diablo wind events that prompt catastrophic wildfire risk and possible PSPS events. A 3 kilometer (km) by 3 km high-resolution 30-year climatology study is used to develop a detailed historical view of the highest-risk fire weather areas across the service territory. This 3km hi-resolution climatological analysis is currently being re-run with the latest hi-resolution model upgrade to 2km (essentially more than doubling the 3km granularity). This analysis is used as a guide to align weather station placement with highest meteorological risk on and off the PG&E grid. By the end of

2021, there will be a PG&E weather station roughly every 20 circuit miles in Tier 2 and Tier 3 HFTDs, with approximately 1,300 weather stations total. Meteorologists continue to reach out to agency partners like the NWS and CAL FIRE in the siting process and incorporate siting suggestions from key wildfire safety partners.

ACTION PGE-44 (Class B)

1) Explain why it finds installation of weather stations far from PG&E electrical assets to be necessary, and
2) Explain how installation of such weather stations will augment its situational awareness.

Response:

The goal of the PG&E weather station program is multi-faceted. There is a benefit to weather stations both from a real time situational awareness perspective and a predictive perspective. Both perspectives benefit not only PG&E but also agency partners like the NWS, CAL FIRE, national and state forests, and other agencies. Critical fire weather conditions persist across the state, far away from PG&E assets. These areas still need observation from a situational awareness perspective. For example, PG&E may not have assets across portions of the far northern edges of our service territory, but having weather stations there alerts meteorologists that conditions are materializing upstream of forecast risk areas. This essentially signals that weather is starting and tracking with forecast models for that place/time and will translate accordingly downstream to areas planned for PSPS. This is also true for agencies like the NWS that are monitoring conditions as they materialize and using those observations to adjust critical fire weather forecasts. These observations also help in remote fire response; both as a tool for decision making (e.g., assessing wind conditions and knowing where to place crews or, in the case of CALFIRE, where to place brigades safely).

These observations are also incorporated into our fire spread and consequence modeling. Some of these observations take place in areas that have not previously been observed. This provides critical data for fire spread modeling that is not only useful in real time but can also be used for long-term gains in model training and bias correction. Meteorologists are also beginning to develop a tool using observations and machine learning techniques to create statistical model outputs, which will enhance wind forecasts for critical fire weather events. With this data publicly available, it is likely that agencies like the NWS will use the data in the same manner. This would help create an additional better and more accurate forecast to keep our high fire risk communities safe. The wildfire safety mission is bigger than PG&E; therefore, it is crucial to install weather stations both along PG&E assets as well as in remote areas where no assets exist.

7.3.2.1.4 Wildfire Cameras

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) ***Risk to be mitigated/problem to be addressed:***

   Wildfire cameras are used by CAL FIRE, the California Governor's Office of Emergency Services, USFS, PG&E, and other local agencies to identify, confirm and track wildfires and general conditions (based on fire behavior and associated weather risks) in real time. Cameras allow firefighting agencies to wildfire confirm reports quickly, assess size and spread of the fire, and evaluate where to deploy fire suppression resources in affected areas. PG&E can also utilize these cameras to assess a fire's impact on our assets.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   The high-definition, Pan/Tilt/Zoom (PTZ) wildfire cameras improve PG&E's real time visual situational awareness. Cameras are a valuable tool for PG&E's WSOC, first responders and external fire agencies like CAL FIRE and the USFS. These external fire agencies can control the PTZ cameras to assist with their respective wildfire response efforts. An example of a camera output is provided in Figure PG&E-7.3.2-9 below.

   The cameras have near infrared capabilities, allowing them to operate in low-to-no sunlight conditions. They offer a time-lapse function to confirm wildfire reports and monitor wildfire progression and environmental conditions. They are often featured on local television broadcasts. Live feeds and time-lapse data from the camera's network are available to the public at pge.com/weather and via www.alertwildfire.org.

   PG&E has leveraged an existing and mature platform used by three major California utilities, CAL FIRE, USFS and other local agencies (where cameras are accessible by anyone using the AlertWildfire platform).

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")***

   In 2018, PG&E installed nine high-definition cameras in HFTD areas through a pilot program to test the technology. In 2020, PG&E met the installation target of 200 cameras (333 lifetime cameras). PG&E will install an additional 135 cameras by December 31, 2021, bringing the total number of operational cameras from 333 to 468. The additional wildfire cameras will be installed with viewsheds facing toward Tier 2 & Tier 3 HFTD areas.

4) Progress on initiative (amount spent, regions covered) and plans for next year

The number of wildfire camera installations has grown beyond the capability to manually monitor. As a result, PG&E leverages other information, such as satellite fire detections and Integrated Reporting of Wildland-Fire Information (IRWIN), to help determine which wildfire camera(s) should be viewed. In coordination with University of California Regents, the Alert Wildfire consortium and other partners, PG&E will support research aimed at advancing automated capabilities further. Specifically, this research is aimed at identifying and incorporating Artificial Intelligence (AI) early fire detection software, and visualization techniques to display 360° imagery. This would allow cameras to automatically rotate and zoom to view emerging incidents quicker.

5) Future improvements to initiative

Beyond 2022, PG&E plans to reassess our wildfire camera network coverage, as several other external agencies, such as Sonoma Water, CAL FIRE and USFS, install wildfire cameras in our service territory. Similar to the weather station program, PG&E welcomes input from external parties on wildfire camera deployment to maximize their impact on enhancing public safety and improve emergency response efforts.

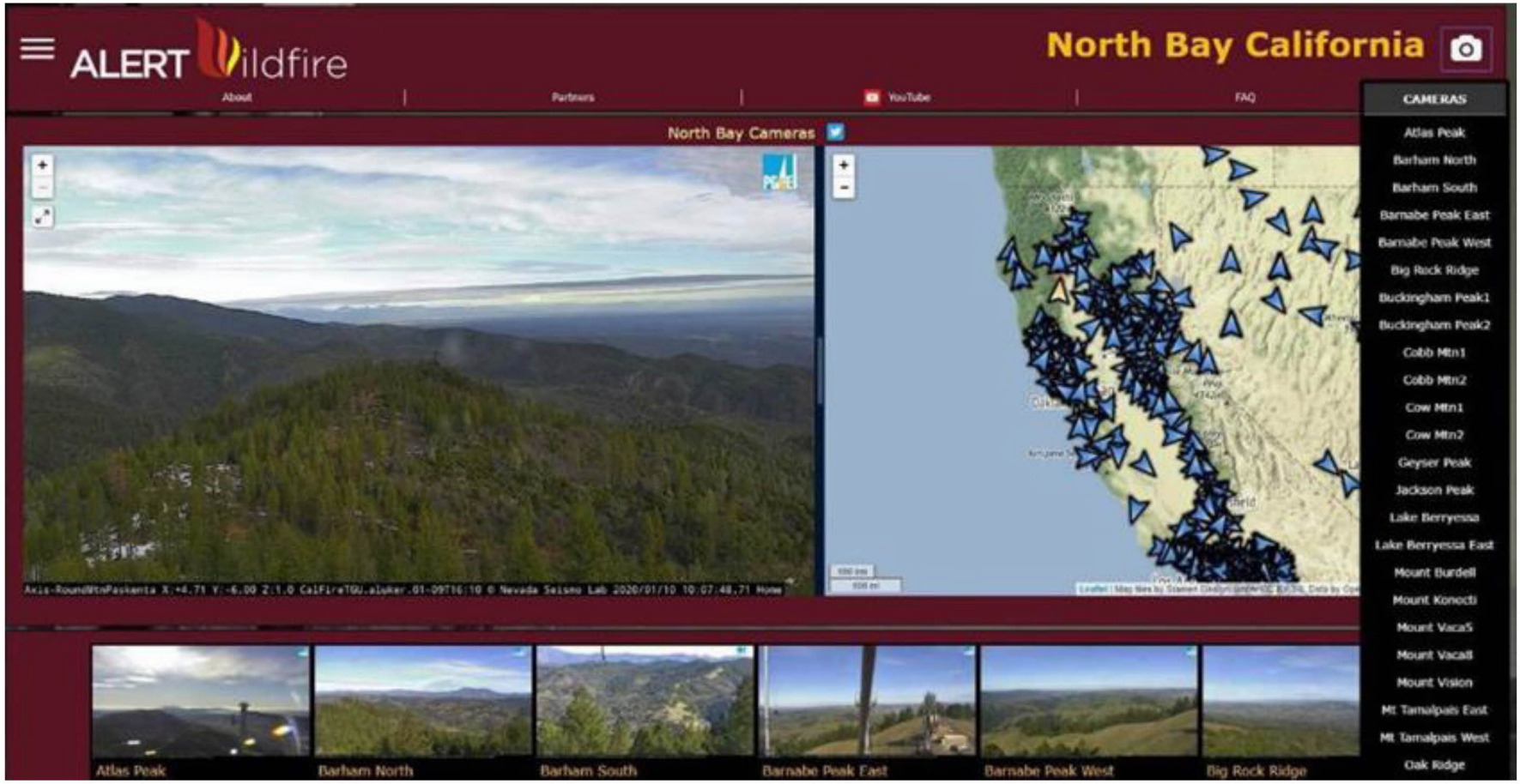
ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Installation goals should be completed by 2022. At that point, the project is expected to go into a steady state mode, which includes operational maintenance of the cameras. After that, there will be incremental additions to support agency location requests and PG&E location optimization. In addition, PG&E continues to look for opportunities to pilot nascent technologies such as enhanced AI camera software capabilities. If the pilots are successful, we expect to invest in these technologies.

FIGURE PG&E-7.3.2-9: EXAMPLE CAMERA OUTPUT, WEB INTERFACE, AND CAMERA NETWORK DENSITY FROM ALERTWILDFIRE.ORG



7.3.2.1.5 Fire Detection & Alerting

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

PG&E needs to be situationally aware of all wildland fire activity occurring within our territory regardless of causation. Satellite fire detections provide valuable information to the utility regarding the presence of new fires and the spread of existing fires in a timely fashion. This information can be used to ensure the safety of utility workers in the area, help identify assets at risk and provide situational awareness as to the burn severity and rate of spread. A satellite-based fire detection system is also much more cost effective than the prior solution, which was fixed-wing flight patrols.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Satellite technology has matured to a point where data from geostationary and polar-orbiting satellite data can be utilized to monitor fires in near-real time. PG&E's Meteorology team deployed a fully operational state-of-the-art satellite-based fire detection and alerting system in 2019 and enhanced the system in 2020 by adding more polar satellite data. As of January 1, 2021, the system ingests and reconciles fire detection data from 2 Geosynchronous Satellites (GOES-West, GOES-East), and four polar-orbiting satellites (MODIS-AQUA, MODIS-TERRA, Suomi NPP), and NOAA-20). PG&E developed the system to incorporate new fire detection data feeds as they become available. PG&E is working directly with industry-leading fire detection algorithm developers and experts from the SSEC at the University of Wisconsin-Madison to procure a customized feed of satellite fire detection data just for California with the lowest latency available. SSEC has deployed primary and backup servers in SSEC data centers specifically for PG&E that process the raw satellite data to produce fire detections.

To visualize and interact with the fire detection data, PG&E developed a proprietary application in-house in 2019 and an external application available to the public in 2020 that combines and displays fire detections as they arrive. The internal web application also disseminates new fire detection alerts via the internal web-application and through email. The web application displays each location where fire was recently detected and PG&E meteorologists or analysts with the WSOC can quickly review live feeds from the nearest wildfire cameras to confirm fire and/or smoke in an area. The satellite data also contains a measure of the fire intensity called FRP, and the web-app allows the user to retrieve an FRP timeseries in order to track the intensity of fires in each location. The applications also display current incidents available from CAL FIRE as well as fire perimeters from federal agencies. PG&E is actively sharing fire alerts with CAL FIRE through the California National Guard and with numerous county and local fire departments. PG&E is also sharing this data with other California utilities and CAL FIRE through Technosylva Wildfire Analyst Enterprise software.

PG&E is committed to sharing this data with interested stakeholders and to the general public. This tool helps PG&E respond to new and emerging events quickly and make faster operational decisions.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

There is no regional prioritization with regards to this work. The GOES-West and GOES-East satellites scan the entire continental United States every five minutes and thus provide new fire detection data in five-minute intervals. In addition, each satellite has two mesoscale sectors that scan a regional area every minute. PG&E does not have control or input on where the mesoscale sectors are located as these are controlled by federal sources.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year***

In 2020, PG&E added NOAA–20 data into the suite of fire detection data. NOAA-20 is the first spacecraft of NOAA's Joint Polar Satellite System, the new generation of polar-orbiting satellites that carries the Visible Infrared Imaging Radiometer Suite (VIIRS). VIIRS is a proven tool for fire detection.

In 2020, PG&E developed an external application available to the public where satellite detection data can be found: https://pgefdp.lovelytics.info/pge_fire_app/. In addition, PG&E is actively sharing this data with Technosylva, who has developed an application called Wildfire Analyst Enterprise. This application is used by other California utilities and CAL FIRE. PG&E has allowed all stakeholders using this application in California to access and visualize PG&E's fire detection data free of charge. PG&E is also interested in receiving fire detection data available from Fire Guard, which is produced by the California National Guard and available to CAL FIRE.

In 2021, PG&E plans to operate the system with no major enhancements or planned changes. However, if new satellite data becomes available, such as Fire Guard outputs, we may incorporate it into the system, time and data permitting.

Below PG&E provides example of: (1) output of the PG&E Fire Detection and Alert System (FDAS) (Figure PG&E-7.3.2-10); (2) fire detection alert email distributed automatically by the PG&E FDAS (Figure PG&E-7.3.2-11); and (3) integration of PG&E wildfire cameras and the PG&E FDAS (Figure PG&E-7.3.2-12).

FIGURE PG&E-7.3.2-10: EXAMPLE OUTPUT OF THE PG&E FDAS – SNAPSHOT TAKEN ~3:45 PM 9/9/2019 AND ACTIVE FIRE SHOWN IS THE WALKER FIRE – VIIRS AND MODIS FIRE DETECTIONS ARE NOT SHOWN

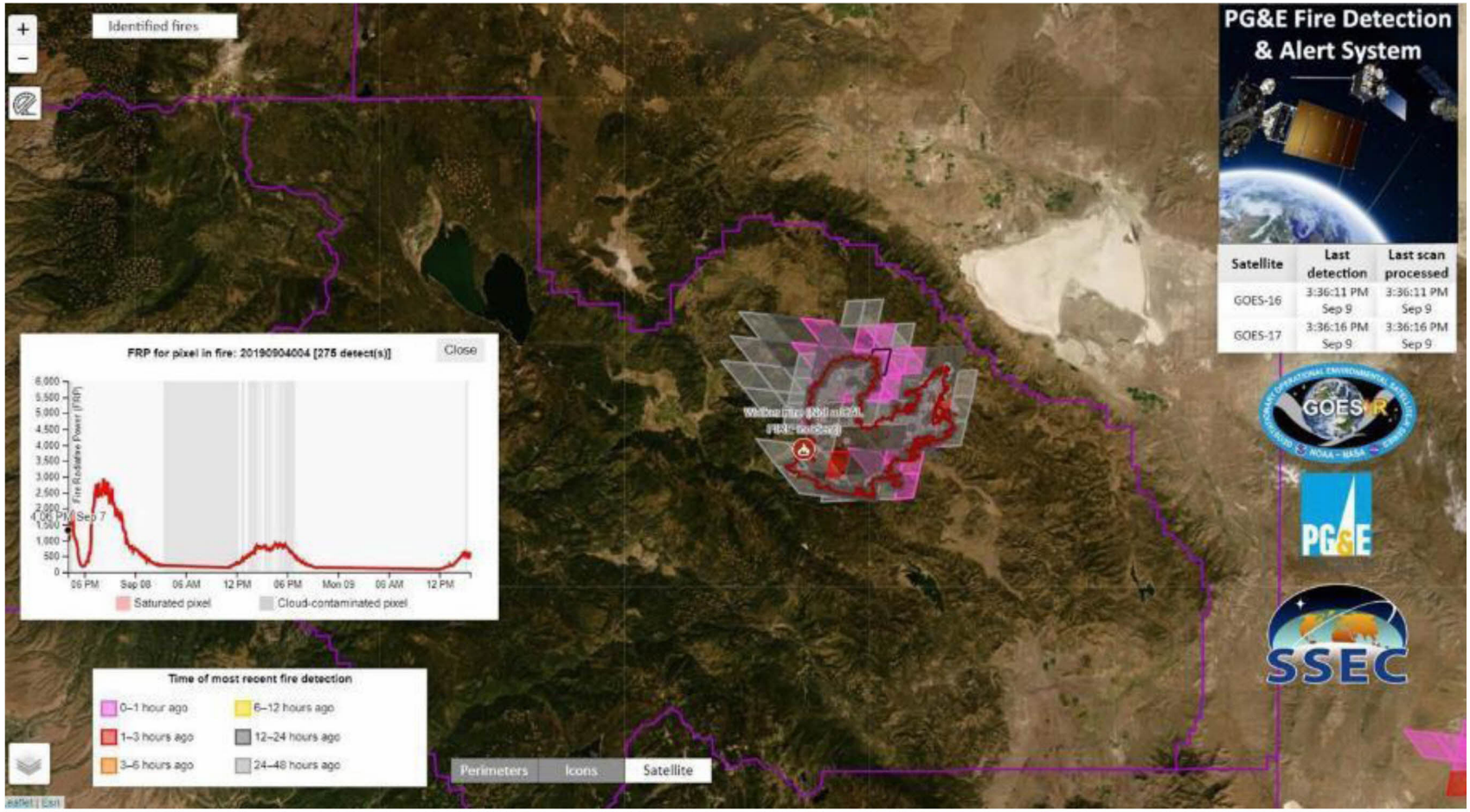


FIGURE PG&E-7.3.2-11: EXAMPLE FIRE DETECTION ALERT EMAIL DISTRIBUTED AUTOMATICALLY BY THE PG&E FDAS – THIS INCIDENT WAS THE MARSH FIRE THAT WAS REPORTED IN CONTRA COSTA COUNTY ON AUGUST 3, 2019

Sat 8/3/2019 3:31 AM

WA

Weather Alerts <wx-alerts@pge.com>

New Fire Detection in PG&E's Diablo Division (Contra Costa County)

A new GOES17 fire detection has occurred in PG&E's Diablo Division (Contra Costa County) in a Tier2-Elevated CPUC High Fire-Threat District. The possible fire has been assigned an internal ID: 20190803003

Visit the PG&E Fire Detection web page (internal PG&E only) to see a map of this detection.

Detection latitude/longitude centroid: 37.893333/-121.834908 (note fire could be up to 3 miles away from the centroid point).

Additional Links:
Google Maps
Local Weather Station Data
Alert Wildfire Cameras

Alert Issued at: 08/03/19 3:31 (Local Pacific Time).

Please note:
These alerts are disseminated only if multiple satellite detections occur in a given space/time. No more alerts will be sent for this possible fire with internal ID: 20190803003. Note that alerts are only generated for fire detections in the PG&E service territory. In addition, no alerts are generated for fires in the agricultural and urban areas in the Central Valley due to over-alerting related to planned agricultural fire activities. This satellite-based system will not detect all fires and some false detections are possible and typically occur near bodies of water or near large solar installations.

This notice was sent by PG&E Meteorology Operations and Analytics (925-244-4630). If you have any questions, please contact WeatherDeptAdmins@pge.com.

FIGURE PG&E-7.3.2-12: EXAMPLE INTEGRATION OF PG&E WILDFIRE CAMERAS AND THE PG&E FDAS –THIS EXAMPLE SHOWS A SMOKE PLUME VISIBLE FROM A FIRE DETECTED FROM FDAS – THIS EXAMPLE IS FROM THE FIRE THAT OCCURRED IN THE NUSTAR ENERGY FACILITY IN CROCKETT, CALIFORNIA

5) Future improvements to initiative:

Beyond 2020, NOAA plans to launch three additional polar-orbiting satellites in this new generational fleet, with the next satellite launch presently scheduled for 2022. PG&E may incorporate additional fire detection data into the suite once available. PG&E may also evaluate adding other public and proprietary data sources as they become known or available.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E will continue operating the satellite fire detection and alerting system for the next decade. The program has proven to be a cost-effective way to monitor and track new fires across PG&E's territory automatically using satellite data. New sources of fire detection data are likely to come online over the next decade, such as NOAA satellites and privately owned options as well. These new sources of data likely will be evaluated for inclusion based on efficacy and costs.

7.3.2.1.6 Other Meteorology Tools and Upgrades

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

In addition to the tools and programs discussed in the previous sections, the meteorology tools and upgrades outlined below help PG&E gain further situational awareness as it relates to weather intelligence across the PG&E service area.

- High Performance Cloud Computing, Model Validation and other initiatives
- Medium- to Seasonal-Range Diablo Wind Forecasting
- Addressing Weather Forecast Model Uncertainty
- PG&E Lightning Detection Network (PLDN)
- Information Sharing

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Each of the initiatives described below allows us to advance situational awareness capabilities as well as enable process and computation of extremely large datasets.

High Performance Cloud Computing, Model Validation and other initiatives

The meteorology data PG&E processes and computes exceeds multiple terabytes per day. In order to process, store and visualize these large datasets, we migrated our weather prediction capabilities to the cloud. This migration allows us to expand our processing and data storage needs dynamically and prepare for the near future where data sizes and computation demands are expected to increase.

PG&E actively partnered with multiple external experts in numerical weather prediction to develop POMMS V3.0, which is run and post-processed entirely in the AWS cloud.

In 2020, PG&E deployed a scalable, high-performance cloud computing environment in AWS to achieve the significant increase in computation required to run the higher-resolution weather models and post-process data multiple times per day. PG&E's POMMS model is now run and entirely post-processed in the cloud. This was a major accomplishment in 2020 and will allow PG&E to continue to advance our numerical weather prediction and data science fronts in this scalable environment. The POMMS model was built to be run across multiple AWS regions for redundancy and PG&E's model post-processing environment consists of development, quality assurance and production computing environments to develop, test, and deploy operational code.

Medium- to Seasonal-Range Diablo Wind Forecasting

Diablo winds have been responsible for most of the catastrophic fires in Northern California history. These are analogous to Santa Ana winds across Southern California. In 2020, PG&E developed an experimental short-range (2 – 4 weeks) Diablo wind forecasting system. PG&E evaluated if teleconnections such as El Nino, the Pacific Decadal Oscillation and the Madden Julian Oscillation, to name a few, provided predictive skill to forecast Diablo wind events outside the range of global weather models.

Addressing Weather Forecast Model Uncertainty

To address uncertainty in weather forecast modeling, PG&E employs multiple methods. First, PG&E leverages numerous sources of global and high-resolution forecast model data and compares results to determine forecast alignment. For example, if all weather forecast models agree a certain weather event will transpire, then confidence is generally high. In Figure PG&E-7.3.2-13 below, PG&E provides an example of tools it employs to quickly compare pressure gradient forecasts and wind speeds from multiple sources of forecast data. Another method applied is ensemble prediction. PG&E leverages outputs and visualizations from the European Centre for Medium-Range Weather Forecasts (ECMWF) EPS, which is comprised of 50 model members.

FIGURE PG&E-7.3.2-13: EXAMPLE OUTPUT FROM THE PG&E PRESSURE GRADIENT TRACKING TOOL THAT SHOWS OBSERVATIONS (BLACK DOTS) VERSUS PRESSURE GRADIENT FORECASTS FROM SEVERAL DETERMINISTIC FORECAST MODELS

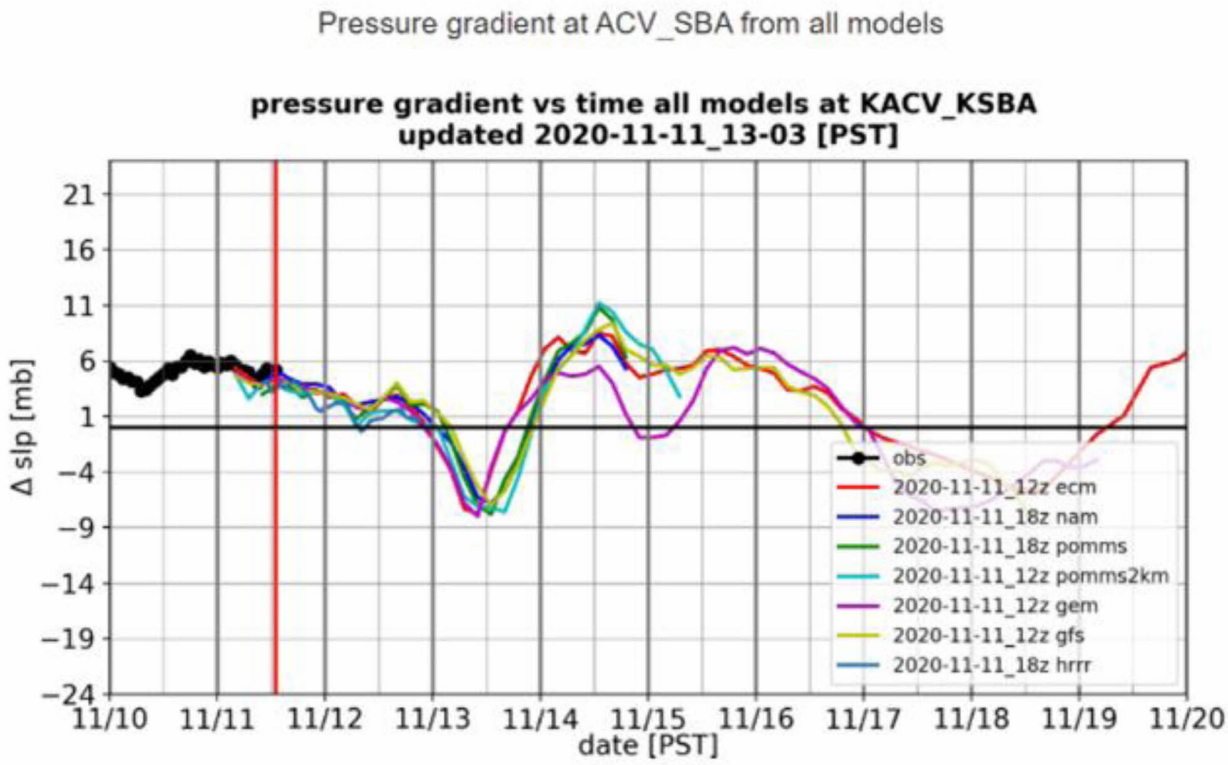
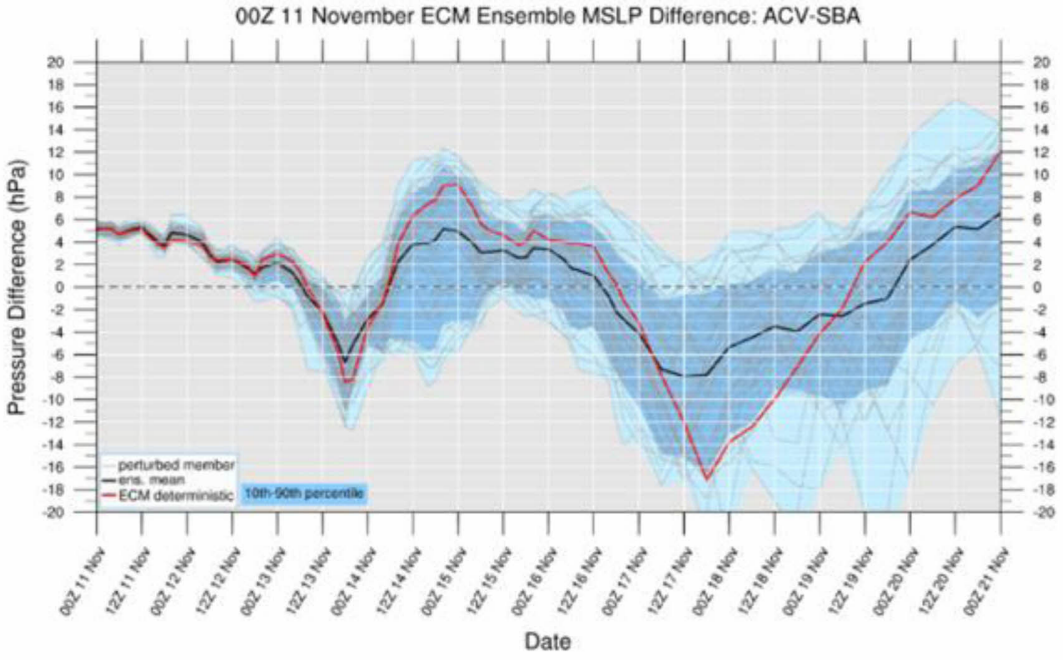


Figure PG&E-7.3.2-14 below shows the forecasted Arcata, California to Santa Barbara, California pressure differential from every ECMWF ensemble member. This Arcata to Santa Barbara pressure differential is an important predictor of outage activity during winter storms while other pressure differentials have been found to be important predictors of other weather patterns. One can generally see very good alignment (thus high confidence) in the near-term forecast, following by increased dispersion (lower confidence) in model solutions generally farther out in time. PG&E also leverages the ECMWF EPS for precipitation forecasting.

FIGURE PG&E-7.3.2-14: EXAMPLE OUTPUT FROM THE PG&E ECMWF EPS GRADIENT TOOL THAT SHOWS MODEL RESULTS FROM 50 EPS MEMBERS (GRAY LINES) THE TOP AND BOTTOM 10 PERCENT (LIGHT BLUE SHADING), THE EPS MEAN (BLACK LINE) AND THE DETERMINISTIC ECMWF MODEL (RED LINE)



PG&E also processes and visualizes data from the Global EPS (the GFS ensemble) in a similar way as described above. Figure PG&E-7.3.2-15 and Figure PG&E-7.3.2-16 below present operational examples of the GEFS and POMMS-EPS.

FIGURE PG&E-7.3.2-15: EXAMPLE OUTPUT FROM THE PG&E GEFS GRADIENT TOOL THAT SHOWS MODEL RESULTS FROM GEFS MEMBERS (GRAY LINES) THE TOP AND BOTTOM 10% (LIGHT BLUE SHADING), THE MEAN (BLACK LINE) AND THE DETERMINISTIC MODEL (RED LINE)

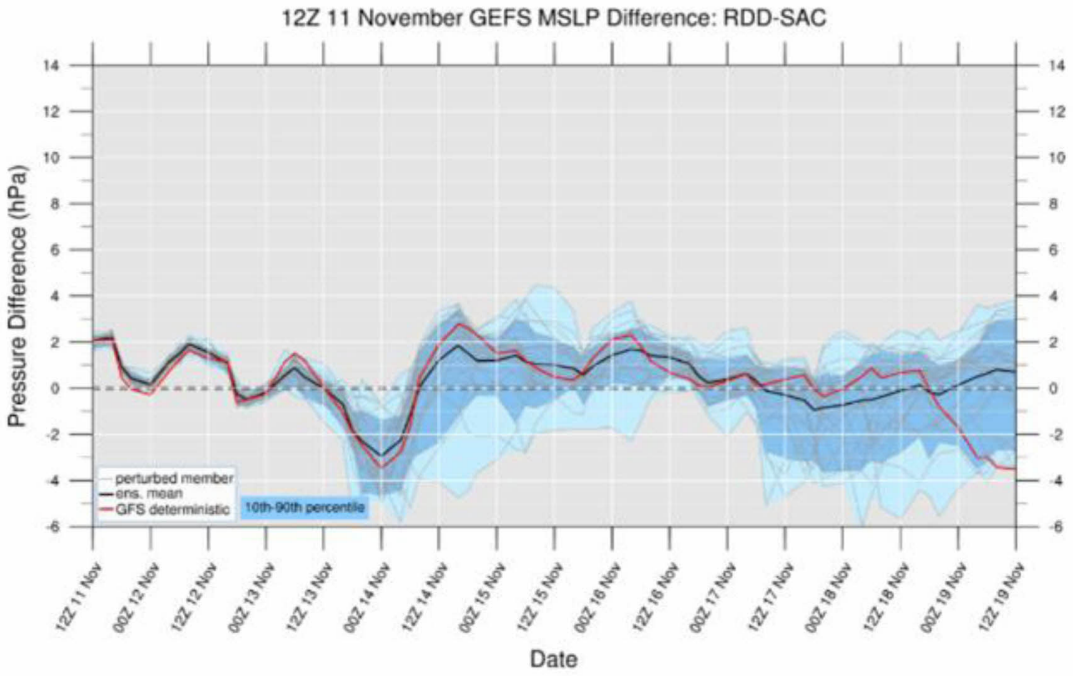
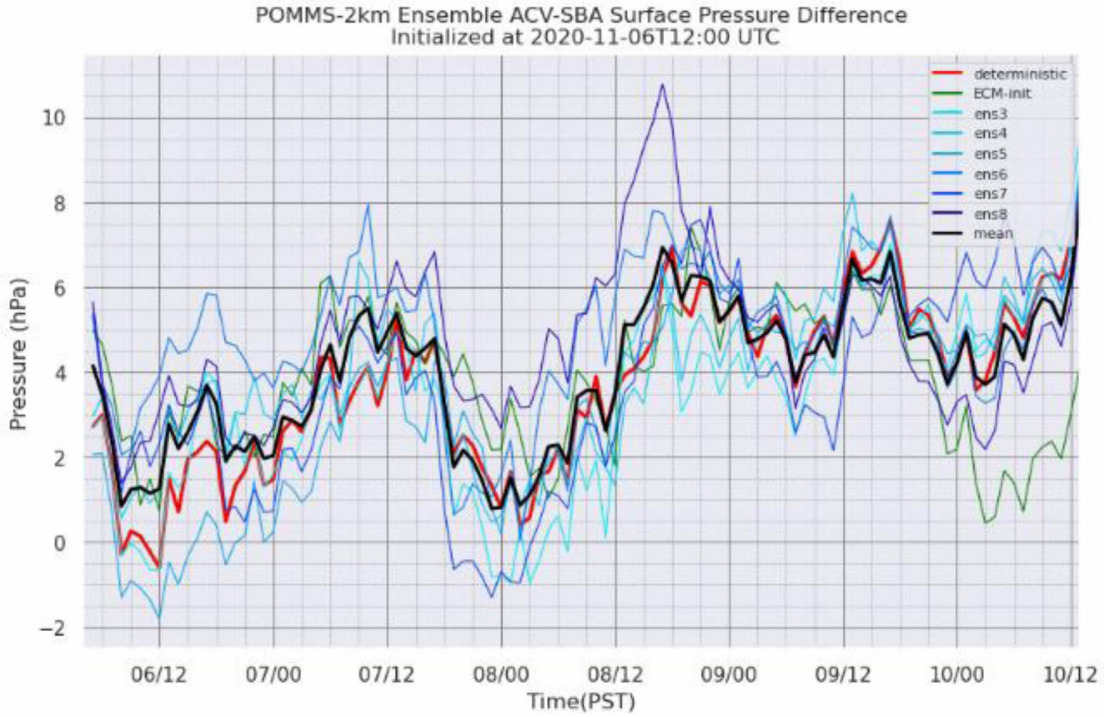


FIGURE PG&E-7.3.2-16: EXAMPLE OUTPUT FROM THE PG&E POMMS-EPS GRADIENT TOOL THAT SHOWS MODEL RESULTS FROM ALL MEMBERS (COLORED LINES), THE ECMWF-INITIALIZED FORECAST (GREEN LINE), THE MEAN (BLACK LINE) AND THE DETERMINISTIC MODEL (RED LINE)

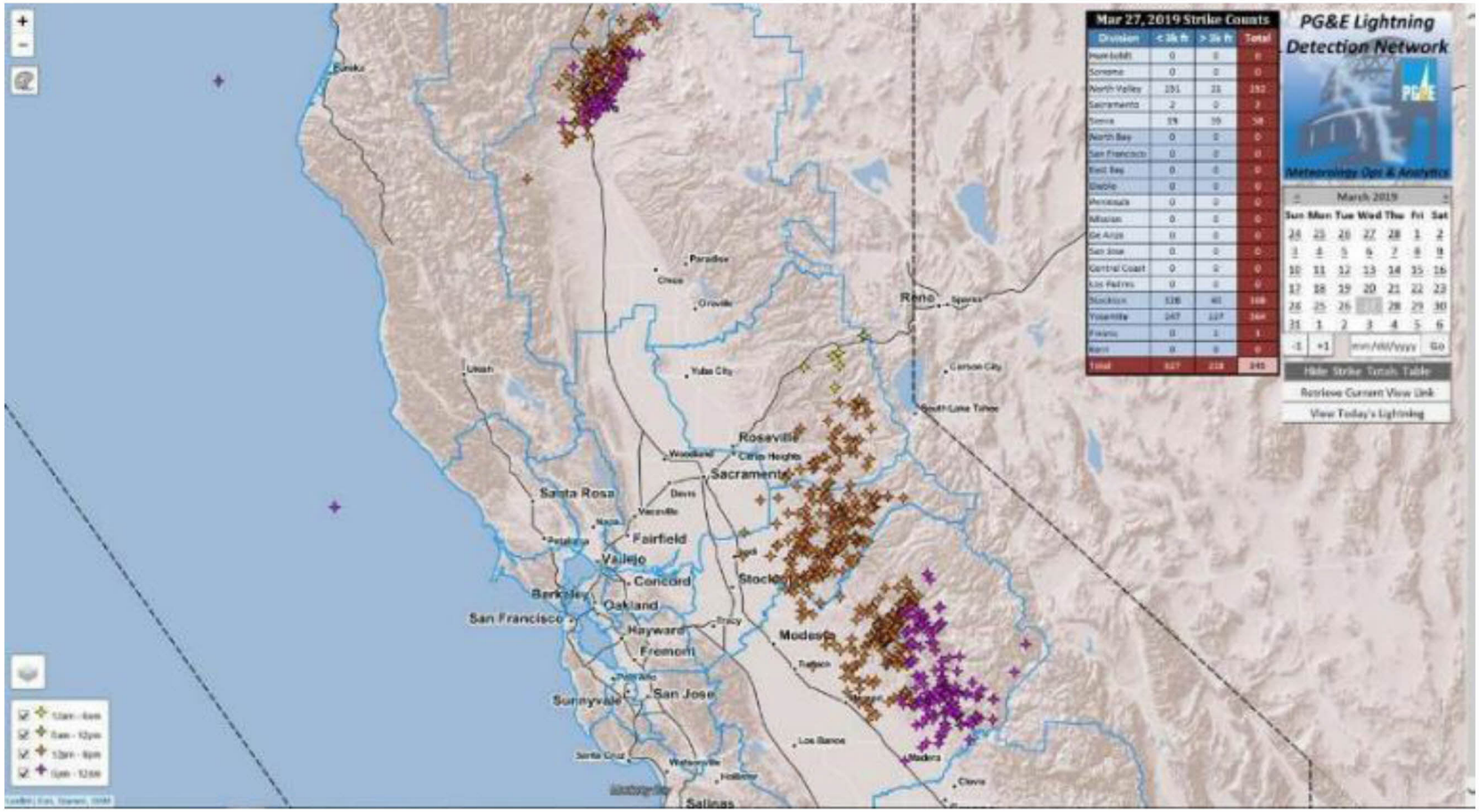


PG&E Lightning Detection Network (PLDN)

PG&E operates several lightning detection sensors that feed into a larger network: The Global Lightning Network. Cloud to ground lightning strikes can cause utility outages as well as result in fire ignitions. For example, from June 20 to 21, 2008 more than 20,000 lightning strikes occurred resulting in more than 2,000 fires. Another catastrophic lightning outbreak occurred in 2020, resulting in many of the largest fires in California history. PG&E also developed a custom internal application that displays lightning strikes in real time and allows a user to customize alerts received for just specific areas of interest. The application also gives the user the ability to see historical lightning as well as the peak lightning stroke amperage.

In Figure PG&E-7.3.2-17 below, PG&E provides example output from the PLDN showing historical lightning from March 27, 2019.

FIGURE PG&E-7.3.2-17: EXAMPLE OUTPUT FROM THE PLDN SHOWING HISTORICAL LIGHTNING FROM MARCH 27, 2019



Information Sharing

PG&E is committed to sharing weather, fire detection information, camera data and PSPS potential forecasts with stakeholders and the public. PG&E values the role state, county and federal agencies (e.g., CAL FIRE, NWS, Predictive Services) play in communicating fire danger and risk to the general public. In 2019 and 2020, several meetings were held with agencies and stakeholders to better align on how PG&E would share information with the public. PG&E currently shares the following information daily:

- Data collected from > 1000 weather stations every 10 minutes
- Live feeds from alert wildfire cameras
- Fire detection information publicly, and directly with the California National Guard, CAL FIRE, other investor-owned utilities and county and municipal fire agencies
- PG&E's 7-day PSPS forecast and discussion

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

We perform this work across the entire service territory. There is no regional prioritization for this work.

4) Progress on initiative (amount spent, regions covered) and plans for next year

High Performance Cloud Computing, Model Validation and other initiatives

In 2020, the National Center for Atmospheric Research (NCAR) experienced issues distributing the GFS model data used to initialize PG&E's high-resolution forecast data. Although this did not impact PG&E in 2020, it showed that our high-resolution modeling efforts are dependent on NCAR's ability to deliver the initialization datasets to the public. However, PG&E has been exploring the ability to run the POMMS model using the ECMWF (European model) initialization as part of the POMMS Ensemble Prediction System. During the NCAR outage in 2020, PG&E determined it can shift the operational POMMS model configuration to use the ECMWF initialization rather than GFS. This new capability will mitigate the risk that future NCAR and other upstream data outages would prevent PG&E POMMS model from running correctly.

In 2020, PG&E developed the ability to put forecasts in context with history. For example, PG&E can evaluate the forecast, hour by hour and by each grid point, including where the forecasted wind speed ranks historically over the past 30 years. To accomplish this, PG&E developed wind-speed distributions at 2 x 2 km grid point across 30 years of historical data and can use the forecasted wind speed to rank the forecast by percentiles. This allows PG&E meteorologists to quickly determine if models are forecasting a tail-end or extreme event.

In Figure PG&E 7.3.2-18, Figure PG&E 7.3.2-19, and Figure PG&E 7.3.2-20 below, PG&E provides an example product menu for the POMMS v3.0 model

showing a sample array of model output. Model output visualizations of wind gusts and RH below. Figure PG&E 7.3.2-21 shows an example wind speed forecast translated to percentile ranked against the 30-year climatology.

FIGURE PG&E-7.3.2-18: SAMPLE PRODUCT MENU FOR THE POMMS MODEL

FIGURE PG&E-7.3.2-19: POMMS MODEL OUTPUT, WIND GUSTS/WIND SPEED BARBS

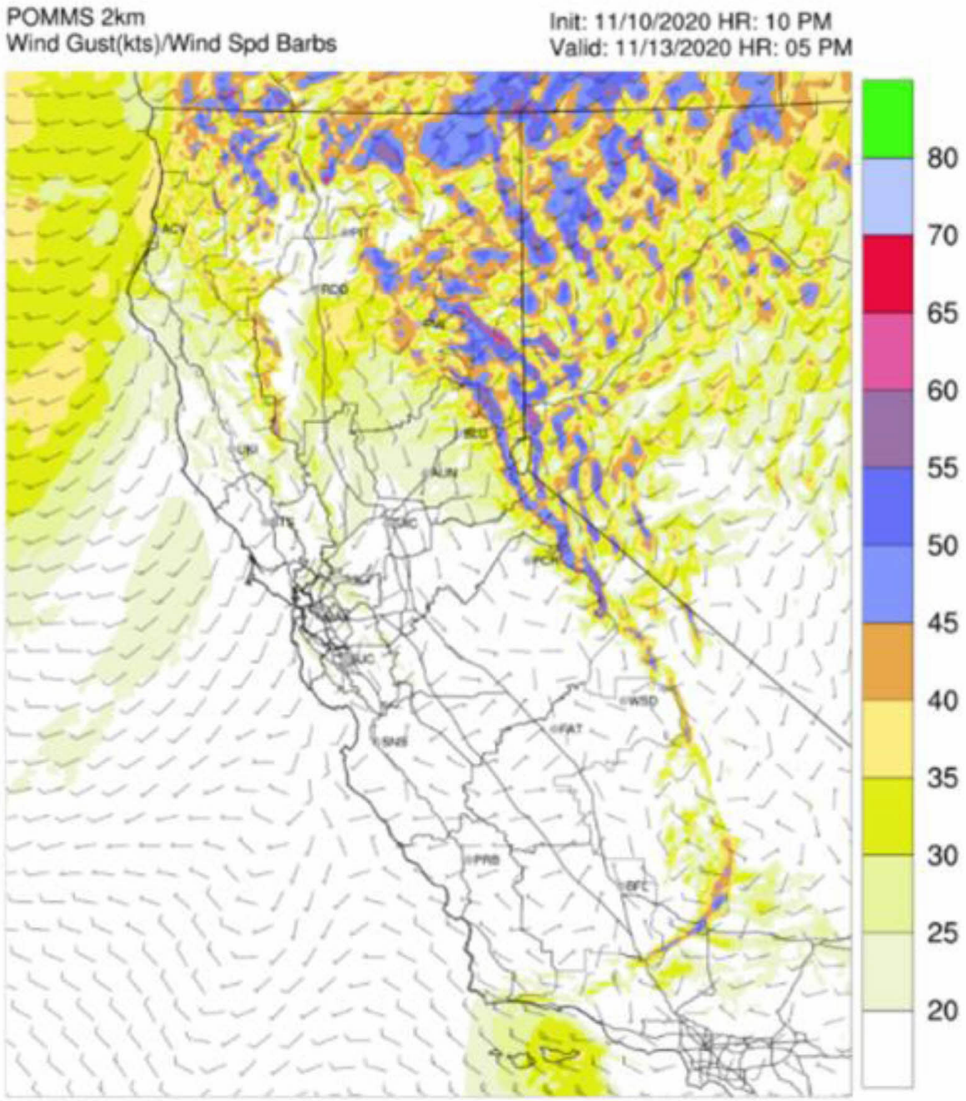


FIGURE PG&E-7.3.2-20: POMMS MODEL OUTPUT, 2M RH/WIND BARB

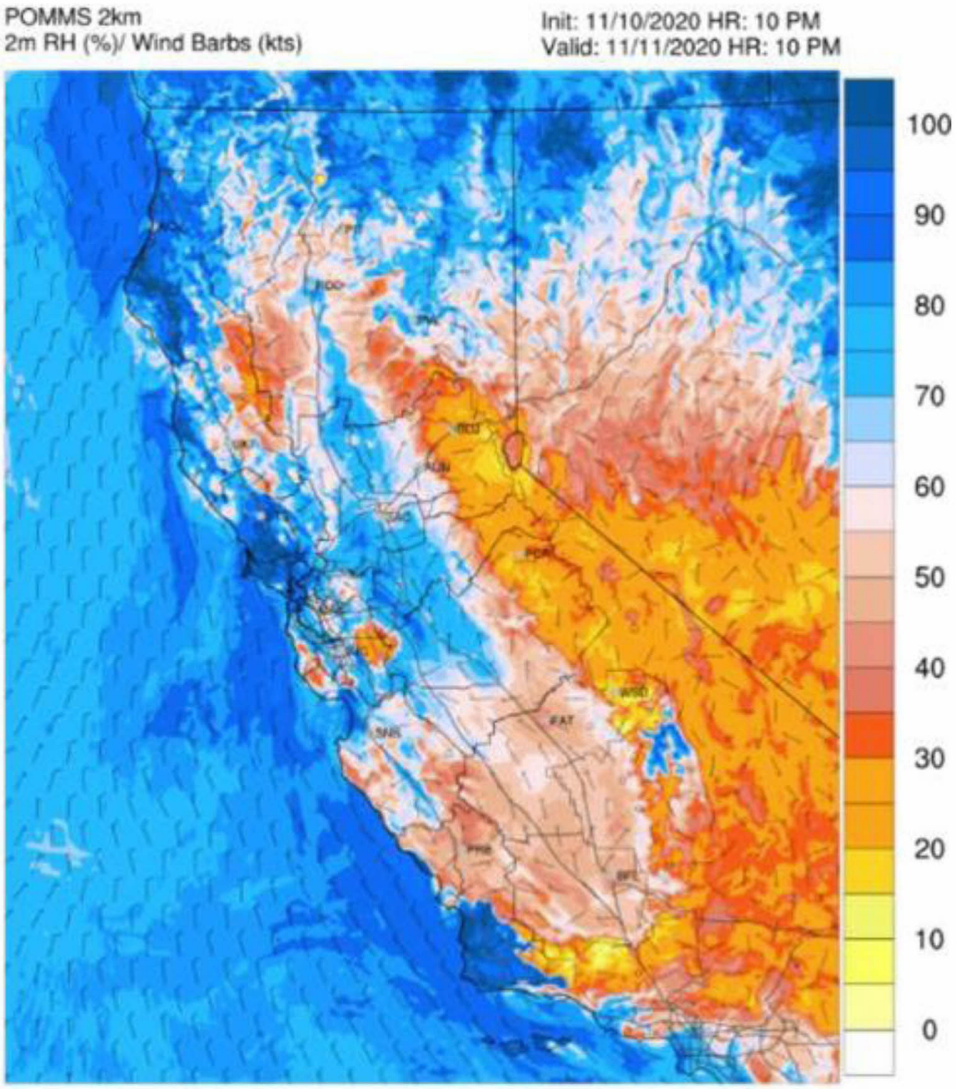
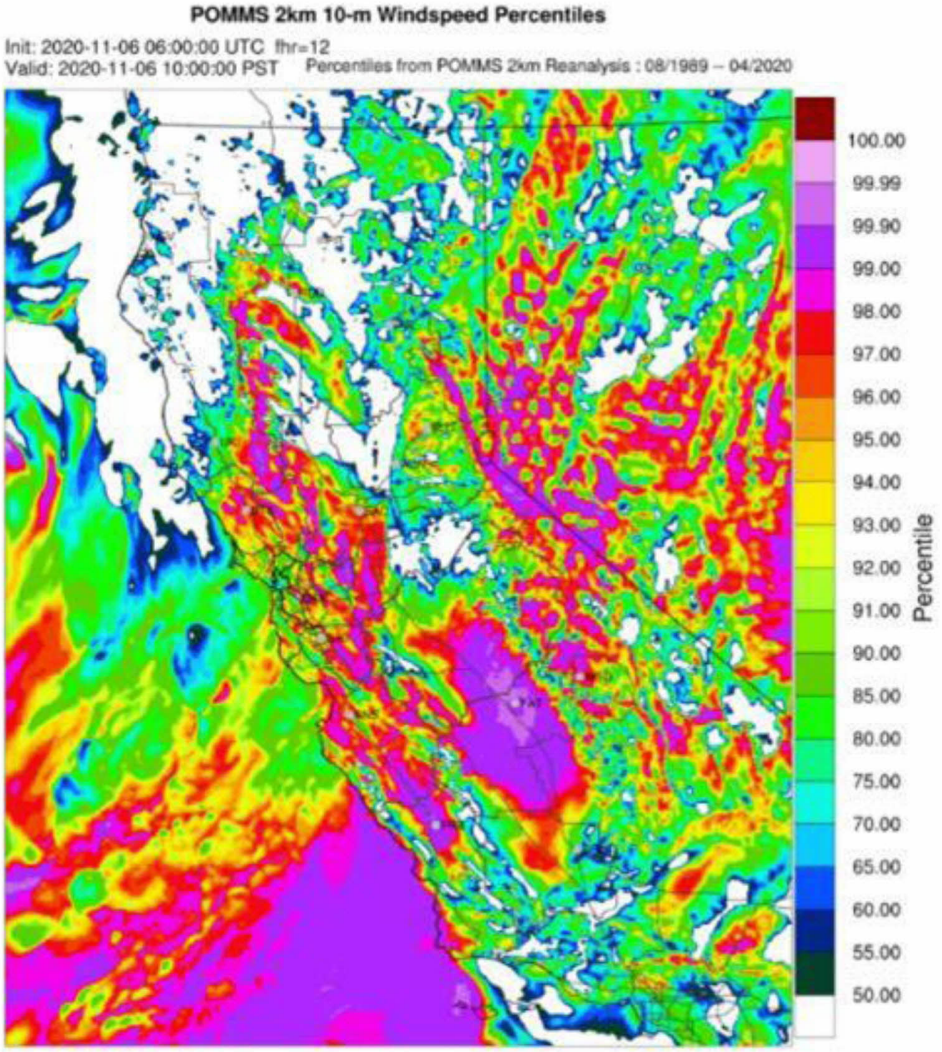


FIGURE PG&E-7.3.2-21: POMMS MODEL OUTPUT, FORECASTED WIND SPEED REPRESENTED AS PERCENTILES (BASED ON 30-YEAR CLIMATOLOGY)



Medium- to Seasonal-Range Diablo Wind Forecasting

As indicated in response to Question 2 above, in 2020, PG&E developed an experimental short-range (2 – 4 weeks) Diablo wind forecasting system. PG&E evaluated if teleconnections such as El Nino, the Pacific Decadal Oscillation and the Madden Julian Oscillation, to name a few, provided predictive skill to forecast Diablo wind events outside the range of global weather models.

Addressing Weather Forecast Model Uncertainty

In 2020, PG&E deployed an in-house high-resolution model POMMS-EPS that is based on the POMMS model. This package includes eight model members that provide hourly forecasts at 2 km resolution across the PG&E territory. This will significantly increase the amount of forecast data generated daily near the surface from 100 million data points in 2019 to over 1 billion in 2020.

PLDN

There are no 2020 improvements to note as part of this initiative. PG&E plans to continue operating and maintaining lightning sensors deployed across the PG&E territory in 2020 and 2021.

Information Sharing

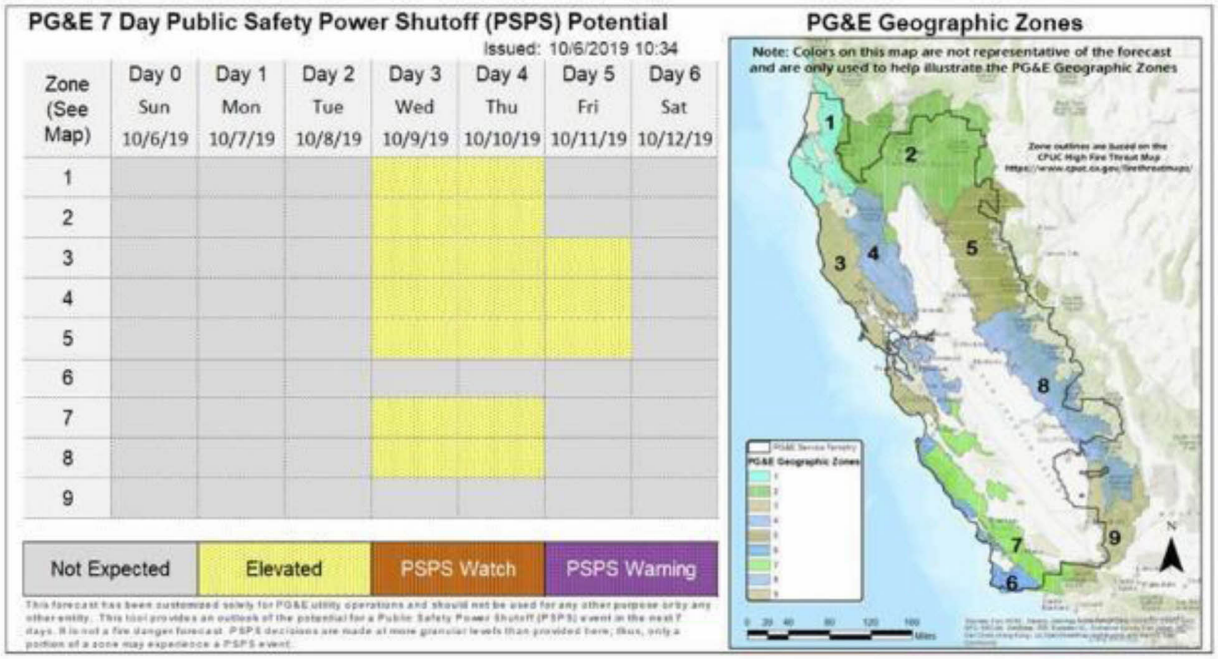
Starting in 2019 and through 2020, PG&E developed and then operationally implemented a publicly available 7-day forecast on the potential of implementing a PSPS. This forecast is published daily by an operational meteorologist or fire scientist from PG&E. The forecast is customized for PG&E utility operations and provides an overview for a potential PSPS event in the next seven days as determined from an analysis of forecasted weather, the potential for wind-related damage, and fuel moisture content in dead and live vegetation.

The forecast is broken down by broad PG&E Geographic Zones numbered 1-9; however, PSPS decisions are made at more granular levels with more detailed information shared with state, county and local officials as well as the public, once more detailed analysis is performed. The forecast is presented in one of four discrete categories for each geographic zone:

- Not Expected: Conditions that generally warrant a PSPS event are not expected at this time.
- Elevated: An upcoming event (typically a period of adverse weather combined with dry fuels) is being monitored for an increased potential of a PSPS event.
- PSPS Watch: The PG&E Emergency Operations Center (EOC) is activated for a reasonable chance of executing PSPS to reduce public safety risk in a given geographic zone due to a combination of adverse weather and dry fuel conditions. A PSPS watch is typically only issued within 72 hours before the anticipated start of an event.
- PSPS Warning: The PG&E EOC is activated and customers in areas being considered for PSPS have been or are being notified. This level indicates execution of PSPS is probable given the latest forecast of weather and fuels and/or observed conditions. PSPS is typically executed in smaller and more targeted areas than PG&E Geographic Zones. This level does not guarantee a PSPS execution as conditions and forecasts may change.

Figure PG&E-7.3.2-22 below provides an example of a PSPS forecast.

FIGURE PG&E-7.3.2-22: EXAMPLE OF A PSPS FORECAST ISSUED ON 10/6 FOR AN UPCOMING PERIOD OF FIRE RISK ON 10/9-10/11



As indicated in response to Question 2 above, in 2020, PG&E held meetings with agencies and stakeholders to better align on how PG&E would share information with the public. PG&E also continued to develop and then operationally implement a publicly available 7-day forecast on the potential of implementing a PSPS. This forecast is published daily by an operational meteorologist or fire scientist from PG&E.

5) Future improvements to initiative:

High Performance Cloud Computing, Model Validation and other initiatives

In 2021, PG&E will expand the historical weather climatology at 2 x 2 km resolution to back-fill all of 2020 and explore a methodology to back-fill the climatological data each quarter moving forward. We will also evaluate extending the deterministic forecast to provide another 24 hours of forecast data (from 105 hours currently to 129 hours). Finally, we will evaluate if the POMMS-EPS ensemble mean is more or less accurate than the deterministic POMMS model.

Medium- to Seasonal-Range Diablo Wind Forecasting

In 2021, PG&E plans to continue these projects as well as work with an external partner to develop and deploy a seasonal Diablo wind report based on statistical, machine learning and/or AI techniques. A longer lead-time of an upcoming offshore, Diablo wind events would provide crucial preparation time for PG&E and potential communities impacted by these events.

Addressing Weather Forecast Model Uncertainty

PG&E has found value in evaluating output from multiple deterministic and ensemble weather models to assess forecast uncertainty. The complete list of models that PG&E leverages can be found in Section 7.3.2.1. We will continue to leverage multiple weather models to determine the uncertainty in a forecast as well as continue to evaluate our own POMMS ensemble prediction system. One of the ways we will evaluate this is determining if the POMMS ensemble mean provides more statistical forecast skill than the deterministic model.

PLDN

No major changes to this initiative are anticipated at this time in the next 3-10 years.

Information Sharing

In 2021, PG&E plans to adjust the public 7-day forecast to provide more granularity and clarity around the potential for a PSPS event possibly by county. This forecast is aimed at providing as much lead time as possible for the public to prepare for a possible PSPS event.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

No major changes to this initiative are expected in the next 3 – 10 years. Additional tools will likely be incrementally improved or created to enhance situational awareness.

7.3.2.2 Continuous Monitoring Sensors

WSD Initiative Definition: *Installation, maintenance, and monitoring of sensors and sensorized equipment used to monitor the condition of electric lines and equipment.*

For this initiative, PG&E has several sub-initiatives including:

- 7.3.2.2.1: Electric Transmission SEL T400L
- 7.3.2.2.2: SmartMeter™ Partial Voltage Detection
- 7.3.2.2.3: Distribution Fault Anticipation (DFA) Technology and Early Fault Detection (EFD)
- 7.3.2.2.4: Sensor IQ (SIQ)
- 7.3.2.2.5: Line Sensor Devices
- 7.3.2.2.6: Distribution Arcing Fault Signature Library

7.3.2.2.1 Electric Transmission SEL T400L

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

Bolted transmission electrical faults (when the conductors are considered connected to ground) can result in extreme heat, sparks and molten material with a potential to cause a wildfire ignition. To help predict developing problems on PG&E's electric transmission system, PG&E will implement more proactive maintenance protocols, such as using data from transmission monitoring technology, to reduce potential hazards and improve public safety. PG&E will also continue to evaluate, deploy and operate technological applications that provide data of real time continuous sensor monitoring and analytics of asset health and performance.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

Line monitoring non-tripping travelling wave relays (SEL T400L's) are being installed on selected transmission lines to capture high frequency travelling waves emitted by faults or other electric system anomalies (high corona for example). High Corona is a low-level electric field discharge that is present on areas of the electric system with metallic sharp edges or other surface discontinuities. System Protection and the relay vendor are evaluating the relay data to determine if vulnerable locations along the transmission line can be identified prior to the condition evolving into a bolted transmission electrical fault. The SEL T400L relay is the only device providing automatic line monitoring for incipient faults using a C37.94 communication channel.

***3) Region* prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")**

To implement this pilot initiative, PG&E installed the subject relays on transmission lines in Northern and Southern Sierra regions in both HFTD and Non-HFTD areas. PG&E chose these transmission lines because they lent themselves to quick installation of the relays on a limited budget, which provided the fastest path to data acquisition. The lines were also selected based on their historically high level of fault activity.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2019, PG&E defined the scope of this pilot installation to include 16 transmission lines (60 kilovolt (kV) to 230kV). PG&E has completed installation on 10 lines (and data is available per a daily download). Installation on 6 lines is in progress. However, IT dependencies are required to complete five of the six lines "in-progress" (as the electrical installation and settings are

complete). PG&E estimates completing installation on five lines by end of first quarter of 2021. The SEL T400L relay installation that will not be completed in 2021 has dependencies on another project that is scheduled to be completed in 2022.

The installed relays have not yet produced any actionable incipient fault data. However, the devices have been used to validate and improve on fault location estimates. This has helped troublemen find fault locations and issue repair tags for at-risk equipment. The data analysis of this pilot initiative could validate this technology's viability and allow PG&E to broaden the scope to include critical wildfire transmission lines.

5) Future improvements to initiative:

PG&E will continue to collaborate with subject matter experts at SEL, the equipment vendor. This includes PG&E providing relay data to SEL showing traveling wave signature anomalies, including double ended fault locations and histogram bin counts. PG&E and SEL will evaluate the PG&E data periodically downloaded from these devices to provide actionable data when possible. PG&E will implement recommendations from SEL resulting from the evaluations as the data may help identify relay problems, firmware problems, or provide other insights. For example, one existing benefit from this technology is in providing more accurate estimated fault locations.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E has not yet determined a long-term plan for this initiative. The 2021 data will provide actionable direction in order to make long term plans.

7.3.2.2.2 SmartMeter™ Partial Voltage Detection (Formerly Known as Enhanced Wires Down Detection)

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

Prior to implementing SmartMeter™ technology, Control Center Operators and Dispatch were not provided with information on partial voltage conditions which indicate loss of phase/conductor on the distribution circuit. In addition, SmartMeters™ only informed Control Center Operators of full power out conditions. PG&E has now enabled Single-Phase SmartMeters™ to send real time alarms occurring in the Distribution Management System under partial voltage conditions (25 percent-75 percent of nominal voltage). Detection of partial voltage conditions allows Control Center Operators to dispatch field personnel to locations where equipment may be in a condition that increases wildfire risk.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

This enhanced situational awareness can help detect and locate downed distribution lines more quickly to enable faster response. Faster response may reduce the amount of time a line is down and allow first responders to more quickly extinguish wire down-related ignitions, if they occur.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

SmartMeter™ technology is software-based and can be deployed across PG&E's service territory, including all HFTDs. That said, deployment will not be limited to HFTDs.

The continuation of partial voltage expands coverage of the detection algorithm from the initial 4.5 million single-phase meters to an additional 365,000 Three-Phase SmartMeters™ (as explained below). This will provide coverage to more areas and allow for the detection of additional types of partial voltage conditions, including four-wire circuits.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

Coverage of single-phase meters was completed in 2019. In 2020, PG&E initiated plans to continue developing this solution to extend the partial voltage detection enhancement to 365,000 Three-Phase SmartMeters™ and 4-Wire distribution systems. Once implemented, the coverage for partial voltage detection will extend across PG&E's service territory, including HFTDs. In PG&E's 2020 WMP, the three-phase deployment of partial voltage detection was planned to be completed in 2020. However, due to technical, software issues discovered during testing, the schedule for this implementation has been revised to complete by June 30, 2021.

This deployment schedule change was articulated in PG&E's December 11, 2020 Change Order Report which WSD approved on January 28, 2021.

On February 1, 2021 PG&E received a pre-release version of the revised Partial Voltage Detection software from the vendor that addresses the previously identified defects and has commenced functional testing. PG&E remains on track to meet the June 30, 2021 implementation date, in alignment with the previously filed and approve Change Order.

5) Future improvements to initiative:

The data gathered from SmartMeters™ are being consolidated and displayed to the operators and dispatch, who will then identify partial voltage impacted areas. The information helps operators and dispatch decide on how and where to respond. As such, only the phase one technology for single phase meters has been expanded to cover all 4.5 million single phase meters in our service areas, in both HFTD and non-HFTD areas. Phase 2 technology for three phase meters will be implemented by June 30, 2021. Note that these are exploratory technologies that may require refinements, and timeline commitments are based on best available information at the time of filing.

PG&E continues to use this technology to investigate ways to improve the partial voltage detection algorithm abilities. Some of these concepts include detection of short-duration, high-frequency outages and increasing sensitivity of alerting on higher risk days.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E will have completed all planned implementation of this technology to all applicable meters by June 30, 2021. At that point, the technology will be in full operation. PG&E will continue to investigate ways to enhance the functionality as part of the continuous improvement process but has not determined a long-term plan for this initiative.

7.3.2.2.3 DFA Technology and EFD

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

In some cases, non-equipment failure type outages (where no problems are found) indicate the presence of latent conditions that can result in more significant issues or a fire risk in the future, if left unresolved. There are also other power flow anomalies/disruptions that are indicative of incipient faults. Since these issues lack visibility and sensitivity, they are difficult to perceive using existing detection methods and patrol techniques. More advanced monitoring methods – such as the utilization of DFA technology and EFD that measure different electrical parameters over the distribution circuits can harness advance sensors, along with analytical methods, to detect these issues early in their degradation mode.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

Addressing latent or incipient issues in their early stages may remove many of the conditions that cause wildfires. With the ability to proactively detect failing conditions as they evolve and eliminate them quickly, PG&E can better reduce the risk of wildfire. The DFA and EFD sensors may also be able to more quickly detect and locate aggressively failing components during high-risk conditions and allow field crews and fire protection personnel to more immediately respond and minimize wildfire risks.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The technology deployment will be prioritized to the highest fire risk areas, beginning with the highest fire risk circuits. PG&E will then roll out the technology to all fire risk areas on a full circuit-based deployment.

4) Progress on initiative (amount spent, regions covered) and plans for next year

This pilot project was completed in 2020 with the recommendation to continue deployment. EFD was deployed on one additional circuit in 2020, Silverado 2104. DFA was deployed in one additional circuit in 2020, Calistoga 1102.

Each of these technologies is emerging. 2021 is the start of a ramped-up mass deployment. DFA will be scaled up to a level higher than previously operated by any utility. It will require additional process refinements and operational enhancement. EFD is also being deployed on a larger scale than seen before. There is additional development required to simplify deployment, along with

operational enhancements to utilize the data generated. As we have seen with other emerging technologies, these challenges may impact the scope and speed of deployment.

The intent is to deploy EFD and DFA sensors on a total of 600-800 circuits in Tier 2 and Tier 3 HFTD areas, mitigating 28,000 total line miles (20,200 miles in Tier 2, 7,800 miles in Tier 3), across several General Rate Case (GRC) cycles.

5) Future improvements to initiative:

The technology is nascent and provides data that has not been previously available.

These two technologies each have different evolution paths.

- The DFA technology is more established, with some of its foundation being rooted in Texas A&M Electrical Power System Engineering research team for over 20 years. Within the past five years, DFA has evolved into a more commercialized product that is readily deployed in larger volumes.
- The EFD system is an emerging technology that still requires refinement to make it commercially deployable and operable on a large scale. As such, PG&E believes that it will be a year or two before there is an operational path to expand coverage.

As these systems continue to be implemented, new methods, accuracy and efficiencies will be applied. PG&E continues to work with each of the technology vendors to increase effectiveness of the locational and predictive functionality and to develop more operationally efficient platforms with the vision of deploying the technology to all HFTD circuits. It has also been observed that the two technologies are complimentary in that they each detect different elements of failure conditions. The intent is to seamlessly integrate them together and automate the functionality into existing operating systems.

ACTION *PGE*-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As PG&E continues to evaluate the two technologies, it is simultaneously building a strategy to deploy this technology to 600+ HFTD circuits over the next 8-10 years covering multiple GRC planning cycles. These technologies will also be increasingly incorporated into wildfire detection and prevention operational applications as they mature and are available.

7.3.2.2.4 Sensor IQ (SIQ)

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

The Sensor IQ or SIQ software works with existing SmartMeters™ to capture and store high resolution, RT, and granular load, voltage and outage data to enable predictive maintenance data analytics. SIQ does not currently have a direct impact for wildfire reduction. However, we anticipate the additional data source may provide an analytical methodology to detect early-stage equipment failure resulting in voltage and other meter-detectable conditions including, loose conductor splices, failing/overloaded transformers, momentary secondary and primary vegetation contact. The goal is to decrease overall wildfire ignition risk by detecting early-stage equipment failure and conducting repairs before infrastructure fails.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

PG&E believes useful and valuable wildfire related data can be obtained from SmartMeters™. The current SmartMeters™ are only able to capture limited lower frequency and less comprehensive real time data. PG&E has worked to harness as much intelligence from the meters as possible in the current configuration. The SIQ software is expected to provide higher resolution data and additional data fields that can be set to report in real time, allowing for a more insightful view of undesirable changes that could negatively impact PG&E equipment. Early awareness of degrading conditions can allow for a prompt response and help reduce the risk of potential wildfire ignition sources.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

The pilot will be prioritized to cover circuits in the HFTDs. Since this is a software solution, it can be deployed almost concurrently over the entire area.

4) Progress on initiative (amount spent, regions covered) and plans for next year

PG&E began this new technology development and implementation pilot in 2020. The original plan identified in the 2020 WMP was to complete deployment for 500,000 SmartMeters™ in HTFD areas in 2020. Due to the new development of this technology, the original program milestones were missed due to a combination of circumstances: (1) a vendor product interoperability issue was identified during testing and deployment activities that required redevelopment to resolve; and (2) the SIQ application is a component of the base SmartMeter™ operations system which is being migrated from a hosted system to an internal data center. This migration was also impacted due to PG&E's bankruptcy and delayed part of the SIQ implementation schedule. In PG&E's September 11, 2020 Change Order Report,

we identified a proposed change to our SIQ Pilot under Section 5.3.2 of our 2020 WMP. At that time PG&E's proposed time frame to complete the Sensor IQ pilot was: to have Sensor IQ (SIQ) functionality in place on all planned SmartMeters™ (500,000) by 6/1/2021 and to complete the full evaluation for how to use the technology by 10/31/2021. WSD approved PG&E's Change Order on January 5, 2021.

In January 2021, PG&E completed implementation of SIQ head-end software, data interfaces, and data repository for analyzing meter data. PG&E attempted our first deployment of Sensor IQ profiles to 1,000 in-field, production SmartMeters™ on January 22, 2021. This initial deployment was unsuccessful on 10% of those meters, and the root cause for this failure is still being investigated. Learnings from the initial deployment also identified the need to do additional performance tuning in the production metering system to ensure that customer billing and outage management capabilities are not impacted when SIQ is deployed to meters.

Based on the initial deployment experience of Sensor IQ, and the iterative learning nature of technology pilots, PG&E is taking a more measured approach to the large-scale deployment of this technology to avoid adverse impact to existing production capabilities. We cannot put at risk the existing billing and operational functions of SmartMeters™ by deploying Sensor IQ if identified potential issues have not been fully resolved. Due to the issues identified to date and the uncertainty related to further challenges with this new technology, PG&E now expects to have Sensor IQ capability deployed on all planned SmartMeters™ (500,000) by 12/31/21 and to complete the full evaluation for how to use this technology by Q1 2022. PG&E will move as quickly as is feasible based on the stability and performance of the Sensor IQ and overall SmartMeter™ systems.

5) Future improvements to initiative:

PG&E will use an advanced data analytics and machine learning platform to evaluate the data from the SIQ pilot. The data from the pilot will be ingested into an advanced data analytics and machine learning platform. Several focused efforts on the various event types will be conducted to determine if we can improve our ability to find loose conductor splices, failing/overloaded transformers, momentary secondary and primary vegetation contact.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

If the technology proves to be effective in early detection of fire risks, the deployment of this tool may be extended to continue coverage past the currently planned pilot for the 500K pilot meters, including possibly deploying to all 5.5M electric SmartMeters™ across PG&E's service territory.

7.3.2.2.5 Line Sensor Devices

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

Existing detection methods and patrol techniques miss non-equipment failure types since they lack visibility and sensitivity. Non-equipment failure-type outages (no problem found) are indicators, in some cases, of latent conditions that could result in more significant issues or fire risks if left unresolved. There are also other power flow anomalies/disruptions that may be indicative of incipient faults. Advanced monitoring methods that measure different electrical parameters over the distribution circuits can harness these advanced sensors with analytical methods to find conditions early in their degradation mode.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

Line sensors are primary conductor-mounted devices that continuously measure current in real time and report events as they occur, and in some cases the current waveform of grid disturbances. These line sensors are next-generation fault indicators (covered in Section 7.3.2.3 below) with additional functionality and communication capabilities.

We can remove many of the conditions that could cause a wildfire by addressing latent or incipient issues in their early stages. By proactively detecting and resolving failing conditions quickly before they evolve, we can reduce risk of causing a wildfire.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Building from our Smart Grid Pilot Program, PG&E began deploying 801-line sensing devices on 60 key circuits in 2019 at Tier 2 and Tier 3 HFTD areas in Humboldt, North Bay, North Valley, Sierra, Sonoma, and Yosemite. Efforts were focused on reducing wildfire risk and improving public safety by monitoring the grid continuously, performing analytics on captured line disturbance data, identifying potential hazards and, when necessary, dispatching field operations to proactively patrol, maintain, and repair failing field conditions or assets. These efforts intend to expand coverage of the technology first to the highest fire-risk areas.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2020, line sensors have been deployed on 46 additional feeders (60 total for 2019/20) in Tier 2 and Tier 3 HFTD areas. The deployment included 612 additional sensors (801 total for 2019/20) on an additional 4,131-line miles (4,898 total for 2019/20).

5) Future improvements to initiative:

PG&E began operationalizing line sensors in 2019 to proactively monitor and locate distribution grid disturbances and analyze times to dispatch field inspectors. PG&E continues to use data from line sensor technologies to bolster asset health and performance.

Using an engineering approach, PG&E will identify additional circuits in Tier 2 and Tier 3 HFTD areas and redesign an optimal line sensor device footprint to further support wildfire mitigation. PG&E will strategically deploy, gain further experience, and operate state-of-the-art systems and technologies to continuously monitor the grid and analyze data to prevent asset failures and reduce risk. The intent is to deploy line sensors on a total of 600-800 circuits in Tier 2 and Tier 3 areas, mitigating 28,000 total line miles (20,200 miles in Tier 2, 7,800 miles in Tier 3), across several GRC cycles. To handle the additional amount of data, we will need to integrate into an automated analytics and detection platform. This analytics platform will cross analyze the data from other relevant sources including SmartMeters™, other distribution sensors, asset history, and meteorology. Our goal is to access as much visibility of circuit conditions as possible so we can react and correct issues as they happen and remove incipient issues before they become fire risks. Other areas of improvement include refining sensor settings and detecting methodologies based on continuous evaluation of event data.

In 2021, PG&E will continue to benchmark other leading utilities and manufacturers to learn alternatives to improve our predictive analytics and preventative operational practices, while evaluating new and/or emerging technologies.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As PG&E continues to evaluate this technology, it is simultaneously building a strategy to deploy the technology on 600-800 HFTD circuits over the next 8-10 years covering multiple GRC planning cycles. This technology will also be increasingly incorporated into wildfire detection and prevention operational applications as they mature and are available.

7.3.2.2.6 Distribution Arcing Fault Signature Library

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

Until recently, the ability to collect extremely high-resolution data waveforms (the unique signature) from a broad range of fault events and precursors has been limited to the equipment available. In addition, deconstructing and analyzing these waveforms requires significant analytics and computer processing power. This level of effort has been a challenge within a utility environment. In order to have analytical and machine learning tools that can react to specific types of events the faults need to be known and understood. Utilization of this method on a distributed analytics platform allows the high volume of data to be locally processed and improves detection time, enabling future control technologies to take accurate segmentation action.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

This Research & Development (R&D) project is the foundation for this data collection. This project is intended to better identify the signatures of incipient fault conditions. Once this high-resolution sensor data waveform library is built it will assist in identifying events caused by incipient fault conditions as they occur. By understanding and detecting these conditions, PG&E can build better tools and methods to reduce or correct risks by proactive maintenance or real time protective circuit de-energization. This project takes advantage of a cooperative effort between PG&E's distribution operational system subject matter experts and two Department of Energy national labs using technologies originally built for Department of Defense analytical expertise used to solve hyper complex problems. The technology includes installing a high-fidelity optical sensor technology on a distribution feeder. The optical sensors, with immunity to electromagnetic interference and instrument transformer saturation, will provide high frequency sampling of voltage, current, temperature, pressure, vibration, and acoustic variables. The Distribution Arcing Fault Signature Library will inform PG&E about the types and resolutions of sensors needed to detect incipient fault conditions on the distribution system and intervene with proactive maintenance to reduce wildfire risks.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Since this is purely an R&D project, the initial scope of deployment will be on a single circuit that has a high occurrence of faults with a wide range of causes. The circuit includes sections that are within the Tier 2 and Tier 3 HFTD areas.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

The specialized sensor installation was completed in December 2020. By end of 2021, the project will have completed a 6-month minimum analytic stage capturing all events on the installed circuit (Half Moon Bay 1103).

5) Future improvements to initiative:

Once the R&D project is complete at the end of 2021, the team will perform a strategic assessment of the results. If the team can develop a comprehensive fault signature library, this information will be fed into the larger incipient fault analytics tools that will be used to proactively detect and mitigate conditions that could result in a wildfire. The team will also assess for further potential deployment and applications.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As detailed in the Future Improvement section above, a long-term plan for this initiative is contingent on the strategic assessment arising out of the R&D project.

7.3.2.3 Fault Indicators for Detecting Faults on Electric Lines and Equipment

WSD Initiative Definition: *Installation and maintenance of fault indicators.*

1) ***Risk to be mitigated/problem to be addressed:***

Fault indicators are used to help troubleshooters in the field to locate where conductors have failed. Fault indicators are also installed to shorten outage times and facilitate restoration.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

Protective devices de-energize faulted conductors when fault indicators are activated. Fault indicators show a blinking light when large fault currents pass through them. Troubleshooters follow the blinking lights to find the fault, typically where a branch has fallen across the conductors or the conductor has fallen on the ground. In very rare instances when protective devices do not sense faults and do not act, fault indicators are still able to direct first responders to the faulted conductors so that the lines can be safely de-energized more quickly.

Fault indicators help PG&E narrow the scope of patrols and inspections in response to an outage, thus increasing efficiency and limiting the scope of area that Troublemen need to patrol. By narrowing the area to patrol, it shortens the outage duration for PG&E's customers.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")***

If you have SCADA, fault indicators are not needed because you can look at SCADA screens in the distribution control centers to see if a fault occurred. If you do not have SCADA, you must send out a Troubleman to see where fault indicators are blinking. There is not proactive plan to install fault indicators. However, fault indicators are placed either by a Troublemen during outage restoration, or after outages, engineering and operator teams decide where to place them based on how to best troubleshoot outages on a particular circuit in the future. Fault indicators are generally installed where SCADA visibility is limited, which is primarily in rural areas.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

In areas where fault indicators are not present, restoration workers install them as needed. Fault indicators are placed either by Troublemen or, after outages, engineering and operator teams decide where to place them based on how to best troubleshoot outages on a particular circuit in the future. Installation of fault indicators is ongoing, but we do not have a specific installation goal as the fault indicators are installed when needed.

5) Future improvements to initiative:

Technology such as Line Sensors is being explored (see Section 7.3.2.2.5). Line Sensor technology is not new in the industry, but it is a relatively new implementation at PG&E. In addition to Line Sensors, PG&E is looking at additional fault indicating methods utilizing more SCADA or SmartMeter™ technologies. This would enable remote communication of fault locations to expedite outage responses.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

We have not yet determined a long-term plan for fault indicators and their detection of faults on electrical lines and equipment. Long-term plan milestones are still under development with Electric Operations and Asset Management as we evaluate our current protection and automation standards/initiatives. The purpose of this evaluation is to drive informed decisions based on past performance and data-related performance of fault indicators as part of our broader fault detection schemes.

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7.3.2.4 Forecast of a Fire Risk Index, FPI, or Similar

WSD Initiative Definition: *Index that uses a combination of weather parameters (such as wind speed, humidity, and temperature), vegetation and/or fuel conditions, and other factors to judge current fire risk and to create a forecast indicative of fire risk. A sufficiently granular index shall inform operational decision-making.*

1) Risk to be mitigated/problem to be addressed:

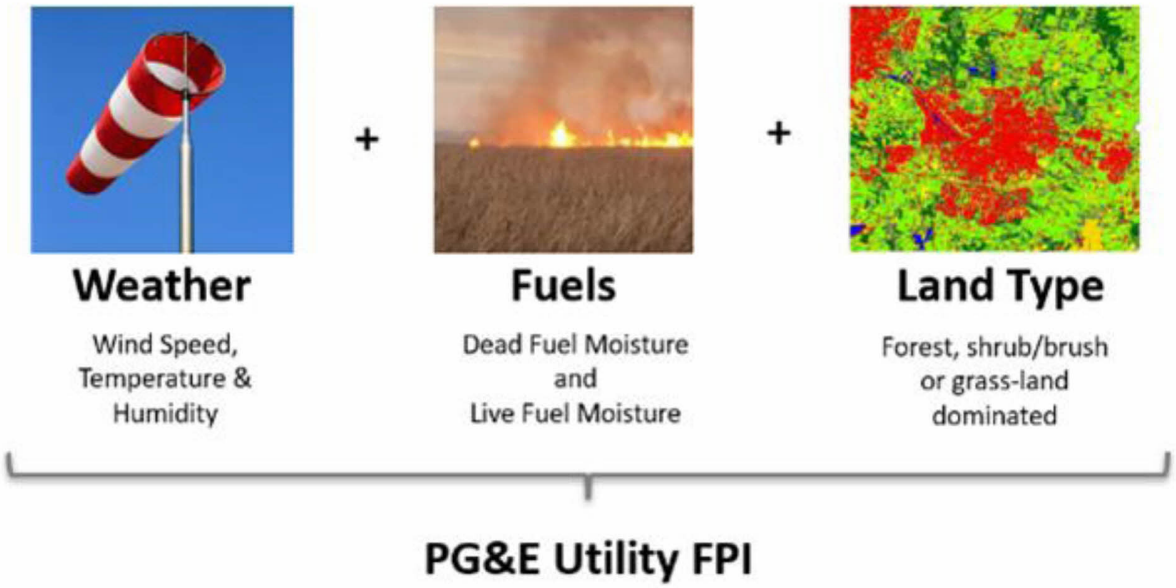
Current publicly available fire danger forecasts available from WFAS.net only provide a one-day-out forecast of fire danger and are only available at the few hundred RAWS stations deployed in the state. To understand the potential for large fires to occur across the PG&E territory at a high resolution and hourly, four days in advance, PG&E developed the FPI Model in 2015 and significantly enhanced the model in 2018 and 2019. The current FPI Model is modeled on historical fires using PG&E's 30-year downscaled climatology, DFM and LFM Models, fire weather indices, and other models and data. The FPI framework, model, features, and evaluation are discussed at length in this section.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

The PG&E FPI Model was built and calibrated by PG&E data scientists, meteorologists, and fire weather experts. First, the conditions contributing to large and catastrophic fires were studied in detail. PG&E combined a USFS fire occurrence dataset with fires in the PG&E territory from 1992 – 2018 as well as PG&E's robust high-resolution climatology of weather and fuels. For each fire, PG&E extracted weather, fuel moisture and land-type and ruggedness features from the climatology and other GIS datasets. When constructing the FPI model, PG&E wanted to understand which variables and variable combinations provided the most predictive skill. To that end, PG&E built and evaluated over 4,000 FPI models using different combinations of weather components, fire weather indices (FFWI, the Hot-Dry-Windy Index, the Santa Ana Wildfire Threat weather index), outputs from NFDRS, Nelson DFM model, a machine-learning derived LFM model, and 'containment' and 'land characteristic' features such as road density, distance to nearest fire station, and land-use type among several others.

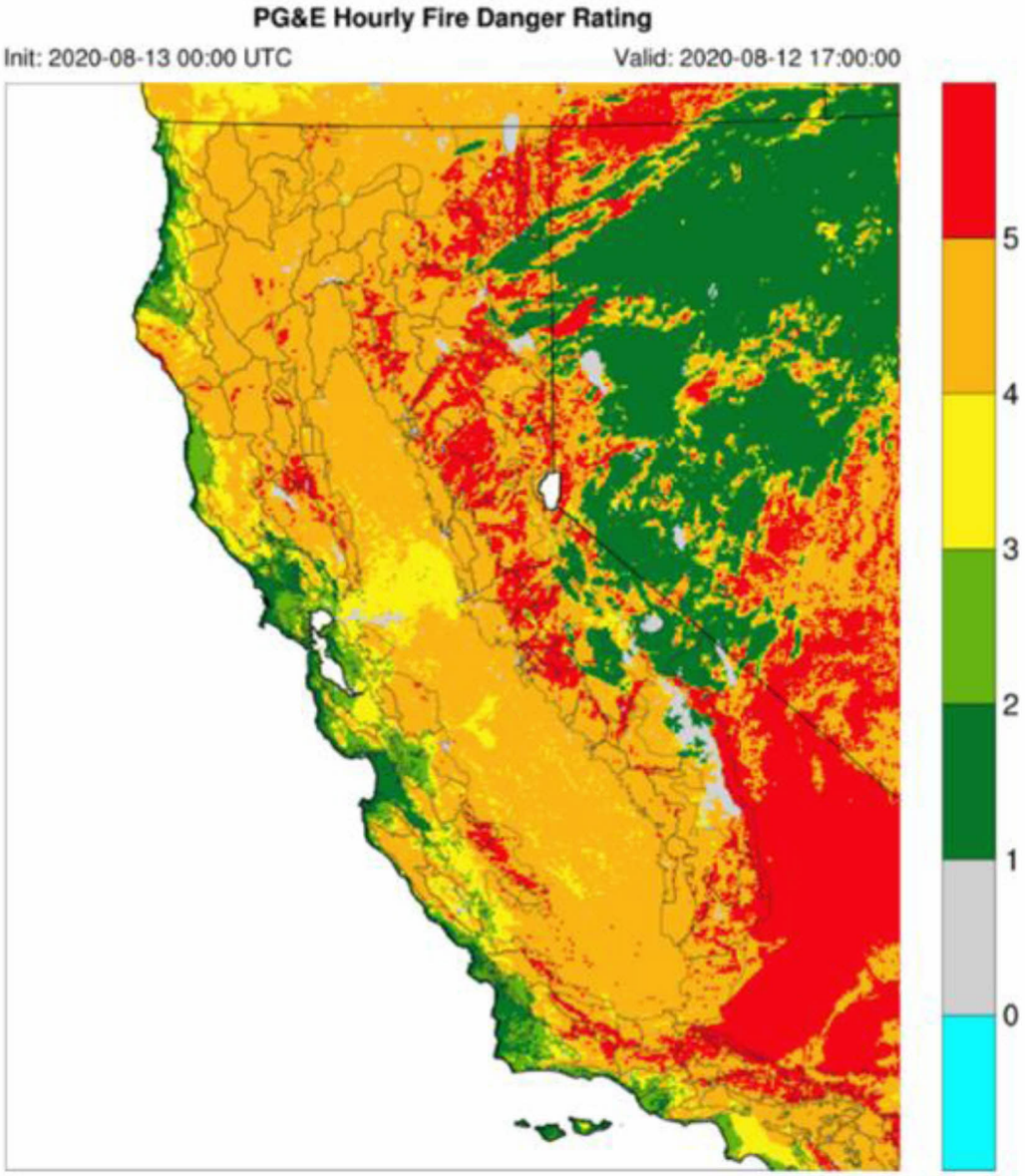
The PG&E FPI deployed in 2019 combines fire weather parameters (wind speed, temperature and RH), dead and LFM data, and land use type, as depicted in Figure PG&E-7.3.2-23 below.

FIGURE PG&E-7.3.2-23: PG&E UTILITY FPI



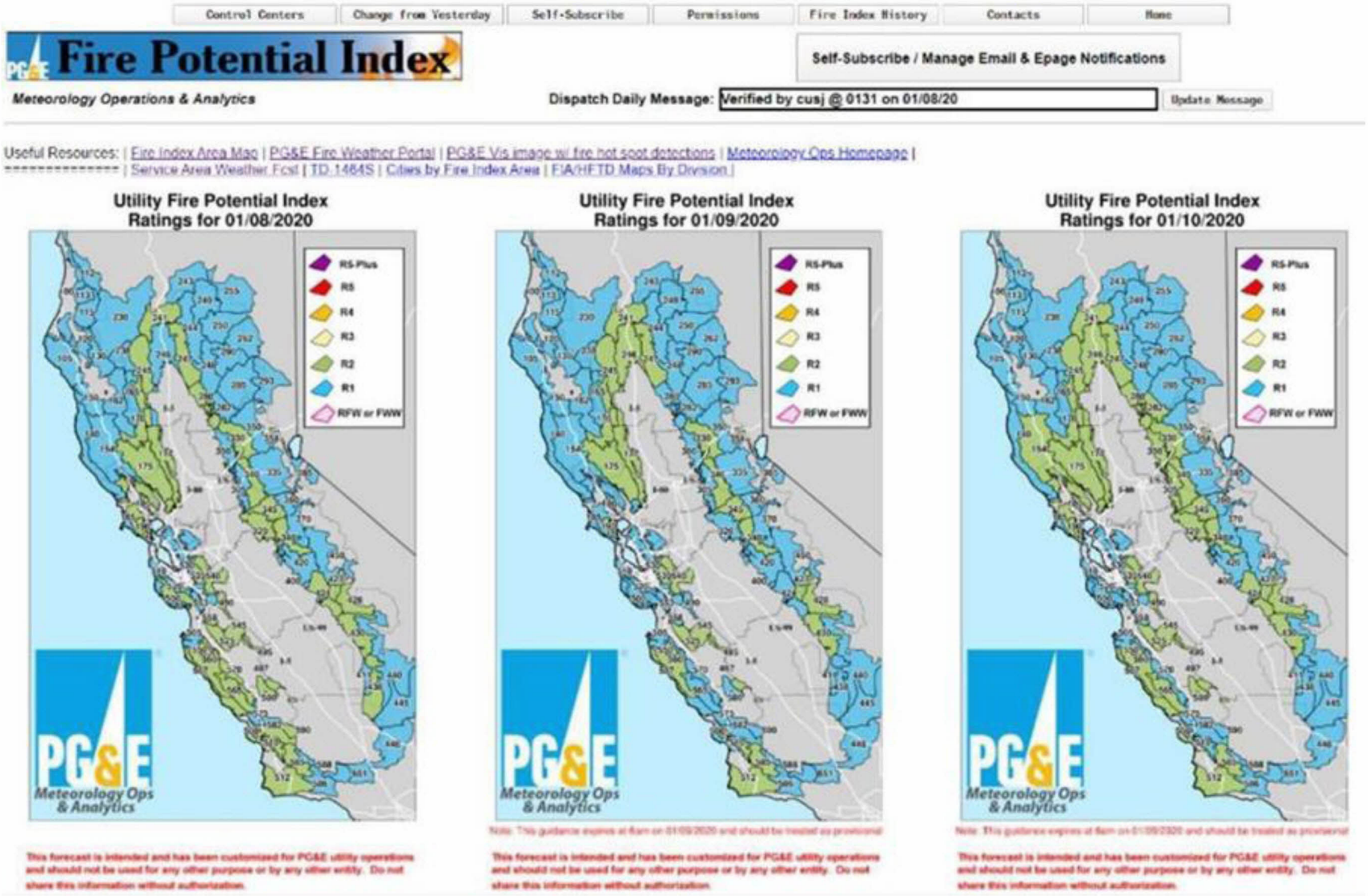
The FPI Model is run at 2 x 2 km resolution using PG&E's high-resolution weather and fuels coupled models and provides hourly forecasts out four days currently. The FPI Model outputs the probability from 0 – 100 percent of observing a large fire (>1000 acres), given an ignition. Figure PG&E-7.3.2-24 below is an example of FPI Model forecast for hourly fire danger ratings.

FIGURE PG&E-7.3.2-24: EXAMPLE FPI MODEL FORECAST AT 2 X 2 KM MODEL RESOLUTION (1 = R1, 5 = R5)



The FPI Model is used as an hourly input to PG&E's PSPS framework and is also used as a daily tool to drive operational decisions to reduce fire risk. The FPI Model informs daily operational actions to reduce the risk of fire ignition per company standards. Some of these daily actions include placing restrictions on higher risk field activities such as welding and grinding. For these day-to-day operational decisions, the granular FPI data are aggregated to FIAs. Maps and data available in GIS formats are available for the next three days via a web application.
Figure PGE-7.3.2-25 below is an example output of the FPI Model web application.

FIGURE PG&E-7.3.2-25: EXAMPLE OUTPUT FROM THE PG&E UTILITY FPI WEB APPLICATION



3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The FPI Model is run for all POMMS grid cells in HFTD areas.

4) Progress on initiative (amount spent, regions covered) and plans for next year

PG&E plans to enhance the FPI Model by September 1, 2021 using additional data and an enhanced fire occurrence dataset. In 2020, PG&E partnered with Sonoma Technology Inc. to produce an enhanced fire occurrence dataset using satellite fire detections from MODIS and VIIRS. This enhanced dataset that combines traditional data sets but augments them with granular satellite information to provide daily growth metrics for each fire. PG&E plans to evaluate if the FPI Model predictive skill is improved by using this new dataset over previous USFS datasets.

2020 was also an extreme year with over 4 million acres burned. This has resulted in significant changes in California landscape, which ultimately changes the fire risk profile in many areas. Once the climatology data is back-filled for 2020, PG&E plans to re-calibrate the FPI with 2020 data at 2 km resolution. In addition, PG&E will evaluate using an updated fuel map produced by Technosylva in the FPI land-type classification. In 2020, Technosylva make significant upgrades to the fuel map used in fire spread simulations. This fuel map is based on the latest LANDFIRE fuel model map and is significantly enhanced by incorporating more recent satellite data as well as burn-severity analysis to account for recent fires.

5) Future improvements to initiative

As indicated above, PG&E plans to enhance the FPI Model by September 1, 2021 using additional data and an enhanced fire occurrence dataset. PG&E is open to sharing daily FPI data with interested stakeholders but greatly values the role state and federal agencies play in communicating fire danger and risk to the general public. As a result, PG&E's data sharing strategy centers not on communicating the fire potential, but rather the potential for executing PSPS. Before the 2022 WMP, PG&E plans to recalibrate the FPI Model using the 2 km climatology with 2020 included. PG&E also plans to evaluate if the new fire occurrence dataset provides more predictive skill and incorporate the new Technosylva fuel mapping layer into FPI calculations if it provides more predictive skill of large fires.

In 2021 and beyond, PG&E is open to working directly with external stakeholders to refine how information in this area is shared and distributed.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E expects to continue to operate, maintain and incrementally improve the FPI Model and its components over the next 3 to 10 years. Due to the recent catastrophic

fires in California and across the world, there is more research being devoted to being able to better forecast fire risk. PG&E is partnering with SJSU to perform some of this needed research. The long-term vison is to leverage the best available high-resolution weather and fuel models, and the latest scientific methods to more accurately and granularly forecast the fire potential across Northern and Central California for PSPS and day-to-day operations.

7.3.2.5 Personnel Monitoring Areas of Electric Lines and Equipment in Elevated Fire Risk Conditions

WSD Initiative Definition: *Personnel position within utility service territory to monitor system conditions and weather on site. Field observations shall inform operational decisions.*

1) ***Risk to be mitigated/problem to be addressed:***

PG&E's SIPT consists of two-person International Brotherhood of Electrical Workers (IBEW) crews who are trained and certified in safety and infrastructure protection. The SIPT supports fire risk mitigation by:

- Providing standby resources for PG&E crews performing work in Tier 2 and Tier 3 HFTD areas
- Performing fire risk mitigation work proactively around PG&E assets
- Pre-treating PG&E assets to protect from wildfire loss and reduce risks from pole failures during an ongoing wildfire

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

In response to Senate Bill 901, PG&E established in-house fire protection services and began planning for the program in December 2018.

At the discretion of PG&E Leadership, the SIPT plays an important role during PSPS events. When PG&E activates for a PSPS event, SIPTs are deployed to collect valuable weather and fuel data. This information is then reported to the WSOC. With input from meteorology, the WSOC makes decisions related to resourcing and locating Field Observers to determine where the SIPT is sent within a targeted PSPS zone. The number of field observers vary depending on the total number of miles, surrounding terrain, facility attributes and quantity of PSPS zones within the scope of the event. SIPT resources may also be redeployed from performing Field Observations to support other safety needs during a PSPS event.

On-the-ground, real time field observations provide details on weather and field conditions regarding potentially impacted PSPS circuits to help determine where SIPTs should be sent before wind-event start and end times. Observations provide qualitative information (i.e., flying debris, downed trees/branches, conductor movement) on the potential of experiencing R5-Plus conditions (the most critical fire weather) and the possibility of triggering a PSPS event sooner than expected. Observations also provide information to support weather "all clear" conditions necessary to authorize patrol and restoration activities.

Potential hazards related to wind conditions, which may lead to outages, are noted. Additional recorded observations include date/time and location specifics on the following conditions: downed trees/branches, flying debris, conductor movement, and wind speed.

The SIPT also collects localized LFM data, which informs PG&E Meteorology's Utility FPI model and guides PG&E's operational decisions. Furthermore, SIPTs utilize weather data and local conditions to calculate ignition potential based on existing firefighting standards.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")***

SIPTs are located throughout the PG&E service territory but are primarily focused within Tier 2 and Tier 3 HFTD areas.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year***

During the establishment of the SIPT program in 2018, PG&E employees:

- Developed a custom SIPT engine design based on existing PG&E fleet vehicles
- Designed custom-built pumps capable of applying fire retardant
- Acquired and outfitted temporary engines
- Specified and acquired firefighting tools, radios and personal protective equipment
- Developed software applications for monitoring resource locations, scheduling SIPTs and documenting work activities
- Developed a three-week new employee training program and adopted procedures to ensure maintenance of Emergency Medical Technician certification
- Established routine and emergency operational procedures
- Implemented a comprehensive change management program to integrate SIPTs with PG&E's field operations

In 2020, the SIPT program grew from 28 crews in 25 locations and three supervisors, to 40 crews in 32 locations, one manager, seven supervisors, two clerks and one analyst. The growth of the program was driven by a need to:

- Reduce span of control issues and improve balance for supervisor/employee ratios
- Decrease the physical size of supervisorial areas
- Reduce response times in underserved areas
- Provide additional response capacity to support wildfires and PSPS events
- Distribute program administrative workload

5) ***Future improvements to initiative***

In 2021, the SIPT Program will implement minor technology improvements to the SIPT Viewer to improve data capture for both routine and emergency work. SIPTs will maintain staffing levels to support fire prevention and mitigation activities. Currently, the targeted staffing level equates to 40 crews and 40 engines and associated equipment.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

The SIPT has proven to be very valuable in filling a gap by providing fire prevention and mitigation services. It has also demonstrated that asset protection, using fire retardant, prevents asset loss and results in safety improvements and cost savings. At this time the long-term plan is to maintain the SIPT program with the current staffing level with the potential to expand as we further refine the fire prevention and mitigation needs of PG&E.

7.3.2.6 Weather Forecasting and Estimating Outage Probability on Electric Lines and Equipment

WSD Initiative Definition: *Development methodology for forecast of weather conditions relevant to utility operations, forecasting weather conditions and conducting analysis to incorporate into utility decision-making, learning and updates to reduce false positives and false negatives of forecast PSPS conditions.*

1) ***Risk to be mitigated/problem to be addressed:***

The Storm Outage Prediction Model (SOPP), a storm outage prediction program and model developed, maintained, and operated by the Meteorology team on behalf of Electric Emergency Preparedness and Response, is one of the primary tools PG&E uses to mitigate operational risk from all adverse weather drivers that create an increased volume of outages above "blue sky" weather days. These drivers are primarily heat, wind, rain, and snow. This model guides PG&E to be proactive and thus prepared for storm events of any type. In addition, unplanned outages can also pose a fire ignition risk when surface fuels are extremely dry. Thus, elements of the SOPP project, specifically aimed at better understanding the probability of wind-related outages, support the PSPS program.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

Functionally, the SOPP is a collection of tools, techniques and utility subject matter expertise that are employed to predict unplanned outage activity on the distribution and transmission system every day. This model guides PG&E to be prepared in advance of inclement weather by forecasting the volume, timing and location of unplanned outage activity. This helps drive staffing decisions, crew allocation and relocation and EOC activations if required. This model has been operational at PG&E since 2011 and forecasts are produced 365 days a year by PG&E's meteorology department.

The SOPP is a combination of sub-models that seek to understand the following weather-related outage drivers:

- Northerly/offshore wind events (PSPS events)
- Southerly wind events
- Winter storms (rain and wind combination)
- Low-elevation snow events
- Heat events
- Rain and flooding events

The purpose of this initiative is to enhance the SOPP and sub-models by leveraging our rich historical weather datasets to better understand the weather to outage drivers. PG&E is evaluating the two main sources of error as it relates to outage prediction: (1) error or bias in the weather forecast and (2) errors or bias in the weather-outage models/relationships. As described in detail in Section 7.3.2.1.1, as part of this project, PG&E has actively worked with external

experts to improve our numerical weather prediction systems and historical datasets. In addition, this section also speaks to some work performed to address the weather-outage models and relationships.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

There is no regional prioritization associated with this work.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2019, PG&E's meteorologists and data scientists developed the Dynamic Pattern and Analog Matcher (DPAM) tool that automatically matches GFS forecasts for the next seven days against the NARR from January 1995 through July 2019. DPAM dynamically utilizes seven atmospheric fields: 500- and 700-hPa geopotential height, 250- and 500-hPa winds, 700-hPa temperature, precipitable water, and sea-level pressure to return the top 20 historical weather days and the outage patterns on those days. These days can be studied in more detail by PG&E meteorologists to help guide the SOPP outage forecast. This is a technique utilized in the meteorology industry called analog-forecasting.

In order to better model the wind-outage relationships and to develop a tool that can be used to guide PSPS decisions, PG&E developed an Outage Producing Wind (OPW) Model to support mitigation of utility caused wildfire risk through PSPS and other wildfire risk mitigation programs. The OPW Model forecasts the probability of unplanned outages associated with wind events occurring in PG&E's service area. The OPW Model is based on an analysis of windspeeds from PG&E's 30-year weather climatology and approximately 400,000 sustained and momentary outages occurring on distribution grid from 2008 to 2020, which includes wire down events. There is not a single relation between wind speeds and wire down events, as the wind speed required for an outage vary across PG&E's system based on differences in topography, vegetation and climatological weather exposure. Further details concerning the OPW Model can be found in Section 4.2.A(f).

Figure PG&E-7.3.2-26 below provides an example of an exploratory dashboard from the OPW Model and Figure PG&E-7.3.2-27 provides example output from the DPAM tool.

5) Future improvements to initiative

In 2021, PG&E plans to recalibrate the OPW Model using the 2 km climatology that will be extended to capture all outage events in 2020. This will include all 2020 sustained and momentary outages, as well as damages found during post-PSPS event patrols in 2020. An annual or biennial calibration is recommended to account for recent changes to the wind-outage relationship due to grid-hardening efforts, vegetation management, and other factors.

After 2021, PG&E will continue to investigate methods to make the OPW Model more granular without sacrificing predictive skill. In addition, other SOPP sub-models will be explored for improvement, such as the heat-outage model and snow-outage model.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

PG&E expects to continue to operate, maintain and incrementally improve the SOPP and its components over the next three to 10 years. PG&E has been focused on better understanding and modeling the wind-outage relationship to leverage in PSPS; however, better forecasting of other weather drivers can be achieved. The SOPP will continue to be generated and used daily as an outage prediction and storm preparation tool to ensure PG&E is prepared in advance of storms of any type and magnitude.

FIGURE PG&E-7.3.2-26: OPW MODEL EXPLORATORY DASHBOARD EXAMPLE

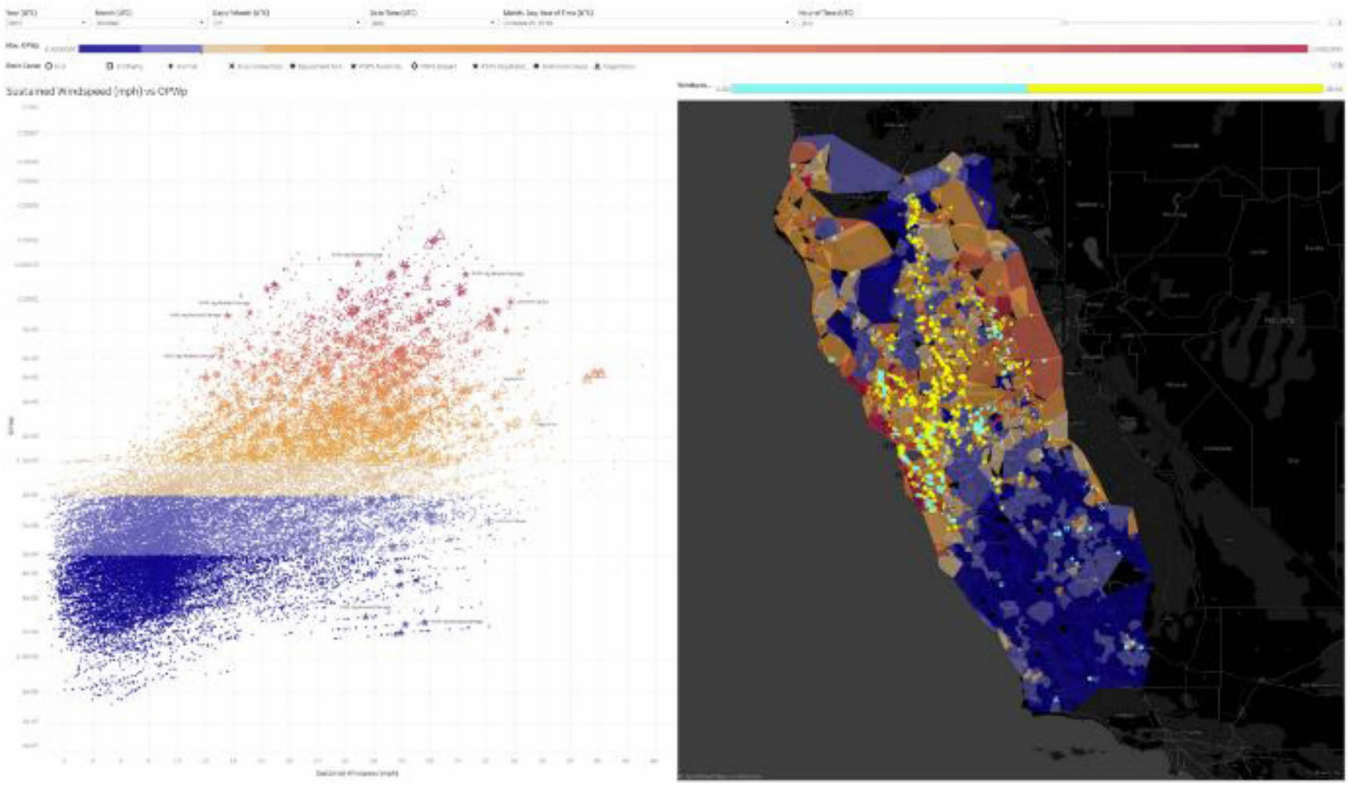
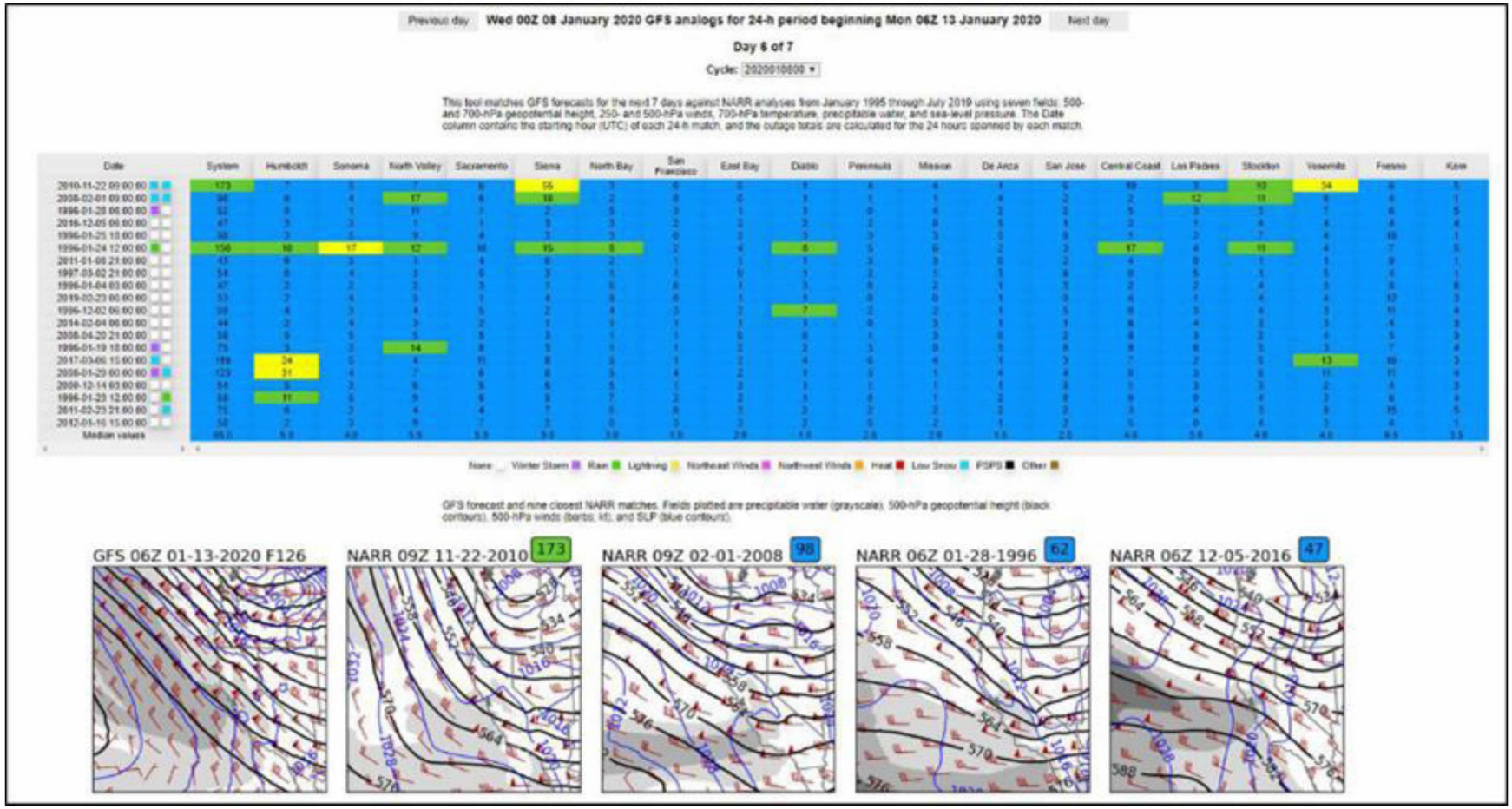


FIGURE PG&E-7.3.2-27: EXAMPLE OUTPUT FROM THE DPAM TOOL



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7.3.2.7 Wildfire Safety Operations Center

WSD Initiative Definition: *N/A This is not a WSD-defined initiative. This is an initiative that PG&E is adding to the 2021 WMP to describe the WSOC.*

1) ***Risk to be mitigated/problem to be addressed:***

To more effectively and efficiently respond to wildfire threats within the service territory, PG&E established the WSOC. The WSOC is a physical facility which serves as PG&E's central information hub for all wildfire-related data. The WSOC team monitors, analyzes and initiates wildfire mitigation and response efforts throughout the service area.

The WSOC team monitors for fire ignitions across PG&E's service area in real time using weather information collected by PG&E weather stations, wildfire camera data, publicly available weather information, as well as data from local and state first responders. The WSOC also collects on-the-ground data from PG&E field personnel, including the Public Safety Specialists (PSS) and the SIPT.

Once it has confirmed that wildfire activity (including size and spread) may impact assets and communities in the service territory, the WSOC communicates this information to company leadership and impacted operating centers. PG&E then deploys utility resources to affected areas to further assess the size and spread of the wildfire, as well as support wildfire mitigation and other emergency efforts.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

The data gathered at the WSOC serves as a critical source of information regarding ongoing wildfire conditions for PG&E and emergency responders. The WSOC generates and distributes notifications or reports via text message or email on incidents that have met established criteria, such as wildfire status, threatened or involved PG&E assets and incident location. The report is sent to a pre-determined internal distribution list made up of PG&E field staff, control center personnel, executive staff, supporting lines of business (LOBs) and other emergency responders. These notifications facilitate the sharing of critical incident information in order to effectively respond to fire threats in a coordinated fashion internally.

The WSOC has established notification protocols for communicating fire threat information to various operations centers within PG&E, such as Gas Control, Electric Grid Control, Electric Distribution Control, IT, Security and Power Generation.

The WSOC also coordinates with PG&E's PSS team, which interfaces with CAL FIRE, USFS and other agency having jurisdiction incident commanders to oversee the organizational response to wildfire threats. The WSOC and PSS

team engage in information sharing regarding ongoing fires and new ignitions that have a potential impact to PG&E facilities. The real time risk information communicated to internal operation centers, field employees and affected public safety partners allows PG&E to act swiftly to protect PG&E assets and communities from wildfires.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")***

The WSOC monitors the entire PG&E service territory for wildfire threats.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year***

In 2020, PG&E continued to mature WSOC capabilities. The WSOC reviewed and updated monitoring, analysis, communications and logging procedures based on lessons learned in 2019 and discussions with internal stakeholders. Onboarding and technical training programs were introduced to better prepare WSOC analysts. This training included scenario-based monitoring and fire analysis, PSPS processes and tools and PG&E internal notification triggers.

Technology enhancements were also implemented to improve situational awareness capabilities. Examples of these enhancements include the inclusion of IRWIN, satellite detection information such as GOES 16 and 17, and fire perimeter maps of ongoing and historic wildfires into the Wildfire Incident Viewer, a tool used by PG&E to log and monitor fires.

5) ***Future improvements to initiative***

In 2021, PG&E will update the WSOC Procedural Documentation to include the expansion of WSOC into the All Hazards Center ("Center"). Like the WSOC, this Center will be staffed 24/7, with employees monitoring and reporting on broader real time events. The core capabilities include monitoring, assessment and communications. The Center will continue to serve as the central information hub which communicates emergency and hazard intelligence to internal stakeholders. That said, the Center would not replace existing communication processes within the respective LOBs; it will instead serve as a "one-stop shop" communicating real time situational awareness and intelligence to all relevant stakeholder groups.

The WSOC owns and maintains an Active Incidents Dashboard, which displays event information in a read-only fashion to internal PG&E employees. In 2021, the team will be expanded for additional stability and to incorporate new data streams and expand the number of viewers.

Through the Center, PG&E will monitor internal and external information sources for issues and emerging risks. This will help PG&E develop and regularly update real time information on dashboards which will be made available to all relevant key stakeholders.

The Center will produce periodic internal situational awareness reports and briefing documents, as well as initiate two-way communications with key LOBs to share and receive intelligence information and initiate notifications according to established protocols. PG&E will also establish communications protocols for information-sharing with external entities.

Lastly, PG&E will establish hazard risk awareness and escalation protocols for potential emergency situations. Based on agreed-upon triggers for scope of emergency situations, the Center will initiate escalated responses by engaging with the PG&E EOC Duty Officer and other key points of contact.

In 2021, PG&E will begin phase one of the expansion (with future plans to stabilize and mature the Center in 2022). Anticipated staffing levels to support the Center include 36 full-time employees, consisting of one director, one manager, one principal, two business analysts, one admin clerk, 16 wildfire analysts, five supervisors, three technology specialists and six all-hazard analysts.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

The WSOC will continue to expand and develop into an All-Hazards Warning Center, in which the center will alert and communicate various types of emergency events to company leaders and employees. The WSOC will be doing this in a phased approach to incorporate various hazards into the scope of the center and will continue to grow and stabilize this program over the next three years. Within the next 10 years, the WSOC will assess new technologies that can be incorporated into the Center's functions.

7.3.2.8 Meteorology Analytics/Operations Center

***WSD Initiative Definition*:** *N/A This is not a WSD-defined initiative. This is an initiative that PG&E is adding in the 2021 WMP to describe the Margaret Mooney Meteorology Analytics/Operations Center (MMAC).*

1) ***Risk to be mitigated/problem to be addressed:***

   Before 2020, the PG&E Meteorology and Fire Science team operated out of separate offices and lacked a space to collaborate in person on in-flight initiatives and monitor real time conditions.

   In 2020, PG&E broke ground on the MMAC, which will allow for better communication and collaboration between PG&E Meteorology and the Fire Science team.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   The MMAC is named after Margaret Mooney, who was one of the first female utility meteorologists in the nation and worked at PG&E from 1966 – 1994. The MMAC will act as a central hub where PG&E Meteorologists, data scientists and fire weather experts can monitor real time and forecasted weather impacts as well as collaborate on projects. This center will feature a large video wall, where weather conditions can be monitored in RT, as well as six pods for meteorologists and data scientists. This center was also built to be used as an emergency backup for the WSOC.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")***

   There is no regional prioritization for this program as it relates to weather monitoring across PG&E's system territory.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year***

   In 2020, PG&E broke ground on the MMAC at the PG&E San Ramon Technology Center in San Ramon, California. The MMAC construction was completed in 2020 and will be staffed and utilized in 2021 once COVID restrictions are lifted.

5) ***Future improvements to initiative:***

   Once the MMAC is fully operational, it will be staffed by PG&E personnel in order to foster better in-person collaboration on in-flight initiatives and to monitor real time conditions. PG&E does not anticipate that the MMAC will be fully staffed onsite until COVID restrictions are lifted.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E plans to operate the MMAC through the next decade. No changes are expected.

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7.3.3 Grid Design and System Hardening

7.3.3.1 Capacitor Maintenance and Replacement Program

Wildfire Safety Division (WSD) Initiative Definition: *Remediation, adjustments, or installations of new equipment to improve or replace existing capacitor equipment.*

In addition to providing responses to below five questions for Initiative 7.3.3.1 – Capacitor Maintenance and Replacement Program, Pacific Gas and Electric Company (PG&E) is including our response to Class C Condition PGE-4 at the bottom of this section.

1) Risk to be mitigated/problem to be addressed:

Low voltage conditions can cause increased current loads on conductors, potentially leading to excessive wire sag, which is a fire ignition risk and leads to damage to customer and PG&E equipment. Capacitors can improve low voltage conditions. Once deployed, capacitors are maintained to ensure proper operations and mitigation of any risks associated with the failure of the capacitor itself.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Capacitors are placed on the distribution system based on engineering capacity studies that target low voltage areas where installing capacitors can improve low voltage conditions. Once installed, PG&E's capacitor maintenance, inspections, and replacements are governed by Utility Procedure: TD-2302P-05. This utility procedure classifies maintenance tasks for electric overhead and underground equipment, including capacitor banks, fault indicators, interrupters, reclosers, voltage regulators, Supervisory Control and Data Acquisition (SCADA) and Primary Distribution Alarm and Control controls, sectionalizers, streetlights, and sump pumps. The capacitor inspection and replacement program are intended to reduce the risk of capacitor failure. A failed capacitor can impact wildfires by causing a low voltage condition as described above. This condition can cause wire sag or wire failure which in turn can ignite a fire. In addition, if a capacitor fails during operation it has the potential to spread molten material from the various parts that make up a capacitor on the pole.

Individually, capacitor banks in the distribution system, both overhead and pad- mounted, are tested and inspected annually. The visual part of the inspection includes verifying conditions on the bushings, switches, capacitor tanks, cut-outs, fuses, control cabinets. Within the control cabinet, PG&E further visually inspects the controller, controller box socket and rack to make sure it is properly grounded, as well as inspecting the potential and current transformers.

Annual testing entails recording a clamp-on ammeter reading on the primary jumper on each phase of the bank while the capacitor bank is energized. These values are compared to standard expected ranges based on the tank size and circuit voltage. If recorded values exceed the normal ranges, further inspection is required to determine the possibility of a failed capacitor unit or a bad connection. This comprehensive annual testing validates the proper operation and wildfire safety of capacitors deployed in PG&E's system.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

Annual capacitor maintenance is performed on all distribution capacitors regardless of geography or other factors. As noted above, the actual location of capacitors is determined based on system conditions. Planning engineers perform capacity reviews generally targeting capacitor for areas with known low voltage conditions such as long rural circuits or areas with high inductive loads due to large air conditioning or industrial power usage.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

Work on this initiative is done annually. The testing typically starts in the first quarter and is completed by April 1. PG&E annually tests and inspects approximately 11,400 capacitors, approximately 10 percent of which require corrective action in any given year based on inspection results. All repairs or replacements are required to be completed by June 1 before peak summer conditions increase electric load. PG&E plans to continue this annual inspection and testing approach going forward.

5) ***Future improvements to initiative:***

PG&E is developing a program to remove unneeded capacitors and other voltage regulating equipment. Engineering studies of system capacity needs for this equipment are ongoing. In certain instances where loads have been removed or conductor sizes have been increased, removal of capacitors and voltage support equipment may be feasible. By removing this equipment, the risk of a fire ignition caused by capacitors is reduced. Complicating these analyses, however, are the changing dynamics of the electric distribution system. Photovoltaic (PV) generation (rooftop solar) as well as LED lighting is changing voltage requirements on the distribution system. In some instances, these changes support analyses that some capacitors are no longer needed. However, further industry studies are required to develop overall policies to address long-term PV (rooftop solar) effects on the distribution system as it relates to capacitor needs. We are also investigating approaches to add updated and SCADA-enabled controllers to all capacitors so that they can be operated

remotely to address operational needs.

In addition to removing no longer needed capacitors, PG&E is investigating removing or using switches on one type of equipment: fixed bank capacitors. Fixed bank units pose a potential safety risk to utility personnel.

ACTION PGE-25 (Class B)

1) *Integrate discussion on long-term planning within the respective section of each individual initiative.*

The long-term plan for this initiative is aligned to the future improvements described above. Industry studies, benchmarking and other industry involvement are critical in driving any ensuing possible changes to long-term planning for this class of voltage regulating equipment.

Class C Condition:

PGE-4 is one of the Class C conditions that Wildfire Safety Division (WSD) directed PG&E to address in the 2021 Wildfire Mitigation Plan (WMP). We are including our response below:

DEFICIENCY (PGE-4) (Class C): *PG&E capacitor bank failures on its distribution system cause 500 percent higher rates of ignition compared to other large electrical corporations. Although capacitor bank failures only comprise 2 percent of total PG&E ignitions, the average rate of ignition per incident is high at 15 percent. This means that 15 percent of the time a capacitor bank fails, the failure leads to an ignition.*

CONDITION: *In its 2021 WMP update, PG&E shall list and describe mitigation measures that it is undertaking to reduce the likelihood of a capacitor bank ignition.*

RESPONSE TO CONDITION PGE-4:

The mitigation measures that PG&E is undertaking to reduce capacitor bank failures are described in the response above. PG&E performs annual maintenance on capacitor banks to ensure proper operation and wildfire safety. PG&E is also undertaking the analyses described above in the response to Question 5 to potentially remove capacitors where they are no longer needed, thereby removing the wildfire-related risk posed by that asset.

7.3.3.2 Circuit Breaker Maintenance and Installation to De-Energize Lines Upon Detecting a Fault

WSD Initiative Definition: *Remediation, adjustments, or installations of new equipment to improve or replace existing fast switching circuit breaker equipment to improve the ability to protect electrical circuits from damage caused by overload of electricity or short circuit.*

The below narrative for Section 7.3.3.2 covers the circuit breaker program, including distribution and transmission. In Table 12 (see Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx), we provide financial and RSE analysis for each initiative. However, Initiative 7.3.3.2 is split into the following 4 categories to accurately reflect the financial spend and RSE information for each of the following circuit breaker programs:

- Baseline – Maintenance Substation Distribution (ongoing base control work that are identified through routine inspection via ground in distribution substations);
- Baseline – Maintenance Substation Transmission (ongoing base control work that are identified through routine inspection via ground in transmission substations);
- Enhanced – Maintenance Substation Distribution (maintenance work that are identified through supplemental inspection via drone in distribution substations); and
- Enhanced – Maintenance Substation Transmission (maintenance work that are identified through supplemental inspection via drone in transmission substations).

1) Risk to be mitigated/problem to be addressed:

PG&E's maintenance program ensures that circuit breakers are properly maintained to prevent operational failures. Improper operation of a circuit breaker may result in a variety of problems including increased time to interrupt a line fault and failure to restore power after an outage. Failures may also result in an increased risk of ignition.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Prior to releasing a new circuit breaker for service, it is tested to meet all performance requirements, including opening time. Once a circuit breaker is released for service, the maintenance program oversees its performance to ensure that the circuit breaker operates within its design specification.

When a circuit breaker is identified as no longer being able to reliably operate as designed through the maintenance program, corrective action is initiated to repair or replace. In addition, the proactive replacement program evaluates, prioritizes and replaces circuit breakers based on wildfire risk, equipment condition, age, manufacture, and model.

The maintenance of circuit breakers is governed by PG&E Utility Standard TD-3322S Circuit Breaker Maintenance Template and PG&E Utility Procedure TD-3322M Substation Maintenance and Construction (SM&C) Manual Circuit Breakers Booklet. This standard defines the required maintenance tasks and the frequency in which the tasks are performed. This procedure defines maintenance tasks for circuit breakers from visual inspections to more complex mechanism, compressor, hydraulic system services, and overhauls.

Different maintenance tasks have different time-based frequencies. In addition to the time-based requirements, additional condition-based maintenance may be triggered. An example of a time-based maintenance task is a monthly visual inspection. An example of a condition-based task is a Breaker Oil Analysis performed when an oil circuit breaker reaches 50 percent of the Accumulated Critical Current (ACC) trigger, which is an estimate of the total fault current interrupted by the circuit breaker.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")***:

Substation circuit breaker maintenance is not targeted based on regional location. This maintenance program applies to all substation circuit breakers in the PG&E system, including those installed in substations located in High Fire Threat District (HFTD) areas. Circuit breakers targeted for replacement program are ranked based on wildfire risks, equipment condition, age, manufacture, and model.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

In 2020, the existing maintenance program as defined in PG&E Utility Standard TD-3322S Circuit Breaker Maintenance Template and PG&E Utility Procedure TD-3322M SM&C Manual Circuit Breakers Booklet has been followed. For 2021, we plan to follow our existing maintenance program for all circuit breakers in the PG&E system. This includes both the time-based and condition-based triggers for circuit breaker maintenance.

5) ***Future improvements to initiative:***

The circuit breaker maintenance program is periodically evaluated and adjusted based on equipment performance trends. Currently, there are no planned changes to the maintenance program for 2021. Improvements to the proactive replacement program include factoring in overstress and percent ACC as ranking criteria for replacement. These improvements will be in place for circuit breakers targeted in 2021 and beyond.

ACTION PGE-25 (Class B)

1) *Integrate discussion on long-term planning within the respective section of each individual initiative.*

Response:

The circuit breaker maintenance program works in conjunction with planned (capital) circuit breaker replacement program to maintain operation and service reliability. Planned replacements are identified through a ranking and prioritization based on circuit breaker condition. Recent efforts include enhancing condition data inputs, which will continue in the short-term, as data gaps are closed. The replacement program shifted priority in recent years to address increases in substation emergency work, effectively reducing the annual planned implementation rates. The 10-year plan is to slowly increase annual replacement rates to reach approximately 50 to 60 distribution and 30 to 45 transmission breakers systemwide.

For the long term, we will continue with periodic evaluations of both the circuit breaker maintenance and replacement programs. These evaluations typically include circuit breaker performance trends, emerging technology and other risk factors. Updates will be made to the programs based on these evaluations.

7.3.3.3 Covered Conductor Installation

WSD Initiative Definition: *Installation of covered or insulated conductors to replace standard bare or unprotected conductors (defined in accordance with General Order (GO) 95 as supply conductors, including but not limited to lead wires, not enclosed in a grounded metal pole or not covered by: a "suitable protective covering" (in accordance with Rule 22.8), grounded metal conduit, or grounded metal sheath or shield). In accordance with GO 95, conductor is defined as a material suitable for: (1) carrying electric current, usually in the form of a wire, cable or bus bar, or (2) transmitting light in the case of fiber optics; insulated conductors as those which are surrounded by an insulating material (in accordance with Rule 21.6), the dielectric strength of which is sufficient to withstand the maximum difference of potential at normal operating voltages of the circuit without breakdown or puncture; and suitable protective covering as a covering of wood or other non-conductive material having the electrical insulating efficiency (12 kilovolts per inch (kV/in) dry) and impact strength (20 foot-pound (ft-lb)) of 1.5 inches of redwood or other material meeting the requirements of Rule 22.8-A, 22.8-B, 22.8-C or 22.8-D.*

In this section, PG&E discusses our covered conductor installation initiative and addresses Action PGE-14 (Class A).

1) Risk to be mitigated/problem to be addressed:

The installation of covered conductor in both primary and secondary systems can help to reduce the occurrences of phase-to-phase contact (when lines come in contact with each other) either directly or through a medium such as a tree branch, eucalyptus bark, palm fronds, animal/bird, or a foreign object which may result in a wildfire ignition.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PG&E installs covered conductor and replaces existing poles, cross-arms, and other equipment as part of our System Hardening Program. Because this installation also includes covered jumpers, animal protection, and eliminates most exposed energized components, it is also effective to mitigate many phase-to-ground type outages. This is an effective mitigation in areas prone to these types of impacts where undergrounding or other mitigations are not as cost-effective. In addition to wildfire related safety benefits, the elimination of these numerous transient type outages also has the potential to improve reliability, the overall health of the power systems, and life expectancy. PG&E's System Hardening Program is described in more detail in Section 7.3.3.17.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Covered conductor installation is being performed as part of PG&E's System Hardening Program and in reconstruction work performed in the HFTD designated areas to address the risk of wildfire ignition. While system hardening is not currently being performed in non-HFTD areas, it can be an effective mitigation for reliability issues in non-HFTD areas to limit the impacts due to recurring outages.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

See the discussion of the System Hardening Program in Section 7.3.3.17.1 for program details, future improvements, and financial analysis.

5) Future improvements to initiative:

See System Hardening Program in Section 7.3.3.17.1 for program details, future improvements (including long-term planning), and financial analysis.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Please reference Section 7.3.3.17.1 for more information on future improvements for this initiative.

ACTION PGE-14 (Class A)

In its 2021 WMP update, PG&E shall 1) provide an explanation as to how it is prioritizing replacing aluminum conductors in areas that overlap both corrosion zones and the HFTD, 2) if PG&E is not prioritizing aluminum conductors located in overlapping corrosion zones and HFTDs, explain why, and 3) explain whether any higher priority is given to aluminum conductor within corrosion zones outside of HFTDs.

Response:

The prioritization, tracking, and funding of conductor replacement projects in HFTD vs non-HFTD areas is done through two separate Major Work Categories (MWC). Circuit hardening within HFTD areas is completed under MWC 08W while reconductoring of deteriorated conductors within non-HFTD is completed under MWC 08J.

The MWC 08W (HFTD program) is informed by risk modeling that takes many consequence and probability factors into account. Specifically, PG&E's Vegetation Probability of Ignition and Equipment Probability of Ignition Models focus on vegetation and equipment failure modes as they represent a high percentage of the overall ignitions by cause. Combined with the Wildfire Consequence Model, the initiatives are designed to reduce ignitions in the highest wildfire risk areas. These models are described in more detail in Sections 4.3 and 4.5.1.

The focus of MWC 08J (non-HFTD program) is small conductor with high wire down rates and small Aluminum Conductor Steel-Reinforced (ACSR) conductor within severe and moderate corrosion zones because this combination deteriorates the health of the conductor at a higher rate than outside of the corrosion zone. Approximately 70 percent of targeted 4 ACSR conductor within corrosion zones is in the non-HFTD areas.

While aluminum and corrosion are significant indicators of conductor failure, they do not necessarily align with the key factors for wildfire risk. In cases where they do align, they are prioritized by the models described above that used in the prioritization of the MWC 08W program. In general, the criticality of the MWC 08W program is a higher priority than the MWC 08J program given the potential wildfire impact and consequences.

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7.3.3.4 Covered Conductor Maintenance

WSD Initiative Definition: *Remediation and adjustments to installed covered or insulated conductors. In accordance with GO 95, conductor is defined as a material suitable for: (1) carrying electric current, usually in the form of a wire, cable or bus bar, or (2) transmitting light in the case of fiber optics; insulated conductors as those which are surrounded by an insulating material (in accordance with Rule 21.6), the dielectric strength of which is sufficient to withstand the maximum difference of potential at normal operating voltages of the circuit without breakdown or puncture; and suitable protective covering as a covering of wood or other non-conductive material having the electrical insulating efficiency (12 kV/in dry) and impact strength (20 ft-lb) of 1.5 inches of redwood or other material meeting the requirements of Rule 22.8-A, 22.8-B, 22.8-C or 22.8-D.*

1) ***Risk to be mitigated/problem to be addressed:***

   Covered conductor maintenance, which occurs as part of routine overhead maintenance conducted through PG&E's GO 165 Program, is focused on the identification, assessment, prioritization, and documentation of the current condition of PG&E's covered conductor facilities. This maintenance would help reduce the risk of water egress into the insulated line and to identify any locations where the jacket could be damaged reducing its insulative properties.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:***

   Covered conductor maintenance occurs as part of PG&E's GO 165 Program and looks to identify potential conditions during patrols and inspections of PG&E's distribution facilities, and any conditions that may occur as a result of operational use, degradation, deterioration, environmental changes, or third-party actions.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")****:*

   Covered conductor maintenance will be performed anywhere covered conductor is installed and found to have conditions requiring maintenance. The majority of the covered conductor would be found in the Tier 2 and Tier 3 HFTD areas and Buffer Zones.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

   Maintenance on covered conductors will occur as a part of PG&E's GO 165 program, including maintenance in Buffer Zones. As more covered conductor is installed, this equipment will be inspected as a part of that program.

5) Future improvements to initiative:

PG&E will continue to inspect and monitor covered conductor systems and enhance the requirements in the GO 165 program as needed.

ACTION PGE-25 (Class B)

Response:

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Since this initiative is closely related to GO 165 requirements, any long-term changes will be guided by changes/updates to GO 165. PG&E does not currently have any plans to change this initiative in the long-term.

7.3.3.5 Crossarm Maintenance, Repair, and Replacement

WSD Initiative Definition: *Remediation, adjustments, or installations of new equipment to improve or replace existing crossarms, defined as horizontal support attached to poles or structures generally at right angles to the conductor supported in accordance with GO 95.*

1) Risk to be mitigated/problem to be addressed:

PG&E does not have a formal program to replace cross-arms. PG&E replaces cross-arms as they are deemed necessary for replacement as part of our Electric Corrective (EC) maintenance. Crossarm failure has the potential to drop energized conductors to the ground as well as other falling hazards from the top of utility poles, which can create the potential for an ignition.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PG&E has an extensive condition monitoring program for overhead assets, including crossarms, in accordance with requirements in GO 165. PG&E conducts annual patrols in urban areas and bi-annual patrols in rural areas, visually looking for damaged equipment and other defects on the distribution overhead system. A detailed inspection is performed every five (5) years in non-HFTD, (every year (1) in Tier 3 and every three (3) years in Tier 2) looking for any damaged or deteriorated equipment.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

GO 165 mandated inspections and patrols, lead to the identification of cross-arms that require replacement. This work has been prioritized because it can prevent fire ignition and hazards to public from falling wire and parts. HFTD areas receive a higher frequency of GO 165 inspections so these regions receive more attention to address failing assets such as cross-arms. In addition, the work being done for this program also includes maintenance in Buffer Zones.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

Progress continues towards completion of identified EC tags including cross-arm EC tags, especially in HFTDs. PG&E prioritizes the completion of EC tags based on risk ranking which includes the evaluation of Facility Damage Action (FDA). The cross-arm facility in FDA typically receives high prioritization for replacement. PG&E inspectors and construction supervisors conduct post-job reviews for crossarm maintenance work performed by contract and internal crews to

ensure the work matches the work called for in the job order and is in compliance with GO 95 requirements regarding how overhead facilities should be constructed.

5) Future improvements to initiative:

PG&E identifies failing crossarms primarily through GO 165 inspections and patrols. Through these inspection programs, PG&E identified and completed repairs or replacements of approximately 6,500 crossarms in 2020. Implementation of composite cross-arms is providing an additional level of longevity for cross-arms as the strength and ultimate life span of composite is significantly longer than older standard wood cross-arms.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E will continue to inspect and monitor crossarms and enhance the requirements in the GO 165 program as needed. PG&E does not currently have any plans to change this initiative in the long-term.

7.3.3.6 Distribution Pole Replacement and Reinforcement, Including with Composite Poles

WSD Initiative Definition: *Remediation, adjustments, or installations of new equipment to improve or replace existing distribution poles (i.e., those supporting lines under 65 kilovolts (kV)), including with equipment such as composite poles manufactured with materials reduce ignition probability by increasing pole lifespan and resilience against failure from object contact and other events.*

1) Risk to be mitigated/problem to be addressed:

Distribution poles need to be inspected and evaluated to determine their condition to support conductors and keep energized conductors in the air, which reduces ignition probability.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

The failure of a distribution pole creates the risk of a potential wires down event and ignition risk. To address the risk of a distribution pole failure, PG&E has an extensive condition monitoring program for wood poles in accordance with requirements of GO 165. We conduct annual patrols in urban areas and bi- annual patrols in rural areas, visually looking for damaged poles and other defects on the distribution overhead system. PG&E performs a detailed inspection every 5 years in non-HFTD, (every year (1) in Tier 3 and every three (3) years in Tier 2) to look for external damage or deterioration, as well as an intrusive inspection approximately every 10 years to identify internal or below ground decay that may be present in the pole. PG&E also identifies and repairs pole top damage especially woodpecker damage.

The pole replacement program replaces poles that that PG&E has determined are overloaded or need to be upgraded to support the attachment of telecommunications or cable companies' facilities. PG&E has used both wood and non-wood or composite poles as replacements. Composite poles in conjunction with covered conductor and exempt equipment are less susceptible to cause an ignition, if branches or trees fall onto the conductor, they are less likely to spark and start a fire. Ancillary benefits of composite poles are that they retain their strength if exposed to wildfire temperatures, they are lighter to carry into remote areas, they are less prone to woodpecker, insect, and fungus rot, they do not need intrusive pole testing, and they do not need hazardous disposal when removed.

As a facet of pole replacement, PG&E has been concerned about the lack of current industry standards concerning the performance of distribution poles in wildfire conditions. As referenced in the 2020 WMP, PG&E began exploring new options for pole replacements. Comparative data gathering was performed in 2019 on 11 different sets of poles (33 total) from 7 different manufacturers as a result of a cooperative

evaluation between PG&E and various manufacturers. One of the best performing products, per the test report, was the wood pole with an intumescent mesh covering. PG&E has been working with the manufacturer and as a result of the information gained from the comparative data gathered in 2019, additional evaluations concerning the toxicity of the intumescent mesh covering, the ability to determine the pole condition after a fire and the reusability of the pole, PG&E has selected the wood pole with an intumescent mesh covering as our standard pole for use in the Tier 2 and 3 HFTD areas, including new pole installations, routine pole replacements, and the System Hardening Program described in Section 7.3.3.17.1.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Poles identified for remediation each year by the various inspection programs are scheduled for replacement. Replacements are prioritized using a risk-based approach. Specifically, poles replacements are prioritized based on probability of consequence and probability of failure. Probability of consequence takes into account HFTD and circuit density (count of customers). Probability of failure takes into account some pole factors, such as age, class (class 5 poles are smallest) and treatment (cellon).

We use these factors to score each pole and prioritize their replacement accordingly. PG&E scores each of the poles with replacement tags and ranks them based on their scores. The poles that score the highest get worked first. Please note that this is for E/F Tags only. Priority A/B tags are prioritized first, and we try to work them within the time specified by the inspector (*e.g.,* 30 days for A tags and 90 days for B tags). In addition, the work being done for this program also includes maintenance in Buffer Zones.

4) Progress on initiative (amount spent, regions covered) and plans for next year

PG&E works on poles identified for remediation by various inspection programs. Poles that require reinforcement are typically worked the following calendar year. So, poles identified in 2020 will be reinforced in 2021. Through these inspection programs, PG&E identified at least 9,800 poles for replacement and at least 4,100 poles for reinforcement in 2020. Poles identified for reinforcement are in good condition, except for decay around the ground line. By installing a steel truss and banding it to these poles PG&E can restore the strength of the pole to 100 percent.

5) Future improvements to initiative

PG&E continues to review and evaluate improved manufacturing techniques from composite pole manufacturers that participated on the 2019 pole testing with third-party test facilities. However, at this time, we

have no plans to expand the application of composite poles except for areas that require them such as environmental or extreme loading conditions.

ACTION PGE-25 (Class B)

1) *Integrate discussion on long-term planning within the respective section of each individual initiative.*

Response:

At this time, there is no specific long-term plan that is applicable to this initiative other than the pole selection for HFTD Tier 2 and Tier 3 areas described above in the response to Question 2). Programs associated with this initiative are funded by the General Rate Case and discussed in the California Public Utilities Commission (CPUC or Commission) compliance plan quarterly. Industry guidance and availability of alternative pole materials may help guide any future long-term initiatives.

7.3.3.7 Expulsion Fuse Replacement

WSD Initiative Definition: *Installations of new and California Department of Forestry and Fire Protection (CAL FIRE)-approved power fuses to replace existing expulsion fuse equipment.*

In this section, PG&E discusses our covered non-exempt fuse replacement initiative and addresses Actions PGE-46 (Class B) and PGE-48 (Class B).

1) Risk to be mitigated/problem to be addressed:

To address increasing wildfire risks, PG&E created a program to replace non-exempt fuses and cutouts. Replacing non-exempt fuses with exempt fuses reduces wildfire risk. If a non-exempt fuse fails, it has the potential to spread hot molten metal material which could cause one or more ignitions, while exempt fuses are designed to internalize any molten material which may result from a fuse failure.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Non-exempt equipment is equipment that may generate electrical arcs, sparks, or hot material during its normal operation. The replacement of non-exempt equipment with exempt equipment will further reduce fire risk since the exempt equipment is considered “non-expulsion” and does not generate arcs/sparks during normal operation. By using exempt fuses, we can reduce the potential for vegetation ignitions due to molten material spread.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

HFTD areas are the focal point for the non-exempt fuse replacement program, specifically Tier 2 and 3 HFTD areas.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2019 and 2020, PG&E completed 708 and 751 fuse replacements, respectively.

PG&E forecasts replacing approximately 1,200 fuses/cutouts, and other non-exempt equipment identified on poles in Tier 2 and Tier 3 HFTD areas in 2021.

5) Future improvements to initiative:

The pace of PG&E’s fuse replacement program after 2021 will be determined based on available funding and prioritization of other wildfire

initiatives.

ACTION PGE-25 (Class B)

1) *Integrate discussion on long-term planning within the respective section of each individual initiative.*

Response:

PG&E plans to keep replacing fuses with the total target of replacing approximately 10,000 fuses in the next 7-8 years. The pace and scope of replacement will depend on funding and prioritization.

ACTION PGE-46 (Class B)

1) *Explain whether it is increasing the scope of fuse replacements and, if so, why,*

2) *Explain whether the replacement of the originally identified fuses (i.e., 625 per year) are being prioritized before replacement of those in the increased scope (i.e., 1,200 per year), and*

3) *Describe how prioritization has changed since the initial scope in 2019.*

Response:

1) PG&E is increasing the scope of our fuse replacement program in 2021. The target in 2019 and 2020 was 625 fuses per year (which PG&E exceeded in both years). The target in 2021 is replacing 1,200 fuses. The pace of replacement after 2021 will be determined based on available funding and prioritization of other wildfire initiatives. The scope of the program is expanding in order to expedite the replacement of non-exempt fuses (which are all located in HFTD areas) to mitigate ignition risks, as well as mitigate ongoing Vegetation Management (VM) at these non-exempt locations. Fuses will play an important role in hardening our infrastructure against unanticipated surges of energy and the replacement of non-exempt fuses with exempt fuses can mitigate wildfire ignition risks.

2) The increase in the fuse replacement target from 625 in 2020 to 1,200 in 2021 is not the result of replacing different kinds of fuses. Instead, PG&E is replacing non-exempt fuses in HFTD areas in both years. PG&E has increased the pace of the program, but this does not result one group of fuses (i.e., the 625 fuses) being prioritized over other fuses (the additional fuses beyond 625). PG&E is prioritizing non-exempt fuses in HFTD areas for replacement, as explained in more detail in response to subpart (3) below, and sets a program target and funding for each year.

3) As this program evolves and matures, so will the prioritization framework, which is shifting to become more targeted as more data is increasingly integrated into the decision-making process; this means that replacement targets will change and become better-informed from year to year. Prior to 2020, the targeted 625 replacements were based on execution risk and inputs from the engineering

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department. In 2020, as the program exceeded the original 625 replacement target to hit 751 total units replaced, PG&E placed an increased emphasis on particularly at-risk districts as part of our prioritization framework. As the program expands in 2021 to replace 1,200 units, detailed Geographic Information System (GIS)-based inputs from Technosylva models around the highest fire ignition risks will determine priority replacements going forward.

ACTION PGE-48 (Class B)

1) *Provide the cost/benefit analysis performed regarding fuse replacements, including the calculation of reduction of VM costs per fuse replaced.*

Response:

Fuse replacements occur periodically as those that are end-of-life need to be substituted for new ones, while VM is an annually recurring cost that includes high outliers in specific instances.

On average, a single fuse installation costs approximately $12,500 per unit, which includes approximately $4,000 in equipment costs and $8,500 in all other costs, such as labor, permitting, and traffic control. Once installed, the fuse-holding device (i.e., cut-out) will not need to be replaced for up to 40 years. On the other hand, the annual base cost for vegetation replacement is approximately $900 per tag, but can range as high as $5,000 per tag, depending on complications that arise from "refusals" from disputing property owners who aim to prevent VM work.

As a result, in the most conservative estimate for a low-cost VM scenario of $900 per tag, the fuse installation would break even in less than 14 years. However, the costs of a fuse replacement can break even as quickly as under three years should there be high-cost refusals, a reasonably likely scenario within PG&E territory. There are ancillary benefits in terms of customer satisfaction when vegetation is not removed and instead a fuse is replaced.

This cost/benefit analysis does not take include the benefits associated with wildfire ignition risk reduction associated with a wildfire that could potentially be ignited by a non-exempt fuse.

7.3.3.8 Grid Topology Improvements to Mitigate or Reduce Public Safety Power Shutoff (PSPS) Events

WSD Initiative Definition: *Plan to support and actions taken to mitigate or reduce PSPS events in terms of geographic scope and number of customers affected, such as installation and operation of electrical equipment to sectionalize or island portions of the grid, microgrids, or local generation.*

For this initiative, PG&E has several sub-initiatives including:

- 7.3.3.8.1: Distribution Line Sectionalizing;
- 7.3.3.8.2: Transmission Line Sectionalizing; and
- 7.3.3.8.3: Distribution Line Motorized Switch Operator (MSO) Pilot.

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7.3.3.8.1 Distribution Line Sectionalizing

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

The installation of remote operated SCADA sectionalizing devices on PG&E's distribution system can support our ability to segment the distribution circuits near the HFTD area boundary to reduce the impact and scope of PSPS events.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PSPS events can cause significant disruption to communities and customers and therefore we are working to minimize the number of customers impacted. PG&E plans to continue enhancing our distribution segmentation strategy to minimize the number of customers impacted during future PSPS events by being even more precise on what areas of the circuit to shutoff.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Distribution sectionalizing device installations have been focused on all circuits that traverse into HFTD areas. PG&E plans to incorporate learnings from past events and focus efforts primarily on counties and specific areas that are repeatedly impacted by PSPS. This includes (but is not limited to) Butte, Yuba, Sonoma, Napa, Nevada, and El Dorado counties.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

a. PG&E installed 603 SCADA commissioned distribution sectionalizing devices by September 1, 2020.

b. In 2021, PG&E plans to install at least 250 more distribution sectionalizing devices integrating learnings from 2020 PSPS events, 10-year historical look-back of previous severe weather events, and feedback from county leaders and critical customers.

5) Future improvements to initiative:

As each yearly wildfire PSPS season concludes, PG&E will integrate learnings from actual PSPS events and feedback from county leaders and critical customers to become even more precise on what areas of circuits to target for shutoff to minimize customer impact and outage

duration. With this data and feedback PG&E can continue to install new SCADA automated sectionalizing devices closer to the refined meteorological shutoff boundaries and learn what areas of the community to analyze for even further granular sectionalizing.

ACTION PGE-25 (Class B)

1) *Integrate discussion on long-term planning within the respective section of each individual initiative.*

Response:

Since PG&E has already installed over 800 SCADA-enabled distribution sectionalizing devices in years 2019 and 2020 and plans to install at least 250 additional new devices in 2021, it is anticipated that future segmentation needs will be greatly reduced. PG&E plans to install at least 100 new distribution sectionalizing devices annually starting in 2022 and beyond, and within 10 years, it is expected that all HFTD/High Fire Risk Area (HFRA) locations will be fully sectionalized with remote-capability where beneficial.

7.3.3.8.2 Transmission Line Sectionalizing

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

PG&E has been installing remote-operated SCADA sectionalizing devices on our transmission system to support the ability to segment the transmission circuits within the HFTD boundary. This will allow operational flexibility to reduce the scope and impact of PSPS events.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PSPS events can cause significant disruption to communities and customers. PG&E plans to continue implementing our transmission segmentation strategy to minimize the number of customers impacted during future PSPS events by narrowing down the segments of a circuit to de-energize.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Prioritization of new or upgraded transmission sectionalizing devices is based on HFTD location, likelihood of potential de-energization during future PSPS events (based on a study of ten years of weather data), and potential customer impact. Switch upgrades are typically identified at line junctions and substations, where operational flexibility may be most beneficial.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2020, we installed 54 transmission switches for PSPS mitigation. Some of these switches were redirected from non-HFTD to the HFTD locations. Of these devices, over 23 were installed before the 2020 wildfire season, as committed to in the 2020 WMP.

For 2021, PG&E is planning on installing 29 additional switches impacting HFTD areas. All 29 switches are planned for installation by September 1, 2021.

5) Future improvements to initiative:

Future installation of all identified HFTD transmission sectionalizing devices will be prioritized based on potential PSPS benefit (such as expected frequency of a line being de-energized and impact of de-energization) to provide operational flexibility during future PSPS

events. These switches also contribute to overall reliability outside of PSPS events. Approximately 200 additional switches are planned in the next three to five years.

ACTION PGE-25 (Class B)

1) *Integrate discussion on long-term planning within the respective section of each individual initiative.*

Response:

Within 10 years, it is expected that all HFTD/HFRA locations will be fully sectionalized with remote-capability where beneficial. Switches will continue to be prioritized based on potential operational benefit during PSPS events and funded at engineering and/or constructing approximately 60 switches per year.

7.3.3.8.3 Distribution Line Motorized Switch Operator Pilot (MSO)

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

Motorized Switch Operators (MSO) switches were initially installed on PG&E's distribution system as sectionalizing devices with the ability to reduce the scope of PSPS events. Despite these switches being understood to meet CAL FIRE's exempt criteria for not posing an ignition risk during normal operation, PG&E crews identified a risk that some MSO switches were reported to exhibit an arc flash during the opening (de-energizing) operation. Based on this feedback and subsequent testing PG&E is undertaking this sub-initiative to remove or retrofit MSO switches to address this potential risk.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

After some concerns regarding MSO switches were identified in the field, PG&E undertook an evaluation of this equipment. During testing of an MSO switch in PG&E's lab environment to replicate the reported field conditions, the MSO switch exhibited an arc flash during its opening operation. PG&E immediately halted further installations of MSO switches. After further testing, PG&E determined that the current version of MSO switches would no longer be installed and is taking the remedial steps described in Question 4 below. This sub-initiative seeks to determine the best alternative for removing this equipment going forward.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E installed over 100 SCADA automated MSO switches during 2019 to be utilized as PSPS sectionalizing devices to deenergize lines traversing into the Tier-2 and Tier-3 HFTD areas. PG&E discovered the problems with these switches in late 2019, as described above. This initiative is focused on just those locations and is not otherwise prioritized or targeted regionally.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

Until all installed MSOs can be replaced or retrofitted, PG&E has issued guidance document TD-076253-B004 "Limited Use of Inertia SCADA MSO" which sets controls in place to mitigate wildfire risk. This control requirement mandates that any MSOs in the field are to be only operated with a Qualified Electrical Worker present during OPEN and CLOSE operations to handle any onsite issues that might arise.

During 2021, PG&E will be assessing various alternatives to address the identified risk with MSOs. PG&E plans to explore several pilot options that will help inform which are the best alternatives and select the appropriate corrective action for MSOs for the next WMP update. Specifically, PG&E will explore corrective actions to prevent any potential arc flash including retrofitting the MSO with new vacuum-break technology or replacement with either new automated Line Reclosers or new automated SCADAMATE-SD switches.

5) Future improvements to initiative:

Based on the results of the pilots in 2021 described above, a strategy to retrofit or replace all MSO switches in HFTD areas and/or intended for use to reduce the scope of PSPS events. This sub-initiative will then be complete once all the MSO switches have either been retrofitted to address the potential arc flash risk or replaced.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E forecasts that all MSO switches used for PSPS will be either retrofitted or replaced by the end of 2022 and there will not be a long-term need for this sub-initiative.

7.3.3.9 Installation of System Automation Equipment

WSD Initiative Definition: *Installation and replacement of electric equipment with remote capability that provides operations with the ability to control and monitor circuit status. This includes the ability to remotely change device settings like disabling automatic reclose on recloser and FuseSavers (switching devices designed to detect and interrupt faults and can reclose automatically to detect if a fault remains, remaining open if so).*

For this initiative, PG&E has several sub-initiatives including:

- 7.3.3.9.1: Installation of system automation equipment; and
- 7.3.3.9.2: Installation of single phase reclosers.

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7.3.3.9.1 Installation of System Automation Equipment

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

High impedance faults are conditions where line to ground faults do not draw a full fault current that a protective device can reliably sense and trip (function of contact resistance to ground) creating a potential ignition source. The replacement of the legacy SCADA recloser controls protecting fire Tier 2 and 3 HFTD areas with new recloser controllers will enable the use of protective features designed to address high impedance fault conditions as well as integrating with current communication protocols.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Under this distribution system automation initiative, the existing oil filled reclosers and controllers will be replaced with a solid dielectric recloser and new micro-processor controller with protection elements like Downed Conductor Detection, Sensitive Ground Fault, and platforms that allows for future protection elements that are under development to reliably detect high impedance faults.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

There are approximately 80 remaining distribution line legacy 4C controllers and PG&E will replace all those remaining that are located throughout PG&E's service territory serving Tier 2 and 3 HFTD areas. These 4C distribution line controllers will be replaced prior to the end of 2021.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

PG&E's 2020 WMP indicated that we would pursue system automation initiatives including the replacement of legacy 4C controllers. In order to meet the 2021 goal of replacing all 84 4C controllers, the design and estimating started in 2020. With the devices' locations having been identified, work packages were submitted to estimating and locations will be ready for construction in early 2021. Under this initiative, the 84 remaining 4C recloser controls within the Tier 2 and 3 HFTD areas will be replaced.

5) Future improvements to initiative:

This sub-initiative will be completed by the end of 2021 after which time no further improvements are currently planned.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

As stated in the section above, this sub-initiative will be completed by the end of 2021 after which time no further improvements are currently planned.

7.3.3.9.2 Single phase reclosers

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

A single phase recloser is a cost-effective intelligent device which can replace fuses and act as a single phase recloser with the capability to trip all phases (*i.e.*, open all phases) eliminating the risk associated with wire down events where a downed wire remains energized by a back-feed condition.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Distribution laterals are single phase or three phase taps off the mainline distribution circuit that serve single or small groups of customers. The laterals are protected by fuses (one per phase) which isolate faults keeping the mainline energized limiting outages to a smaller number of customers. Fuses are designed to trip open for a fault condition on the phase or phases that experience a fault condition. Fuses are a practical and cost effective way to isolate faults from the mainline, but there is a risk when a fault event like a wire down condition trips the faulted phase but transformers connected to the faulted phase and an un-faulted phase can keep the wire down energized by a "back-feed" condition. The way to mitigate this problem is trip all phases on the faulted lateral. However, fuses do not have the capability to trip all phases.

This sub-initiative will install single phase reclosers on laterals that have a history of energized wire down conditions. The single phase recloser will open all phases for the initial line to ground fault and eliminate the risk of ignition from a back-feed condition. A single phase recloser can be installed with SCADA allowing for remote operation including non-test and open and close capability.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E piloted a single phase recloser device in 2019, and it was used in 2020 as an automatic sectionalizing device for potential PSPS areas where field conditions did not require a three phase recloser. In 2020, we identified locations for 2021 single phase recloser device installations based on the following criteria: (1) in Tier 2 or Tier 3 HFTD areas; (2) three or more wire down outages in the last 10 years; (3) fused cutout experienced FIA fire potential days (R4, R5, or R6, which are elevated fire risk classifications); (4) load on all phases greater than 1 ampere (amp); and (5) fault duty below 6,000 amps symmetric.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2020, locations were selected based on the above criteria and estimating is in progress. By the end of 2021, PG&E plans to install 70 sets of single phase reclosers. PG&E is working with the manufacturer to make design improvements to the existing device that allows more universal application of the device within the fire areas.

5) Future improvements:

The current version of single phase reclosers and similar brands are powered from the energized line and require a minimum of a few amps to function. In many locations, the off-peak load falls below the minimum load requirement and the device stops communicating back to the SCADA system. PG&E will continue to work with manufacturers to develop a cost-effective single phase recloser that are voltage powered and do not have minimum load limitations allowing for more universal application.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E is in the process of developing a long-term strategy for single phase reclosers. The device limitations described above restrict the wide-spread deployment within Tier 2 and 3 HFTD areas, but there are locations where the existing technology can mitigate risk associated with back-feed conditions. In the near-term, PG&E will use historical data and risk models for selection and prioritization of suitable locations to install single phase reclosers. The long-term view envisions larger scale deployment of single phase reclosers to address the risk of back-feed conditions when the technology meets all the needs of the distribution system serving the Tier 2 and 3 HFTD areas.

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7.3.3.10 Maintenance, Repair, and Replacement of Connectors, Including Hotline Clamps

WSD Initiative Definition: *Remediation, adjustments, or installations of new equipment to improve or replace existing connector equipment, such as hotline clamps.*

1) Risk to be mitigated/problem to be addressed:

Connector failure can lead to a wires down condition and wires down can lead to a risk of ignition.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

With regard to connectors generally, through PG&E's infrared patrols distribution connectors are identified that may be compromised, EC tags are generated based on these infrared findings, and connectors are replaced as needed. For PG&E's transmission lines, maintenance of connectors is generally performed as part of the overhead inspection program with repairs and/or replacement done as determined necessary during these inspections. In addition, as part of other programs such as pole replacement, new business, system hardening, and capacity and reliability, distribution lines must be built to current standards which includes new and improved connectors.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Inspection of connectors through infrared patrols or overhead inspection includes maintenance in Buffer Zones and overall throughout PG&E's system. See Sections 7.3.4.4 and 7.3.4.5 for more information on PG&E's infrared inspection program.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

PG&E will continue to maintain, repair and/or replace connectors pursuant to our established condition-based maintenance programs. PG&E will also replace existing connectors with new equipment on facilities that are hardened as part of the System Hardening Program.

5) Future improvements to initiative:

There are currently no expected future programmatic improvements. However, PG&E's standards teams meet regularly with industry representatives at trade shows and Institute of Electrical and Electronic Engineers committees to evaluate new technology and products. Fire resilient connectors are one of the items that has received attention

recently in industry discussions.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

At this time, there is no long-term plan that is applicable to this initiative since as previously discussed, connectors/claps are identified/replaced through ongoing inspection and infrared testing. Additionally, replacement of these components through significant amount of ongoing replacement work continue to adhere to our current rigorous standards of improved component material. Future industry guidance/studies may possibly have an impact on any new ensuing long-term plans for this asset class of components.

7.3.3.11 Mitigation of Impact on Customers and Other Residents Affected During PSPS Event

WSD Initiative Definition: *Actions taken to improve access to electricity for customers and other residents during PSPS events, such as installation and operation of local generation equipment (at the community, household, or other level).*

For this initiative, PG&E has several sub-initiatives including:

- 7.3.3.11.1: Generation for PSPS Mitigation:

  This sub-initiative provides an overview of microgrids and back-up generation to mitigate the impact of PSPS events. PG&E then provides more detail concerning five programs as well as responses to certain Action Items:

  A) Generation Enablement and Deployment;

  B) Temporary substation microgrids;

  C) Temporary distribution microgrids;

  D) Back-up power for individual critical customer facilities;

  E) Community Resource Centers; and

  F) Responses to Action Items PGE-49 (Class B) and PGE-50 (Class B).

- 7.3.3.11.2: Substation activities to enable reduction of PSPS impacts; and

- 7.3.3.11.3: Emergency Back-up Generation – PG&E Service Centers & Materials Distribution Centers.

7.3.3.11.1 Generation for PSPS Mitigation

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

This section addresses Actions PGE-49 (Class B) and PGE-50 (Class B).

1) Risk to be mitigated/problem to be addressed:

De-energization due to PSPS can create public safety risks for customers, as well as broader impacts for communities. Keeping communities and "main street corridors" energized helps to mitigate these risks. Temporary microgrids for PSPS mitigation support both the energization of broader communities and specific "main street corridors" with shared services and critical facilities to minimize the impacts of PSPS events.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PG&E has two microgrid initiatives designed to support customers during PSPS, each of which is configured to address a different type of PSPS impact: (1) temporary Substation Microgrids are focused on keeping safe-to-energize customers online when a substation serving them is impacted by an upstream de-energization; and (2) temporary Distribution Microgrids are focused on energizing "main street corridors" with shared services and critical facilities when the distribution line serving these areas is de-energized. These specific initiatives are described below in subsections B and C. There are two other PSPS mitigation workstreams that leverage temporary generation, these are addressed in subsections D and E.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

To determine the appropriate locations for temporary microgrids for PSPS mitigation, PG&E assesses the expected relative frequency of future PSPS impacts through analysis of historical meteorological data, prior PSPS event impacts, and parallel work- in-progress directed at reducing future impacts. The foundational data for selecting temporary microgrid sites for 2021 is an analysis of 10 years of historical weather events and actual 2020 PSPS event data.

Additionally, PG&E seeks to complement our internal location screening process for PSPS microgrids with county and local government collaboration to ensure that local priorities help shape site selection and design where technically feasible.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

Information on the progress of the Temporary Substation Microgrids and Temporary Distribution Microgrids is provided in subsections B and C below.

5) Future improvements to initiative:

In 2021, PG&E intends to expand the pool of contractors and technologies for the development of microgrids, pilot viable non-diesel technologies, and explore opportunities to build a portfolio of non-fossil solutions for the longer term. This improvement is tied to PG&E's desire to meet California's clean energy goals and to increasing the ability of microgrids as one tool to mitigate wildfire risk and increase PSPS resilience.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

***Response**:*

PG&E is in the process of shaping long-term plans for our microgrid initiatives, including microgrids for PSPS mitigation, through the Microgrid Order Instituting Rulemaking (OIR) (i.e., Rulemaking 19-09-009). As directed by the Track 2 Decision in that proceeding,[1] PG&E expects to file an application by June 30, 2021 proposing a long-term framework for using generation at substation to mitigate PSPS outages, including consideration of permanent and temporary solutions, the use of diesel alternatives, and the method of considering long-term microgrid solutions against other wires-based solutions. As part of that forthcoming application, PG&E expects to address the continuing evolution of fire risk modeling, which currently creates significant uncertainty regarding the long-term need for PSPS mitigation at specific locations. The framework will therefore need to be flexible, allowing decisions to be based upon the best information available at any given point in time and identifying, based on that information, any long-term microgrid initiatives that are reasonable and prudent across a range of scenarios. The resolution of that Application will determine long-term plan milestones set in future WMPs for this initiative.

A) Generation Enablement and Deployment

1. Risk to be mitigated/problem to be addressed:

The Generation Enablement and Development organization establishes permanent positions comprised of 10 Full-Time Equivalents (FTE) per the following functions: one Senior Manager to oversee the organization; one manager and four supervisors to ensure the safety of internal and

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1 D.21-01-018, App. A, pp. A-6 to A-8.

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contractor crews during deployments, operational readiness and PSPS activations; one Operations Lead to coordinate with the Control Center processes and enhancements; one Substation Strategy manager to study effective and efficient utilization of TG at substations; one Process and Project Management to ensure that processes are developed, financial oversight and any operational readiness activities are appropriately project managed; Testing, Standards and New Technology manager in charge of continually improving and evolving a greener generation program.

Program breakdown of 10 FTE's per the below:

- 9 FTEs of this Temporary Generation (TG) organization are geared toward PSPS readiness and scalability processes for PSPS; and

- 1 FTE of this TG organization will Primarily support the Clean Substation pilot projects contemplated by the Microgrid OIR and more generally the transition to a cleaner fleet of TG as contemplated in that Rulemaking.

The TG Project Management Office (PMO) will reside within the Generation Enablement and Development organization with the purpose to coordinate, organize and establish a single source of reporting to senior leadership the operational readiness of procured TG in relation to the four workstreams incorporated within the TG PMO: Substation; Microgrids & Temporary Microgrids; Back-up Power Support; and Community Resource Centers (CRC). The TG PMO will also staff, coordinate and train Emergency Operations Center (EOC) TG members for PSPS event response along with other major emergency events.

2. ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:***

Establish a permanent organization structure to ensure uniformity year over year by managing improvement and efficiency gains by capturing, implementing and documenting the actions taken to support reduction of customer impacts during PSPS events. The new organization structure will also be better prepared to develop and execute longer duration New Technology project pilots and implementation.

3. ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

The TG PMO will perform an annual analysis of generation uses as it relates to other system hardening, grid improvements, historical data and meteorological study. This analysis will inform the procurement and deployment of generation throughout the PG&E system for the combined four workstreams. The TG PMO will also engage Transmission and Distribution (T&D) planning and other system planning groups and provide suggestions to help improve electrical infrastructure that might reduce the need of TG for PSPS event.

4. ***Progress on initiative (amount spent, regions covered) and plans for next year:***

In Q1 of 2021, PG&E will establish the new Generation Enablement and Development team, post the above positions and hire successful candidates. The goal of this team will be to procure and deploy TG system wide across the four workstreams as described prior to the start of the 2021 PSPS season. This team will also work closely with stakeholders, vendors and regulators to ensure a transition to a cleaner TG fleet in 2021. The goal for this team is to establish at least one Clean Substation Project candidate site for testing and demonstration in 2021, and work to deploy the project if bids meet CPUC established cost-effectiveness criteria.

5. ***Future improvements to initiative:***

- Support for the filing of an application to establish a long-term framework for the procurement of local generation and other solutions to mitigate grid outages; once approved, carrying out the solicitations, grid upgrades, and other work described in the approved framework;

- The TG department will continue to position the organization to fall into line with the PG&E corporation's goal of meeting the new 60 percent by 2030 Renewable Portfolio Standard (RPS) mandate set forth by Senate Bill 100, as described in our RPS Procurement Plans filed at the CPUC. This will be achieved by continued testing, research, and development by the Generation Enablement and Deployment team to shift current temporary energy solutions to greener solutions that have a significantly lower carbon footprint;

- Support business continuity needs for other TG use cases such as:

  – Winter Storms;

  – Capacity Shortfall;

  – Planned Outages (T&D); and

  – Catastrophic Events (earthquakes, etc.).

- Develop internal represented classification that can perform the TG interconnection process that we are currently contracting.

B) Temporary Substation Microgrids

1. ***Risk to be mitigated/problem to be addressed:***

PG&E transmission lines that run through HFTD areas may be de-energized if weather and operational conditions warrant a PSPS event. It is possible that a distribution substation and its customers could be de-energized even if they physically reside outside of the PSPS event footprint because the transmission line serving the substation is de-energized.

2. ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:***

Temporary substation microgrids are focused on keeping customers online when the substation serving them is impacted by an upstream transmission line de-energization and the substation still has safe-to-energize load. During 2020 PSPS events, PG&E was able to energize all substations impacted by a transmission-level outage that still had some safe-to-energize load.

TABLE PG&E-7.3.3-1: 2020 TEMPORARY SUBSTATION MICROGRIDS ENERGIZED

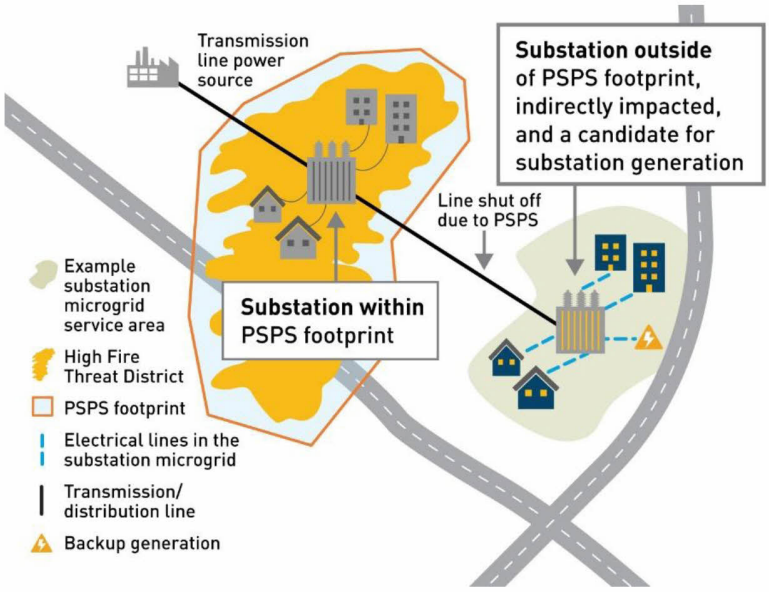
PSPS Event	Substation	Megawatts (MW)	Safe-to-Energize Customer Accounts Served
7-Sep	Brunswick	20	4,191
25-Oct	Hoopa	6	1,791
25-Oct	Willow Creek	12	2,332
25-Oct	Brunswick	20	4,259
25-Oct	Russ Ranch	0.5	2

3. ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

To determine the appropriate locations for substation temporary microgrids for 2021 PSPS mitigation, PG&E assesses the relative frequency of historical PSPS impacts through analysis of historical meteorological data, actual 2020 PSPS event impacts, and parallel work-in-progress directed at reducing future impacts. The foundational data for selecting temporary substation microgrid sites for 2021 is an analysis of 10 years of historical weather events. This "historical lookback" takes historical weather events and builds the associated PSPS events that would have occurred, including both T&D impacts.

This analysis identifies 28 weather events with 18 potential PSPS events involving transmission-level impacts. Through the historical look-back of these 18 transmission-level events, PG&E identifies substations that are most frequently experience de-energization due to a transmission or distribution PSPS outage. The circuits served by those substations that frequently experience PSPS de-energization in the look-back are screened for the presence of safe-to-energize distribution load. In addition, substations and their circuits are reviewed to determine whether other 2021 PSPS mitigations might remove them from scope (e.g., a switching solution, VM, etc.) or whether an existing solution is already in place (e.g., use of the existing Humboldt Bay Generating Station to create a multi-substation island).

FIGURE PG&E-7.3.3-1: EXAMPLE TEMPORARY SUBSTATION MICROGRID CONFIGURATION



4. Progress on initiative (amount spent, regions covered) and plans for next year:

2020

For 2020, PG&E reserved 350 megawatts (MW) (nameplate capacity) of TG for use across 62 substations in 19 counties. As the 10-year lookback analysis was not yet available, 2020 temp gen substation site selection was based on in-scope substations with safe-to-energize load during 2019 PSPS events.

i. The following substation site selection was used:

1. During 2019 PSPS events, 124 substations were de-energized due to transmission impacts but could carry some or all distribution load;
2. Less 51 substations that had fewer than 2 PSPS impacts caused by upstream transmission outages in 2019;
3. 73 substations had 2 or more transmission impacts with safe-to-energize distribution load;
4. Less 16 substations to be served by Humboldt Bay Generating Station;
5. 57 candidate substations for temp gen 2020; and
6. Additional substations added and removed based on analysis from Subject Matter Experts (SME) in Electric Operations.

PG&E prepared substations to receive TG in 3 different ways. This approach ensured PG&E could cover all 62 substations with 350 MW of TG (less than

the total peak load of all the substations). The strategy accounted for several substation characteristics including, historical frequency of impact, available land, proximity to other substations, and travel time. Table PG&E-7.3.3-2 below describes these distinct preparation strategies and the number of substations allocated to each strategy.

TABLE PG&E-7.3.3-2: TEMPORARY SUBSTATION DEPLOYMENT STRATEGIES AND NUMBER OF SUBSTATIONS IMPACTED

Deployment Strategy	Description of Strategy	Number of Substations and MWs of Generation Allocated
"Ready-to-Energize"	Substations that have generation interconnected, tested and released in advance of a PSPS event.	18 Substations – 225 MW
"Staged at Substation"	Substations that have generation placed at the substation in advance of a PSPS event.	3 Substations – 50 MW
"Hub-and-Spoke"	Substations that have an engineering guide to interconnect generation during a PSPS event. Generators are staged at yards regionally and dispatched to subs as needed.	39 Substations – 75 MW

2021 Planning

While PG&E has not yet completed the substation selection process described above, PG&E is currently planning to prepare at least eight substations to receive TG for 2021 PSPS mitigation. In addition, PG&E plans to pursue at least one clean substation pilot leveraging diesel-alternative technologies. PG&E issued a solicitation for diesel-alternative front-of-the-meter generation in January 2020 and is also exploring potential behind-the-meter and demand response opportunities at substations identified as needing a 2021 PSPS mitigation.

It is likely that a far higher percentage of substations (but not necessarily MWs) will be supported via a "Ready to Energize" (i.e., interconnected and tested) deployment strategy in 2021 than in 2020. This is due to learnings from 2020 PSPS events which indicated that the time between completion of "Playbook D" (identifies substations that will be de-energized) and de-energization can be constrained to less than 48 hours. PG&E's process to select locations and procure temporary generation for 2021 PSPS mitigation is still underway. This forecast and the associated language reflect PG&E's best-available data at the time of this filing. A more complete list of substation candidates for TG in 2021, the total MWs needed to support these substations, and a financial forecast will be submitted in the first quarter of 2021 as part of a Tier 2 Advice Letter required by the CPUC's Track 2 Decision in the Microgrid OIR.[2]

[2] D.21-01-018, App. A, pp. A-1 to A-3.

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5. Future improvements to initiative:

As described above, the following improvements are being made to substation site selection and deployment strategy:

- Use of 10-year historical lookback and 2020 PSPS event actuals to inform substation selection;
- Transitioning towards greater reliance upon generation that is pre-interconnected at a substation to reduce in-event execution risk; and
- Development of at least one clean substation pilot.

C) Temporary Distribution Microgrids

1. Risk to be mitigated/problem to be addressed:

Temporary distribution microgrids aim to support communities by energizing "main street corridors" with shared services and critical facilities when the distribution line serving these areas are de-energized as a result of a PSPS event.

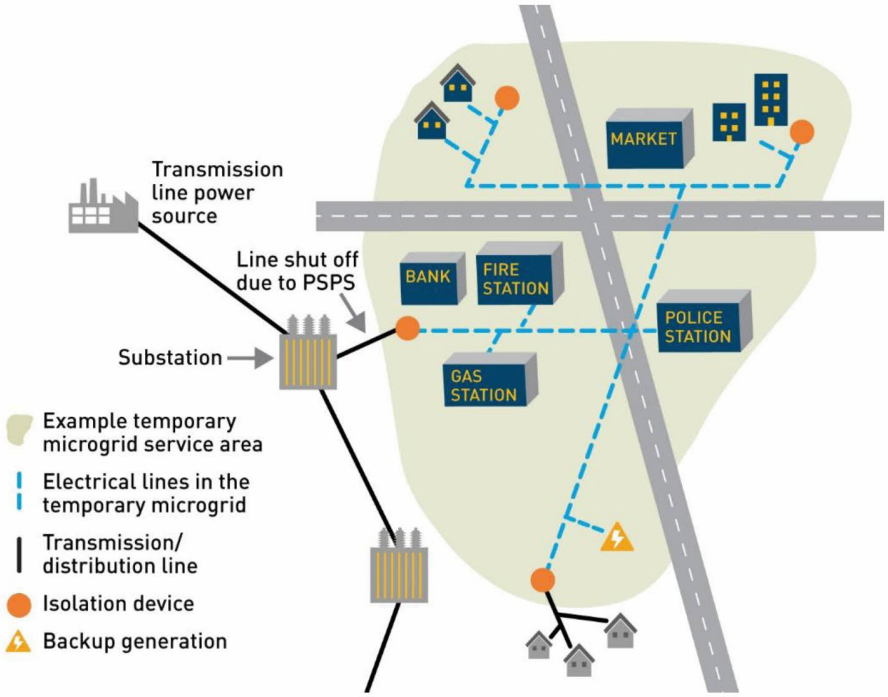
2. Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PG&E's temporary distribution microgrids are designed to reduce the number of customers impacted by PSPS events and support community resilience by powering a cluster of shared resources (e.g., commercial corridors and critical facilities within the energized zones) so that those resources can continue serving surrounding residents during PSPS events. Though each distribution microgrid varies in scale and scope, the following design features are likely for each:

- Devices used to disconnect the distribution microgrid from the larger electrical grid;
- A pre-determined space for backup generation and equipment to allow for rapid connections (e.g., pre-installed interconnection hub (PIH)); and
- The use of temporary generators allowing PG&E to shorten the design and construction time typically required to ready a permanent microgrid for operation.

The diagram below represents an approximate layout of a temporary microgrid. With safety being the most critical design factor, each temporary microgrid is unique and is designed based on a number of different variables that dictate the size of the microgrid, what community services are served and what elements are included in the design. The layout and dimensions below are approximate and for illustrative purposes only.

FIGURE PG&E-7.3.3-2: EXAMPLE TEMPORARY DISTRIBUTION MICROGRID



3. ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

   To determine the appropriate locations for distribution microgrids, PG&E identifies distribution circuits most likely to be impacted by PSPS events in the future. PG&E reviews these circuits to identify communities with clusters of shared services (i.e., those involving food, fuel, healthcare and shelter) and critical facilities served by electrical infrastructure that would likely be safe to energize during PSPS events. To determine whether distribution microgrids present viable, effective near-term mitigation measures for a particular location, PG&E also reviews them for implementation feasibility (i.e., land availability and construction complexity) and the potential to be served by alternative grid solutions.

4. ***Progress on initiative (amount spent, regions covered) and plans for next year:***

   In 2020, PG&E operated four distribution microgrids with PIHs; thereby, energizing over 2,000 unique service points (customers) for as many as four PSPS events per service point (approximately 5,600 customer-events). PG&E committed 40 MW of TG to temporary distribution microgrids in 2020. The distribution microgrids are identified in Table PG&E-7.3.3-3 below.

TABLE PG&E-7.3.3-3: DISTRIBUTION MICROGRIDS THAT OPERATED IN 2020

Site	County	Year PIH Constructed	Approx. qty service pts	Number of 2020 PSPS Events Supported
Angwin PIH	Napa	2019 Pilot	48	4
Shingletown PIH	Shasta	2020	79	4
Calistoga PIH	Napa	2020	1554	3
Placerville	El Dorado	In progress for 2021	487	1

In addition, in late October 2020, PG&E readied two additional distribution microgrids in Lake County using a temporary configuration without a PIH. These distribution microgrids in North and South Clearlake were on standby to support customers if needed during the October 25, 2020 PSPS event and subsequent PSPS events.

For 2021, PG&E is planning to develop at least five additional distribution microgrid PIHs by the end of the calendar year. PG&E will continue to follow the methodology described in above to locate these sites, which considers likelihood of PSPS impacts, presence of shared services in corridors that can likely be safely energized during PSPS events, and implementation feasibility. As in prior years, PG&E will collaborate with county and local government to ensure local priorities help shape site selection and design where technically feasible.

5. Future improvements to initiative:

In 2021, PG&E intends to expand the pool of contractors and technologies for the development of microgrids, pilot viable non-diesel technologies, and explore opportunities to build a portfolio of non-fossil solutions for the longer term. This improvement is meant to further California's clean energy goals, rather than an activity tied to wildfire risk mitigation or PSPS resilience.

Additionally, the temporary distribution microgrid initiative will benefit from operational and administrative improvements derived from the Generation Enablement and Development organization being stood up in 2021 (see Section 7.3.3.11.1 subsection A for more information).

D) Back-Up Power for Individual Critical Customer Facilities

1. Risk to be mitigated/problem to be addressed:

The loss of power at certain critical customer facilities during a PSPS event could pose significant public health and safety risks, especially for prolonged outages (48 + hour).

2. Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

As a general policy, PG&E does not offer backup generation to individual facilities. However, PG&E's policy allows for granting exceptions for critical facilities when a prolonged outage could have a significant adverse impact to public health or safety.

3. ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

   PG&E supports individual critical customer facilities through two distinct processes: (1) pre-planned sites; and (2) ad hoc support during an event. For the 2020 wildfire season, PG&E supported intensive care unit hospitals identified in partnership with the California Hospital Association and the Hospital Council of Northern and Central California that were at higher risk of experiencing one or more PSPS-related outages during the 2020 season. PG&E also supported pre-determined vote tabulation centers from October to December for the 2020 national election.

   In-event ad-hoc backup power support occurs during a PSPS event. Customers submit a request for mobile backup generation through their PG&E contact or account manager to our EOC. The request is reviewed, and a determination is made as to whether a prolonged outage for the requesting customer would either directly or indirectly affect public health or safety. If the request is approved, mobile TG is deployed to the requesting customer. There is no pre-determined prioritization of these customers, and the location of these customers is dependent on the scope and location of the ongoing weather event. While there is no pre-determined prioritization, there are pre-determined "societal Impact" locations (sites where power loss may impact public health and safety) for which designated customer representatives execute in-event additional outreach to ensure they have a backup power strategy in place. If these locations do not have a backup power strategy in place, a request for backup power deployment is routed to the EOC.

4. ***Progress on initiative (amount spent, regions covered) and plans for next year:***

   In 2021, PG&E plans to continue to support critical customers with backup power support in exceptional circumstances, utilizing our policy to determine eligibility and prioritization. During the first half of 2021, PG&E will continue our direct engagement with critical customers and in coordination with counties to provide consultative support for readiness and resiliency for all hazard, emergencies and the 2021 fire season.

5. ***Future Improvement to Initiative:***

   Improvements to the program will include streamlining the outreach process prior to and during a PSPS event by PG&E customer team, utilizing more hub locations for quicker deployments to the edges of the service territory, and explore clean generation solutions where applicable.

E) Customer Resource Centers

1. ***Risk to be mitigated/problem to be addressed:***

   To minimize public safety impacts during a PSPS event, PG&E opens CRCs focused on providing essential services to customers affected by PSPS events. The risk to be mitigated is ensuring all CRCs in potential PSPS areas are fully equipped with backup power throughout the PSPS season.

2. ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:***

   PG&E mobilizes CRCs in counties and tribal communities potentially impacted by PSPS events to provide customers a safe location to meet their basic power needs, such as charging medical equipment and electronic devices.

3. ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

   PG&E closely coordinates with counties, local governments and tribes to determine appropriate locations for CRCs. Additional details regarding CRC region prioritization can be found in Section 8.2.1.

4. ***Progress on initiative (amount spent, regions covered) and plans for next year:***

   PG&E pre-staged 77 generators to support indoor CRC sites and ultimately activated 62 indoor CRC sites with TG during PSPS events in 2020. More information regarding progress on the CRC program can be found in Section 8.2.1.

5. ***Future Improvement to Initiative:***

   In 2021, PG&E will continue evaluating additions or changes to our indoor CRC portfolio while taking into consideration factors such as potential PSPS scope, communities impacted by 2020 PSPS events and input from counties and tribes. PG&E will continue to review the program for improvements and efficiencies by reviewing elements such as resources provided, the customer journey and CRC staffing.

F) Responses to Action Items

ACTION PGE-49 (Class B)

Provide additional information about its specific backup generation sites, including

a) the number of times used; and

b) challenges faced with the completion of this project and its operation.

Response:

a) The number of times backup generation sites were used during PSPS events:

During 2020 PSPS events, PG&E utilized a total of eight microgrid sites: four temporary substation microgrid locations and four temporary distribution microgrid locations. In addition, PG&E provided backup power support to 31 critical single—customer facilities, including hospitals, water and wastewater plants, and emergency response personnel such as fire and police stations.

Table PG&E-7.3.3-4 below indicates the number of times these sites were energized during the 2020 PSPS events. Some microgrids and single-customer facilities were energized during multiple events, for a total of 53 backup generation site uses across all PSPS events:

TABLE PG&E-7.3.3-4: NUMBER OF TIMES SITES WERE ENERGIZED DURING 2020 PSPS EVENTS

PSPS Event	Temporary Substation MG	Temporary Distribution MG	Individual Critical Customer Backup Power Support	Total
7-Sep	1	2	11	14
26-Sep		1	3	4
14-Oct		4	2	6
25-Oct	4	4	20	28
2-Dec			1	1
Total	5	11	37	53

For additional information regarding microgrids please see Sections 7.3.3.11.1 subsection B (Temporary Substation Microgrids) and 7.3.3.11.1 subsection C (Temporary Distribution Microgrids).

For additional information regarding backup power support to single -customer facilities that were supported with backup power per event please see Section 7.3.3.11.1 subsection D (Back-up power for individual critical customer facilities).

b) Challenges faced with the completion of this project and its operation:

Challenges with Project Completion:

As described in PG&E's First Quarterly Report, there are two broad categories of limitations to microgrid deployment for PSPS mitigation:

1. Limitations related to the safety of energizing microgrids with overhead lines in the context of high wind conditions that trigger a PSPS de-energization (i.e. overhead lines that run through the "wind polygon"); and

2. Limitations related to space constraints for siting generation for microgrids with high peak MW and megawatt -hour requirements over a 24+ hour period.

While the above limitations presented challenges, PG&E largely fulfilled our objective of providing temporary substation microgrids, temporary distribution microgrids, and critical single -facility sites during PSPS events through the use of TG. Energization challenges were managed through the development of site -specific energization playbooks and an in-event scoping process that ensured that only substations with safe-to-energize load outside of the wind polygon were energized. Safe-to-energize limitations for temporary distribution microgrids were managed by limiting energization only to underground lines or short segments of sufficiently hardened overhead lines reviewed by fire safety specialists.

Space constraints were overcome through the utilization of energy-dense, mobile temporary generators and in some instances, collaboration with local governments and landholders to secure temporary easements in advance of 2020 PSPS events which allowed PG&E to place generation outside of our substation fence. In some instances, available land was insufficient, leading to constraints in the number of temporary generators that could be used to serve potential safe -to -energize load from any particular substation. In the case of the Brunswick substation, which was energized during two PSPS events, space constraints meant that only 20 MW of nameplate generating capacity would fit within the substation footprint. The substation has a peak load of 60 MW. Safe -to -energize limitations for temporary substation microgrids led to very few substations being suitable for energization during 2020 PSPS events.

Challenges with Project Operation:

PG&E managed two major challenges in the operation of these sites:

1. PSPS event wind polygons, and thus the PSPS impact scope, can continue to change throughout the event scoping process. Thus, identification of temporary microgrids with safe -to -energize load that will be de--energized can be identified less than 48 hours before de--energization when the final Transmission -level "playbook" is produced, therefore limiting time available to deploy TG to these sites. To manage this operational challenge, PG&E prepared 18 temporary substation microgrids and all temporary distribution microgrids as "ready -to -energize", with generation interconnected, tested, and released in advance of a PSPS event. In 2021, it is likely that a far higher percentage of substations will be supported via this strategy to further limit in -event operational constraints; and

2. Given the dynamics of event scoping, sophisticated and ongoing real--time coordination was required between PG&E's EOC, Electric Distribution Emergency Center, field engineers overseeing TG deployment, and TG contractors delivering and connecting

generators. To manage this operational challenge, PG&E created a specialized EOC "Temporary Generation" Branch within the Operations Section. The TG Branch centralized planning, logistics, and operations functions to ensure as many customers would be supported with TG as safely possible during each event. The TG Branch was staffed with four teams of six individuals each. All individuals who served in the TG Branch underwent significant online training and engaged in at least one of PG&E's PSPS exercises in advance of wildfire season. In 2021, PG&E is seeking to increase staffing for our TG organization to provide a more permanent solution to this resource issue.

ACTION PGE-50 (Class B)

In its 2021 WMP Update, PG&E shall: (1) provide the cost/benefit analysis completed for microgrids as a mitigation, and (2) define what is meant by a "bridge" solution and "other solutions," and (3) include a timeline for how long an interim "bridge" solution would be in place.

Response:

This portion of PG&E's First Quarterly Report was referencing temporary substation and distribution microgrids. In this response, PG&E refers to "temporary microgrids" to include both kinds of microgrids (i.e., substation and distribution).

1) Provide the cost/benefit analysis completed for microgrids as a mitigation:

Decisions regarding the development of temporary microgrids for PSPS mitigation are driven by a location's expected relative impact frequency and near--term implementation feasibility rather than a cost/benefit analysis. This is in line with a temporary microgrid's intent to be used to serve safe -to -energize areas where no alternate grid solutions can be feasibly implemented in the near--term (i.e., within the next fire season) to mitigate PSPS impacts.

As described in Section 7.3.3.11.1, temporary microgrids are considered as potential PSPS mitigations for locations with a high expected relative frequency of future PSPS impacts. If the analysis of historical meteorological data and prior PSPS events indicates that a location can be expected to experience future PSPS impacts, and no alternate solution can be implemented within the next fire season to mitigate those impacts, that location can be studied for technical feasibility of implementing a temporary microgrid to support customers in the near--term.

For the PSPS mitigation use case, PG&E does not use a quantitative cost/benefit analysis to supplement the methodology described above. Quantifying the exact benefits of a temporary microgrid is difficult because the CPUC has not adopted a standard "value of resilience" or other methodology to quantify the benefit of keeping customers energized when they would otherwise be impacted by PSPS events. To maximize benefits

derived from these mitigation measures, in addition to considering expected relative impact frequency, PG&E generally seeks to site temporary substation microgrids in locations that maximize the number of customers that can be safely energized, and temporary distribution microgrids in commercial corridors with critical and shared services that can serve surrounding residents (i.e., to energize "Main Street").

2) Define what is meant by a "bridge" solution and "other solutions":

In the case of temporary microgrids for PSPS mitigation, PG&E used the term "bridge" solution to refer to the near--term implementation feasibility of temporary microgrids at certain locations where other grid solutions might not be viable prior to the next fire season. Temporary microgrids do not present a "bridge" solution for every location—in some locations, they may not be able to be implemented more quickly than an alternate grid solution under consideration.

PG&E used the term "other solutions" to refer to grid solutions that can reduce PSPS scope, and thereby reduce or potentially eliminate the need for a temporary microgrid for PSPS mitigation. "Other solutions" can include undergrounding overhead lines, as well as measures that improve the health score of a transmission line, allow for more granular meteorological event scoping, and enable distribution and transmission sectionalizing.

3) Include a timeline for how long an interim "bridge" solution would be in place:

As PG&E continues to develop and refine our risk modeling (see Section 4.5.1), these developments will drive changes to PSPS scope (see Section 8), and therefore, mitigation solutions designed to address PSPS impacts. Timelines for how long temporary microgrids will be in place as "bridge" solutions will be driven by improvements to PSPS risk modeling and de-scoping criteria, and will vary by location and the demonstrated effectiveness of "other solutions" to mitigate PSPS impacts in those locations.

At certain locations, some of the "other solutions" listed above might be implemented as soon as the year after a temporary microgrid is made operationally ready. At such locations, PG&E would consider adapting site preparation at the start of PSPS season to reflect the availability of an alternate solution. For example, some of the temporary substation microgrids that were made "Ready -to -Energize" in 2020 based on 2019 event actuals might not have generation interconnected and tested on-site in 2021 based on the reduced expected impacts due to improvements to event scoping and transmission health scores. This, however, may not eliminate the potential need for a temporary microgrid solution at these sites altogether. For these sites, PG&E would retain the engineering guide to interconnect generation if needed, even if generators are not staged on-site given the relatively low probability of impacts.

At some locations, "other solutions" may not be available to reduce the need

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for temporary microgrids for multiple years. This is particularly true for temporary microgrid sites near undergrounding projects. Upon completion, undergrounding projects may reduce the need for nearby temporary microgrids to mitigate PSPS impacts. However, due to the time -consuming nature of undergrounding work (see Section 7.3.3.16), PG&E expects to continue to rely on temporary microgrids for PSPS mitigation in these locations for multiple years.

The recent Track 2 Decision in the Commission's Microgrid OIR provides additional upcoming opportunities to evaluate alternative solutions for mitigating PSPS impacts. First, the decision directs PG&E to submit an Advice Letter describing the substations at which PG&E proposes to use TG microgrids to mitigate PSPS outages in 2021.[3] That Advice Letter, which PG&E expects to file in the first quarter of 2021, will describe the process by which PG&E evaluated candidate substations, including our evaluations of near--term solutions other than temporary substation microgrids (and noting where those alternative solutions obviated the need to pre--stage TG at certain substations). Second, the decision requires PG&E to file an application by June 30, 2021 proposing a long--term framework for evaluating the need for generation at substations to mitigate PSPS outages.[4] In that application, PG&E expects to present an analytical methodology to consider the longer--term alternatives for mitigating PSPS outages, including further consideration of whether it is reasonable to continue using temporary or longer--term microgrids as a bridge until other solutions can be put in place.

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3 D.21-01-018, App. A, pp. A-1 to A-3.

4 *Id.*, App. A, pp. A-6 to A-8.

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7.3.3.11.2 Substation activities to enable reduction of PSPS impacts

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

The risk to be mitigated are the potential impacts of PSPS events on communities and customers. Risk mitigation efforts include:

Substations Requiring Protection Upgrades

Substation activities that enable the reduction of PSPS impacts include the installation or upgrade of protection equipment and automatic sectionalizing devices at various substations to improve operating flexibility thereby minimizing the frequency, scope, and duration of PSPS events.

Substation Microgrid Locations

Another activity is substation equipment and protection upgrade to accommodate "Microgrids for PSPS Mitigation" initiative that enables the connection of a generation source or tie line to the substation to serve in an island-configuration during a PSPS event. Additional information about the substation and distribution microgrids initiative can be found in Section 7.3.3.11.1 subsection B and 7.3.3.11.1 subsection C above.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Both these risk mitigation efforts support PSPS events. PSPS events can potentially impact many customers given the configuration of PG&E's electrical system. As a result, a power shut-off may occur in areas that are not directly in the weather zone, but is served by facilities that are impacted by the extreme wind/weather conditions. The substation activities will allow for minimizing the scope of PSPS events, enable faster restoration for those impacted and, in some cases, an alternative power source (generation) during PSPS events.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Substations Requiring Protection Upgrades

Relays for substation equipment operate within overlapping layers of protection zones that are set in such a way that the timing allows the relay to operate in a structured sequence. For example, when a line is taken out of service, PG&E is required to maintain coordination within the remaining energized zone. If the substation equipment (i.e., fuse) within

the remaining energized zone does not have the ability to coordinate with the upstream relays, then either the decision is made to de-energize the equipment, remain with the coordinating deficiency, or, if the equipment cannot be adequately protected, then remove it from service.

Substation Microgrid Interconnection

The feedback to determine microgrid locations include but are not limited to transfer capability, infringement to future site plans, adherence to design standards and maintenance considerations. For more details please see Section 7.3.3.11.1 subsection B.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

Substations Requiring Protection Upgrades

Based on system protection reviews, PG&E has identified one substation for protection or SCADA installation, or upgrade noted within Table PG&E-7.3.3-5 below. The specific dates for this work to be operative are preliminary and may change depending on the availability of resources and other prioritized work.

TABLE PG&E-7.3.3-5: SUBSTATION ELIGIBLE FOR UPGRADE, PROTECTION OR SCADA INSTALLATION

Line No.	Substation Name	Operative Year
1	Rincon	2021

Substation Microgrid Interconnection

Information regarding substation microgrid efforts can be found in Section 7.3.3.11.1.

5) Future improvements to initiative:

Substation activities are driven by the PSPS and microgrid strategy in Section 7.3.3.11.1. This work is necessary to ensure safe and reliable operations and protection of the electric grid.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

As stated above, please reference Section 7.3.3.11.1 for more information on future improvements for this initiative.

7.3.3.11.3 Emergency Back-up Generation – PG&E Service Centers & Materials Distribution Centers

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

While several PG&E facilities have an existing emergency backup system onsite, very few are configured to back up the entire campus. In most cases, the emergency system will supply backup power to existing critical communications, emergency lighting and possibly a storm room or EOC. While this level of backup may have been enough for shorter duration emergency response events, such as a mild winter storm, it can be inadequate for the longer duration PSPS events, which can last several days.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Because the existing emergency generation systems only backup a select number of circuits within the campus, critical systems such as fuel islands, gate operators, exterior lighting, and operations buildings may not be backed up. This can result in operational inefficiencies during PSPS events. Additionally, because some facilities have limited or no existing emergency generation, personnel who would typically work out of these locations have had to work either remotely or at alternate locations in order to support restoration events.

In order to address this issue, PG&E's Corporate Real Estate Strategy and Services (CRESS) department has initiated a three-year (2020-2022) capital project in order to harden a number of service center locations throughout our service territory against the possibility of extended utility power loss events.

As part of this project, 52 locations will be equipped with an emergency generation system capable of backing up the campus in its entirety. In order to achieve this, it is expected that existing emergency generators, automatic transfer switches, and in most cases, main switchboards, will need to either be replaced or reconfigured in order to achieve emergency generation back up the for the entire site.

In addition to the locations mentioned above, another 43 locations will be equipped with generator tap boxes and transfer switches but will not be equipped with permanent generators. This will also allow for the entire campus to be backed up through emergency generation, with the difference being that these locations will be prepared to accept a portable generator instead of being equipped with a permanent generator.

When completed, the electrical reconfiguration and additional equipment installed at these locations will allow these sites to operate with the same amount of functionality as they would if they were being fed from their normal source (utility power). This will ensure that restoration efforts being performed by operational personnel working out of the site can carry on unimpeded.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

This three-year project was split into three phases, with one phase being targeted for execution each year (e.g., Phase One (2020), Phase Two (2021), Phase Three (2022)). Each site was evaluated and ranked based on the population of employees working out of the facility and its adjacency to HFTD areas. Sites with higher populations of employees and that are located close to or within an HFTD area were ranked higher and included in Phase One. Sites with lower populations or not adjacent to an HFTD area were ranked lower and included in Phase Three of the project.

Phase One (2020): Phase One of the project will concentrate on the 23 highest priority sites as determined by the facility's location regarding HFTD areas and the workforce population operating out of the facility. As these sites are closest in proximity to the HFTDs they are most likely to be impacted by PSPS event. Prioritizing these sites within the multi-year project thereby presents the greatest benefit to customers since it's most likely that PSPS restoration efforts will be managed out of these locations. By ensuring that these sites are fully operational during an extended power loss events we maximize our operational efficiency during restoration efforts, thereby minimizing outage times for impacted customers.

Phase Two (2021): 2021 will focus on the next highest priorities, again determined by adjacency to HFTD areas and the headcount assigned to the facility. We estimate that approximately 30 sites will be addressed in this phase.

Phase Three (2022): 2022 will focus on the lowest priority sites. These are sites where the likelihood of experiencing a PSPS event is low or the long-term strategy for the facility is currently being evaluated.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

By the end of 2021, at least 23 PG&E Service Centers & Materials Distribution Centers will be equipped to receive permanent or temporary generation. By the end of 2022, the 72 remaining PG&E Service Centers & Materials Distribution Centers will be equipped to receive permanent or temporary generation.

5) Future improvements to initiative:

There are currently no additional plans on this initiative beyond what is described above.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

As stated in the section above, there are no further improvements planned at this time other than the work described above through 2022.

7.3.3.12 Other Corrective Action

WSD Initiative Definition: *Other maintenance, repair, or replacement of utility equipment and structures so that they function properly and safely, including remediation activities (such as insulator washing) of other electric equipment deficiencies that may increase ignition probability due to potential equipment failure or other drivers.*

For this initiative, PG&E has several sub-initiatives including:

- 7.3.3.12.1: Distribution substations;
- 7.3.3.12.2: Transmission substations;
- 7.3.3.12.3: Maintenance, Transmission; and
- 7.3.3.12.4: Maintenance, Distribution.

7.3.3.12.1 Distribution Substation

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

The primary wildfire risk with substations is an arc flash event within the substation that propagates into adjacent wildlands. PG&E has taken two specific actions to address this risk. First, we have initiated a defensible space program for substations located in Tier 2 and Tier 3 HFTD areas. Second, we have improved our animal abatement program.

In addition to these specific actions, we also perform corrective repairs and equipment replacements identified through the enhanced inspections of substations. This work is intended to correct deficiencies identified and ensure that substation equipment operates as designed.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Defensible Space: Defensible space for substations is a 100' perimeter around substation equipment that includes both a 30' clean zone and a 70' reduced fuel zone. Defensible space is normally achieved by removing combustible material (primarily vegetation) from these areas. Defensible space is intended to reduce the risk of an event within a substation, igniting a fire, that propagates outside of the facility. By implementing these requirements, the risk of fire spreading is significantly reduced and provides a higher probability that a fire can be extinguished without involving third party property.

Substation Animal Abatement: PG&E has been conducting an animal abatement program for our substations, with reliability (i.e., lower customer outage) as the main driver. The program was expanded to address wildfire risks by reducing the probability of an arc flash within the substation. Animal contacts may result in a catastrophic failure of equipment that can project ignited materials into HFTD areas.

Repairs and Replacements from Enhanced Inspections: PG&E conducts enhanced inspections in substations located in HFTD areas. These inspections identify deficiencies with substation equipment and components. The repair and replacement work are performed to reduce the risk of an equipment failure or miss operation.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

Defensible Space: The program requires defensible space to be established and maintained on substations located in Tier 2 and Tier 3 HFTD areas, where possible. At some locations, it is not possible to attain defensible space due to adjacent structures, third-party property owners, or permitting issues.

Substation Animal Abatement: Animal abatement was identified during the 2019 Wildfire Safety Inspection Program (WSIP) as a mitigation to minimize fire ignition, specifically in Tier 2 and Tier 3 HFTD areas. All substations located in these areas that have achieved defensible space will have animal abatement installed. Substations located in these areas that are not able to achieve defensible space will have additional animal abatement installed to further reduce the likelihood of an animal contact

Repairs and Replacements from Enhanced Inspections: Enhanced inspections are performed at substations located in HFTD areas. As a result of these inspections, corrective work is identified at substations located in HFTD areas. The identified repair and replacement work are prioritized based on risk and completed based on the prioritized schedule.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

Defensible Space: As of December 31, 2020, 96 percent of substations (168 of 175) located in Tier 2 and Tier 3 HFTD areas have attained defensible space. At some locations, it is not possible to attain defensible space due to adjacent structures, third party property owners, or permitting issues.

Substation Animal Abatement: 77 locations have been identified as requiring animal abatement. Of these 77 locations, 18 were completed in 2019, 21 were completed in 2020, and the remaining 38 are being prioritized for completion.

Repairs and Replacements from Enhanced Inspections: PG&E has a total of 126 distribution substations located in HFTD areas. Each of these locations is inspected through the enhanced inspection program. All repair and replacement work identified by the inspections is reviewed, prioritized and scheduled for completion. In 2020, 47 of these substations were inspected by the enhanced inspection program and in 2021, 57 of these substations are planned to be inspected. The repair and replacement work generated from these inspections will be reviewed, prioritized and scheduled for completion.

5) Future improvements to initiative:

At this time, no future improvements have been identified; the programs will continue to execute at the substations that have been identified.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

For the long-term, we will continue with periodic evaluations of the defensible space, animal abatement and the repairs and replacement programs. These evaluations typically include performance trends, inspection results, emerging technology and other risk factors. Updates will be made to the programs based on these evaluations.

7.3.3.12.2 Transmission Substation

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

The primary wildfire risk with substations is an arc flash event within the substation that propagates into adjacent wildlands. PG&E has taken two specific actions to address this scenario. First, we have initiated a defensible space program for substations located in Tier 2 and Tier 3 HFTD areas. Second, we have improved our animal abatement program.

In addition to these specific actions, we also perform corrective repairs and equipment replacements identified through the enhanced inspections of substations. This work is intended to correct deficiencies identified and ensure that substation equipment operates as designed.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Defensible Space: Defensible space for substations is a 100' perimeter around substation equipment that includes both a 30' clean zone and a 70' reduced fuel zone. Defensible space is normally achieved by removing combustible material (primarily vegetation) from these areas. Defensible space is intended to reduce the risk of an event within a substation, igniting a fire, that propagates outside of the facility. By implementing these requirements, the risk of fire spreading is significantly reduced and provides a higher probability that a fire can be extinguished without involving third party property.

Substation Animal Abatement: PG&E has been conducting an animal abatement program for our substations, with reliability (i.e., lower customer outage) as the main driver. The program was expanded to address wildfire risks by reducing the probability of an arc flash within the substation. Animal contacts may result in a catastrophic failure of equipment that can project ignited materials into HFTD areas.

Repairs and Replacements from Enhanced Inspections: PG&E conducts enhanced inspections in substations located in HFTD areas. These inspections identify deficiencies with substation equipment and components. The repair and replacement work are performed to reduce the risk of an equipment failure or miss operation.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Defensible Space: The program requires defensible space to be established and maintained on substations located in Tier 2 and Tier 3 HFTD areas, where possible. At some locations, it is not possible to attain defensible space due to adjacent structures, third-party property owners, or permitting issues.

Substation Animal Abatement: Animal abatement was identified during the 2019 WSIP as a mitigation to minimize fire ignition, specifically in Tier 2 and Tier 3 HFTD areas. All substations located in these areas that have achieved defensible space will have animal abatement installed. Substations located in these areas that are not able to achieve defensible space will have additional animal abatement installed to further reduce the likelihood of an animal contact.

Repairs and Replacements from Enhanced Inspections: Enhanced inspections are performed at substations located in HFTD areas. As a result of these inspections, corrective work is identified at substations located in HFTD areas. The identified repair and replacement work are prioritized based on risk and completed based on the prioritized schedule.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

Defensible Space: As of December 31, 2020, 100 percent of substations (40 of 40) located in these areas have attained defensible space. In 2020, PG&E spent $1.7 million and in 2021, we are planning to spend $2.5 million on defensible space for transmission substations.

Substation Animal Abatement: nine locations were identified as requiring animal abatement, two were completed in 2019, two are were completed in 2020, and the remaining five are being prioritized for completion. In 2020, PG&E spent $1.0 million and in 2021, we are planning to spend $3.1 million on animal abatement in transmission substations.

Repairs and Replacements from Enhanced Inspections: PG&E has a total of 60 transmission substations located in HFTD areas. Each of these locations is inspected through the enhanced inspection program. All repair and replacement work identified by the inspections is reviewed, prioritized and scheduled for completion. In 2020, 29 of these substations were inspected by the enhanced inspection program and in 2021, 22 of these substations are planned to be inspected. The repair and replacement work generated from these inspections will be reviewed, prioritized and scheduled for completion.

5) Future improvements to initiative:

At this time, no future improvements have been identified; the program will continue to execute at the substations that have been identified.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

For the long-term, we will continue with periodic evaluations of both the defensible space and animal abatement programs. These evaluations typically include performance trends, emerging technology and other risk factors. Updates will be made to the programs based on these evaluations.

7.3.3.12.3 Maintenance, Transmission

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

Since 2019, PG&E has conducted enhanced transmission inspections (performed with enhanced inspection protocols). Detailed inspections are performed with two vantage points (e.g., by ground and by aerial) to fully capture all asset conditions. These inspections have resulted in a significant increase in the volume of corrective action notifications for maintenance. These maintenance notifications are key to trending, prioritizing and reducing asset risk by correcting identified asset hazards, poor conditions, and non-standard concerns.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

The maintenance (repair or replacement) work done as a result of enhanced inspections is an important step in mitigating risk. Although there are general priority timelines given to maintenance notifications when identified, prioritization and additional field safety assessments may be done in order to reduce the wildfire risk and manage the work of the maintenance notifications resulting from enhanced inspections. Furthermore, analysis of inspection and maintenance data provides opportunities for trending and refinement of risk prioritization.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E is prioritizing maintenance on the highest risk notifications and using additional Field Safety Reassessments (FSR) to mitigate the risk and manage this large volume of work.

The process for prioritization of these notifications uses the following definitions:

- Ignition-related notification: Notifications related to components included in the 2019 Failure Modes Effects Analysis (FMEA). Ignition risks can be either time-dependent or time-independent, e.g., a bird's nest or steel crossarm that is "no good/out of standard.";
- Non-ignition-related notification: Notifications that do not pose an ignition risk and are not considered to be a failure mode for a component in the 2019 FMEA, e.g., a missing "high voltage" sign;

- Time-dependent notifications: Conditions that will worsen with time, e.g., mechanical degradation including fatigue, corrosion, can all worsen with time and are time-dependent; and

- Time-independent notifications: Conditions that will not worsen with time, e.g., a missing sign or a missing guy insulator.

Using these definitions, notifications are prioritized as follows:

- Ignition-related notifications on structures in HFTD areas are prioritized over non-ignition-related notifications or notifications in non-HFTD areas;

- Ignition-related notifications are divided into time-dependent and non-time-dependent notifications. Time-dependent notifications are prioritized above non-time-dependent notifications because of the possibility that the condition can degrade further if the repairs are deferred;

- Time-dependent notifications in high fire spread areas are prioritized ahead of notifications in lower spread areas; and

- These considerations result in the following prioritization (highest to lowest):

  – Time-dependent ignition-related notifications in highest fire spread areas of HFTDs;

  – Time-dependent ignition-related notifications in lower fire spread areas of HFTDs;

  – Time-independent ignition-related notifications in HFTDs; and

  – Non-ignition-related notifications in HFTD areas or notifications outside of HFTDs.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2020, approximately 11,900 notifications within HFTD areas were completed (not including those for steel structures, further discussed in Section 7.3.3.15). In 2021, approximately 8,900 notifications within HFTD areas are expected to be completed, not including any urgent priority notifications that may be identified in 2021.

In 2021, PG&E is expecting to complete all ignition-related notifications in HFTD areas found before 2020 and all time-dependent ignition-related notifications found in 2020 on high fire spread areas, in addition to any new urgent priority notifications identified in 2021.

5) Future improvements to initiative:

As data is collected through enhanced inspections and maintenance, trending analysis will allow for understanding of deterioration rates of specific asset conditions and used to influence future inspection frequency and prioritization. Trending of notification find rates can also influence the maintenance strategy for specific lines or sections. This information will also be utilized in the programmatic approach for repair and replace decisions.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Long term, it is expected that the volume of maintenance notifications generated through enhanced inspections will be executed in accordance with appropriate timelines associated with the damage found. Where notifications cannot be completed per the timeline, field safety reassessments (FSR) are conducted, and information will help to refine the understanding of the damage mode decay rates. This information will also be used to improve guidance to maintenance inspectors. Additionally, it is expected that effectiveness of maintenance will be trended and used to inform future maintenance mitigations, processes, and procedures.

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7.3.3.12.4 Maintenance, Distribution

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

The distribution overhead enhanced inspection program is used to identify potential asset failures and gain a better understanding of asset condition for asset maintenance and replacement. EC notifications are a byproduct of the enhanced inspection process. These maintenance notifications are key to reducing asset risk by correcting identified asset hazards, poor conditions, and non-standard concerns.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Detailed inspections are performed with enhanced inspection protocols. Enhanced inspection activities lead to corrective actions taken on the issues identified during the inspection. Since 2019, distribution assets have been inspected more rigorously than in previous years through PG&E's WSIP. These changes have resulted in a significant increase in the volume of EC notifications based on a FMEA approach. The maintenance (or replacement) work done as a result of the inspections is the final step in mitigating risk in the HFTD area.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Since 2019 the distribution enhanced overhead inspection process has been used on all distribution assets located in Tier 2 and Tier 3 HFTD areas. These enhanced inspections exceed GO 165 five-year cycle times as follows:

- Tier 3 – enhanced overhead inspection yearly; and
- Tier 2 – enhanced overhead inspection every three years.

The EC maintenance notifications generated through the enhanced inspection program are assigned a priority based on the potential safety impact. PG&E uses the following priorities:

- A: conditions that require immediate action;
- B: conditions that generally need to be addressed within three (3) months from the date a condition is identified;
- E: conditions that need to be addressed within twelve (12) months from the date the condition is identified or within six (6) months for conditions creating a fire risk located in Tier 3 HFTD areas; and
- F: conditions that need to be addressed within five (5) years from the date the

condition is identified.

Given the high volume of identified tags since 2019, PG&E utilized a risk-informed prioritization approach to address the highest risk issues on PG&E's facilities. The largest volume of identified corrective actions are the E and F tags, which includes findings such as chipped or broken insulators, pole repairs for woodpecker holes, loose cotter keys (E tags), missing markers, signage, or foundation mastic application (F tags). PG&E has prioritized execution of E and F tags based on ignition risk circuit prioritization and plans to continue to make repairs based on this prioritization.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

As of September 30, 2020 (the end of Q3 2020), the following HFTD tag progress has been made since 2019:

- WSIP-Generated Tags: 208,510 tags had been created, 73,359 had been closed (repairs have been completed) and 135,151 remain open; and
- Non-WSIP-Generated Tags: 84,949 tags had been created, 21,305 had been closed (repairs have been completed) and 63,644 remain open.

PG&E is continuing to verify the status of tags in Q4 2020, and thus is currently unable to provide the Q4 2020 information. Open tags will continue to be worked in a risk-based priority including new tags generated through the 2021 inspection program. Priority A and B tags are expected to be completed by the required due date. Due to the high volume of priority E and F tags, a risk ranking utilizing the FMEA severity score will be used. Any tag that contains a "time dependent" element and cannot be completed and beyond the due date will receive an FSR.

5) Future improvements to initiative:

PG&E is evaluating integrating the 2021 Wildfire Distribution Risk Model results into our maintenance program to allow prioritization of notifications by wildfire risk at the tag location level. This would pinpoint specific locations of ignition concern, allowing both the highest probable ignition potential issues as well as the highest consequence areas to be addressed first.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

At this time, there is no long-term plan beyond 2021. However, we will continue to evaluate the risk-based approach for enhanced inspections, including inspection frequency and methods. Additionally, the results of the integration between the

Wildfire Distribution Risk Model and the maintenance program will allow for further analysis and planning.

7.3.3.13 Pole Loading Infrastructure Hardening and Replacement Program Based on Pole Loading Assessment Program

WSD Initiative Definition: *Actions taken to remediate, adjust, or install replacement equipment for poles that the utility has identified as failing to meet safety factor requirements in accordance with GO 95 or additional utility standards in the utility's pole loading assessment program.*

1) Risk to be mitigated/problem to be addressed:

PG&E started our pole loading program to reduce the risk of potential fire ignitions resulting from pole failures by evaluating poles so that each pole meets GO 95, Rule 44 strength requirements throughout its service life, both when initially installed and while in-service despite changing conditions, impacts from maintenance activities, attachment additions and potential wood strength degradation. Replacing overloaded poles eliminates the risks associated with pole failure, including potential ignition risk. This program also reduces risk by providing asset intelligence to identify locations that require corrective actions driven by pole safety factors or limitations for wind speeds.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

During a pole's service life, pole loading calculations are performed when load is added to a pole or if a suspected overload condition is observed during inspection. Pole loading calculations are performed in O-Calc software during the design phase to ensure poles are sized correctly to satisfy GO 95 requirements. When poles are analyzed and determined to be overloaded or the pole loading evaluation indicates that the pole does not satisfy GO 95 requirements, a pole replacement tag is initiated to correct the condition.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E's pole loading program has focused on assessments of poles in the Tier 2 and 3 HFTD areas with the goal to be fully implemented (100 percent poles analyzed) in these areas by 2024. Poles located in non-HFTD areas will follow, with the goal to be fully implemented (100 percent poles analyzed) by 2030.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

PG&E is strengthening pole loading model parameters and variables considering historical data with various meteorological factors (e.g., wind speed). These enhancements include evaluation of advanced wire strength, clearance, and pole loading using acquired imagery and Light

Detection and Ranging (LiDAR) from Inspections, Drones and Helicopters. In addition, the program is using LiDAR to geo-correct pole locations.

In the 2020 WMP, PG&E forecast assessing approximately 230,000 poles in Tier 2 and Tier 3 HFTD areas. However, PG&E did not anticipate the huge volume of poles that our internal estimating teams would be analyzing every year. In addition, we switched vendors and refined quality standards, which slowed down the evaluation process in 2020. As of December 1, 2020, we have completed pole loading analysis of over 160,000 poles, all of which are considered the highest risk poles, either due to the pole characteristics or location (i.e., located in an HFTD area). In 2021, we will continue to focus on HFTD areas and plan to analyze approximately 160,000 poles. PG&E is on-track to finish poles in Tier 2 and Tier 3 HFTD areas by end of 2024 as originally forecast.

5) Future improvements to initiative:

PG&E is reviewing our pole loading calculation software to see if it can enable analysis of multiple pole models at once, enabling span linking to ensure structural connectivity.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E does not currently have specific long-term planning beyond 2030, since this effort extends until 2030. When poles are determined to be overloaded, their replacement is incorporated into our overall pole replacement program. Please refer to Section 7.3.3.6 for further discussion on pole replacements.

7.3.3.14 Transformers Maintenance and Replacement

WSD Initiative Definition: *Remediation, adjustments, or installations of new equipment to improve or replace existing transformer equipment.*

1) Risk to be mitigated/problem to be addressed:

PG&E's GO 165 Program, which covers distribution transformer maintenance, is primarily focused on the identification, assessment, prioritization, and documentation of abnormal conditions, regulatory conditions, and third party caused infractions that can negatively impact safety or reliability.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Transformers may by maintained, repaired, or replaced based on their condition as assessed during the GO 165 process. The conditions identified during patrols and inspections of PG&E's distribution facilities may occur as a result of operational use, degradation, deterioration, environmental changes or third-party actions.

Transformers that fail in connection with an outage may be replaced as part of PG&E's Routine Emergency or Major Emergency programs. PG&E is also replacing certain transformers on circuits that are included in the System Hardening Program discussed in Section 7.3.3.17.1

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

This work is covered under PG&E's GO 165 program covers Buffer Zones and all of our service area. GO 165 inspections for HFTD are the same for non-HFTD. However, while the scope of the inspection is the same, the frequency for HFTD and non-HFTD areas is different. The frequency of GO 165 program inspections is 1-3 three years in HFTD areas as opposed to 5 years in non-HFTD areas.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

PG&E will continue to maintain, repair, or replace transformers as warranted by their condition as part of our ongoing GO 165 maintenance program and Emergency programs. PG&E may also replace certain transformers as part of our System Hardening Program.

5) Future improvements to initiative:

PG&E has two Electric Program Investment Charge (EPIC) projects that are evaluating SmartMeters™ technology, data science, and remote monitoring to proactively identify and replace some overloaded transformers before they fail. These projects are covered in depth in Sections 7.1.D.3.12 – EPIC 3.20 and 7.1.D.3.11 – EPIC 3.13.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Since this initiative is closely related to GO 165 requirements, the long-term vision will be guided by changes/updates to the GO 165 requirements. Please see references in the response to Question 5) above for more context.

7.3.3.15 Transmission Tower Maintenance and Replacement

WSD Initiative Definition: *Remediation, adjustments, or installations of new equipment to improve or replace existing transmission towers (e.g., structures such as lattice steel towers or tubular steel poles that support lines at or above 65 kV).*

1) Risk to be mitigated / problem to be addressed:

Maintenance, repair and replacement of transmission towers, particularly those located in Buffer Zones and HFTD areas, are integral means of mitigating risk associated wildfire, public and employee safety, and customer reliability.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PG&E's transmission tower maintenance, repair and replacement program focuses on high-risk steel structures. Many factors feed into determination of high-risk steel structures—including prior inspection conditions, environmental factors (such as location in an HFTD area or corrosion zone), age, structure design, prior outages, prior repairs, etc. Needs associated with Transmission tower maintenance are generally identified through system inspections and patrols.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Prioritization of maintenance, repair and replacement are based on severity of the issue found, fire ignition risk (i.e., risk associated with HFTD areas and HFRA), and time-dependency of the issue. As conditions are identified, they are given a time-based priority based on guidance in PG&E's Electric Transmission Preventative Maintenance Manual. For certain tags (E and F priority tags), additional prioritization occurs based on the damage found. If the repair needed is time-dependent (meaning that the damage can worsen with time), and in an HFTD area, it may be prioritized before other non-time-dependent, non-ignition potential tags.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2020, approximately 5,100 tags associated with steel transmission tower repair were completed within HFTD areas. Of these, approximately 50 tags associated with steel structure painting were completed in 2020 in order to extend structure asset life. In 2021, approximately 4,000 tags associated with steel transmission tower repair have been prioritized for completion within HFTD areas, not including any urgent priority tags that may be identified in 2021. Approximately 500 tags associated with steel structure painting are prioritized for completion in 2021 within HFTD

areas. Overall, in 2021, it is expected to complete all ignition-related tags in HFTD areas found before 2020 and all time-dependent ignition-related tags found in 2020 on high potential wildfire spread lines, in addition to any new urgent priority tags identified in 2021.

5) Future improvements to initiative:

PG&E is piloting additional inspection and asset-life extension technology for steel structures, which is planned to feed into asset health modeling and repair-replace decision for these assets. For example, below-grade foundation inspections (see Section 7.3.4.10) will inform future repairs and replacements. These inspections aim to assess condition of steel structure foundations below the ground-line. Investigation will include a measure of soil resistivity, pH, Redox & Half Cell Measurement as well as a visual assessment with photographic evidence of each excavated foundation leg. The results will validate data from models, inform (preventive) maintenance and repair decisions, and inform locations most requiring of cathodic protection.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Long term, PG&E will evaluate potential steel structure failure modes through inspection, maintain structures with life-extension methods such as cathodic protection and tower coating, and replace steel structures at a sustainable rate. There are current pilots underway to expand some of the failure mode identification and life extension methods. Successful completion or additional research will be conducted until proven methods can be integrated into the lifecycle management of the assets, system-wide as needed based on risk priority.

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7.3.3.16 Undergrounding of Electric Lines and/or Equipment

WSD Initiative Definition: *Actions taken to convert overhead electric lines and/or equipment to underground electric lines and/or equipment (i.e., located underground and in accordance with GO 128).*

1) Risk to be mitigated / problem to be addressed:

Undergrounding electric lines and facilities can significantly reduce wildfire risk by eliminating overhead lines which may be prone to wires down events or otherwise prone to potential wildfire ignitions. The installation of underground facilities is considered among a suite of alternatives to mitigate wildfire risk in areas prone to tree failures. PG&E also considers secondary risks such as PSPS impacts, egress/ingress routes to support fire department response times and public safety, past fire history and effects on available fuels, current system condition, environmental risks to reconstruction activities, and general accessibility considerations to enhance employee safety when determining whether specific facilities should be undergrounded.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Undergrounding can be an effective means of addressing wildfire risk, but it is also time-consuming and costly. Thus, each location must be separately evaluated to determine if undergrounding is a prudent approach for mitigating wildfire risk. PG&E does not, for wildfire mitigation purposes, have a stand-alone targeted program to relocate overhead facilities to underground.[5] Instead, PG&E relocates existing high risk overhead medium voltage lines to underground as part of our System Hardening Program. When considering an underground alternative, it is essential to consider risk reduction from undergrounding as well as all execution risks and costs. Execution risks include accessibility, rights-of-way, public utility easements, private property crossings, the number of services, space for necessary subsurface and pad-mounted equipment, environmental restrictions such as naturally occurring asbestos or endangered species, Archeology and Historic Preservation, soil remediation, and soil conditions.

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5 PG&E has an undergrounding program under Rule 20A, but that program is not related to wildfire mitigation.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

The location and prioritization of undergrounding is addressed in the discussion of PG&E's System Hardening Program in Section 7.3.3.17.1

4) Progress on initiative (amount spent, regions covered) and plans for next year:

The progress on undergrounding and plans for 2021 is addressed in the discussion of PG&E's System Hardening Program in Section 7.3.3.17.1

5) Future improvements to initiative:

Future improvements related to undergrounding are addressed in the discussion of PG&E's System Hardening Program in Section 7.3.3.17.1

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

As stated above, please reference Section 7.3.3.17.1 for more information on future improvements for this initiative.

7.3.3.17 Updates to Grid Topology to Minimize Risk of Ignition in HFTDs

WSD Initiative Definition: *Changes in the plan, installation, construction, removal, and/or undergrounding to minimize the risk of ignition due to the design, location, or configuration of utility electric equipment in HFTDs.*

For this initiative, PG&E has several sub-initiatives including:

- 7.3.3.17.1: System Hardening – Distribution;
- 7.3.3.17.2: System Hardening – Transmission;
- 7.3.3.17.3: Non-Exempt Surge Arrestor Replacement Program;
- 7.3.3.17.4: Rapid Earth Fault Current Limiter;
- 7.3.3.17.5: Remote Grid; and
- 7.3.3.17.6: Butte County Rebuild Program.

7.3.3.17.1 System Hardening – Distribution

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative*

In addition to describing PG&E's sub-initiative for our System Hardening Program for electric distribution, this section also provides responses to the following Action Items: Action PGE-3 (Class B), PGE-9 (Class-B), PGE-10 (Class B), PGE-32 (Class B), PGE-35 (Class B), and PGE-36 (Class B).

1) Risk to be mitigated / problem to be addressed:

PG&E's System Hardening Program focuses on the mitigation of potential catastrophic wildfire risk caused by distribution overhead assets. This program targets the highest wildfire risk miles and applies various mitigations such as line removal, conversion from overhead to underground, application of remote grid alternatives, mitigation of exposure through relocation of overhead facilities, and in-place overhead system hardening. The highest wildfire risk miles are separated into three categories:

1. The top 20 percent of circuit segments as defined by PG&E's 2021 Wildfire Distribution Risk Model for System Hardening;

2. Fire rebuild areas; and

3. PSPS mitigation projects.

PG&E also considers secondary risks and benefits as part of the System Hardening Program effort such as PSPS impacts, egress/ingress routes to support fire department response times and public safety, past fire history and effects on available fuels, current system condition, environmental risks to reconstruction activities, and general accessibility considerations to enhance employee safety.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Distribution overhead assets represent high ignition risk due to a combination of a high exposure area (overhead assets traversing HFTD areas) and proximity to risk factors such as vegetation. For utility equipment, estimated distribution-related ignitions per circuit mile are 1.6 times that of transmission-related ignitions. For vegetation drivers, estimated distribution ignitions per mile are up to 6x greater than for transmission circuits. Table PG&E-7.3.3-6 below illustrates the CPUC reportable ignitions from 2015 to September 2020 broken down into major contributing causes in Distribution and Transmission systems.

TABLE PG&E-7.3.3-6: CPUC REPORTABLE IGNITIONS AND ESTIMATED IGNITIONS PER 1,000 CIRCUIT MILES

	2015 - 2020 YTD[1] CPUC Reportable Ignitions in HFTD		Estimated Ignitions per 1,000 Circuit Miles in HFTD[2]	
Initiating Cause	Distribution	Transmission	Distribution	Transmission
Equipment – PG&E	217	30	8.5	5.4
Vegetation	305	11	11.9	2.0
All Other[3]	195	34	7.6	6.1

1. YTD represents data as of the end of September 2020.
2. Circuit mileage in HFTD areas source: 2020 Wildfire Safety Plan – 25,598 of distribution overhead mileage in HFTD areas, 5,542 of transmission overhead mileage.
3. Other includes ignitions primarily driven by 3rd Party and Animal.

PG&E's System Hardening Program is an important initiative that can reduce wildfire ignitions caused by distribution facilities. The System Hardening Program targets the highest wildfire risk miles as identified by PG&E's 2021 Wildfire Distribution Risk Model for system hardening (the 2021 Wildfire Distribution Risk Model is explained in further detail in Section 4.5.1), and also targets overhead structures impacted directly by wildfires, and those areas most impacted by PSPS. There are several ways that locations are identified for system hardening including:

- Identifying circuit segments with the highest wildfire risk using the 2021 Wildfire Distribution Risk Model;
- Locations where past events have identified deteriorated overhead conductor;
- Electric Corrective Optimization Program (ECOP), where a number of identified corrective repair tags on a single segment of line indicate that hardening the line may be more prudent than repairing each tag individually;
- Projects to mitigate the need for PSPS in a certain area;
- Fire damaged line sections requiring rebuild; and
- Idle facilities or other line removal opportunities.

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3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

As discussed above, the System Hardening Program identifies locations to perform this work based primarily on PG&E's 2021 Wildfire Distribution Risk Model for system hardening. Projects are prioritized at the circuit segments level, as opposed to regional or full circuit. In addition to the highest priority segments based on the risk model, projects are also included in the system hardening portfolio when needed to address overhead structures damaged directly by wildfires (described in subsection (e) below) and those areas most impacted by PSPS. The following mitigation options (subsections (a)-(c)) are considered for each circuit segment when developing a System Hardening Program project. Those options are evaluated through PG&E's process to consider system hardening alternatives (subsection (d)). Finally, this section also describes PG&E's consideration of Buffer Zones in system hardening (subsection (e)).

(a) Line Removal and Remote Grid

Complete removal of an existing overhead distribution line will also completely eliminate the fire risk associated with that line and is therefore explored for every identified system hardening project. A line removal mitigation can be applied in various ways. The simple application of this mitigation alternative is for known or suspected idle facilities, that are not currently, actively serving customer load. PG&E follows the procedures and requirements in Utility Procedure: TD-2459P-01 "Idle Facility Program" to investigate potential idle facilities and determine if they can be permanently removed. Another line removal alternative is the rearrangement or re-alignment of the existing circuit path. PG&E reviews the targeted circuit segment for redundant distribution ties through high risk areas. It may be possible that removal of certain circuit segments would have little impact on operational flexibility and provide the most cost-effective measure to reduce wildfire risk. Finally, a future removal opportunity lies with the application of the Remote Grid alternative discussed in Section 7.3.3.17.5 below.

(b) Relocation of Overhead to Underground

PG&E will relocate existing high-risk overhead distribution lines to underground as part of this mitigation. When considering an underground alternative, it is essential that all execution risks are considered to provide an accurate cost projection for the installation and lifetime of the asset. Among the cost risks to installing underground assets are: accessibility, rights-of-way, public utility easements, private property crossings, the number of services, space for necessary subsurface and pad-mounted equipment, environmental restrictions such as naturally occurring asbestos or endangered species, Archeology and Historic Preservation, soil remediation, and soil conditions to name a few.

PG&E has found that there are many impediments to underground

construction that limit its viability to be a cost-effective mitigation alternative when compared directly to overhead system hardening. The teams responsible for scoping this work also take tree density and strike potential trees into consideration as well as ingress/egress risks as some of the primary drivers for choosing an underground alternative.

Another impediment to this alternative is its schedule risks. A typical overhead hardening project can advance from idea to execution, documentation, and close out in 13-16 months. Whereas an underground project can often take 18-45 months depending on the various risks presented. The most impactful driver in many cases is land rights. Most of our systems in the high-risk areas have existing overhead rights only and require the acquisition of new underground easements to complete the relocation. As PG&E is often unable to construct underground in the exact same path as the overhead, these easements are often required with customers and/or agencies without current agreements. This land rights acquisition process alone can take 6-18 months and requires the project to be at a fairly mature design stage prior to contacting property owners about the needed rights.

The final consideration, for PSPS mitigation, is that underground construction presents the most reliable method for mitigating the need for PSPS operations. There will be occasions that undergrounding is chosen even when it does not present the best Risk Spend Efficiency (RSE) of the hardening options because it is the most reasonable alternative to mitigate all risks considered.

(c) Overhead Hardening

The most frequently used method for system hardening is overhead hardening in place. Overhead system hardening can be done more quickly than that of many other alternatives through the use of existing rights and easements. After analyzing projected performance of overhead hardened facilities on more than 4,600 outage types, it is projected that overhead system hardening will reduce 62 percent of the distribution overhead asset ignitions from either equipment failures or due to external contact such as vegetation. This alternative has a higher RSE when compared to the undergrounding alternative in many scenarios. Overhead system hardening achieves risk reduction through these foundational elements:

- **Primary and secondary covered conductor replacement**

  Replacement of bare overhead primary (high voltage) conductor and associated framing with conductor insulated with abrasion-resistant polyethylene coatings (sometimes referred to as covered conductor or tree wire) can be an effective mitigation of wildfire ignitions on distribution lines. Installing covered conductor can help reduce the likelihood of faults due to line to line contacts, tree-branch contacts, and faults caused by animals. Installing covered conductor on secondary lines has similar benefits to installing it on primary lines.

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- **Pole Replacements**

  All existing poles are evaluated for the strength requirements to withstand the new heavier covered conductor. Often the majority or all poles on a circuit segment will need to be replaced to support the new, heavier covered conductor and associated equipment. When poles need to be replaced, PG&E has tested and confirmed that composite poles and intumescent wrapped poles have increased fire damage resiliency to reduce the risk of a pole failure during a wildfire.

- **Replacement of Non-Exempt Equipment**

  Replacement of existing primary line equipment such as fuses/cutouts, and switches with equipment that has been certified by CAL FIRE as low fire risk is another component of our System Hardening Program. This replacement work eliminates overhead line equipment and devices that may generate exposed electrical arcs, sparks or hot material during their operation.

- **Replacement of Overhead Distribution Line Transformers**

  Upgrading transformers to those that contain "FR3" dielectric fluid as part of PG&E's current equipment standards (PG&E implemented the transition from mineral oil to FR3 in 2014) can also be an effective wildfire ignition mitigation. Newer transformers are filled with fire resistant "FR3" insulating fluid, a natural ester derived from renewable vegetable oils—providing improved fire safety, transformer life, increased load capability, and environmental benefits. In addition, new transformers are manufactured to achieve higher Department of Energy electrical efficiency standards.

- **Framing and Animal Protection Upgrades**

  Replacing crossarms with composite arms, wrapping jumpers, and installing animal protection upgrades to reduce contacts and pole related ignition risks.

- **Vegetation Clearing**

  Vegetation is a critical component of the System Hardening Program. In order to access our facilities to execute a project, it often requires significant undergrowth clearing which removes vegetation on the ground directly beneath the lines. In addition, some of the previously mentioned components of a system hardening project require additional clearance space to execute. Regulatory requirements mandate 4 feet of clearance all year long, so that if there is a change to a line's profile, including using taller poles or wider cross-arms, the vegetation must be cleared to be consistent with any changes and provide the required clearing for new overhead lines.

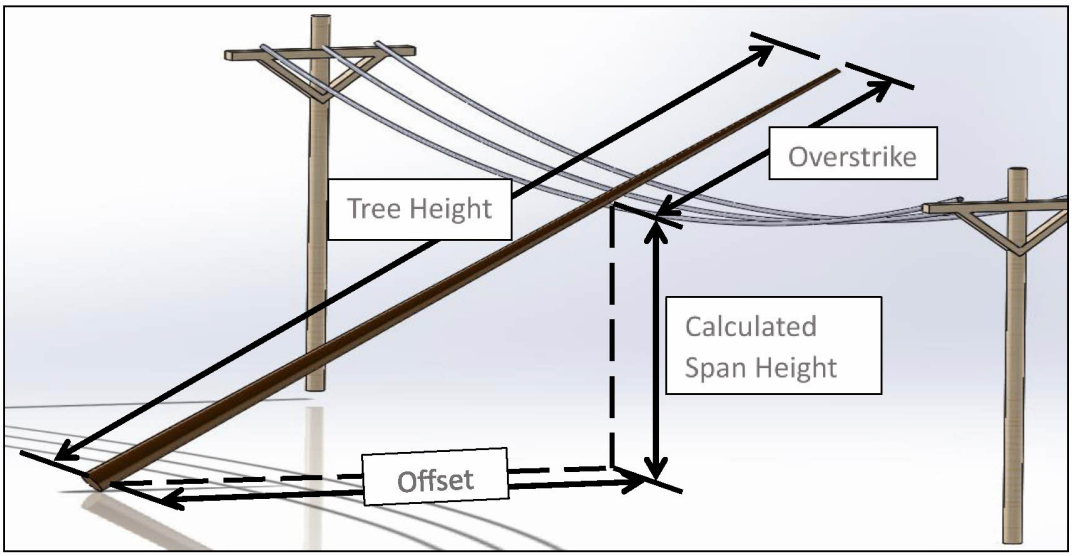
(d) System Hardening Process – Alternatives Consideration and Final Design

Once a circuit segment is targeted for system hardening, a project is launched for a segment that is no larger than 10-miles long. PG&E's Distribution Planning Engineers develop three primary alternatives for construction: (1) all overhead; (2) all underground; and (3) a hybrid alternative utilizing the specific hardening alternative thought to be the best fit for each section in the project. Line removal options are also considered during this scoping phase and, if feasible, thoroughly evaluated as generally the fastest and lowest-cost approach.

The system hardening project design options are brought to a scoping desktop review team made up of various experts to discuss and analyze additional risks such as tree strike potential, ingress and egress, localized fuel types and past fire history, land constraints, environmental risks, PSPS impacts, and general constructability concerns.

The tree strike potential factor is analyzed by PG&E's Applied Technical Services team. LiDAR data processing extracts pole, span, and fall-in tree geospatial information. This data is processed into an excel spreadsheet to determine Tree-span-pole associations. The tree strike threat is calculated as the number of fall-in trees in each span that can touch the line. A "fall-in tree" is simply a tree that is tall enough to potentially strike the span regardless of wind direction (i.e., when there is a non-zero overstrike, as shown in the figure below). Figure PG&E-7.3.3-3 shows an example of the overstrike assumptions used to calculate this risk.

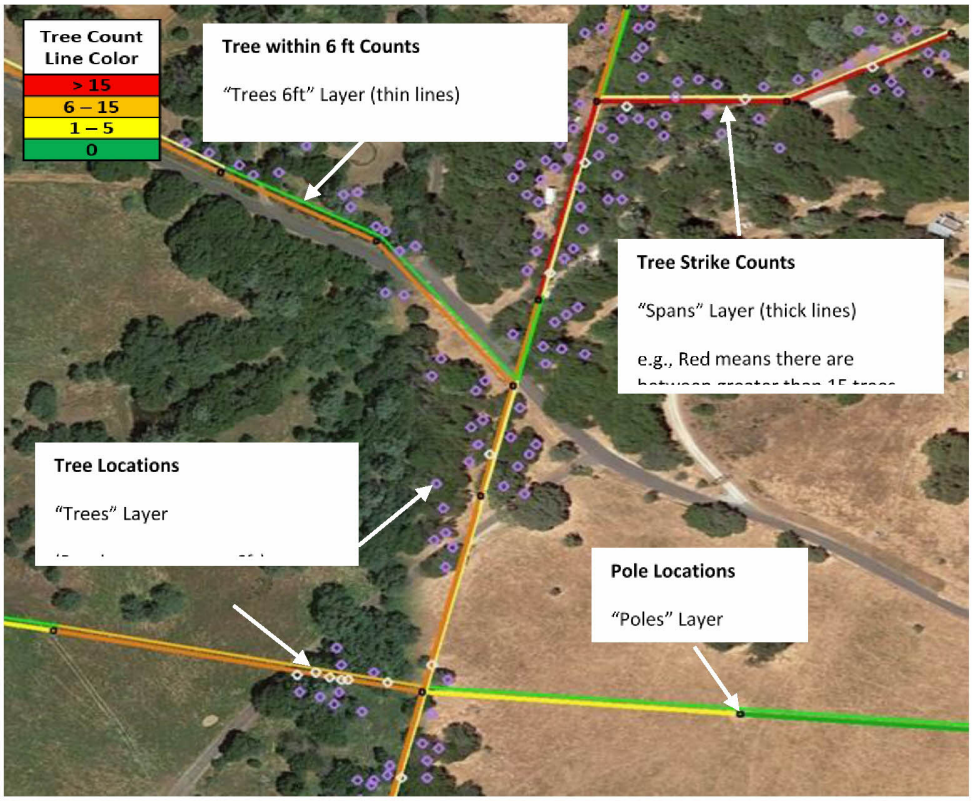
FIGURE PG&E-7.3.3-3: OVERSTRIKE ASSUMPTIONS USED TO CALCULATE RISK



Spans are then ranked based on the number of fall-in trees in each span. The results are outputted to Google Earth for visualization. The lines are color coded to represent the number of fall-in trees that can touch the line: Red for greater than 15, Orange for 6 to 15, Yellow for 1-5, and green for 0.

Figure PG&E-7.3.3-4 below is an example of the tree count and color coding for a potential system hardening project. Cost and constructability are key considerations in which the final mitigation alternative is chosen, but it is important to know and assess this tree fall-in potential risk as it is the largest single remaining risk to an overhead line that has been hardened.

FIGURE PG&E-7.3.3-4: TREE COUNT AND COLOR CODING FOR POTENTIAL SYSTEM HARDENING



Ingress, egress, fuel types and past fire history is also determined and provided by PG&E's Public Safety Specialist (PSS) to the field scoping desktop meeting. The PSS team are PG&E's field fire risk experts, many of them with significant first responder experience (often decades), that help inform PG&E's decision-making process. They analyze the area with a fire fighters' mindset to better understand the fuel types in the area, the historical fires, and the main egress and ingress routes. These experts are invaluable in providing analysis and first-hand experience in these areas, often working with local fire officials to understand the risks and available mitigations. Within the field scoping desktop meeting, it is often recommended to protect main egress routes through undergrounding, relocation or fire resilient poles. Areas where an ignition may be hard to spot are often areas a relocation may be chosen to ensure response times for local first responders are minimized.

The execution of these projects is very challenging with the various environmental and other conditions found in high fire risk areas. Land and environmental specialists analyze the alternatives provided prior to the desktop meeting and Google Earth images are provided to aid in the

analysis. Where significant environmental risks, water features, endangered species and habitats, known cultural areas, and local agencies required for the new rights are identified, appropriate scope, schedule, and cost impacts are discussed to aid in the decision making.

Projected PSPS impacts are also analyzed by meteorology team and provided to the project scoping team to aid in the understanding of past potential frequency and customer impact. In areas where greater than an average of one PSPS event per year has been modeled, or greater than 5,000 customer meters are projected to be impacted, the design alternative for undergrounding is strongly recommended due to the potential PSPS mitigation benefits. This benefit can still be difficult to capture in all cases due to the radial (i.e. "one-way") nature of the majority of PG&E's distribution system. If lines that are targeted for hardening are undergrounded, but the source of electricity is still coming from overhead lines that are likely to be de-energized, the PSPS savings may not be realized until significantly more work is done.

Utilizing all of this information, the field scoping team will review the design alternatives provided, make changes as necessary, and provide a final field scope document to the estimating team. An estimator then performs a field check to analyze the assumptions made during the field scoping desktop meeting to confirm viability of the constructability and execution risks associated with the mitigations chosen.

Once the design alternatives have been vetted to this level, a final economic analysis is performed creating net present values for the lifetime costs of each design approach, including long-term maintenance needs and costs including annual vegetation management, inspections, etc. A final recommendation and associated documentation is then submitted to PG&E's Wildfire Risk Governance Steering Committee (WRGSC) to review the project scope, risk spend efficiency and related analysis. The WRGSC provides guidance and approval for the projects that the System Hardening Program should execute upon and the mitigation action to be taken on each project. Once approved, these projects are scheduled for final design, permitting, and execution.

(e) Urgent Fire Rebuild Targeted for System Hardening

During PG&E's emergency response to a wildfire that has damaged our overhead or underground assets, several alternatives may be considered when restoring services to customers. The following guidance has been provided to the Grid Design Engineers, estimators, and assessment leads when choosing the best rebuild alternative tailored to the needs of the area. These alternatives are provided in the order of consideration for each segment and circuit for evaluation:

- **Removal** – Radial tap lines that are identified as Idle Facilities or circuit back-ties that are not required by our design standards for operational flexibility should not be rebuilt or be removed;

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- **Remote Grid or Customer Self-Provided Standalone Power System (SPS)** – Isolated customer(s) in Tier 2/3 HFTD areas fed by >0.5 miles of distribution line that, if removed or not rebuilt, could be served remotely through temporary generation solutions until a permanent SPS is installed;

- **Underground** – Distribution primary conductor in an accessible area with adequate space and rights to facilitate underground infrastructure. Questions to evaluate this option include: Are gas facilities candidates to participate in the trench? Telecoms? Temporary generation may be required to support immediate customer restoration while the underground planning and construction project progresses;

- **Overhead Harden in a Different Location** – Distribution primary conductor through rural, heavily wooded, or inaccessible terrain should be evaluated for relocation to a road or more accessible location. Temporary generation would be required to support immediate customer restoration while the planning and construction project progresses;

- **Overhead Harden in Place** – This solution is appropriate for primary distribution overhead conductor in Tier 2/3 HFTD areas where >4 spans require full reconstruction or large sections of intermittent damage (generally greater than 50 percent of the segment) requires rebuild. These lines often represent mainline or major customer lines that cannot be effectively generated or switched to alternate sources of power and serve large sections of customers/critical facilities;

- **Restore in place** when intermittent damage is found without significant rebuild required; and

- **All of the Above** – some combination of all of the above depending on the circumstances for a given circuit.

Once an entire segment has been assessed, the Grid Design Engineer works closely with the Estimating team to document the damage notifications into a Google Earth image to clearly identify the damage found on the distribution assets. Then routes are determined, and initial recommendations are made for protection, switches and wire size. These designs are sent to estimating to discuss with the incident commander at base camp, to distribution planning for fuse sizes and protection settings, and to land and environmental to begin the process of easement acquisitions and dependency clearing. In some cases, more time dependent alternatives must be rejected in favor of quicker mitigations to support customers by quickly restoring service to a community, for example when local, temporary generation until new assets can be constructed is not practical. The incident commander at the assigned base camps has final authority to ensure the customer needs are being met.

(f) Buffer Zones

In addition to work performed in HFTD areas, PG&E may also perform system hardening into "Buffer Zones." Buffer Zones are areas immediately

adjacent to an HFTD area. Because a specific distribution line may continue from an HFTD area into a Buffer Zone, hardening the line may include both hardening the HFTD area portions of the line as well as portions of a line in the Buffer Zone.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2019, based on prioritization derived from the 2019-2029 Wildfire Risk Model, the System Hardening Program began with a target of completing 150 miles of hardened facilities. Much of this targeted work was overhead hardened facilities, though there was also undergrounding, and removal included in this target. In total, 171 miles were hardened by the end of 2019. This included targeted hardening work, idle facility removals, fire rebuild miles and hardened facilities associated with New Business and Capacity projects. As the first year of the program 2019 also featured the development of many key processes such as establishing a clearly defined field scoping document and process, the development of ECOP for evaluating sections with a number of identified corrective tags, the beginning stages of the finite element analysis for tree strikes, and building execution capacity to support annually increasing the target.

In 2020, the System Hardening Program established a 220-mile target to harden overhead facilities within the highest fire risk miles based on 2019-2029 Wildfire Risk Model. PG&E completed approximately 342 total miles, which includes approximately 194 miles hardened in HFTD areas during fire rebuild efforts and another 21 miles undergrounded through the Butte rebuild effort described in Section 7.3.3.17.6. The unprecedent wildfires in 2020 and the damage to PG&E led to the development of a more standardized fire rebuild process, which allowed PG&E to complete nearly 200 miles of hardened fire rebuild in the last four months of 2020.

In addition to the system hardening work completed, in 2020, PG&E further built on our 2019 execution progress by developing a standard tree strike analysis utilizing LiDAR data for facilities and tree locations. PG&E standardized the use of wood poles with an intumescent wrap to increase fire resiliency of hardened lines and supplement the supply limitations and design challenges associated with composite poles. Project strategies were refined to better coordinate permitting, easements, vegetation clearing, and other dependencies in advance of construction.

For 2021, PG&E has switched over from REAX to Technosylva as our Wildfire Consequence Modelling tool. The Wildfire Consequence Model was incorporated into PG&E's 2021 Wildfire Distribution Risk Model. This change and other associated improvements in our modeling, data, and understanding of fire risk, has led to a shift in thinking about where to target system hardening resources. PG&E's 2021 Wildfire Distribution

Risk Model resulted in a significant change for PG&E in the targeting of where work would be directed to continue to harden the highest wildfire risk miles.

As mentioned earlier in this section, highest wildfire risk miles are separated into three categories:

1. The top 20 percent of circuit segments as defined by PG&E's 2021 Wildfire Distribution Risk Model for System Hardening;

2. Fire rebuild miles; and

3. PSPS mitigation miles.

PG&E is targeting 180 miles in 2021. In particular, PG&E is targeting that 80 percent of these miles be highest risk miles (one of those three categories above) and 10 percent must be performed through undergrounding or asset removal over the 3-year period from 2021-2023.

While this 2021 target of 180 miles does represent a drop from the 2020 mileage target, this is as a result of the previously referenced improvement in modeling and significant pivot in targeting. PG&E needed to change course, stop previously selected projects and start different projects that are in alignment with our updated risk model. More importantly, the 180 miles targeted in 2021 represent a greater risk reduction value than if we had continued on the previously planned work plan and executed approximately 300 miles in 2021. Under the new risk model the 301 miles of potential system hardening work originally planned for 2021 equated to 125 risk units in PG&E's multi-attribute value function (MAVF) calculation. The 180 miles now targeted for completion in 2021 are worth 198 risk units, a 58% increase in quantifiable risk reduction even though the mileage number is reduced. With the significant pivot in the program this target for 2021 is still aggressive because the cycle time for a system hardening project generally exceeds 12 months, as of late January PG&E is moving aggressively to design and execute the 2021 plan as 60 percent of the planned work is still in first project phase (scoping).

5) Future improvements to initiative:

Although we will be hardening fewer miles in 2021 than previously targeted, PG&E will use this year to rebuild our pipeline of projects in alignment with the new risk model that are identified, vetted, designed and permitted for future construction. In doing so, the pace of system hardening will increase substantially in 2022 and going forward to between 450 to 500 miles per year. Even with the shift in the risk model PG&E anticipates generally aligning with previously outlined system hardening goals for the three-year WMP timeframe (2020-2022). In the 2020 General Rate Case (GRC), PG&E targeted 1,021 miles of system

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hardening for this period and our updated WMP plan forecasts completing 992 miles[6], within 3% of the original, GRC plan.

In addition to increasing the pace of system hardening work in upcoming years, as PG&E continues to develop our risk models (as described in more detail in Section 4.5.1), we will be able to incorporate more data sets, make further programmatic refinements and better scope and target our System Hardening Program. We will be analyzing hardened facilities performance with regard to actual outages, incidents and ignitions so that we can continue to refine our strategy and improve the scope of the System Hardening Program. Performance of hardened facilities that experience a wildfire will also continue to validate assumptions on life expectancy and effectiveness of hardened facilities (like wrapped poles) in various conditions. In addition, improvements in protection schemes—such as Rapid Earth Fault Current Limiters (REFCL)—may allow for a reduced level of work required to make safe a line in a high-risk area. Finally, we will seek closer alignment of our system hardening efforts with PSPS mitigation opportunities.

ACTION PGE-25 (Class B)

1) *Integrate discussion on long-term planning within the respective section of each individual initiative.*

Response:

As mentioned above, we will focus on enhancing our risk models and hardened facilities performance analysis to ensure that hardening for at-risk infrastructure is consistent with evolving risk prioritization and strategies. For 2024 and beyond, we are targeting to complete between 450 and 500 miles per year of system hardening. These efforts will also be aligned with PSPS mitigation strategies to maximize the total reduction in wildfire risk.

ACTION PGE-3 (Class B)

1) *Explain why only hardening efforts are identified within a higher risk tranche as a solution for the 7,100 miles scoped for system hardening, and no other initiatives are viable as a solution;*

2) *Define what hardening consists of in regard to the 7,100 miles identified to be hardened;*

3) *Provide the supporting materials and calculations showing that assets in the 7,100 is 2.75 more likely to fail, including all conclusions as to the reason why the failure rate is higher;*

4) *The location of the 7,100 miles; and*

5) *The explanation of the overlap and increase for these 7,100 and the*

[6] 2020 actual: 342 miles, 2021 target: 180 miles, 2022 target:470 miles = 992 from 2020-2022.

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5,500 discussed in PGE-5 identified for hardening.

Response:

PG&E is no longer targeting a specific set of miles such as the 7,100 miles or 5,500 miles referenced in the previous WMP. This strategy relies on a stagnant or non-changing risk model and assumes a specific risk reduction from that base value. As PG&E continues to study and enhance the risk model, this value will shift and change. PG&E will continue to harden at-risk infrastructure consistent with the evolving risk prioritization and strategies. For 2021-2023, the target is to harden 1,120 of the highest risk miles as described in Section 7.3.3.17.1. For 2024 and beyond, PG&E is targeting between 450 and 500 miles per year.

1) PG&E is not restricting other mitigation measures from being applied as a short-term wildfire risk mitigation to the highest risk miles. System hardening is a more complete measure as well as a long-term improvement initiative that will take some time to complete. Therefore, it is necessary to consider many other initiatives as part of our risk mitigation efforts both prior to and as part of a system hardening project.

2) A system hardening project can consist of multiple initiatives including but not limited to covered conductor installation, undergrounding, remote grid, PSPS mitigation through undergrounding, non-exempt fuse and surge arrestor replacement and line removal.

3) The calculations that show that the 7,100 miles are approximately 2.75 times more likely to fail are attached (see Attachment 2021WMP_ClassB_Action-PGE-3_Atch01). To get to that result, all probabilities of failure were added for the two groups: (1) targeted miles (i.e., 7,100), and (2) the rest of miles (18,300). Subsequently the sum of these probabilities was normalized per mile which resulted in two numbers that represent the expected failure probability per mile of Distribution lines in HFTD for each group. Lastly, to compare these two numbers, they were divided and the result shows that failure rate per mile of Distribution line in HFTD is approximately 2.75 times higher for the system hardening target miles than for those outside the scope of system hardening at the time. See cell U6:W8 for actual calculations in the attached workbook.

   Regarding the reasons why, the failure rate was higher for certain portions of the distribution system. As previously described in Condition PGE-7, the sub-model #1 for likelihood of failure processed 20 different input variables using a logistic regression algorithm. The results of this sub-model generate a likelihood of failure for a specific circuit segment. The results were later validated with the proper SMEs to corroborate that the areas showing higher failure rates match their knowledge of the system. While the reasons might vary depending on each individual segment of the distribution system being evaluated, typical conclusions that can be deducted from the model were that sections in certain environments, with higher vegetation density, higher frequency of outages, certain materials of construction, higher number of overhead miles in HFTD areas, or a combination of the aforementioned, were more significant in predicting a higher failure rate.

It is worth noting that the results and calculations were objectively reasonable based on the 2018-19 Wildfire Risk Model results, however, PG&E anticipates a change if a similar calculation was to be conducted today given the improvements reflected in the 2021 Wildfire Distribution Risk Model described in Section 4.5.1.

4) Through the improvement of PG&E's risk model as described in Section 4.5.1, the location of the highest risk miles has shifted and the geographic representation of the 7,100 miles as requested is not representative of the current direction of the System Hardening Program.

5) There is not increase from 5,500 to 7,100 miles. As stated in Condition PGE-5, the 5,500 miles was just an observation from the model. The observation captured the fact that the results showed that 95 percent of the wildfire risk prioritization of system hardening was in 22 percent of the distribution line miles. The 5,500 miles was not meant to represent the scope of the System Hardening Program. It should be noted, however, that the 5,500 miles were part of the 7,100 miles identified for hardening at the time.

ACTION PGE-9 (Class B)

1) Provide details on the System Hardening Hybrid Program, particularly when comparing it to covered conductor and the standard system hardening projects discussed within the WMP;

2) When comparing the system hardening hybrid to standard hardening, provide the risk reduction per mile implemented;

3) Provide the locations in which the system hardening hybrid has been deployed and piloted, including an explanation of the rationale and any supporting calculations to determine the use of the hybrid over standard hardening approach in those areas; and

4) Provide the locations in which the system hardening hybrid is planned to be deployed, including an explanation of the rationale and any supporting calculations to determine the use of the hybrid over standard hardening approach in those areas.

Response:

The System Hardening Hybrid Program was being considered as an alternative program in 2020 to help target specific areas of risk for hardening while completing other low impact work to complete in lower risk sections. Specifically, PG&E would target installing covered conductor in areas where tree exposure exists in high risk zones identified by risk modeling and would leave bare conductor in areas with zero tree strike, branch fall, or branch/bark/frond blow in risk. This alternative has not been deployed and we have no plans to implement the System Hardening Hybrid Program at this time. PG&E is focused on reducing risk more fully with an emphasis on alternatives such as undergrounding. It is not believed that the Hybrid alternative addresses enough risk to pursue at this time.

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ACTION PGE-10 (Class B)

1) *Provide details on the Wildfire Targeted System Upgrades, particularly when comparing it to covered conductor and other system hardening projects discussed within the WMP*

2) *When comparing the Wildfire Targeted System Upgrades to covered conductor, provide the risk reduction per mile implemented*

3) *Provide the locations in which Wildfire Targeted System Upgrades have been deployed and piloted, including an explanation as to the reasoning and any supporting calculations to determine the use of upgrades in those areas*

4) *Provide the locations in which the upgrades are planned to be deployed, including an explanation as to the reasoning and any supporting calculations to determine the use of upgrades in those areas.*

Response:

The Wildfire Targeted System Upgrades Program was being considered as an alternative program in 2020 to target low-impact risk reduction alternatives in areas with zero tree strike, branch fall, or branch/bark/frond blow in risk. This would include animal protection, re-framing, pole loading calculations, and potentially spreader brackets to ensure mechanical separation between phase conductors. This would provide potentially a higher RSE mitigation in areas that are potentially high consequence risk yet low probability of failure. This alternative has not been deployed and we currently do not plan to implement the Wildfire Targeted System Upgrades Program. PG&E is focused on reducing risk more fully with an emphasis on alternatives such as undergrounding. It is not believed that the Wildfire Targeted System Upgrades alternative addresses enough risk to pursue at this time.

ACTION PGE-32 (Class B)

1) *Explain how the system hardening initiatives provided in this response are prioritized in comparison to one another.*

Response:

PG&E's process for comparing alternatives within the System Hardening Program is described in Section 7.3.3.17.1(d) above.

ACTION PGE-35 (Class B)

1) *Describe the reason behind the increase in RSE for system hardening between 2020-2022 and 2023-2026, and*

2) *Provide the calculations used to determine the RSEs for both date ranges.*

Response:

The RSE for System Hardening increases between 2023-2026 versus 2020-2022 for a number of reasons, most significantly:

Climate change increases the frequency of ignition and therefore the overall risk, hence the outer years (2023-2026) have higher risk reduction[7] by the deployment of this mitigation program.

In the 2020 RAMP Report, PG&E adjusted risk reduction and RSEs for a mitigation program considering a portfolio of mitigations.[8]

- Increased miles of investment in system hardening means a larger contribution to the overall portfolio risk reduction benefits, leading to higher allocation of portfolio risk reduction; and

- Other cross cutting programs have mitigation benefits that expire in the outer years.

For the details of the risk reduction contribution and allocation, please see Attachment 2021WMP_ClassB_Action-PGE-35_Atch01.

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7 Please refer PG&E's 2020 RAMP Report, Pages 10-17

8 As discussed in PG&E's post-RAMP filing workshop held on July 14, 2020 _ see Attachment "2021WMP_ClassB_Action-PGE-35_Atch02".

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7.3.3.17.2 System Hardening – Transmission

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative*

1) Risk to be mitigated / problem to be addressed:

The failure of overhead transmission assets can cause an ignition and create wildfire risk. To address this risk, PG&E has a number of programs designed to address the safety and health of our transmission system. In addition, aspects of the transmission system are upgraded or improved to reduce the impact of PSPS events from transmission facilities. PG&E's programs related to the hardening of the transmission system are described in more detail below.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PG&E does not have a single, specific System Hardening Program for our transmission assets. Rather, transmission related programs target the highest wildfire risk areas as identified primarily by PG&E's Operability Assessment (OA) Model, in conjunction with wildfire consequence and/or weather data. These programs have the effect of hardening PG&E's transmission system and mitigating ignition and wildfire risk.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Transmission line related programs are focused in HFTDs but some are also extended into non-HFTD areas. Efforts associated with these programs are prioritized based on review of OA Model results for asset health, historical performance, wildfire consequence, and PSPS likelihood.

PG&E's programs that are related to hardening the transmission system, including impact reduction of PSPS events, are described below.

(a) Line De-energization, Grounding and Removal

The target of this mitigation program is known or suspected idle facilities. PG&E follows the procedures and requirements in Utility Procedure: TD-1003P "Management of Idle Electric Transmission Line Facilities Procedure" to investigate potential idle facilities. When these facilities are identified and confirmed to be within an HFTD area with no operational needs, they are prioritized for de-energization, grounding, and/or removal. Grounding of an already de-energized line addresses residual wildfire risk of induction from nearby energized line(s), until conductor removal or repurposing of the facilities can occur.

(b) Transmission System Islanding and Temporary Substation Microgrid

In some high wildfire risk scenarios, such as PSPS events, transmission islanding schemes and temporary substation microgrid may be the used to mitigate wildfire risk and reduce customer impact. The islanding schemes (such as the Caribou Power House or Humboldt Bay Power Plant Islands) allow a local area of transmission lines and substations to stay energized via local generation, as the system's primary transmission line sources are de-energized for wildfire safety purposes. The temporary substation microgrid focuses on serving substations that have safe-to-energize load. Both of these mitigations allow for those at-risk lines to be de-energized for wildfire risk mitigation, while keeping customers energized.

c) Overhead Hardening, Inspections, and Maintenance

- **Pole Replacements:** PG&E implemented enhanced design criteria for replacing wood pole structures. Most transmission wood poles are replaced with steel (most commonly light duty steel poles (LDSP)) when warranted based on condition or system capacity needs. LDSP have greater phase-to-phase conductor separation and are designed to accommodate peak wind speeds. Steel structures are also less likely to ignite compared to wood poles and crossarms. LDSP also are designed to reduce bird contact incidents by eliminating the exposure between energized conductors and grounded down guys;

- **Animal Protection Upgrades:** Installation of animal protection upgrades such as bird diverters, crossarm shields, and insulated fiberglass link to reduce contacts and pole related ignition risks is another element of transmission line centric system hardening efforts;

- **Enhanced Inspections and Prioritized Maintenance:** Enhanced inspections are designed to capture condition information aligned with components that can pose an ignition risk. These inspections are performed more frequently in HFTD areas. In addition, inspection methods such as below-grade foundation inspection are being piloted to provide further information on ignition risk failure modes that may not be easily detectable through existing methods. Maintenance work identified through inspections are prioritized (see Section 7.3.3.12.3) based on wildfire risk, wildfire spread consequence and the deterioration mode of the condition found;

- **Sectionalizing Devices:** The addition of transmission line SCADA switches (*see* Section 7.3.3.8.2) provides operating flexibility for lines that traverse HFTD areas. These switches, typically installed at junctions and near substations, can help isolate customers and reduce PSPS impact. During other planned or unplanned line outages, the switches can also be used to reduce outages and shorten restoration time;

- **Asset Replacement:** Though not the sole project driver, asset replacements in HFTD areas help reduce wildfire risk by introducing new assets in place of degraded, out-of-standard, or aged equipment. For major transmission line components – structures, conductor, insulators, and switches, there are corresponding targeted replacement programs to address asset lifecycle and extent of condition concerns. For example, there are several conductor replacement projects for addressing obsolete or failure-prone conductor. In addition, assets may be replaced for compliance or system capacity requirements; and

- **Asset Life Extension:** For some assets not in the highest priority for asset replacements, maintenance programs such as tower coating (see Section 7.3.3.15) and cathodic protection are used to extend useful life of the asset. These programs reduce exposure of steel structures to corrosion, thus maintaining its strength and integrity. Another example of life extension pilot program is installation of buddy bushings in hanger plates, to provide additional support to cold-end hardware such as C-hooks. This fail-safe design is being evaluated for more extensive application.

d) Urgent Fire Rebuild Targeted for System Hardening

During PG&E's emergency response to damaged transmission facilities during the 2020 Lightning Complex wildfire, more robust designs were incorporated into the rebuilt efforts. In addition to hardening the lines upon rebuilding (e.g. replacing prior wood poles with steel), conductor was also replaced to ensure future needs of the circuit or assets are met.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2020, approximately 2,700 wood pole structures within HFTD areas were replaced with steel. Avian protection retrofits were installed on 78 structures, mostly on the Drum-Rio Oso 115 kV Lines, which had a high likelihood of bird incidents. Approximately 216 miles of transmission rights-of-way (ROW) were cleared within HFTD areas. Approximately 103 miles of conductor replacement was completed on lines traversing HFTD areas.

In 2021, approximately 1,500 wood pole structures within HFTD areas are expected to be replaced with steel. Avian protection retrofits are identified and addressed through maintenance notifications based on activities. The level of retrofit is expected to decrease as more wood poles are replaced with steel and insulated fiberglass links are installed on poles in HFTD areas. Approximately 200 miles of Transmission ROW expansion are planned within HFTD areas. Replacement of approximately 92 miles of conductor on lines traversing HFTD, including associated asset hardware, is planned to be in-service in 2021.

Other maintenance tags, sectionalizing devices, and tower coating progress is described in their respective sections.

In addition, asset health and risk models informing future planning of system hardening work will be updated. It is anticipated that enhancements such as digitized design data and refinements to the corrosion model will be integrated into the OA Model (see Section 4.5.1(h)) in 2021. The vegetation LiDAR Risk Score Model (see Section 7.3.5.8) will also continue to be validated and improved in 2021. Finally, in 2020, PG&E switched over from REAX to Technosylva, which PG&E has adopted for wildfire spread and consequence information. This data was incorporated with the OA Model in 2021 to provide another layer of risk information to existing workstreams.

5) Future improvements to initiative:

Continued development/maturity of asset risk models will help focus mitigations and key issues, leading to a better understanding of most effective inspection, repair, and replace decision making timelines based on asset design, environment, age, and performance and maintenance history. A new initiative is developing machine learning/artificial intelligence models to predict the presence of various asset threats, such as mechanical wear and corrosion.

The Transmission Overhead Asset Information Collection will search historic asset records, engineering drawings and other information to provide new, quality data fields into the system of record. This will provide better data to the various asset health and risk models, improving granularity and reducing the number of assumptions needed to be made around fields such as asset age.

Continued exploration of new technology for inspections and repair will close the gap on non-visual failure modes, as well as provide additional life extension techniques for medium-risk assets.

ACTION PGE-25 (Class B)

1) *Integrate discussion on long-term planning within the respective section of each individual initiative.*

Response:

PG&E is working towards a more granular and centrally accessible asset data in better inform various risk models. These predictive, probability and consequence, models will drive more refined risk-informed maintenance plans, repair prioritization and proactive replacements for all transmission line assets to minimize failure and ignition risk.

Based on maintenance condition assessment and wood pole testing, PG&E projects to replace approximately 56 percent (15,000 of the remaining 26,700) wood poles in the HFTD area with steel poles in the next ten years.

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Additionally, PG&E is working towards a steady, sustainable level of replacement for key assets such as structures, conductor, insulators and switches.

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7.3.3.17.3 Non-Exempt Surge Arrester Replacement Program

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative*

1) Risk to be mitigated / problem to be addressed:

The surge arrester sub-initiative is a program that replaces existing non-exempt surge arresters with exempt surge arresters, which have less propensity to cause a fire ignition. In addition, while it is performing replacements, PG&E separates transformer and surge arrester grounds at designated locations.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

The purpose of the non-exempt surge arrester replacement program is to remove ignition risks in HFTD areas and an ancillary benefit of this is to modernize the connections and equipment on the pole at these locations which may improve reliability. The replacement of non-exempt surge arresters with exempt surge arresters will reduce wildfire fire risk since exempt surge arresters are considered "non-expulsion" and do not generate arcs/sparks during normal operation.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

The surge arrester program is targeting replacement of non-exempt surge arresters in HFTD areas. PG&E will review lightning strike maps combined with the highest remaining work concentration areas to prioritize completion of surge arresters for 2021. Once HTFD areas are completed this program will be expanded to non-HFTD areas in throughout PG&E's service territory.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In the 2020 WMP, PG&E forecast replacing 8,850 surge arresters in Tier 2 and Tier 3 HFTD areas. The Surge Arrester Program replaced approximately 10,300 as of December 31, 2020. PG&E anticipates mitigating the remaining Tier 2 and Tier 3 non-exempt surge arresters by the end of 2021. Mitigating non-exempt surge arresters generally involves replacing non-exempt surge arrestors and installing grounds at subject locations. In some instances, surge arrestors have already been replaced under other projects, such as new business or fire resiliency projects. In these instances, the surge arrestor program considers these a "mitigated" location as well.

The surge arrestor program not only replaces non-exempt surge arrestors at each location, but also addresses deficient grounding at each location. The initial reason for the surge arrestor program was to provide separate grounds on poles where surge arrestors and transformers were co-located and shared a single ground. By separating the grounds, lightning strikes and other surges can now safely dissipate to their dedicated surge arrestor ground, while not affecting the separately grounded transformer co-located on the same pole.

The installation of grounds at some locations poses unique challenges, especially in heavily granite and lava cap areas in the Sierra and Cascade foothills. Large HFTD portions of the service territory where these surge arrestor mitigations are needed are located in this rocky soil. Geotechnical studies have been conducted, PG&E grounding Standards have been adjusted, and innovative excavation techniques have been incorporated to safely install these grounds. Unfortunately, multiple attempts and techniques are required to complete some of these ground installations.

Every attempt will be made to complete all of the remaining surge arrestor locations in HFTD in 2021. Even with advance geotechnical surveys, the ability to install grounds at some sites may not be known until crews begin excavating. At these locations rock-drilling or blasting may be required which may extend completion of these sites into 2022. Based on prior years success with these rock locations and the variability of terrain we will likely complete a range of 15,000 to 22,000 locations in 2021.

5) Future improvements to initiative:

Once existing non-exempt surge arrestors in HFTD areas are replaced, PG&E will then shift our focus to the system overall.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

This initiative is expected to end by 2023 and thus long-term planning is not applicable.

7.3.3.17.4 Rapid Earth Fault Current Limiter

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated / problem to be addressed:

A high impedance fault like a wire down or tree contact could remain undetected and become an ignition source. In addition, high impedance line to ground faults on distribution circuits are difficult to detect with traditional overcurrent protection. REFCLs are intended to address these risks.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

REFCL technology mitigates ignitions from line to ground faults such as wire down or tree contacts using technology called Ground Fault Neutralizer (GFN) that detects line to ground faults and limits the fault current below ignition thresholds.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E initiated a pilot project for REFCL technology in Calistoga based on wildfire risk in that area and historical line-ground outage events. The Calistoga substation and associated circuits (1101 and 1102) met the design criteria for the REFCL system that include 3-wire 12 kV with transformers connected line to line and charging current less than 100 amps.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

The Calistoga REFCL pilot project finished construction in 2020. The field installation involved replacing 15 line reclosers with advanced controllers, replacing 14 sets of line fuses with Fuse Saver devices that trip all three phases, updating all the distribution line voltage regulating devices, and installing 12 capacitive balancing units to balance the circuit capacitance necessary to tune the REFCL system and maintain sensitivity. The substation work included installing the GFN and Arc Suppression Coil with associated controls (Figure PG&E-7.3.3-5) along with upgrading the feeder relays and voltage regulators.

FIGURE PG&E-7.3.3-5: ARC SUPPRESSION COIL / GFN

PG&E plans to have the final results from this pilot project by September 2021. The system testing will involve stress testing the new and existing distribution equipment by energizing the GFN and adjusting the voltage to simulate a line to ground fault condition. The stress test will be followed by a series of fault test where a specialized test trailer will connect to an energized conductor and create an actual line to ground fault condition. During the live test, the actual line to ground current will be measured to ensure currents are below 0.5 amps (below ignition levels) and the GFN activates within the specified times for the conditions. The result of the pilot project will drive the longer-term REFCL strategy.

5) Future improvements to initiative:

Assuming the result of the pilot supports additional deployment, a long-term strategy will be developed to install REFCL in HFTD areas. The project team will identify improvements to design and materials. Future deployments will utilize PG&E's risk model tools to help drive deployment.

ACTION PGE-25 (Class B)

1) *Integrate discussion on long-term planning within the respective section of each individual initiative.*

Response:

A long-term plan will be developed after successful completion of the pilot and identifications of lessons learned in 2021.

7.3.3.17.5 Remote Grid

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

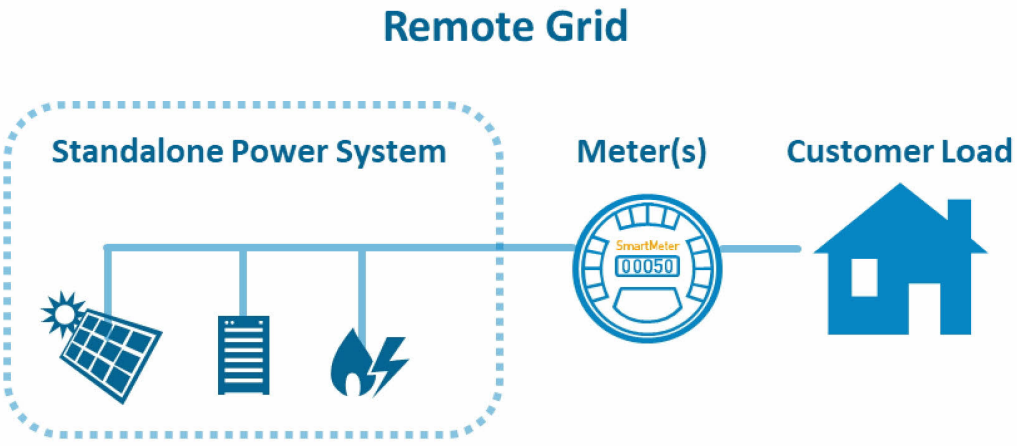
This section describes PG&E's Remote Grid initiative and provides a response to Action PGE-51 (Class B).

1) Risk to be mitigated / problem to be addressed:

Throughout PG&E's service territory, there are pockets of isolated small customer loads that are currently served via long electric distribution feeders. In certain circumstances, these feeders are overhead line construction that traverse HFTD areas and require significant annual maintenance and VM. If these long feeders were removed and the customers served from a local and decentralized energy source (i.e., a "Remote Grid"), the resulting reduction in overhead lines could reduce fire ignition risk as an alternative to or in conjunction with system hardening and other risk mitigations.

"Remote Grid" refers to relatively small, permanently islanded distribution facilities serving customers who are generally located on remote portions of PG&E's distribution system. The Remote Grid facilities include a SPS made up of local sources of electricity supply, such as solar PV generation, battery energy storage, and other distributed generation, as well as distribution and service facilities to connect customers to the SPS. Figure PG&E-7.3.3-6 below provides an example of the components of a Remote Grid.

FIGURE PG&E-7.3.3-6: DIAGRAM OF EXAMPLE COMPONENTS OF A REMOTE GRID



2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Remote Grid is a new concept for utility service using decentralized

energy sources for permanent energy supply to remote customers as an alternative to energy supply through hardened traditional utility infrastructure. The program leverages clean, emergent technologies such as solar-paired battery storage in a way that is intended to be cost-effective and/or more resilient relative to current distribution service delivery options. The objective of the Remote Grid sub-initiative is to develop and validate the Remote Grid concept as an alternative to other service arrangements and/or wildfire risk mitigation activities such as system hardening. Remote Grids that allow for the removal of lines in high wildfire risk areas could provide benefits to both the customers served by Remote Grids and to all distribution customers who will benefit from the cost-effective elimination of wildfire risks associated with distribution lines that run for significant distances through HFTD areas to serve a small number of remotely located customers. The elimination of these lines will serve two key objectives: (1) reducing the likelihood of fire ignition due to damage or failure of such lines; and (2) elimination or reduction of the cost to harden these lines and to conduct enhanced VM to mitigate the fire-related risks. In addition to acting as an alternative to conventional system hardening approaches for the hardest to reach customers at the end of distribution lines, Remote Grid could help to reduce wildfire risk and be a cost-effective solution for the rebuild of fire-damaged or destroyed infrastructure.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

Initial Remote Grid project locations were selected in order to validate a range of Remote Grid configurations while simultaneously providing immediate risk mitigation value at a reduced cost when compared to alternative risk mitigations. In 2019 and 2020, PG&E undertook an extensive review of all distribution feeders in Tier 2 and Tier 3 HFTD areas and developed a preliminary screening protocol, to identify potential Remote Grid projects where this alternative distribution method could deliver superior risk-spend efficiency and overall distribution cost reduction (including reduced capital costs). PG&E prioritized sites for detailed evaluation based on a combination of factors including:

- Located at the end of a radial distribution line;
- Consist of a small number and size of customer loads;
- Historically served by a long section of line;
- Preliminary feasibility assessment based on initial customer outreach and desktop screening for technical viability and constructability of a SPS';
- Potential cost savings: Remote Grid vs preferred alternative risk mitigation strategy (e.g., hardened overhead distribution or

underground conversation); and

- Risk ranking of line segment(s) to be eliminated or hardened.

From this list of preliminary screening results, PG&E has applied criteria including customer response, solar access (shading), civil constructability, and site accessibility to identify initial Remote Grid projects which are likely feasible for this early stage of Remote Grid deployment. PG&E believes initial sites can prove successful, both in terms of operational feasibility and in terms of delivering wildfire ignition risk reduction in a more cost-effective manner. Through initial projects, PG&E aims to develop the actual data needed to validate costs, performance, and customer acceptance of the Supplemental Provisions. Further validation is needed to increase the certainty of this portfolio and to identify the "total addressable market" for Remote Grid.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

PG&E has three (3) Remote Grid projects in the advanced stages of development which when completed will eliminate a total of 25.2 miles of overhead line (1.4 miles in HFTD areas and 23.8 miles in non-HFTD areas) by deploying SPS' at 5 locations to serve 10 customer meters. These initial projects are located in San Luis Obispo and Mariposa Counties. Note that the projects in San Luis Obispo County have been delayed due to unforeseen permitting delays due to presence of threatened species. PG&E plans to begin operations of the first Remote Grid project to serve customer load by the end of 2021.

Key accomplishments in 2020 toward validation and standardization of Remote Grids include:

- A detailed protocol was developed to identify and evaluate potential remote grid projects;

- Technical specifications have been iteratively refined through detailed design of the in-flight projects;

- Commercial availability of specialist vendor equipment and services has been verified at the preliminary level through a successful competitive solicitation for design and construction of a SPS;

- Assumptions about upfront capital costs and ongoing maintenance and operations expenses have found initial validation and refinement through a successful negotiation of a turnkey Purchase and Sale Agreement and a 10-year full-wrap Maintenance Agreement, forming a reusable template for future SPS procurements;

- The majority of customers engaged to date have voiced positive initial interest in pursuit of service conversion from overhead line to a Remote Grid;

- Terms of service have been drafted into a form of Supplemental Provisions to the Electric Rules, as a tariffed form agreement;

- The proposed form of Supplemental Provisions Agreement was filed with the CPUC in Advice 6017-E[9] on December 15, 2020; and

- Benchmarking with other utilities shows a point of validation in the advanced program now operational under Horizon Power in Western Australia.[10] In California, Liberty Utilities has procured its first SPS for a similar application.

In addition to the current projects, PG&E has identified and begun development on a portfolio of potential additional Remote Grid deployments designed to validate the viability of this new class of distribution asset. These projects are currently undergoing detailed scoping and feasibility assessment to verify customer interest, environmental requirements, solar access, civil constructability, and site accessibility. After initial assessment of feasibility, projects will move to the design, permitting and build phase which can take 9-12 months or more depending on specific site conditions. A number of site-specific conditions can reduce individual project feasibility or delay implementation. Examples include; customer acceptance, physical space constraints, shading and other constructability related considerations such as grading requirements and geological conditions, permitting challenges such as presence of threatened species, cultural heritage, or adjacency to scenic highway among others.

In 2021, PG&E will continue to mature the Remote Grid concept toward an eventual standard distribution grid configuration. Experience gained through the deployment and initial operation of the first Remote Grid projects will contribute to refinements in the deployment processes, design and performance standards, customer agreements and operational protocols for the end-to-end Remote Grid solution. PG&E expects to further validate the availability of viable commercial sourcing agreements via another round of competitive solicitations for SPS' and supporting services. In addition, PG&E is seeking CPUC approval of a Supplemental Provisions Agreement to extend and clarify how the existing rules and tariffs apply to a customer served by Remote Grid, and to make clear the roles, restrictions, and responsibilities of both PG&E and the customer.

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9 See AL 6017-E "Remote Grid SPS Supplemental Provisions Agreement": https://www.pge.com/tariffs/assets/pdf/adviceletter/ELEC_6017-E.pdf.

10 https://renewtheregions.com.au/projects/standalone-power-systems/.

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5) Future improvements to initiative:

In addition to potential Remote Grid facilities, PG&E is pursuing additional alternative configurations to eliminate the need to harden or rebuild overhead distribution lines in fire-prone areas. The alternative models include the option for PG&E to provide an incentive payment, tied to discontinuance of utility service, that would be sufficient to enable a customer to purchase and maintain its own SPS. If this option for self-provision proves preferable to a PG&E Remote Grid solution for some customers, then it could improve the portfolio reach of the Remote Grid Initiative by enabling broader customer agreement.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E has not determined a long-term plan yet for this initiative. Pending the success of initial Remote Grid projects, we will be evaluating the reduction in wildfire ignition risk and costs, engineering and execution feasibility, and overall service quality in order to determine the long-term path and program scalability. The long-term goal of the Remote Grid Initiative is to productize Remote Grids as standard offerings such that they can be considered alongside of or in lieu of other conventional service arrangements (including rebuild), and/or wildfire risk mitigation activities such as system hardening, particularly where such alternatives would represent significant costs and/or wildfire risk. Scaling up deployment of Remote Grids will involve creating design standards, developing new planning and decision-making evaluation tools, and establishing operational agreements and commercial arrangements with vendors.

Another long-term goal is to continue to identify other generation and storage technologies that can be effectively utilized in a Remote Grid configuration. Should alternative generation and storage technologies provide similar capabilities while being more favorable to environmental constraints (land availability, solar availability, etc.) and still prove cost-effective, PG&E will continue to incorporate such technologies into the Remote Grid configuration.

ACTION PGE-51 (Class B)

1) Expand on the remote grid initiative in detail and explain the feasibility of it.

Response:

Information requested is incorporated within the narrative provided in Section 7.3.3.17.5 above.

7.3.3.17.6 Butte County Rebuild Program

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

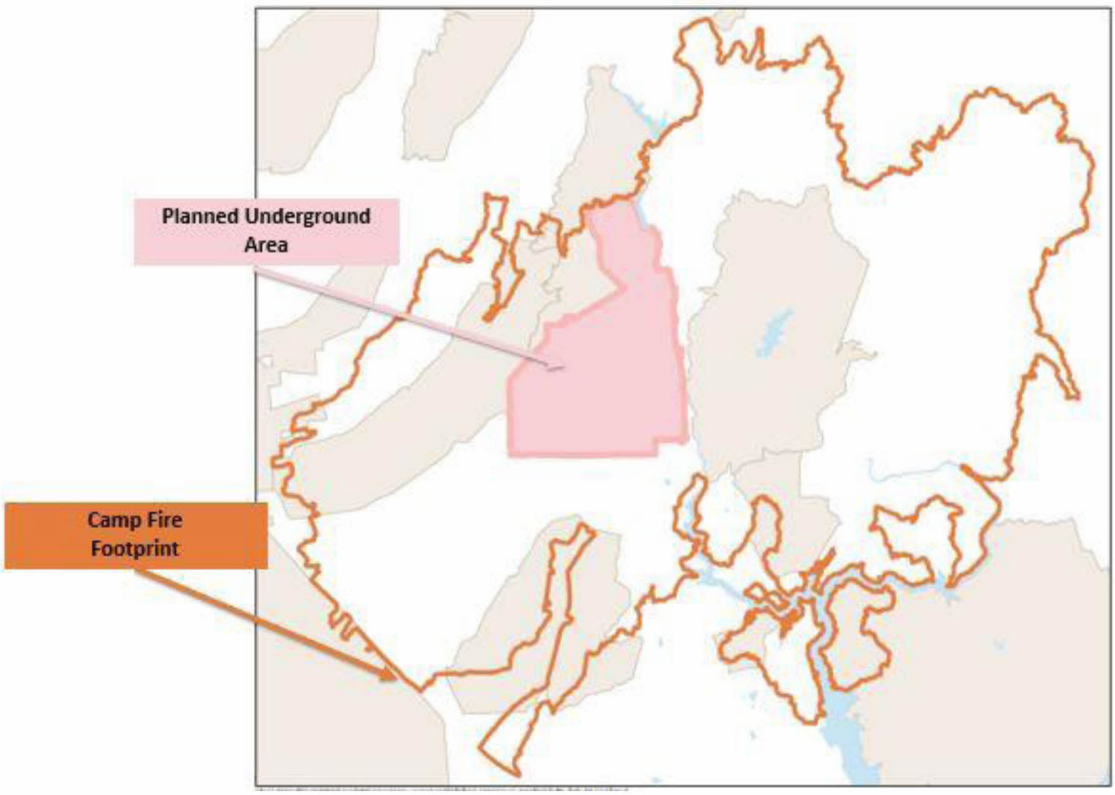
1) Risk to be mitigated / problem to be addressed:

The 2018 Camp Fire devastated the Town of Paradise (Paradise) and surrounding areas in Butte County. The Butte County Rebuild Program is focused on rebuilding the utility infrastructure to serve Paradise and the surrounding County assets destroyed during the Camp Fire in the safest and most cost-effective manner.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

In the 2018 Camp Fire, over 18,000 structures were destroyed, including 13,400 premises. The impacted area is primarily in Tier 2 and Tier 3 HFTD areas. Approximately 207 miles of electric distribution lines and 34 miles of gas pipeline were destroyed. Some electric distribution lines, such as the Bucks Creek 1101 circuit, have been burned multiple times in the last decade. Paradise and Butte County have expressed a strong desire for underground utilities, which would reduce fire risk and have the added benefit of reducing routine Vegetation Management costs. PG&E plans to underground all 207 miles of the destroyed distribution assets within a 5-10 year period. Figure PG&E-7.3.3-7 below shows the Butte County Rebuild Program area.

FIGURE PG&E-7.3.3-7: BUTTE COUNTY REBUILD PROGRAM AREA

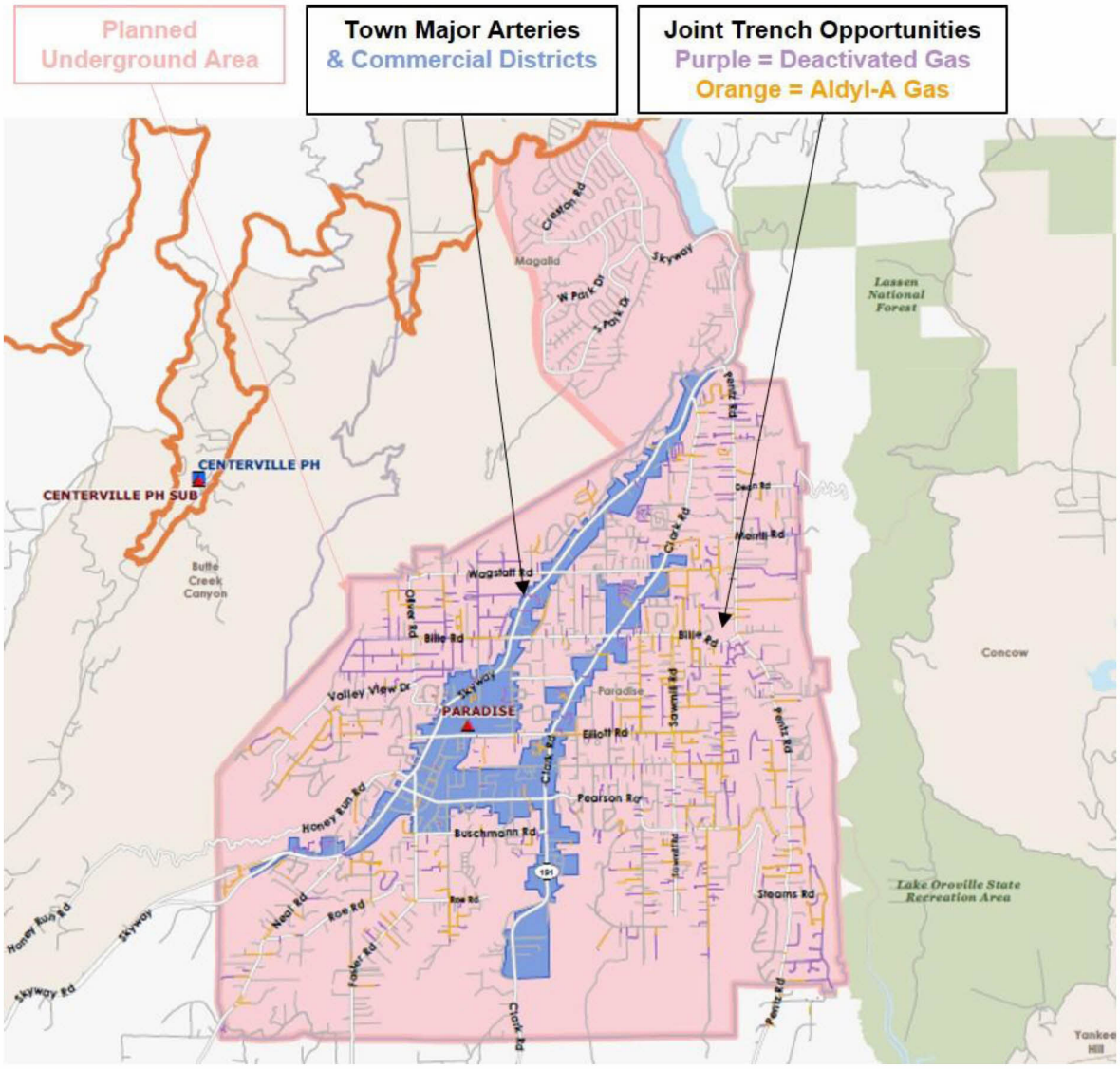


In addition to the electric distribution assets that were destroyed, 34 miles of gas distribution were destroyed by the Camp Fire and must be replaced. PG&E also had plans before the Camp Fire to replace an additional 248 miles of gas distribution pipeline under the Aldyl-A gas pipeline replacement program. For the Butte Rebuild, there is a unique opportunity to cost-effectively underground electric distribution assets by sharing the costs to underground assets in a joint-trench for 58 out of the 207 miles of electric distribution undergrounding.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

The Butte County Rebuild Program is coordinating the project plans closely to align with Paradise's and Butte County's re-development plans with the goal of completing construction in specific areas before Paradise repaves the roads of their main arteries and restores the commercial district. In addition, PG&E also prioritizes restoring areas with deactivated gas destroyed by the fire to prevent customers from needing temporary propane if they are ready to rebuild in those areas. Figure PG&E-7.3.3-8 below provides more detail regarding the Butte County Rebuild Program, including commercial areas and joint trenches.

FIGURE PG&E-7.3.3-8: BUTTE COUNTY REBUILD PROGRAM DETAIL



Finally, Paradise has one of the highest rates of PSPS incidents in the PG&E service territory due to the high fire risk. As the Butte County Rebuild Program is executed over the next several years, it will further enable undergrounded areas of Paradise to remain energized during PSPS events. Scoping for the Butte County Rebuild Program is prioritizing PSPS mitigation while working with the community to align with their rebuild plans

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In our 2020 WMP, PG&E articulated a 2020 goal of completing 20 miles for the Butte County Rebuild Program, counting only those miles in HFTD areas, and completed just over 21 miles in HFTD areas. For the 2021 WMP, PG&E has identified that all work on this project, including those segments that are in non-HFTD areas (the center of Paradise is non-HFTD on the 2018 CPUC HFTD map) are relevant to track and report on as they are all fire rebuild areas, where a prior fire has indicated an elevated wildfire risk. Therefore, for 2021, the Butte County Rebuild Program target is 23 miles (including both HFTD and non-HFTD areas).

5) Future improvements to initiative:

PG&E is developing the base maps for the future electric distribution system in Paradise before estimating all underground infrastructure. The base maps help speed up the design process, which has been a current bottleneck for initiating project construction. PG&E aims to have all base maps complete for all currently scheduled rebuild areas through 2023 by the end of 2021.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Once the base maps are done, the goal for PG&E is to bundle the underground projects in multi-year contracts with construction firms. This will help drive down construction costs and provide for stable project schedules. PG&E recognizes that there may be a greater need to underground utilities in the future. In coordination with our construction standards team, PG&E is exploring ways to improve underground construction. Two ideas to bring efficiencies to underground construction include:

- Looking into innovative methods to backfill trenches that will reduce trucking emissions, reduce cost, and reduce schedule time; and

- Piloting an underground project in the North Complex Fire rebuild to install a single-phase cable-in-duct to help drive down the cost of underground construction while maintaining quality, improving reliability and reducing system risk.

Finally, PG&E is working with the Edison Electric Institute and recently launched a disaster rebuild benchmarking survey to share best practices with other utilities on how to strategically rebuild after a major disaster. Once PG&E has evaluated the results of the survey, we may incorporate other new items into our long-term planning.

7.3.4 Asset Management and Inspections

Overview:

This section provides an overview to Pacific Gas and Electric Company's (PG&E) asset management and inspection programs and provides information in response to Action PGE-26 (Class A) identified by the Wildfire Safety Division (WSD) in the evaluation of PG&E's Remedial Compliance Plan.

Preventive maintenance tasks such as enhanced inspections of overhead assets are a key means for PG&E to proactively identify potential failure modes that could lead to ignition if not resolved timely. Through a combination of ground inspection, intrusive wood pole testing, aerial inspections, infrared assessments, and patrols, PG&E seeks to identify conditions that require repair or replacement of assets prior to failing. Previously, PG&E utilized a time-driven cycle to prescribe patrol and inspection activities to transmission circuits or distribution plat maps. Since 2019, PG&E has undertaken efforts to develop risk-informed models that prioritize preventive asset patrol and inspection activity cycles aligned with the risk of wildfire ignition, including increasing the frequency of such preventive tasks in High Fire Threat District (HFTD) Tiers 2 and 3. Similarly, the evaluation and finalization of corrective findings by a Centralized Inspection Review Team (CIRT) was established for distribution, transmission, and substation inspection programs in 2019 and continues as a core component of the patrol and inspection program.

For 2020 through 2022, PG&E considers enhanced detailed inspections of overhead assets, which exceed the minimum requirements of General Order (GO) 165 to include the following tasks:

- Distribution: digitized capture of detailed visual inspection via checklists and photographic documentation from a ground vantage point; and
- Transmission: digitized capture of detailed visual inspection via checklists and photographic documentation, both from ground position and by aerial vantage, are coupled to complete an enhanced inspection cycle; and
- Transmission (500 kilovolt (kV)): this examination also includes structural integrity assessment of tower structures via climbing inspection.

The supplemental (enhanced) substation inspections carried on in addition to the baseline GO 174 inspections include digitized capture of detailed visual inspection via checklists and photographic documentation, both from ground vantage and by aerial means, coupled to complete an enhanced inspection. Supplemental enhanced substation inspections also include an infrared (IR) assessment of the station equipment in addition to the visual inspection.

Action PGE-26 (Class A)

In its 2021 Wildfire Mitigation Plan (WMP) update, PG&E shall explain whether and where enhanced inspections have replaced or been merged with routine inspections. PG&E shall also describe the areas outside of the HFTD that have had routine inspections replaced by enhanced inspections.

Response:

Enhanced inspections, meaning the use of digital checklists, documentation of asset features, capture of standard imagery, and centralized inspection review of findings, as well as work quality monitoring, have been applied systemwide for overhead transmission and distribution assets as of 2020 detailed inspection cycles. This includes ground, climbing, and aerial inspection collection methods in transmission and distribution, whether in HFTD or otherwise. Corrective findings from patrol inspections, IR inspections, and other emergent inspection methods are also subjected to centralized inspection review, but those patrol and inspection methods have not yet shifted to use the electronic documentation approach and remain largely paper based in their documentation.

Although the approach to digital data capture for enhanced inspections in HFTD and non-HFTD areas is the same, the frequency of inspections and specific checklist content may be different. For 2020 through 2022, PG&E intends to complete enhanced detailed inspections of overhead electric assets in HFTD areas at the following recurrence interval:

- HFTD Tier 3 annually; and
- HFTD Tier 2 every three years.

Aerial inspections of overhead transmission assets in the following recurrence interval:

- HFTD Tier 3 annually; and
- HFTD Tier 2 every three years.

Climbing inspections of 500kV transmission tower structures in the following recurrence interval:

- HFTD Tier 3 annually; and
- HFTD Tier 2 every three years.

Patrol inspections (patrols) of overhead assets of transmission and distribution in the following recurrence interval:

- HFTD Tier 2 on years when enhanced detailed inspections are not scheduled (*e.g.*, two of every three years).

Infrared patrols of overhead assets of transmission, and substation in the following recurrence interval:

- HFTD Tier 3 annually; and
- HFTD Tier 2 every three years.

Infrared patrols of overhead assets of distribution in the following recurrence interval:

- HFTD Tier 3 1/3 annually for three years; and
- HFTD Tier 2 1/3 annually three years.

Supplemental Ground and Aerial Inspections of Substation assets in the following recurrence interval:

- HFTD Tier 3 annually; and
- HFTD Tier 2 every three years.

Intrusive wood pole inspections of overhead wood poles in the following recurrence interval:

- Within 15 years of wood pole installation date, and every ten years thereafter.

Aside from locations with access constraints, PG&E plans to complete these enhanced inspections in HFTD Tiers 2 and 3 locations before July 31, 2021.

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7.3.4.1 Detailed Inspections of Distribution Electric Lines and Equipment

Wildfire Safety Division (WSD) Initiative Definition: *In accordance with GO 165, careful visual inspections of overhead electric distribution lines and equipment where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.*

1) ***Risk to be mitigated/problem to be addressed:***

   Enhanced detailed inspections of overhead distribution assets seek to proactively identify and treat pending failures of asset components which could create fire ignition if left unresolved or allowed to "run to failure." Proactive identification of Level 2 and Level 3 GO 165 concerns also permits PG&E to evaluate potential investments in risk mitigation activities such as system hardening, enhanced vegetation management, reconductoring, among other programmatic tools.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   PG&E's prior practice of completing inspections and patrols on a time-driven cadence has been enhanced to address the increased risk from overhead asset or component failure in HFTD areas. Moreover, the scope of inspections has expanded to identify potential equipment issues that could cause a wildfire ignition. PG&E's prior inspection practice resulted in a corrective notification creation rate of 11 percent for distribution facilities. Our current enhanced inspection protocols yielded corrective notification creation rates of 23 percent in 2020 for distribution facilities. In addition to identifying potential equipment issues which may result in an ignition, the enhanced inspections also improve our visibility to field conditions which may inform new programmatic asset risk management responses or guidance clarifications.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

   Selection criteria of assets for each inspection cycle is driven by factors such as location, system operating criticality, public safety concerns, and overall risk modeling. One key component of the 2021 Wildfire Distribution Risk Model are the data inputs from enhanced inspection results from 2019 and/or 2020. Assets that continually show signs of concern can be inspected more frequently. The resulting "1-to-n" prioritization of assets by circuit ranking is then coupled with operational field knowledge and constraints, including restricted physical access periods, to develop an annual schedule for completion. In general, PG&E schedules patrol and inspection activities in Tier 2, Tier 3, and Zone 1 HFTD areas earlier in the year to provide time for necessary repairs prior to peak fire season.

4) Progress on initiative (amount spent, regions covered) and plans for next year.

For 2020 through 2022, enhanced inspections of overhead distribution assets, which exceed the minimum requirements of GO 165, included the following: (1) digitized capture of detailed visual inspection via checklists and photographic documentation from a ground vantage point; and (2) digital checklists that align to the Failure Modes and Effects Analysis (FMEA) for the structure, associated equipment and components. Both objective and subjective criteria are used to evaluate the condition of the asset and identify corrective actions. Examples of components evaluated during enhanced overhead inspections include anchors and guys, conductor, equipment, hardware and framing, structure. For the 2021 enhanced inspection cycle, the checklist for distribution inspections includes 14 unique components across 55 questions/246 possible answers.

In 2020, PG&E completed 339,728 units of overhead distribution enhanced inspections and projects on 100 percent of distribution poles in Tier 3 and 33 percent of the distribution poles in Tier 2. Additionally, PG&E also completed 45 percent of the distribution poles in non-HFTD areas.

For 2020 through 2022, PG&E plans to complete enhanced detailed inspections of overhead distribution assets in the following recurrence intervals: (1) Tier 3 and Zone 1 – annually; and (2) Tier 2 and High Fire Risk Areas (HFRA) within the non-HFTD – every three years. PG&E will schedule these inspections to be completed by July 31, 2021, barring exceptions due to physical conditions or landholder refusals which delay or hinder PG&E access to facilities.

5) Future improvements to initiative

For 2021 and beyond PG&E will be leveraging the latest risk model, currently the 2021 Wildfire Distribution Risk Model, to drive the selection of assets to be inspected and work planning. Based on PG&E's experience in 2019 and 2020, future improvements to this initiative may include: reviewing or revising inspection cycles in alignment with the latest wildfire consequence modelling, updating inspection criteria and wording to increase objectivity and deliver more consistency between evaluators, and evaluating our corrective work prioritization thresholds to more directly mirror General Order 95 Rule 18 (levels 1, 2, 3 versus PG&E's historic A, B, E, F prioritization). During the enhanced inspections, PG&E has collected a substantial amount of digital records and photo documentation regarding the condition of distribution facilities. In 2021, the continuation of the digital records collection and photo documentation will enable ongoing asset registry improvements.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

PGE-DIXIE-NDCAL-000004972

Response:

Future improvements to detailed inspections of overhead distribution electric lines and equipment will focus on broader incorporation of enterprise information, evolution of questionnaires and technology, and continued insourcing of inspection resources. Specifically, future improvements may include further integration of data sets and systems to expedite data corrections identified during the inspection task. This could include further integration with customer billing data, GIS (Geographic Information System) and asset risk models that either provide or utilize data collected during inspections. Similarly, the questionnaires which guide inspection reports may also evolve to incorporate more or fewer questions in response to the differing risk profiles of the specific assets. In addition, PG&E may make investments in emerging technologies such as Machine Learning and Artificial Intelligence for visual data recognition and analysis. Long-term recurrence intervals for HFTD Tiers 3 and 2 assets may be tailored based upon more comprehensive asset health and risk models, such that the inspections are deployed on an as-needed basis, rather than the current annual and triennial cycles, respectively. Concurrently, PG&E plans to continue development of long-term internal staffing models that limit reliance upon external vendor personnel and provide more consistency in workforce cycle over cycle. This includes reintroduction of Knowledge Assessments for measuring the skill and competence of the Qualified Company Representative (QCR) hired or contracted to perform asset inspections.

7.3.4.2 Detailed Inspections of Transmission Electric Lines and Equipment

WSD Initiative Definition: *Careful visual inspections of overhead electric transmission lines and equipment where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.*

In this section, PG&E provides information regarding transmission line inspections and provides a response to Action PGE-17 (Class B).

1) ***Risk to be mitigated/problem to be addressed:***

   Enhanced detailed inspections of overhead transmission assets seek to proactively identify and treat pending failures of asset components which could create fire ignition if left unresolved or allowed to "run to failure." Proactive identification of Level 2 and Level 3 GO 165 concerns also permits PG&E to evaluate potential investments in risk mitigation activities such as system hardening, enhanced vegetation management, reconductoring, among other programmatic tools.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   PG&E's expanded inspections are expected to identify precursors of overhead asset or component failure in HFTD areas, which can cause a wildfire ignition. PG&E's previous inspection program generated 10,137 corrective notifications for transmission facilities in 2018. Our current checklist-guided inspection protocols yielded 52,399 corrective notifications from 26,282 enhanced transmission inspections in 2020 (both ground and aerial evaluation). In addition to identifying potential equipment issues which may result in an ignition, the enhanced inspections also improve our visibility to field conditions which inform new programmatic asset risk management responses or drive guidance clarifications.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

   Selection criteria of assets for each inspection cycle is driven by factors such as location, system operating criticality, public safety concerns, and general risk modeling. For example, a 500 kV tower providing bulk power transport within HFTD Tier 3 will be inspected more frequently than a 60 kV structure in a non-HFTD area, with low public safety threat. In regard to asset health, the Transmission Operability Assessment Model is directly informed by enhanced inspection results from 2019 or 2020. Assets that continually show signs of concern can be inspected more frequently. The "1-to-n" prioritization of assets by circuit ranking is then coupled with operational field knowledge and constraints, including restricted physical access periods, to develop an annual schedule for completion. In general,

PG&E schedules patrol and inspection activities in Tier 2, Tier 3, and Zone 1 HFTD areas earlier in the year to provide time for necessary repairs prior to peak fire season.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

For 2020 through 2022, PG&E considers enhanced inspections of overhead transmission assets to include the following: (1) digitized capture of detailed visual inspection via checklists and photographic documentation from a ground and aerial vantage point; and (2) digital checklists that align to the FMEA for the structure, associated equipment and components. For 500 kV transmission facilities, this examination also includes structural integrity assessment of tower structures via climbing inspection.

Enhanced detailed inspections are guided by digital checklists that align to FMEA for the structure, associated equipment and components. Both objective and subjective criteria are used to evaluate the condition of the asset and identify corrective actions. Examples of components evaluated during enhanced overhead inspections include anchors and guys, conductor, insulators, equipment, hardware and framing, structure. For the 2021 enhanced inspection cycle, the transmission ground checklist includes 26 unique components across 97/359 possible answers questions. Aerial transmission inspections encompass 14 components and 95/322 possible answers to questions.

PG&E intends to complete enhanced detailed inspections and aerial inspections of overhead transmission assets in the following recurrence interval: (1) Tier 3 and zone 1 – annually; and (2) Tier 2 and HFRA within the non-HFTD every three years. In addition, PG&E intends to complete aerial inspections of 500kV tower structures irrespective of the HFTD location every 3 years.

In 2020, PG&E completed 26,282 units of overhead transmission enhanced inspections and projects. This represents 100 percent of HFTD Tier 3 transmission structures and 33 percent HFTD Tier 2 structures as defined in the 2020 WMP. Similarly, PG&E planned to complete aerial inspections (drone, helicopter, aerial lift-vehicle) for 25,412 assets.

In 2021, for HFTD and HFRA transmission assets, PG&E plans to continue these protocols and re-inspection intervals consistent with 2020. In 2021, 100 percent of overhead transmission poles in HFTD Tier 3 and Zone 1, roughly one third of poles in HFTD Tier 2 and HFRA will be subjected to detailed enhanced inspections and some form of aerial assessment (helicopter, drone, aerial lift, climbing). PG&E will schedule these inspections to be completed by July 31, 2021, barring exceptions due to physical conditions or landholder refusals which delay or hinder PG&E access to facilities.

5) Future improvements to initiative:

For 2021 and beyond PG&E will be leveraging the latest risk model to drive the selection of assets to be inspected and work planning. Based on PG&E's experience in 2019 and 2020, future improvements to this initiative may include: reviewing or revising inspection cycles in alignment with the latest wildfire consequence modelling, updating inspection criteria and wording to increase objectivity and deliver more consistency between evaluators, piloting and adoption of new inspection technology to target difficult to detect failure modes. During the enhanced inspections, PG&E has collected a substantial amount of digital records and photo documentation regarding the condition of distribution facilities. In 2021, the continuation of the digital records collection and photo documentation will enable ongoing asset registry improvements. In addition, PG&E will explore investments in emerging technologies such as Machine Learning and Artificial Intelligence that may eventually expedite visual data recognition and analysis.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Going forward, detailed transmission inspection data will be trended and measured to ensure that proactive identification of asset threats is effective. In-service failure data will also be analyzed to identify any gaps in methodology. As discussed in Section 7.3.4.10, additional methods of inspection, if proven effective, may become part of the system inspection cadence. Furthermore, asset inspection cycles, with the benefit of robust data and asset health modeling (e.g. the OA Model) will be further risk-informed (e.g., more targeted application of annual inspections based on probability and consequence rather than all HFTD Tier 3 areas as is the current practice). This risk-informed inspection frequency may also vary by component, as certain components (e.g., structure, switch, insulator, etc.) may warrant more frequent, targeted inspection than other components.

ACTION PGE-17 (Class B)

1) Define "asset investment opportunities" and, 2) explain how these opportunities benefit from enhanced inspections.

Response:

1) Asset investment opportunities are defined by work that supports the asset management plan, meaning optimized management of the transmission line asset inventory, assessment of asset conditions, performance and performance measures, risks and efforts to mitigate those risks, as well as associated life cycle management costs. For example, rotten wood poles identified through enhanced inspections may become an asset investment opportunity by converting the wood pole to steel upon replacement to address risk, or by bundling the pole replacement with other work

needed from an asset management perspective – such as insulator replacement, conductor replacement, etc.

2) These opportunities benefit from enhanced inspection in several ways. First, timely identification of issues through enhanced inspections allows for bundling opportunities and potential to "build for the future", choosing appropriate structure class or circuit size to meet existing and future environmental and electrical capacity needs. Second, identification of issues through enhanced inspections allows for system trending. These trends and extent of condition analysis can inform proactive programs for targeted replacement.

7.3.4.3 Improvement of Inspections

WSD Initiative Definition: *Identifying and addressing deficiencies in inspections protocols and implementation by improving training and the evaluation of inspectors.*

1) ***Risk to be mitigated/problem to be addressed:***

   Effective inspections are critical to identify equipment conditions and issues that may result in equipment failure creating a potential wildfire ignition risk. In addition, inspection information provides critical supports for the refinement of our asset investment and operational risk models.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   To drive repeatability in results and reduce costs over time, inspection tools, methods, and guidance are evaluated for improvement opportunities at least annually.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

   Inspection processes generally cover PG&E's entire service area. In addition, PG&E has implemented protocols and processes for enhanced inspections in Tier 2 and Tier 3 HFTD areas because of the greater wildfire risk associated with these areas. The selection of assets is driven by a risk ranking performed by Asset Management to prioritize enhanced inspection activities to assets with higher relative risk scores.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year.***

   Inspection programs are evaluated at the close of each annual cycle by a cross-functional team from the inspection execution team as well as asset strategy and standards to identify opportunities to improve efficiency and effectiveness of the programs. Such changes to improve inspection effectiveness may include expanded visual references, further refinements of definitions and terms, or the inclusion of secondary or nested questions to provide further detail. For example, in 2020 the programs reviewed and updated 2019 Wildfire Safety Inspection Program (WSIP) checklist software tool, checklist wording, question formatting, software tool performance, and reference materials to guide more consistent and repeatable results. For 2021, a similar retrospective assessment was performed. Revisions in all overhead inspection checklists to refine the flow and wording, as well as to address gaps in content from prior cycles, such as presence of non-exempt equipment, and new criteria for cold end hardware degradation (C-hooks) were completed as a result. Annual refresher trainings were delivered in 2020. Revised orientation trainings are prepared for both incumbent and new inspection personnel in 2021 as well.

5) Future improvements to initiative.

For 2021, results of inspections in 2020 cycle were used to identify areas of further refinement in 2021 training materials and job aids, to improve repeatability of results. The continued build out of internal quality management staffing and protocols for sampling and process quality monitoring seeks to create a rapid feedback loop to frontline personnel and leaders. This feedback identifies inspectors, programs, and questions that are problematic in some manner and may require corrective intervention. For example, inspectors who have abnormally low or high corrective finding rates relative to peers in similar areas, or questions which result in a large number of CIRT adjustments (escalating or de-escalating priorities) may need to be clarified or retrained to inspectors. Additional technology tool investments are also in progress to improve field performance of hardware (connectivity, battery life) and usability of the mobile application (integration of additional GIS and SAP data sets, work flow enhancements) as well as back office support tools that visualize the annual work plan and progress against execution of inspection. Finally, analytics and trending of conditions found through enhanced inspection will continue to inform future condition-based inspection cycles.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Long-term, PG&E's inspections programs will continue to refine asset data and condition collection needs, modify approaches to support varying risk profiles of assets, and pursue execution efficiencies. PG&E anticipates that asset detail inspection questionnaires will be refined cycle over cycle to focus on collection of data that changes over time and is utilized in various asset health and risk models across the enterprise. The strategy to applying inspection treatment types may also evolve to seek more or less overlap of inspection programs (patrol, detail, IR, LiDAR, PT&T, etc.), depending on the specific risk profile of the target assets. PG&E will also work to build more cross-program execution alignment via process and technology changes to reduce duplicate "touches" of the same asset in a given inspection cycle.

7.3.4.4 Infrared Inspections of Distribution Electric Lines and Equipment

WSD Initiative Definition: *Inspections of overhead electric distribution lines, equipment, and right-of- way using infrared (heat-sensing) technology and cameras that can identify "hot spots", or conditions that indicate deterioration or potential equipment failures, of electrical equipment.*

In this section, PG&E addresses Infrared Inspections for electric distribution lines and provides the responses to Actions PGE-54 (Class B), PGE-55 (Class B), and PGE-56 (Class B).

1) ***Risk to be mitigated/problem to be addressed:***

   Although the majority of failure modes can be detected via visual inspections required by existing rules and regulations, there are some that may not be easily detectable (e.g., components experiencing excessive heat condition). Lack of detection can lead to asset failure and associated consequences. For that reason, PG&E has adopted an infrared inspection program that go beyond mandated inspections in order to identify these potential risks and address them before a failure occurs.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   Excessive heat can contribute to component failure. Abnormal conditions attributed to excessive heat in distribution components (e.g. connectors, splices, transformers) are difficult to find during an enhanced ground inspection. Infrared inspections help identify potentially damaged and/or faulty components that are not detectable by visual inspection methods alone. In addition, infrared assessments can potentially prevent wire down equipment failures and help pinpoint areas for maintenance and conductor replacement. Infrared technology provides the opportunity to identify “hot spots” utilizing infrared imaging and temperature measuring systems to detect and record heat radiation from a target relative to its surrounding measurements. The Distribution Infrared program utilizes trained contractors to identify hot spots (abnormal temperature) for corrective action.

   PG&E uses infrared inspections on distribution circuits in the HFTD to help detect and correct abnormal conditions. Overhead infrared inspection is not a mandated inspection requirement. Infrared technology provides the opportunity to identify abnormal conditions “hot spots” by utilizing infrared imaging and temperature measuring systems to detect and record heat radiation from a target relative to its surrounding measurements. Based on historical infrared results we expect IR to effectively detect abnormal heat in the following assets: Conductors, Jumpers, Splices, Connectors, Transformers, Fuses, Cutouts, Arresters, Switches.

   In 2021, infrared inspections will be performed in conjunction with enhanced ground and aerial inspections, but will not be considered as, or substituted

for, a detailed inspection. Any findings are coupled with the infrared image to initiate SAP corrective maintenance tags, prioritized in accordance with TD-2022P-01 (IR Inspections of Electric Distribution Facilities).

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

The 2020 HFTD infrared distribution circuit plan utilized the 2019 REAX scoring component to rank each circuit and was used to select the 2020 HFTD infrared circuit list.

For 2021, PG&E's HFTD infrared plan will evaluate using the new distribution risk model for primary overhead conductor which uses Technosylva instead of REAX modeling. Unlike the 2019 circuit scoring model, the new overhead conductor model includes a probability and consequence component to derive the actual risk score at the protection zone level.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year.***

PG&E generally schedules patrol and inspection activities in Tier 2, Tier 3, and Zone 1 HFTD areas earlier in the year to provide time for necessary repairs prior to peak fire season. However, infrared inspections are deployed in a targeted manner as the effectiveness of the technology is heavily influenced by the level of electric load in the lines being inspected. If the electric load is low, it can be challenging to capture meaningful data through Infrared inspections.

PG&E relies on contract resources to perform infrared patrols. Our prime contractor was unable to hire enough qualified electrical worker infrared inspectors to complete the required infrared patrols in 2020. The 2020 HFTD infrared plan target for distribution included 151 circuits and approximately 8,300 circuit miles. As of December 29, 2020, 120 circuits and 5,450 circuit miles were completed in HFTD areas.

To help address potential resource limitations in the future, PG&E contracted with a second firm in 2020 on a pilot basis, as an alternative resource for performing infrared patrols. After the successful pilot of this second vendor, PG&E will continue to work with at least two vendors, while evaluating others as well, to complete PG&E infrared patrols in future years.

The current 2021 distribution infrared plan is to complete approximately one-third of the HFTD area circuits based on funding levels and similar to the Tier 2 enhanced inspection cycle.

5) ***Future improvements to initiative.***

PG&E is continuing to evaluate what technical improvements can be made when utilizing infrared technologies for increased effectiveness.

Additionally, PG&E is evaluating what technologies can be paired with Infrared inspections to improve operations efficiency, such as better mapping, upgraded equipment and computing power.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E has not determined a long-term plan yet for this initiative. We will be evaluating the use of alternate technologies such as drones versus current handheld and vehicle mounted cameras. The evaluation would review whether access is better suited for drone use from time to result efficiency. It would also include a review of the technology itself (valid IR image extracted)

Long-term plan milestones are still under development with Electric Operations and Asset Management. In order to facilitate that review, an analysis of inspection findings will be done. This will allow PG&E to better understand effectiveness at reducing asset failures. Finally, in the longer term, PG&E will be able to analyze data to determine if a greater reduction in asset failure could be attained by increasing the annual scope mileage of the program.

ACTION PGE-54 (Class B)

1) Provide the source that states 70 percent of IR findings are not identified visually, and

2) Provide the percentage of PG&E findings via IR that were not identified during prior visual inspections.

Response:

1) The 70 percent statistic was an approximation based on internal employee knowledge when reviewing the IR findings known as hot spots relative to a visual inspection without an IR tool. The fact that IR inspections can identify findings that would not be identified in a visual inspection is also supported by industry literature. In the Electric Power Research Institute's (EPRI) Distribution Infrared Inspection Guidebook #3002007982 dated December 2016, EPRI concluded that "Infrared inspection identifies heating equipment needing maintenance or replacement that visual inspection usually cannot." (Page 1-1). The EPRI guidebook also notes that "excessive equipment heating cannot normally be visually distinguished, but it can be observed using an infrared camera (IR) camera." (Page 2-3).

2) PG&E's IR inspections are separate from the other inspection programs and they are not on the same schedule. In some instances, the two separate inspection programs could be a year apart and thus it would not be applicable to compare them because an incident or issue may have occurred after one inspection but before the other inspection. The review of IR findings that were not identified in prior visual inspections is something that PG&E could consider for our long-term analysis of the program,

although, as explained, it may be difficult to draw conclusions from such a review given the differing timing of inspections.

ACTION PGE-55 (Class B)

1) Provide the expected risk reduction for using IR inspections, as well as all inputs and algorithms used for the calculation, and

2) Provide the estimated cost savings, both overall and per Overhead circuit mile, that IR inspections provide.

Response:

1) The Expected Risk Reduction and Risk Spend Efficiencies for IR inspections are provided in Table 12 in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx and the associated workpapers.

2) PG&E estimates the cost savings based on the comparison between the cost of IR inspection versus the cost of an outage and the cost of an outage that could lead to an ignition. The cost of the program is approximately $2.2M, or $155 per mile. In 2020, there were 67 B tags identified by infrared inspection. With an estimation of 50% of the B tags leading to a failure within 1 year, the anticipated number of failures prevented from IR inspections is 33.5 potential failures. Based on the financial cost of an outage and the financial cost of an ignition (including the likelihood of an ignition), the estimated cost of an outage is approximately $96,000. Multiplying this by 33.5 potential failures means the IR inspections provided a cost savings of approximately $3.2M.

Financial cost estimations were derived by the following:

Based on the 2020 RAMP Report, PG&E gathered the associated financial cost of an outage and an ignition, used to support the Failure of Distribution Overhead Failure and Wildfire risk assessment.

The financial cost of an outage was based on 2017-2019 outages associated with distribution, details seen in Attachment 2021WMP_ClassB_Action-PGE-55_Atch04.xlsx. These costs were used as inputs for the Financial consequence in the assessment of Distribution Risk. By dividing the annual financial consequence by the annualized number of outages for distribution, shown in Attachment 2021WMP_ClassB_Action-PGE-55_Atch02.xlsx, PG&E calculates an average cost of an outage to be ~$5,000.

The financial cost of an ignition was based on a combination of 2015-2019 PG&E data, shown in 2021WMP_ClassB_Action-PGE-55_Atch05.xlsx for smaller ignitions and CALFIRE data, shown in 2021WMP_ClassB_Action-PGE-55_Atch06.xlsx for larger ignitions. These costs were used as inputs for the Financial consequence in the assessment of the Wildfire Risk. By dividing the annual financial consequence by the annualized number of ignitions, shown in 2021WMP_ClassB_Action-PGE-55_Atch03.xlsx, PG&E calculates an average cost of an ignition to be $5.2 million. However, given that not every outage results in an ignition, PG&E adjusted the dollars of an outage that could lead to an ignition by dividing the annual number of ignitions / annual number of outages,

which is approximately 1.76%. By multiplying the financial cost of an ignition of $5.2 million x 1.76%, the financial cost of an outage that could lead to an ignition is an additional ~$91,000.

Between the cost of the program and the cost savings, it is anticipated that this activity saves approximately $1 million per year, or $75 per mile. Details of the calculation can be seen in Attachments 2021WMP_ClassB_Action-PGE-55_Atch01.xlsx, 2021WMP_ClassB_Action-PGE-55_Atch02.xlsx, and 2021WMP_ClassB_Action-PGE-55_Atch03.xlsx.

ACTION PGE-56 (Class B)

1) Explain why IR inspections are used to determine splice count, and why it does not currently retain that information otherwise.

Response:

PG&E does not have a comprehensive primary splice database; however, as part of the IR program, we started collecting primary splices from 2013-2019. Since the purpose of this effort was to help identify the location of deteriorated conductor, only spans with more than three (3) splices in an individual phase were collected. These splices are currently in a map guide GIS system and displayed by span (max/phase and total/span).

The IR inspection was one of several ways that PG&E has collected primary splice counts. Primary splices are also collected during vegetation management patrols following vegetation cased outages and collected in the past if a distribution engineer went into the field to complete an equipment failure wire down review.

PG&E intends to leverage the INSPECT app to collect splice counts in the future. Retention of this information will be migrated from map guide to ED GIS (PG&E's current Electric Distribution GIS platform).

The primary splice database is currently used to determine conductor health and scope limits of projects.

7.3.4.5 Infrared Inspections of Transmission Electric Lines and Equipment

WSD Initiative Definition: *Inspections of overhead electric transmission lines, equipment, and right-of-way using infrared (heat-sensing) technology and cameras that can identify "hot spots", or conditions that indicate deterioration or potential equipment failures, of electrical equipment.*

1) ***Risk to be mitigated/problem to be addressed:***

Infrared inspections help identify potentially damaged and/or faulty components that are not detectable by visual inspection methods alone. In addition, infrared assessments can potentially prevent wire down equipment failures and help pinpoint areas for maintenance and equipment replacement.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

Infrared technology provides the opportunity to identify “hot spots” by utilizing infrared imaging and temperature measuring systems to detect and record heat radiation from a target relative to its surrounding measurements. Based on our FMEA, we expect IR to effectively detect:

- Hot/Heating Conductors, Jumpers, Splices, Contacts/Live Parts, Quick Break Attachments;
- Loose Splices, Clamps; and
- Contaminated Insulators.

Infrared inspections will be performed in conjunction with enhanced ground and aerial inspections, but will not be considered as, or substituted for, a detailed inspection.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

PG&E prioritizes infrared inspections in Tier 2 HFTD areas every three years and in Tier 3 HFTD areas every year. Infrared inspections are deployed in a targeted manner as the effectiveness of the technology is heavily influenced by the level of electric load in the lines being inspected. It is generally necessary for lines, or segments of lines, to be loaded to 40 percent or greater of the operating ratings in order to perform a meaningful infrared inspection. Lines operating at significantly lower or no load will therefore not be able to be inspected using infrared technology.

4) Progress on initiative (amount spent, regions covered) and plans for next year.

In 2020, infrared inspections were performed on all summer-peaking transmission lines with structures in Tier 2 or Tier 3 HFTD areas. Winter peaking transmission lines with structures in Tier 2 or Tier 3 will have Infrared inspections performed in January/February 2021. In total, the 2020 transmission Infrared program covered 5,313 miles.

For 2021, we plan to conduct Infrared inspections on 100 percent of transmission circuits in Tier 3 HFTD areas, 33 percent of transmission circuits in Tier 2 HFTD areas, and 20 percent of transmission circuits in non-HFTD areas. Circuits supporting Diablo Canyon Power Plant (DCPP) and Morro Bay Power Plant, and the tie lines for the Western Electric Coordinating Council (WECC) will be inspected by Infrared. The planned scope of Transmission Infrared Inspections in 2021 is approximately 8,000 miles.

5) Future improvements to initiative.

We currently intend to utilize the 2020 data to trend and analyze the effectiveness of this technology compared to the other inspection methodologies currently employed. In addition, PG&E will evaluate opportunities to combine the infrared sensor technology with other aerial visual data capture on the same flight to drive improved cost efficiencies where possible.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

For infrared inspection, PG&E will continue to evaluate the effectiveness of infrared through benchmarking and calibration of the methodology. If deemed effective, PG&E will continue to use infrared inspections in the transmission line inspection cycle. If deemed ineffective, alternate methods of failure mode identification must be identified, piloted, proven effective and deployed. Effectiveness measures will be established to ensure long term goals of the program (proactive identification of asset threats) are met.

PGE-DIXIE-NDCAL-000004986

7.3.4.6 Intrusive Pole Inspections

WSD Initiative Definition: *In accordance with GO 165, intrusive inspections involve movement of soil, taking samples for analysis, and/or using more sophisticated diagnostic tools beyond visual inspections or instrument reading.*

1) ***Risk to be mitigated/problem to be addressed:***

   Intrusive pole inspections, also called Pole Test and Treat (PT&T), are a way to evaluate in-service wood poles and are conducted on an approximate 10-year cycle for early detection of deterioration. These inspections can be effective in identifying wood poles that need to be replaced before a pole failure, which may result in an ignition event.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   PT&T prolongs the service life of wood poles through reapplication of preservative and/or restoration of structural strength through reinforcement. PT&T identifies poles that are nearing the end of their service life and recommends these poles for replacement prior to failure. PG&E's PT&T program has existed since 1994 and is fully implemented across transmission and distribution wood pole structures.

   Intrusive wood pole testing involves the direct measurement of shell thickness, examination of below grade degradation, and application of preservatives. Intrusive wood pole testing is a control against premature or unintended failure of wood pole structure due to shell degradation.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

   Selection criteria of assets for each inspection cycle is driven by the date of wood pole installation into service. GO 165 requires a maximum 20-year cycle through the life of the wood pole, and PG&E prescribe an initial interval of 15 years, with a recurrence of 10 years thereafter. In 2021, the HFTD location is not a factor in the selection of wood poles for intrusive testing, however enhanced inspections may trigger the need for off cycle intrusive testing based upon initial visual examination.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year.***

   PT&T annually examines approximately 10 percent of PG&E's wood poles, or roughly 240,000 poles, and historically identifies approximately 8,000 units which require remediation, up to and including replacement.

   In 2020, PG&E completed approximately 238,000 units of intrusive wood pole testing including: (1) 10,491 poles in HFTD Tier 3; (2) 28,346 poles in

HFTD Tier 2; and (3) the remainder in non-HFTD areas. In addition, upon completion of approximately 40,000 incremental field assessments that were reported to the CPUC in 2020, 5,363 poles were included in the 2020 testing to ensure compliance with the 20 year GO 165 cycle.

PG&E contracts out the execution of PT&T to a specialized contractor who performs this work for other utilities as well. QA is provided through sampling and reinspection by internal PG&E personnel, as well as the vendor performance reports. PT&T has its own QA program of the inspections. PG&E's Internal Audit department performs audits as requested or recommended, in accordance with their requirements

5) *Future* improvements to initiative.

In 2021, PG&E intends to upgrade the PT&T program's existing field hardware and software tools to enhance recordkeeping and data system integration. This transition will also enhance the capability of PT&T to report asset registry discrepancies, and to collect photographic data to supplement test report results, and aid in the asset registry enhancement efforts.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Future improvements to intrusive wood pole inspections (PT&T) will be informed by the increased data gathered during the 2022 cycle utilizing the refreshed technology solution. Based upon the asset risk models and results of PT&T, long-term recurrence intervals may be tailored, such that the inspections are deployed on an as-needed basis, rather than the current ten-year cadence.

7.3.4.7 LiDAR Inspections of Distribution Electric Lines and Equipment

WSD Initiative Definition: *Inspections of overhead electric distribution lines, equipment, and right-of-way using LiDAR (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).*

1) ***Risk to be mitigated / problem to be addressed:***

Inspections, including inspections using LiDAR, can help identify and treat pending failures of asset components which could create fire ignition if left unresolved or allowed to "run to failure." LiDAR and imagery can improve PG&E's effort to digitize our inventory and update our data sets for our mobile equipped workforce and improve our knowledge about distribution asset condition.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

LiDAR technology can provide information for work planning and operational workflows. Aerial LiDAR collection includes use of helicopters with mounted LiDAR sensors and photogrammetry equipment operated by an onboard technician. Large three-dimensional point clouds and hi-resolution imagery datasets collected during the flight missions are then processed to register data to real world coordinates. The data is used to measure relative distances between classified objects (for example the height of a pole). The LiDAR collection using vehicles includes a 360-degree area collection system mounted on top of the car that can create point cloud data and imagery to be used to identify specific features. LiDAR can: (1) provide accurate measurements to improve pole loading; (2) provide an accurate location for distribution inspection and (3) improve mapping. LiDAR allows for operational decision making from a desktop and minimizes field visits which improves efficiency and safety.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

This initiative was first targeted at HFTD areas. However, the data and operational knowledge gained from its inception has the potential to be leveraged and utilized for additional portions of PG&E's service area.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

LiDAR Collection Work and Data Leveraged:

- In 2019, LiDAR collection (*i.*e., the acquisition of LiDAR and imagery) was completed in HFTD areas via various LiDAR platforms. Aerial LiDAR and imagery were collected in the HFTD areas and where distribution assets

were near public roads within the HFTD, LiDAR imagery was also collected via mobile vehicles;

- In 2020, approximately 3,000 miles of LiDAR imagery was collected in the Northern regions primarily in Tehama, Shasta, Trinity, and Humboldt Counties. This northern area was targeted for circuits related to the HFTD area boundaries and areas with dense vegetation; and

- In 2020, PG&E was able to operationalize LiDAR for updating positional accuracy of electrical distribution GIS (EDGIS) mapping and Pole Loading.

LiDAR Data and Operation Refinement:

- In 2020, PG&E also worked to validate the collection and data received, working on Quality Assurance, Quality Control, and optimization of the LiDAR data to understand relative and absolute positional accuracy, and false negatives and positives from automated vegetation identification;

- Backpack mounted LiDAR was also tested in 2020 and showed some initial promising results.

- Operational progress for both the geospatial asset data improvement project to improve EDGIS and Pole Loading are underway;

- As part of Wildfire Order Instituting Investigation, PG&E is executing a conductor line slap analysis pilot leveraging LiDAR data collected through the Vegetation management process to assess the risk of conductor line slap on circuits in the PG&E service area and will be looking to understand how this analysis can inform operations and procedures in the field; and

- For 2021, the focus is on incorporating the existing information in order to leverage broader adoption across PG&E for existing digital tools, plans to analyze aerial data and mobile data to be used together for use cases with operations such as streetlights, third party attachments, mapping conflation and other areas.

5) Future improvements to initiative.

While no specific improvements for this initiative are currently planned, PG&E intends to continue to use both aerial and mobile LiDAR (collection platforms) datasets and high-resolution imagery to improve our recording of asset locations and is looking for ways to utilize LiDAR data to improve, safety, efficiency, and accuracy. In 2021, evaluation of how to effectively integrate the data into existing operational tools will be conducted. Based on the effectiveness of operationalizing the derivative LiDAR products, additional LiDAR collection may be planned and considered for non HFTD areas. Evaluation of the quality of LiDAR to provide detailed measurements for engineering purposes is being conducted that will support how viability this tool is for additional use cases. The investment to collect additional LiDAR is also dependent on prioritized areas defined by the risk model.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E will be evaluating LiDAR accuracy from the available modes of collection and sensors including but not limited to dual sensors on fixed wing planes and 360 degree vehicle mounted sensors to reliably identify equipment type attached to poles and conductor types. A combination of these collection modes is also being evaluated to determine the best collection platform combination to address the most operational use cases variables to determine what the long-term path is. Several operational groups are leveraging these datasets including Pole Loading, GIS Mapping, Estimating, and Third Party Attachments. Long-term plan milestones are still under development with Electric Operations and Asset Management. We forecast this program to remain stable at its current stage until operational integration is developed for production deployment at which point the further deployment could be expected.

These steps seek to drive toward decision-making based increasingly on integrated datasets that can leverage more informed inputs for its operations. Potential outcomes include developing new applications to leverage the LiDAR data, increasing our gathering of LiDAR data, and optimizing our LiDAR deployment strategy based on lessons learned. PG&E intends to use both aerial and mobile LiDAR (collection platforms) datasets to improve our recording of asset locations and is looking for ways to utilize LiDAR data to improve safety, efficiency, and accuracy, based on effective integration with operational tools scheduled for 2021. Evaluation of the measurement quality for engineering purposes is being conducted to confirm viability to additional use cases.

7.3.4.8 LiDAR Inspections of Transmission Electric Lines and Equipment

WSD Initiative Definition: *Inspections of overhead electric transmission lines, equipment, and right-of- way using LiDAR (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).*

PG&E does not currently have a program to leverage LiDAR for the inspection of Electric Transmission Assets. While we use LiDAR for the evaluation of vegetation in proximity to Electric Transmission lines, as discussed in Section 7.3.5.8, we are still evaluating alternatives and value propositions for using LiDAR to supplement our transmission asset inspection programs.

1) ***Risk to be mitigated/problem to be addressed:***

   Inspections can help identify and treat pending failures of asset components which could create fire ignition if left unresolved, the use of LiDAR as part of the Asset Inspection effort is being explored.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   PG&E does not have a formal initiative for the use of LiDAR for Transmission assets. LiDAR data collected on Transmission assets is collected through our Vegetation Management program (as detailed in Section 7.3.5.8) and that data is then used to aid in:

   - Tree strike potential analysis by the PG&E Applied Technical Services (ATS) team. LiDAR data processing extracts pole, span, and fall-in tree geospatial information. Tree strike threat is calculated as the number of fall-in trees in each span that can touch the line.

   - Ad-hoc assessment of the current position of conductor as it relates to required clearance from other conductors, physical features as well as the ground.

   - Modeling of conductor position, sag and sway, calibrated to the ambient temperature and loading at the time that the LiDAR data was captured.

   - PLS-CADD (Power Line Systems - Computer Aided Drafting & Design) model development. PLS-CADD is the industry standard overhead power line design software. The modeling includes terrain, structures, and wires and uses the Finite Element Analysis feature to combine a system of structures as a single model, which accounts for load between adjacent structures. Our PLS-CADD software automatically assess the conductor for a range of temperatures and creates a NERC alert file for any situations that might be out of compliance.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

LiDAR data is collected as a part of PG&E's Vegetation Management program that includes our entire service area.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year.***

PG&E does not have a formal LiDAR initiative for transmission facilities. Rather, LiDAR information is gathered as a part of PG&E's Vegetation Management programs.

5) ***Future improvements to initiative.***

PG&E will evaluate the further and/or programmatic use of LiDAR data, or additional LiDAR data collection, to supplement existing Transmission asset inspection programs and make any changes or adjustments required going forward.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E does not have a long-term plan established for LiDAR inspections of electric transmission assets. As noted above, PG&E is exploring the use of this technology which may, or may not, result in the development of a program to leverage this technology for asset inspections in the future.

7.3.4.9 Other Discretionary Inspection of Distribution Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

WSD Initiative Definition: *Inspections of overhead electric distribution lines, equipment, and right-of-way that exceed or otherwise go beyond those mandated by rules and regulations, including GO 165, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.*

1) ***Risk to be mitigated/problem to be addressed:***

   No incremental discretionary inspection activities beyond those described in Sections 7.3.4.1 and 7.3.4.4 are planned for electric distribution facilities in 2021.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   See the response to Question 1 above.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

   See the response to Question 1 above.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year.***

   See the response to Question 1 above.

5) ***Future improvements to initiative.***

   See the response to Question 1 above.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

See the response to Question 1 above.

7.3.4.10 Other Discretionary Inspection of Transmission Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

WSD Initiative Definition: *Inspections of overhead transmission lines, equipment, and right-of-way that exceed or otherwise go beyond those mandated by rules and regulations, including GO165, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.*

1) Risk to be mitigated/problem to be addressed:

Although the majority of failure modes can be detected via visual inspections required by existing rules and regulations, there are some conditions that may not be easily detectable (e.g., conductor core condition or below-grade foundation condition). Lack of detection can lead to asset failure and associated consequences. For that reason, PG&E has initiated several pilot inspection programs to consider technology and methodology to further improve the inspection program.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

The following transmission line inspection programs are currently under pilot to address situations which may be difficult to identify in routine regulatory inspections, or to augment the enhance inspection programs:

- Below-Grade Foundation Inspections: This pilot program aims to assess the condition of steel structure foundations below the ground-line. The investigation includes a measure of soil resistivity, pH, Redox and Half Cell Measurement, as well as a visual assessment with photographic evidence of each excavated foundation leg. The results will validate data from models, inform (preventive) maintenance and repair decisions and also inform locations most requiring of cathodic protection.

- Corona Inspections: This pilot program aims to assess non-visible conditions, particularly of insulator and insulator hardware, via the detection of corona (free electrons that fragment stable oxygen molecules (O_2) combining with others to create ozone (O_3) gases.) concentration. The results will inform preventive maintenance and provide additional data for asset management.

- Conductor Measurement/Inspections: This pilot program aims to assess the condition of steel-core conductors via the measurement of remaining cross-sectional area of steel core wires and detection of local flaws such as deep pits or broken strands (by measurement of magnetic flux leakage). The results will inform conductor replacement programs and provide additional data for asset health modeling.

- Drone-Span Inspections: This pilot program aims to assess the condition of conductors through mid-span high-resolution imagery and inspector review. The results will provide additional visual assessment of the mid-span assets (i.e., conductors, splices, flying bells, marker balls, etc.), which may not be visible during routine aerial or ground-based structure inspections. The drone-span inspections provide an understanding and safety assessment of conductor condition severity during the interim period between project kick-off and project completion (which could be several years depending on permitting, clearances, etc.).

3) Region prioritization ("where" to engage activity) - include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")

- The Below-Grade Foundation Inspections pilot covers approximately 1,000 steel structure locations, chosen to provide a statistical representation of various foundation types and environments throughout PG&E service territory;
- Corona Inspections were and will be included on all lines planned for infrared inspection in 2020 and 2021; and
- The Conductor Measurement/Inspections pilot will be field-tested on a 115 kV line in the East Bay in 2021.
- The Drone-Span Inspections pilot was tested on a 115 kV line in the East Bay in 2020 based on locally identified conductor condition concerns.

4) Progress on initiative (amount spent, regions covered) and plans for next year.

- Below-Grade Foundation Inspection: Pilot began December 2020 and is expected to continue until Q2 2021. Pilot results will be evaluated, and a recommendation made whether to continue funding additional inspections in the future. The cost for 1,000 structures is approximately $1.1 million.
- Corona Inspections: In 2020, Corona Inspections were performed during infrared inspections. In 2021, Corona Inspections will also be performed during infrared inspections.
- Conductor Measurement/Inspections: In 2021, an initial field pilot will be conducted. Cost is still under evaluation but will likely be less than $100,000.
- Drone-Span Inspections: In 2020 and 2021, costs have been included as part of targeted projects for conductor replacement. Drone-Span Inspections may continue to be tested on select, targeted circuits in 2021 as triggered by condition.

5) Future improvements to initiative.

For all of these pilots, success of the methodology must be determined, based on cost to benefit (number of quality findings), usability/calibration of the data (is the data provided from the inspections useful for asset health modeling) and benchmarking with others in the industry. For remaining failure modes that are not easily detectable with current pilot or enhanced inspection methods, additional research into potential design or inspection method changes will be considered based on consequence of failure.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

The goal for discretionary inspections going forward is to identify effective means of inspecting assets for potential failure modes, test and prove the methodology and incorporate effective inspection methods into the standard maintenance cycles for assets. A good example of this is the piloting of drone inspections in 2019, and the full incorporation into the enhanced detailed inspection maintenance cycle in 2020.

Additionally, effectiveness of existing inspection methods can be reviewed and compared against potential new methodologies for informing amendments to existing methods or frequencies. For example, the use of artificial intelligence/computer vision to supplement existing inspection methods.

7.3.4.11 Patrol Inspections of Distribution Electric Lines and Equipment

WSD Initiative Definition: *In accordance with GO 165, simple visual inspections of overhead electric distribution lines and equipment that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.*

1) ***Risk to be mitigated/problem to be addressed:***

Patrol inspections of distribution electric lines and equipment are routinely undertaken for assets not scheduled for a detailed or climbing inspection within the calendar year. Patrol inspections are defined within the EDPM (TD-2301M) as maintenance activities that include a simple, visual examination of applicable overhead and underground facilities to identify obvious structural problems and hazards. Patrol inspections are visual reviews of the asset condition to proactively detect imminent or existing safety or reliability hazards in alignment with GO 165. Distribution overhead patrols may be executed on foot or by vehicle as appropriate to the terrain. Patrol inspections reduce the risk of unforeseen equipment failure that could result in a wildfire ignition by ensuring that assets not scheduled for a detailed inspection are patrolled within the calendar year.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

Overhead asset patrols seek to proactively identify and treat actual or pending failures of asset components which could create fire ignition if left unresolved or allowed to "run to failure."

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

Prior practice of completing inspections and patrols solely on a time-driven cadence did not adequately address the increased risk from overhead asset or component failure in HFTD areas. As such, the HFTD assets not selected for enhanced detailed inspection are normally scheduled for patrol. For 2021 through 2022, PG&E intends to complete patrol inspections of overhead assets in the following recurrence interval: Tier 2 HFTD areas on years when enhanced detailed inspections are not scheduled (*e.g.*, two of every three years). For example, the subset of Tier 2 HFTD area assets not slated for detailed inspections in 2021 is instead scheduled for patrol inspections in cycle 2021. In general, PG&E schedules HFTD patrol and inspection activities earlier in the year to provide time for necessary repairs prior to peak fire season.

Because all Tier 3 HFTD area assets are scheduled for detailed overhead inspections annually, they are not subjected to patrol inspections on a routine basis.

4) Progress on initiative (amount spent, regions covered) and plans for next year.

In 2020, PG&E planned to complete 1.638 million units of overhead distribution patrols and projects. This represents approximately 445,000 HFTD Tier 2 poles and 1.193 million poles non-HFTD areas. In 2021, PG&E anticipates completing a total of 1.181 million units of inspection patrol in HFTD Tier 2 and other areas not subject to detailed inspection.

5) Future improvements to initiative.

Improvements in the Patrol Inspections of Distribution Electric Lines and Equipment anticipated in future include adjustments based upon the results of 2019 and 2020 cycles. Such refinements may include asset selection and work planning to align with revised risk models, clarification and evaluation of corrective work prioritization thresholds to more directly mirror GO 95 Rule 18 (levels 1, 2, 3 versus historic A, B, E, F).

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Long-term improvements to Patrol Inspections of Distribution Electric Lines and Equipment are expected to evolve in recurrence interval to align with detailed inspections of the same assets, informed by expanded asset risk and health models. In addition, the patrol inspections are anticipated to adopt digitized recordkeeping similar to the enterprise solutions already deployed for Detailed Overhead Inspections documentation. While such technology will not alter the intent or scope of the patrol inspections, it will more rapidly integrate patrol inspection results into the system of record.

7.3.4.12 Patrol Inspections of Transmission Electric Lines and Equipment

WSD Initiative Definition: *Simple visual inspections of overhead electric transmission lines and equipment that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.*

1) ***Risk* to be mitigated/problem to be addressed:**

Patrol inspections of transmission electric lines and equipment are routinely undertaken for assets not scheduled for a detailed or climbing inspection within the calendar year. Patrol inspections are defined within the EDPM (TD-2301M) as maintenance activities that include a simple, visual examination of applicable overhead and underground facilities to identify obvious structural problems and hazards. Patrol inspections are visual reviews of the asset condition to proactively detect imminent or existing safety or reliability hazards in alignment with GO 165. Transmission overhead patrols may be executed on foot or by vehicle as appropriate to the terrain. Patrol inspections reduce the risk of unforeseen equipment failure that could result in a wildfire ignition by ensuring that assets not scheduled for a detailed inspection are patrolled within the calendar year.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

Overhead asset patrols seek to proactively identify and treat actual or pending failures of asset components which could create fire ignition if left unresolved or allowed to "run to failure."

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

For 2021 through 2022, PG&E intends to complete patrol inspections of overhead transmission assets in the following recurrence interval: Tier 2 HFTD areas on years when enhanced detailed inspections are not scheduled (*e.g.*, two of every three years). For example, the subset of Tier 2 HFTD area assets not slated for detailed inspections in 2021 is instead scheduled for patrol inspections in cycle 2021.

Because all Tier 3 HFTD area assets are scheduled for detailed overhead inspections annually, they are not subjected to patrol inspections on a routine basis. In general, PG&E schedules HFTD patrol and inspection activities earlier in the year to provide time for necessary repairs prior to peak fire season.

4) Progress on initiative (amount spent, regions covered) and plans for next year.

In 2020, PG&E completed 150,725 units of overhead transmission patrols. This represents 33 percent of all HFTD Tier 2 poles and 20 percent of all non-HFTD poles. For 2021, PG&E forecasts to complete a total of 191,000 units of patrol inspection in HFTD Tier 2 and other areas not subject to detailed inspections.

5) Future improvements to initiative.

Improvements in the Patrol Inspections of Transmission Electric Lines and Equipment anticipated in future include adjustments based upon the results of 2019 and 2020 cycles. Such refinements may include asset selection and work planning to align with revised risk models, clarification and evaluation of corrective work prioritization thresholds to more directly mirror GO 95 Rule 18 (levels 1, 2, 3 versus historic A, B, E, F).

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Long-term improvements to Patrol Inspections of Distribution Electric Lines and Equipment are expected to evolve in recurrence interval to align with detailed inspections of the same assets, informed by expanded asset risk and health models. In addition, the patrol inspections are anticipated to adopt digitized recordkeeping similar to the enterprise solutions already deployed for Detailed Overhead Inspections documentation. While such technology will not alter the intent or scope of the patrol inspections, it will more rapidly integrate patrol inspection results into the system of record.

7.3.4.13 Pole Loading Assessment Program to Determine Safety Factor

WSD Initiative Definition: Calculations to determine whether a pole meets pole loading safety factor requirements of GO 95, including planning and information collection needed to support said calculations. Calculations shall consider many factors including the size, location, and type of pole; types of attachments; length of conductors attached; and number and design of supporting guys, per D.15-11-021.

1) ***Risk to be mitigated/problem to be addressed:***

   Determining whether an electric pole is overloaded is an important element of preventing pole failure and the associated potential wildfire ignition risk. PG&E started our pole loading program to reduce the risk of potential fire ignitions resulting from pole failures by evaluating whether a pole meets GO 95 Rule 44 strength requirements throughout its service life, both when initially installed and while in-service despite changing conditions, impacts from maintenance activities, attachment additions, and potential wood strength degradation.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   During a pole's service life, pole loading calculations are performed when load is added to a pole, or if a suspected overload condition is observed during inspection. Pole loading calculations are performed in O-Calc software during design phase to ensure poles are sized correctly to satisfy GO 95 requirements. PG&E created a centralized database to retain pole loading calculation record information, in accordance with D.09-08-029.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

   The program has focused on assessments of poles in the Tier 2 and 3 HFTD areas with the goal to be fully implemented (100 percent poles analyzed) in these areas by 2024. Poles located in non-HFTD areas will follow, with the goal to be fully implemented (100 percent poles analyzed) by 2030.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year.***

   As of December 1, 2020, this program has completed pole loading analysis of over 160,000 poles, all of which are considered the highest risk poles, either due to the pole characteristics or location, being in an HFTD area. The program continues to focus on the HFTD areas, planning to analyze approximately 160,000 poles in 2021.

5) Future improvements to initiative.

PG&E is using enhanced field collected images, obtained during recent inspections, for the pole loading evaluations, as well as LiDAR data to geo-correct pole locations. PG&E is also strengthening the pole loading model parameters by considering historical meteorological data (e.g., wind speed) to ensure poles are strong enough before field installation. In addition, PG&E is working with the pole loading calculation software vendor to enable analysis of multiple pole models together, enabling span linking to structural connectivity.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

This is a 10-year program continuing the work started in 2020 that focuses on structural desk top review assessments of all poles. Due to the higher risk of potential fire ignition exposure in the HFTD Tier 2 and 3 areas, PG&E's goal for these poles is full implementation of assessments (100 percent poles analyzed) in these areas by 2024. Poles located in PG&E's non-HFTD areas will follow with the goal to be fully implemented (100 percent poles analyzed) by 2030.

Throughout this period, PG&E is continually evaluating risk associated with the completion of this work and will adjust course as necessary to meet the objective. At this time, we have gone through a request for proposal process and selected a vendor, but during the course of this ten-year project, contracts will be signed in two-year intervals to provide PG&E flexibility to course correct as necessary.

7.3.4.14 Quality Assurance / Quality Control of Inspections

WSD Initiative Definition: *Establishment and function of audit process to manage and confirm work completed by employees or subcontractors, including packaging QA/QC information for input to decision making and related integrated workforce management processes.*

1) ***Risk to be mitigated/problem to be addressed:***

Quality assurance and quality control are important tools for providing consistent and reliable inspection results for PG&E's equipment and facilities, which ultimately can reduce wildfire risk.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

Quality assurance/quality control of inspections utilizes a combination of program, process, tool, and other control points intended to rapidly identify anomalies in inspection and patrol results with the intention of addressing the gap, determining the root cause, and pursuing improvement opportunities. Among other things, quality assurance could mean establishing baseline metrics and measures of program performance to highlight outliers in any inspection process step. Quality controls can be established to identify inspection personnel who report abnormally high or low rates of corrective findings in the field. This could also mean identifying inspection personnel who experience abnormal rates of changes of their initial findings (increased or decreased priority of findings, rejection of findings). PG&E's practice of a secondary review of all field inspection findings via a CIRT prior to recording the finding in the system of record is one operational practice that works to drive consistency in inspection results. In 2020, PG&E established a consolidated CIRT team under the System Inspections department that includes supervisors and dedicated staff for transmission, distribution, and substation facility inspections.

For inspections, quality assurance and quality control support are also provided after-the-fact by internal departments such as Internal Auditing (IA) and EQM, who sample work to ensure it conforms to the governing process guidance. IA uses a risk-based approach in developing its annual Audit Plan. As part of this process, IA considers key and/or emerging risks that the Utility is facing, such as those related to the Utility's electric system that is exposed to wildfire hazards. IA includes audits covering these risks in its annual Plan; examples for 2020 include audits of inspection and maintenance processes for transmission and substation assets, and inspection and maintenance processes for distribution assets. In performing each individual audit, IA develops a risk and control matrix to document the relevant risks and controls and to help identify gaps and determine the scope of the audit. More specifically, in performing inspection and maintenance audits of electric assets, IA generally performs audit steps to assess the following:

- There is a complete population of electric assets for inspection;
- Utility and/or contract personnel performing the inspection and maintenance work are appropriately trained/qualified;
- Inspections and corrective work are completed within required timeframes;
- Work is performed to standard;
- Inspection and maintenance records are complete, accurate, and retrievable; and
- Inspection and maintenance guidance documents are current.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")

PG&E applies quality assurance and quality control to inspections that occur throughout our service area. The CIRT reviews of corrective findings operate as first in-first out, with priority given to reviewing Level 1 or 2 findings (PG&E priority A or B) which have shorter resolution durations. The initial CIRT review of corrective notifications targets a turnaround time from the date the condition was observed in the field: 5-day for priority B, or 30-day for priorities E and F notifications. Similarly, inspection work verification sampling and data analysis seek to rapidly sample and monitor performance to enable timely corrective interventions such as re-training, guidance clarification, and even re-inspection. Internal Audit and Electric Quality Assurance efforts tend to be retrospective and may look back to prior cycles.

4) Progress on initiative (amount spent, regions covered) and plans for next year.

For the 2020 inspection and patrol cycle, CIRT reviewed more than 84,000 transmission and 170,000 distribution corrective notifications generated by one or more asset inspection programs. CIRT has the ability to reference internal and external guidance, call upon subject matter experts, and review prior inspection reports to guide their final determinations. Of the total corrective notifications, approximately 7,000 transmission and 7,000 distribution findings were rated as “B” priority (GO 95 Rule 18 priority 1 or 2). CIRT made changes to the priority, scope, or other aspect of the initial inspection field finding in 12 percent of transmission cases and 7 percent of distribution cases.

In late 2020, PG&E published initial process quality control metrics for field data collectors, inspectors, and gatekeepers (Inspection Review Specialists). Work verification of inspector results by supervisory personnel, or through a representative re-inspection sampling scheme, has historically been used for inspection quality management. In 2021, PG&E is shifting to

trend data collected during digital paperless inspections to lessen the need for this type of after-the-fact sampling approach.

5) Future improvements to initiative.

Improvements to the inspection quality management for 2021 are focused on timeliness of reporting process quality results to support remedial actions while inspectors are still in-area. This supports lower overall costs by reducing re-mobilization of personnel back into a geography previously considered complete. Other improvements to internal quality oversight include ensuring data analysis of processes, such as inspector productivity rates, notification creation rates, notification rejection/duplication rates are actionable for inspection supervisory personnel. In addition, in 2021, PG&E has hired internal and contract staff into Inspection Review Specialist roles. The Inspection Review Specialists are primarily tasked to provide technical guidance and quality oversight to field inspection personnel and CIRT personnel (PG&E and contractor), including work performance coaching and work quality sampling. The Inspection Review Specialists exist within the inspection execution arm, separate from the Internal Audit and Electric Quality Management departments.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Long-term, the Quality Assurance / Quality Control of Inspections will continue to mature in process documentation, rigor, and timeliness. PG&E will continue to build out capabilities for process quality monitoring and control, with a focus on near-real-time data trending and feedback. This may include increased data analytics capabilities to monitor control limits for key performance indicators, via technology investments and staffing.

7.3.4.15 Substation Inspections

WSD Initiative Definition: *In accordance with GO 174, inspection of substations performed by qualified persons and according to the frequency established by the utility, including record-keeping.*

The below narrative for Section 7.3.4.15 covers Substation Inspections, including distribution and transmission. However, in Table 12, in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx we have separated the financials and Risk Spend Efficiency calculations for distribution and transmission.

1) ***Risk to be mitigated/problem to be addressed:***

   PG&E's routine substation preventive maintenance practices, including inspections, were developed to comply with requirements of various regulatory agencies such as the CAISO, NERC, WECC, CPUC. In 2019, routine substation inspections in Tier 2 and Tier 3 HFTD areas were supplemented as part of WSIP. Supplemental ground and aerial substation inspections seek to proactively identify and treat pending failures of substation components which could create fire ignition if left unresolved or allowed to run to failure. In addition, the proactive identification of less urgent concerns permits PG&E to evaluate potential investments in risk mitigation activities such as system hardening, enhanced vegetation management, reconductoring, among other programmatic tools.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   The supplemental inspection program includes three methods: Drone-based aerial inspection, Ground-based visual inspection, and Infrared inspection. These supplemental inspections are performed in addition to the routine inspections that are part of the maintenance practices described in Utility Standards TD-3322S and TD- 3323S. To develop this supplemental inspection program, FMEA was performed on all substation equipment. Enhanced detailed inspections are guided by digital checklists that align to the FMEA for the structure, associated equipment and components. Both objective and subjective criteria are used to evaluate the condition of the asset and identify corrective actions. The improved visibility from enhanced inspections may inform new programmatic responses including equipment replacements, improvements to maintenance tasks, changes in frequency of maintenance or guidance clarifications.

   Supplemental inspections will be performed in PG&E-owned substations based on the following risk factors: location in an HFTD area, Transmission Substation criticality, and Distribution Substation customer count.

   For the 2021 supplemental inspection cycle, the substation enhanced ground will evaluate 17 unique components with 252 questions, and the substation aerial evaluation assesses 16 components with 606 questions. Examples of components evaluated during enhanced inspections include

the items such as: batteries, breakers, bus, load tap changer, shunt capacitors, synchronous condensers, transformers, among other equipment.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk.")***

For 2021-2022, supplemental inspections are planned annually for all Tier 3 HFTD area substations and on a three-year cycle for substations in Tier 2 HFTD areas. Additional non-HFTD sites may also be assessed using these supplemental inspection methods. For 2020-2022, the baseline GO 174 monthly (or bi-monthly) station inspections are anticipated to proceed consistent with existing procedures. In general, PG&E schedules patrol and inspection activities in HFTD areas earlier in the year to provide time for necessary repairs prior to peak fire season.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year.***

For 2020, PG&E assessed 192 substations: 42 HFTD Tier 3 substations; 33 HFTD Tier 2 substations; 23 in substations adjacent to Tier 2 and 3 HFTD areas (*i.e.*, in Buffer Zones); and 94 non-HFTD substations via the supplemental ground and aerial inspections.

For 2021, PG&E intends to complete supplemental ground and aerial inspections of 100 substations: 42 in HFTD Tier 3, 38 in HFTD Tier 2; and 20 in substations adjacent to Tier 2 and 3 HFTD areas.

5) ***Future improvements to initiative.***

Future improvements may include asset selection and work planning to align with revised risk models and the consideration of 2019 and 2020 supplemental inspection findings, evolution of objective inspection criteria and wording to deliver more consistency between evaluators, and incorporation of aspects of the supplemental inspection into routine station checks.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Going forward, supplemental inspections for substation in HFTD areas is expected to continue. However, PG&E will evaluate efficiency opportunities between supplemental and routine inspections.

7.3.5 Vegetation Management and Inspections

Overview of Pacific Gas and Electric Company's (PG&E or the Utility) Vegetation Management (VM) Program

Given the growing wildfire threat, PG&E has further expanded and enhanced our VM around assets in High Fire Threat Districts (HFTD). This includes addressing vegetation that poses a higher potential for wildfire risk in high fire-threat areas through PG&E's Enhanced Vegetation Management (EVM) program. The goal of this important wildfire safety effort is to reduce the risk of trees, limbs and branches contacting power lines and equipment to help keep our customers and communities safe.

This work is critical because PG&E operates in a heavily forested and vegetated area, particularly compared to the other large California utilities. Additionally, PG&E's service area includes approximately:

- 81,000 circuit miles of overhead distribution power lines with approximately 25,200 circuit miles in HFTD areas
- 18,000 circuit miles of overhead transmission power lines with approximately 5,520 miles in HFTD areas

The EVM program is being done in addition to other baseline and long-standing, multi-pronged PG&E VM programs with various elements all designed to:

- Proactively conduct tree work that reduces the likelihood of tree failure that could impact electric facilities and pose a public safety risk;
- Comply with State and Federal regulations regarding minimum vegetation clearances for the Electric Transmission (ET) and Distribution overhead systems;
- Perform recurring cycle inspections so required vegetation clearances are maintained, remain compliant year-round and hazardous trees are abated;
- Maintain vegetation-to-line clearances, and radial clearances around poles, pursuant to California Public Resource Code (PRC) Sections 4292 and 4293, General Order (GO) 95 Rule 35, and Federal Agency Code (FAC)-003-4 (Federal ET standard), to ensure year-round compliance and risk reduction; and
- Validate that work was done as planned and intended through Work Verification (WV) and Quality Assurance (QA) reviews, including maintaining auditable records of all work done.

PG&E's EVM program encompasses all overhead distribution lines in Tier 2 and Tier 3 HFTD areas and is designed to exceed its Routine VM work to comply with California Public Utilities Commission (CPUC) mandated clearances (GO 95, Rule 35). In HFTD areas, PG&E's Routine VM meets regulations requiring four feet (ft) radial clearance around overhead distribution lines. The EVM program is much more expansive and includes the following:

- Radial Clearances: Exceeding the 4-ft minimum clearance requirement by ensuring vegetation requiring work is trimmed to the CPUC recommended 12-ft clearance at time of trim and in some cases, trimming beyond 12 ft depending on tree growth rates, among other factors. Trimming to the CPUC recommended 12-ft clearance ensures compliance with GO 95 Rule 35.

- Overhang Trimming: Removing overhanging branches and limbs four ft out from the lines and up to the sky around electric power lines to further reduce the possibility of wildfire ignitions and/or downed wires and outages due to vegetation-conductor contact.

- Assessing Trees with the Potential to Strike: Evaluating all trees in HFTDs tall enough to strike electrical lines or equipment and, based on that assessment, trimming or removing trees that pose a potential safety risk, including dead and dying trees.

Objectives, Strategies, and Tactics for VM

1. Collaboration with Local Land Managers and Regulation Compliance

In order to facilitate timely completion of VM activities, PG&E collaborates with local landowners and communities, local governments, state agencies and federal agencies. This includes coordinating with cities, counties and other local authorities to obtain local encroachment permits. PG&E's VM activities comply with endangered species and fish and game restrictions, California Department of Forestry and Fire Protection (CAL FIRE) forest practices rules, and state permitting requirements that could trigger review under the California Environmental Quality Act (CEQA). PG&E's VM Program is focused to a large degree on compliance with GO 95, Rule 35, PRC 4292, and PRC 4293. Additionally, VM is focused on the commitments within PG&E's Wildfire Mitigation Plan (WMP).

While VM is focused on complying with regulatory requirements, PG&E's higher mission is to perform VM in ways that reduce wildfire threat as circumstances dictate. Because climate threat conditions today are more severe than those that existed when regulations were developed and adopted, PG&E views VM requirements as the minimum standards for reducing risk. The program includes inspection identification, clearing and removal of potentially problematic vegetation, as well as QA review of the work performed. PG&E's EVM Overhang Clearing supports compliance with GO 95 Rule 35 and PRC 4293, which require that no vegetation approach within four feet of electric distribution wires at any time.

2. Identification and Determination of Ignition Risk

PG&E complies with Decision 14-02-015 in which the CPUC adopted a Fire Incident Data Collection Plan that requires investor-owned utilities (IOU) to collect and annually report certain information related to fire-related events. PG&E's annual report includes: the number of fire incidents; number of incidents by fire size; suspected ignition cause (e.g., third-party contact, equipment/facility failure, wire/wire contact, objects); object type suspected of causing ignition; and equipment failure type suspected of causing ignition. In addition, PG&E provides additional information about the tree species suspected of causing ignition. The data contained in these reports is analyzed to identify and determine the causes of ignition risk which ultimately drives the development of the WMP.

3. Determination to Trim Beyond GO 95 Requirements

PG&E has determined that in certain circumstances it is prudent to exceed the GO 95 requirements for tree trimming. For example, instead of the required four ft radial clearance around conductors, PG&E is trimming trees from the conductor to sky for overhang clearing. Additionally, through our EVM program, PG&E abates or trims trees outside of the GO 95 prescribed 4-ft clearance where trees more than four ft away from a power line are determined to have a defect as identified through the tree assessment tool (TAT) and have a clear path to strike.

4. Mitigation of Strike Trees

As part of our EVM program, PG&E performs an inspection of all strike trees adjacent to our distribution lines in HFTDs and uses the TAT as a guide for addressing strike trees with defects. PG&E will conduct a study to assess the need for and scope of the targeted tree species program. Depending on the circumstances, trees that are dead, diseased, or dying or that are identified by the TAT as "abate" may be removed under either Enhanced VM or the Tree Mortality Program.

5. Overall VM Initiatives

PG&E's VM and EVM initiatives are designed to address the overall VM objectives including:

- Enhance community and public safety by further reducing the risk of power outages, wires down, and fires caused by trees growing or falling into high voltage distribution lines;
- Maintain the reliability of the electric distribution system and continue to comply with vegetation clearance regulations through the Routine Tree Work and Vegetation Control programs;
- Maintain program and work quality through Quality Verification (QV) and QA programs;
- Continue to educate the public about the hazards posed by high voltage lines and vegetation through Public Education efforts;

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- Further improve field working conditions and safety practices for tree workers through the Contractor Safety Oversight Program; and

- Continue to comply with environmental regulations while performing VM work.

The initiatives that PG&E introduced in 2018 and continues to develop include:

- Overhang Clearing: Removing branches overhanging electric power lines to further reduce the possibility of wildfire ignitions and/or downed wires due to vegetation- conductor contact;

- Fuel Reduction: Reducing vegetative fuels in the area under and adjacent to power lines with the intention of further reducing wildfire risk;

- Light Detection and Ranging (LiDAR): Using analytics from LiDAR and imagery (collectively referred to as remote sensing) data collection to augment the information gathered through manual patrols.

PG&E continues to refine our VM and EVM programs based on additional data and experience, feedback from stakeholders and the Commission, and developments within the VM industry.

7.3.5.1 Additional Efforts to Manage Community and Environmental Impacts

Wildfire Safety Division (WSD) Initiative Definition: *Plan and execution of strategy to mitigate negative impacts from utility VM to local communities and the environment, such as coordination with communities to plan and execute VM work or promotion of fire-resistant planting practices.*

1) Risk to be mitigated/problem to be addressed:

Our VM activities face numerous legal challenges, such as land rights issues, local permit requirements, environmental requirements, and other state and federal requirements. These issues can involve concerned landowners and communities, local governments, state agencies, or federal agencies, and can cause significant delays in performing VM work.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

PG&E wants customers and communities to be completely informed about the VM work taking place and our role in increasing public safety and reducing fire risk. PG&E proactively communicates and partners with impacted customers, landowners, government agencies and community organizations regarding the planned work and long-term solutions in and around their neighborhood or community. Communication efforts focus on community and environmental impacts that provide program information, share plans and engage in partnerships where possible, including the promotion of utility compatible, fire resistant landscaping education.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

Communication efforts to mitigate community and environmental impacts are performed within all PG&E regions by various PG&E lines of business (LOB), such as VM, Governmental Relations, Division Leadership Teams, Call Center Operations, Customer Communications and Local Customer Experience. The various forms of communication used include letters, postcards, door hangers, fact sheets, brochures, presentation materials, Interactive Voice Response outbound calling, web site, social media, email letters, texting, and work plan portals.

In some cases, through PG&E's outreach regarding this work, opportunities can arise for communities or agencies to support or leverage the work PG&E is performing along power lines to further enhance community safety. Since 2014, PG&E has provided grant and other funding to community organizations (Fire Safe Councils) and agencies to support local or jurisdictional efforts toward reducing community wildfire risk mitigation, like fire break clearing and fuel cleanup in areas that are not adjacent to PG&E powerlines and are outside of the scope of PG&E's VM programs.

4) Progress on initiative (amount spent, regions covered) and plans for next year

To address the requirements described above, PG&E's land and environmental management, customer care, and legal teams work closely with PG&E's VM team annually to overcome community and environmental challenges. They coordinate and plan the work in order to reach out to landowners, communities, and local governments to address concerns in advance of the proposed VM activities. PG&E tries to reach mutually agreeable results with concerned parties, but this regularly causes delays, that in certain situations prompt PG&E to seek court orders. PG&E routinely engages with the CPUC, state and local agencies, as well as legislature to address these constraints.

In 2020, PG&E started using a web-based file transfer program known as "ProjectWise" to share workplans and schedules associated with VM programs and activities. This is an elective enrollment-based process. Current scope includes monthly outlooks for Routine and EVM activities. The Local Government VM Data Sharing corrective actions #17 of twenty system enhancement corrective actions agreed upon in the Wildfire Order Instituting Investigation Settlement Agreement with the Commission. The platform is being extended to the Regional Water Quality Control Board Representatives in 2021.

PG&E continues discussion with the Board of Forestry and CAL FIRE regarding Forest Practice Rules and application of Utility Exemptions for VM and WMP Plan activities. Workshops are scheduled to begin in December 2020 and continue through 2021.

5) Future improvements to initiative

PG&E will continue to communicate and partner with stakeholders regarding this public safety vegetation work and promote fire resistant planting. PG&E informs cities and counties of VM work within their community and works with them to address any questions they may have.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Managing community and environmental impacts is one of PG&E's top priorities and will continue to be well beyond the next 10 years. Long-term, PG&E is planning on better partnerships and agreements with agencies to perform VM work on federal or state lands without additional permitting requirements that could slow the mitigation of crucial work activities. PG&E also wants to promote fire-resistant plantings on these agency lands to reduce the community and environmental impacts of continuing to perform VM activities on a regular basis.

7.3.5.2 Detailed Inspections of Vegetation Around Distribution Electric Lines and Equipment

***WSD Initiative Definition*:** *Careful visual inspections of vegetation around the right-of-way (ROW), where individual trees are carefully examined, visually, and the condition of each rated and recorded.*

This section also addresses Action PGE-78 (Class B).

1) Risk to be mitigated/problem to be addressed:

Vegetation located close to electrical equipment can cause a fire by contacting the equipment, either catching fire or dropping a spark that could cause other vegetation to ignite. Vegetation trimming and dead tree removal reduce the availability of fuel that could start or spread a fire, whatever the cause. PG&E's VM program inspects approximately 100,000 miles of overhead electric facilities on a recurring cycle.

PG&E's distribution VM program consists of several different inspections (Patrols) that help PG&E safely and reliably operate primary distribution circuits and secondary distribution lines, while complying with the state laws and regulations. These inspections identify the following:

- Dead, dying, and declining trees, or dead portions of trees including dead overhangs, that can contact PG&E facilities if they fail
- Green trees observed within the Minimum Distance Requirement (MDR) or with the potential to encroach within the MDR before the next patrol cycle
- Green hazard trees with the potential to impact the electric facilities
- Trees causing strain or abrasion on secondary lines
- Abnormal field conditions

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives

PG&E's Distribution VM program has been designed and implemented to ensure safe and reliable operation of distribution facilities and to prevent foreseeable vegetation outages. In addition, the Distribution VM program is designed to monitor compliance with state and federal laws and regulations including GO 95 Rule 35, PRC 4292, PRC 4293 and PG&E's 2021 WMP.

Each state and federal law requires the following:

- GO 95 Rule 35 requires a year-round clearance below power lines of a minimum 18 inches. New fire safety regulations require a minimum clearance of four ft year-round for high-voltage power lines in the CPUC-designated HFTDs.

- PRC 4292 is administered by the CAL FIRE. It requires that PG&E maintain a firebreak of at least 10 feet in radius of a utility pole, with tree limbs within the 10-ft radius of the pole being removed up to eight ft above ground. From eight ft to conductor height requires removal of dead, diseased or dying limbs and foliage. This applies in the State Responsibility Area (SRA) during the designated fire season.

- PRC 4293 is also administered by CAL FIRE. It requires that PG&E maintain a 4-ft minimum clearance for power lines between 2,400 and 72,000 volts (V), and a 10-ft clearance for conductors 115,000 V and above. PRC 4293 also requires the removal of dead, diseased, defective, and dying trees that could fall into the lines. This applies to the SRA during the designated fire season.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

VM inspects all distribution circuit miles in PG&E's service territory on a recurring cycle using a combination of different Patrol methodologies and Patrol types, please see below.

Patrol Methodologies:

- Direct visual inspection from the ground

- Direct visual inspection from the air

- Ground-based LiDAR inspection

- Aerial LiDAR Inspections

Patrol Types:

- Routine Patrol – The VM routine program performs scheduled inspections on all overhead primary and secondary distribution facilities to maintain radial clearance between vegetation and conductors by identifying trees that will encroach within the MDRs required by law or PG&E procedures, dead, dying and declining trees.

- Mid-cycle Patrol – The VM Second Patrol program, (also known as CEMA Patrol), performs scheduled mid-cycle patrols approximately six months before or after the routine patrol on all overhead primary and secondary distribution facilities to maintain radial clearance between vegetation and conductors by identifying trees that will encroach within the MDRs required by law or PG&E procedures and by identifying dead, dying and declining trees that have the potential to strike the conductors. Second patrols occur primarily within HFTDs.

- EVM Patrol – The EVM Program is a multi-year program that performs risk-based, scheduled patrols on overhead primary distribution facilities. EVM patrols occur on specific line sections, based on risk, within HFTD Tier 2 and Tier 3. Additionally, EVM patrols include a tree assessment of all trees with the

potential to strike the facilities. This aspect of the EVM program is specified in section 7.3.5.15.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2020, PG&E trimmed approximately 1.5 million trees (including 2019 carry-over) in Routine VM. PG&E identified approximately 68,000 CEMA trees and trimmed approximately 65,000 trees (including 2019 carry -over).

At this time, PG&E is forecasting to work on approximately 1,800 circuit miles and mitigate approximately 190,000 trees in 2021, for the EVM program.

5) Future improvements to the initiative

Future improvements include, but are not limited to, increasing staff for general oversight and WV, as well as improvements to the QV process described in Section 7.3.5.13 (QA/Quality Control (QC) of Inspections).

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Long-term, PG&E plans to improve patrol procedures for all programs to incorporate additional details and lessons learned to help employees and contract staff members perform better inspections that benefit all customers. This is an effort that will be continuous and carried out well beyond 2025. WV and QV processes are projected to continue to expand within the next five years. Expansions of these processes will allow PG&E to use internal audit results to improve inspections of vegetation around distribution electric lines and equipment.

ACTION PGE-78 (Class B)

1) describe whether it has evaluated implementing Utility Defensible Space (UDS) for distribution ROW, and either

a) provide locations where UDS for distribution ROW is being implemented or planned to be implemented, or

b) explain why PG&E is not utilizing UDS for distribution ROW vegetation maintenance.

Response:

PG&E has evaluated implementing UDS within Distribution and is in the process of building the framework for the program. At this time, the program will not include fire retardant application because it is pending further environmental reviews as mentioned in the Transmission UDS pilot Class B- action 77. The goal for 2021 Distribution UDS is to leverage the Vegetation Risk Model developed by the Asset Strategy team to identify

sections of high-risk circuit protection zones (CPZ) to identify projects for performing modification of vegetative fuels. No section locations have been identified at this time. Any projects identified outside the Vegetation Risk Model will be locations based on a combination of local knowledge and a cohesive strategy to work with CAL FIRE, US Forest Service (USFS), and municipalities on wildfire prevention initiatives.

7.3.5.3 Detailed Inspections of Vegetation Around Transmission Electric Lines and Equipment

WSD Initiative Definition: *Careful visual inspections of vegetation around the ROW, where individual trees are carefully examined, visually, and the condition of each rated and recorded.*

This section also addresses Actions PGE-70 (Class B) and PGE-77 (Class B).

1) Risk to be mitigated/problem to be addressed:

Trees or other vegetation that make contact or cross within flash-over distance of high voltage transmission lines can cause local, regional or cascading, grid-level service interruption. Vegetation encroachment can cause phase to phase or phase to ground electrical arcing which can cause injury, death, or wildfire ignitions. Vegetation growing close to poles or towers with non-exempt equipment can act as a fuel bed for wildfire ignition. Vegetation growing close to any structure can impede inspection of the structure base and in some cases can damage to the structure.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives

PG&E's Transmission VM program has been designed and implemented to ensure safe and reliable operation of transmission facilities and to prevent foreseeable vegetation outages to reduce wildfire risk. PG&E manages approximately 18,200 miles of ET Lines across our service territory ranging from 60 kilovolt (kV) to 500 kV. This includes approximately 6,800 miles of "critical" lines as designated by the North American Electric Reliability Corporation (NERC) and subject to the Federal VM Standard FAC-003-4 and approximately 5,500 miles of line in Tier 2 & 3 of the HFTD. All lines are subject to additional state VM regulations including GO 95 Rule 35, PRC 4292, PRC 4293, and the California Independent System Operator Field Maintenance Agreement.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

PG&E operates our lines in ET corridors that are home to vast amounts of vegetation. This vegetation ranges from sparse to extremely dense. PG&E's transmission lines also pass through urban, agricultural, and forested settings. The corridor environment is dynamic and requires focused attention to ensure vegetation stays clear of energized conductors and other equipment.

Vegetation inspection is a required operational step in an overall VM Program. Accordingly, PG&E has developed a recurring cycle inspection program as part of our overall Transmission VM Program to respond to the diverse and dynamic environment of our service territory.

This initiative is executed systemwide consisting of the following elements:

- Routine NERC – LiDAR inspection, visual verification of findings, and mitigation of vegetation encroachments as well as other vegetation conditions on approximately 6800 miles of NERC Critical lines. 100 percent inspection and work plan completion required by Federal VM Standard FAC-003-4.

- Routine Non-NERC - LiDAR inspection, visual verification of findings, and mitigation of vegetation encroachments as well as other vegetation conditions on approximately 11,400 miles of transmission lines not designated as critical by NERC.

- ROW Expansion – A program that removes vegetation to widen existing 60 kV/70/kV115/kV ET corridors in Tier 2 and Tier 3 HFTD areas. The work scope seeks to address lines that have radial clearance of vegetation but do not necessarily have clear corridors. At a minimum, ROW expansion establishes a 20' corridor (10' on either side of centerline). Greater ROW widths are obtained where land rights (easements) allow; or where property owners are willing to partner. In addition, trees outside of the ROW that could fall and touch a PG&E line are inspected after initial ROW expansion activities conclude to assess any potential risks that may have developed as a result of the ROW clearing activities.

    - The program addresses approximately 200-line miles each recurring patrol cycle targeting trees and other woody vegetation for removal.

    - Work is prioritized based on wildfire risk, PSPS frequency, historic outage performance and tree risk characteristics.

    - Slash and fuels from previous VM work is chipped onsite with an off-road-tracked chipper machine or masticated in place where it is reasonable to do so.

    - Areas inaccessible to machinery have fuel treatments of lop and scatter.

- Integrated Vegetation Management (IVM) – Ongoing maintenance program designed to maintain cleared rights-of-way in a sustainable and compatible condition by eliminating tall-growing and fire-prone vegetation and promoting low-growing, fire-resistant vegetation. Prioritization is based on aging of work cycles and evaluation of vegetation re-growth.

- LiDAR Mid-cycle inspection of 80 percent to 100 percent HFTD Tier 2 and Tier 3 Transmission Lines – Started in 2020 to provide a snapshot of vegetation growing conditions and conductor clearances at the height of the growing season and immediately prior to the height of the fire season.

4) Progress on initiative (amount spent, regions covered) and plans for next year

- 2020 Commitment Performance:

TABLE PG&E-7.3.5-1: 2020 TRANSMISSION INSPECTIONS

Work Category*	Unit Description	Plan Units	Areas inaccessible to machinery have fuel treatments of lop and scatter; Year End Actual Units	Region
Routine NERC	mile**	6,779	6,779	Systemwide
Routine Non-NERC	mile**	11,441	11,441	Systemwide
ROW Expansion	mile	207	207	HFTD
IVM	acre	7,895	7,895	Systemwide
LiDAR Mid-Cycle	mile	5,662	5,662	Tier2 and Tier3, HFTD

Note: Mileage is reconciled annually from ET GIS data

- 2021 Transmission Inspections

In addition to compliance inspections, in 2021, approximately 200 miles of Transmission ROW expansion work are planned within HFTD areas. PG&E will also continue to perform IVM Maintenance based on aging of work cycles and evaluation of vegetation re-growth and will conduct LiDAR mid-cycle inspections on 80 percent-100 percent of HFTD Tier 2 and Tier 3 Transmission lines.

5) Future improvements to initiative

Future improvement opportunities include continued improvement of LiDAR Risk Score Model. This model is being reworked, validated, and vetted by a team of internal and consulting experts as well as an industry panel that was assembled by the North American Transmission Forum (see Section 7.3.5.8 concerning LiDAR Inspections of Vegetation Around Transmission Electric Lines and Equipment).

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Work related to inspections around transmission electric lines and equipment is recurring work that will expand beyond 2030. Due to the higher risk of potential fire ignition exposure in the HFTD Tier 2 and 3 areas, PG&E's goal is to remove vegetation to widen existing 60kV/70/kV115/kV ET corridors in Tier 2 and Tier 3 HFTD areas. Throughout this period, PG&E will be evaluating risk associated with the completion of this work and will adjust course as necessary to meet the objective.

ACTION PGE-70 (Class B)

1) Provide the resource allocation in terms of percentage between transmission ROW expansion and PSPS risk-tree work, and

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2) Provide the number of circuit miles completed in 2020 for transmission ROW expansion and PSPS risk-tree work, respectively.

Response:

1) ROW Expansion refers to work intended to clear a minimum 20' ROW on lines identified by a number of risk factors, primarily: fire risk, outage frequency and number of times the line was in scope for a PSPS event. "PSPS risk-tree work" targets trees outside the ROW, either before or after full scope ROW expansion, to address trees identified as having higher risk relative to other trees based primarily on geospatial characteristics identified by LiDAR inspection. Working from those two descriptions, resources were allocated as follows:

- 98 percent ROW Expansion
- 2 percent PSPS risk tree work

Resource allocation is extrapolated from the number of trees completed in each work group as well as taking into consideration the efficiencies associated with scale: PSPS 3592 trees, ROW Expansion 269,892 trees. It is important to note that the PSPS work is a necessary component of the ROW Expansion work. They are not separate programs. They complement each other and support the same goals.

2) ROW Expansion and PSPS risk-tree work are multi-year projects. Therefore, PG&E does not track circuit miles completed within a calendar year. However, VM completed 207 corridor miles of transmission ROW Expansion in 2020. PG&E VM completed 206 corridor miles of Transmission PSPS targeted risk-tree removal work in 2020. This represents mitigation of the highest risk trees as identified by LiDAR on a circuit. See Table PG&E-7.3.5-2 below for details

TABLE PG&E-7.3.5-2: COMPLETED CORRIDOR MILES OF TRANSMISSION ROW EXPANSION AND PSPS TARGETED RISK-TREE REMOVAL WORK

Miles completed in 2020: This represents the total corridor miles worked on the Transmission lines below

PSPS targeted Risk-tree 2020	Miles	ROW Expansion	Miles
Apple Hill #1	1.4	Colgate-Alleghany	2.9
Black Tap	0.5	Colgate-Grass Valley	0.2
Carberry Sw Sta RND MTN	12.6	Deer Creek-Drum	5.7
Eldorado Missouri Flat 1&2	13.4	DeSabla-Centerville	5.9
Forbestown Tap	0.2	Donnells-Curtis	12.1
Forks of the Butte	0.2	Drum-Higgins	7.5
Haas Woodchuck	3.8	Drum-Summit #1	2.5
Humboldt Bay 1	2.5	French Meadows-Middle Fork	5.2
Malin Round Mtn 2	48.3	Fulton-Calistoga	15.9
Pit 1 Cottonwood	50.4	Fulton-Pueblo	43.5
Pit 4	7	Gold Hill #1	9.9
Pit 6	3.4	Humboldt-Trinity	3.3
Pit 6 JCT RND Mtn	8.1	Keswick-Trinity	7.6
Pit 7	3.6	Kilarc-Deschutes	7.6
Round MTN Cottonwood 1&2	26.5	Laytonville-Willits	0.1
Tiger Creek Electra	13.9	Middle Fork #1	4.4
Briones Tap	5	Monta Vista-Burns	3.6
Delta- Mtn Gate Jct	0.1	Monte Rio-Fulton	4.4
Halsey- Placer	1.8	Philo Jct-Elk	19.4
Mountain Gate Tap	0.7	Pit #1-Cottonwood	10.8
Volta – South	1	Pit #5-Round Mtn #1	11.7
Windsor- Fitch Mountain	1.3	Trinity-Cottonwood	9.9
	205.7	Trinity-Maple Creek	3.1
		Weimar #1	3.0
		Green Valley-Paul Sweet Rel	5.0
		Moraga-Oakland	0.1
		Moraga-San Leandro	1.5
			206.6

ACTION PGE-77 (Class B)

1) Provide the percentage and number of overhead circuit miles that underwent the Transmission UDS pilot program, including the Transmission UDS and ROW Expansion overlap, for both completed and scheduled work, and

2) Explain how it determines UDS is beneficial on top of TVM, and how the benefits between the two differ.

Response:

1) Our Transmission UDS pilot was focused on application of fire retardant around selected poles and towers where fuel reduction had been completed by some of our TVM programs. However, this program was not implemented in 2020. It is pending additional environmental reviews including, but not limited to, product toxicological and environmental analysis, efficacy analysis, and environmental planning and permitting. No circuit miles underwent the UDS pilot in 2020, and there was no overlap between the

pilot and ROW expansion.

2) The Transmission UDS Program is intended to be an additional layer of protection against wildfire that uses the application of fire-retardant chemicals to prevent the start or slow the growth of an ignition. The application of fire retardant is not included in the scope of any other TVM programs. UDS is unlike other TVM programs because of its potential to address multiple modes of failure, whether it be vegetation or equipment failure. TVM programs only address vegetation failures.

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7.3.5.4 Emergency Response Vegetation Management Due to Red Flag Warning or Other Urgent Conditions

WSD Initiative Definition: *Plan and execution of VM activities, such as trimming or removal, executed based upon and in advance of forecast weather conditions that indicate high fire threat in terms of ignition probability and wildfire consequence.*

1) Risk to be mitigated/problem to be addressed:

All trees identified for work by pre-inspectors are evaluated for the priority of the required tree work. If vegetation is determined to be an immediate risk to PG&E facilities, described as a Priority 1 Condition in the VM Priority Tag Procedure (TD-7102P-17), the condition will be mitigated within 24 hours of identification as long as conditions are safe for the tree crew to proceed with work. Vegetation identified as pending Priority 2 work within the Red Flag Warning (RFW) area will be reviewed and re-prioritized if determined necessary by the local PG&E VM Point of Contact. Vegetation identified for follow-up work that shows no near-term risk factors, as outlined in the VM Priority Tag Procedure, is scheduled following the standard mitigation process.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives

It is important to review areas with potentially increased risk during a RFW or other elevated fire weather events and mitigate any identified vegetation risk to PG&E facilities.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

This activity takes place in areas identified as RFW conditions by PG&E's Meteorology Department where Priority Trees (per procedure TD-7102P-17 stated above) are pending.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2020, PG&E used the VM Priority Tag Procedure (TD-7102P-17) to identify, and mitigate, trees that represented an immediate risk to PG&E facilities during RFWs or other elevated fire weather events. RFWs and other elevated fire weather events continue to be prioritized daily. Accordingly, PG&E will continue using this process to mitigate wildfire risk in 2021.

5) Future improvements to the initiative

PG&E has no current plans for improvements to this initiative. However, PG&E will continue to evaluate the process annually by reviewing the execution of the work.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As stated in the section above, there are no further improvements planned at this time.

7.3.5.5 Fuel Management and Reduction of "Slash" From VM Activities

WSD Initiative Definition: *Plan and execution of fuel management activities that reduce the availability of fuel in proximity to potential sources of ignition, including both reduction or adjustment of live fuel (in terms of species or otherwise) and of dead fuel, including "slash" from VM activities that produce vegetation material such as branch trimmings and felled trees.*

In addition to describing the Fuel Reduction Program this section also addresses Action PGE-8 (Class B).

1) Risk to be mitigated/problem to be addressed:

The Fuel Reduction or UDS Program is intended to reduce vegetation fuels close to potential sources of ignition. Through this program, PG&E aims to remove dead fuels and to reduce, or adjust, live fuels to reduce the spread and intensity of fires associated with PG&E assets.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives

The goal of the fuel reduction work is to create "fire defense zones" to mitigate the spread of an ignition if one were to occur under or adjacent to PG&E powerlines while enhancing defensible space for communities, properties, and buildings. Locations for fuel reduction work are identified during pre-inspections (PI), beginning with the 2021 EVM high-risk circuits. VM may also identify some locations not on the Vegetation Risk Model to successfully complete cohesive strategy projects.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The program will leverage the Vegetation Risk Model developed by the Asset Strategy team to identify sections of high-risk CPZs to identify projects for performing modification of vegetative fuels. Any projects identified outside the Vegetation Risk Model will be locations based on a combination of local knowledge and a cohesive strategy to work with CAL FIRE, USFS, and Municipalities on wildfire prevention initiatives.

4) Progress on initiative (amount spent, regions covered) and plans for next year

PG&E is still in the process of building a framework for fuel reduction work. In 2020, different strategies were discussed and benchmarking with other utility companies was completed. The future work will target high- risk areas in all six regions based on the Vegetation Risk Model. There is no specific mileage target or budget for this work in 2021, this work in 2021 will be included in the 2021 EVM program (Section 7.3.5.15).

5) Future improvements to the initiative

Incoming data will be used to determine effectiveness and risk spend efficiency of a fuel reduction program. In addition, PG&E will use incoming data to identify the most effective schedule and cycle time. As mentioned above, PG&E has completed benchmarking with other utility companies. PG&E will be one of the first utility companies developing an official fuel reduction program.

In addition, as part of our UDS Program, PG&E is evaluating the use of fire-retardant products to reduce risk of ignition from utility infrastructure.

Traditionally, the use of fire-retardant chemicals has been limited to firefighting operations during active wildfires. PG&E is interested in land application of fire-retardant chemicals as a preventative measure to reduce potential ignitions related to utility infrastructure during extreme weather events in HFTDs. In the U.S., there is currently no single regulatory framework for the production, authorization and use of fire retardants. PG&E intends to conduct a review of commercially available fire-retardant products. This review will consist of the following:

- Product toxicological and environmental analysis
- Efficacy analysis
- Environmental planning and permitting initial assessment
- Scope of use including asset protection and proactive application

PG&E's review of fire-retardant chemicals will take place ahead of the 2021 wildfire season.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E has not determined a long-term plan yet for this initiative. Depending on the results of PG&E's fire-retardant review, PG&E will establish best management practices for future use of fire retardants. Additionally, PG&E will work with regulatory agencies to secure permits for future product use and application. Long-term plan milestones are still under development with VMs Leadership team.

ACTION PGE-2 (Class B)

1) Provide an RSE calculation for fuel and slash management

2) Provide a description of how this value was calculated.

Response:

1) PG&E is actively exploring fuel management in more detail to represent its risk reduction benefits and effectiveness. Much like other vegetation-related programs, the

intent of fuel management is to prevent an ignition, however unlike other vegetation related programs fuel management addresses multiple modes of failure, whether it be vegetation or equipment failure. Since this is a new program, PG&E continues to explore ways to provide an estimation of RSE. As PG&E will be one of the first utility companies developing an official fuel reduction program, we believe incoming data will help in identify preliminary effectiveness and cost estimations. While PG&E does not have data to use, PG&E intends to provide rough estimations for RSEs for the February 26th submission to better represent this program.

2) The method of calculation will utilize the standard Enterprise Risk Model. Given that this is a new project scope, the effectiveness and cost estimations will be preliminary estimations until this activity is performed in practice.

ACTION PGE-8 (Class B):

1) Discuss how PG&E is piloting the use of fire retardant, including how PG&E is choosing areas to undergo the pilot,

2) Discuss how long it takes to deploy fire retardant, including when such a decision would be made,

3) Describe the environmental permitting process needed for deployment of fire retardant, and

4) Explain what continuing "to explore the potential of this 'fail safe' alternative"14 consists of.

Response:

1) PG&E has re-evaluated the concept of using of long-term commercially-available fire retardants to pre-treat ROWs and around equipment in select locations to limit a spark from causing an ignition. Before this concept can be further explored, retardants must be evaluated for potential environmental impacts associated with preventative pre-treatments in the absence of wildfires.

2) See the response to subpart (1) above.

3) The environmental permitting process to apply fire retardant materials to PG&E facilities or ROWs will vary based on the type of fire retardant used and the application process. Other similar treatments that are applied to electric facilities include herbicides and tower treatment materials. If not a preapproved material, application of herbicides and treatments must be approved for use on state and federal lands. The USFS requires the issuance of a Pesticide Use Permit and both the National Parks Service (NPS) and Bureau of Land Management (BLM) require National Environmental Protection Act (NEPA) review. Non-wildfire related projects proposing use of herbicides not previously approved in the USFS and BLM have been subject to review timelines upwards of a year.

PG&E has various Operations and Maintenance (O&M) agreements with state and federal land management agencies across our service territory (including USFS, NPS, and California State Parks) which establish timelines to review PG&E O&M work.

However, application of fire retardant material is not a "covered activity" under the various O&M agreements. Since PG&E's existing O&M Plans do not cover these activities, it is expected that PG&E will need to pursue a Special Use Permit with the relevant agencies. It is likely that the process of obtaining a Special Use Permit from these agencies will require a NEPA/CEQA review, similar to the process of getting herbicides approved for use of state/federal property. The agencies will likely require documentation to support the choice of product use as a fire retardant and will want to better understand of potential impacts it may cause to the health of both humans and the environment.

If the method for applying fire retardant is limited to precise application to PG&E equipment by a crew person who accesses by ft (or via truck from an access road), then it will be significantly lower impact than application to the material to the entire ROW or beyond.

For work proposed on private property, a land rights assessment will be necessary. Depending on the rights granted to PG&E within the easement document, application of fire retardant materials may not be covered and will need property owner approval. Additionally, if the application of fire retardant is required outside of the ROW width that is granted by an easement, PG&E will need new rights or property owner approval.

4) PG&E's evaluation and "exploration" of this alternative is described in subparts (1) and (3) above. The findings described in subpart (3) will inform the feasibility of resuming an evaluation of using of long-term commercially available fire retardants to pre-treat ROWs and around equipment in select locations to limit a spark from causing an ignition.

7.3.5.6 Improvement of Inspections

***WSD Initiative Definition**: Identifying and addressing deficiencies in inspections protocols and implementation by improving training and the evaluation of inspectors.*

1) Risk to be mitigated/problem to be addressed:

Identifying and mitigating hazards related to vegetation is an effort that requires a series of different protocols to properly manage. Training courses and inspection protocols must be continuously monitored and revised to ensure proper management of potential and unforeseen risk in the field while conducting work.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives

Vegetation Management Inspectors provide real-time support to VM operations by ensuring safety and compliance with VM project scope, contract adherence and PG&E standards and specifications. Evaluating the work of PG&E inspectors is critical to the sustainability of our VM program. PG&E has implemented multiple work authentication processes that allow us to identify deficiencies and improve upon our protocols, please see below:

- WV – Validates that 100 percent of vegetation work in EVM was completed to scope through an audit of all work performed. This process provides confirmation that requirements have or have not been met.
- QV - Reviews a sample of inspections and recently completed tree work to validate that all work was performed in accordance with PG&E standards. This process provides confirmation that requirements have or have not been met. (See Section 7.3.5.13)
- QA – Uses a random sample of PG&E systems to estimate the work quality rate for the VM process from PI to completion of tree work. This process provides assurance that procedures are followed. (See Section 7.3.5.13)

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

Vegetation inspection is a required operational step in an overall VM Program. Accordingly, PG&E has developed a recurring cycle inspection program as part of our overall Transmission VM Program to respond to the diverse and dynamic environment of our service territory. Through our WV process, 100 percent of vegetation work completed is cycled through our audit process for EVM. Please see Sections 7.3.5.2 (Detailed inspections of vegetation around distribution electric lines and equipment) and 7.3.5.3 (Detailed inspections of vegetation around transmission electric lines and equipment) for additional information regarding region prioritization.

Each of our work authentication processes allows us to identify deficiencies in our inspection processes and revise training as needed to improve the performance of

inspectors.

4) Progress on initiative (amount spent, regions covered) and plans for next year

PG&E continues to develop new training to support changes, such as assessing burned redwoods in response to the 2020 fires and focused training on Priority Tags in response to procedure changes. In all cases, our training will be developed with and managed through the PG&E Academy to ensure proper development and learner completion tracking. Please refer to Section 7.3.5.14 (Recruiting and Training of VM Personnel) regarding additional progress on this initiative.

5) Future improvements to the initiative

Please refer to Sections 7.3.5.2 (Detailed inspections of vegetation around distribution electric lines and equipment), 7.3.5.3 (Detailed inspections of vegetation around transmission electric lines and equipment) and 7.3.5.13 (QA/ QC of Inspections) for future improvements regarding this initiative.

ACTION PGE-25 (Class B)

Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As stated above, please reference Section 7.3.5.2, Section 7.3.5.3, and Section 7.3.5.13 for more information on future improvements for this initiative.

7.3.5.7 LiDAR Inspections of Vegetation Around Distribution Electric Lines and Equipment

WSD Initiative Definition: *Inspections of ROW using LiDAR, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).*

1) Risk to be mitigated/problem to be addressed:

LiDAR is a remote sensing method that uses pulsed laser light, in all light ranges, to sense relative distance of objects in the environment and provide precise measurements. Due to its high level of accuracy, PG&E will pilot the use of LiDAR derived data as an additional layer of review for quality in Routine VM.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

LIDAR and remote sensing data can consistently take measurements and, depending on the time of acquisition, this can be leveraged to verify radial clearance and compliance on distribution lines. The resulting detections can be documented for later analysis and record keeping and can be used to provide positive confirmation of compliance.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

LiDAR and Remote Sensing data is targeted toward distribution lines in HFTDs Tier 2 and Tier 3. Data will be collected on pilot circuits in Routine VM.

4) Progress on initiative (amount spent, regions covered) and plans for next year

LiDAR and Remote Sensing data was collected for distribution lines in HFTD Tier 2 and Tier 3 in 2019 and reviewed in 2020. (See also Section 7.3.4.7, LiDAR Inspections of Distribution Electric Lines and Equipment.) In 2021, PG&E will expand the pilot use of ground-based LiDAR for QC of 4 ft. radial clearances in Routine VM for a portion of our Routine VM program dependent on time of roll-out and resource availability. LiDAR is not used to perform EVM inspections at this time.

5) Future improvements to initiative:

Future LiDAR and Remote Sensing initiatives will focus on the continued evaluation of the use of LiDAR in QC and WV for radial clearances in Routine VM.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E will pilot the use of ground-based LiDAR datasets for QC in Routine VM in HFTD areas. We will be evaluating future LiDAR and remote sensing initiatives and will utilize lessons learned from previous and upcoming pilots to determine what the long-term path is. Long-term plan milestones are still under development, with the VM Leadership team.

7.3.5.8 LiDAR Inspections of Vegetation Around Transmission Electric Lines and Equipment

WSD Initiative Definition: *Inspections of ROW using LiDAR, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).*

1) Risk to be mitigated/problem to be addressed:

Vegetation encroachment upon high voltage Transmission Lines presents a serious risk to public safety due to the risk of wildfire, electrical injury, or electrocution. Vegetation encroachment can cause electric service interruptions capable of disrupting the electric grid. Vegetation encroachment can also result in violations of both State and Federal regulations. Encroachment can occur as a result of tree growth, movement of the conductors, or trees failing from within or outside of the ROW.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

The Transmission System traverses substantially more rugged and inaccessible terrain as a percentage of the system than does distribution. This presents numerous safety exposures to ground inspectors and significantly increases the time it takes to complete inspections. Aerial LiDAR is a safer, more efficient, more effective, and more accurate means of conducting transmission vegetation inspections.

LiDAR inspections produce vegetation to conductor measurements with five-centimeter accuracy and include movement of the conductor caused by conductor sag (due to ambient temperature and electrical loading) and conductor sway (due to wind). In addition to identifying vegetation in immediate proximity to the lines, LiDAR captures tree data for trees on and adjacent to the ROW that can strike the lines. LiDAR provides a high level of accuracy in these measurements and helps to minimize possible human error.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The PG&E Transmission VM Program conducts LiDAR inspections on 100 percent of PG&E's Transmission System (lines carrying 60kV and above) as an integral first step of our routine program.

PG&E conducts a second, "mid-cycle" LiDAR inspection in the HFTD areas of our system at the height of the vegetation growing season which coincides with the beginning of historically the most active part of the California fire season. 2020 marks the first year the mid-cycle LiDAR patrol was conducted. PG&E plans to continue this activity in 2021.

4) Progress on initiative (amount spent, regions covered) and plans for next year

TABLE PG&E-7.3.5-3: 2020 TRANSMISSION LIDAR INSPECTIONS

Work Category	Unit Description	Plan Units	Year End Target	Year End Actual Units	Region
LiDAR Routine	mile*	18,220	96% –100%	18,220	Systemwide
LiDAR Mid-Cycle	mile	5,662	100%	5,662	Tier2 and Tier3, HFTD

TABLE PG&E-7.3.5-4: 2021 TRANSMISSION LIDAR INSPECTIONS

Work Category	Unit Description	Year End Target	Region
LiDAR Routine	mile*	96% – 100%	Systemwide
LiDAR Mid-Cycle	mile	80% – 100%	Tier2 and Tier3, HFTD

5) Future improvements to initiative

The Transmission VM team in collaboration with the PSPS team has developed a tree risk model, referred to as the "LiDAR Risk Score Model." This model calculates the relative risk of individual trees within the HFTD that have strike potential to a transmission conductor. The LiDAR Risk Score Model is being reviewed and validated by a team of internal and consulting experts as well as an industry panel that was assembled by the North American Transmission Forum.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

100 percent LiDAR inspections of ET lines are ongoing and in 2020 PG&E began a mid-cycle LiDAR inspection process that coincides with fire season. In addition, long-term, PG&E plans to use the LiDAR Risk Score Model. This model calculates the relative risk of individual trees within the HFTD that have strike potential to a transmission conductor. That model is being reworked, validated and vetted by a team of internal and consulting experts as well as an industry panel that was assembled by the North American Transmission Forum. In addition to the LiDAR Risk Score Model, PG&E will review subject matter expert input to make determinations on scoping or descoping of transmission lines prior to PSPS events.

PGE-DIXIE-NDCAL-000005036

7.3.5.9 Other Discretionary Inspection of Vegetation Around Distribution Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

WSD Initiative Definition: *Inspections of ROWs and adjacent vegetation that may be hazardous, which exceeds or otherwise go beyond those mandated by rules and regulations, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.*

1) Risk to be mitigated/problem to be addressed:

Dead and dying trees, as well as portions of dead trees, present a risk to PG&E's facilities if they fall. In addition, trees causing strain or abrasion on secondary lines, and other abnormal field conditions, may also require enhanced inspections beyond those mandated by State and Federal rules and regulations in order to mitigate wildfire risks.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

The CEMA Program is a compliance requirement per CPUC Resolution (Res.) ESRB-4. CEMA (also referred to as "mid-cycle") inspections follow approximately six months after PG&E's routine maintenance schedule. CEMA inspections are used to identify and mitigate conditions that have changed since the routine inspection and to address conditions that are not safe to leave unresolved until the next routine inspection.

This bi-annual inspection frequency helps identify and mitigate dead or dying trees in a timely manner in accordance with CPUC Res.ESRB-4, which directs "increasing vegetation inspections and removing hazardous, dead and sick trees and other vegetation near the IOUs' electric power lines and poles."

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

VM performs a second inspection in many parts of our service territory, namely HFTDs, and SRAs that are at higher risk of tree mortality and/or wildfire risk, Federal Responsibility Areas, and Fire Hazard Severity Zones. CAL FIRE, the CPUC and PG&E have identified these areas as the highest likelihood of catastrophic wildfire risk.

4) Progress on initiative (amount spent, regions covered) and plans for next year

PG&E uses operational and financial performance measurement processes/reviews to provide updates regarding the performance of different "sub-budgets" within the CEMA Program.

Table PG&E-7.3.5-5 displays the total inspections completed by the region for each quarter of 2020.

TABLE PG&E-7.3.5-5: 2020 CEMA QUARTERLY INSPECTIONS BY REGION

Region	Quarter	Inspections	Miles
Bay	Q1	135	1,662
Central Coast	Q1	129	1,684
Central Valley	Q1	123	2,187
North Coast	Q1	54	1,666
North Valley	Q1	74	1,751
Sierra	Q1	73	1,169
Total		**588**	
Bay	Q2	251	1,008
Central Coast	Q2	157	2,404
Central Valley	Q2	101	1,902
North Coast	Q2	77	1,685
North Valley	Q2	74	921
Sierra	Q2	73	1,465
Total		**733**	
Bay	Q3	193	1,096
Central Coast	Q3	79	1,361
Central Valley	Q3	123	2,949
North Coast	Q3	72	1,802
North Valley	Q3	47	1,236
Sierra	Q3	60	1,710
Total		**574**	
Bay	Q4	125	1,187
Central Coast	Q4	130	2,776
Central Valley	Q4	153	3,794
North Coast	Q4	75	2,121
North Valley	Q4	33	1,654
Sierra	Q4	94	2,185
Total		**610**	

5) Future improvements to initiative

PG&E will continue to use and build upon the CEMA second patrol program that utilizes two forms of inspections, ground and aerial, to patrol the distribution lines. Ground patrols involve a contract pre-inspector walking along the distribution lines inspecting for any issue that meets the scope of mid-cycle patrol. Ground patrols are the main method of inspection for the second patrol program. Aerial patrols involve a pre-inspector flying in a helicopter over the distribution lines inspecting any issue that meets the scope of the second patrol. To improve upon CEMA inspections, PG&E will begin updating our contracts with the intent of diversifying the pre-inspector vendors we use, continue to assess areas appropriate for aerial patrols, and evaluate the frequency of patrols in Wildland Urban Interface and non-HFTD areas.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

PGE-DIXIE-NDCAL-000005038

Response:

PG&E has not determined a long-term plan yet for this initiative. We will be assessing potential future CEMA improvements and second patrol procedure enhancements to boost focus on HFTD areas for inspectors to ensure efforts are concentrated on wildfire risk reduction. Long-term plan milestones are still under development with VMs Leadership team. These steps seek to drive toward decision-making based upon current second inspection in many parts of our service territory, namely HFTDs, and SRA that are at higher risk of tree mortality and/or wildfire risk, Federal Responsibility Areas, and Fire Hazard Severity Zones.

7.3.5.10 Other Discretionary Inspection of Vegetation Around Transmission Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations

WSD Initiative Definition: *Inspections of rights-of-way and adjacent vegetation that may be hazardous, which exceeds or otherwise go beyond those mandated by rules and regulations, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.*

Please refer to Section 7.3.5.3 Detailed inspections of vegetation around transmission electric lines and equipment.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As stated above, please reference Section 7.3.5.3 for more information on future improvements for this initiative.

7.3.5.11 Patrol Inspections of Vegetation Around Distribution Electric Lines and Equipment

WSD Initiative Definition: *Visual inspections of vegetation along ROW that is designed to identify obvious hazards. Patrol inspections may be carried out in the course of other company business.*

Please see Section 7.3.5.2 (distribution inspections) above for a discussion of PG&E's vegetation inspection programs for distribution facilities. There is no specific program to perform "patrols" around distribution lines unique from the inspections described in Section 7.3.5.2.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As stated above, please reference Section 7.3.5.2 for more information on future improvements for this initiative.

7.3.5.12 Patrol Inspections of Vegetation Around Transmission Electric Lines and Equipment

WSD Initiative Definition: *Visual inspections of vegetation along rights-of-way that is designed to identify obvious hazards. Patrol inspections may be carried out in the course of other company business.*

Please refer to Section 7.3.5.3 Detailed inspections of vegetation around transmission electric lines and equipment. There is no specific program to perform "patrols" around transmission lines unique from the inspections described in Section 7.3.5.3.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As stated above, please reference Section 7.3.5.3 for more information on future improvements for this initiative.

7.3.5.13 Quality Assurance/Quality Control of Inspections

WSD Initiative Definition: *Establishment and function of audit process to manage and confirm work completed by employees or subcontractors, including packaging QA/QC information for input to decision-making and related integrated workforce management processes.*

In addition to describing quality control/ quality assurance of inspections this section also addresses Action PGE-76 (Class B).

1) Risk to be mitigated/problem to be addressed:

PG&E assesses VM work performance using both QA and QV processes. Both QA and QV processes use sampling methodologies to determine which samples to assess. The QA effort is designed to validate program effectiveness and to provide confidence that the desired outcomes, including regulatory goals, are met. QV samples inspections and tree work recently completed to provide competence that work was performed in accordance with PG&E standards. QA and QV also identify areas where expectations are not being met.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives

QA and QV are accomplished through the physical inspection of sample locations. The objective of sampling is to provide confidence and to mitigate risk across the system. We verify the work quality and compliance rate for all trees in the geographic area covered by an audit/review. QA is the program that estimates compliance while QV is more specific to work quality.

For QA, PG&E uses the results of the QA Programs to identify and address compliance related issues through short-term corrective actions or long-term preventive actions.

QV chooses the work they review by sampling, which generates review locations where work has been listed by inspectors and/or invoiced by tree crews. PG&E uses the results of the QV Program Reviews to identify areas of work quality that need improvement as well as to take short term corrective actions.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

There is no regional prioritization as QA and QV will perform audits of the entire system and sample by Defined Scope (bundling circuits geographically). For QV, all mid-cycle reviews for 2021 will be in HFTD and SRA non-HFTD areas.

4) Progress on initiative (amount spent, regions covered) and plans for next year

The Quality Management Team has developed an annual audit plan based on Key Enterprise Risk. Key Enterprise Risk is compiled by Internal Audit and shared with

Quality Management. Findings from the audits are shared with the LOB leadership for corrective action. In 2020, our QV goal was to complete approximately 2000 audits. QV completed approximately 2500 audits. QA completed 88 percent of its Distribution compliance audit goal for 2020. For 2021, the Veg QA and QV teams will conduct approximately 2000 audits/reviews.

5) Future improvements to the initiative

Quality Management Veg QA and Veg QV are beginning to use Survey123/Collector to perform audits/reviews. This is being done to align with how the LOB performs its work, and to efficiently communicate findings and take advantage of a system (front end, database, dashboards) rather than a paper-based process.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E has not determined a long-term plan yet for this initiative. PG&E would like for all QC efforts to be completely paperless and utilize digital products only. Enhancing our QC efforts will take an internal coordinated team approach to successfully implement a process that is effective and efficient. Long-term plan milestones are still under development and will continue to be discussed well beyond 2021.

ACTION PGE-76 (Class B)

1) explain what the verification process entails for the 100 percent of EVM work being checked, including the length of time it takes the WV process to be completed per circuit mile, and

2) explain why it finds it necessary to increase the WV process for Routine Maintenance from 10 percent to 25 percent.

Response:

1) Work verification involves the following steps:

A. A Work Verification order is sent to the team performing EVM work on a line segment to ensure work is completed by both Pre-Inspectors and Tree crews
B. Work verification personnel go to the field and verify that each EVM work checkpoint is completed. Work verification personnel collect data in the field and enter it into the collector tool as part of a survey.
C. All correlated points and surveys are reviewed by algorithmic scripts (computer coded directions) to ensure data integrity and completeness.
D. Once the script (computer coded directions) reviews the data, the segment is passed or failed in the collector tool so that operations has increased visibility.

Currently, PG&E does not track the length of time it takes to complete the Work Verification process per circuit mile.

2) In 2020, PG&E shifted the work model in our routine program to give contractors more autonomy to perform work with the goal of improving their efficiency. Since there is more contractor autonomy involved, PG&E took a proactive approach to check a higher percentage of the vendor work to ensure the work quality meets PG&E's standards.

7.3.5.14 Recruiting and Training of Vegetation Management Personnel

WSD Initiative Definition: *Programs to ensure that the Utility is able to identify and hire qualified VM personnel and to ensure that both full-time employees and contractors tasked with VM responsibilities are adequately trained to perform VM work, according to the Utility's WMP, in addition to rules and regulations for safety.*

In addition to describing recruitment and training of vegetation management personnel, this section also addresses Actions PGE-72 (Class B), PGE-73 (Class B) and PGE-75 (Class B).

1) Risk to be mitigated/problem to be addressed:

VM work is dependent on having fully staffed PI and Tree Crew resources. There is an increased risk of a vegetation related outage or wildfire ignition events, if this work is not completed in a timely manner.

Logging and tree felling are one of the most hazardous industries in the nation, and the Northern California forests pose a very different challenge than in most parts of the country, due to the dry conditions, tall trees and high-risk species. Safely removing a 200+ ft tall tree in proximity of a high voltage distribution line must be done by a qualified professional. Therefore, hiring and training workers from outside of California requires additional training in the unique vegetation conditions in California and Northern California in particular.

There is a limited pool of qualified personnel, which causes constraints when responding to emergency events (Snow, Wind, Wildfire) each year. Additional Contractor resources are also pulled away from PG&E during large natural disasters events in other parts of the county, as individual contracts are paid premium rates during emergency events.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

Without a qualified workforce PG&E is unable to complete VM work, to address this constraint in the coming years, PG&E is exploring approaches to increase the population of qualified tree workers to perform this work. We use our Pre-Inspector basics Structured Learning Path (SLP) to provide specific, well-defined training related to the work being performed. To bolster recruitment and the pipeline of qualified personnel, we have partnered with the IBEW and educational institutions, such as Butte Glenn Community College District, to establish a training program designed to provide the skills and knowledge necessary to perform tree crew work safely and competently.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

VM works with Contract Management to engage with contract vendors to recruit appropriate personnel to support VM programs across our service territory. Prior to

identifying the most effective contract vendors we ensure the vendor is appropriate to perform the scope of work identified and we validate the vendors' safety presence in the industry. The VM Department regularly sources qualified talent for internal positions from current contract staff, who usually have extensive experience working in the industry and for PG&E. PG&E's efforts to recruit and train VM personnel will support VM across PG&E's service territory and, in particular, HFTD areas.

Certification is currently not a requirement for pre-inspectors. For pre-inspectors to become certified, they require a certain level of experience and on-the-job training. With that, PG&E has taken the approach of developing Tree Crew and Inspector Training programs to support a steady pipeline of qualified personnel who may later join our contract or internal VM workforce. PG&E's PI basics SLP and related training courses provides personnel with an opportunity to earn continuing education credit that can be used towards obtaining certification. Our educational partnerships allow us to provide employees and contractors with a direct path of obtaining certification.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2020, VM assisted in identifying additional resources, PG&E has partnered with the Utility Arborist Association a branch of the International society of Arboriculture (ISA) to support and expand their Utility Vegetation Management (UVM) Certificate Program. Our partners are excited that PG&E is providing full-tuition scholarships to the UVM offered through University of Wisconsin–Stevens Point as well. This is an on-line course comprised of six, 12-week course completed over two years. It is available to anyone in the utility or tree industry that wishes to obtain certification in UVM. Like the tree worker training program, this allows individuals a way to improve their skills resulting in a larger and better qualified workforce supporting PG&E Vegetation Operations to support efforts for promotions or just to better themselves. These courses are funded to continue through 2022.

5) Future improvements to initiatives

Since 2020, PG&E has been supporting Butte College in developing and funding a 5-week tree worker training program intended to develop and support individuals looking to make a transition to the utility tree worker industry. This course allows individuals the ability to be certified and competitive when seeking a job as a utility tree worker. Not only does this support retraining and return to work for individuals, it also allows employers the ability to hire someone who can start work immediately. In 2021, PG&E will fund the digitization of course material to make material available online and to significantly reduce out of pocket cost for students currently purchasing hard copies of materials.

Once Butte College is comfortable that the course is working successfully, PG&E will foster the expansion of this program to other community colleges throughout California.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Recruiting and training of VM personnel is an effort that will expand well beyond 2030 as we continue the work started in 2020 that focuses on improving worker qualifications and supporting certification of employees and contractors. Long-term, PG&E plans to help improve the availability of tree workers not only in PG&E's service territory, but in the territories of other California IOUs. PG&E will continue to seek educational partnerships and explore other opportunities for employees and contractors to seek certification and advanced worker qualification.

ACTION PGE-72 (Class B)

Provide the pass-rate and identify the score required to pass the Pre-Inspector assessment.

Response:

All Pre-inspectors are required to pass inspection assessments with a score of 100 percent. PG&E works with pre-inspectors so that they are able to achieve the 100 percent score. We do not collect pass rate data because we work with pre-inspectors until they are able to pass, and pre-inspectors can only pass when they get 100 percent.

ACTION PGE-73 (Class B)

1) Explain whether and how it ensures that PI work not completed by an ISA certified pre-inspector is verified by an ISA certified arborist during the WV process,

2) Furnish any supporting procedures and documents demonstrating that VM work is checked by an ISA certified arborist at some point in the process, and

3) Clarify if PG&E's understanding of "vast majority" of work professionals having ISA certification correlates to the "50 percent" of the WV Team being ISA Certified Arborists, mentioned earlier within its response to the "Work Verification" explanation of this section.

Response:

1) There is no process in place to ensure that pre-inspection work not completed by an ISA certified pre-inspector is verified by an ISA certified arborist during the WV process. However, the WV team consists of about 90% ISA certified arborists. The other 10% of the team consists of individuals who are experienced in extensive forestry and/or utility line clearance work.

2) There are no procedures in place to demonstrate that all VM work is checked by an ISA certified arborist.

3) Yes, PG&E's understanding of "vast majority" of work professionals having ISA

certification correlates to more than "50 percent" of the WV team being ISA Certified Arborists. Currently, 90 percent of PG&E's WV team have been ISA certified.

ACTION PGE-75 (Class B)

Explain the resources and processes it provides to employees to support ISA certification of its pre-inspectors.

Response:

ISA Certification is currently not a requirement for pre-inspectors. For pre-inspectors to become ISA certified, they require a certain level of experience and OJT. For example, to become an ISA Certified Arborist, you must be trained and knowledgeable in all aspects of arboriculture and meet a minimum qualification of having three or more years of on-the-job experience. With that, PG&E has taken the approach of developing Tree Crew and Inspector Training programs to support a steady pipeline of qualified personnel who may later join our contract or internal VM workforce. PG&E's PI basics SLP and related training courses provide contractors with an opportunity to earn continuing education credit that can be used towards obtaining ISA certification. Our partnership with Butte College also allows us to provide employees and contractors with a direct path to obtain the ISA certification. For more information, please see Section 5.4.2.

7.3.5.15 Remediation of At-Risk Species

***WSD Initiative Definition**: Actions taken to reduce the ignition probability and wildfire consequence attributable to at-risk vegetation species, such as trimming, removal, and replacement.*

In addition to describing the remediation measures, this section also addresses Actions PGE-57 (Class B), PGE-58 (Class B), PGE-59 (Class B), PGE-74 (Class B), and PGE-79 (Class B).

1) Risk to be mitigated/problem to be addressed:

In addition to overhead facility hardening, accurately identifying and mitigating trees at elevated risk of failure can reduce the risk of wildfire ignitions associated with vegetation contact with electric facilities.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

The ability to accurately identify and mitigate trees at elevated risk of failure has risk reduction value both on its own and in conjunction with system hardening. This work is focused on further limiting the possibility of wildfire ignitions and/or downed wires due to vegetation-conductor contact by removing branches and limbs that are overhanging within four ft of the conductors and up to the sky.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

Tree failure mitigation is planned in Tier 2 and Tier 3 HFTD areas under PG&E's EVM program. EVM program prioritization starting in 2021 is based on the Vegetation Risk Model, which is a risk-informed model that allows us to prioritize our work at the Circuit Segment level. Circuit segments are the smallest non-overlapping sections of the distribution grid that can be de-energized.

All EVM work is functionally conducted at the regional level. Regional capacity constraints require separate prioritization within each region because a universal prioritization might place too much or too little work in a given region. Pre-inspectors evaluate trees using PG&E's TAT during inspections, which is a tool that evaluates an individual tree's likelihood of failing and indicates whether to abate the tree. TAT incorporates historical data on tree failures, regional species risk, and local wind gust data and assesses different components of an individual tree's health to determine the risk of falling into PG&E lines or equipment.

4) Progress on initiative (amount spent, regions covered) and plans for next year

As described above, the TAT identifies trees at risk of failure. This tool went into effect March 2020 and has been in continuous use since that time. As PG&E addresses the challenges that come with implementing an evolving and expansive program, the miles to be worked under the EVM program will continue to be re-

assessed on a year-by-year basis. PG&E completed 1,878 miles in 2020 (exceeding the target of 1,800 miles) and forecasts working approximately 1,800 circuit miles in 2021 for the EVM program.

5) Future improvements to initiative

In the future, PG&E will study post-EVM treatment outage and ignition data for opportunities to improve TAT effectiveness as part of our ongoing effort to improve our VM program. We anticipate that the results of this study will impact our VM practices beyond 2021. For further details on the Targeted Tree Species study, see Section 4.4.1.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

In the short-term, PG&E will continue the ongoing work of identifying and mitigating trees at elevated risk of failure. In the long-term, PG&E will study post-EVM treatment outage and ignition data for opportunities to improve TAT effectiveness. This study (which will be concluded in 2022), in conjunction with lessons learned, will be used to work toward a proactive analysis instead of reactive. The EVM program will continue to address approximately 1,800 miles per year as we continue to work through all HFTD Tier 2 and Tier 3 areas in a prioritized, risk-informed manner.

ACTION PGE-57 (Class B)

1) Explain the prioritization of hazard tree work in relation to the highest risk areas, and

2) Prioritization of work relative to TAT scoring.

Response:

1) Starting in 2021, EVM program prioritization is based on the 2021 Vegetation Risk Model, which is a risk-informed model that allows us to prioritize our work at CPZs. CPZs are the smallest non-overlapping sections of the distribution grid that can be de-energized.

We understand "hazard tree work" to be referencing the risk posed by entire trees or large portions of trees failing and striking electrical facilities. This tree failure risk is primarily mitigated by the selective removal of trees based on our TAT. See Section 7.3.5.15. As part of the EVM program, TAT assessment is performed on all trees with potential to strike facilities and trees worked according to the TAT result.

Trees assessed for failure risk are prioritized in accordance with our Vegetation Management Priority Tag Procedure (TD-7102P-17). A Priority 1 tag must be mitigated within 24 hours of identification when reported. A Priority 1 condition is a hazard that meets any of the following scenarios:

- The vegetation is in contact or showing signs of previous contact with a primary conductor.

- The vegetation is actively failing or at immediate risk of failing and could strike the facilities.

- The vegetation presents an immediate risk to the facilities.

A Priority 2 tag must be mitigated within 30 days, unless constrained. A Priority 2 condition meets the following scenario:

- The vegetation has encroached within the PG&E minimum clearance requirements and is not in contact with a conductor.

2) The TAT evaluation does not designate prioritization between trees, it only provides direction of whether to abate or to not abate a specific tree. TD-7102P-17 is utilized for trees requiring priority mitigation and describes scenarios for proper prioritization.

ACTION PGE-58 (Class B)

1) Provide the top 10 at-risk EVM species categorized by geographical area, and

2) Provide a list of vegetation work prescribed based on specific tree species, if such exists and differs from at-risk identification.

Response:

1) PG&E does not use a top 10 list for at-risk species. However, see below for a list of 10 species with the highest estimated overall risk per EVM region. The species included in the list only includes species that have caused >1% of the region's outages.

TABLE PG&E-7.3.5-6: HIGHEST RISK SPECIES BY REGION

Region	Species
Sierra	Oak
	Gray Pine
	Pine
	Cottonwood, Freemont
	Willow
	Lodgepole Pine
	Black Oak
	Live Oak
	Eucalyptus
	Valley Oak
Bay	Gray Pine
	Black Oak
	Blue Gum
	Tan Oak
	Live Oak
	Acacia
	Madrone

Region	Species
	Monterey Cypress
	Douglas Fir
	Liquid Ambar (Sweet Gum)
Central Coast	Gray Pine
	Alder
	Sycamore
	Blue Gum
	Tan Oak
	Monterey Pine
	Madrone
	Cottonwood, Freemont
	Coast Live Oak
	Douglas Fir
Central Valley	Blue Gum
	Italian Stone Pine
	Cottonwood, Freemont
	Gray Pine
	Oak
	Poplar
	Black Oak
	Interior Live Oak
	Valley Oak
	Pine
North Coast	Willow
	Tan Oak
	Black Oak
	Gray Pine
	Pine
	Bishop Pine
	Alder - Red
	Grand Fir
	Madrone
	Live Oak
North Valley	Blue Gum
	Gray Pine
	Cottonwood, Freemont
	Poplar
	Valley Oak
	Black Oak
	Oak
	Eucalyptus
	Live Oak
	White Fir

2) Tree work is not prescribed based on specific species, but regional species risk values are an input to TAT results. Therefore, species risk values are a contributing factor to whether or not a tree should be abated, as determined by the TAT.

ACTION PGE-59 (Class B)

1) provide the percentage of trees within PG&E's inventory that are classified as a "Green Hazard Tree," and

2) provide the percentage of both "Green Hazard Trees" worked and removed in relation to

a) identified "Green Hazard Trees,"

b) total tree inventory,

c) work performed on tree inventory, and

d) total tree removals.

Response:

For the 2020 Patrol year, the following are the percentages of Green Hazard trees for EVM and Routine VM.

TABLE PG&E-7.3.5-7: GREEN HAZARD TREE PERCENTAGE (EVM & ROUTINE VM))

	EVM	Routine VM
Percentage of trees within PG&E's inventory that are classified as a ""Green Hazard Tree,"	2.8%	1.44%
Percentage of both "Green Hazard Trees" worked and removed in relation to		
a) identified "Green Hazard Trees"	38.6%	65.5%
b) total tree inventory	5.9%	0.95%
c) work performed on tree inventory	11.2%	1.62%
d) total tree removals	13.2%	8.53%

ACTION PGE-79 (Class B)

Provide quantitative determinations of effectiveness for its fuel management efforts broken down by geographical area, demonstrating how PG&E tracks effectiveness when optimizing its processes based on geography.

Response:

At this time, it is still unknown if the use of fire retardant for the Transmission UDS Program will be approved. PG&E is unable to determine the effectiveness until the environmental evaluations have been completed.

ACTION PGE-74 (Class B)

1) Explain how it verifies and improves the TAT,

2) Provide the timeline/frequency of verification and improvements, and

3) Provide a list of SMEs that contributed to and "endorsed"40 the TAT.

Response:

1) PG&E performs TAT field verification on 100% of trees tall enough to strike our electrical facilities as part of our EVM. In addition, PG&E will be working with external resources to study TAT effectiveness and improvement as part of our Target Tree Species Study. (See 4.4.1 Targeted Tree Species Study).

2) This Target Tree Species Study is planned to be completed by Q2 2022. In connection with the study, PG&E will set up a system for continuous monitoring of TAT for ongoing evaluation.

3) The SMEs that contributed to and endorsed the TAT are members of the Department of Environmental Science, Policy and Management Ecosystem Sciences Division, University of California, Berkeley and the Urban Forest Ecosystems Institute of California Polytechnic State University (Cal Poly). A list of the names of the SMEs will be provided directly to the WSD.

7.3.5.16 Removal and Remediation of Trees with Strike Potential to Electric Lines and Equipment

WSD Initiative Definition: *Actions taken to remove or otherwise remediate trees that could potentially strike electrical equipment, if adverse events such as failure at the ground-level of the tree or branch breakout within the canopy of the tree, occur.*

PG&E does not perform a separate effort to identify, remove and remediate trees with strike potential. This is one risk that our inspectors assess and take action to resolve as part of our other vegetation management activities. Therefore, please refer to Sections 7.3.5.2 (Detailed inspections of vegetation around distribution electric lines and equipment), 7.3.5.3 (Detailed inspections of vegetation around transmission electric lines and equipment), and 7.3.5.15 (Remediation of At-Risk Species) for information regarding efforts to identify and remove or remediate trees with strike potential, sometimes referred to as "hazard trees".

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As stated above, please reference Sections 7.3.5.2, 7.3.5.3, and 7.3.5.15 for more information on future improvements for this initiative.

7.3.5.17 Substation Inspections

WSD Initiative Definition: *Inspection of vegetation surrounding substations, performed by qualified persons and according to the frequency established by the Utility, including record-keeping.*

For this initiative, PG&E has several sub-initiatives including:

- 7.3.5.17.1: Substation Inspections, Distribution
- 7.3.5.17.2: Substation Inspections, Transmission

7.3.5.17.1 Substation Inspections, Distribution

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) *Risk to be mitigated/problem to be addressed:*

PG&E is assessing the area around Electric Distribution Substations in Tier 2 and Tier 3 HFTDs to identify flammable fuels and vegetation for removal in order to minimize ignition spread outside of facilities and to provide improved structure defense capability for firefighting purposes by ensuring there is a safe distance between vegetation and critical infrastructure.

2) *Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.*

In 2019, the WSIP assessed the defensible space surrounding 176 Electric Distribution Substations using CAL FIRE recommendations as guidance. During these inspections, it was determined that a programmatic approach would be needed to:

- Meet or exceed CAL FIRE recommendations (PRC 4291) for defensible space by clearing vegetation in and around Tier 2 and Tier 3 HFTD Electric Distribution Substations

- Provide for routine annual[1] ground-based inspections by qualified persons and vegetation maintenance operations of defensible space in and around Electric Distribution Substations within or adjacent to a Tier 2 or Tier 3 HFTD. Inspections and maintenance operations are recorded electronically.

3) *Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")*

The Electric Distribution Substations inspected were located within or adjacent to the CPUC's current Tier 2 and Tier 3 HFTD. Inspections took place in order of highest threat (Tier 3) to lowest (Tier 2) HFTD area. Areas adjacent to Tier 2 and Tier 3 HFTD areas are referred to as Buffer Zones.

4) *Progress on initiative (amount spent, regions covered) and plans for next year*

In 2020, inspections were performed at all 176 Electric Distribution Substations within or adjacent to Tier 2 and Tier 3 HFTD (*i.e.,* in HFTD areas or Buffer Zones). Inspections included prescription of vegetation work for defensible space

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1 PG&E's planned inspection timeframe for all assets is November 15 of the prior year through November 15 of the current year (i.e. 11/15/20-11/15/21 for the 2021 plan year) however delays including inaccessible facilities, sensitive environments or other limitations may delay some inspections for the current plan year by a few weeks, but still ensuring completion by the end of the end of the calendar year (i.e. 12/31/21).

maintenance and continued adherence to CAL FIRE recommendations. In 2021, these inspections of Electric Distribution Substations within or adjacent to Tier 2 and Tier 3 HFTD will continue.

5) Future improvements to initiative

For 2021, PG&E will inspect 263 Electric Distribution Substations not within a Tier 2 or 3 HFTD for purposes of achieving defensible space and fuel reduction beyond Tier 2 and Tier 3 HFTD. In addition, during routine defensible space inspections of Distribution Substations within a Tier 2 and Tier 3 HFTD, PG&E will identify and pursue vegetation removal and thinning work on undeveloped privately owned land neighboring PG&E property for further risk reduction purposes.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

This program is funded through 2024. The work is ongoing and focuses on assessing the area around Electric Distribution Substations in Tier 2 and Tier 3 HFTDs to identify flammable fuels and vegetation for removal. In addition, during routine, defensible space inspections of Distribution Substations within a Tier 2 and Tier 3 HFTD, PG&E will identify and pursue vegetation removal and thinning work on undeveloped privately owned land neighboring PG&E property for further risk reduction purposes. PG&E will continue inspections and prescription of vegetation work for defensible space maintenance and continued adherence to CAL FIRE recommendations.

7.3.5.17.2 Substation Inspections, Transmission

WSD Initiative Definition: N/A. *This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

PG&E is assessing the area around ET Substations and Hydro Facilities in Tier 2 and Tier 3 HFTDs to identify flammable fuels and vegetation for removal in order to minimize ignition spread outside of facilities and to provide improved structure defense capability for firefighting purposes by ensuring there is a safe distance between vegetation and critical infrastructure.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

In 2019, the Wildfire Safety Inspection Program (WSIP) assessed 46 ET Substations and 63 Hydro facilities for defensible space using CAL FIRE recommendations as guidance. During these inspections, it was determined that a programmatic approach would be needed to:

- Meet or exceed CAL FIRE recommendations (PRC 4291) for defensible space by clearing vegetation in and around Tier 2 and Tier 3 HFTD ET Substations and Hydro facilities.

- Provide for routine annual[2] ground-based inspections by qualified persons and vegetation maintenance operations of defensible space in and around ET Substations and Hydro facilities within or adjacent to a Tier 2 or Tier 3 HFTD. Inspections and maintenance operations are recorded electronically.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The ET Substations and Hydro facilities inspected were located within or adjacent to the CPUC's current Tier 2 (Elevated) and Tier 3 (Extreme) HFTD. Inspections took place in order of highest threat (Tier 3) to lowest (Tier 2) HFTD area.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2020, inspections were performed at all 46 ET Substations and 63 Hydro facilities within or adjacent to Tier 2 and Tier 3 HFTDs. Inspections included prescription of vegetation work for defensible space maintenance and continued adherence to CAL FIRE recommendations. In 2021, these recurring cycle inspections of ET

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2 PG&E's planned inspection timeframe for all assets is November 15 of the prior year through November 15 of the current year (i.e. 11/15/20-11/15/21 for the 2021 plan year) however delays including inaccessible facilities, sensitive environments or other limitations may delay some inspections for the current plan year by a few weeks, but still ensuring completion by the end of the end of the calendar year (i.e. 12/31/21).

Substations and Hydro facilities within or adjacent to Tier 2 and Tier 3 HFTDs will continue.

5) Future improvements to initiative

In 2021, PG&E will inspect 41 ET Substations not within a Tier 2 or 3 HFTD to achieve defensible space and fuel reduction beyond Tier 2 and Tier 3 HFTD. In addition, during routine, defensible space inspections of Transmission Substations within a Tier 2 and Tier 3 HFTD, PG&E will identify and pursue vegetation removal and thinning work on undeveloped privately owned land neighboring PG&E property for further risk reduction purposes.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

This program is funded through 2024. The work is ongoing and focuses on assessing the area around ET Substations and Hydro Facilities in Tier 2 and Tier 3 HFTDs to identify flammable fuels and vegetation for removal. In addition, during routine, defensible space inspections of Transmission Substations within a Tier 2 and Tier 3 HFTD, PG&E will identify and pursue vegetation removal and thinning work on undeveloped privately owned land neighboring PG&E property for further risk reduction purposes. PG&E will continue inspections and prescription of vegetation work for defensible space maintenance and continued adherence to CAL FIRE recommendations.

7.3.5.18 Substation Vegetation Management

WSD Initiative Definition: *Based on location and risk to substation equipment only, actions taken to reduce the ignition probability and wildfire consequence attributable to contact from vegetation to substation equipment.*

For this initiative, PG&E has several sub-initiatives including:

- 7.3.5.18.1: Substation Vegetation Management, Distribution
- 7.3.5.18.2: Substation Vegetation Management, Transmission

PGE-DIXIE-NDCAL-000005062

7.3.5.18.1 Substation Vegetation Management, Distribution

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

In accordance with CAL FIRE defensible space recommendations (PRC 4291), PG&E removes flammable fuels and remove or trim vegetation in and around Electric Distribution Substations within or adjacent to Tier 2 and Tier 3 HFTDs to minimize ignition spread outside of facilities and provide improved structure defense capability for firefighting purposes and to reduce risk of potential loss.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

In 2019, the WSIP assessed the defensible space surrounding 176 Electric Distribution Substations using CAL FIRE recommendations as guidance. Following the inspections, PG&E determined that it needed to perform additional work in 2020 to remove fuel and vegetation to meet or exceed CAL FIRE recommendations for Defensible Space around the inspected facilities.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The 176 Electric Distribution Substations inspected in 2020 are located within or adjacent to the CPUC's current Tier 2 (Elevated) and Tier 3 (Extreme) HFTDs. Facility VM operations were prioritized in order based on the highest threat (Tier 3) to lowest (Tier 2) HFTD areas.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2020, PG&E will perform continued facility VM and maintenance operations at 169 Electric Distribution Substations within or adjacent to Tier 2 and Tier 3 HFTDs. PG&E is in the process of performing VM and maintenance operations at the remaining 7 Electric Distribution Substations. Each of these Distribution Substations requires extensive permitting. Facility VM work performed included mechanical weed abatement, tree trim, newly identified hazard trees, and brush and debris removal in accordance with CAL FIRE recommendations for defensible space. In 2021, all 176 Electric Distribution Substations will receive maintenance operations, and additional CAL FIRE recommended tree, brush and debris compliance work will be prioritized based on the highest risk in (Tier 3) to lowest in (Tier 2) HFTD areas.

5) Future improvements to initiative

In 2021, PG&E will improve the defensible space program with herbicide treatment plans within defensible space zones for improved long-term control and abatement of noxious weeds and reoccurring/regenerating brush species, where permitted. Also, PG&E will perform additional vegetation thinning and/or removal work beyond

CAL FIRE recommended zones for defensible space.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

This program is funded through 2024. The work is ongoing and in accordance with CAL FIRE defensible space recommendations (PRC 4291), it focuses on the removal of flammable fuels and the removal or trim of vegetation in and around Electric Distribution Substations within or adjacent to Tier 2 and Tier 3 HFTDs. PG&E will also look to improve the defensible space program with herbicide treatment plans, where permitted. PG&E will perform additional vegetation thinning and/or removal work beyond CAL FIRE recommended zones for defensible space, where permitted. Electric Distribution Substations will receive maintenance operations while additional CAL FIRE recommended tree, brush and debris compliance work will be prioritized from highest (Tier 3) to lowest (Tier 2) HFTD area.

7.3.5.18.2 Substation Vegetation Management, Transmission

WSD Initiative Definition: *N/A. This is a "PGE-defined sub-initiative" that supports the response for the (parent) WSD-defined Initiative.*

1) Risk to be mitigated/problem to be addressed:

In accordance with CAL FIRE defensible space recommendations (PRC 4291), PG&E removes flammable fuels and removes or trims vegetation in and around ET Substations and Hydro facilities within or adjacent to Tier 2 and Tier 3 HFTDs to minimize ignition spread outside of facilities, provide improved structure defense capability for firefighting purposes, and reduce risk of potential loss.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

In 2019, the WSIP inspected 46 ET Substations and 63 Hydro facilities for defensible space using CAL FIRE recommendations as guidance (See Section 7.3.5.17.1). Following the inspections, PG&E determined that it needed to perform additional work in 2020 to further remove fuel and vegetation to meet or exceed CAL FIRE recommendations for defensible space around the inspected facilities.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The 46 ET Substations and 63 Hydro facilities inspected in 2020 are located within or adjacent to the CPUC's current Tier 2 (Elevated) and Tier 3 (Extreme) HFTD. Facility VM operations were prioritized in order of highest threat (Tier 3) to lowest (Tier 2) HFTD area.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2020, PG&E performed continued facility VM and maintenance operations at 46 ET Substations and 63 Hydro facilities within or adjacent to Tier 2 and Tier 3 HFTD. Facility VM work performed included mechanical weed abatement, tree trim, newly identified hazard trees, and brush and debris removal in accordance with CAL FIRE recommendations for defensible space. In 2021, all 46 ET Substations and 63 Hydro facilities will receive maintenance operations while additional CAL FIRE recommended tree, brush and debris compliance work will be prioritized from highest (Tier 3) to lowest (Tier 2) HFTD area.

5) Future improvements to initiative

In 2021, PG&E also looks to improve the defensible space program with herbicide treatment plans within defensible space zones for improved long-term control and abatement of noxious weeds and reoccurring/regenerating brush species, where permitted. In addition, PG&E will perform additional vegetation thinning and/or removal work beyond CAL FIRE recommended zones for defensible space, where permitted.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

This program is funded through 2024. The work is ongoing and in accordance with CAL FIRE defensible space recommendations (PRC 4291), it focuses on the removal of flammable fuels and the removal or trim of vegetation in and around ET Substations and Hydro facilities within or adjacent to Tier 2 and Tier 3 HFTDs. PG&E will also look to improve the defensible space program with herbicide treatment plans, where permitted. PG&E will perform additional vegetation thinning and/or removal work beyond CAL FIRE recommended zones for defensible space, where permitted. ET Substations and Hydro facilities will receive maintenance operations while additional CAL FIRE recommended tree, brush and debris compliance work will be prioritized from highest (Tier 3) to lowest (Tier 2) HFTD area.

7.3.5.19 Vegetation Inventory System

WSD Initiative Definition: *Inputs, operation, and support for centralized inventory of vegetation clearances updated based upon inspection results, including (1) inventory of species,(2) forecasting of growth, (3) forecasting of when growth threatens minimum ROW clearances ("grow-in" risk) or creates fall-in/fly-in risk.*

1) Risk to be mitigated/problem to be addressed:

PG&E's VM Department currently uses multiple centrally managed systems via various platforms, databases and collection devices based on programmatic requirements to document planned and completed tree work. By using multiple centralized systems, there is a decrease in visibility regarding work being performed at different times and in different locations.

The solution to this issue is to build or identify a tool that is flexible and accessible enough to manage our various program requirements and to support our work processes.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

With increased integration between our databases and data, additional visibility of what work is being performed at what times could be achieved to reduce the risk of overlapping programs, reduce potential of disruption to our customers, and enable better risk-informed planning and decision-making.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

This tool will be prioritized and implemented system-wide on core VM programs.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In 2020, PG&E began reviewing data requirements from the Wildfire Safety Division to ensure that the system that is developed and implemented will support its requirements. PG&E also began drafting a project plan and documenting processes to support the development of a vegetation inventory system. PG&E is reviewing work management platforms and is planning to perform proof-of-concepts with one or more vendors in 2021 to begin to test how platforms may perform with current data collected in VM programs as well as to collect additional data required by the WSD Guidance 10 Data standards. VM is also engaging with PG&E's internal Information Technology department to define and plan database support.

5) Future improvements to initiative

PG&E will continue to work on a project plan in 2021. This project plan will be utilized as a working document to move this initiative forward. As with all projects plans, we will expect changes to this document as new requirements are identified.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E is drafting a project plan that will be used as a working document to move toward the long-term goal of having one vegetation inventory system. PG&E will continue to document processes in support of this process as well as to review and test work management platforms. Long-term plan milestones are still under development.

7.3.5.20 Vegetation Management to Achieve Clearances Around Electric Lines and Equipment

WSD Initiative Definition: *Actions taken to ensure that vegetation does not encroach upon the minimum clearances set forth in Table 1 of GO 95, measured between line conductors and vegetation, such as trimming adjacent or overhanging tree limbs.*

VM to achieve clearances around electric lines and equipment is conducted as part of the routine and EVM programs as described in Section 7.3.5.2 for the primary distribution efforts related to "achieving clearances" and Section 7.3.5.3 for transmission efforts on that front.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

As stated above, please reference Section 7.3.5.2, and Section 7.3.5.3 for more information on future improvements for this initiative.

7.3.6 Grid Operations and Protocols

7.3.6.1 Automatic Recloser Operations

***Wildfire Safety Division (WSD) Initiative Definition**: Designing and executing protocols to deactivate automatic reclosers based on local conditions for ignition probability and wildfire consequence.*

1) Risk to be mitigated/problem to be addressed:

Reclosing devices, such as circuit breakers and line reclosers, are used to quickly and safely de-energize lines when a problem is detected. When the problem is cleared, lines are re-energized. Supervisory Control and Data Acquisition (SCADA) devices can remotely de-energize a line for a hazard condition like a tree contacting a line, a car hitting a pole where the pole is broken but the wires are still energized, live wire down on the ground, or a broken wire hanging from the pole, but not contacting a grounded surface. These types of situations can create public safety hazards as well as wildfire risk from a potential ignition.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Pacific Gas and Electric Company (PG&E or the Company) Utility Procedure TD-1464P-01 (Fire Index Patrol and Non-Reclose Procedure) establishes precautions for wildfire risks associated with recloser protection functions. Using analyses provided by fire officials and PG&E's Meteorology team regarding each year's fire season timeline and exposure, PG&E makes an informed decision on when to disable automatic reclosing/testing during elevated fire conditions in protection zones that intersect Tier 2 or Tier 3 High Fire Threat District (HFTD) areas. Timing for disabling/enabling is based on the condition of fuels and a recommendation made by the Wildfire Safety Operations Center (WSOC) and Meteorology. Once the decision to disable has been approved by the Vice President of Asset Management, Community Wildfire Safety Program, all reclosing devices (for transmission 115 kilovolts (kV) and below) and distribution lines will be disabled during the determined utility fire risk season for protection zones that intersect Tier 2 or Tier 3 HFTD areas.

There are approximately 2,875 distribution reclosing devices on PG&E lines serving Tier 2 and Tier 3 HFTD areas. The devices with reclosing functionality include substation circuit breakers, line reclosers and FuseSavers (single phase reclosers utilized for tap-lines that can have SCADA-capability). There are approximately 2,850 reclosing devices serving Tier 2 and Tier 3 HFTD areas that have SCADA capability. For the remaining non-SCADA distribution reclosing devices serving Tier 2 and Tier 3 HFTD areas, PG&E will manually disable automatic reclosing/testing during the determined utility fire risk season. Note that all remaining TripSavers (single phase reclosers utilized for tap-lines but

do not have SCADA capability) serving the Tier 2 and Tier 3 HFTD areas had their automatic reclosing functionality permanently removed before June 2020, so they are no longer included in the count of reclosing devices.

In addition, reclosing devices located on nearly 400 transmission lines with voltages of 115 kv and below are included in the program. Over 95 percent of the transmission line devices are SCADA-enabled and can be disabled remotely, and like the distribution devices that are not SCADA-enabled, PG&E will manually disable remaining devices during the determined utility fire risk season for protection zones that intersect Tier 2 or Tier 3 HFTD areas.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

Reclosing is disabled on all automatic devices within the Tier 2 and Tier 3 HFTD areas prior to fire season

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

As described in the 2020 Wildfire Mitigation Plan (WMP), all TripSavers serving Tier 2 and Tier 3 HFTD areas had the reclosing functionality permanently disabled prior to the 2020 fire season. There are no future actions associated with TripSavers. PG&E initiated reclose disabling in May 2020 and devices remained disabled until fire season was declared over. PG&E will follow the same procedure for 2021.

5) ***Future improvements to initiative:***

As referenced above, PG&E Utility Procedure TD-1464P-01 establishes precautions for wildfire risks associated with recloser protection functions. This procedure will continue to be followed for 2021.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

We will continue to follow the utility procedure for automatic recloser disabling prior to fire season and re-enabling after fire season.

7.3.6.2 Crew-Accompanying Ignition Prevention and Suppression Resources and Services

WSD Initiative Definition: *Those staff and equipment (such as fire suppression engines and trailers, firefighting hose, valves, and water) that are deployed with construction crews and other electric workers to provide site-specific fire prevention and ignition mitigation during on-site work.*

1) ***Risk to be mitigated/problem to be addressed:***

   PG&E's Safety and Infrastructure Protection Team (SIPT) Program consists of two-person International Brotherhood of Electrical Workers (IBEW)-represented crews trained and certified in safety and infrastructure protection. SIPTs are expected to be utilized to mitigate wildfire threats in high fire-threat areas and gather critical data to help PG&E prepare for and manage wildfire risk. During elevated fire risk conditions, SIPTs accompany PG&E personnel during high-risk work activities and perform critical fuel reduction work around PG&E assets to prevent damage from wildfires.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:***

   SIPTs are highly trained in fire suppression and prevention. Their presence at PG&E worksites can significantly reduce the risk of ignitions while performing work. SIPTs also review compliance with Standard TD-1464S, Preventing and Mitigating Fires While Performing PG&E Work.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

   SIPTs will accompany teams, when available, in Tier 2 and Tier 3 HFTD areas where wildfire ignition is possible.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

   The SIPT has continued to grow, now consisting of 40 crews, one Manager, seven Supervisors, two Clerks and one Analyst. The SIPT continues to develop internal practices and procedures necessary to support program needs.

5) ***Future improvements to initiative:***

   When required, SIPT will utilize various data points to aid in work prioritization. Factors include, but are not limited to, meteorological forecasts, location, and geography.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

The SIPT program has proven to be very valuable at PG&E and has filled a gap in providing fire prevention and mitigation services, a capability that was previously unavailable within the Company. It has also demonstrated that asset protection, using fire retardant, prevents asset loss and results in safety improvements and avoided cost savings. For these reasons, the program will remain in existence for the foreseeable future and may expand as the SIPT teams further refine the fire prevention and mitigation needs of PG&E. In the future, SIPTs will continue stabilizing current technology solutions and processes. SIPTs will also assess effectiveness of the program and develop business cases to potentially increase staffing levels and equipment needs.

7.3.6.3 Personnel Work Procedures and Training in Conditions of Elevated Fire Risk

WSD Initiative Definition: *Work activity guidelines that designate what type of work can be performed during operating conditions of different levels of wildfire risk. Training for personnel on these guidelines and the procedures they prescribe, from normal operating procedures to increased mitigation measures to constraints on work performed.*

1) Risk to be mitigated/problem to be addressed:

PG&E Standard TD-1464S, Preventing and Mitigating Fires While Performing PG&E Work, aligns with California Public Resources Code (PRC) Sections 4427, 4428, and 4430. This standard provides detailed requirements on prevention and mitigation actions for PG&E and contractor personnel when performing PG&E work. This supports risk reduction associated with utility-caused ignitions.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Standard TD-1464S establishes requirements for PG&E employees and contractors to follow when traveling over, performing work or operating on any forest, brush or grass-covered lands. In 2019, this standard was updated to better reflect PRC Sections 4427, 4428, and 4430 by laying out specific mitigations and restrictions based on the work being performed and daily wildfire danger.

In addition to Standard TD-1464S, two attachments were also posted: Wildfire Mitigation Matrix and Wildfire Mitigation Checklist. The Wildfire Mitigation Matrix reviews various types of daily work performed by PG&E employees and contractors, along with required preventative measures that must be taken based on the daily fire danger. The Wildfire Mitigation Checklist is a guideline that can be used by PG&E employees and contractors to review worksite preventative measures for their specific job. A version of Standard TD-1464S was also created for contractor personnel.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Standard TD-1464S applies to all PG&E employees and contractors working on or near forest, brush or grass-covered lands throughout PG&E's service area.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

Prior to the 2020 wildfire season, impacted PG&E employees were

identified to complete mandatory web-based training materials, in addition to virtual briefing sessions communicating updates to Standard TD-1464S. Newly-developed SafetyNet observation cards allowed PG&E leadership to observe and coach our employees and note fire mitigation readiness to assure adherence to the standard while work is performed.

The SafetyNet observation cards have been widely utilized by PG&E personnel. In 2020, there have been over 9,500 observation cards submitted through SafetyNet. These cards have shown that 99.1 percent of the observed activities have been safe, and employees have adhered to the standard.

In partnering with SIPTs, the WSOC also developed a pilot quality control audit process to measure adherence to Standard TD-1464S. This pilot is taking place in the Central Coast Region where SIPTs observe work performed by contract crews. The audit results are made available to Contract Management leadership, while learnings from the pilot will be incorporated into PG&E's expansion of the quality control program in 2021.

5) Future improvements to initiative:

In 2021, PG&E will finalize learnings from the quality control program pilot and begin to adjust the program as findings require. PG&E will then implement the quality control program to assess contractor fire prevention and mitigation readiness.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E will annually evaluate the quality of trainings associated with Standard TD-1464S and update standard requirements as needed to support fire mitigation actions. In the next 3-10 years, PG&E will continue to develop and implement our quality control audit process program and expand it to all contractors and employees working in high-fire danger conditions where this standard is applicable.

7.3.6.4 Protocols for Public Safety Power Shutoff (PSPS) Re-Energization

WSD Initiative Definition: *Designing and executing procedures that accelerate the restoration of electric service in areas that were de-energized, while maintaining safety and reliability standards.*

This section covers both distribution and transmission. However, in Table 12 in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx we have separated the financials and Risk Spend Efficiency calculations for distribution and transmission.

1) Risk to be mitigated/problem to be addressed:

Prior to re-energization, PG&E inspects lines for incidents of wind-related damages or hazards during patrols of de-energized circuits. Damages are conditions that occurred during the PSPS event, which are likely wind-related and necessitate repair or replacement of PG&E's asset, such as downed wires or a fallen pole. Hazards are conditions that might have caused damages or posed an electrical arcing risk had PSPS not been executed *(e.g.,* a tree limb found suspended in electrical wires). In each case, PG&E repairs or replaces damaged equipment or cleared the hazard before re-energizing the line.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PG&E's PSPS re-energization objective is to provide a safe and efficient restoration of PG&E electric facilities (i.e., transmission lines, substations and distribution circuits). Using the Incident Command System as a base response framework, each circuit is assigned a taskforce consisting of Supervisors, crews, Troublemen and Inspectors. This structure allows PG&E to patrol and perform step restoration in alignment with the centralized control centers. During a weather event, Incident Response teams and PG&E Meteorology teams monitor real-time and forecasted weather conditions based on weather models, weather station data and field observations. Patrol crews and helicopters are also pre-positioned in anticipation of a weather "all clear" to begin patrols. Using this incoming information, weather "all clears" are issued in a phased approach to restore customers as soon as possible.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PSPS re-energization is dependent on the impacted location within PG&E's service territory. PSPS primarily occurs in High Fire Risk Areas (HFRA), but re-energization will occur anywhere in PG&E's service territory that has been affected by a PSPS event.

The PG&E Emergency Operations Center (EOC) Officer-in-Charge

makes the decision to initiate PSPS patrols and re-energization by approving the re-energization of impacted assets within the event footprint as recommended by the PSPS event meteorologist in charge. This approval is termed the weather "all clear", indicating that a return to weather conditions supporting the commencement of restoration (both the patrol and re-energizing activities) activities in given area(s). Re-energizing activities then commence in the event footprint including conducting patrols and removing and repairing hazards.

The protocol for re-energization (when both transmission and distribution assets, including substations, are involved) typically includes executing re-energizing of both transmission and distribution assets simultaneously. The transmission element is often prioritized to ensure system stability (including the system protection component) is accounted for. It also provides a source for substations and their associated distribution circuits that could be impacted.

The transmission line patrol prioritization strategy is driven by electrical system stability (i.e., ensuring adequate transmission facilities are in service to support the overall grid and accompanying local loads along with ensuring that the system protection component is addressed) followed by the customer impacts associated with each line impacted in the event. Distribution circuit "segmenting" is also used to better align both field and control center Personnel. In supporting and performing distribution circuit-based isolation (segmentation) PG&E uses a circuit-based patrol personnel hierarchy structure. The segmenting process can commence immediately following the impacted distribution assets being de-energized. The process is usually done in a de-energized state (while the weather event is ongoing) and typically consists of using previously created distribution circuit segment guides on impacted circuits to open pre-identified distribution field devices downstream of the open source device (used to de-energize given portion(s) of a distribution circuit). This allows for setting up "step restoration" once the weather "all clear" is received.

To support re-energizing activities, resource needs are identified for the scale and scope of the event footprint during PSPS event pre-planning. Resources typically include helicopters, PG&E personnel, contractors, and mutual aid. These resources are then provided to the impacted areas and staged to support the event.

4) Progress on initiative (amount spent, regions covered) and plans for next year: next year

With PG&E's weather expanded network of weather stations and high-definition wildfire cameras, hawse have improved our ability to forecast and identify safe weather and declare the weather "all clear" in more granular areas. This year, we were able to identify weather "all clears" on a more granular and event specific level, to re-energize more customers faster rather than delaying restoration until the entire area or

"Time-Place" (geographical area with same de-energization time and restoration estimated time) is safe to energize. While this restores service quickly for many customers, it is a complex process to manage and coordinate between the field and EOC teams. PG&E will develop processes to more effectively issue and restore granular weather "all clears" in 2021 to enable an improved restoration to our customers.

As further described in Section 8.1, we are focused on improving our restoration processes from lessons learned in 2020 to improve our restoration time and allow for an improved customer experience.

5) Future improvements to initiative:

Going forward, PG&E will review and confirm guidance document, PSPS-1000P-01, and the distribution circuit segmentation process are reviewed and updated as appropriate based on lessons learned from the 2020 wildfire season.

PG&E will work to meet the CPUC requirement that all customers be restored within 24 hours of the weather clearing when safe to do so, but we do not have a specific target for an expected reduction in PSPS event duration in 2021.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E will also investigate ways for the Incident Command and meteorology teams to improve the monitoring real-time and forecasted weather conditions based on weather models, weather station data, and field observations while working to make the patrol crews and helicopters positioning more efficient in anticipation of the weather "all clear" to begin patrols. These efforts will further increase granularity and allow for earlier customer restoration. PG&E is also investigating increasing the aerial patrol fleet to augment ground and truck restoration patrols as well as studying and benchmarking the use of drone technology in the restoration process. To review PG&E's aviation support plan, please see Section 7.3.6.7.

7.3.6.5 PSPS Events and Mitigation of PSPS Impacts

WSD Initiative Definition: *Designing, executing, and improving upon protocols to conduct PSPS events, including development of advanced methodologies to determine when to use PSPS, and to mitigate the impact of PSPS events on affected customers and local residents.*

This section covers both distribution and transmission. However, in Table 12 in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx we have separated the financials and Risk Spend Efficiency calculations for distribution and transmission.

1) Risk to be mitigated/problem to be addressed:

PG&E's PSPS Program proactively de-energizes a portion of the electric system in the interest of public safety when weather forecasts predict conditions of an extreme fire threat. The principal benefit of de-energization is to prevent PG&E's equipment from causing a catastrophic wildfire that could harm customers' lives and property. Public safety risks of a PSPS de-energization mean impacted communities may spend an extended period of time without electricity. PG&E considers the public safety impacts of de-energizing by looking at the total count of impacted customers and the impact of potential de-energization upon medical baseline customers, critical facilities, back-up generation capabilities of critical facilities that pose societal impact risks if de-energized (e.g., critical infrastructure) and reviews any alternatives and mitigations available prior to making the decision to de-energize.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

De-energization is necessary to protect public safety when PG&E believes there is significant risk of strong winds impacting PG&E assets, which may potentially result in destructive wildfires should ignition occur. PSPS is used as a measure of last resort and is only deployed when other measures are not adequate alternatives.

PSPS addresses a specific type of risk. While other measures described in the WMP help reduce the need to de-energize communities, PSPS remains a unique tool at the utility's disposal to use in the interest of public safety if extreme conditions are forecasted. A key objective of the PSPS Program is to implement measures dramatically reducing customer impacts of PSPS events without compromising safety.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PSPS de-energization is dependent on the impacted location within

PG&E's service territory. PSPS primarily occurs in HFRA areas, but de-energization will occur anywhere in PG&E's service territory that has been affected by a PSPS event.

PG&E uses the following tools to identify a potential PSPS event, as well as mitigate impacts on our customers who are de-energized for public safety:

Meteorological Guidance

In 2020, the PG&E Meteorology team has improved the granularity of our PSPS guidance tools: Utility Fire Potential Index (FPI) and the Outage Producing Wind Models. These improvements enable the models to predict severe fire weather risks on more focused areas and identify those areas which exceed distribution risk guidance with better geographic precision.

Transmission Line Scoping

Transmission line scoping for 2020 utilizes the same updated Utility FPI Model as the distribution scoping process; however, the process uses transmission-specific thresholds for asset health and outage likelihood. In addition, the transmission asset analysis is more granular than 2019, with assets analyzed against guidance at the structure level.

Temporary Generation

PG&E uses temporary generators to mitigate PSPS impacts on our customers. Temporary generators are used to energize substations and temporary microgrids that keep power on for services supporting community normalcy. This includes stand-alone facilities serving public safety, hospitals supporting coronavirus response and other emergencies, vote tabulation centers, and indoor Community Resource Centers (CRC).

Islanding

In some cases, customers remained energized by "off-grid" islanding. PG&E leverages islanding capabilities to keep some customers islanded apart from the rest of PG&E's transmission system and energized by generation located within the island.

Sectionalizing Devices

PG&E installed over 600 sectionalization devices and 54 transmission switches near and within the boundaries of the Tier 2 and Tier 3 HFTD areas to enable PG&E to narrow the de-energization scope as close as possible to the boundaries of the critical fire weather where it is unsafe to leave PG&E facilities energized.

Community Resource Centers

To minimize public safety impacts during a PSPS event, PG&E opens CRCs in potentially impacted counties and tribal communities. CRCs provide customers and residents a safe location to meet their basic power needs, such as charging medical equipment and electronic devices. For a more in-depth description of our CRC resources, site criteria/locations and in-event coordination, see Section 8.2.1. This section also includes more information on other ways PG&E is mitigating customer impacts during a PSPS event.

See Section 8.1 for a discussion on how PG&E identifies locations for PSPS mitigations. See Section 8.2.4 for information on customer communication during PSPS events and Section 8.4 for information on how PG&E is engaging vulnerable communities during PSPS events.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

PG&E had six PSPS events in 2020 which resulted in approximately 55 percent fewer customer de-energizations than those six weather events would have caused in 2019. While the weather in every year is different, progress in limiting the impact of PSPS can be seen by modeling 2020 event weather with PG&E's 2019 scoping methodology, assets and processes. This modeling shows that the six 2020 events would have resulted in approximately 1.5 million customer de-energizations under 2019, but with the 2020 mitigations and processes in place the actual total of the six 2020 PSPS events was approximately 650,000 customer de-energizations.

5) Future improvements to initiative:

Going forward, PG&E will continue to utilize lessons learned during the PSPS season to lessen the number of customers impacted and mitigate the effects on those who are impacted. PG&E expects to see further PSPS scope reductions as we continue to increase the maturity of our PSPS Program and tools. With the incorporation of descoping criteria into our PSPS tools, PG&E will also begin to see some reductions from our overhead hardened lines. In this time frame, newer technologies currently only in pilot phases such as Rapid Earth Fault Current Limiter and Distribution, Transmission, and Substation: Fire Action Schemes and Technology may begin enabling some lines to remain energized during high wind conditions, contributing to event size reductions. For more details, please see Section 8.1.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E expects a significant reduction in PSPS impacts as technologies currently in pilot phases are deployed at scale and significant portions of our long-term system hardening program are completed. Further description of long-term planning for PSPS mitigation can be found in Section 8.1.

7.3.6.6 Stationed and On-Call Ignition Prevention and Suppression Resources and Services

WSD Initiative Definition: *Firefighting staff and equipment (such as fire suppression engines and trailers, firefighting hose, valves, firefighting foam, chemical extinguishing agent, and water) stationed at utility facilities and/or standing by to respond to calls for fire suppression assistance.*

1) ***Risk to be mitigated/problem to be addressed:***

   PG&E's in-house SIPT supports ignition prevention and suppression activities. SIPTs consist of two-person crews. Each crew member is IBEW-represented and trained and certified in safety and infrastructure protection. SIPTs perform wildfire mitigation functions and gather critical data to help PG&E prepare for, and manage, wildfire risk and emergencies. If engaged in any planned assignments, they are prepared to swiftly redirect to an emergency situation by the WSOC and the SIPT Duty Officer.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:***

   There are 40 SIPTs available to respond Monday through Friday during normal work hours. During the summer preparedness period, eight SIPTs remain on-call, with availability to respond for emergency needs on weekend and holidays. When necessary, additional SIPTs can be mobilized to support. If the wildfire danger risk is elevated, the WSOC and SIPT leadership frequently identify additional standby SIPT personnel to support response.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

   On-call SIPTs are located throughout the PG&E service territory, primarily focused in Tier 2 and Tier 3 HFTD areas.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

   The SIPT has continued to grow, and now consists of 40 crews, one Manager, seven Supervisors, two Clerks and one Analyst. SIPTs have met the commitment outlined to stabilize staffing. By the end of 2021 the SIPT Program will evaluate internal practices and procedures in the Teams site, as necessary, to support additional program needs.

5) ***Future improvements to initiative:***

   The SIPT Program will review internal practices and procedures to inform modifications to targeted staffing levels and associated equipment needs

in order to support on-call and standby as needed.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Given the benefits seen so far, the SIPT program may expand as the SIPT teams further refine the fire prevention and mitigation needs of PG&E. In the future, SIPTs will continue stabilizing current technology solutions and processes. SIPTs will also assess effectiveness of the program and develop business cases to potentially increase staffing levels and equipment needs.

7.3.6.7 Other – Aviation Support

WSD Initiative Definition: *N/A This is not a WSD-defined initiative. This is an initiative that PG&E is adding to the 2021 WMP to describe Aviation Services.*

1) Risk to be mitigated/problem to be addressed:

The Aviation Services team manages all enterprise flight operations (Fixed-wing, Helicopter Operations and Unmanned Aerial Systems [UAS]), vendors and aviation assets. Aviation Services provides scheduling and dispatching for passenger transport, aerial inspection and construction with our internal and third-party assets providing vendor governance, contract management and oversight for all enterprise aviation operations.

The following wildfire-related programs utilize one or more aviation assets:

- Vegetation Inspection/Patrol
- System Hardening
- Wildfire Restoration/Rebuild
- SIPT
- Pre-PSPS Inspections/PSPS Inspections

The increased risk and workload from the above programs are pushing the limits of safe operations due to the de-centralized configuration of the organization. The increase in aerial operations has resulted in the need to increase aviation support staff to safely and efficiently manage aerial assets. With the increase of both staffing and increase in flight hours of helicopters, fixed-wing, and drones there is a need to migrate to a centralized aviation industry corporate aviation model. A centralized fleet and support operations mitigate the following risks:

- Weather is optimal for aviation operations, allowing more Visual Flight Rules flights which decrease flight risk
- Align with creating an in-house helicopter maintenance program to improve heavy-lift availability, controls and oversight for Wildfire Mitigation Operations, a centralized location for all assets' maintenance operations
- Coordination, accessibility, accountability, consistent availability of materials (i.e., maintenance, human external ropes, central warehouse for job materials)

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives: What are our projects?

Aerial resources are currently managed by each aviation services department (in different locations) based on the asset type. Through a centralized model, decisions of what assets are best suited for the work

type will be determined and communicated from one location and one department. There are instances where a helicopter may be scheduled to complete an aerial inspection or when there may be another asset, fixed-wing, drone or a combination of assets available to complete the work needed (which may be more cost efficient and have a greater safety margin).

PG&E's Aviation fleet consists of:

- Four heavy-lift helicopters purchased in 2018/19 to enhance wildfire safety and support utility infrastructure projects. The helicopters guarantee heavy-lift resource availability for PG&E facility restoration and construction support during fire season. The helicopters are fitted with fire suppression equipment such as a Bambi Buckets. If needed and requested, they are available to aid in suppression efforts under the direction of the agency leading the response (e.g., CAL FIRE).
- Two Cessna fixed-wing assets for operational practices: to perform electric system operations in a manner that reduces the possibility of wildfire ignition in times of elevated fire danger conditions and reduces fire spread in the use of PSPS.
- 30 UAS to enhance wildfire safety and support utility infrastructure projects.

PG&E's Aviation Services would consolidate operations to:

- Vacaville: Centralization of PG&E's aviation organization. Removing the current decentralized operations from physically managing and conducting operations from three locations (Concord Fixed-wing/UAS Drone, Vacaville Helicopter, Red Bluff Helicopter) to a centralized model.
- Winters: Identified as a training center away from PG&E's Aviation Base. Due to Federal Aviation Administration (FAA) Regulations, Drone Operations cannot be within five miles of an airport. This is a centralized location for Drone Operations maintenance and flight training.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E's Aviation Services support wildfire mitigation efforts throughout PG&E's service territory of varied topography.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

Aviation Services has successfully completed all wildfire aerial work requests for their various departments, including, but not limited to, over 50,000 tower inspections, 20,000 helicopter poles/tower inspections and 30,000 UAS pole/tower inspections.

5) Future improvements to initiative:

Future potential aviation include:

1) Growth of Fixed-Wing Program:

   There is potential for an increase to the fixed-wing fleet over the next two years. The increase of these assets within PG&E will reduce, if not eliminate, the need to contract aircraft operators to perform inspection work. In addition, the fleet increase will have a direct impact on the number of helicopter assets required to conduct inspection work in low elevation and long span areas.

2) Wide-scale UAS Adoption:

   Over the next two years, Aviation Services will continue to develop and implement further deployments of drones as a tool to support electric system operations and/or wildfire risk reduction. PG&E is participating in a Technical Assist Project for UAS Solution for Linear Infrastructure Inspections with the FAA in order to minimize the risks noted above, PG&E has a large workforce, consisting of Journey Linemen, Apprentice Linemen, Troublemen and Foremen, that is geographically distributed and can move across PG&E's service territory to handle emergency events as needed.

   In coordination with other utilities, PG&E is benchmarking to further develop drone use within our service territory. Through these benchmarking engagements, PG&E continues to source ideas to increase safety margins for our field employees, improve repair, restoration efficiency and reduce costs through the development and incorporation into PG&E's wildfire safety efforts and, potentially, future WMPs.

   Working with the Edison Electric Institute (EEI), the FAA and other partner utilities, PG&E is engaged with the development of Beyond Visual Line of Sight (BVLOS), which will allow PG&E to further manage asset usage and reduce the reliance of helicopters and fixed-wing for some inspections.

   BVLOS will require a centralized control room to coordinate and manage drone flights concurrent to other aerial operations.

   PG&E will continue to leverage the BVLOS development and EEI forums and the relationships developed to share our learnings to date and cast a broad net for best practices, lessons learned, tools, technologies and ideas that can help PG&E and California reduce wildfire risk.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Aviation Services' long-term work is highly dependent on the Line of Business needs and requirements. Timelines are subject to move up or back based on demand. All strategic planning is driven by the organizations that utilize aerial assets. In addition to the items discussed above in response to Question 5, an additional long-term planning item includes:

Insourcing Helicopter Fleet:

As noted, PG&E has participated in benchmarking discussions with other utilities to understand their use of helicopters and operational management. The insourcing of patrol/medium lift helicopters will reduce the contracting cost inspections and construction, while increasing safety margins through complete mission and operational control.

7.3.7 Data Governance

7.3.7.1 Centralized Repository for Data

Wildfire Safety Division (WSD) Initiative Definition: *Designing, maintaining, hosting, and upgrading a platform that supports storage, processing, and utilization of all utility proprietary data and data compiled by the utility from other sources.*

In addition to providing responses to below five questions for Initiative 7.3.7.1 Centralized Repository for Data, Pacific Gas and Electric Company (PG&E or the Company) is including our response to Condition PGE-16 (Class C) and response to Action PGE-81 (Class B) below.

1) ***Risk to be mitigated/problem to be addressed:***

   This section provides an overview and update to PG&E's efforts to operationalize a data analytics environment that integrates asset-related information from disparate data sources into a single environment, enabling data-driven approaches to wildfire risk mitigation. To enable and sustain value from this environment, PG&E is also implementing enterprise data management practices and seeking certification of our asset information/data management practice as part of our Electric Asset Excellence program targeting ISO (International Organization for Standardization) 55000 certification.

   A practical data integration approach that utilizes data pipelines from source data systems into an integrated data platform is necessary. This approach, combined with an effective data management practice, enables access to timely, trusted, and consistent information, that can be used for advanced data analytics, thereby enabling the ability to make more effective, data-driven decisions.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.***

   In 2020, PG&E made significant gains on this initiative. In Q2 2020, we implemented the pilot of a central, enterprise data platform – Palantir's Foundry – and quickly operationalized two data products that dramatically improved our situational awareness, decision-making and customer notifications capability for Public Safety Power Shutoff (PSPS) events in 2020. PG&E also developed two prototype products focused on asset failure analysis and grid fault location detection and prediction, which continue to be matured. In November 2020, based on the successful use-cases, PG&E entered into a long-term contract with Palantir for its data platform services. To-date we have integrated 50+ source data systems, which contain billions of records relevant to asset information, such as our Geographic Information System (GIS), SAP, customer, and SmartMeters™ systems, thereby setting the foundation for future analytics development as described below.

Evolution of PG&E Data Systems

PG&E's data environment has evolved organically over decades with the development and deployment of large, built-for-purpose data source systems (e.g., SAP, GIS). PG&E has historically integrated data between individual systems on a case-by-case basis through data interfaces. This has led to a many-to-many relationship between data systems, with no centrally integrated environment that facilitates an effective development of analytics. In order to mitigate wildfire risks, PG&E must be able to access, integrate, and analyze data across disparate systems. In many instances, existing software systems were not designed to be easily accessed or integrated with other systems. These systems were purpose-built to support specific capabilities. For example, customer data, spatial and as-built data, work management data, operations data, and event data have traditionally been managed in separate systems, with independent data stores, without being integrated centrally. However, there is an increasing need to integrate these data sets and efficiently perform analyses to improve data-driven decision-making around asset and risk management. Electric Operations (EO) systems and processes related to wildfire mitigation have been maturing at an accelerated rate, and the systems that generate and store data relevant to those mitigation activities are seeing aggressive expansion in both volume of data collected and breadth of application since 2019.

Data streams from new technologies, such as remote sensing and Light Detection and Ranging, introduce emerging data needs for high capacity storage and processing, while advanced analytics (including Artificial Intelligence and Machine Learning) offer the potential to leverage data to better manage risk and predict events before they happen. PG&E is responding to these challenges by developing and implementing strategies for data management, integration and access.

Asset & Risk Management Data Architecture

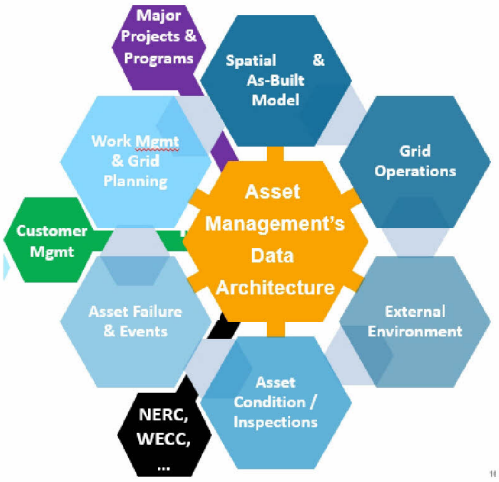
As part of our strategy to mature PG&E's asset and risk management practices, we are developing a central repository of asset and risk management data and implementing data management practices guided by a broader Enterprise Data Management Program. These efforts are responsive to the following drivers of improvements to asset and risk management practices: (i) increasing need for data availability, data quality and trusted analytics; (ii) increasing demand for advanced analytics, Business Intelligence (BI), visualizations, dashboards and data sharing; and (iii) increasing need for data security and privacy.

The central asset data repository will contain governed, trusted and accessible data necessary for critical business decision-making for asset and risk management. This repository will bring together physical, operational, lifecycle and environmental data elements from disparate built-for-purpose data systems into a single environment to better enable access to data in support of asset planning, risk management, and

operations, and embedded data analytics for *ad hoc* analyses (see Figure PG&E-7.3.7-1 below). Within this repository, data objects are curated, data attributes are defined, data sources are documented, data pipelines are governed, and key connections between disparate data sets are established. PG&E will also develop and host BI dashboards, analytics, and data science models in this environment.

This architecture, and the associated data management practices, will significantly advance PG&E's ability to make data-driven decisions around asset and risk management by improving the accessibility, quality, and use of information, maturing analytical capabilities, and enabling deployment and scaling of analytical products.

FIGURE PG&E-7.3.7-1: ASSET & RISK MANAGEMENT DATA ARCHITECTURE

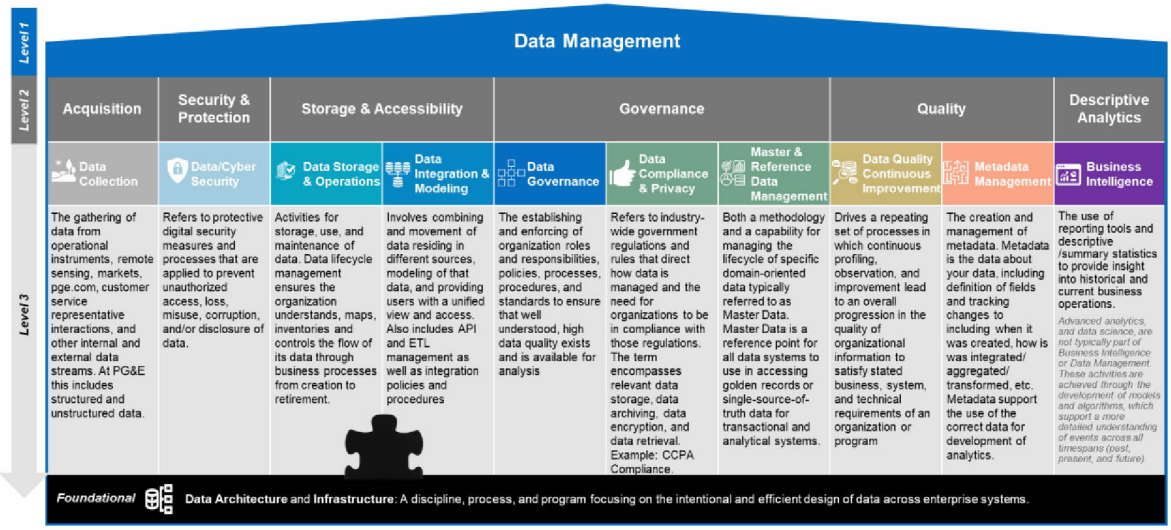


Data Management

In parallel to developing the asset and risk management data architecture, PG&E is maturing our data management capabilities. Data management creates the organization, policies, and processes that are necessary to achieve and sustain capabilities around data-driven decision-making.

PG&E's will mature our data management capabilities in alignment with the domains reflected in Data Management Framework presented in Figure PG&E-7.3.7-2 below. We are taking a phased approach to the data strategy with near-term focus on enhancing Data Maturity (data is high-quality and fit-for-purpose), Data Quality (establishing processes to continuously profile and improve data quality), and Data Security (establishing protective measures to prevent unauthorized access to data).

FIGURE PG&E-7.3.7-2: DATA MANAGEMENT FRAMEWORK



Source(s): Based on Data Management Association International's Data Management Body of Knowledge, Gartner, role model benchmarking, and SME industry experience

At the enterprise level, PG&E established in 2020 an Enterprise Data Management organization, with a Director of Data Governance. This organization is responsible for developing the enterprise level data strategy, policies, standards and objectives. EO has developed a Data Management and Analytics (DM&A) organization to guide electric data strategy, data quality efforts, and data management efforts. This organization will establish the overall priorities, standards and processes to manage data critical to wildfire risk mitigation. Implementation of the electric data strategy will be led by the DM&A organization in partnership with the Enterprise Data Management team, Information Technology (IT) business partners and EO business units. Centralization of the data management function helps provide alignment of data strategies across EO and the enterprise and improves PG&E's ability to make data-driven decisions around wildfire risk management.

The alternative to the development and implementation of a centralized data platform would be to continue producing analytics through historically siloed systems that were purpose-built and not designed for more efficient integration. This could result in ineffective decision-making based on incomplete data, missed opportunities to improve wildfire risk management decisions by scaling data analytics, under-utilization of our analytic and engineering human resources, and an inability to more effectively share data with external partners (e.g., Wildfire Safety Division (WSD), California Department of Forestry and Fire Protection (CAL FIRE), local government agencies).

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")***

The prioritization and rationalization of the elements contributing to the integration of data are summarized as follows:

- Central Data Platform: In November 2020, PG&E piloted and subsequently procured a DM&A platform, Palantir Foundry, based on results from operational use-cases implemented with Palantir in 2020. This included the successful and impactful migration of situational intelligence for PSPS operations into Foundry for the 2020 wildfire season. This investment was made to advance PG&E's ability to make data-driven decisions by improving the accessibility, quality, and usability of information to inform critical decisions.

- Data Products: PG&E will build on the data foundation created in 2020 and deliver new, high-value data products that improve wildfire mitigation capabilities on the Palantir Foundry platform in 2021. This includes continued development of data products and deployment of analytical risk models, including creation of related data pipelines and curation of data. This work will also create a trusted data foundation for management of distribution, substation and transmission asset lifecycles, including wildfire and risk management. Specific data products to be developed in 2021 are further described in response to question 4 below. The platform and the associated program will be used to maintain data pertaining to the entire PG&E system, including High Fire Threat District (HFTD) areas.

- Data Management: PG&E will establish and implement a data management program with a focus on maintenance of the data architecture, data governance, data quality, and data security. Data management efforts are foundational to ensuring effective use of data for wildfire mitigation.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year***

Foundry Data Platform

In 2020, PG&E contracted with Palantir to implement the Foundry enterprise data platform, to centralize, curate, and transform data into business insights through creation of various data products.

Foundry currently is connected to 50+ source systems, which contain billions of records relevant to asset health analytics such as GIS and SAP. The number of connected systems, records, and enabled analytics models will continue to grow as additional data products are developed. The data platform does not replace the underlying source data systems of record, but rather provides a central platform to enable data

integration/virtualization and access, support for data management and advanced analytics.

PG&E is developing several data product suites in 2021 that are designed to (1) target the integration of critical, foundational datasets from disparate data systems, (2) enhance wildfire risk management capabilities, and (3) enable effective asset management. These data product suites include the following:

- **PSPS Situational Intelligence Platform:** PG&E has built a central platform to inform PSPS decision-making, reporting, and communications. The features include PG&E's Situational Intelligence Reporting, Customer Notification Management, Event Scoping, Re-Energization Management, Regulatory Reporting and more. The platform is also used to generate information shared with external parties such as CAL FIRE and local emergency management agencies.

  In 2020, PG&E used this platform to develop and manage situational intelligence for all of our PSPS events, which reduces the impact on customers from PSPS events. This product resulted in significant operational efficiencies and improved accuracy of PSPS customer notification (accuracy of customer contacts for PSPS events was increased to over 99 percent, a significant improvement over 2019).

  In 2021, PG&E will develop new features within this platform to continue enhancing PSPS event scoping decisions, customer notification and re-energization management.

- **Asset Failure & Maintenance:** PG&E is developing a platform to investigate and characterize asset failure incidents to inform asset management plans, with the goal of reducing catastrophic asset-failure-related wildfire ignition frequency in the future. This platform will enable us to identify trends in asset condition, create alerting workflows for Asset Managers, build predictive risk metrics, and bring the data asset to field patrols.

  In 2020, PG&E built a prototype asset failure analysis tool for conductor and distribution transformer asset failure in Foundry.

  In 2021, PG&E will build expand upon the prototype product to develop a framework for end-to-end asset failure management for one asset class (e.g., overhead conductor) and evaluate the ability to extend this framework to other assets.

- **Grid Data Analytics Tool (GDAT):** PG&E is developing a data product that leverages data from distribution system sensors (including SmartMeters™, line reclosers and Supervisory Control and Data Acquisition-enabled reclosers) to more efficiently and rapidly identify and resolve the source of unknown cause outages and to identify and

resolve incipient grid conditions before they result in catastrophic failure.

In 2020, PG&E built a prototype tool to identify the location of unknown cause outages and potential sources of intermittent faults. This will serve as the foundation for the operational GDAT tool.

In 2021, PG&E will enhance this product by integrating additional data and building workflows within the Foundry platform. As part of a related Electric Program Investment Charge project (3.20), PG&E will also test the ability to apply predictive analytics to the grid data and proactively identify/ resolve issues before they result in catastrophic failure.

- **Asset Risk Management:** In 2021, PG&E will evaluate whether and how to migrate and continue to develop our 2021 Wildfire Distribution Risk Model and Transmission Operability Assessment Model into the Foundry data platform. This has the potential to mature the access and curation of modeling data and aid in the application of model results to the development of wildfire risk mitigation workplans. The work being developed in Foundry is in support of the risk models discussed in Sections 4.3 and 4.5.1.

- **WSD GIS Data Standard:** In 2021, PG&E will consider whether to leverage the Foundry data platform to develop a central data schema and automate (as much as practical) the production of the quarterly delivery of WSD's GIS Data Standard, which currently takes thousands of person-hours to produce each quarter.

- **Critical Business Terms:** In 2021, through the development of data products mentioned above, PG&E will continue to catalogue and integrate data associated with our critical business terms for EO into Foundry. This will establish a foundational registry and repository of data that can expedite the development of future products that could be used for wildfire risk mitigation.

  In 2021, PG&E will also publish and begin implementation of our Metadata Management Standard, which will guide the documentation of critical business terms.

5) Future improvements to initiative

As stated above, PG&E intends to operationalize a data analytics environment that integrates asset-related information from disparate data sources into a single environment, enabling data-driven approaches to wildfire risk mitigation. This requires not only the deployment of the platform but also the maturation of data management practices and development of new processes to support effective deployment and utilization of the platform.

ACTION PGE-25 (Class B)

PGE-DIXIE-NDCAL-000005095

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Long-term plan milestones are under development, with EO in consultation with Enterprise Data Management. These milestones will guide PG&E's efforts to continue building our central data platform, data products and data management capabilities to improve asset and risk management capabilities through efficient and effective data-driven decision making. Below are several data-centric initiatives PG&E is evaluating for 2021 and beyond.

- **Data Schema:** In 2021, PG&E will evaluate and decide whether to develop and implement a central data schema for EO building from the Common Information Model, which has been officially adopted by the International Electrotechnical Commission, in alignment with the WSD GIS data schema. Conceptually, this model would align asset, operational, maintenance and other data to PG&E's assets and operations, creating a "digital twin" of the utility. If PG&E determines that this work should be undertaken, implementation would be a multi-year effort.

- **Product Development:** PG&E, through EO and Enterprise governance processes, will mature the data products mentioned above and add new products that enable wildfire risk mitigation capabilities, including enhanced situational intelligence, risk modeling, asset management and work planning/tracking. PG&E will also evaluate whether to develop an end-to-end asset management platform within its Foundry. Implementation of an end-to-end asset management platform would be a significant, multi-year effort as it would require integration of many separate workflows, processes, and data systems.

- **Data Management:** PG&E has embarked on an effort to mature our Data Management capabilities, which will ultimately enhance our abilities to make effective data-driven decisions around wildfire mitigation. Consistent with the Data Management Framework above, PG&E will continue to advance our data management maturity using a phased approach, with the focus for the next 2-3 years being Data Architecture, Data Governance, Data Quality and Data Security. This will entail the development and implementation of new standards, processes, and tools to support the maturation of data management practices.

Response to Condition PGE-16 (Class C):

PGE-16: *PG&E's record keeping is deficient.*

Deficiency: *PG&E's history of poor record keeping. PG&E is only just moving from a paper records system to digitized records. The California Public Utilities Commission (CPUC or Commission) has found that PG&E's record keeping is*

deficient in other contexts with serious safety implications, including records on the location of its underground natural gas and electric lines. PG&E should explain whether it has detected errors or other problems with its wildfire mitigation records.

Condition: *In PG&E's 2021 WMP update, PG&E shall:*

i. Disclose any problems with its paper record keeping system described in its WMP, and

ii. Outline any gaps (missing records), inaccuracies (inadvertent or intentional) and other errors.

Response:

PG&E-16 | Class C Condition

(i) As described in the above section, PG&E's core business processes are actively shifting to electronic systems and records. Wildfire mitigation related activities, such as PSPS, detailed inspections, enhanced vegetation management, and system hardening, have fully shifted to using electronic record-keeping systems. However, some elements of maintenance and construction activities will take more time to transition due to legacy systems that rely on paper processes.

PG&E has recently identified some existing paper-related challenges related to our vegetation management program:

1. PG&E discovered that our Vegetation Management Database (VMD) system has a digital character limitation that prevented a complete input of all the information that may have been documented on the associated paper forms. A short-term mitigation has been identified to notate in the VMD when the information on the paper record exceeds the digital character limit and instructing the user to review the physical record.

2. There is a gap where formal QA/QC is not occurring for the data entered by vegetation management contractors from paper forms into the VMD system. While a fully digitized data entry solution is available, some vegetation management contractors work in remote locations with limited network connectivity. Due to the lack of connectivity, paper forms may be used. Once the contractor returns to an area with connectivity, they are required to upload the information recorded on paper forms into the VMD. Upon investigation, no formal process exists for transferring the paper forms into PG&E's custody or confirming if that is necessary. PG&E's Enterprise Records & Information Management (ERIM) team is actively working with the Vegetation Management team to resolve this.

While these challenges are being actively addressed, PG&E has not identified that they drive any limitations or "problems" for PG&E's wildfire risk mitigation Vegetation Management work. PG&E is confident that the upcoming complete shift to electronic form capture and technical enhancements to the VMD system will alleviate the challenges outlined above. In addition, near-term mitigations are already underway

to add manual procedural steps and documentation to begin addressing these known gaps before the comprehensive electronic transition can be completed.

In general, PG&E recognizes that paper-processes require manual oversight and checking, allowing mainly controls that are detective in nature, as opposed to being preventative (such as electronic form pre-validation before submission). Also, information contained within paper records cannot be easily aggregated for systemic trends or statistical analysis. The limited ability to quickly access or analyze the information in historical paper records creates limitations in our ability to review and analyze some data. We have not quantified any precise impacts from this less-accessible data issue on our WMP initiatives, but the general limitations caused by a lack of machine-readable data are:

- Inability to evaluate and improve the effectiveness of processes by identifying trends, making adjustments, and evaluating the impact of those adjustments to confirm impact;

- Incorrectly heightened weight on limited, high profile data points that appear significant due to the inability to confirm if the identified cases are actual trends (as opposed to a limited or singular outlier that can be safely resolved or monitored); and

- Incorrectly diminished weight of individual data points that appear insignificant due to the inability to confirm if cases are anomalies/outliers (as opposed to a signal of a systemic trend that should be acted upon).

(ii) Despite the above discussion, after internal review, PG&E is not aware of any problems, gaps, inaccuracies or other errors with current or on-going paper record keeping systems that impact the quality, execution, effectiveness or performance of WMP initiatives. Paper-centric processes across PG&E have multiple layers of controls and oversight to manage potential human error. However, these layers of manual oversight and remediation are inefficient and time intensive, which is another key motivator to replace them with electronic systems.

A key example of PG&E's improvement in this area is how detailed inspections are now performed and tracked in a purely data-driven manner. Inspections are scoped and completed at the asset-level using equipment records from enterprise systems to confirm exactly which locations require detailed inspection. Completions are recorded back into those same systems with positive confirmation that every location was visited. Compliance is validated using data to ensure nothing is missed. Field employees have been critically valuable and disciplined in aligning to this data-driven approach. If, for any reason, the system data does not line up with the assets the front line team identifies in the field, those issues are flagged and documented for resolution so that the inspection can be completed properly and accurately documented in the system.

Another example of shifting from paper to electronic documentation is that PG&E's Vegetation Management department historically relied on paper Hazard Tree Rating System (HTRS) forms to be filled by inspectors in the field to identify and address possible at-risk tree species. Relying on paper forms to evaluate individual tree risk

PGE-DIXIE-NDCAL-000005098

and assess the need for mitigation was cumbersome and required additional manual verification. Starting in March 2020, inspectors began evaluating trees using PG&E's digitized Tree Assessment Tool (TAT), which replaced the HTRS. Itis a tool that evaluates an individual tree's likelihood of failing and indicates whether to abate the tree. TAT incorporates historical data on tree failures, regional species risk, and local wind gust data and assesses different components of an individual tree's health and risk of falling into PG&E lines or equipment. The TAT is completely digital, and field employees can input data directly into a mobile platform that immediately generates a risk mitigation determination.

Much of PG&E's historic data, including detailed information on specific assets, remains on paper. While many systems, particularly for newly created data and records, have been shifted to electronic systems, the limited ability to quickly access or analyze the information in historical paper records does create limitations in our ability to review and analyze some data. We also know that the conversion processes from paper to digital records, for example from paper maps to PG&E's Geographic Information System (GIS), has resulted in some inaccuracies. We have processes in place to resolve those issues when they are identified.

In particular, PG&E has a defined process to identify and correct issues caused by the shift from paper maps to an electronic GIS system as follows:

When Field Personnel find an inaccuracy between our GIS maps and what they see in the field, they create a Request for Work (RW) Map correction. There are multiple ways to get this map correction to PG&E's mapping department:

1. Field Personnel take photos, fill out a map correction form and hand in or send a picture of the form and photos of the asset to the clerical support for their team. The clerk then has the choice to utilize SAP or the Electric Distribution (ED) or Electric Transmission (ET) GIS Web Viewer to input the RW map correction request. It is routed to the mapping department from SAP for resolution.

2. The Field Personnel can utilize ED or ET GIS Web Viewer directly to input the data themselves, and it will route to the mapping department for resolution.

3. Field Personnel can utilize PG&E's mobile enabled Inspect App to create an RW by choosing "Assets Differ" on their application and fill out the necessary information and add the required photos. It goes through the same process through SAP to the Mappers for resolution.

4. Once a Map correction is completed, the mapper closes out the job in SAP which triggers an email to the initiator and sends the RW notification over to Maintenance Planners to update their maintenance plans (in case the assets have changes which might impact the required maintenance schedule).

PG&E will continue to monitor our data, records and processes to identify further gaps or challenges and resolve them. While we have successfully converted our wildfire mitigation-related record keeping efforts to digital formats, we know that there will be more opportunities to continue to improve

our capturing of records and information to support further maturation of our analysis and risk understanding.

ACTION PGE-81 (Class B)

1. *Explain whether these developments are solely for newly collected data or if these developments allow retroactive data integration for previously collected data; and*

2. *If they do not allow for previous data usage, explain (a) why PG&E does not have such capability and (b) why PG&E deems its plan to be sufficient.*

Response:

In our First Quarterly Report, PG&E mentioned the developments of new strategies for data governance, management, integration and access. These new developments will allow retroactive data integration for previously collected data, so that new and retrospective data can be assessed and evaluated together.

PG&E's implementation of these data-focused strategies does not distinguish between previously collected data and newly collected data. For example, Data Governance & Data Management, described in WMP Section 7.3.7.1, is largely focused on robust and comprehensive improvements to how data is modeled and how teams are organized to review, cleanse, and provide guidance of proper data usage as it exists within enterprise systems. PG&E's strategic improvements to our data models & organization will not distinguish between old versus new data, and PG&E does not intend to build data models or organizations that can only be leveraged for newly collected data.

7.3.7.2 Collaborative Research on Utility Ignition and/or Wildfire

WSD Initiative Definition: *Developing and executing research work on utility ignition and/or wildfire topics in collaboration with other non-utility partners, such as academic institutions and research groups, to include data-sharing and funding as applicable.*

1) Risk to be mitigated/problem to be addressed:

PG&E is engaged in various collaborative research projects related to utility ignition and/or wildfire risk. These activities can result in tools, concepts, or analyses that can contribute to risk mitigation in various areas within wildfire risk.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

PG&E believes that there is significant long-term benefit from engaging in the development of wildfire risk mitigation research, tools or solutions. The potential value that may be identified through new research is unknown, and it is, in the near term, determined by the actual tools or solutions identified through these efforts. Investing in ongoing collaboration has the potential to enhance wildfire risk mitigation activities in a number of ways including providing new ideas for risk mitigation or improve targeting and understanding of wildfire risks. While engaging in the collaborative research has not been quantitatively analyzed, the learnings and outcomes can contribute to quantitative risk reduction and development of alternative risk reduction activities to be evaluated. PG&E does not view the primary alternative of not collaborating with other partners as prudent, particularly in light of the ongoing learnings about wildfire risks in California.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

This work is not performed in a specific geographic area. The solutions and tools identified through these efforts may apply across the entirety of PG&E's service territory or only portions thereof. As a result, no regional prioritization is relevant to this initiative.

4) Progress on initiative (amount spent, regions covered) and plans for next year

PG&E has continued to engage with various non-utility partners on wildfire risk mitigation ideas and research. Some examples of recent, ongoing or upcoming activities include:

- Leveraging nuclear industry risk modelling to develop wildfire risk assessment: PG&E has partnered with the B. John Garrick Institute for

the Risk Sciences at the University of California Los Angeles (UCLA) to leverage the rigorous modeling used in the nuclear industry to perform thorough and complex wildfire risk assessments and management planning. PG&E has used a probabilistic risk assessment model for over 30 years at our Diablo Canyon Nuclear Power Plant. The model is constantly updated with current plant design and state of the art analysis methodologies. Data from 30 years of industry and plant specific experience is used to model component reliability and unavailability. The model can perform quantitative assessment of risks from a multitude of complex factors, including internal plant failures, seismic events, fire and flooding. Each model element has been independently reviewed by industry peer review teams and the results have been audited on numerous occasions by the Nuclear Regulatory Commission. The model is capable of quantitatively risk ranking over 3,000 individual system components including the transmission lines that supply Diablo Canyon with offsite power. PG&E is working with risk experts at UCLA to develop a similar model for wildfire risks for our electrical assets within HFTD areas. PG&E also worked with the UCLA risk experts in 2020 on our High Fire Risk Area analysis as discussed in Section 4.4.2.

- Distribution Arcing Fault Signature Library: As discussed in Section 7.3.2.2.6 – PG&E partnered with two National Laboratories to install a high-fidelity optical sensor technology on a distribution feeder in 2020 for the completion of a Distribution Arcing Fault Signature Library. By end of 2021, the project will have completed at least a 6-month minimum analytic stage capturing all events on the installed circuit (Half Moon Bay 1103). Once the Research and Development project is complete, the team will perform a strategic assessment of the results. If the team can develop a comprehensive fault signature library, this information will be fed into the larger incipient fault analytics tools that will be used to proactively detect and mitigate grid conditions that could result in a wildfire.

- California Polytechnic State University, San Luis Obispo (Cal Poly) Wildland Urban Interface (WUI) Institute: PG&E is engaged in an advisory role with Cal Poly in their establishment of an interdisciplinary Woodland Urban Interface (WUI) Institute to facilitate the research, education, training and outreach needed to address the catastrophic wildfire problem in California and beyond. PG&E is partnering with and advising on the direction of research and associated activities by the institute as it embarks on the development of solutions for sustainable fire resilient communities and safer and more effective fire-preparedness and response operations.

5) Future improvements to initiative

In the near future, PG&E will continue to be involved with the three research initiatives described above. Going forward, PG&E will grow and add partnerships with non-utility institutions, as appropriate, as we continue to grow and improve our wildfire risk mitigation efforts. Ongoing

and future engagements generally take one of two forms, either (a) identifying the need for a non-utility partner to help address a specific challenge, as is the case in working with UCLA's Risk Institute to leverage established risk models for understanding wildfire risk, or (b) evaluating opportunities offered to PG&E to participate in existing or new opportunities, as is the case with the Cal Poly WUI Institute. The evolution of PG&E's partnerships will largely be driven by these two factors, needs and opportunities, as PG&E and other entities continue to learn more about wildfire risk mitigation.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E does not have specific long-term plans regarding the changes to our collaborative research engagements over the next 3 to 10 years. Research engagements by their nature evolve and iterate based on findings and identified needs. As research opportunities or needs are identified, we will assess and pursue those opportunities in support of our wildfire risk mitigation efforts.

7.3.7.3 Documentation and Disclosure of Wildfire-Related Data and Algorithms

WSD Initiative Definition: *Design and execution of processes to document and disclose wildfire-related data and algorithms to accord with rules and regulations, including use of scenarios for forecasting and stress testing*

1) Risk to be mitigated/problem to be addressed

PG&E leverages several programs and processes to support the sharing of wildfire-related data with the CPUC and other parties. These programs and processes assist in the overall, ongoing maturity and increasing understanding about wildfire risk and risk mitigation activities.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

Many of the wildfire-related data sharing and submissions are required by the CPUC and various stakeholders. The programs and processes described below follow specific steps to ensure the information provided, primarily to the CPUC, is properly retrieved, vetted, and accurate.

- WSD Quarterly Submission/GIS Data Standard

PG&E submits quarterly GIS Data Files and associated information in accordance with the *Draft Wildfire Safety Division (WSD) Geographic Information System (GIS) Data Reporting Requirements and Schema for Electrical Corporations* issued on August 5, 2020 (*Draft GIS Requirements*). This submission (collectively referred to as "GIS Data Standard submission") includes data and information for six feature datasets comprising 53 feature classes or related tables. The feature datasets included are as follows:

(i) Asset Point;

(ii) Asset Line;

(iii) Risk Event;

(iv) PSPS Event;

(v) Initiatives; and

(vi) Other.

The data is submitted in the format of a file geodatabase (FGDB) and includes points, lines, polygons, and their associated attribute tables. In addition, PG&E provides WSD with a Status Report which provides information on the data submission, including whether the data is included in the current submission, explanations for why data may be unavailable, processes required to collect or transform missing data into

WSD's schema, and whether data is confidential.

The GIS Data Standard submission requires PG&E to

(i) collect data from Subject-Matter Experts (SME) teams and core systems;

(ii) curate data across various sources and architectures;

(iii) transform the data into a geospatial format (FGDB);

(iv) run the data through a cybersecurity (Autonomous Vehicle) scan; and

(v) submit the data via CPUC's Kiteworks secure file transfer.

These processes are detailed at a high level via the bullets below:

- ✓ Data collection: Data is collected from a variety of sources, including but not limited to core data systems, databases, repositories and SME inputs;
- ✓ Data curation: Data is curated across sources and data architectures into single tables to best align with the data schema provided by the WSD in its Draft WSD GIS Data Reporting Requirements and Schema;
- ✓ Data transformation: Data is transformed from table or csv files and database or repository inputs into geospatial file format (FGDB);
- ✓ Cybersecurity Scan: PG&E runs an antivirus/cybersecurity scan of the data to ensure safety and compliance with WSD requirements; and
- ✓ Submission: PG&E submits our data (and other documentation) through CPUC's Kiteworks secure file transfer.

Since the release of the *Draft GIS Requirements*, PG&E has instituted multiple measures to improve on our First Quarterly Report, filed on September 9, 2020. This has resulted in an increase in the number of Feature Classes and data attributes included in our Second Quarterly Report, filed on December 9, 2020, while providing a more comprehensive Status Report to describe the FGDB data elements. To meet the first objective, PG&E implemented internal data collection processes for this new reporting requirement to enable more efficient data collection, curation, and organization and invested significant time in mapping the WSD GIS Schema to PG&E's internal GIS schema. While PG&E aims to continuously improve our submission, future improvements will largely require more complex and integrated operational and technological changes. Future enhancement opportunities will largely require more involved operational and technological changes, including a significant level of resources required to collect, curate, and organize the Data Standard submissions on a recurring basis, while simultaneously advancing our data maturity. PG&E looks forward to continued conversation and collaboration with the WSD and other stakeholders on the *Draft GIS Requirements*.

- Recurring tabular/non-spatial data submissions

In 2020, PG&E undertook an effort to streamline and improve the accuracy and consistency of Maintenance Tag reporting. This effort consisted of the following steps to ultimately produce a standardized and automated Tag Reporting Dashboard:

- ✓ Identifying and documenting data requirements with ongoing reports related to open and closed tags;
- ✓ Identifying and documenting the associated systems of record and filter criteria required to meet the reporting requirements;
- ✓ Building data aggregation tools to centralize data extracts from the system of record;
- ✓ Building dashboards that utilize the documented filter criteria and that leverage the aggregated data; and
- ✓ Reviewing draft outputs of the automated dashboard against manually produced dashboards to ensure automation is working properly.

- Data Response Unit (DRU) Responses to Data Requests associated with wildfires

PG&E's DRU provides wildfire data in response to data requests from the CPUC and other agencies. Wildfire data produced by the DRU is provided by internal PG&E organizations and SME who follow processes discussed in this section. Before any response is delivered by PG&E, the information is reviewed by SME and quality control personnel to ensure the information is accurate and responsive to the request.

Beyond the specific processes discussed above, PG&E also shares and submits numerous other forms of wildfire-related data in alignment with rules and regulations, including our post-PSPS event reports and annual ignition data submissions. Similar to the discussions above, we leverage unique and specific processes for retrieving and vetting these data before they are provided.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

Region prioritization is not relevant for this initiative. While PG&E's wildfire mitigation strategies are primarily targeted for the HFTD in our service area, we maintain generally the same data across all of our service area.

4) Progress on initiative (amount spent, regions covered) and plans for next year

In response to Question 2 above, PG&E described the progress it made in 2020 to provide wildfire-related data and information to the CPUC and other stakeholders.

5) Future improvements to initiative

We continue to evaluate our processes for refinement and improvements. Please see Section 7.3.7.1 for more information on our approach to storing data and the anticipated improvements from new programs that will help in cataloguing and providing data to all external parties.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Documenting data collection, cleansing, transformation, quality assurance/control, and delivery steps are all crucial components of PG&E's long-term goals for data maturity. PG&E is exploring several platforms and approaches to make progress on this front and then scale in a consistent manner across all groups involved to supply data to requestors. This includes:

- Ensuring data stewards and process owners are clearly documented and maintained through the life cycle of a data product;
- Documenting technical steps in a way that can be repeated by resources with similar skillsets;
- Regular scrutiny on reporting capabilities for accuracy and consistency between different resources pulling data or pulling data on different days; and;
- Identifying gaps and implementing solutions to close them through process improvement, enhanced governance, etc.

7.3.7.4 Tracking and Analysis of Near Miss Data

WSD Initiative Definition: *Tools and procedures to monitor, record, and conduct analysis of data on near miss events.*

1) Risk to be mitigated/problem to be addressed:

Gathering data on "near miss events", which have been redefined by WSD as "risk events" in the Glossary provided by WSD for the 2021 WMP, can be helpful in analyzing and evaluating events which have a probability of the ignition of a wildfire. The WSD defined a risk event as:

An event with probability of ignition, including wires down, contacts with objects, line slap, events with evidence of heat generation, and other events that cause sparking or have the potential to cause ignition. The following risk events all qualify as risk events:

- Ignitions;
- Outages not caused by vegetation;
- Vegetation-caused outages;
- Wire-down events
- Faults; and
- Other risk events with potential to cause ignitions.[1]

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives

Capturing data concerning risk events to better understand the conditions that lead to potential wildfire ignitions is critical for PG&E. With this data, PG&E can further improve and develop models and procedures to avoid scenarios of increased ignition risk from occurring in the future. The goal is to continue learning the "behavior" of ignitions, or for this purpose, the "behavior" of events that could lead to an ignition. Understanding that behavior will allow us to better inform tool developers, operations, and mitigation initiatives.

PG&E also provides similar risk event data to the CPUC as part of our ongoing reporting obligations. As described in the response to Question 4 below, PG&E provided our initial report of "near hit" data in September 2020.[2] The next report is scheduled to be provided on February 15, 2021. In addition, we

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1 Resolution WSD-011-Attachment 2.2, page 12.

2 Data was provided in September under D. 20-05-019. In November 2020, as part of R.18-10-007, the WSD renamed "near misses" to "risk events" in WSD-011, Attachment 2.1, p. 17.

provide information in Tables 2, 7.1, and 7.2 (Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx) of the 2021 WMP involving risk event data.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")***

PG&E tracks risk event data in all areas of our service territory.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year***

PG&E has created a focused team to collect risk event data across our service territory. This data is gathered year-round and pulled from several PG&E databases including:

- Field Automation System – (FAS);
- Integrated Logging Information System – Operations Data Base (ILIS-ODB);
- Transmission Operations Tracking & Logging (TOTL); and
- Corrective Action Program database (CAP).

In September 2020, consistent with a corrective action from Decision (D.) 20-05-019, PG&E submitted data to SED providing information regarding "Near Hit" Potential Fire Incidents. This submission contained PG&E's data that defined in a settlement agreement as relating to "Near Hit" events on PG&E's system. The next quarterly data deliverable will be provided on February 15, 2021. Given WSD's recent definition of "risk events," PG&E is working with the CPUC to align future quarterly reporting with the same parameters.

5) ***Future improvements to initiative***

As PG&E and other parties such as SED and WSD review and analyze reported risk event data, we anticipate that our collective understanding of the mechanisms that cause ignitions will improve. In order to improve this process, PG&E suggests that a technical working group be created for all utilities, stakeholders, and the WSD to outline a consistent approach to risk event data gathering and to create a well-defined metric supported by all parties.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

Risk event reporting provides valuable data for improving wildfire risk management practices. The long-term plan for this initiative is to maximize our learning from risk events. By 2025, PG&E intends to develop a simulation for the potential adverse impacts of risk events, which is an improvement over only considering the immediate consequences. This approach will improve our ability to determine an appropriate level of response to the risk event, i.e., investigation, analysis, and follow-up. It also aligns with best risk practices in other industries.

7.3.7.5 Other, IT projects to support Wildfire Mitigation work

WSD Initiative Definition: *N/A This is not a WSD-defined initiative. This is an initiative that PG&E is adding to the 2021 WMP to describe the IT projects that support wildfire mitigation work.*

1) **Risk to be mitigated/problem to be addressed:**

Information Technology (IT) is a critical aspect of PG&E's business operations and supports and enables many of the capabilities required for wildfire mitigation. Initiative 7.3.7.1 Centralized Repository for Data is a key foundational component of the overall IT strategy, but there are many additional IT projects that are underway or planned for 2021 and beyond that are needed to deliver PG&E's overall wildfire mitigation plan. This section provides a high-level overview of those projects.

2) **Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.**

As described in this WMP, PG&E is evaluating new technologies as part of our effort to mitigate wildfire risks across our service territory. For example, new and developing technologies like remote sensing and LiDAR offer the potential to leverage data to better manage risk and predict events before they happen. In addition, PG&E now collects significant amounts of weather and environmental data for use in weather modeling, fire spread and consequence modeling and PSPS scoping criteria. In order to take full advantage of new technologies and information, PG&E must develop platforms to manage the significant amounts of data being collected, integrate it with PG&E's legacy systems, and perform analysis to support risk informed decisions.

PG&E is also sponsoring IT projects to improve our ability to provide critical data and information to our customers and other stakeholders. During PSPS events, PG&E wants to improve our ability to provide outage information and customer impact data to our Public Safety Partners. Additionally, we are looking for ways to better share weather modeling, fire penetration shape files, and aerial videos with our external stakeholders in order to improve community responses to wildfire.

These are just a few examples of the IT projects that PG&E has initiated to support our wildfire mitigation work. Further details for the projects are provided in response to Question 4 below.

3) **Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")**

Many of PG&E's IT projects relating to data management and communication will support wildfire mitigation work across PG&E's service territory. For example, tools that help PG&E improve our vegetation

management data collection practices will support that work across PG&E's entire territory. In addition, PSPS communication tools will benefit all communities that fall within the scope of a PSPS event. Other IT projects, however, will be focused on gathering data to support mitigation work in HFTDs. Please see the response to Question 4 for more specific information on each project.

4) Progress on initiative (amount spent, regions covered) and plans for next year

Table PG&E-7.3.7-1 below captures the IT projects that are managed under PG&E's CWSP Portfolio and directly support the WMP. These include projects that are in-flight (carryover from 2020) as well as new projects planned to start in 2021. The projects identified here include the IT-specific costs for these projects. Additional activities and costs including 3rd party service providers, change management and other projects aspects are not included.

TABLE PG&E-7.3.7-1: SUMMARY OF 2021 WMP IT PROJECTS

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
Asset Health and Performance Center - Grid Data Analytics Tool	The Asset Health and Performance Center (AHPC) project will develop a Foundry-based toolset with the goal of identifying, locating and rectifying potential fire ignition risks using grid sensor data. The platform will also manage investigation work flows and results to maintain a continuous feedback loop further enhancing outcome accuracy driving a long-term goal to build the ability of auto-detection and auto-field dispatch. This is a new project for 2021 which builds on POC UC5, SIQ, EPIC 3.20/3.43, and Line Sensor projects to provide: 1. Integrated Outage Investigation: Identify targeted areas to patrol, investigate and resolve unknown-cause sustained outages by combining GIS asset information, sensor analytics, and meteorology data. 2. Outage Investigation Inbox: Automatically prioritize unknown-cause outages by relevancy and risk. Track investigation results, artifacts and outcomes collaboratively.	7.1.D.3.9 7.1.D.3.12 7.1.D.3.13	Asset Analytics & Grid Monitoring	$2,034

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Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
Asset Failure Data Collection	PG&E plans to improve the tools, systems, and processes involved to collect data when an asset fails. This is a new project for 2021. The objectives of this project include compiling key data needed to perform failure causal analysis, developing frontline data collection tools, and implementing tools with Field Operations processes. In 2021, we will execute a pilot with Field Operations with an application on handheld devices that requests specific key data and photo inputs, links relevant information based on current inputs, and provides further guidance depending on the asset failure. Collected data will be centralized and accessible to other processes and data users.	7.3.4.3	Asset Management and Inspections	$144
Asset Failure Analysis Data Product	PG&E is committed to improving our understanding of grid asset failure mechanisms and leading indicators in order to reduce the instance of catastrophic failures and ignition events in the future. This is a new project for 2021 that builds on work done in POC UC3 to develop a Foundry data product that enables asset owners to perform asset failure analysis. The objective of this project includes linking multiple backend databases, compiling key metrics to provide asset overviews, incorporating risk-analysis and trending processes, and creating workflows for asset owners to manage their assets. Our focus for 2021 will be on Distribution conductor/wire down incident investigations and transformer failures.	7.3.4.3	Asset Management and Inspections	$2,557
Aerial Inspection - Sherlock Tool	This project will continue the development of the Sherlock tool suite that leverages AI and advanced analytics to support our Transmission inspection process, including accelerating the identification of FMEA insights from images/media. This is a carryover project from 2020. In 2021, we will build additional machine learning models for computer vision analysis and intend to deliver a suite of over 20 models, including both component identification and potential anomaly detection.	7.1.D.3.8 7.3.4	Asset Management and Inspections	$7,453
Inspect: Electric Compliance	This project will continue the development of technologies that enable Electric Transmission & Distribution field employees to view and document assigned preventative	7.3.4	Asset Management and Inspections	$1,540

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
	maintenance work, complete work, and create corrective tags on assets. This is a carryover project from 2020. For 2021, we will make improvements to the application user interface, property access details, digitization of additional paper forms/process, capabilities related to reporting asset registry corrections, pre-submission report summary information, and access to open corrective work notifications are planned for implementation.			
WSD/WMP Automated Reporting	This project will support and improve required WSD data reporting. This is a new project for 2021 that will use Foundry to automate and consolidate the collection of data across source systems (GIS, SAP, ILIS, Work Management Tools, excel spreadsheets, etc.) and associated initiative work (grid hardening, asset inspections, vegetation management) and curate that data into the required WSD schema.	7.3.7.1	Data Governance	$1,421
Microgrid OIR Portal	This project will create a separate, access-restricted portal for local and tribal governments to access utility data to help identify microgrid development opportunities. This is a new project for 2021 that will provide: (a) Details of utility planned work and grid investments in both tabular and GIS format; (b) GIS layer representation of High Fire Threat Districts; (c) GIS layers including electrical infrastructure; and (d) GIS layers showing weather polygons or other key weather-related determining factors that led to the decision to deenergize distribution and transmission lines during prior PSPS events.	8.2	Emergency Planning and Preparedness	$1,164
Wildfire Data Viewer	This project will provide an interactive map interface on our website for the general public to access relevant PSPS and wildfire safety initiative information. We will utilize ArcGIS Hubs to collect and share spatially enabled datasets with internal and external stakeholders. This is a new project for 2021 that will deliver a minimum viable product by June 2021 with initial focus on the number of prior PSPS events, a PSPS impact heat map, areas more likely to be impacted by a future PSPS event, and wildfire safety improvement work.	7.3.10.1	Emergency Planning and Preparedness	$1,097

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
WSOC Incident Viewer	This project will continue development of the platform for the complete workflow of PSPS field observations and the tracking of active wildfires. This is a carryover project from 2020. Key features for 2021 include an effort to increase stability and performance of the WIV tool and the ability for additional situational awareness and decision support to additional users across the Enterprise. The WIV tool will be enhanced with the ability to handle new data and allow other platforms to leverage the data services like an All Hazards Dashboard.	8.1 7.3.9	Emergency Planning and Preparedness	$2,760
Safety & Infrastructure Protection Team (SIPT) Scheduling	This project will continue development of the SIPT Scheduling tool providing the SIPT crews a system for creating orders and collecting data in the field when performing fire mitigation work around PG&E assets. This is a carryover project from 2020. In the first half of 2021, we will complete the initial project scope in preparation for the 2021 fire season. This includes tracking for prioritization of work by risk rank category for SIPT crews to easily view high priority orders on their iPad to address those orders before lower risk items. This system will increase data integrity by eliminating the current use of excel spreadsheets for data collection and provide the ability take photos to document work completed.	7.3.9	Emergency Planning and Preparedness	$220
PSPS Trusted Data	This project will continue the development of tools and processes to improve the quality of data needed to support PSPS events and broader wildfire mitigation objectives and build on dashboards and knowledge gained in 2020. This is a carryover project from 2020. Objectives for 2021 include: * EO Data Quality Synch Dashboard – An automated Data Quality dashboard to identify, measure, and monitor data synchronization issues between SAP and GIS for Support Structures. * EO Dashboard: Integrate Risk Data into the EO Synchronization Dashboard to prioritize and resolve high risk data quality issues. * Building out the metadata collection and using the EO Dashboard to monitor and resolve high risk data quality issues.	8.1; 7.3.7.1	Emergency Planning and Preparedness	$1,958

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
Emergency Web Remediation	This project will increase the stability of our web platform used during emergencies and improve customer user experience with new and enhanced functional capabilities and content. This is a carryover project from 2020. In 2021, PG&E will focus on improvements based on feedback in 2020 such as adding the ability to report an outage and the ability to sign up for notifications. We will also include design improvements and the ability to automate certain back-end tasks.	8.1 7.3.9.2	Emergency Planning and Preparedness	$3,031
PSPS Field Patrol	This project will continue the development of the PSPS Field Inspection and Patrol solution suite that supports identification of damage, hazards, and risk events and the ability to assign, document, and track PSPS field inspections. This is a carryover project from 2020 that will focus on the following in 2021: * Connection to Palantir Foundry, provide Incident and Investigation Quality Control (I&I QC) and Reporting tool for Damage/Hazard data * Mass Photo Download/management capability * Doc Sync Status and alert * Map Screenshot Capture, Screenshot/photo mark-up features	8.2	Emergency Planning and Preparedness	$2,365
OMT/DMS Enhancements	This project will continue enhancements to DMS and OMT to support data quality, ETOR management efficiency, hazard tracking and overall workflow and support for PSPS workflows. This is a carryover project from 2020 that will focus on the following for 2021: DMS- The addition of weather polygons into the DMS network model (i.e., map of as-is field conditions for the Distribution grid) that functions as a "layer" providing real-time weather updates for PSPS de-energization zones OMT- 911 Color Coding for resources who are not en route	5.2 7.3.3.8 8.2.1 7.1.D.3.5	Emergency Planning and Preparedness	$990

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
PSPS Viewer Enhancements	This project will deliver enhancements to the PSPS Viewer that provides the ability to orchestrate the scoping of a PSPS event from planning until the point of de-energization. This is a carryover project from 2020. For 2021, we will add scoping process automation including weather polygon ingestion and quality checks. In addition, we plan to improve the ability to incorporate libraries for abnormal switching configurations and circuit status into the scoping process. Finally, PG&E plans to enhance the integration of temporary generation and microgrids into the scoping process including customer notification outputs.	8.1; 7.3.9 5.2 8.2.1 7.1.D.3.5 7.3.3.8	Emergency Planning and Preparedness	$4,980
Sharing PSPS Data Externally	This Project will further our capabilities to share PSPS data with Public Safety Partners. This is a carryover project from 2020. In 2021, PG&E plans to enhance and create additional functionality including cloud migration of data processing scripts and end-to-end process automation for sharing of PSPS event data. PG&E plans to enhance user interface based on feedback from PSPS Portal External Working Group of Public Safety Partners. PG&E also plans to consolidate data sharing services and GIS layers, with PSPS outage and restoration data updated every 30 minutes from OMT.	8.1 8.2.1 7.1.D.3.5 7.3.3.8	Emergency Planning and Preparedness	$3,030
PSPS Situational Intelligence Platform (PSIP)	This platform provides the primary interface to support PSPS events, connecting PSPS data together across multiple systems for real-time intelligence and post-event reporting. This is a carryover project from 2020 and is based on our Foundry platform. In 2021, PG&E plans to reduce sync time between PSIP and the PSPS Viewer. PG&E plans to enhance Situation Reports based on internal debriefs and Public Safety Partner feedback. PG&E plans additional automation and other improvements to advanced de-energization customer notifications. PG&E also plans to connect to additional data sources.	8.1; 7.3.7.1 8.2.1 7.1.D.3.5	Emergency Planning and Preparedness	$4,088

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
PSPS Field Communication	This program provides radio communications hardware and solutions to support essential roles activated in support of PSPS restoration and patrols. This is a carryover project from 2020. Plans for 2021 include the following: Q1 - *Start VHF assessment for cross banding in common PSPS areas *Complete high value area improvement studies *Utilize historical PSPS area data to set the high priority areas that require improvements in radio coverage *Identify permanent test locations for fill-site quick deploy cabinets *Build up two helicopter-deployable quick deploy radio cabinets. Q2 - *Perform high level aerial coverage testing with fixed and rotary wing for VHF/UHF common PSPS areas *Begin VHF transmitter replacements and crossbanding efforts, focusing on highest impact PSPS sites first *Deploy two quick-build cabinets on impactful fill coverage sites	8.2	Emergency Planning and Preparedness	$3,000
Transmission Support Structures 2	Transmission Support Structures Loading Calculations (TLC) are generated from T-Line engineering, and PG&E is required to maintain load calculations for the life of all Transmission Support structures. The objectives of this project include a greater understanding of failure modes, establishment of a common repository of data gathered, and updated workflows of key asset systems to align with new data strategies.	7.3.3.15	Grid Design and System Hardening	$910
Wind Loading Assessment 2	This project will reduce risk by providing asset intelligence to identify locations that need corrective actions and a determination of pole safety factors or limitations for wind speeds. Phase 2 is a new project for 2021 that builds on the original WLA project that will complete in Q1 2021. It addresses the following: * Significant changes to O'Calc 6.0 * Enhancement items from WLA Phase 1 * Expense to cover possible data migration work * Change management/training led by PG&E	7.3.3.13 7.1.D.3.17	Grid Design and System Hardening	$740*

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
	business resources *The cost is split 80/20 between 2021 and early 2022.			
Wind Loading	This project will reduce risk by providing asset intelligence for Electric Distribution to identify locations that need corrective actions and a determination of pole safety factors or limitations for wind speeds. This is a carryover project from 2020. This project will complete as training is rolled out to the estimators by Q2 2021 and will be followed by Wind Loading Assessment Phase 2.	7.3.3.13 7.1.D.3.17	Grid Design and System Hardening	$375
Pilot Probabilistic Risk Assessment Model	This will implement UCLA's proprietary risk framework for wildfire risk modelling to inform how possible actions will drive optimal outcomes. This is a new project for 2021 that will enable AWS implementation of the UCLA tool. IT work will involve taking the models/application that UCLA built, refactor to fit PG&E technology stack, enable any data pipelines required to feed data into UCLA mode/application, support testing and deployment to our production environment.	4.5.1	Risk Assessment and Mapping	$1,361
2022 Wildfire Distribution Risk Model	PG&E is developing a Distribution Asset Risk Model, tuned for Wildfire Risk which will: * Provide situational awareness of the current wildfire risk on the distribution system * Enable risk informed decision making in the budget planning process * Allow PG&E to report risk reduction metrics to regulatory entities. This is a new project for 2021 that builds on a project started in 2020. In 2021, we will deploy the initial model onto the Foundry data platform, completing operationalization (including live integration into PG&E's data systems) and refining the user interface (GUI).	4.3	Risk Assessment and Mapping	$1,361

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
ET Operability Assessment Model and Probability of Asset Failure	Electric Transmission (ET) Asset Strategy has developed models that predict asset health and behavior in specific situations. The Operability Assessment (OA) Model was developed in 2019 to inform ET line PSPS scope. The Probability of Asset Failure (PAF) model framework was developed in 2019 to predict ET asset health. This is a carryover project from 2020. We will migrate the models developed in 2020 onto the Foundry platform, providing improved integration of source data and model verification that will support improvements to the accuracy and usefulness of their predictions.	7.3.1 7.3.3.17.2	Risk Assessment and Mapping	$2,795
Sensor IQ (SIQ) Implementation for High Resolution Meter Data	This project will implement Sensor IQ to 500K SmartMeters™ in High Fire Threat Districts and customize data reads and alarms to identify service transformer failures, with other use-cases to be considered based on wildfire risk reduction and/or other business value. This is a carryover project from 2020. Technology deployment to 500K meters in Tier2/3 HFTD will commence in January 2021. The goal is to complete deployment by the end of 2021 and complete the technology evaluation in Q12022.	7.3.2.2.4	Situational Awareness and Forecasting	$577
Numerical Weather Prediction Upgrade	This project enables a scalable cloud-based computation environment which can be expanded to process current and future weather models and provide access to model outputs. This is a carryover project from 2020. The major areas to be addressed in 2021 are: * Expand the historical weather climatology at 2 x 2 km resolution to back-fill all of 2020 * Explore methodology to back-fill the climatological data each quarter moving forward * Evaluate extending the deterministic forecast to provide another 24 hours of forecast data (from 105 hours currently to 129 hours) * Evaluate if the POMMS EPS ensemble mean is more or less accurate than the deterministic POMMS model.	4.2 7.3.2.1	Situational Awareness and Forecasting	$4,200

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
Partial Voltage Detection (Enhanced Wires Down) Phase 2	This project extends the partial voltage functionality to the entire meter fleet to provide alerts and locational information of potential asset failures, enabling earlier detection of "wires down" events. This is a carryover project from 2020. Certification of meter firmware with partial voltage detection capability is in progress. There is a plan to complete deployment of meter firmware to 365K meters in Tier2/3 HFTD by Jun 1, 2021.	7.3.2.2.3	Situational Awareness and Forecasting	$343
Weather Station Installation	PG&E continues to improve real-time environment monitoring on the grid through the implementation of additional weather stations. This is a carryover project from 2020. The plan for 2021 is to install an additional 300 weather stations to bring us to a total of 1300 weather stations.	7.3.2.1	Situational Awareness and Forecasting	$8,100
Wildfire Consequence Model Updates	We will support continued implementation of Technosylva for Meteorology to enable Wildfire Risk Reduction for Asset Hardening, Wildfire Risk Forecasting and Monitoring & Wildfire Simulation for Real-Time Analysis. This is a carryover project from 2020. In 2021, PG&E plans to achieve the following to enhance our Fuel Moisture Sampling and Modeling efforts: * Evaluate extending the deterministic DFM and LFM forecast to provide another 24 hours of forecast data * Continue the LFM sampling at 30 locations across PG&E's territory to bolster situational awareness and build historical datasets for model calibration. * Evaluate sampling DFM as observations of DFM 100hr and DFM 1000hr fuels are currently sparse	7.3.2.1.2	Situational Awareness and Forecasting	$3,900
Remote Sensing Data Platform	This project will establish a centralized, ESRI compatible platform that acts as a centralized coordinator of the various remote sensing data sets (LiDAR, hyper/multi-spectral, drone imagery, and thermal), allowing for greater data access and minimizing duplication of remote sensing data capture. This is a new project for 2021/2022 with initial focus on developing standards, governance and infrastructure to ingest, store, and access remote sensing data.	7.3.5.7	Vegetation Management and Inspections	$2,941

Project Name	Description	Reference Section	Plan Area	2021 Forecast Total ($000)
Enhanced Vegetation Management	This project continues to enhance the EVM Tools used to help further reduce wildfire risks by reducing vegetation above and adjacent to overhead primary voltage powerlines in CPUC HFTD. This is a carryover project from 2020. Our 2021 focus for EVM includes the following: • Execute EVM platform update (V9) • Provide support to field workers with issues related to the Collector Tool • Work to implement a process for handling P1 and P2 priority tags for Distribution	7.3.5	Vegetation Management and Inspections	$5,539
One Vegetation Management	This platform will enable a new GIS-based Vegetation Management System that all VM Programs will utilize. This is a new project for 2021. PG&E will complete a detailed project plan in 2021 that will define the primary objectives and milestones to be delivered. This project plan will be utilized as a working document to move this initiative forward.	7.3.5	Vegetation Management and Inspections	$2,400

5) Future improvements to initiative

In the table above, we set forth our 2021 plans for each IT project that directly supports wildfire mitigation work. Throughout the course of this year, PG&E will evaluate the progress of each project to determine whether the project is feasible and if it supports our goals of wildfire risk mitigation and improved customer and community awareness.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

The IT projects represented in this section are managed and prioritized on an annual planning cycle at PG&E to ensure that we are focused on the most important work. As mentioned, these projects are all in support of advancing PG&E's capabilities across the WMP initiatives and are aligned with the long-term planning objectives of those sections.

7.3.8 Resource Allocation Methodology

7.3.8.1 Allocation Methodology Development and Application

Wildfire Safety Division (WSD) Initiative Definition: *Development of prioritization methodology for human and financial resources, including application of said methodology to utility decision-making.*

1) Risk to be mitigated/problem to be addressed:

In any work prioritization effort, Pacific Gas and Electric Company (PG&E) puts safety first as we navigate through the challenges of financial and resource constraints. We understand there is a high volume of work to do in our territory, but in an effort to keep costs down for our customers, we go through a prioritization effort that puts a premium on the highest risk work in our system, and currently that is wildfire risk.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

Allocating financial and human resources to wildfire risk mitigation activities is one aspect of PG&E's overall prioritization process. Below is a high-level flow of a normal prioritization effort.

- Receive work intake from the line of business on volume and cost;
- Assign risk score methodology to the work (PG&E's answers to questions 4 and 5 of this section present the risk model that drives prioritization on both the human and financial side);
- Understand both human and financial constraints as compared to the work identified as a part of the intake process; and
- PG&E will use risk-based methodology to allocate the highest priority work in alignment with the available financial and human resources available.

This prioritization effort is led by Electric Business Operations (EBO) as a part of the revised Five-Year Investment Planning process. EBO works with teams across the business including groups from Asset Strategy, Risk Management & Safety, Work Execution & Delivery, and Business Finance to put forward a safe and affordable plan. Additionally, PG&E is consistently looking to be more affordable. We have an affordability team that is evaluating our portfolio to find cost efficiencies with an effort to execute as much risk mitigating work as possible.

Resource supply is identified for major working groups, particularly the construction, engineering, and estimating resource groups within Electric Operations' (EO) Transmission Operations, Distribution Operations and Major Projects & Programs organizations. These are the primary resources that execute work for, and on, electric assets.

PG&E ensures that our financial plan and workforce plan are aligned in any cycle. This is critical for PG&E to put forward an affordable plan that we can execute.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

As indicated above, PG&E emphasizes wildfire risk mitigation work in our prioritization and planning processes. This work mostly occurs in the Tier 2 and Tier 3 High Fire Threat District (HFTD), as defined by the California Public Utilities Commission. We believe that work in the HFTDs addresses the largest amount of wildfire risk in our service territory. PG&E's responses to questions 4 & 5 of this section outline PG&E's risk methodologies.

4) Progress on initiative (amount spent, regions covered) and plans for next year

For the 2020 Planning Cycle, PG&E used a 1-9 Ranking Methodology for Risk:

1. Work that prevents fire ignition;
2. Overhead Assets (with strong Safety link);
3. Emergency Preparedness;
4. Underground/Network (with strong Safety link);
5. Compliance/Commitments with strong Safety link;

5a. Mitigates System Wide failure risk;

6. New Business and work at the request of others;
7. General Rate Case (GRC) Commitments;
8. Compliance/commitments (low Safety risk); and
9. Reliability (low Safety risk).

PG&E chose this risk methodology so as to prioritize wildfire and public safety above everything else.

5) Future improvements to initiative

Starting in 2021, PG&E will be moving towards a Portfolio Prioritization Framework (PPF). One anticipated benefit of this new framework is that it will be consistently used across the company.

The PPF will be framed around 5 work types:

- Emergency Response;
- Customer Requested & Load Growth;
- Compliance;
- Risk Reduction; and
- Operational Coordination.

PG&E recognizes that every work type needs some level of funding within the overall prioritization process to ensure PG&E has a sustainable business intended to prioritize work based on risk. We believe this new framework prioritizes risk and public safety without losing sight of our compliance obligations and commitments to serve new customers.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

We believe PG&E is on the right path with regards to prioritizing wildfire, public safety, and our customers within the resource allocation process. Our 3-10 year outlook acknowledges that we have key areas to improve on moving forward. These bullet points below highlight the areas that we will be focusing on.

- Risk effectiveness by mitigation is deeply embedded into the resource allocation process, guiding the prioritization and tradeoff analysis. We believe the rollout of Risk Spend Efficiencies (RSE) across our portfolio will give us the granularity we need to make more sound decisions based off risk.

- Refine use of investment decision optimization tools to achieve completion of both our resource and financial plans in a more streamlined and transparent manner. In 2021, we will be rolling out Copperleaf (C55) to our electric business. We do expect immediate efficiencies such as data integrity and a user friendly interface, but we expect most benefits to come to fruition in 3-5 years as our team members gain expertise working with the tool and we get a chance to build in our Risk Value Framework within the tool.

- Enhance the end-to-end work management processes via the implementation of the EO E2E Work Management Process Improvement program through streamlining both upstream and downstream processes to ensure visibility and alignment across seven key process areas: Plan (includes Manage Assets, Work & Resource Planning, and Investment Planning), Inspect, Design & Estimate, Dependency Management, Schedule, Execute, and Close. Key milestones include completion of current state process mapping, future state process mapping, technology portfolio management integration, process piloting, initial process rollout, and post-deployment adoption and support.

- Improve staff competencies with risk and investment modeling tools by bolstering up the Investment Planning and Workforce Strategy & Resource Management teams to support and maintain the implementation of the Copperleaf C55 system.

7.3.8.2 Risk Reduction Scenario Development and Analysis

WSD Initiative Definition: *Development of modelling capabilities for different risk reduction scenarios based on wildfire mitigation Initiative implementation; analysis and application to utility decision-making.*

1) Risk to be mitigated/problem to be addressed:

Risk models help inform workplans and facilitate decision-making by quantifying risk and identifying circuit segments for targeting mitigation deployment..

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

Quantitative risk models facilitate effective risk quantification and evaluation of risk at a localized (e.g. circuit segment) level and assist in the decision-making process to select the most appropriate mitigation program for that location. The Enterprise Risk Model enables the calculation of a Risk Score at the system level and can adjust the risk score based on planned mitigations. PG&E has developed a number of risk models such as the 2021 Wildfire Distribution Risk Model, which are described in detail in Sections 4.2.A, 4.3, and 4.5.1. Specific risk modeling initiatives are described in Sections 7.3.1.1 through 7.3.1.6.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

Enterprise risk modelling capabilities are focused on a system-wide view, whereas the 2021 Wildfire Distribution Risk Model allows for a more granular examination of circuit segments to allow to better identify where to execute work.

4) Progress on initiative (amount spent, regions covered) and plans for next year

For our distribution system, the 2021 Wildfire Distribution Risk Model has focused on Tier 2 and Tier 3 HFTDs. The granularity of the models continues to improve and is moving from circuit-based to circuit segments. Our plans for development and refinement of our risk models in 2021 and beyond is described in more detail in Section 4.5.1.

5) Future improvements to initiative

PG&E's plans for continued development and refinement of our risk models in 2021 and beyond is described in more detail in Section 4.5.1.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

We have outlined a detailed approach in Section 4.5.1 for future improvements which will focus on building out the modeling of risk drivers, improving the granularity of the model results, and providing risk reduction values for mitigation alternatives. Over the next 3 to 10 years, as these focus areas are achieved, the continuous improvement of the wildfire risk models will shift to a more steady-state improvement driven by improvements in input and training data. As we continue to develop and enhance a more formalized long-term perspective, these data improvements will enable model granularity to reach a span and asset level.

7.3.8.3 Risk Spend Efficiency Analysis

WSD Initiative Definition: *Tools, procedures, and expertise to support analysis of wildfire mitigation initiative risk-spend efficiency, in terms of MAVF and/ or MARS methodologies.*

1) Risk to be mitigated/problem to be addressed:

RSE provides a way for initiatives in a portfolio to be compared against each other to better understand the amount of risk reduced for the dollar spent.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives.

RSEs represent the risk reduction divided by the dollar spent, calculated for various initiatives and programs. More specifically, RSEs represent the calculated risk reduction associated with the implementation of an initiative per dollar spent on that initiative and are determined for each initiative by dividing the Risk Reduction by the total cost of the program. All else being equal, the higher the RSE, the more effective the program is at reducing risk for the same dollar spent. However, there are other considerations in determining the prioritization of programs and initiatives. PG&E views RSE as one tool to evaluate risk initiatives and uses it as one input into the Company's overall decision-making process.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk")

The portfolio level Safety Model and Assessment Proceeding (S-MAP) aligned Enterprise Risk Model used for RSE calculations covers PG&E's entire service territory. The tranches in the S-MAP aligned model are being further refined in response to Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Report (presented on November 30, 2020). This update is projected to be completed by the GRC 2023 submission in June 2021.

4) Progress on initiative (amount spent, regions covered) and plans for next year

Since the 2020 Wildfire Mitigation Plan filing, PG&E has continued to develop our RSE analysis as reflected in in our 2020 RAMP Report submitted on June 30, 2020 and in response to Condition Guidance-1 in PG&E's First Quarterly Report, submitted on September 9, 2020.

5) Future improvements to initiative

RSE calculations are continually being refined by better data for effectiveness and scope calculations, coupled with better input from the

SME as the use of data for RSE calculations is better understood with time. PG&E will continue using these methodologies in preparation for the GRC 2023 submission.

ACTION PGE-25 (Class B)

1) Integrate discussion on long term planning within the respective section of each individual initiative.

Response:

PG&E's long-term planning for the RSE initiative is based on the developments of other activities. RSE evaluations will improve as we implement improvements in the following areas:

1. Granularity of risk models with supporting data to segregate risk across the system;
2. Understanding how the risk profile at this granularity is expected to change over time (environmental conditions, asset health, etc.);
3. Understanding and capturing the number of assets, and their health and conditions, at that same level of granularity;
4. Determining the data necessary to calculate effectiveness quantitatively for each initiative; and
5. Collecting and forecasting financial data to support the level of granularity.

Items 1 and 2 help better articulate the current and future level of risk on the system.

Items 3 and 4 help determine the risk reduction each activity provides by taking the difference between baseline and mitigated risk.

Item 5 allows for accurate calculation of risk reduction/spend = RSE.

As each of these five components is developed, the overall efficacy of the RSEs to inform decision-making will improve, and these will be the main focus areas in which PG&E can expect to see improvements in the accuracy and usefulness of RSEs in the long term.

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7.3.9 Emergency planning and preparedness

7.3.9.1 Adequate and Trained Workforce for Service Restoration

Wildfire Safety Division (WSD) Initiative Definition: *Actions taken to identify, hire, retain, and train qualified workforce to conduct service restoration in response to emergencies, including short-term contracting strategy and implementation.*

1) Risk to be mitigated/problem to be addressed:

We have several dedicated departments focused on identifying, hiring, retaining and training a qualified field workforce to ensure power is restored for customers safely, efficiently and in a timely manner.

As a guiding training principle, we utilize California Governor's Office of Emergency Services (Cal OES) Standardized Emergency Management System (SEMS). This is to ensure all agencies responding to a potential event (i.e., Cal OES, County Office of Emergency Services (County OES), Pacific Gas and Electric Company (PG&E or the Company), other Investor-Owned Utilities (IOU)) are aligned and can safely and efficiently communicate and respond.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

In order to minimize the risks noted above, we have a large workforce, consisting of Journeymen Linemen, Apprentice Linemen, Troublemen and Foremen, that is geographically distributed and can move across PG&E's service territory to handle emergency events as needed. These resources are our primary responders and are critical to restoring power during Public Safety Power Shutoff (PSPS) events.

It is important to note that these field-based roles are within the same Line of Progression (e.g., Apprentices become Linemen; Linemen can become Troublemen or Foremen), and PG&E has dedicated resources focused on identifying, hiring and retaining our workforce.

- **Identification** – PG&E Electric Business Operations prepares a yearly and multiyear demand and supply plan to identify resource needs. Resource needs are external positions typically for the Apprentice, experienced Lineman and internal promotions for Troubleman and Foreman roles.

  PG&E's recruiting team puts Apprentices through a number of steps in the selection process to help narrow the candidate pool. Key steps include, but are not limited to:

  – Assessing candidates on soft skills while completing field assessments;

- Interviewing with scorecard ratings so interviews are weighted;
- Adding Hiring Hall tiering as a part of the selection process for Hiring Hall employees that are currently working for PG&E line departments in specific areas that have openings;
- Establishing local hiring parameters for all service areas to identify candidates that are rooted in their geographic areas and minimize future movement/churn;
- Updating interview strategies to align with 100 percent local hiring; and
- Continuing to leverage the Advanced Placement Program to attract experienced applicants.

External experienced Linemen go through a similar process that narrows the candidate pool.

- **Hiring** – Human Resource recruiting puts screened and qualified candidates for all roles in front of hiring leaders. Hiring leaders use the standard PG&E multi-interview process to identify candidates for employment.
- **Retention** – PG&E leadership and Labor Relations teams work with the International Brotherhood of Electrical Workers to incentivize and retain the Company's field workforce. Retention strategies include the Letter of Agreement which states that financial incentives are provided to certain job classifications for Bay Area personnel, ongoing updates to union contracts, internal mobility through bidding process to resource work areas of choice and planned over time/double time opportunities.

These roles go through training programs that vary in duration by classification. Apprentices are put through a 3-year classroom and on-the-job training (OJT). Journeymen are put through 4-week training programs and Troublemen go through a three-week training program. All three classifications also go through refresher trainings annually and/or biannually.

In addition to classification-specific trainings, we require personnel to complete emergency response trainings, such as PSPS-specific trainings. This is to help ensure the internal workforce remains in a steady state of emergency readiness and have the skills and abilities to react and respond to incidents within the service territory. With a trained workforce, we can deploy resources with confidence that restoration efforts are being conducted efficiently and safely, in compliance with standards and regulations.

All Emergency Operations Center (EOC) staff are trained in SEMS and Incident Command System (ICS) procedures to help ensure we are using a systematic approach to respond to emergencies and are coordinating

with other agencies safely and efficiently.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

PSPS or other emergencies can occur throughout our service territory. While PSPS events are more likely to occur in Tier 2 and Tier 3 areas as defined by the California Public Utilities Commission (CPUC or Commission) High Fire Threat District (HFTD) map, these areas cover over half of our service territory. For this reason, we identify, hire and train personnel throughout the service territory concurrently.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

As part of an internal demand and supply review, PG&E has projected a need to hire approximately 40 Linemen and 100 Apprentices each year for the next five years. In 2020, PG&E received over 4,000 applicants and identified and hired 40 Linemen and 100 Apprentices, meeting our hiring goal for the year.

As of November 1, 2020, 100 percent of profiled utility personnel throughout our service territory completed the PSPS-0001WBT PSPS Restoration Overview and the PSPS-0002WBT Distribution Control Center (DCC) Operator Trainings. These courses provide an overview of the ICS and segmenting and assessment processes used when restoring power after a PSPS event. More information on PSPS-0002WBT DCC Operator Training is also referenced in Section 7.3.9.5. As personnel completed this training, status updates were populated in the Learning Management System to track and ensure completion. These trainings are an annual requirement for our utility personnel responding to PSPS events. For 2021, these trainings will be completed by the end of the year. New hires will be required to complete these trainings within 90 days.

As part of PSPS preparedness efforts, utility personnel participated in field exercises by region to test PSPS policies and procedures and identify any gaps or changes needed. We will continue to conduct regional full-scale exercises in 2021.

In February 2020, PG&E, Cal OES, the CPUC, and the other IOUs entered an agreement to help ensure consistent training requirements for all EOC staff. The agreement included the following four-phased approach, targeting completion by 2022:

- **Phase I** – Basic ICS training that includes ICS-100, ICS-200, ICS-700, ICS-800 and SEMS-G606

- **Phase II** – Includes several emergency operational trainings such as G-191 (ICS/Field interface), G775 (EOC Management and Operations),

G197 (Integrating Access and Functional Need) and G626E (Essential EOC Action Planning)

- **Phase III** – ICS 300 and ICS 400
- **Phase IV** – G611 Position Specific

Per the agreement, we completed Phase I training for Command and General staff (that were originally identified) by June 2020. We continue to identify additional EOC staff to support our emergency response efforts. As new staff is brought on, we require they complete Phase I training within 60 days. In 2021, we will continue to train EOC staff, as well as incorporate the remaining operational areas and field personnel, as appropriate.

Due to coronavirus (COVID-19) health considerations, we developed an alternative to the Phase III training, which is typically conducted in-person. In August, we conducted virtual, pilot sessions of ICS 300 and 400 with state training agencies as observers. Both classes were approved by the training agencies to continue virtual until further notice. In 2020, we hosted three ICS 300 trainings, two ICS 400 trainings. All Command staff and select roles in general staff will be required to complete Phase III training by end of Q2 2021.

We will roll out Phase II courses in Q1 2021, including the G197 (Integrating Access and Functional Needs (AFN)) training, which will be completed September 1, 2021. We continue to develop the curriculum for additional parts of Phase II and Phase IV. Following approval of the curriculum by state training agencies, we will roll out these courses virtually (anticipated in 2021).

Note that for Phase IV, the final step in certification is completion of the position-specific task books, showing completion of all required training and demonstrating competency through either exercise or real incident. These training packets will be presented to the state training agencies for sign-off of certification.

5) Future improvements to initiative:

Beyond what has been noted above in this section, there are no additional improvements currently identified. We will continue to update the PG&E's identification, hiring and retaining processes. Trainings will also be revised, updated and adjusted to reflect changes in policy and/or processes, as needed. In addition, as new or emerging technologies are identified for use in the field, training will be developed to facilitate timely use in field operations.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

As stated in the section above, there are no further improvements planned at this time.

7.3.9.2 Community Outreach, Public Awareness, and Communications Efforts

WSD Initiative Definition: *Actions to identify and contact key community stakeholders; increase public awareness of emergency planning and preparedness information; and design, translate, distribute, and evaluate effectiveness of communications taken before, during, and after a wildfire, including AFN populations and Limited English Proficiency populations in particular.*

1) Risk to be mitigated / problem to be addressed:

Community outreach and public awareness is a key component of emergency planning and preparedness to ensure customers and communities are informed and adequately prepared prior to a wildfire or PSPS event. PG&E strives to deliver effective communications before, during and after a wildfire and PSPS events.

The goals of PG&E's detailed outreach and engagement plan, supported by ongoing evaluation of the effectiveness of our outreach efforts, facilitates the following benefits, among others:

- Identifying and engaging with key stakeholder groups
- Creating alignment between PG&E, customers, agencies and community needs
- Informing agencies and customers of emergency planning and preparedness and in their area
- Identifying opportunities to collaborate with key local agencies in the design and planning of wildfire mitigation work to leverage efficiencies in project execution or the pursuit of projects that are closely aligned with community priorities and emergency planning and preparedness
- Preparing agencies and customers for power outages during PSPS events to mitigate the risks associated with those events, especially for our most vulnerable customers
- Aligning the understanding of PG&E's Local Public Affairs (LPA) Representatives, Public Safety Specialists (PSS), Customer Relationship Managers (CRM), and other local engagement teams to efficiently and clearly provide support to key stakeholders

In addition, PG&E designs, translates, distributes and evaluates communications before, during, and after a wildfire, including AFN and non-English speaking customers, to help ensure:

- Customer and communities are aware of PG&E's emergency preparedness and in-event resources
- Customers and communities increase their own emergency preparedness based upon effective PG&E communications

- There is balanced communication to customer populations, where the most vulnerable populations have more access to information

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:***

PG&E develops an outreach and engagement plan for the various stakeholders within our service territory. Key stakeholders include agencies, including federal, state, local and tribal agencies; critical facilities, such as water agencies, communications providers and hospitals; and, customers, including our most vulnerable customers.

Throughout the year, PG&E engages with these stakeholders with a focus on emergency planning and preparedness. PG&E's main outreach and engagement objectives for 2021 include:

- Listening to customers and community leaders in order to fully understand and respond to concerns and feedback about communications.

- Customizing outreach approach and cadence based upon the community's past PSPS and wildfire impacts, with a key focus on providing more heavily impacted communities with information and resources.

- Approaching agencies and customers with humility and transparency while providing timely and accurate information that supports emergency preparedness and localized wildfire mitigation efforts.

- Soliciting agency feedback at key milestones in wildfire mitigation planning processes to ensure that local projects meet community priorities, and that opportunities for efficiency in collaboration may be identified and acted upon.

- Adapting to shifting agency needs and priorities in emergency preparedness and wildfire mitigation, including a mindfulness of other key local priorities such as responding to the ongoing COVID-19 crisis.

- Hosting localized discussions with agency- and geography-specific information in order to enhance agency knowledge of drivers for PSPS events and other potential emergency events in their areas.

- Strengthening relationships between local agencies and external-facing PG&E teams so that agencies are aware of their knowledgeable point-of-contact that can address their needs both during an emergency event and throughout the year.

To further explain PG&E's community engagement approach related to emergency planning and preparedness, we have broken up this section into the following categories:

A) Actions taken to identify and contact key community stakeholders

1. Federal, State, Local and Tribal Governments
2. Critical Facilities and Infrastructure
3. Customers

B) Increase public awareness of emergency planning and preparedness information

1. Agency and Critical Facilities Outreach / Advisory Committees
2. Customer and Community Outreach

C) Design, translate and evaluate effectiveness of communications taken before, during, and after a wildfire (including AFN and non-English speaking customers)

1. Before Wildfires
2. During Wildfires
3. After Wildfires

Please note additional information on outreach conducted during PSPS events is outlined in Section 8.2.4. In addition, PG&E's overall Community Wildfire Safety Program (CWSP) outreach and engagement is outlined in Section 7.3.10.1. It is important to note that many of the strategies and tactics related to emergency planning and preparedness overlaps with PG&E's holistic CWSP outreach and engagement.

A) <u>Actions to Identify and Contact Key Community Stakeholders</u>

PG&E understands the critical importance of identifying key customer, agency and stakeholder contacts so that we can effectively coordinate and collaborate before, during and after emergencies, as required. Below includes information on how PG&E identifies and maintains a contact list to be used during emergency events. For information on how PG&E identifies contacts for additional outreach and engagement activities, see Section 7.3.10.1. In addition, for information on how PG&E engages with these stakeholders during a PSPS event, see Section 8.2.4.

1. **Federal, State, Local and Tribal Governments:** As part of an annual outreach effort and in compliance with the CPUC's PSPS Phase I requirements, in May 2020, PG&E's PSSs, LPA representatives, and Tribal Affairs representatives reached out to County OES local and tribal governments dedicated points-of-contact. This was to request that the agency review and confirm that the contact information currently within PG&E's system is still accurate. PG&E's Federal Affairs, State Government

Relations, and Emergency Preparedness and Response (EP&R) personnel also review and provide updates to the federal and state agency contacts within PG&E's system on a year-round basis due to their frequent interactions with agencies. PG&E will continue to conduct this outreach effort in 2021. Please see Section 7.3.10.1 for additional details.

During a PSPS event, these contacts are notified at set cadences identified for Public Safety Partners. Please see Section 8.2.4 for a more detailed description of the cadences and categories of notifications to agencies during emergency events. It is important to note that this is not a comprehensive list of all emergency management, elected and staff within an agency. Instead, PG&E requests a minimum of two contacts, one of which is a 24-hour contact that should be notified during emergency events. The number and types of contacts for each agency vary, but typically the agency includes contacts such as the emergency Manager, fire/police chief, and dispatch center. PG&E updated the system to reflect revisions received during this outreach and throughout the year, as needed.

2. **Critical Facilities and Infrastructure:** PG&E is committed to coordinating with critical facilities, such as hospitals, fuel suppliers, telecommunications providers, water and wastewater agencies, and transportation agencies, among others, to further understand and more effectively plan for the impacts of wildfires and PSPS on the ability to safely operate these facilities.

   PG&E has developed and validated a list of critical facilities directly with these customers as well as through coordination with counties, tribal governments, and Cal OES as part of our emergency preparedness initiatives. This effort is a continual, ongoing process to ensure the list stays updated.

   In 2020, PG&E contacted cities, counties, and tribes in the Company's electrical service territory to confirm and verify the critical facilities within their respective jurisdictions and suggest any additional facilities that they recommend PG&E should add. As a result of this outreach, 50 agencies provided input and a total of 239 facilities were updated to a critical designation based on the feedback received.[1] PG&E updated the critical facilities list with agency-identified facilities, as appropriate (e.g., facilities provided aligned with CPUC definitions, feedback was able to be

[1] Agencies were asked to provide feedback by June 26, 2020. The outcomes reflect responses received prior to that deadline. PG&E has and will continue to accept additional Critical Facilities feedback from agencies on a rolling basis.

matched to an electric service account, etc.).[2]

To support critical facilities, PG&E also requested that critical facilities provide updated contact information for each location, a 24-hour contact and information about their back-up generation capabilities.[3] PG&E shares insights with critical facilities regarding areas more likely to be subject to a PSPS based on grid configuration and weather risk, and provide information about planned mitigations, backup generation and resources for resiliency planning. As one example of PG&E's engagement with critical facilities, in partnership with United States (U.S.) Environmental Protection Agency Region 9, PG&E supported two water agency resiliency workshops in early 2020, with a focus on small and tribal water systems. After those sessions, PG&E produced quick reference guides and resources in support of emergency planning and PSPS preparedness. We have also partnered with Association of California Water Utilities (ACWA) and the other IOUs to provide resources available for water agency resiliency planning including information on PSPS readiness. And several water agencies participated in our full scale PSPS exercises as players to further enhance their readiness and help us improve critical customer communication and coordination. PG&E plans to continue this type of coordination in 2021.

PG&E provides more details on how it communicates with these customers during a PSPS event in Section 8.2.4.

Additionally, PG&E leverages a team of dedicated Business CRMs to support our industrial, commercial, and agricultural customers with emergency planning. This team ensures that customers update their contact information and provides critical information to customers on emergency preparedness planning, including topics such as business continuity, backup power options, safety, financing, and sourcing.

3. **Customers:** PG&E leverages a multi-pronged approach to identify and contact key customer stakeholders in addition to those customers and efforts described above. For example, PG&E implements outreach campaigns to encourage customers to update contact information. These campaigns include website banners, where, when first logging into pge.com, customers are

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2 More details on PG&E's identification of critical facilities is included in our Bi-Weekly Report of PG&E In Compliance with January 30, 2020 Assigned Commissioners' Ruling Section 2.g "2.g Develop and validate the list of critical facilities by coordinating with counties, tribal governments and Cal OES ahead of the events." (Rulemaking (R.) 18-12-005)

3 PG&E has reached out to critical facilities via Account Managers, outbound call campaigns, and finally through a letter and email campaign.

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asked to update their contact information. In addition, PG&E uses other venues such as bill inserts, newsletters and postcards to urge customers to update contact information. For our business customers, PG&E's CRMs reach out to customers to support efforts to update customers' contact information.

B) Actions to Increase Public Awareness of Emergency Planning and Preparedness Information

Prior to peak wildfire season, PG&E designs and executes a comprehensive wildfire safety and PSPS preparedness community outreach strategy, using lessons learned and feedback received from customers and stakeholders. Further, PG&E conducts community outreach to educate agencies, customers and property owners on aspects of our wildfire mitigation practices, such as vegetation management and system hardening, and the role they play in helping to reduce wildfire risks in their communities.

PG&E incorporates multiple platforms and tactics into our engagement approach that enable PG&E to regularly hear and act upon feedback from agencies with an imperative to serve their communities in emergencies, critical facilities, and other key customers, Community-Based Organizations (CBO) and customer associations. We will remain flexible and have the ability to adjust or customize our approach according to community needs, and to focus efforts strongly on jurisdictions and geographies most heavily impacted by PSPS events, while maintaining an inclusive posture for all agencies impacted by PSPS in the 2019 and 2020 fire seasons.

Due to the ongoing COVID-19 pandemic, PG&E will follow prevailing public health guidelines, including hosting meetings virtually when needed. In years' past, PG&E has been able to collaborate with agencies, critical facilities and other stakeholders on the design of outreach forums, including designing in-person meetings and community town halls. The ongoing COVID-19 pandemic has prevented most in-person engagement efforts for most of 2020 and will continue to restrict in-person engagements in 2021. PG&E will continue to follow prevailing public health guidance first and foremost when planning 2021 engagements and will also take into account the preferences of agencies, customers, communities and our own internal staff.

PG&E maintains an Emergency Preparedness Safety Awareness campaign to provide education to customers, residents, and communities throughout our service territory. This campaign helps customers and the community prepare for emergency situations and take preparatory measures such as updating contact information to ensure delivery of PG&E notifications and signing up for the Medical Baseline (MBL) program. PG&E takes a collaborative approach to our public awareness initiatives by partnering with local public safety officials and community stakeholders to expand the reach of our activities. PG&E uses the tactics

in the sections below to increase public awareness of emergency preparedness.

1. **Agency and Critical Facilities Outreach / Advisory Committees:** PG&E works closely with agencies and critical facilities to ensure they are informed of the importance of emergency planning and preparedness. PG&E often also relies on these agencies to provide key local guidance and partner with PG&E to gain efficiencies in local wildfire project implementation. For example, a local permit may be needed or PSPS preparedness activities may be required to help minimize customer impacts. That is why PG&E has an extensive outreach plan and dedicated representatives to ensure agencies and critical facilities are informed and have an opportunity to provide feedback. Agencies, critical facilities and community groups may also directly engage with PG&E customers and communities and can provide additional outreach support to increase awareness and support of utility wildfire mitigation activities.

   Table PG&E-7.3.9-1 includes the key agency and critical facilities engagements, and the proposed timing of each engagement tactic in 2021.

TABLE PG&E-7.3.9-1: KEY AGENCY AND CRITICAL FACILITIES OUTREACH TACTICS AND TIMING

Type	Description	Timing
PSPS Regional Working Groups	Forum for stakeholders to learn key information on the previous wildfire and PSPS season and to share feedback on wildfire safety work, discuss lessons learned, build regional collaboration and incorporate learnings into future wildfire safety and PSPS plans.	Quarterly
Wildfire Safety Working Sessions	Co-hosted with County OES, this meeting is an opportunity to partner on PSPS planning efforts, share local progress on wildfire mitigation work and track action items.	Q2-Q3 2021
Additional PSPS Trainings & Workshops	Ad-hoc, or as-needed trainings and workshops for agency partners, based upon agency feedback (i.e. PSPS Portal).	Ongoing and as needed
PSPS Listening Sessions	Open forum for PG&E to share information on the previous wildfire and PSPS season and to listen to county, tribal and critical facilities' concerns and gather important feedback on 2021 PSPS events. The feedback will be used to prioritize improvements for 2022.	Q4 2021
PSPS Advisory Committee	Select county, city and tribal governments to obtain focused input, solicit recommendations and gather feedback regarding PSPS improvements.	As needed

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Type	Description	Timing
People with Disabilities and Aging Advisory Council (PWDAAC)	Forum that provides insight into the needs of AFN populations related to emergency preparedness and to facilitate co-creation of solutions and resources to serve the customers reliant on power for medical needs	Quarterly
Other AFN Advisory Councils	Statewide IOU AFN Advisory Council Disadvantaged Communities Advisory Group (DAC-AG) Low-Income Advisory Board (LIOB) among others Communities of Color Advisory Group Customer Advisory panels with National Diversity Coalition (NDC) and Communities of Color These are designed to gather customer feedback on our outreach efforts and other important topics impacting low-income, disadvantaged, and under-served communities.	Varies
Energy and Communications Providers Coordination Group	Forum for communications providers to provide feedback on PG&E's current PSPS implementation protocols and to coordinate engagement before and during PSPS events	As needed
Key Customer Association Collaboratives	Ongoing engagement, intelligence sharing, consultative support, and contact updating efforts	Ongoing
Ongoing Outreach and Coordination	Outreach on a myriad of topics related to wildfire safety work.	Ongoing

- **PSPS Regional Working Groups:** As required by Decision (D.) 20-05-051, PG&E hosts quarterly meetings with tribal and local government entities, public safety partners, and representatives of AFN and vulnerable customers.[4] grouped into five regions across PG&E's territory. These meetings are structured to enable feedback and information sharing on aspects of PSPS event execution and planning. This includes aspects of PSPS, including Community Resource Center (CRC) planning, communication strategies, information sharing, identification of critical facilities, strategies for supporting AFN communities and contingency plans. PG&E began these Regional Working Groups in Q3 2020 and will continue quarterly meetings in 2021.

  In 2021, PG&E plans to integrate two other agency outreach regulatory requirements with the Regionalized Working

4 D.20-05-051 at p. 13.

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Groups: the semiannual meetings required by D.20-06-017 in the Microgrid Order Instituting Rulemaking (OIR) (at p. 46) to discuss electric grid, microgrid projects and the other wildfire safety related topics;[5] and the semi-annual Wildfire Mitigation Meetings requirement by the I.19-06-015 in the Wildfire Order Instituting Investigation (OII) (at Appendix A, Exhibit C, p. 7) to discuss wildfire mitigation activities and solicit feedback. Every other Regional Working Group will be dedicated to one of the two semi-annual agency engagement meetings described above; this will ensure that each of these meeting types will be held at least twice per year as required.

The public safety partners included in the Regional Working Groups overlap significantly with the audiences of the Microgrid OIR semi-annual meetings and the Wildfire OII semi-annual meetings. The Regional Working Groups provide an existing, successful forum to solicit feedback and encourage collaboration on PSPS events, wildfire mitigation activities, and microgrids and other temporary generation that could be leveraged during PSPS.

- **Wildfire Safety Working Sessions:** PG&E offers to meet with counties and federally recognized tribes within our service territory to share county-specific plans for wildfire mitigation, system resiliency and the steps we are taking to address the feedback received during the listening sessions. This outreach is anticipated to be complete by June 1, 2021. PG&E's PSS and Tribal Representatives work with county and tribal OES to cohost Wildfire Safety Working Sessions for their respective jurisdictions. Invitees to these events include regional key stakeholders, such as cities, tribes, Community Choice Aggregators (CCA), telecommunication providers, water agencies, as well as local California Department of Forestry and Fire Protection (CAL FIRE) and Cal OES representatives. Some county and tribal governments may determine that a meeting with PG&E is not needed. The purpose of the sessions is to provide local agencies with an opportunity to have detailed conversations regarding PG&E's wildfire safety work planned in their community and PSPS improvements. The sessions also provide an opportunity for local officials to learn about the electric system in their community and discuss their needs and suggest any further improvements to the CWSP and PSPS Program. Feedback from the sessions has helped to shape local planning for PSPS events, including critical

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5 See PG&E Advice Letter (AL) 5882-E (at p. 6) filed on July 17, 2020, for more detail on this proposal.

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facility locations, CRC locations and local contacts for emergency response.

PG&E will plan to host Wildfire Safety Working Sessions in each jurisdiction impacted by PSPS if desired by that jurisdiction. In 2021, as PG&E determines the content of the Wildfire Safety Working Sessions, we will work to prioritize the needs of jurisdictions impacted the most by PSPS events and wildfires in terms of frequency of events, and total and unique customers impacted, critical facilities impacted, and localized issues that may have caused escalations. While the needs of the most impacted jurisdictions will take highest priority in planning, PG&E will still strive to make these sessions as inclusive and valuable as possible to the broader audience of all jurisdictions.

- **PSPS Exercises and Workshops:** PG&E invites County OES and federally recognized tribal leaders to workshops that review PG&E's PSPS Policies and Procedures document and solicit feedback. PG&E's EP&R department then hosts PSPS full-scale exercises where we test our ability to communicate effectively with our partners during PSPS events, gain efficiencies within roles, and identify possible areas of improvement that PG&E and our partners may undertake in advance of the 2021 fire season. Following the exercises, After-Action Reviews (AAR) are completed to identify adjustments needed to procedures and/or where additional training is required. These PSPS exercise and workshops are a continued best practice in 2021. In 2020, PG&E hosted three regional exercises and workshops.

- **Additional PSPS Trainings and Workshops:** PG&E hosts additional PSPS trainings and workshops for public safety partners, as needed. For example, in 2020, PG&E launched a new PSPS Portal and provided weekly trainings in the summer for public safety partners to ensure appropriate users had access and were able to navigate the tool ahead of any PSPS events.

  Similar to the approach taken for the Wildfire Safety Working Sessions, in designing the scope and content of these PSPS trainings and workshops, PG&E prioritizes topics that are most valuable to the jurisdictions most impacted by PSPS in terms of frequency of events, total and unique customers de-energized, impact to critical facilities, and other localized issues that may have caused escalations.

  PG&E aims to be more customized in our outreach efforts based on the needs of the agency and remain adaptive.

PG&E is looking to incorporate additional customized options for agencies, with a focus on those most impacted by PSPS and wildfires, such as:

- Hosting field tours to view grid control centers or temporary generation sites
- Co-creating ideas for new tools and processes with agency partners
- Establishing additional user testing groups to gather real-time feedback as we build new emergency management tools and processes
- Hosting topic-specific workshops to provide additional information on PG&E programs, localized drivers of PSPS, wildfire mitigation activities in their communities and other topics of interest
- Co-hosting public-facing events with agency partners to address questions and concerns from the community related to PSPS and wildfires.
- Partnering with additional external partners organizations to assist with outreach and engagement

- **Listening Sessions:** PG&E offers to host listening sessions with counties, federally recognized tribal governments, and large commercial customers and critical facilities impacted by PSPS events, if the stakeholder is interested in meeting. This provides an open forum for PG&E to share localized key information on the most recent wildfire and PSPS season, listen to concerns, gather important feedback and identify ways to improve coordination and partnership with local communities going forward. These PSPS Listening Sessions are a continued practice from the 2019 fire season and were well received by agency stakeholders. PG&E uses feedback to guide improvements to our wildfire mitigation activities (i.e., PSPS Portal improvements, PSPS mitigation projects such as sectionalizing and hardening, notifications to customers and agencies, CRC locations and planning, partnerships with CBOs and other topics) and help prioritize key focus areas for the following year. We coordinate with county and tribal emergency Managers to schedule each meeting and to determine the appropriate meeting participants.

- **Advisory Committees:** PG&E's advisory boards provide hands on, direct advisory functions related to PG&E's wildfire mitigation strategies like PSPS. This includes

helping PG&E develop best practices for PSPS protocols, community preparedness, regional coordination and the optimal use of existing and emerging technologies.

- **PSPS Advisory Committee***:* PG&E established a PSPS Advisory Board in 2020, which includes representatives from local and tribal governments. These meetings provide a forum for participants to weigh in on a variety of PSPS program updates such as customer notification scripts, wildfire safety working session content and meeting outlines, and PSPS full-scale exercises, among other topics. PG&E plans to continue to host these meetings periodically to gather feedback on PSPS-related topics, including PSPS planning for 2021 and coordination with local communities and shared resources.

  In 2021, PG&E will evaluate local and tribal representation on the PSPS advisory committee for diversity of regions and PSPS experiences. PG&E may make adjustments to this committee once that evaluation is complete in early 2021.

- **People with Disabilities and Aging Advisory Council (PWDAAC):** PWDAAC consists of members representing a diverse mix of expertise, backgrounds, and perspectives of the AFN population and provides insight into the needs of AFN populations related to emergency preparedness. The Council facilitates co-creation of solutions and resources to serve the customers reliant on power for medical needs before, during and after a PSPS event in PG&E's territory. More details on PWDAAC is included in Section 8.4 and PG&E's 2021 PSPS AFN Plan.

- **Statewide IOU AFN Council:** PG&E, Southern California Edison Company, and San Diego Gas & Electric Company established the Joint IOU AFN Advisory Council. The Joint Council is a diverse group of recognized CBOs, association and foundation leaders supporting the AFN population, and leaders from various state agencies. It provides insight into the unique needs of the IOUs' most vulnerable customers and stakeholders, offers feedback, makes recommendations, and identifies partnership opportunities to serve the broader AFN population before, during, and after a PSPS event. PG&E will continue to meet with these stakeholders and will periodically bring these groups together, along with other stakeholder groups outlined in D.20-05-051, to

solicit feedback on the PSPS Program.

- **Other AFN Councils:** PG&E hosts meetings with the NDC and Communities of Color to provide safety-related outreach such as wildfire safety, PSPS preparedness and specific safety-related gas or electric projects impacting disadvantaged and under-served communities. Through our relationship with NDC and Communities of Color, we host customer advisory panels designed to provide customer feedback on our outreach efforts related to public safety and other important topics impacting low-income, disadvantaged, and under-served communities. PG&E also hosts an annual executive-level meeting with NDC leadership to better understand NDC members' perspectives and recommendations to improve the effectiveness of PG&E's community outreach and engagement. PG&E also leverages opportunities to share emergency preparedness, and CWSP and PSPS updates at other stakeholder meetings such as the DAC-AG and LIOB among others. Further, we use our network of CBOs to support our AFN stakeholder outreach work, as described in Section 8.4.

- **Energy and Communications Providers Coordination Group:** PG&E initiated this group in early 2020, to create a forum for communications providers to provide feedback on PG&E's current PSPS implementation protocols and to coordinate engagement before and during PSPS events. Attendees include, but are not limited to, representatives from AT&T, Verizon Wireless, Comcast, Charter Communications, Frontier Communications, T-Mobile, Consolidated Communications, U.S. Cellular, Sierra Telephone and Cellular Telecommunications and Industry Association. Throughout 2020, PG&E received valuable feedback from this group. For example, representatives from Verizon, AT&T, Comcast, T-Mobile, U.S. Cellular, Charter Communications, Cox Communications, provided feedback to PG&E, CPUC, and Cal OES about PG&E's September 2020 PSPS events. While feedback was generally positive, the group recommended improvements for more accessibility to PSPS event information, including maps in the PSPS portal and the support role provided during PSPS events by PG&E's Critical Infrastructure Lead. In 2021, PG&E to host, as needed, meetings to discuss collaboration and engagement opportunities before

and during PSPS events, and for other wildfire and "all hazards" resiliency and readiness initiatives.

- **Key Customer Association Collaborative:** PG&E regularly meets with key customer stakeholders including large customers, community groups and business associations. PG&E uses these meetings to provide information about emergency preparedness, local progress on wildfire safety measures, and expanded resources available to prepare for PSPS events. For example, throughout 2020, PG&E met with:

  - California Hospital Association (CHA)
  - Hospital Council Board of Directors of Northern and Central California
  - California Association of Medical Product Providers
  - Telecommunications and broadband providers
  - Water agency members of the ACWA, and directly with water and wastewater agencies
  - Industrial and commercial members of California Large Energy Consumers Association, and the Small Business Utility Advocates

  In 2020, PG&E conducted meetings with nearly 300 individual stakeholders. PG&E will continue these meetings throughout 2021. Throughout 2021, PG&E will build on collaborative relationships with the CHA and the Hospital Council of Northern and Central California. PG&E plans to host bi-monthly resiliency workshops with telecommunications and broadband providers, municipal utilities, and with water agencies, both via the ACWA and directly with water and wastewater agencies.

- **Ongoing Outreach and Coordination:** PG&E conducts ongoing outreach with state agencies, counties, cities, tribes, first responders, CCAs, water, wastewater and communication service providers and other local emergency responders and community groups throughout the service area to partner on emergency plans and increase public awareness related to emergency planning and preparedness. Part of this outreach includes reviewing the agency's contact information on an annual basis to ensure the Company is contacting the correct local stakeholders during an emergency event. PG&E also conducts annual gas and electric safety training for first responders, including law enforcement, fire departments, and public works and

transportation agencies to further align emergency plans with local agencies. Additional information on PG&E's outreach efforts related to PSPS planning and preparedness can be found in Section 7.3.10.1.

2. **Customer and Community Outreach:** PG&E continuously engages with customers and communities regarding wildfire safety and with customers who may be directly impacted by a PSPS event. This effort is to increase public awareness and support of PG&E's wildfire mitigation activity. PG&E prioritizes engagement with those most likely to be impacted by PSPS, which include those served by electric lines (specifically those served by electric lines 115 kilovolts and below) which traverse Tier 2 and Tier 3 HFTD areas. PG&E also implements additional touchpoints for MBL customers,[6] those with limited English proficiency and the AFN community.

   PG&E will leverage multiple channels, such as open houses and webinars, e-mails, letters, bill inserts, postcards, radio and television (TV) broadcasting, print media, informational videos, social media, digital engagement (e.g., website), and possibly face-to-face meetings.[7] PG&E will continue direct-to-customer outreach campaigns that are focused on, but are not limited to, building PSPS readiness among customers, gathering updated contact information and sharing backup power safety tips.

   - **Communications for AFN Populations and Limited English Proficiency Populations:** PG&E translates "critical information" which includes resources focused on emergency preparedness, wildfire safety, and PSPS preparedness in 15 prevalent non-English languages. PG&E customers with limited English proficiency can contact PG&E any time, whether during an emergency or simply for a bill inquiry, and have access to in-language support via our Contact Centers, which are equipped to provide translation support in over 250 languages. Additionally, we have partnerships with CBOs and multicultural media partners to provide in-language outreach spoken by people that occupy significant roles in California's agricultural economy (e.g., Mixteco and Zapoteco). Emergency preparedness materials such as webinar presentations and PSPS notifications are recorded in American Sign Language (ASL) via our collaboration with NorCal Services for Deaf and Hard of Hearing. Our wildfire safety and PSPS customer

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6 MBL customers are PG&E customers who are eligible for MBL tariffs and receive an additional allotment of electricity and/or gas per month. The tariffs are designed to assist residential customers who have special energy needs due to qualifying medical conditions.

7 As applicable due to the COVID-19 pandemic and safety concerns with large gatherings

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information and materials are available in alternate formats, including Braille and large print, upon request. Please see Section 8.4 for details on PG&E's communications for AFN populations and limited English proficiency populations.

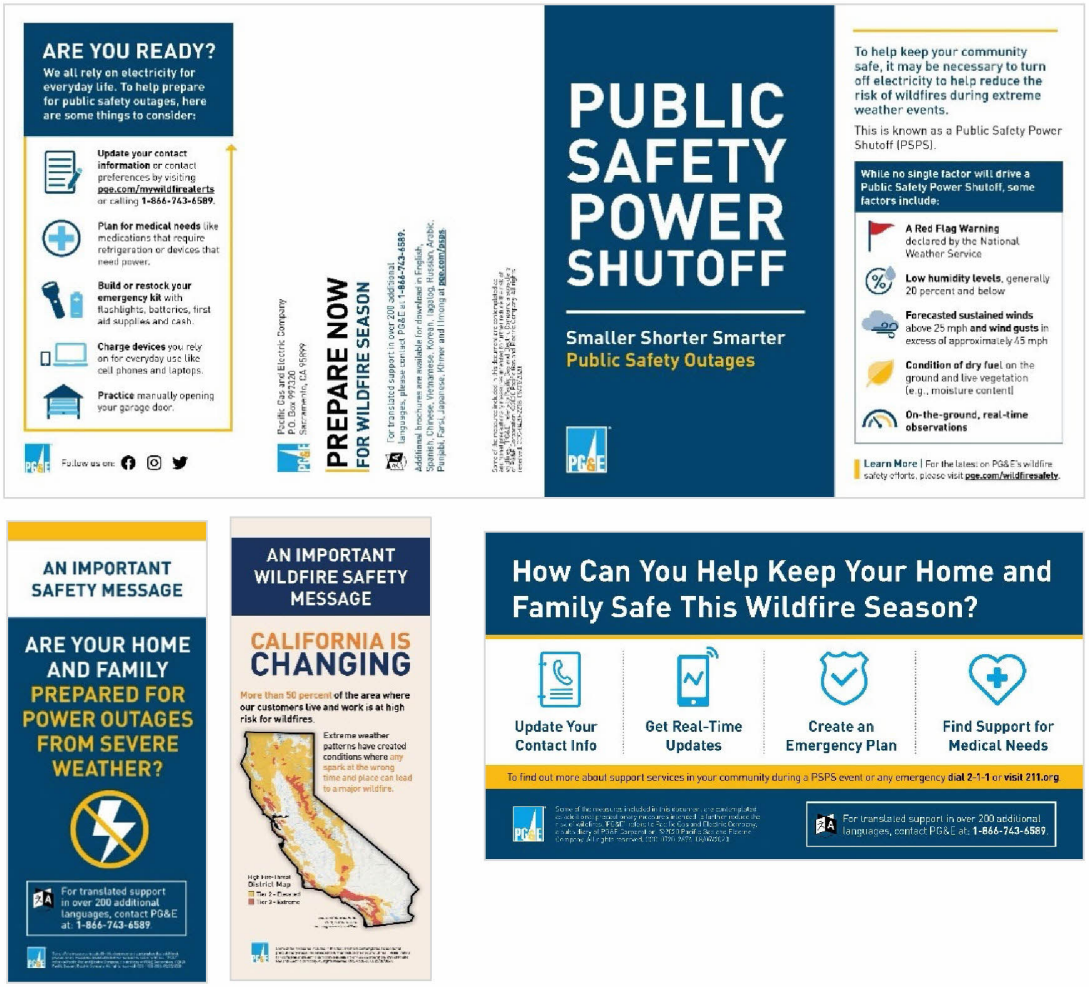
- **"Wildfire Safety Town Halls," Webinars and other Community Events:** PG&E hosts interactive virtual safety town halls[8] where customers can learn about our work to prevent wildfires, hear about emergency preparedness activities they can take, get answers to their questions, and provide feedback on our wildfire prevention plans and PSPS initiatives. Additionally, PG&E holds webinars for our customers and communities to help them prepare for emergency situations (anticipated by June 2021). PG&E plans to continue to host and/or participate in community events focused on customers with disabilities, seniors, and low-income customers, including targeted webinars and participation in meetings hosted by CBOs. In 2021, the format and timing of community events will depend on the public health safety protocols related to COVID-19. PG&E anticipates that the bulk of community events will occur virtually, like many 2020 events. When it becomes safe for our customers, communities, and employees to gather, PG&E plans to resume to in-person events, based on state and local health guidance.

- **Direct-to-Customer Outreach and Education:** PG&E sends direct mail and e-mails to customers throughout the year with information on emergency preparedness resources and reminders to update contact information so PG&E can reach out to customers in advance of a public safety power outage. PG&E may disseminate educational information through e-mail newsletters or special insert included in customer bills, with an electronic version e-mailed to paperless customers, as applicable.

  Figure PG&E 7.3.9-1 includes sample PSPS preparedness brochures, bill inserts, postcards used during PG&E's direct-to-customer outreach.

8 Per I.19-06-015, Joint Motion of PG&E the Safety and Enforcement Division of the CPUC, Coalition of California Utility Employees, and the Office of the Safety Advocate for Approval of the Settlement Agreement, pp. 25-26.

FIGURE PG&E-7.3.9-1: SAMPLE PSPS PREPAREDNESS BROCHURES, BILL INSERTS, AND POSTCARDS



- **Digital Engagement:** PG&E provides emergency preparedness information and safety resources on pge.com.[9] Our dedicated emergency preparedness webpages have detailed information for customers to help them make a plan so that they are ready for emergency events. PG&E provides customer resources on our website that include details on how to create an emergency supply kit,[10] and instructions on ensuring that customers' properties and homes are prepared for emergencies. For example, PG&E provides information to help customers know how to

9 https://www.pge.com/en_US/safety/emergency-preparedness/emergency-preparedness.page.

10 https://www.pge.com/en_US/safety/emergency-preparedness/preparedness-kit/emergency-preparedness-kit.page.

turn off electricity[11] and gas at the main switch and valves.[12] We also provide tips on resiliency, how to safely use a generator[13] and preparing solar customers for winter storms.[14] Additionally, PG&E has created a series of materials[15] that will educate children in kindergarten[16] through 6th grade[17] about the importance of emergency preparedness in a fun and reassuring manner. To ensure that our customers have information about emergency-related outages, we encourage customers to sign up for outage alerts via our online platform "Your Account."

- **Safety Action Center:** PG&E has a dedicated safety webpage (safetyactioncenter.pge.com) featuring helpful information about wildfire risks and what customers can do to keep their home, family or business safe, including tips on how to create an emergency plan, emergency preparedness guides and videos.

- **Informational Videos:** PG&E uses informational videos as an engaging way to inform customers about or CWSP and PSPS available at the newly launched pge.com/pspsvideos webpage. Building off our success in 2020, PG&E will continue a series of videos about the CWSP and PSPS events. For example, in 2020, PG&E developed a series of short (3-5 minute) and long-form videos about the CWSP and PSPS programs. These videos allow us to further the reach of our emergency preparedness messaging and reach a broader group of customers and community members. Our "Preparing for Public Safety Power Shutoff" video, for example, aired between September

11 https://www.pge.com/en_US/safety/electrical-safety/turning-your-electricity-on-and-off/turning-your-electricity-on-and-off.page.

12 https://www.pge.com/en_US/safety/gas-safety/gas-safety-tips.page#p3.

13 https://www.pge.com/en_US/safety/electrical-safety/electric-generator-safety/electric-generator-safety.page.

14 https://www.pgecurrents.com/2015/12/14/how-rooftop-solar-homeowners-can-prepare-for-el-nino/.

15 https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/PGE-Kids-Emergency-Preparedness-Activity-Book.pdf.

16 https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/PGE-Kids-Emergency-Preparedness-K-3-Placemat.pdf.

17 https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/PGE-Kids-Emergency-Preparedness-4-6-Placemat.pdf.

and November 2020 with 25 television placements throughout our Northern and Central California service territory—many of these placements coincided with PSPS events to provide the right information at the right time in affected communities.

- **Media Engagement:** PG&E works closely with external media outlets, including both paid and earned media, to provide broad awareness to Californians to share tips related to wildfire and PSPS preparedness, socialize available resources, and communicate PSPS event information. This includes PG&E multicultural media engagement that reaches our non-English speaking customers and community members, as described in Section 8.4.

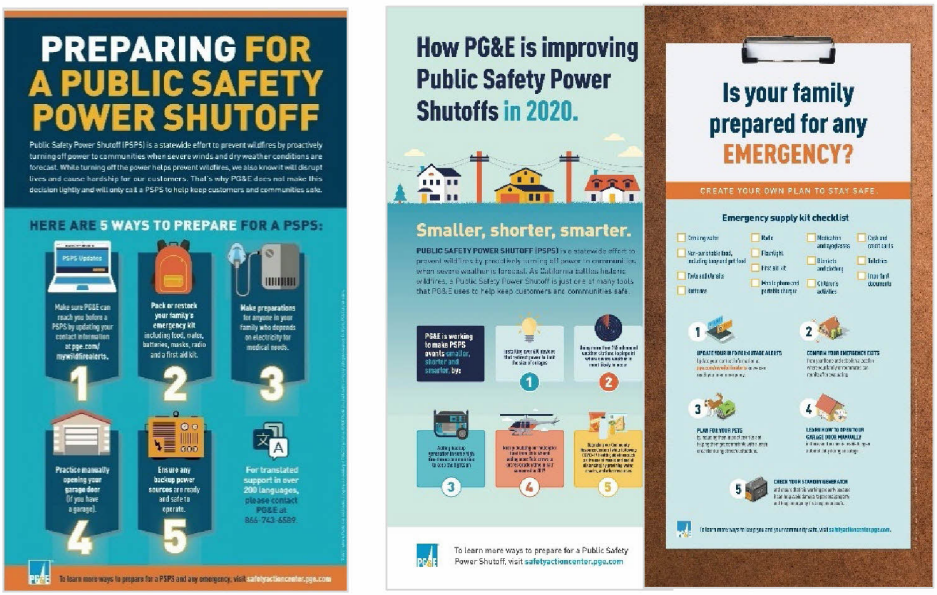
  - **Earned Media:** PG&E engages with the media by issuing news releases, conducting and live streaming news conferences with ASL translators, and participating in media interviews. In turn, these media organizations may provide communications on the radio, broadcast, television, and online. PG&E also reaches out to local newspaper outlets for Op-Ed and Letters to the Editors to further prepare customers for emergencies, PSPS events and help provide information on wildfire safety. To serve customers with limited English proficiency, PG&E engages with over 150 multicultural media outlets throughout the year in an effort to promote safety initiatives, including PSPS, to monolingual or difficult to reach populations that may not have access to mainstream television media or read/speak English. PG&E shares news releases and coordinates interview opportunities with these media outlets to help educate limited English-speaking customers on various PG&E programs, including the CWSP, PSPS, emergency preparedness, and public safety among other topics. Additionally, PG&E schedules media visits with these organizations to discuss other partnership opportunities (e.g., Public Service Announcement, advertising, event sponsorships). During PSPS events, select media outlets are notified based on their geographic coverage and frequency in running event updates.

  - **Paid Media and Advertising:** To supplement PG&E's outreach efforts, PG&E runs wildfire safety and emergency messages to reach customers via paid media channels. PG&E purchases a combination of English and in-language radio ads, as well as digital

banners in English and multiplate languages based on targeted ZIP Codes.

Figure PG&E 7.3.9-2 includes sample print advertisements used in 2020.

FIGURE PG&E-7.3.9-2: SAMPLE 2020 ADVERTISEMENTS



– **Social Media:** PG&E regularly provides customer preparedness resources through our official social media channels, including Twitter, Facebook, Instagram, and Nextdoor. During the 2020 PSPS events, PG&E provided event update videos on our social media platforms in English, ASL, Spanish, and Chinese.[18] Some social media posts are translated into up to 15 languages. We also developed a three-minute YouTube video on safety tips for those with medical needs. We continue to work with 36 multi-cultural media organizations and five CBOs to assist with in-language communications and share our social media posts before and during PSPS events.

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18 See examples of translated social media posts:

- PSPS Alert Banner: https://twitter.com/PGE4Me/status/1321169776014667779/photo/1.
- PSPS Event Update in Chinese: https://twitter.com/PGE4Me/status/1321220048791334912?s=20.
- PSPS Update in Spanish: https://twitter.com/PGE4Me/status/1321219692392968193?s=20.
- PSPS Warning Alert in ASL: https://twitter.com/PGE4Me/status/1320423102866542593?s=20.

PG&E plans to leverage our social media platform throughout 2021.

- **CBO Engagement:** PG&E uses CBOs to support the dissemination of emergency preparedness information, including resources on wildfire and PSPS safety, to their networks via their established communication protocols as well as their social media channels and newsletters. Our CBO network plays an instrumental role in our ability to reach our vulnerable and non-English speaking customers. More details on our CBO engagement are included in Section 8.4.

- **Community Partnerships:** We regularly work with community partners to better prepare for emergencies. For example, PG&E partners with the California Fire Foundation to provide Wildfire Safety and Preparedness grants focused on funding for firefighters and Community/Neighborhood Emergency Response Teams in Northern California, specifically communities identified as extreme or elevated fire risk. PG&E also funds local climate resiliency projects through the Better Together Resilient Communities grant program. Further, PG&E awards grants to local Fire Safe Councils to fund shovel-ready projects to help keep communities safe. The funds help pay for fuel reduction, emergency access and defensible space projects, as well as chipper days in local communities.

For more information, see:

- Section 7.3.10.1 for details on PG&E's outreach related to the CWSP;

- Section 8.2.4 for more information on stakeholder cooperation and community engagement during PSPS events; and

- Section 8.4 for a description of our communication protocols and outreach activities for AFN populations and customers with limited English proficiency. In addition, PG&E includes more details in the 2021 PSPS AFN Plan, filed February 1, 2021.

C) <u>Action to Design, Translate, Distribute, and Evaluate Effectiveness of Communications Taken Before, During, and After a Wildfire</u>

This section describes PG&E's actions to design, translate, and distribute communications taken before, during, and after a wildfire.

1. **Before Wildfires:** Please see the information listed above and

Section 7.3.10.3 and Section 7.3.10.1 for details regarding PG&E's communications before wildfires.

2. **During Wildfires:** PG&E follows the established emergency communication framework outlined in our Company Emergency Response Plan (CERP),[19] General Order (GO) 166 standards, and the Electric Emergency Plan. PG&E uses notification systems to alert customers of an electric outage caused by planned or unplanned outages, such as those related to wildfires. PG&E also alert Public Safety Partners. Both notification systems we utilize send automated notifications via calls, text and e-mail to notify recipients of major events affecting their area and at key milestones. Notifications provide incident-related updates if long-duration outages are anticipated, which may include the cause of the outage, estimated times of restoration and notification once power is restored (where possible). Like our PSPS customer notification protocols, PG&E offers customers a choice for these notifications of their preferred communication channel (i.e., Interactive Voice Recording call, e-mail, text). PG&E sends notifications in the customer's preferred language. If a customer has set their notification preferences to receive outage-related updates, a customer will receive automated notifications with status of the outage. See Section 8.2.4 for additional information related to PSPS event notifications.

   PG&E also provides situational updates to customers and communities via our website, broadcast media (e.g., radio and TV) and social media (e.g., Twitter and Facebook). PG&E personnel are available 24/7 for media interviews when requested during an event.

   - **Agencies and Critical Facilities:** PG&E recognizes the importance of ensuring that agencies and critical facilities have key information during emergency events in order to prepare their own resources, communication channels, and response to community needs. During emergency events, PG&E follows ICS and National Incident Management System structure and protocols to ensure that public safety partners receive timely and appropriate information during PSPS events and other emergencies.

     Specifically, the Liaison and Customer Strategy Officer Command Staff functions within PG&E's EOC and local Operations Emergency Centers (OEC) to prepare and disseminate key information to agencies and critical facilities during events. Beyond automated notifications, the teams also work directly with these stakeholders to answer questions in real-time and solicit feedback to ensure that

[19] Electric Annex to CERP.

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localized and ad-hoc requests during emergencies are fulfilled in a timely manner. Please see Section 8.2.4 for a more information on how PG&E structures the EOC to provide agencies and critical facilities with key information during a PSPS event. This same protocol would be followed for other types of emergencies, with considerations specific to that emergency, under the guidance of the Incident Commander.

PG&E establishes communications with critical facilities such as local water districts, telecommunications infrastructure providers, as well as CBOs, using similar protocols in place for PSPS-related communications.

- **Red-Tagged Customers:** PG&E implements our Emergency Consumer Protection Plan to support eligible customers when the Governor of California or President of the U.S. issues an emergency declaration for a disaster that results in the loss or disruption of the delivery or receipt of utility service and/or results in the degradation of the quality of utility service.[20] In these cases, PG&E partners with fire, emergency services, and county representatives to verify premises that are "impacted" or "red-tagged." PG&E flags "impacted" customers within two miles of the disaster-impacted perimeter area as designated by CAL FIRE or Cal OES or other governmental agencies. An account may carry a "red-tagged" flag because the premise has been deemed dangerous or unfit for human habitation by a government agency, and/or because PG&E's infrastructure was damaged beyond short term restoration capabilities by the disaster, both resulting in the premise being unserviceable.

  These customers will receive a notice from PG&E to help raise awareness of the customer protections that will be available to them (see Section 7.3.9.3 for more details on the consumer protections available to customers). The notice will also include information on how to access in-language support for customers with limited English proficiency.

3. **After Wildfires:** Once a wildfire is fully contained, ongoing communications efforts will continue to ensure key stakeholders and customers have the most up to date information about PG&E's response and rebuild and recovery efforts. Please see Section 7.3.9.3 for details on PG&E rebuild and recovery customer resources and consumer protections for customers impacted by wildfires.

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20 D.19-07-015, Ordering Paragraph (OP) 2.

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Throughout the year, PG&E collects feedback to evaluate agency and customer awareness, understanding, satisfaction, and experience, regarding wildfire safety preparedness and PSPS. This includes quantitative and qualitative research, such as surveys, fora, and other types of direct customer feedback, and by tracking customer engagement (e.g., web traffic, click-through-rates of advertisements, and conversion rates/actions taken by customers as a result of the outreach). Additionally, we gather customer feedback across multiple channels including web surveys, contact center calls, text and e-mail notification responses, live chat focus groups, and select social media posts.

PG&E will adjust as needed to ensure the effective use of available outreach channels.

PG&E provides more details on our CWSP outreach effectiveness evaluation initiatives in Section 7.3.10.1. PG&E submitted our findings from the 2020 CWSP Outreach Effectiveness study, filed with CPUC on December 31, 2020.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E conducts outreach to customers and communities throughout the entire service territory. However, as mentioned previously, PG&E customizes agency outreach based upon agency need. The level of customization will vary according to the 2020 PSPS impact, with the most impacted agencies receiving the most customization in terms of localized topics covered and type of engagement. These agencies are often located in HFTD areas. Accordingly, in 2021, certain agencies may receive more frequent and more customized engagements according to their needs based upon their past experiences with PSPS and wildfires.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In an effort to explain the outreach approach fully and as streamlined as possible, we have included the progress of each outreach initiative in the response to question number two above. For additional references, below are some of PG&E's key 2020 engagement and outreach highlights:

- Hosted over 200 meetings with agencies to share information related to PG&E's CWSP.
- Held over 35 listening sessions with cities, counties, tribes and customers (e.g., telecom providers) to better understand their 2019 PSPS experiences and identify key areas for improvements.

- Co-hosted 34 Wildfire Safety Working Sessions with County OESs.
- Hosted over 15 PSPS Portal trainings with public safety partners.
- Established the various advisory committees and hosted ongoing meetings with each committee.
- Established the five Regional Working Groups and hosted two meetings in each region (Q3 and Q4 meetings).
- Held three regional PSPS workshops and three full-scale PSPS exercises.
- Hosted 15 regional and three systemwide virtual open houses and one safety town hall with over 5,000 attendees to provide a localized update on wildfire safety work happening in respective communities and answer customer questions.
- Placed over 200 posts on PG&E social media channels.
- Sent 17 direct mail pieces to customers.
- Conducted 25 customer e-mail outreach campaigns.
- Had 84 million average monthly advertising impressions in advance of and during the months with the highest likelihood of wildfire and PSPS events (July-November).

Additional information on progress related to community outreach, public awareness, and communications can be located PG&E's 2020 WMP quarterly reports. The May to July[21] and Third Quarter,[22] Condition PGE-28, filed with the CPUC can be found here:

- May and July 2020: https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/wildfire-mitigation-plan/PGE-WildfireMitigationPlans-QuarterlyReport.pdf.
- Third Quarter: https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/wildfire-mitigation-plan/PGE-WildfireMitigationPlans-QuarterlyReport-Q3-2020.pdf.

In 2021, PG&E plans to continue our territory-wide awareness campaigns established and implemented in 2020, with a focus on customers and

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21 PG&E Quarterly Report on 2020 WMP for May to July 2020, submitted September 9, 2020, Condition PGE-28.

22 PG&E Quarterly Report on 2020 WMP for Third Quarter 2020, submitted December 9, 2020, Condition PGE-28.

stakeholders who have been repeatedly impacted by PSPS events given the significant customer impacts associated with PSPS. Please see the response to question number two for PG&E's 2021 outreach and engagement objectives, a table of the planned engagement tactics and a more in-depth description of each engagement tactic.

We will drive execution of customer outreach and engagement, enhanced through ongoing customer and stakeholder feedback, to propel improved customer, community, and utility readiness and resiliency in the face of growing wildfire threat. COVID-19 considerations and other unforeseen factors may also have an impact on PG&E's outreach approach for 2021.

5) Future improvements to initiative:

As referenced in our response above to questions two and four, over the next several years. For example, if our large commercial account customers provide feedback that they desire more listening sessions, our Business Enterprise Solutions account representative team would host more sessions to ensure we are capturing and incorporating real-time feedback into our wildfire mitigation efforts. For more detailed information on the various fora where stakeholders have the opportunity to provide feedback, see the response to questions two and four above.

As new information, best practices, and lessons learned are available, PG&E will refine stakeholder outreach and community engagement approach as we have done over the course of two years.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Table PG&E-7.3.9-2 addresses PG&E's long-term plan regarding community outreach, public awareness, and communication efforts.

TABLE PG&E-7.3.9-2: LONG-TERM PLAN FOR COMMUNITY OUTREACH, PUBLIC AWARENESS, AND COMMUNICATION EFFORTS

Year Range	Focus Areas
2023-2026	Continue to gather and incorporate feedback from community partners and first responders and refine outreach plans, as applicable. Develop new partnerships to build upon, and complement, current outreach.
2027-2030	Continue to coordinate with stakeholders (e.g., agencies, customers, CBOs) to improve outreach, education, and communication efforts based on data, customer insights and feedback. Maturation of processes to seamlessly share information with industry peers, communities government and tribal leaderships, and others inside and outside California.

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7.3.9.3 Customer Support in Emergencies

WSD Initiative Definition: *Resources dedicated to customer support during emergencies, such as website pages and other digital resources, dedicated phone lines, etc.*

1) Risk to be mitigated / problem to be addressed:

Electric service is a critical resource for customers and when it is disrupted due to an emergency, it is important that PG&E provides information and resources that help customers mitigate the impact to the furthest extent possible.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

PG&E administers an Emergency Consumer Protection Plan to "help stabilize communities in the wake of a disaster that affects utility customers, ensure the restoration of basic services, assist with restoring community functionality, and support access to resources that facilitate recovery."[23] PG&E uses a diverse set of tactics to increase customer awareness of available assistance,[24] which includes a dedicated webpage on customer protections, outbound e-mails/calls, media advisories, social media posts, access to live agents via our Contact Center, CBO partnerships and communicating protections in accessible formats.[25] To further explain, we have broken up this section into the following categories:

A. PG&E's Consumer Protection Resources

B. Rebuilding After a Wildfire

C. Customer Communications and Coordination

A) <u>PG&E's Consumer Protection Resources</u>

In March 2018, the Commission opened the *OIR Regarding Emergency Disaster Relief Program to Support California Residents* (Rulemaking (R.) 18-03-011) to consider adopting a comprehensive post-disaster customer protections program.

In July 2019, the Commission required PG&E to establish a permanent emergency disaster relief program via D.19-07-015. Pursuant to D.19-07-015, PG&E offers a suite of assistance measures when the Governor of California or President of the U.S. issues an emergency

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23 D.19-07-015, p. 8.

24 D.19-07-015, Conclusion of Law (COL) 23.

25 D.19-07-015, pp. 35-36.

proclamation for a disaster that results in the loss or disruption of the delivery or receipt of utility service and/or results in the degradation of the quality of utility service.[26]

Specifically, PG&E offers the following customer protections for up to 12 months from the emergency proclamation for an eligible disaster:[27]

- **Waive deposit requirements for affected customers seeking to re-establish service and expedite move in and move out service requests**: PG&E waives security deposit requirements to reestablish service for customers whose home(s) or small business(es) were destroyed by the disaster. In addition to offering this protection, PG&E notes that the Commission adopted D.20-06-003 in June 2020, which prohibits PG&E from requiring re-establishment of service deposits from residential customers.[28] PG&E stopped requiring such deposits from customers, consistent with D.20-06-003.

  In accordance with our Emergency Consumer Protection Plan,[29] PG&E also allows customers whose homes or businesses were red-tagged and had been served under a rate that has since been closed to new customers, to re-establish service under their prior rate schedule at their current location or an alternative location, regardless of the current applicability of their prior rate schedule, as long as the rate schedule is still available and has not been retired.

  D.19-07-015 also requires PG&E to expedite move-in and move-out service requests for affected customers.[30] PG&E expedites these requests based on the date requested by the customer.[31] Consistent with our Emergency Consumer Protection Plan,[32] PG&E also waives the cost for temporary power under Electric Rule 13 for affected customers.

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26 D.19-07-015, Ordering Paragraph (OP) 2.

27 D.19-07-015, COL 14.

28 D.20-06-003, OP 9.

29 The Commission approved PG&E's proposal in AL 4014-G/5378-E to revise Electric Rule 12 to allow customer to reestablish service under a prior rate schedule as part of its Emergency Consumer Protection Plan.

30 D.19-07-015, COL 14.

31 This does not include any meter sets, including multi-unit meter sets or any other requests that require inspections, and/or criteria as required in the PG&E Electric and Gas Service Requirements Handbook.

32 The Commission approved PG&E's proposal in AL 4014-G/5378-E to add waiving fees for temporary service to its Emergency Consumer Protection Plan.

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- **Stop estimated usage for billing attributed to the period when a home/unit was unoccupied due to a disaster:** During natural disasters, PG&E identifies general areas that were evacuated and recalibrates our approach for any bills in the area requiring estimation.

- **Discontinue billing and prorate minimum delivery charges:** PG&E identifies premises of affected customers whose service has been disrupted or degraded and discontinues billing these premises without assessing a disconnection charge. PG&E also prorates any monthly access charge or minimum charges for affected customers.[33]

- **Implement payment plan options, including customers with employment impacted by a disaster**: Following a disaster, PG&E offers impacted and red-tagged customers our most lenient payment arrangement term, which requires a 20 percent down payment and a repayment period of 12 months. Customers are eligible to pay off their arrearage sooner if preferred.

  In addition, customers who indicate that their employment was impacted by the disaster are also eligible for favorable payment plans.[34]

- **Suspend disconnections for non-payment, waive deposit and late fee requirements:** PG&E suspends disconnections for all red-tagged customers for up to 12 months from the Governor or President's emergency proclamation.[35] PG&E waived deposits as described previously and clarifies that it does not charge late fees.

- **Support for low-income customers:** PG&E provides support for low-income customers, including freezing California Alternate Rates for Energy (CARE) eligibility standards and high-usage post-enrollment verification requests, increasing the assistance cap for emergency assistance program, and modifying qualification requirements for the Energy Savings Assistance Program by allowing customers to self-certify they meet income qualifications. PG&E leverages our CARE community outreach contractors to inform customers of the protections available to them. Additionally, PG&E coordinates with the program administrator of the Relief for Energy Assistance Through

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33 D.19-07-015, p. 21.

34 The Commission approved PG&E AL 4145-G/5643-E on October 30, 2019. This AL revised PG&E's Emergency Consumer Protection Plan under Gas and Electric Rule 1 in compliance with D.19-05-037, OP 24.

35 Note that due to the COVID-19 pandemic and pursuant to Resolution M-4842, PG&E suspended disconnections for non-payment for all residential and small business customers through April 16, 2021.

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Community Help (REACH), a PG&E and customer-funded emergency assistance program, to request increasing the assistance cap amount for red-tagged customers from $300 to $600. This assistance allows customers who lost their homes to receive additional financial assistance to pay their current utility bill or to set up new service. PG&E informs all REACH agencies of this financial support for customers.

- **Offer repair processing and timing assistance and timely access to utility representatives:** D.19-07-015 requires PG&E to offer repair processing and timing assistance and timely access to utility customers pursuant to CPUC Section 8386(c)(18).[36] PG&E works with the impacted community to communicate priorities and timelines for repairs and restoration. Specifically, PG&E calls red-tagged customers directly to notify them of the protections available and to provide a single point of contact at PG&E for related support. This includes providing information on the process for receiving temporary power. In addition to directly contacting red-tagged customers, impacted customers have access to utility representatives through multiple channels, such as PG&E's call center, public affairs and customer account representatives, and field teams.

- **Consumer protections for Net Energy Metering (NEM) customers:**[37] In the event a NEM customer is impacted by a natural or man-made disaster, PG&E allows the customer to:

    1. Size their replacement generating system to produce no more than the expected annual usage (kilowatt-hours) of their new premises and remain on their original NEM or NEM2 tariff;[38]

    2. Be exempt from paying interconnection application fee when reapplying to resume service on NEM2 (with some restrictions); and

    3. Identify on the application form that they are disaster-impacted customers to benefit from these provisions

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36 D.19-07-015, COL 15.

37 On April 25, 2019, the CPUC approved PG&E AL 5404-E that, through revisions to its tariff provisions in the NEM Tariff and NEM Successor Tariff (NEM2), allows PG&E to offer these additional protections to NEM customers.

38 The new NEM system is limited to a maximum of 1,000 kilowatts, otherwise it is required to move to the successor tariff (NEM2). The customer must comply with the NEM or NEM2 tariff provisions, as appropriate.

B) Rebuilding After a Wildfire

PG&E is committed to helping our communities throughout the rebuild process. During and after a wildfire, we want to help ensure our customers' and our communities' safety. We prioritize restoring service in wildfire zones as soon as it is safely possible. PG&E has resources and programs in place to help our customers through this difficult process. For example, PG&E has established single points-of-contact for customers seeking to rebuild after wildfires. Our Building and Renovation Services department works directly with customers impacted by wildfires who need temporary power to rebuild structures or live on their properties, and subsequent permanent electric and natural gas services. As described above in the discussion on customer protections, PG&E assists customers affected by wildfires by waiving the fee for connecting temporary power. Additionally, PG&E's offers customers a step-by-step guide on how to safely start their rebuilding journey.[39]

C) Customer Communications and Coordination

- **Webpages and other Digital Resources:** In Section 7.3.9.2, PG&E explains how it uses our website and other digital resources to provide customers and communities with information about emergency-related outages and wildfire safety-related messages. In addition, PG&E established a dedicated webpage as an ongoing resource to help raise awareness about the protections available to customers,[40] which is available for customers to use anytime. This webpage is available in all 15 prevalent non-English languages.[41] PG&E also has a dedicated webpage to support customers during and after a wildfire.[42] This webpage includes resources on how to safely return to premises after a wildfire, having power restored and other safety and wildfire program-specific information.

- **Contact Centers/Dedicated Phone Lines**: PG&E's customer service representatives are available to answer any customer questions or concerns regarding the customer protections. PG&E uses a leading translation service provider in the industry, Language Line Services, to provide translation services in over 250 languages (including 10 indigenous languages) in our Contact Centers. See Section 8.4 for more details on PG&E's in-language support.

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39 https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/natural-disaster-rebuilding.pdf.

40 www.pge.com/consumer-protections.

41 Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.

42 www.pge.com/wildfiresupport.

- **Direct Outreach to Red-Tagged Customers**: PG&E sends letters to all red-tagged customers that provide information on the available protections and direct customers to PG&E's customer protections website for more information. In addition, PG&E has a dedicated team to conduct targeted outreach to highly impacted customers who were unable to receive utility service. PG&E's account representatives contact red-tagged customers through outbound calls, personalized e-mails, and sending brochures with information on how PG&E could help them to rebuild and recover. PG&E also offers the Rebuild@pge.com e-mail box dedicated to customers going through the rebuild process. This e-mail solution allows customers direct access to PG&E's team of rebuild experts and resources.

- **Coordination with Local Government Staff and Elected Officials:** During a natural disaster such as a wildfire, PG&E coordinates with local governments on a regular basis by e-mail and phone to provide updates on outage impacts and estimated time of restoration. In addition to these regular updates, PG&E provides additional updates in response to requests from county and city leaders, including elected officials. In addition, PG&E's Division Leadership Team and Government Relations team provides outreach materials with information on available assistance to local governments to share with impacted communities.

  After a wildfire, PG&E coordinates with local cities, counties and elected officials to support the community's rebuild efforts, as needed and required. Through our Government Relations team, PG&E supports local governments in their rebuild process. For example, PG&E will participate in Town Hall events to provide community members information on PG&E's rebuild process such as customer connections and service planning process, and hazard tree removal policies. Additionally, PG&E proactively obtains the status of city-owned electric infrastructure progress to understand and communicate local government implications to the rebuild (e.g., streetlights, lot clearance, permits, street closure, traffic management, water management.

- **News Releases:** Typically, after a wildfire or other natural disaster, PG&E issues news releases that outline the customer protections. The news releases are circulated to all media outlets in the impacted counties for the best possible reach to applicable customers.

- **Coordination with CCAs:** PG&E coordinates with CCAs during disasters to share information on affected customers.[43] PG&E

[43] D.19-07-015, COL 18.

offers CCAs an automated solution that allows CCAs to have timely access to a list of impacted and red-tagged customers. PG&E uses this process to coordinate with CCAs during disasters.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

PG&E offers protections to customers impacted by natural disasters, including wildfires. As such, customers located in those regions (e.g., counties) that have been impacted by the natural disaster are eligible for the protections. PG&E's communications (e.g., webpages) that describe consumer protections are accessible by all customers throughout our territory.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

Since establishing our Emergency Consumer Protection Plan in 2019, PG&E has provided customer protections for the following disasters:[44]

TABLE PG&E 7.3.9-3: CUSTOMER PROTECTIONS OVERVIEW

Date of Proclamation	Disaster	Affected County	Advice Letter
October 25, 2019	Kincade Fire	Sonoma	4176-G/5682-E 4325-G/5980-E
March 4, 2020	COVID-19	All	4244-G-B/5816-E-B
August 18, 2020	August 2020 Fires	All affected by fires	4305-G/5939-E
September 6, 2020	Creek Fire	Fresno, Madera, Mariposa	4311-G/5957-E
September 25, 2020	Oak Fire	Mendocino	4322-G/5972-E
September 28, 2020	Glass and Zogg Fires	Napa, Sonoma, Shasta	

Pursuant to D.19-07-015, PG&E will continue to offer protections for eligible customers impacted by disasters in 2020 for up to 12 months from the date of the emergency proclamation noted above. In addition, PG&E will offer protections for eligible customers impacted by any new disasters in 2021.

PG&E also filed AL 5744-E on January 24, 2020 to request approval for a

44 For more information, see "Emergency Consumer Protection Plan" in PG&E's Electric and Gas Rule 1.

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pilot program to provide underground electric service pedestals, including installation, to eligible residential customers who request temporary service under Electric Rule 13 for properties impacted by the Camp Fire. The CPUC approved this AL on February 24, 2020.

In 2021, PG&E will continue to offer consumer protections and rebuild resources, and our communications to support our customers before, during and after a wildfire as outlined above. PG&E will also continue to gather feedback from customers and communities and adjust our approach, as required.

5) Future improvements to initiative:

As described in response to questions two and four above, over the next several years, PG&E will continue to evaluate the needs of our customers in order to support them in response to future emergencies and work with the CPUC to seek approval on further emergency protections, as applicable.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

***Response**:*

PG&E's Emergency Consumer Protection Plan is largely driven by requirements and guidance set forth by the CPUC through the OIR Regarding Emergency Disaster Relief Program to Support California Residents (R.18-03-011), which though various Decisions (e.g., D.19-07-015), adopted comprehensive post-disaster customer protections. PG&E's long-term plans center on continued compliance with any and all CPUC Decisions related to emergency consumer protections. In addition, we will gather feedback and insights from our customers, communities and stakeholders, and based on data, propose additional and/or modified emergency consumer protections to the CPUC for consideration, as applicable and as needed. Further, we will continue to refine outreach processes to ensure eligible customers receive information about the protections afforded to them. We will also continue to offer support to agencies and disaster response professionals as requested during emergencies.

7.3.9.4 Disaster and Emergency Preparedness Plan

WSD Initiative Definition: *Development of plan to deploy resources according to prioritization methodology for disaster and emergency preparedness of utility and within utility service territory (such as considerations for critical facilities and infrastructure), including strategy for collaboration with Public Safety Partners and communities.*

1) Risk to be mitigated / problem to addressed:

Any limitation to quickly executing emergency resource deployments can have a significant negative impact on customers and community members by delaying restoration of service. In addition, delays to restoration also impact county and state agencies responsible for community welfare and require them to augment safety-related services, such as food, shelter and lodging.

Because of the dependency on utility service and the impact it has on agencies to ensure community safety, it is critical that agencies and the utility are aligned on potential risks and disaster planning. Failure by the utility to share emergency plans with agencies would leave the utility out of compliance with California Public Utilities Code (PUC) 768.6, which requires each IOU to conduct biennial regional meetings between the utility and agency stakeholders to share our emergency response plans and solicit feedback.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

To minimize the risks noted above, we developed and maintain a CERP. The CERP outlines our response to any type of hazard, including any natural or man-made hazard. The CERP is further supplemented by "Annex" documents that cover specific emergency response protocols ranging from wildfire to cyber incidents to earthquakes. Each Annex is reviewed and updated annually in accordance with GO 166.

In 2020, we updated the CERP to include more in-depth processes for the various outage management tools to determine where emergency resources should be deployed. For example, this includes:

- **Outage Management Tool (OMT):** This tool provides a graphical representation of electric service outages within the Company's electrical service area. It is used to determine where to deploy electric asset restoration crews. In addition, public safety partner facilities, including 911 dispatch centers, local government EOCs, trauma centers/hospitals and fire and police stations, are monitored in the OMT. PG&E utilizes OMT information to prioritize restoration to these facilities during unplanned outage events, when possible.

- **Storm Outage Prediction Project:** This system utilizes over 20 years of observed weather activity across our service territory to forecast the potential customer impacts approximately four days in advance of a potential storm outage and the resources required to effectively and safely restore power. This allows us to pre-stage resources in those areas that are anticipated to be most impacted days in advance.

- **Automated Roster Call Out System:** We use this system to schedule and send automated calls to repair crews that respond to electric emergency outage situations or unplanned events. This automated system allows us to streamline the process and reduce outage duration times by identifying resources and getting them onsite quicker.

- **Field Operations Resource Calculation of Estimated Time of Restoration (FORCE):** This tool is utilized to determine resources needed to patrol and inspect de-energized lines prior to re-energization during PSPS events. Based on a range of inputs and assumptions including resource availability, circuit configurations, terrain, vegetative cover and accessibility, this tool provides recommendations on the number of helicopters and ground patrols units that would be required to meet our restoration requirement.

In recognition of large-scale events that may exceed internal capability, we also work with other utilities to streamline mutual assistance resource deployments, including crew arrival, staging, intake and onboarding in support of emergency field operations. For more information on mutual assistance, see Section 7.3.9.7.

In addition to the biennial outreach requirement of PUC 768.6, PG&E PSS teams interact directly with county emergency management staff throughout the year, particularly during emergencies. For more information on outreach and engagement with county and tribal emergency management agencies, see Section 7.3.9.2 and Section 7.3.10.3.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

The rollout of the annual CERP is completed on a service territory-wide approach, rather than by region or area. As noted in the CERP, PG&E's prioritization for deploying resources during emergencies is dependent upon where the incident is located and the key objectives for the incident.

Regarding outreach to public safety partners and communities about emergency plans, PSS team members are each assigned an area at the county-level. Outreach is not prioritized by region, but rather conducted concurrently across PG&E's service territory. For more information on PG&E's outreach and engagement with local and tribal agencies, see Section 7.3.9.2, Section 7.3.10.1 and Section 7.3.10.3.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

This year, we completed the following milestones:

- Updated our Emergency Response Plans Standard, EMER-2001S. This internal standard includes a revised hazard and functional annex update schedule tailored to capture lessons learned from previous responses, including, any process or procedural improvements to resource forecasting and deployment.

- Published the 2020 CERP, which includes expanded roles and responsibilities of the EOC that are consistent with SEMS and ICS. This aligns our emergency response management system with our public partners, facilitating stronger coordination and alignment during emergency response.

- In 2020, EP&R improved the AAR process to be more thorough and efficient in our identification of strengths and improvement opportunities during exercises and emergency response. The new process includes tools for soliciting and receiving feedback from employees and stakeholders, development of formal corrective actions and input and tracking of these in our Corrective Action Program (CAP). The process collects real-time data during an event or exercise to assist with the identifying strengths and opportunities, in an effort to continuously improve.

As mentioned above, our PSS teams interact directly with county emergency management staff throughout the year, particularly during emergencies. In 2020, the PSS team conducted or participated in over 600 external meetings throughout the service territory. For more information on outreach and engagement with county and tribal emergency management agencies, see Section 7.3.9.2 and Section 7.3.10.3.

In 2021, we will update the CERP and expand the Annexes to include severe weather and tsunamis. Many of the plan elements included in these Annexes can be used in wildfire response including, scalability of the ICS organization, use of Incident Management Teams to support the geographic subdivision of areas inside our service territory based on level of damage, resource needs and complexity.

We will also implement our biennial outreach in compliance with PUC 768.6, which will include coordination related to the CERP and several Annexes, including Electric, Gas, and Power Generation.

5) Future improvements to initiative:

We will further integrate circuit patrol and resource data to update the FORCE tool to optimize the development of a resource plan and deployment of electric asset damage assessors.

- During the years 2021 and 2022, we will develop plan metrics and guidance.

- Beginning in 2021 the EP&R Strategy and Execution CERP Planning Team will integrate concurrent hazard response concepts and methodologies from existing CERP Hazard Response Annexes into the annual revisions of CERP.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Within 10 years, we expect to be using robust emergency management plans and strategies that meet and exceed best practices established in the industry. To reach that goal, the following timeline and milestones will be implemented.

- Beginning in 2022, and annually thereafter, EP&R SE will integrate the WMP with the CERP and Hazard Annexes by including completed temporary WMP projects and initiatives that result in adopted program controls.

- Additional Hazard annexes will be developed according to a Threat and Hazard Identification and Risk Assessment process starting in 2022, and annually thereafter.

- In 2023, the EP&R SE Planning Unit will review the developed metrics and guidance to ensure they reflect current industry best practices and planning guidance.

- The Process Improvement and CERP Planning team will work with the AAR Program Owner to identify program enhancements from AAR reports from exercises and events.

7.3.9.5 Preparedness and Planning for Service Restoration

WSD Initiative Definition: *Development of plans to prepare the utility to restore service after emergencies, such as developing employee and staff trainings, and to conduct inspections and remediation necessary to re-energize lines and restore service to customers.*

1) ***Risk to be mitigated/problem to be addressed:***

   PG&E's electric system is a complex set of assets, including transmission lines and distribution circuits, which connect to both internal facilities and external utilities and deliver energy to millions of customers. Qualified and skilled personnel that are properly trained in restoring power after emergencies are essential to minimize public safety concerns, injuries to employees and damage to public and Company assets.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:***

   PG&E provides responding personnel with in-depth training so that electric service is consistently restored to our customers after emergencies in a safe, efficient and timely manner. This is essential given the size and complexity of our electric system. Responding personnel utilize formal PG&E processes and procedures to ensure that service is restored properly. There are no acceptable alternatives for ensuring procedural compliance while meeting PG&E's key objective of restoring power safely, efficiently and in a timely manner.

   PG&E tests the processes and procedures it currently has in place through field exercises. These are hosted regionally and completed annually. Additional information on how PG&E identifies, hires, retains and trains personnel is included in Section 7.3.9.1.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

   The roll out of the policies and procedures to personnel associated with service restoration in conjunction with wildfire mitigation and/or PSPS efforts are completed on a service territory-wide approach, rather than by region or area. This is because over half of the PG&E service territory consists of Tier 2 and Tier 3 HFTD as defined by the CPUC, so all personnel need to be informed and trained concurrently. See Section 7.3.9.1 for more training details.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

   To explain progress and the plans for next year, this section is broken out by 2020 progress and 2021 plans, and provide updates on the following

topics:

- PG&E Standards and Trainings
- PG&E PSPS Field Exercises
- PG&E PSPS Aircraft
- PG&E Distribution Circuit Pre-Flights
- PG&E Distribution Circuit Segmenting Updates

A) <u>2020 Progress</u>

- **PG&E Standards and Trainings:** The primary policies and procedures that personnel were trained on and utilized in 2020 for wildfire and PSPS response are outlined in the following PG&E documents:
  - **TD-1464S: Preventing and Mitigating Fires While Performing PG&E Work** – Process for working on or near facilities within forest, brush or grass-covered lands using equipment that could result in fire ignition. This is applicable for routine and emergency activities, including PSPS.
  - **TD-1464P-01: Fire Index Patrol and Non-Reclose Procedure** – Outlines process for disabling, reclosing and testing electric circuits along with patrol and restoration actions required during fire season (except during PSPS events).
  - **PSPS-1000S: Public Safety Power Shutoff (PSPS)** – Standard which establishes the guidelines for PG&E's PSPS Program and utilized only during PSPS events.
  - **PSPS-1000P-01: Public Safety Power Shutoff for Electric Transmission and Distribution*** – Utilized only during PSPS events and provides the following procedures:
    1) Scoping and Pre-Event Planning
    2) De-energizing Procedure
    3) Restoration Procedure

  Please note that in 2020, to align with the creation of Standard PSPS-1000S, TD1464B-002: Public Safety Power Shutoff for Electric Transmission and Distribution was updated and converted to Procedure PSPS-1000P-01, which provides for focused procedural alignment with the new PSPS Standard. At a high-level, changes included key previous process elements and:

- PG&E's Officer-in-Charge issues the weather "all clear" for each PSPS impacted area, as applicable. Weather "all clear" indicates that the weather event has passed.

- All impacted transmission and distribution overhead lines that are identified as "event specific assets at risk" in High Fire Risk Areas (HFRA), as directed by the EOC, must be patrolled (via aerial or ground) in their entirety, and all trouble found must be isolated or cleared prior to energizing.

For transmission, patrols occur on the de-energized sections of all lines with identified "event specific assets at risk" as directed by the EOC.

For distribution, patrols occur on all impacted primary (and secondary that extends beyond primary) overhead lines identified as "event specific assets at risk" as directed by the EOC. Secondary does not include service drops.

- If damage to the facilities (i.e., electrical line is down) or hazards (i.e., tree branches touching the electrical line) are interfering with the ability to safely energize the facility, field crews repair the facility or remove the hazard.

- Energization of the electrical line.

The overall process incorporates a holistic "end to end" sequential grouping of the activities associated with PSPS events to allow for maintaining the well-trained workforce required to consistently manage these events safely and consistently.

To further ensure procedural awareness and compliance with both PSPS-1000S and PSPS-1000P-01, the following trainings were developed, formalized and conducted with field and control center personnel:

- PSPS-0001 PSPS Restoration Process (for field personnel)

- PSPS-0002 PSPS Execution for DCC Operators

- **PG&E PSPS Field Exercises:** In June, July and August of 2020, PG&E conducted regional (i.e., North, Central and South) full-scale exercises designed to drill personnel involved with PSPS on processes and procedures, particularly PSPS-1000S and PSPS-1000P-01. All functions and a few external stakeholders participated in the exercises, which allowed PG&E to not only test the procedures, but also gather feedback, identify any gaps and refine the procedures further. Personnel and functions involved ranged from the PG&E EOC, Regional Emergency Centers, OECs, DCCs, and included field personnel performing actual ground and helicopter patrols of the selected HFRA assets within

the given exercise.

These exercises included HFRA selected assets in 18 of the 19 Divisions in PG&E's territory. Though the exercises excluded the San Francisco Division (which does not contain any HFRA), personnel from that Division were included in other exercises so that personnel from the Division could be utilized in an emergency, as needed.

- **PG&E PSPS Aircraft:** By September 2020, PG&E secured 65 helicopters, as well as two fixed-wing aircraft equipped with MX-15 cameras and capable of night flying. These aircraft were utilized during PSPS events to expedite patrols and restoration activities and supported emergent wildfire events and other activities as they occurred.

- **PG&E Distribution Circuit Pre-Flights:** By August 31, 2020, as part of the preparation for potential PSPS events, PG&E utilized local knowledge and/or flew helicopters on each distribution circuit with assets located in a HFRA. The purpose of these patrols was to:

  - Provide critical information used to develop effective plans for air and ground resource needs during PSPS events. This included noting circuits that require ground or air patrols only and ensuring the resources are appropriately staged during events.

  - Improve planning capabilities to ensure more accurate estimated times of restoration forecasting (by gathering patrol time data).

  - Identify potential hazards on circuits and take appropriate action.

  - Enhance patrollers training and expand patrollers resource pool by providing practical and realistic OJT to ensure that an experienced workforce will be available during events.

- **PG&E Distribution Circuit Segmenting Updates:** The HFRA distribution circuit segment guides utilized for "segmenting" during PSPS execution activities were updated from being Fire Index Area (FIA)-based to individual circuit-based. This effort also supported the more detailed meteorology event boundaries which reduced customer impacts and restoration times. The guides also included the additional Supervisory Control and Data Acquisition (SCADA) (remote-controlled) devices installed throughout the year. This allowed distribution field personnel to streamline the process by having the ability to more readily obtain both the segment guides and maps on circuits deemed within scope rather

than needing to identify the circuit based on FIA, as circuits can cross multiple FIAs. This change also significantly reduced both the number of segment guides and accompanying maps, resulting in less ongoing data maintenance and minimized confusion. Migrating to individual circuit-based segment guides was a direct result of feedback from the 2019 PSPS events.

B) 2021 Plan

For 2021, the focal points remain largely the same as 2020. They consist of ensuring processes and trainings are developed (or updated, as needed) to support the safe, efficient and timely service restoration following emergencies while providing for and maintaining procedural compliance.

- **PG&E Standards and Trainings:** Policies and procedures will be updated, as needed, based on any changes or feedback from the 2020 exercises and PSPS events.

  To further continue ensuring procedural awareness and compliance with both PSPS-1000S and PSPS-1000P-01, the following trainings associated with this process for field and control center personnel will be reviewed, updated (as needed) and conducted:

  - PSPS-0001 PSPS Restoration Process (for field personnel)
  - PSPS-0002 PSPS Execution for DCC Operators

  Restoration skills and abilities training will be delivered and measured in the classroom, web-based training and restoration field exercises throughout the service territory at a periodicity driven by performance and behavior. Trainings will be revised, updated and adjusted to reflect changes in policy and/or processes, as needed (i.e., based on lessons learned, technology advancements, etc.). See Section 7.3.6.3, Section 7.3.6.4 and Section 7.3.9.1 for more information.

- **PG&E PSPS Field Exercises:** PG&E will continue to perform PSPS exercises utilizing selected HFRA assets from Divisions within the service territory. These exercises will continue to increase in complexity and difficulty to strengthen PG&E's preparedness posture. The periodicity and number of exercises along with whether they will be full scale or potentially separated into EOC and field exercises will be determined based on feedback that is still being collected and reviewed.

- **PG&E PSPS Aircraft:** PG&E will continue to have helicopters and fixed wing aircraft to support PSPS events and other emergent wildfire events and activities.

- **PG&E Distribution Circuit Segmenting Updates:** Segment Guides and maps will be updated based on new equipment installations, circuit reconfigurations or as otherwise needed.

5) Future improvements to initiative:

PG&E will continue to utilize previous PSPS event(s) performance data (i.e., customer restoration metrics) and incorporate lessons learned, best practices and regulatory changes to update field exercises and trainings.

PG&E also continues to identify and develop technologies to support planning and preparedness for service restoration following an emergency. For example, the Advanced Distribution Management System combines electric distribution circuit mapping with SCADA (remote control-equipped field devices) and can automate the reconfiguring of circuits. In addition, it has the potential to provide visibility of the impacted distribution assets against the defined meteorological boundaries during PSPS events. This helps reduce the time it takes to restore power following emergency events and is an initiative we hope to incorporate in the future.

We are looking into the use of unmanned aerial vehicles that could allow for potential expansion of patrol flight time hours, risk reduction, supplanting existing resources to increase overall patrol capabilities.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Long term planning consists namely on expansion of the themes noted above including:

- Continuous improvement based on utilizing lessons learned, best practices and regulatory changes to update field exercises and trainings to support improved execution of service restoration following emergencies.

- Evolution, procurement and utilization of developing technologies as they become available to support planning and preparedness for service restoration following emergencies.

7.3.9.6 Protocols in Place to Learn from Wildfire Events

WSD Initiative Definition: *Tools and procedures to monitor effectiveness of strategy and actions taken to prepare for emergencies and of strategy and actions taken during and after emergencies, including based on an accounting of the outcomes of wildfire events.*

1) Risk to be mitigated / problem to be addressed:

Wildfire response is complex, multifaceted and requires PG&E to continuously review and adjust policies and procedures quickly, as needed. In 2020, we established a formalized AAR process to identify key lessons learned from every EOC activation. We use the lessons learned to improve and adjust our responses to future incidents.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

As mentioned above, it is imperative that PG&E is flexible and can adjust our processes and procedures quickly to adapt to the current environment. That is why we have formalized an AAR process to identify key lessons learned from each EOC activation. These AARs are conducted immediately after an incident or exercise. PG&E then uses this information to inform the adjustments needed for future incidents. For reference, below is an overview of the steps PG&E takes to identify and apply the lessons learned:

- Gather feedback from EOC staff who supported the activation;
- Develop an improvement plan and disseminate to the appropriate internal stakeholders within the affected Lines of Business;
- Identify corrective actions and enter them into PG&E's CAP for tracking purposes;
- Develop and track individual action items, as appropriate; and
- Monitor and track action items and report status to PG&E leadership.

To formalize PG&E's AAR process and help ensure consistency across all events, we developed the following documents which outline the AAR process and provide instructions on how to fill out and complete related forms:

- CERP per CPUC GO 166, "Standards for Operation, Reliability and Safety During Emergencies and Disasters"
- Activation AAR Process standard (EMER-2003S)

- AAR Process Owner Procedure (EMER-2003P-01)
- 5 Minute Meeting Incident Command Data Collection Briefing
- EOC Daily Hotwash Form (EMER-2003S-JA01)

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

PG&E's AAR process applies to all PG&E EOC activations and exercises that take place within our service territory. The results of the AAR process are used to inform systemwide emergency protocols.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

2020 Progress

In 2020, we incorporated corrective actions and lessons learned into our full-scale exercises. We also developed the AAR standard and procedure and were able to execute this process during PSPS events. This provided an opportunity for us to more quickly identify opportunities for improvement and strength of performance. Improvements included short-terms items for immediate improvements, with plans to continue their development throughout the season. For example, we adjusted the delivery of the Cal OES Form to include a verbal review of the form with Cal OES and answer any questions during submission. This improved the alignment of the form information and improved submission quality. We also implemented the use of the PSPS dashboard in the virtual EOC Teams site. This helped ensure alignment among the EOC team on the current playbook version, playbook phase, and the estimated time of delivery of collateral from team members necessary to complete playbook development, which improved alignment between dependent processes.

2021 Plan

We will evaluate the AAR process with the intent of incorporating process improvements into the AAR Standard and procedure. This includes, but is not limited to, updating the process to more formally receive feedback from local, state and federal governments following each event and improving the management of corrective actions to follow through to closure.

5) Future improvements to initiative:

Future improvements to the AAR process beyond 2021 include, but are not limited to, identifying technology solutions for efficiently capturing, categorizing and prioritizing feedback received (i.e., hotwash items).

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

Use Lean Six Sigma methodologies to continuously improve the AAR Standard and After-Action Procedures which outline the execution steps of the AAR process. Evaluate the overall process at least annually for improvement opportunities to the After-Action Procedures which outline the execution steps of the AAR process.

7.3.9.7 Other, Mutual Assistance Support

WSD Initiative Definition: *N/A This is not a WSD-defined initiative. This is an initiative that PG&E is adding to the 2021 WMP to describe Mutual Assistance Support.*

1) Risk to be mitigated/problem to be addressed:

In cases where there are electrical outages during emergencies, such as during PSPS events or wildfires, without mutual assistance, restoration may be delayed for communities. Mutual assistance can provide additional personnel, equipment and materials to support the restoration efforts during emergencies. Pre-planning for these resources is equally as important to ensure personnel can be deployed quickly, as needed.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

We manage mutual assistance agreements with other utilities through the California Utilities Emergency Association (CUEA), Western Region Mutual Assistance Agreement (WRMAA), Edison Electric Institute (EEI) and American Gas Association (AGA). Through these agreements, PG&E has access to over 80 percent of the public utility industry across the U.S. and Canada.

Mutual assistance is an effective tool used by utilities to provide emergency response assistance in support of one another. During an emergency, mutual assistance allows us access to additional personnel, equipment, and materials to supplement internal resources and increase the speed of restoration. Mutual assistance can only be utilized in emergencies and when restoration cannot be completed with our personnel in a reasonable timeframe.

We consider several factors before requesting mutual assistance. For example, due to the travel time of these resources, it may be determined that mutual assistance would not increase the speed of restoration. The type of work is also a factor we consider. The type of personnel needed to support the emergency response may require qualified electrical workers that have been trained on our specific utilities in order to ensure safety.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Mutual assistance is not prioritized based on region, but rather where an emergency event is located and if additional support is needed.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2020, we did not need to utilize mutual assistance during PSPS or wildfire events because of the necessary travel time of the mutual assistance resources and the type of work at issue. In addition, our prior experience completing wildfire mitigation efforts has improved our ability to restore customers quickly during a PSPS event, without the need of mutual assistance.

We participated in mutual assistance agreement updates and operational coordination calls as part of the normal preparation and response processes.

In 2021, We will maintain mutual assistance agreements through CUEA, WRMAA, EEI, and AGA. These resources will be utilized during emergency events, as needed. We recognize the climate crisis continues to increase the need and frequency of mutual assistance. As a result, we will continue to foster relationships and pre-planning activities through effective coordination with our utility partners.

Note: Mutual assistance is an unplanned expense based on the need for outside agency support. For each agreement, costs are calculated by reimbursing 100 percent of actual costs incurred by the responding utility. As such, specific costs related to Mutual assistance vary based on emergency use. In 2020, no emergency response Mutual assistance costs were incurred.

5) Future improvements to initiative:

We will develop a profile for each mutual assistance member and region that provides visibility to deployment timeframe, capabilities and key safety work methods to improve coordination when support is requested. Mutual assistance is coordinated as part of long-established agreements with existing membership organizations. As needed, improvements are made to mutual assistance processes through concurrence among the members at annual meetings.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

We will continue to improve sharing resources between utilities during emergencies. Modeling after east coast mutual assistance response to hurricanes and ice storms, we will be engaging western utilities to follow a similar model. This will include developing common equipment and personnel contingents to better facilitate rapid movement of like resources. Further, similar to other mutual assistance regions, we will be developing a regional plan for the pre-positioning of resources ahead of anticipated storm impacts versus waiting until damage and restoration times are known. These efforts will result in significantly improved restoration times when additional resources can quickly supplement our emergency response field crews.

7.3.10 Stakeholder Cooperation and Community Engagement

7.3.10.1 Community Engagement

Wildfire Safety Division (WSD) Initiative Definition: *Strategy and actions taken to identify and contact key community stakeholders; increase public awareness and support of utility wildfire mitigation activity; and design, translate, distribute, and evaluate effectiveness of related communications. Includes specific strategies and actions taken to address concerns and serve needs of Access and Functional Needs (AFN) populations and Limited English Proficiency populations in particular.*

This section also addresses Actions PGE-36 (Class A), PGE-37 (Class A), PGE-38 (Class A) and PGE-39 (Class A).

1) Risk to be mitigated / problem to be addressed:

Working together with agencies and customers is an important part of Pacific Gas and Electric Company's (PG&E or the Company) Community Wildfire Safety Program (CWSP). This is to help ensure that communities understand the critical safety work underway in their area and are adequately prepared for wildfire season, specifically Public Safety Power Shutoff (PSPS) events.

The goals of PG&E's detailed outreach and engagement plan, supported by ongoing evaluation of the effectiveness of our outreach efforts, facilitates the following benefits, among others:

- Identifying and engaging with key stakeholder groups;
- Creating alignment between PG&E, customers, agencies and community needs;
- Informing agencies and customers of wildfire safety work across the system and in their area;
- Identifying opportunities to collaborate with key local agencies in the design and planning of wildfire mitigation work to leverage efficiencies in project execution or the pursuit of projects that are closely aligned with community priorities;
- Preparing agencies and customers for power outages during PSPS events to mitigate the risks associated with those events, especially for our most vulnerable customers; and
- Aligning the understanding of PG&E's Local Public Affairs (LPA) Representatives, Public Safety Specialists (PSS), Customer Relationship Managers (CRM) and other local engagement teams to efficiently and clearly provide support to key stakeholders

In addition, PG&E designs, translates, distributes and evaluates communications, including AFN and non-English speaking customers, to help ensure:

- Customer and communities are aware of PG&E's wildfire mitigation efforts;
- Customers and communities increase their own PSPS preparedness; and
- There is balanced communication to customer populations, where the most vulnerable populations have more access to information.

2) ***Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:***

PG&E develops an outreach and engagement plan for the various stakeholders within our service territory. Key stakeholders include agencies, including federal, state, local and tribal agencies; critical facilities, such as water agencies, communications providers and hospitals; and, customers, including our most vulnerable customers.

Throughout the year, PG&E engages with these stakeholders regarding PG&E's critical wildfire mitigation efforts. PG&E's main outreach and engagement objectives for 2021 include:

- Listening to customers and community leaders in order to fully understand and respond to concerns and feedback about communications;
- Customizing outreach approach and cadence based upon the community's past PSPS and wildfire impacts, with a key focus on providing more heavily impacted communities with information and resources;
- Approaching agencies and customers with humility and transparency while providing timely and accurate information that supports emergency preparedness and localized wildfire mitigation efforts;
- Soliciting agency feedback at key milestones in wildfire mitigation planning processes to ensure that local projects meet community priorities, and that opportunities for efficiency in collaboration may be identified and acted upon;
- Adapting to shifting agency needs and priorities in emergency preparedness and wildfire mitigation, including a mindfulness of other key local priorities such as responding to the ongoing coronavirus (COVID-19) crisis;

- Hosting localized discussions with agency and geography—specific information in order to enhance agency knowledge of drivers for PSPS events and other potential emergency events in their areas; and

- Strengthening relationships between local agencies and external-facing PG&E teams so that agencies are aware of their knowledgeable point-of-contact that can address their needs both during an emergency event and throughout the year.

To further explain PG&E's community engagement approach for the CWSP, we have broken up this section into the following categories:

A. Strategy and actions taken to identify and contact key community stakeholders;

B. Increase public awareness and support of utility wildfire mitigation activity;

   1. Agency and Critical Facilities Outreach / Advisory Committees; and

   2. Customer and Community Outreach.

C. Strategy and Actions Taken to Design, Translate, Distribute, and Evaluate Effectiveness of Related Communications; and

D. Strategies and Actions Taken to Address Concerns and Serve Needs of AFN Populations and Non-English-Speaking Customers.

Please note additional information on outreach conducted during PSPS events is outlined in Section 8.2.4. In addition, emergency planning and preparedness outreach is outlined in Section 7.3.9.2.

A) <u>Strategy and Actions Taken to Identify and Contact Key Community Stakeholders</u>

PG&E understands the importance of identifying key community stakeholders. PG&E aims to work together with stakeholders to inform them of wildfire safety work in their area and address unique, local issues in real-time. This is also an opportunity for PG&E to gather feedback and adjust the CWSP to minimize impacts to these groups.

Because public safety partner agencies and other community organizations evolve over time, PG&E must work to keep contact lists updated throughout the year. That is why PG&E has dedicated representatives within our Federal Affairs, State Government Relations, LPA, PSSs, and Tribal Relations departments. These dedicated representatives are solely responsible for identifying and maintaining relationships within federal, state, local, and tribal agencies. These relationships enable PG&E representatives to hear directly from agencies if, and when, there is staff turnover or potentially an additional

agency that requires engagement. PG&E representatives make note of these changes throughout the year and embed them in PG&E's internal tracking systems so that new contacts will be automatically included in future outreach engagements and in-emergency notifications. There are more than 50 representatives among these groups and those that coordinate closely with local agencies are divided into regions to best serve these stakeholders at a local level. PG&E also has CRMs that coordinate regularly with critical facilities and large businesses and are responsible for identifying and maintaining these contacts.

PG&E's representatives work to build trust with their respective stakeholder groups over time and are equipped to share information and seek feedback on future wildfire mitigation work. While teams engage with agencies and critical facilities on a proactive and as needed basis, there are several established engagement activities that also provide a forum for these stakeholders to learn about PG&E's wildfire safety work and provide feedback. This will be addressed further below.

Beyond PG&E's existing relationships, PG&E's Customer Care Department has established partnerships with Community-Based Organizations (CBO) and AFN entities that assist PG&E in our outreach and engagement efforts. These entities can also assist with identifying stakeholder groups that require additional outreach. PG&E also follows best practice guidelines and seeks input from the other California Investor Owned Utilities (IOU) and through our advisory committees to identify additional stakeholders.

For further information on how PG&E identifies and maintains agency and critical facility contact information for PSPS and emergency event notifications, see Section 7.3.9.2.

B) Increase Public Awareness and Support of Utility Wildfire Mitigation Activity

Prior to peak wildfire season, PG&E designs and executes a comprehensive wildfire safety and PSPS preparedness community outreach strategy, using lessons learned and feedback received from customers and stakeholders. Further, PG&E conducts community outreach to educate agencies, customers, and property owners on aspects of our wildfire mitigation practices, such as vegetation management and system hardening, and the role they play in helping to reduce wildfire risks in their communities.

PG&E incorporates multiple platforms and tactics into our engagement approach that enable PG&E to regularly hear and act upon feedback from agencies with an imperative to serve their communities in emergencies, critical facilities, and other key customers and customer associations. PG&E incorporates multiple platforms and tactics into our engagement approach that, enable PG&E to regularly hear and act upon feedback from agencies with an imperative to serve their communities in

emergencies, critical facilities, and other key customers and customer associations. We remain flexible and have the ability to adjust or customize our approach according to community needs, and to focus efforts strongly on jurisdictions and geographies most heavily impacted by PSPS events, while maintaining an inclusive posture for all agencies impacted by PSPS in the 2019 and 2020 fire seasons.

Due to the ongoing COVID-19 pandemic, PG&E will follow prevailing public health guidelines, including hosting meetings virtually when needed. In years' past, PG&E has been able to collaborate with agencies, critical facilities and other stakeholders on the design of outreach forums, including designing in-person meetings and community town halls. The ongoing COVID-19 pandemic has prevented most in-person engagement efforts for most of 2020 and will continue to restrict in-person engagements in 2021. PG&E will continue to follow prevailing public health guidance first and foremost when planning 2021 engagements and will also consider the preferences of agencies, customers, communities, and our own internal staff.

1. **Agency and Critical Facilities Outreach/Advisory Committees:** PG&E works closely with agencies and critical facilities to ensure they are informed of PG&E's wildfire safety work in their area. PG&E often also relies on these agencies to provide key local guidance and partner with PG&E to gain efficiencies in local wildfire project implementation. For example, a local permit may be needed or PSPS preparedness activities may be required to help minimize customer impacts. That is why PG&E has an extensive outreach plan and dedicated representatives to ensure agencies and critical facilities are informed and have an opportunity to provide feedback. Agencies, critical facilities, and community groups may also directly engage with PG&E customers and communities and can provide additional outreach support to increase awareness and support of utility wildfire mitigation activities.

   Table PG&E-7.3.10-1 includes the key agency and critical facilities engagements, and the proposed timing of each engagement tactic in 2021.

PGE-DIXIE-NDCAL-000005188

TABLE PG&E-7.3.10-1: KEY AGENCY AND CRITICAL FACILITIES OUTREACH TACTICS AND TIMING

Type	Description	Timing
PSPS Regional Working Groups	Forum for stakeholders to learn key information on the previous wildfire and PSPS season and to share feedback on wildfire safety work, discuss lessons learned, build regional collaboration and incorporate learnings into future wildfire safety and PSPS plans.	Quarterly
Wildfire Safety Working Sessions	Co-hosted with County Office of Emergency Services (County OES), this meeting is an opportunity to partner on PSPS planning efforts, share local progress on wildfire mitigation work and track action items.	Q2-Q3 2021
PSPS Exercises & Workshops	Review and test PSPS policies, procedures and tools with public safety partners, with a focus on enhancements and new features in advance of the 2021 wildfire and PSPS season.	Q2-Q3 2021
Additional PSPS Trainings & Workshops	Ad-hoc, or as-needed trainings and workshops for agency partners, based upon agency feedback (i.e., PSPS Portal).	Ongoing and as needed
PSPS Listening Sessions	Open forum for PG&E to share information on the previous wildfire and PSPS season and to listen to county, tribal, and critical facilities' concerns and gather important feedback on 2021 PSPS events. The feedback will be used to prioritize improvements for 2022.	Q4 2021
PSPS Advisory Committee	Select county, city and tribal governments to obtain focused input, solicit recommendations and gather feedback regarding PSPS improvements.	As needed
People with Disabilities and Aging Advisory Council (PWDAAC)	Forum that provides insight into the needs of AFN populations related to emergency preparedness and to facilitate co-creation of solutions and resources to serve the customers reliant on power for medical needs	Quarterly
Other AFN Advisory Councils	Statewide IOU AFN Advisory Council Disadvantaged Communities Advisory Group (DAC-AG) Low-Income Advisory Board (LIOB) among others Communities of Color Advisory Group Customer Advisory panels with National Diversity Coalition (NDC) and Communities of Color These are designed to gather customer feedback on our outreach efforts and other important topics impacting low-income, disadvantaged, and underserved communities.	Varies
Energy and Communications Providers Coordination Group	Forum for communications providers to provide feedback on PG&E's current PSPS implementation protocols and to coordinate engagement before and during PSPS events	As needed
Key Customer Association Collaboratives	Ongoing engagement, intelligence sharing, consultative support, and contact updating efforts	Ongoing
Ongoing Outreach and Coordination	Outreach on a myriad of topics related to wildfire safety work.	Ongoing

- **PSPS Regional Working Groups:** As required by Decision (D.) 20-05-051, PG&E hosts quarterly meetings with tribal and local government entities, public safety partners, and representatives of AFN and vulnerable customers[1] grouped into five regions across PG&E's territory. These meetings are structured to enable feedback and information sharing on aspects of PSPS event execution and planning. This includes aspects of PSPS, including Community Resource Center (CRC) planning, communication strategies, information sharing, identification of critical facilities, strategies for supporting AFN communities and contingency plans. Please see Section 7.3.9.2 for a description of how PG&E is planning to integrate two out of four quarterly Regionalized Working Groups with the Wildfire Order Instituting Investigation (OII) (Investigation (I.) 19-06-015) requirement to host Semi-Annual Wildfire Mitigation Meetings. These meetings will provide a forum for PG&E to share regional updates on local wildfire mitigation activities hear critical feedback in each of the five regions.

  PG&E began these Regional Working Groups in Q3 2020 and will continue quarterly meetings in 2021. Please see Section 7.3.9.2 for a description of how PG&E is planning to integrate two out of four quarterly Regionalized Working Groups with the Wildfire OII (I.19-06-015) requirement to host Semi-Annual Wildfire Mitigation Meetings. These meetings will provide a forum for PG&E to share regional updates on local wildfire mitigation activities hear critical feedback in each of the five regions.

- **Wildfire Safety Working Sessions:** PG&E meets with counties and tribes within our service territory to share county-specific plans for wildfire mitigation, system resiliency and the steps we are taking to address the feedback received during the listening sessions. PG&E's PSSs and Tribal Representatives work with county and tribal Office of Emergency Services (OES) to cohost Wildfire Safety Working Sessions for their respective jurisdictions. Invitees to these events include regional key stakeholders, such as cities, tribes, Community Choice Aggregators (CCA), telecommunication providers, water agencies, as well as local California Department of Forestry and Fire Protection (CAL FIRE), and California Governor's Office of Emergency Services (Cal OES) representatives. Some county and tribal governments may determine that a meeting with PG&E is not needed. The purpose of the sessions is to provide local agencies with an opportunity to

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1 D.20-05-051 at p.13.

have detailed conversations regarding PG&E's wildfire safety work planned in their community and PSPS improvements. The sessions also provide an opportunity for local officials to learn about the electric system in their community and discuss their needs and suggest any further improvements to the CWSP and PSPS Program. Feedback from the sessions has helped to shape local planning for PSPS events, including critical facility locations, CRC locations and local contacts for emergency response.

PG&E will plan to host Wildfire Safety Working Sessions in each jurisdiction impacted by PSPS if desired by that jurisdiction. In 2021, as PG&E determines the content of the Wildfire Safety Working Sessions, we will work to prioritize the needs of jurisdictions impacted the most by PSPS events and wildfires in terms of frequency of events, and total and unique customers impacted, critical facilities impacted, and localized issues that may have caused escalations. While the needs of the most impacted jurisdictions will take highest priority in planning, PG&E will still strive to make these sessions as inclusive and valuable as possible to the broader audience of all jurisdictions.

- **PSPS Exercises and Workshops:** PG&E invites County OES and Tribal Leaders to workshops that review PG&E's PSPS Policies and Procedures document and solicit feedback. PG&E's Emergency Preparedness and Response (EP&R) Department then hosts PSPS full-scale exercises where PG&E test our ability to communicate effectively with our partners during PSPS events, gain efficiencies within roles, and identify possible areas of improvement that PG&E and our partners may undertake in advance of the 2021 fire season. Following the exercises, after action reviews are completed to identify adjustments needed to procedures and/or where additional training is required. These PSPS exercise and workshops are a continued best practice in 2021. In 2020, PG&E hosted three regional exercises and workshops.

- **Additional PSPS Trainings and Workshops:** PG&E hosts additional PSPS trainings and workshops for public safety partners, as needed. For example, in 2020, PG&E launched a new PSPS Portal and provided weekly trainings in the summer for public safety partners to ensure appropriate users had access and were able to navigate the tool ahead of any PSPS events.

Similar to the approach taken for the Wildfire Safety Working Sessions, in designing the scope and content of these PSPS trainings and workshops, PG&E prioritizes topics that are most valuable to the jurisdictions most impacted by PSPS in terms of frequency of events, total and unique customers de-energized, impact to critical facilities, and other localized issues that may have caused escalations.

PG&E aims to be more customized in our outreach efforts based on the needs of the agency and remain adaptive. PG&E is looking to incorporate additional customized options for agencies, with a focus on those most impacted by PSPS and wildfires, such as:

- Hosting field tours to view grid control centers or temporary generation sites;
- Co-creating ideas for new tools and processes with agency partners;
- Establishing additional user testing groups to gather real-time feedback as we build new emergency management tools and processes;
- Hosting topic-specific workshops to provide additional information on PG&E programs, localized drivers of PSPS, wildfire mitigation activities in their communities and other topics of interest;
- Co-hosting public-facing events with agency partners to address questions and concerns from the community related to PSPS and wildfires; and
- Partnering with additional external partners organizations to assist with outreach and engagement.

- **Listening Sessions:** PG&E will host listening sessions with counties, tribal governments, and large commercial customers and critical facilities impacted by PSPS events, if the stakeholder is interested in meeting. This provides an open forum for PG&E to share localized key information on the most recent wildfire and PSPS season, listen to concerns, gather important feedback and identify ways to improve coordination and partnership with local communities going forward. These PSPS Listening Sessions are a continued practice from the 2019 fire season and were well received by agency stakeholders. PG&E uses feedback to guide improvements to our wildfire mitigation activities (i.e., PSPS Portal improvements, PSPS mitigation projects such as sectionalizing and hardening, notifications to customers and agencies, CRC locations and planning,

partnerships with CBOs and other topics) and help prioritize key focus areas for the following year. We coordinate with county and tribal emergency Managers and customers, to schedule each meeting and to determine the appropriate meeting participants.

- **Advisory Committees:** PG&E's advisory boards provide hands-on, direct advisory functions related to PG&E's wildfire mitigation strategies like PSPS. This includes helping PG&E develop best practices for PSPS protocols, community preparedness, regional coordination and the optimal use of existing and emerging technologies.

  - **PSPS Advisory Committee***:* PG&E established a PSPS Advisory Board in 2020, which includes representatives from local and tribal governments. These meetings provide a forum for participants to weigh in on a variety of PSPS Program updates such as customer notification scripts, wildfire safety working session content and meeting outlines, and PSPS full-scale exercises, among other topics. PG&E plans to continue to host these meetings periodically to gather feedback on PSPS-related topics, including PSPS planning for 2021 and coordination with local communities and shared resources.

    In 2021, PG&E will evaluate local and tribal representation on the PSPS advisory committee for diversity of regions and PSPS experiences. PG&E may make adjustments to this committee once that evaluation is complete in early 2021.

  - **People with Disabilities and Aging Advisory Council (PWDAAC):** PWDAAC consists of members representing a diverse mix of expertise, backgrounds, and perspectives of the AFN population and provides insight into the needs of AFN populations related to emergency preparedness. The Council facilitates co-creation of solutions and resources to serve the customers reliant on power for medical needs before, during and after a PSPS event in PG&E's territory. More details on PWDAAC is included in Section 8.4 and PG&E's 2021 PSPS AFN Plan.

  - **Statewide IOU AFN Council:** PG&E, Southern California Edison Company (SCE), and San Diego Gas & Electric Company established the Joint IOU AFN Advisory Council. The Joint Council is a diverse group of recognized CBOs, association and foundation leaders supporting the AFN population, and leaders from various state agencies. It provides insight into the

unique needs of the IOUs' most vulnerable customers and stakeholders, offers feedback, makes recommendations, and identifies partnership opportunities to serve the broader AFN population before, during, and after a PSPS event. PG&E will continue to meet with these stakeholders and will periodically bring these groups together, along with other stakeholder groups outlined in D.20-05-051, to solicit feedback on the PSPS Program.

- **Other AFN Councils:** PG&E hosts meetings with the NDC and Communities of Color to provide safety-related outreach such as wildfire safety, PSPS preparedness and specific safety-related gas or electric projects impacting disadvantaged and underserved communities. Through our relationship with NDC and Communities of Color, we host customer advisory panels designed to provide customer feedback on our outreach efforts related to public safety and other important topics impacting low-income, disadvantaged, and underserved communities. PG&E also hosts an annual executive-level meeting with NDC leadership to better understand NDC members' perspectives and recommendations to improve the effectiveness of PG&E's community outreach and engagement. PG&E also leverages opportunities to share emergency preparedness, and CWSP and PSPS updates at other stakeholder meetings such as the DAC-AG and the LIOB among others. Further, we use our network of CBOs to support our AFN stakeholder outreach work, as described in Section 8.4.

- **Energy and Communications Providers Coordination Group:** PG&E initiated this group in early 2020, to create a forum for communications providers to provide feedback on PG&E's current PSPS implementation protocols and to coordinate engagement before and during PSPS events. Attendees include, but are not limited to, representatives from AT&T, Verizon Wireless, Comcast, Charter Communications, Frontier Communications, T-Mobile, Consolidated Communications, U.S. Cellular, Sierra Telephone, and Cellular Telecommunications and Industry Association. Throughout 2020, PG&E received valuable feedback from this group. For example, representatives from Verizon, AT&T, Comcast, T-Mobile, U.S. Cellular, Charter Communications, Cox Communications, provided feedback to PG&E, California Public Utilities Commission (CPUC or Commission), and Cal OES

about PG&E's September 2020 PSPS events. While feedback was generally positive, the group recommended improvements for more accessibility to PSPS event information, including maps in the PSPS portal and the support role provided during PSPS events by PG&E's Critical Infrastructure Lead. In 2021, PG&E to host, as needed, meetings to discuss collaboration and engagement opportunities before and during PSPS events, and for other wildfire and "all hazards" resiliency and readiness initiatives.

- **Key Customer Association Collaborative:** PG&E regularly meets with key customer stakeholders including large customers, community groups and business associations. PG&E uses these meetings to provide information about wildfire mitigation efforts, local progress on wildfire safety measures and expanded resources available to prepare for PSPS events. For example, throughout 2020, PG&E met with:

  - California Hospital Association (CHA);
  - Hospital Council Board of Directors of Northern and Central California;
  - California Association of Medical Product Providers;
  - Telecommunications and broadband providers;
  - Water agency members of the Association of California Water Agencies (ACWA), and directly with water and wastewater agencies; and
  - Industrial and commercial members of California Large Energy Consumers Association and the Small Business Utility Advocates.

  In 2020, PG&E conducted meetings with nearly 300 individual stakeholders. PG&E will continue these meetings throughout 2021. Throughout 2021, PG&E will build on collaborative relationships with the CHA and the Hospital Council of Northern and Central California. PG&E plans to host bi-monthly resiliency workshops with telecommunications and broadband providers, municipal utilities, and with water agencies, both via the ACWA and directly with water and wastewater agencies.

- **Ongoing Outreach and Coordination:** As noted above, PG&E's Federal Affairs, State Government Relations, LPA, PSSs, Tribal Relations, and Customer Care departments

have dedicated representatives responsible for ongoing coordination with their respective stakeholder groups.

For example, PG&E supports the unique and complex needs of our largest industrial, commercial, and agricultural customers with a dedicated team of over 60 CRMs supporting over 3,500 business customers. PG&E's dedicated CRMs provide critical information and timely updates before, during and after a PSPS event to large business customers. PG&E will continue to engage with business and critical customer accounts to support wildfire, PSPS and emergency preparedness planning, including topics such as business continuity, backup power options, safety, financing, and sourcing.

2. **Customer and Community Outreach:** PG&E continuously engages with customers and communities regarding wildfire safety and with customers who may be directly impacted by a PSPS event. This effort is to increase public awareness and support of PG&E's wildfire mitigation activity. PG&E prioritizes engagement with those most likely to be impacted by PSPS, which include those served by electric lines (specifically those served by electric lines 115 kilovolts and below) which traverse Tier 2 and Tier 3 High Fire Threat District (HFTD) areas. PG&E also implements additional touchpoints for Medical Baseline (MBL) customers,[2] those with limited English proficiency and the AFN community.

   PG&E will leverage multiple channels, such as open houses and webinars, e-mails, letters, bill inserts, postcards, radio and Television (TV) broadcasting, print media, informational videos, social media, digital engagement (e.g., website), and possibly face-to-face meetings.[3] PG&E will continue direct-to-customer outreach campaigns that are focused on, but are not limited to, building PSPS readiness among customers, gathering updated contact information and sharing backup power safety tips.

   - **Communications for AFN Populations and Limited English Proficiency Populations:** PG&E translates "critical information" which includes resources focused on emergency preparedness, wildfire safety, and PSPS preparedness in 15 prevalent non-English languages. PG&E customers with limited English proficiency can contact PG&E any time, whether during an emergency or simply for a bill inquiry and have access to in-language support via our Contact Centers, which are equipped to

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2 MBL customers are PG&E customers who are eligible for MBL tariffs and receive an additional allotment of electricity and/or gas per month. The tariffs are designed to assist residential customers who have special energy needs due to qualifying medical conditions.

3 As applicable due to the COVID-19 pandemic and safety concerns with large gatherings.

provide translation support in over 250 languages. Additionally, we have partnerships with CBOs and multicultural media partners to provide in-language outreach spoken by people that occupy significant roles in California's agricultural economy (e.g., Mixteco and Zapoteco). Many of our materials such as webinar presentations and PSPS notifications are recorded in American Sign Language (ASL) via our collaboration with NorCal Services for Deaf and Hard of Hearing. Our wildfire safety and PSPS customer information and materials are available in alternate formats, including Braille and large print, upon request. Please see Section 8.4 for details on PG&E's communications for AFN populations and limited English proficiency populations.

- **Wildfire Safety Town Halls,[4] Webinars and other Community Events:** PG&E hosts interactive virtual safety town halls and webinars to share safety and utility service-related information with attendees and gather feedback from members of the community (anticipated by June 2021). These events are designed for anyone who is interested in learning more about our CWSP and allow community members to learn more about wildfire safety and emergency preparedness, meet with PG&E representatives, ask questions and share feedback. The presentation portion of certain webinars are recorded in 16 languages, including ASL. PG&E makes the full schedule of webinars, along with presentation documents and recorded and translated videos of presentations, available at pge.com/firesafetywebinars. PG&E plans to continue to host and/or participate in community events focused on customers with disabilities, seniors, and low-income customers, including targeted webinars and participation in meetings hosted by CBOs. In 2021, the format and timing of community events will depend on the public health safety protocols related to COVID-19. PG&E anticipates that the bulk of community events will occur virtually, like many 2020 events. When it becomes safe for our customers, communities, and employees to gather, PG&E plans to resume to in-person events, based on state and local health guidance.

- **Direct-to-Customer Outreach**: To help customers prepare for emergencies and a potential PSPS event, PG&E plans to conduct a multi-channel outreach and awareness campaign throughout 2021 including letters, e-mails, emergency preparedness resources, tenant education kits, postcards

4 Per I.19-06-015, Joint Motion of PG&E the Safety and Enforcement Division of the CPUC, Coalition of California Utility Employees, and the Office of the Safety Advocate for Approval of the Settlement Agreement, pp. 25-26.

and more. These include, but are not limited to large customer "Update your contact information" e-mails; Public safety partner e-mails (water, telecom, transportation); a PSPS awareness bill package; Residential customer "Update your contact information" postcards; Master Meter MBL tenant e-mails; Master Meter tenant education e-mails; tenant education kits; "No Contact Information" bill packaging/envelope messaging; PSPS awareness e-mails; MBL acquisition letter/e-mails; PSPS awareness bill insert/envelope messaging; Backup power education e-mails; and PSPS preparedness brochure/MBL brochures.

As mentioned above, PG&E also supports the unique and complex needs of our largest industrial, commercial and agricultural customers.

Figure PG&E-7.3.10-1 includes a sample brochure, fact sheet, bill insert, postcards and doorhanger used during PG&E's direct-to-customer outreach.

FIGURE PG&E-7.3.10-1: SAMPLE BROCHURE, FACT SHEET, BILL INSERT, POSTCARDS, AND DOORHANGER

- **Wildfire Program Outreach:** PG&E conducts community outreach to educate customers/property owners on the details of PG&E's wildfire safety programs and the potential need for their participation to reduce wildfire risks in their communities. PG&E maintains an open channel of communication with customers and communities who proactively reach out to PG&E when identifying safety risks related to these programs.

  To identify and implement efficient and appropriate customer and community communications, PG&E assesses the anticipated program impacts related to planned road closures, property access needs, tree removal, pole inspections, and helicopter operations, among others. To set expectations with customers and with the goal of limiting work refusals or access issues, PG&E uses various communication methods, such as letters, postcards, text messages, e-mails, and automated calls through Interactive Voice Recordings. PG&E will provide translated outreach in alignment with the language access and translations strategy described in Section 8.4.2..

  Outreach includes broad communications about PG&E's wildfire safety-related work scope in neighborhoods, cities, and counties, as well as direct communications to customers/property owners who may be impacted by PG&E employees and contractors requiring access to their sites to conduct the necessary safety-related wildfire prevention work.

  PG&E also responds to issues raised by customers/property owners including general access issues (e.g., locked gate), or sensitive access issues (e.g., medical concerns). In some cases, properties requiring access/work may be occupied by a customer of record that differs from the property owner, in which case PG&E will engage with both. PG&E addresses these issues by contacting the customers/property owners directly to understand their concerns and to develop a mutual solution that allows access to complete the relevant wildfire safety work.

  In certain instances, such as in the system inspections program, if PG&E is unable to coordinate access to our facilities with the customer/property owner, PG&E may leverage authorization via Rule 11 to turn off customers' power to complete safety-related work to inspect or repair facilities. PG&E will only consider this tactic to ensure safety related work can be completed and will work to limit such instances. Customers will receive multiple advanced

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communications from PG&E if this action must be implemented.

PG&E works with customers to develop solutions to resolve property owner non-compliance issues (e.g., property access or work refusals) and escalated CPUC complaints by landowners that are impacted by PG&E's CWSP programs, including Electric Vegetation Management, system hardening, and system inspections.

Throughout 2021, PG&E will continue to conduct customer outreach and respond to customer-related access issues. As we do with all customer outreach, we will look for ways to improve our programs, focusing on building relationships with property owners where PG&E assets are located.

- **Digital Engagement**: PG&E's website is a key tool in ensuring customers and community members have access to information about wildfire mitigation activities, PSPS readiness initiatives, and PSPS event information. PG&E's website (pge.com) allows customers to have access to 24/7 information before, during and after a wildfire and/or PSPS event. PG&E's website provides customers with convenience and flexibility by allowing them access to a variety of topics associated with wildfire related including wildfire safety (pge.com/wildfiresafety), emergency preparedness (pge.com/emergencypreparedness) and PSPS planning and preparedness information (pge.com/psps). Our wildfire safety webpages provide customer resources that include details on wildfire safety events, program resources such as the MBL Program, and information on preparing for multiple day outages. Our web-based CWSP resources provide customers and community members important information about our wildfire safety initiatives, and a bi-weekly update on the progress we have made toward our commitments. To ensure that our customers have information about emergency-related outages, including those related to wildfire and/or PSPS, we encourage customers to sign up for outage alerts via our online platform "Your Account."

  An important feature of our website is our "Safety Action Center,"[5] which is a dedicated safety webpage featuring helpful information about wildfire risks and what customers can do to keep their home, family or business safe, including tips on how to create an emergency plan, emergency preparedness guides and videos.

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5 https://www.safetyactioncenter.pge.com/.

To ensure scalability during high volume emergency events, including PSPS events, PG&E launched a standalone cloud-based website called the "Safety and Alerts Center." The Safety and Alerts Center is located at pgealerts.alerts.pge.com; however, consumers do not need to learn this new Uniform Resource Locator. Whenever there is a high-volume event, PG&E will redirect traffic from pge.com over to the standalone site. Once on the new site, users can choose to stay there to get PSPS information or to continue on to pge.com. PG&E's main website pge.com, currently has the capacity to serve 400 million hits[6] per hour, and PG&E's emergency website, which maintains the PSPS event update information, can serve 240 million hits per hour. Both sites use a cloud-based provision solution. The alerts site allows PG&E to handle traffic spikes while maintaining normal course of business (e.g., customers log into their accounts to view energy statements, pay a bill, submit a service application).

Other website improvements include an "all-in-one" map that includes both PSPS planned outages and actual outages (previously two separate maps and webpages), more precise event maps at the parcel level (rather than buffered polygons that may falsely indicate certain addresses are included or excluded from the event scope). Today, the website provides lower bandwidth options, including "no map" outage tools on the website, which are easier to access for certain customers (such as cell phone users), and uses more concise language and layouts for fast, clear information delivery.

PG&E's website is also accessible for customers with AFN. For example, our emergency website, used during PSPS, includes 15 non-English languages. Additionally, many of our wildfire and emergency preparedness webpages are also available in 15 non-English languages. Further, the PSPS alert site has been designed with accessibility in mind and that each feature has been tested by our accessibility partner, Level Access, before moving the feature into production. More details on PG&E's support for customers with limited English proficiency and AFN website accessibility can be found in Section 8.4.

- **Informational Videos**: PG&E uses informational videos to inform customers about or CWSP and PSPS available at the newly-launched pge.com/pspsvideos webpage. Building off

6 Website hits measure requests for data sent to a server when a user accesses a webpage (e.g., images viewed, data downloaded). One page visit or page view can result in one or more hits.

our success in 2020, PG&E will continue a series of videos about the CWSP and PSPS events. For example, in 2020, PG&E developed a series of short (3-5 minute) and long-form videos (30 minutes) about the CWSP and PSPS programs. Topics include PSPS improvements, PSPS decision-making, and weather monitoring. PG&E also created and aired a 30-minute television program, called "Preparing for Public Safety Power Shutoff," which provides details of our CWSP and shares ways customers and communities can plan and prepare for PSPS events. The program aired between September and November 2020 with 25 television placements throughout our Northern and Central California service territory—many of these placements coincided with PSPS events to provide the right information at the right time in affected communities. PG&E is planning to develop additional short-form videos about other wildfire safety topics, including electric vegetation management, microgrids, PSPS power restoration steps and more.

- **Media Engagement:** PG&E works closely with external media outlets, including both paid and earned media, to provide broad awareness to Californians to share tips related to wildfire and PSPS preparedness, socialize available resources, and communicate PSPS event information. This includes PG&E multicultural media engagement that reaches our non-English speaking customers and community members, as described in Section 8.4.

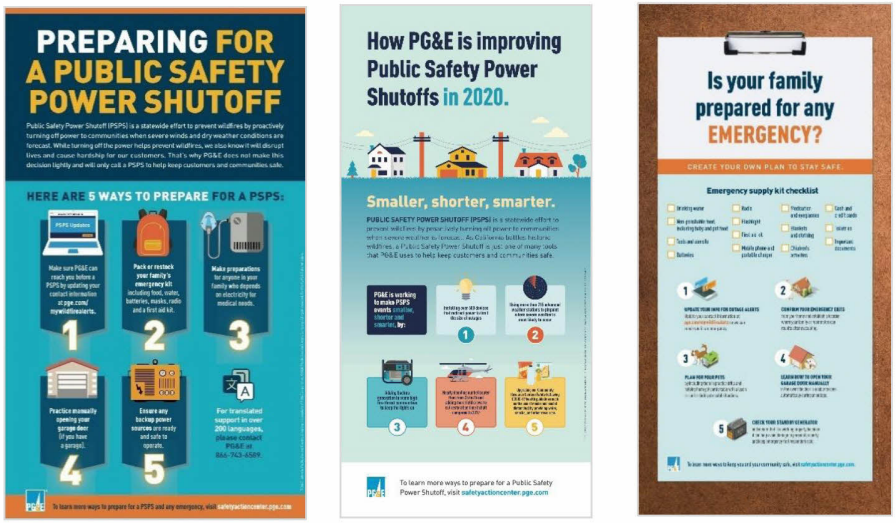
  - **Media Outreach:** PG&E engages with the media by issuing news releases, conducting and live streaming news conferences with ASL translators, and participating in media interviews. In turn, these media organizations may provide communications on the radio, broadcast, TV, and online. PG&E also reaches out to local newspaper outlets with PG&E Letters to the Editors to further prepare customers for emergencies, PSPS events and help provide information on wildfire safety. To serve customers with limited English proficiency, PG&E engages with over 150 multi-cultural media outlets throughout the year in an effort to promote safety initiatives, including PSPS, to monolingual or difficult to reach populations that may not have access to mainstream television media or read/speak English. PG&E shares news releases and coordinates interview opportunities with these media outlets to help educate limited English-speaking customers on various PG&E programs, including the CWSP, PSPS, emergency preparedness, and public

safety among other topics. Additionally, PG&E schedules media visits with these organizations to discuss other partnership opportunities (e.g., Public Service Announcement, advertising, event sponsorships). During PSPS events, select media outlets are notified based on their geographic coverage and frequency in running event updates.

– **Paid Media and Advertising:** To supplement PG&E's outreach efforts, PG&E runs wildfire safety and emergency messages to reach customers via paid media channels. PG&E purchases a combination of English and in-language radio ads, as well as digital banners in English and multiple languages based on targeted zip codes.

Figure PG&E-7.3.10-2 includes sample print advertisements used in 2020.

FIGURE PG&E-7.3.10-2: SAMPLE 2020 ADVERTISEMENTS



– **Social Media**: PG&E regularly provides customer preparedness resources through our official social media channels, including Twitter, Facebook, Instagram, and Nextdoor. During the 2020 PSPS events, PG&E provided event update videos on our social media platforms in English, ASL, Spanish, and Chinese.[7] Some social media posts are translated into

7 See examples of translated social media posts:

- PSPS Alert Banner: https://twitter.com/PGE4Me/status/1321169776014667779/photo/1.

up to 15 languages. We also developed a three-minute YouTube video on safety tips for those with medical needs. We continue to work with 36 multi-cultural media organizations and five CBOs to assist with in-language communications and share our social media posts before and during PSPS events. PG&E plans to leverage our social media platform throughout 2021.

- **Community Partnerships:** We regularly work with community partners to better prepare for emergencies. For example, PG&E partners with the California Fire Foundation to provide Wildfire Safety and Preparedness grants focused on funding for firefighters and Community/Neighborhood Emergency Response Teams in Northern California, specifically communities identified as extreme or elevated fire risk. PG&E also funds local climate resiliency projects through the Better Together Resilient Communities grant program. Further, PG&E awards grants to local Fire Safe Councils to fund shovel-ready projects to help keep communities safe. The funds help pay for fuel reduction, emergency access and defensible space projects, as well as chipper days in local communities.

C) <u>Strategy and Actions Taken to Design, Translate, Distribute, and Evaluate Effectiveness of Related Communications</u>

As noted above, PG&E engages with agencies and critical facilities in multiple fora that foster open and transparent communication and encourage key stakeholders to provide candid feedback. The feedback is then reviewed internally and determined if feasible and appropriate to implement into PG&E's operational and/or engagement plans. Below is a list of evaluation mechanisms that PG&E employs to assess effectiveness of agency and critical facility outreach and identify improvements as needed:

- **After engagement surveys:** Provided to agencies, critical facilities, large businesses and other stakeholders that have participated in engagement efforts to ask for feedback on effectiveness of the engagement and solicit ideas for engagement improvement and future topics for engagements and trainings.

- PSPS Event Update in Chinese: https://twitter.com/PGE4Me/status/1321220048791334912?s=20
- PSPS Update in Spanish: https://twitter.com/PGE4Me/status/1321219692392968193?s=20
- PSPS Warning Alert in ASL: https://twitter.com/PGE4Me/status/1320423102866542593?s=20

- **After-engagement internal evaluations:** After each type of engagement (e.g., listening sessions and regional working groups), PG&E evaluates feedback from stakeholders received on the effectiveness of the meeting and determines where improvements can be made before the next engagement effort. In this way, PG&E seeks to continuously improve in terms of the value of engagements to our stakeholder partners.

- **Advisory committees and councils:** The advisory committees and councils described in the section above (*Strategies and Actions Taken to Identify and Contact Key Community Stakeholders*) are designed to help PG&E improve our actions to help communities prepare for emergencies including PSPS, and to provide input on our wildfire mitigation activities generally. Part of this scope will include committee and council evaluations on effectiveness of communications, covering stakeholder engagement throughout the year, as well as in-emergency stakeholder notifications. PG&E will take committee and council feedback into account when designing future engagements and communication plans.

- **Feedback from local PG&E representatives:** Local PG&E representatives—PSS, LPA, Tribal Representatives, and CRMs—seek feedback on communication effectiveness from agencies, community stakeholders and customers throughout the year, both in formal engagements and during informal conversations. These local PG&E representatives share this valuable feedback internally and it is then used to evaluate effectiveness of communications and to identify specific actions that PG&E can take to improve.

The section above (*Strategies and Actions Taken to Identify and Contact Key Community Stakeholders*) also notes the various ways PG&E engages with customers. We understand that every customer is different, and it is important to have various engagement types on to engage frequently. To measure effectiveness, PG&E collects feedback from customers on outreach and identifies barriers and areas for improvement. The feedback is collected both prior to and after wildfire and/or PSPS events.

We evaluate outreach effectiveness around wildfire safety and PSPS preparedness through both qualitative and quantitative research. Examples of qualitative research include input from small groups of customers. Quantitative research involves representative surveys of a specific population (customers, CBOs, etc.) that may measure statistically significant progress over time. These include measures of message awareness and recall, message understanding, and reported changes in behavior. Non-survey quantitative measures include web-traffic, click-through rates of advertisements and conversion rates / actions taken by customers as a result (e.g., attendance of a webinar,

updates made to contact information, or adoption of various customer programs).

- **Opinion Surveys**: Before and after the start of wildfire season, PG&E conducts semi-annual surveys with customers (in both English and Non-English languages) to capture awareness and recall, understanding of, and satisfaction with PG&E's customer communications and to measure statistically-significant changes over time.

- **Transactional Surveys**: PG&E hosts website surveys that allow customers to provide direct feedback on the site page and topic. PG&E's e-mail newsletters also provide customers the option to score the value of the content and to provide direct comments.

- **Customer Feedback**: PG&E regularly reviews customer sentiment received directly by account Managers, via the Contact Center, the website, and other social outlets during and after events. Additionally, PG&E conducts qualitative research in collaboration with customers to identify solutions and potential program offerings to improve future customer experience and outreach.

- **Input from local organizations**: PG&E continues to work with CBOs that serve the AFN populations to both amplify messaging and solicit feedback before and after outreach.

PG&E also quantitatively tracks customer engagement at different periods of time throughout wildfire season to understand customer behavior in the following ways:

- **Web Traffic**: Traffic to relevant pages on PG&E's website, such as wildfire alerts, updates to contact information, wildfire safety pages, safety action center, statewide PSPS program. Website traffic is currently measured by assessing number of unique visitors, visits, and page views.[8]

- **Click-through-rates of advertisements**: Click-through-rate of advertisements is an industry-accepted standard that measures the number of people visiting a webpage who access a hyperlink to an advertisement (e.g., wildfire safety). To note, advertisement click-through-rates measure the immediate response to an advertisement but not necessarily the overall response.

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8 Unique visitors are the number of individuals that visit the specific webpage. These unique visitors may make multiple visits to the webpage. Page views account for all webpages served by the website (pge.com) whereby a unique visitor goes to multiple pages on the website.

Customers may see the advertisement, absorb the messaging, and choose to act later.

- **Conversion rates / actions taken by customers as a result**: Conversion rates of customers are the measurable actions taken by customers based on the outreach (e.g., updating contact information, attending an open house, enrolling in MBL Program).

As required by D.20-03-004 OP 16, PG&E filed our independent survey results that assess the effectiveness of 2020 community outreach on December 31, 2020.

PG&E will continue to apply best practices and leverage lessons learned from our 2020 customer outreach experience. Going forward, we support a collaborative, data driven process to define the most effective and appropriate outreach and in-language translation requirements.

D) Strategies and Actions Taken to Address Concerns and Serve Needs of AFN Populations and Non-English-Speaking Customers[9]

PG&E is committed to providing additional services to AFN and medically sensitive customers by partnering with organizations that assist and provide services to the AFN community. PG&E will continue to engage and collaborate with local governments and CBOs that serve AFN groups to encourage awareness and enrollment of the MBL Program.

Please see Section 8.4 that provides more details on our AFN population support strategy before and during PSPS events, including programs that serve these customers, preparedness outreach approaches that are focused on vulnerable populations, and in-event customer communications that serve AFN populations. This is also detailed in PG&E's 2021 PSPS AFN Plan, filed February 1, 2021.

- **MBL Program Outreach:** MBL enrollments increased significantly in 2020 due to a new acquisition campaign, the launch of the online self-certification, the COVID-19 customer protections that suspended program removals and the ability for customers to provide authorization of eligibility from a qualified medical

9 Section 8.4 Engaging Vulnerable Communities includes the definition of AFN populations and prevalent languages in PG&E's territory.

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practitioner.[10] PG&E will continue to conduct additional outreach to eligible customers to drive participation in the program, collect contact information in preparation for PSPS events, and share other relevant PG&E program and services information to streamline communications, as appropriate. This support includes:

- Continuing our acquisition campaign using our propensity model to better target eligible customers;
- Launching an online process that allows qualified medical practitioners to electronically certify that a customer is eligible for the program;
- Providing financial support to CBOs for marketing, outreach, and other services to MBL customers;
- Increasing our engagement with the healthcare industry to encourage more program enrollments;
- Providing master meter tenant education with both owners and tenants; and
- Adding self-identified vulnerable, vulnerable senior, and disabled customers to our MBL outreach efforts.

In 2021, PG&E plans to implement improvements to the MBL enrollment and unenrollment processes such as:

1. Creating an electronic process for medical practitioners to certify and renew customer MBL eligibility,
2. Sending e-mail reminders to customers to recertify eligibility, and
3. Providing a welcome package that includes additional information about the MBL Program.

- **CBO-Engagement and Multi-Cultural Media Organizations:** PG&E partners with CBOs throughout the year in targeted

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10 In light of the COVID-19 pandemic, shelter-in-place requirements and customers' limited access to medical practitioners, PG&E made significant revisions to our MBL Program requirements for the coming year. On May 1, 2020, PG&E filed in Advice Letter (AL) 4244-G/5816-E (and supplemented with two additional ALs, AL 4244-G-A/5816-E-A and AL 4244-G-B/5816-E-B), which included the following modifications to the MBL Program: (1) Allowing customers to self-certify their eligibility to enroll in the MBL Program without a signature from a qualified medical professional; (2) Suspending all customer removals from the MBL Program; and (3) No longer sending forms to customers that require them to re-certify for the MBL Program through a doctor or other eligible medical professional.

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communities to increase their capacity to serve AFN communities, such as medically sensitive customers, low-income, limited- English speaking and tribal customers. Our focus is on EP&R, disaster resiliency and expanded access to 211 referral services. We partner with multicultural media organizations to help translate communications and make them more accessible for people with disabilities. Through CBO collaborations, PG&E also seeks to provide additional, customer-specific support to AFN community member customers during a PSPS event, such as medical device charging at local Independent Living Centers, accessible transportation to PG&E CRCs, funds for hotel stays and short-term loans of a portable backup power batteries.

As of December 2020, PG&E has engaged with over 250 CBOs for information sharing and has secured contracts with 66 CBOs to provide additional resources to customers during PSPS events (e.g., portable battery provision, food replacement and translation services/event communications in indigenous languages). PG&E will continue outreach for, and management of, ongoing customer support programs such as the Disability Disaster Access and Resources Program, Portable Battery Program, MBL Program, Tribal Engagement, Food Bank and Meals on Wheels Programs, Well Pump Generator Rebate Program, Self-Generation Incentive Program, CRC Program, and 211 referral service. More details on these customer our support programs can be found in Section 8.2.1 and Section 8.4.

- **Income-Qualified Customers and Disadvantaged Communities**: PG&E will engage stakeholders who represent, support and advocate for our income-qualified customers and disadvantaged communities. This includes engaging with Communities of Color, the CPUC's DAC-AG and the LIOB to provide relevant PSPS Program updates and gain input from participants regarding approaches to support disadvantaged communities. PG&E will also leverage California Alternate Rates for Energy and Energy Savings Assistance contractor networks to help educate customers on wildfire and PSPS preparedness. PG&E will continue to seek other ways and opportunities to engage disadvantaged and underserved communities' stakeholders and customers.

- **AFN Populations Feedback and Research:** PG&E continually seeks formal and informal feedback to improve our CWSP and PSPS-related outreach and education. We do this through consultation with PG&E PWDAAC, Statewide IOU AFN Council, DAC-AG, LIOB, local government advisory councils and working groups, Communities of Color Advisory Group, as well as research directly with customers. Please see Section 8.4, which describes how PG&E incorporated feedback from these groups into our programs and services.

Please see Section 8.4 for more details on our AFN population support strategy before and during PSPS events, the programs that serve these customers, the preparedness outreach approaches that are focused on vulnerable populations, and the in-event customer communications that serve AFN populations. This is also detailed in PG&E's 2021 PSPS AFN Plan, filed February 1, 2021, as part of Rulemaking (R.) 18-12-005 and in compliance with Decision (D.) 20-05-051.

3) ***Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):***

PG&E conducts outreach to customers and communities throughout the entire service territory. However, as mentioned previously, PG&E customizes agency outreach based upon agency need. The level of customization will vary according to the 2020 PSPS impact, with the most impacted agencies receiving the most customization in terms of localized topics covered and type of engagement. These agencies are often located in HFTD areas. Accordingly, in 2021, certain agencies may receive more frequent and more customized engagements according to their needs based upon their past experiences with PSPS and wildfires.

4) ***Progress on initiative (amount spent, regions covered) and plans for next year:***

In an effort to explain the outreach approach fully, and in a streamlined manner, we have included the progress of each outreach initiative in the response to question number two above. For additional references, below are some of PG&E's key 2020 engagement and outreach highlights:

- Hosted over 200 meetings with agencies to share information related to PG&E's CWSP;
- Held over 35 listening sessions with cities, counties, tribes and customers (e.g., telecom providers) to better understand their 2019 PSPS experiences and identify key areas for improvements;
- Co-hosted 34 Wildfire Safety Working Sessions with County OESs;
- Hosted over 15 PSPS Portal trainings with public safety partners;
- Established the various advisory committees and hosted ongoing meetings with each committee;
- Established the five Regional Working Groups and hosted two meetings in each region (Q3 and Q4 meetings);
- Held three regional PSPS workshops and three full-scale PSPS exercises;

- Hosted 15 regional and three systemwide virtual open houses and one safety town hall with over 5,000 attendees to provide a localized update on wildfire safety work happening in respective communities and answer customer questions;

- Placed over 200 posts on PG&E social media channels;

- Sent 17 direct mail pieces to customers;

- Conducted 25 customer e-mail outreach campaigns; and

- Had 84 million average monthly advertising impressions in advance of and during the months with the highest likelihood of wildfire and PSPS events (July-November).

Additional information on progress related to stakeholder cooperation and community engagement can be located PG&E's 2020 Wildfire Mitigation Plan (WMP) quarterly reports. The May to July[11] and Third Quarter,[12] Condition #28, filed with the CPUC can be found here:

- May and July 2020: https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/wildfire-mitigation-plan/PGE-WildfireMitigationPlans-QuarterlyReport.pdf

- Third Quarter: https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/wildfire-mitigation-plan/PGE-WildfireMitigationPlans-QuarterlyReport-Q3-2020.pdf

In 2021, PG&E plans to continue our territory-wide awareness campaigns established and implemented in 2020, with a focus on customers and stakeholders who have been repeatedly impacted by PSPS events. Please see the response to question number two for PG&E's 2021 outreach and engagement objectives, a table of the planned engagement tactics, and a more in-depth description of each engagement tactic. We will drive execution of customer outreach and engagement, enhanced through ongoing customer and stakeholder feedback, to propel improved customer, community, and utility readiness and resiliency in the face of growing wildfire threat. COVID-19 considerations and other unforeseen factors may also have an impact on PG&E's outreach approach for 2021.

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11 PG&E Quarterly Report on 2020 WMP For May to July 2020, submitted September 9, 2020, Condition PGE-28.

12 PG&E Quarterly Report on 2020 WMP for Third Quarter 2020, submitted December 9, 2020, Condition PGE-28.

5) Future improvements to initiative:

As referenced in our response above to questions two and four, over the next several years, PG&E will continue to ground our stakeholder cooperation and community engagement initiatives in customer and stakeholder feedback that we receive throughout each year on an annual basis.

As new information, best practices, and lessons learned are available, PG&E will refine stakeholder outreach and community engagement approach as we have done over the course of two years.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

In response to Action PGE-25, Table PG&E-7.3.10-2 illustrates PG&E's long-term plan regarding community outreach, public awareness, and communication efforts.

TABLE PG&E-7.3.10-2: LONG-TERM PLAN FOR COMMUNITY OUTREACH, PUBLIC AWARENESS, AND COMMUNICATION EFFORTS

Year Range	Focus Areas
2023-2026	Continue to gather and incorporate feedback from community partners and first responders and refine outreach plans, as applicable. Develop new partnerships to build upon and complement current outreach.
2027-2030	Continue to coordinate with stakeholders (e.g., agencies, customers, CBOs) to improve outreach, education, and communication efforts based on data, customer insights and feedback. Maturation of processes to seamlessly share information with industry peers, communities, government and tribal leaderships, and others inside and outside California.

ACTION PGE-36 (Class A):

In its 2021 WMP update, PG&E shall describe how it vets and chooses PSPS Advisory Committee representatives.

Response:

PG&E's approach to soliciting advice from key stakeholders on all aspects of the PSPS Program parallels the approach other IOUs have implemented and complies with all CPUC requirements. We have selected a representative group of state, tribal, county and city emergency Managers in both rural and urban areas across our

service territory to participate in our monthly PSPS advisory committee. In selecting PSPS Advisory Committee participants, we strove for a diversity of geography, jurisdiction size and category (state, city, county, tribal), and further refined the list based on jurisdictions' level of engagement with us around PSPS performance, prioritizing the most engaged jurisdictions. Once we selected candidates for participation, we extended invitations to join the PSPS Advisory Committee.

PG&E's PSPS advisory committee is comprised of seven counties, one city, two tribal agencies, and representatives from League of Cities and California State Associate of Counties. We developed this participant list to ensure a two-way dialogue that provides committee members the opportunity to provide feedback and share lessons learned in an open and collaborative format, while also keeping meeting sizes manageable and productive. We vetted this advisory committee based upon their level of experience in emergency management, their responsibilities to serve communities during emergencies (often based on the scope of their current positions), and/or their deep knowledge of local issues and concerns facing cities, counties and tribes in the context of wildfire mitigation and PSPS.

We are revisiting the PSPS advisory committee structure for 2021. In fact, we may broaden the participant list to include additional key stakeholders, to ensure greater engagement of participants and to bring in fresh perspectives. We are open to suggestions from the Commission and others on how we can continue to improve inclusivity while still encouraging participants to share feedback and lessons learned.

ACTION PGE-37 (Class A):

In its 2021 WMP update, PG&E shall explain how it intends to remedy the lack of communication with the three counties that declined to meet for the Wildfire Safety Working Sessions.

Response:

In 2020, PG&E reached out to counties within our electric service territory to partner in hosting Wildfire Safety Working Sessions for local agencies and organizations. Five counties (Amador, Glenn, Merced, San Luis Obispo, and Sutter) formally declined PG&E's offer to partner in hosting a Wildfire Safety Working Session.

PG&E's PSSs followed-up multiple times via phone and e-mail to offer to meet at a time that worked best for the county. Each county provided different reasons for declining our offer, including, but not limited to:

- Having limited time to meet due to the COVID-19 pandemic response efforts; especially in light of shelter-in-place response activities and guidelines;
- Having minimal PSPS or other wildfire mitigation activity impacts in their community; and
- Having a current understanding of the wildfire safety efforts in their community without further questions.

We provided county-specific Wildfire Safety Working Session meeting materials via e-mail to all five counties that declined a meeting, and our PSSs remain available to answer questions.

In general, PG&E provides multiple opportunities for counties, cities, and tribes to engage on wildfire mitigation issues throughout the year because agencies, specifically office of emergency services, are often balancing multiple issues simultaneously and may need to decline a meeting. In Spring of 2021, we will provide all counties in our service territory the opportunity to participate in a Wildfire Safety Working Session. We plan to take the same approach described above to counties that decline a session.

ACTION PGE-38 (Class A):

In its 2021 WMP update, PG&E shall provide a list of every PG&E contact and their counterparts and the cities, counties, tribal governments, and first responder entities and description of their interaction.

Response:

See 2021WMP_ClassA_Action-PGE-38_Atch01.xlsx for a list of the current PG&E contacts and their primary counterparts (name and department) in cities, counties, tribal governments, including first responder entities. We have also included dispatch centers, where PG&E coordinates with the on-duty staff, rather than a single point-of-contact. Note that this information is as of January 1, 2021 and subject to change as we continuously develop new contacts and external counterparts change positions.

Table PG&E-7.3.10-3 provides a general description of the engagement activities conducted for each department type. This includes planning and preparedness outreach, outreach during a PSPS event and outreach after a PSPS event. Please note the below summary is not all-inclusive.

TABLE PG&E-7.3.10-3: GENERAL DESCRIPTION OF ENGAGEMENT ACTIVITIES BY DEPARTMENT TYPE

Dept	PG&E Owner	Planning and Preparedness Outreach	During a PSPS Event	After a PSPS Event
OES	PSSs	Invited to Wildfire Safety Working Sessions; Provided opportunity to invite other local organizations Invited to PSPS workshops, exercises, and other trainings Provided direct access to their local PSS to answer questions, share information, discuss PSPS preparedness, etc. Note: A subset of OES leads are also included in Regional Working Groups and PSPS Advisory Committee	Receives automated calls, texts and e-mails at key milestones before, during and after an event Assigned an Agency Representative that can answer questions in real-time Invited to daily Systemwide Cooperators Call Access to PSPS Portal where maps, situational reports and other event information is located	Receives post-PSPS event de-energization report for feedback Invited to PSPS Listening Session; Provided opportunity to invite first responder entities, cities and other agencies/organizations Ongoing coordination with PSS
First Responder Entities	PSSs	Invited to emergency planning trainings Ongoing PSS coordination	Receives automated calls, texts and e-mails at key milestones before, during and after an event Invited to daily Systemwide Cooperators Call Access to PSPS Portal where maps, situational reports and other event information is located	Receives post-PSPS event de-energization report for feedback Ongoing coordination with PSS

TABLE PG&E-7.3.10-3: GENERAL DESCRIPTION OF ENGAGEMENT ACTIVITIES BY DEPARTMENT TYPE (CONTINUED)

Dept	PG&E Owner	Planning and Preparedness Outreach	During a PSPS Event	After a PSPS Event
City/County Gov't	LPA Rep	Invited to Wildfire Safety Working Session Ongoing coordination with LPA Note: A subset of city/county representatives are also included in Regional Working Groups and PSPS Advisory Committee	Receives automated calls, texts and e-mails at key milestones before, during and after an event Invited to daily Systemwide Cooperators Call Ongoing coordination with LPA Access to PSPS Portal where maps, situational reports and other event information is located	Receives post-PSPS event de-energization report for feedback Ongoing coordination with LPA
Tribal Gov't	Tribal Relations Rep	Invited to Wildfire Safety Working Sessions Invited to PSPS workshops, exercises, and other trainings Ongoing coordination with Tribal Rep Note: A subset of tribal representatives are also included in Regional Working Groups and PSPS Advisory Committee	Receives automated calls, texts and e-mails at key milestones before, during and after an event Assigned a Tribal Agency Rep that can answer questions in real-time Invited to daily Systemwide Cooperators Call Invited to twice daily Tribal Cooperators Calls Access to PSPS Portal where maps, situational reports and other event information is located	Receives post-PSPS event de-energization report for feedback Invited to PSPS Listening Session Ongoing coordination with Tribal Rep

Note: For most outreach activities, PG&E follows the Standardized Emergency Management System model, where the primary contact and coordination is with County/Tribal OES. The OES lead then cascades pertinent information to other first responder entities or cities within their jurisdiction.

ACTION PGE-39 (Class A):

In its 2021 WMP update, PG&E shall explain how it intends to remedy any planned meetings that were not completed and ensure adequate communication is maintained when meetings are not held.

Response:

In 2020, over 50 scheduled engagement activities were cancelled or postponed, primarily due to COVID-19 considerations. Where applicable, PG&E representatives transitioned the activity to a virtual engagement, such as a WebEx meeting or addressing the engagement activity over e-mail/phone call. This effort included, but was not limited to, one-on-one meetings with government officials as well as Board of Supervisor meetings. However, some activities, such as the 2020 Earth & Arbor Day event, were cancelled for the year and will resume once it is deemed safe.

In many cases, agencies requested that engagements be cancelled or postponed, such as neighborhood meetings or local conferences. In instances where PG&E needed to cancel or postpone an engagement, a PG&E representative coordinated with the affected agency to confirm they agreed to the cancelation or postponement and to mutually determine next steps. Possible next steps included, but were not limited to, the following:

- Rescheduling the engagement to a later date;
- Canceling the engagement but following up by providing relevant materials and information; or
- Canceling the engagement entirely.

Please see the response to Action PGE-37 for a list of potential reasons why agencies declined meetings in 2020. We will continue to reach out to agencies to reschedule meetings that have been postponed to determine the appropriate next steps.

PG&E's LPA Representatives, PSSs, and Tribal Relations Representatives are responsible for maintaining relationships with local and tribal agencies. These dedicated representatives have an ongoing, two-way dialogue with each of their counterparts and agencies and can contact their appropriate representative 24/7 to address unique, local issues in real-time.

In addition to the ongoing coordination, PG&E has an extensive, proactive outreach approach that provides multiple forums for agencies to gather information and provide feedback. For more information, see the following sections:

- Section 7.3.9.2 which includes emergency planning and preparedness outreach;
- Section 7.3.10.1 which includes PG&E's CWSP outreach; and
- Section 8.2.4 which includes PG&E's outreach during PSPS events.

7.3.10.2 Cooperation and Best Practice Sharing With Agencies Outside CA

WSD Initiative Definition: *Strategy and actions taken to engage with agencies outside of California to exchange best practices both for utility wildfire mitigation and for stakeholder cooperation to mitigate and respond to wildfires.*

1) Risk to be mitigated / problem to be addressed:

Preventing wildfires is a challenge that goes beyond California's borders. With continuous operational improvements being a part of PG&E's mission statement, we actively participate in various industry groups to benchmark and identify potential alternative solutions from industry leaders around the world.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

As mentioned above, continuous operational improvements are part of PG&E's core mission. We engage with parties both inside and outside the state of California, as also discussed in Section 7.3.10.3, to share practices, tools and approaches on numerous topics, including wildfire risk reduction. This includes but is not limited to benchmarking with:

- Utilities in Australia on their experiences from that country's wildfire / bushfire challenges. For example, the Rapid Earth Fault Current Limiter technology that PG&E installed in 2020 and is actively testing to assess wildfire risk mitigation benefits (see Section 7.3.3.17.4) was developed in Australia.

- Entities beyond the utility industry to identify synergies and lessons learned for addressing wildfire risks. As noted in Section 7.3.10.4, PG&E has been engaged with federal landowners on how to partner on mitigating wildfire risks on those lands. PG&E is also partnering with educational institutions and firms from across the country to explore technologies or tools (like risk models from the nuclear industry) that may contribute to reducing wildfire risk. Examples include the Distribution Fault Anticipation Technology (Section 7.3.2.2.3) and Fault Signature (Section 7.3.2.2.6) technology.

- Utilities in the United States through industry associations like the Edison Electric Institute to facilitate a series of engagements regarding "Wildfire Technology" exploration, sharing, and discussion. The California IOUs also meet weekly to discuss topics such as outreach and engagement strategies, CPUC requirements, technology solutions and operational plans.

PG&E is also a founding member of the Utility Executive Steering Group for the International Wildfire Risk Mitigation Consortium (IWRMC). The consortium is industry-sponsored and provides a forum for members of the global utility

community to share wildfire risk mitigation insights and strategies. The group hosts regular technical working group meetings to discuss:

- Asset Management;
- Risk Management;
- Operational Practice; and
- Vegetation Management.

Through these working groups, PG&E continues to benchmark our operational and wildfire-related practices and identify areas for further review and refinement.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

The benefits of benchmarking are applicable across PG&E's service territory. Regional prioritization is not applicable to this initiative.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

As noted above, PG&E's engagements with numerous entities continued in 2020 and grew with the founding of the IWRMC in 2020. The efforts mentioned above are ongoing with adjustments and improvements made as gaps or opportunities are identified.

5) Future improvements to initiative:

PG&E will continue to engage with partners from inside and outside California to share experiences and identify tools, technologies or other best practices to reduce wildfire risk. As one key aspect, PG&E will continue building the IWRMC by supporting the inclusion of additional industry players in an effort to identify additional wildfire mitigation solutions. In light of some of the experiences from the 2020 wildfire season, PG&E is also seeing increased interest and engagement from utilities in the Pacific Northwest on wildfire knowledge and best practices.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

PG&E plans to continue to grow the number of parties we engage with in cooperation and coordination efforts over the long-term through supporting additional parties joining industry forums (like IWRMC, as noted above) and scanning for and reaching out to other entities or groups with potentially helpful insights. Additionally, PG&E

plans to better standardize and operationalize our process for identifying, reviewing and implementing best practices or other ideas that can provide wildfire risk mitigation benefits.

7.3.10.3 Cooperation With Suppression Agencies

WSD Initiative Definition: *Coordination with CAL FIRE, federal fire authorities, county fire authorities, and local fire authorities to support planning and operations, including support of aerial and ground firefighting in real-time, including information-sharing, dispatch of resources, and dedicated staff.*

1) Risk to be mitigated / problem to be addressed:

Providing ongoing coordination with CAL FIRE, federal fire authorities, county fire authorities and local fire authorities to support planning and operations serves to eliminate gaps between PG&E and these agencies. This helps to promote more effective safety alignment and emergency response operations. It also improves future collaboration with these agencies.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

To minimize the risks noted above, PG&E has a team of 25 PSSs (and three Supervisors) that are dedicated to maintaining established relationships with agency partners and supporting emergency planning activities and information sharing during emergency events. Every member of the PSS team has an extensive public safety background, including previous law, fire or emergency management experience.

During active emergency events, PSSs serve as PG&E's Agency Representatives and are responsible for coordinating and integrating PG&E's response with Agencies Having Jurisdiction (AHJ). The Agency Representatives assist with facilitating communication between relevant AHJs, PG&E Incident Management Teams, PG&E first responders, PG&E Operational Emergency Centers, Emergency Operations Center staff, and the Wildfire Safety Operations Center personnel, as well as supporting other internal Lines of Business. The real-time intelligence sharing includes, but is not limited to, PG&E's tactical plans and the deployment of necessary aerial and ground resources to support fire mitigation and asset protection activities.

These efforts mitigate risks associated with communication gaps, as well as the potential for incongruent mission response activities between PG&E and local emergency responders. Not only is the coordination critical for emergency response and event/incident coordination, it is also important for advanced planning and post-event (after action) support.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

The PSS team is organized into North, Central and Southern response areas to ensure timely and effective response presence across the PG&E service territory. Each area has an assigned Supervisor and each respective PSS is assigned to one or more counties to support both regulatory compliance needs and

emergency response engagement. Within the respective counties, PSS contacts have been pre-identified and PSS members are responsible for maintaining coordination and engagement with their assigned agency contacts on an ongoing basis. While there is no specific prioritization of external engagement, these assignments allow for simultaneous outreach to local, state and federal agencies across PG&E's service territory.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

In 2020, the PSS team underwent a consolidation, combining PSS members from Gas Operations and Electric Operations. PG&E also hired 11 additional members, expanding the team to 25 PSSs and three Supervisors.

Throughout the year, the PSS team supported over 600 external engagement activities including, but not limited to attending and/or hosting:

- PSPS listening sessions;
- Wildfire Safety Working Sessions;
- Regional Working Group meetings;
- Gas/electric safety workshops;
- Professional group meetings;
- Wildfire safety trainings; and
- Gas safety outreach with external public safety partners.

Given the numerous wildfire response efforts in 2020, the PSS team worked closely with external fire safety partners, which improved overall operational efficiencies and communication. For 2021, the PSS team is positioned to provide similar support and engagement.

5) Future improvements to initiative:

There are no additional improvements identified for this initiative at this time. The PSS team will continue to support engagement activities, along with cross-training and information sharing opportunities, for even greater collaboration. As the program develops, the PSS team will adjust their outreach and coordination approach.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

As stated in the section above, there are no further improvements planned at this time.

7.3.10.4 Forest Service and Fuel Reduction Cooperation and Joint Roadmap

WSD Initiative Definition: *Strategy and actions taken to engage with local, state, and federal entities responsible for or participating in forest management and fuel reduction activities; and design utility cooperation strategy and joint stakeholder roadmap (plan for coordinating stakeholder efforts for forest management and fuel reduction activities).*

1) Risk to be mitigated / problem to be addressed:

As a result of severe drought periods and the bark beetle infestation over the past decade in California, the United States Forest Service (USFS) land has more dead and dying trees than ever before. These factors have had a direct impact on forest lands and create additional fuel which in turn increases the likelihood of catastrophic wildfires, placing PG&E facilities and the surrounding communities at risk.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

The Fuels Reduction Partnership Program was initiated due to the current state of the national forest land within PG&E service territory. As mentioned above, a decade of accumulated fuel loads, bark beetle infestation and the California drought, has created an increased likelihood of wildfires, creating risk for PG&E's facilities and the surrounding communities.

PG&E has had long-standing relationships with the USFS and other federal landowners upon whose land PG&E assets are located. PG&E coordinates frequently with these agencies regarding proposed work on their property. In some cases, PG&E assets on government lands pre-date the existence of the federal mandate establishing the forest, park or entity that now manages the land.

PG&E's relationships with federal entities have evolved over the last decade and become more cohesive in recent years, as the risk of wildfires in California has grown. PG&E and the USFS have recognized the need for faster action to support wildfire risk mitigation. Since 2013, the USFS and PG&E have worked together under a partnership Memorandum of Understanding (MOU) 13-MU-11020000-014 to proactively improve the ecological function, health, and resiliency of National Forests.

As part of this MOU, PG&E developed the Fuels Reduction Partnership Program which provides funding to the USFS to address fuel reduction for all 11 forests within PG&E's service territory. This program focuses on areas where PG&E does not have land rights or authorization to complete these fuel reduction activities. The program's main objectives include:

- Identifying and funding projects that provide sustainable and lasting ecological benefits to the forest; and

- Accelerating the time of completion of prescribed burns, bio-mass removal and other fuel treatment methods by providing resources to the USFS; For example,

  - The USFS was able to acquire the necessary machinery to efficiently and safely complete fuels reduction project work in 2020. This machinery will also support additional fuels reduction work over multiple years on acreages above and beyond the 2020 work areas.

  - Many "implementation ready" projects are available for field crews to complete fuel reduction work. This program allows USFS to hire contractors and provide staff time to get this work completed, which would not otherwise be completed due to lack of funding.

In some cases, the USFS uses this funding to partner with local and state governments to leverage their funding in order to complete larger scale fuel reduction projects.

While PG&E staff members are in near-daily, operational contact and communication with USFS staff, PG&E leadership also meets with USFS leadership on a biannual basis to explore opportunities where both parties can collaborate further to reduce wildfire risk within California. Topics that have been explored through these meetings are clarifying the process for the disposition of felled trees (e.g., timber sale, lop and scatter, chipping), funding USFS positions to assist with the review of PG&E work requests and the Integrated Vegetation Management approach that would allow the use of USFS-approved herbicides to control utility-incompatible vegetation while seeking to encourage a low-growing stable plant community around powerlines.

PG&E also has activities underway with other federal and state landowners in addition to the USFS. Some highlights include:

- **California State Parks:** PG&E has finalized a process agreement that allows for streamlining utility work throughout California State Parks across the entire service territory. This agreement allows for non-invasive and emergency work to proceed without delay and minor wildfire fuels reduction work to proceed after a two-week notification process;

- **Bureau of Land Management (BLM):** Building on ongoing efforts to reduce the threat of wildfires through active management, the BLM California State Office worked with SCE and PG&E to issue a new policy to limit fire risk from power lines crossing BLM-managed public lands. The new policy was enacted May 20, 2019 and extended through 2025, and it allows PG&E to facilitate and expedite Operations and Maintenance (O&M) activities necessary to reduce the risk of wildfire by conducting the activities without prior authorization. Additionally, PG&E continues to work with the BLM Bakersfield Field Office on a Programmatic Right-of-Way (ROW) renewal process and

O&M Plan which may be used as a template to streamline process with other field offices in the future; and

- **National Park Service (NPS):** In 2019, PG&E worked with the NPS Pacific West Region to put establish eight park-specific 1-Year Special Use Permits for 2020 which will allow PG&E to expedite critical, routine O&M activity within NPS- managed land. The permits require park approval within 15 days for most routine utility O&M activity and will also authorize drone usage within parks for utility purposes like asset inspections.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

Activities supported by the Fuels Reduction Partnership Program focus on work outside of PG&E ROWs, which are areas where PG&E does not have rights to complete fuel reduction activities. Typically, the USFS prioritizes the project areas based on seasonal access, equipment available, and fire risk to nearby communities. In addition, projects funded by the program are assessed, taking into consideration both proximity and risk to PG&E assets.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

2020 Progress

The Fuels Reduction Partnership Program provided $5 million in funds to the USFS' 11 forests in Region 5. Funds were granted to the following 6 USFS areas for fuel reduction implementation work projects covering approximately 5,000 acres of USFS land: Los Padres National Forest, Shasta-Trinity National Forest, Stanislaus National Forest, Plumas National Forest, Sequoia National Forest, and Six Rivers National Forest.

While PG&E does not dictate the timing of projects, during the last joint meeting, the USFS indicated they are on track to complete 2020 projects. Please see the response in question number two above for additional 2020 progress updates.

2021 Plan

The Fuels Reduction Project Program is currently being examined to include applications for funding from both the USFS and the NPS. Funding in the amount of $5 million would potentially be allocated between both agencies and create a utility designed cooperation effort for forest management on both USFS and NPS lands.

5) Future improvements to initiative:

PG&E is the first IOU in California to partner with a federal agency on a program of this type. The Company is always looking at ways to improve and make the Fuels Reduction Partnership Program more effective. As we gain experience

partnering with the USFS, we will continue to improve and solve timing issues to speed up the process from time of application to project completion. For example, we have already streamlined the collection agreement process, cutting several months from previous review process by USFS and PG&E.

Future coordination of the program will also identify and focus on areas of improvement such as funding adjustments, use of new technologies, and new process developments for fuels management.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

This is a pilot program and while we have seen successes in the 2019 partnership awards, PG&E plans to develop an internal committee to look at the overall program in the 4th quarter of 2021 and decide if the program should continue into future years.

7.3.10.5 Project Management Office (PMO) and General Wildfire Support

WSD Initiative Definition: *N/A This is not a Wildfire Safety Division-defined initiative. This is an initiative that PG&E is adding to the 2021 WMP to describe the PMO office and general wildfire support.*

1) Risk to be mitigated / problem to be addressed:

Wildfire safety work is complex and multi-faceted. It requires a wide range of internal subject matter experts—both operational, supporting and focused on communications—to assist with developing comprehensive solutions and supporting our customers, communities, and other partners. The CWSP PMO aims to:

- Coordinate with the various operational teams to develop cohesive operational plans that maximize wildfire risk reduction and minimize community and customer impacts;
- Monitor, govern and support wildfire risk mitigation workstreams in the delivery of activities to meet goals, align with plans, and aggressively reduce wildfire risk;
- Coordinate with various outreach teams to have a coordinated communications plan for engaging with customers, agencies, tribes, critical facilities, and other key stakeholders;
- Have accurate and timely data for internal tracking, governance and management and that can be shared with external stakeholders;
- Lead and facilitate regulatory reporting and filings on Wildfire programs, including the WMP process; and
- Provide a feedback loop from external stakeholders to the operational teams.

Given the increase in the volume of work in our Wildfire Mitigation Programs, regulatory reporting requirements and focus on execution of these mitigations, PG&E has seen growth in the management, oversight, and support needed for wildfire programs. This management support spans across various functions in Electric Operations, providing leadership and oversight to the various wildfire mitigations the Company is undertaking.

2) Initiative selection ("why" engage in activity) – include reference to a risk informed analysis on empirical (or projected) impact of initiative in comparison to alternatives:

Given the breadth of skillsets needed to complete PG&E's CWSP, the PMO acts as a central hub to support the critical delivery of wildfire risk mitigation activities through:

- Providing governance to ensure the program goals are met;

- Ensuring that PG&E is meeting regulatory requirements and responding to stakeholder needs;
- Increasing communications and transparency cross functionally;
- Providing a feedback loop from external stakeholders to the operational teams;
- Encouraging innovative problem solving; and
- Providing a forum for leadership and cross-functional decision making.

The CWSP PMO is a comprised of leaders from various PG&E departments including, but is not limited to: Electric Operations, Government Affairs, Regulatory Relations, Customer Care, Marketing and Communications, Information Technology, Finance and Law department.

3) Region prioritization ("where" to engage activity) – include reference to a risk informed analysis in allocation of initiative (e.g., veg clearance is done for trees tagged as "high-risk"):

The activities of the CWSP PMO and related support functions are applicable across PG&E's service territory, particularly focused on HFTD areas. Regional prioritization is not applicable for this initiative.

4) Progress on initiative (amount spent, regions covered) and plans for next year:

The CWSP PMO Team has grown in 2020 to include seven dedicated PG&E staff plus contractor support that cover program management, work tracking, regulatory deliverables (including the development of the WMP itself), wildfire workstream coordination, communications planning and issue resolution. The cross-functional PMO partner team from across PG&E continues to meet at least weekly and will operate with a similar approach in 2021.

In part due to the support of the CWSP PMO, PG&E continues to meet, and in some cases exceed, our operational goals and has improved our outreach to communities and customers. For example, in 2020, the CWSP engagement PMO has improved turnaround time to respond to agency inquiries, while also providing more detailed data and information. For more information on PG&E's engagement efforts and status, which are coordinated by the PMO, please reference Section 7.3.10.1, Section 7.3.9.2, and Section 8.2.4. The CWSP PMO will change as the program evolves and as new best practices are identified.

CWSP PMO and support functions experienced growth in 2020 to ensure the right level of leadership and support was available to enable the successful execution of our wildfire mitigations. We will continue to see growth in 2021 as we continue to focus on delivering wildfire risk mitigation activities and the increasing volume of regulatory reporting requirements.

5) Future improvements to initiative:

There are no material future improvements planned for this initiative at this time. PG&E will continually improve and the CWSP PMO will provide leadership, governance and coordination as PG&E's wildfire activities change as new approaches or best practices are identified. The PMO also helps facilitate wildfire benchmarking and collaborative activities which can drive improvement opportunities across the wildfire program.

ACTION PGE-25 (Class B)

1) Integrate discussion on long-term planning within the respective section of each individual initiative.

Response:

The PMO functions in support of wildfire mitigation activities and is anticipated to remain similar to the current model over the long-term.

PACIFIC GAS & ELECTRIC COMPANY

SECTION 8

PUBLIC SAFETY POWER SHUTOFF (PSPS),

INCLUDING DIRECTIONAL VISION FOR PSPS

8.1 Directional Vision for Necessity of Public Safety Power Shutoff (PSPS)

Describe any lessons learned from PSPS since the utility's last Wildfire Mitigation Plan (WMP) submission and expectations for how the utility's PSPS program will evolve over the coming 1, 3, and 10 years. Be specific by including a description of the utility's protocols and thresholds for PSPS implementation. Include a quantitative description of how the circuits and numbers of customers that the utility expects will be impacted by any necessary PSPS events is expected to evolve over time. The description of protocols must be sufficiently detailed and clear to enable a skilled operator to follow the same protocols.

When calculating anticipated PSPS, consider recent weather extremes, including peak weather conditions over the past 10 years as well as recent weather years and how the utility's current PSPS protocols would be applied to those years.

Pacific Gas and Electric Company's (PG&E or the Company) most important responsibility is protecting the health, welfare, and safety of our customers and the communities we serve. When severe weather or other circumstances threaten the ability to provide electricity safely, PG&E must take the appropriate steps necessary to protect the public. PG&E's PSPS program proactively de-energizes a portion of the Company's electric system, in the interest of public safety, as the wildfire prevention measure of last resort when there is a potential for a catastrophic wildfire should the lines be left energized. PG&E understands that de-energizing customers causes significant disruption and is actively working to reduce the impact on our customers.

Due to severe weather, in 2020, PG&E implemented multiple PSPS events, including some of the largest events in California history. While our execution of PSPS events in 2020 was significantly improved in terms of making each event smaller, shorter and smarter for our customers, PG&E acknowledges there is room for further improvement in our implementation of PSPS. PG&E is committed to learning from each event and advancing our PSPS tools and practices for the future. PG&E is committed to executing our PSPS program in a manner that exceeds Resolution ESRB-8, Decision (D.) 19-05-042 and other California Public Utilities Commission (CPUC or Commission) directives[1] in addition to minimizing the effects of these events for our customers.

In 2020, PG&E executed six PSPS events. These events took place during a historic fire season in California where over 4 million acres burned and five of the six largest fires in California history occurred in PG&E's service territory.[2] The six PSPS events ranged widely in scale, from affecting approximately 600 to 345,000 customers and ranging in average total duration from 19 to 37 hours.

Importantly, despite 2020's record-breaking weather and fire season, PG&E successfully executed on our goals of making PSPS events smaller, shorter, and smarter. PG&E's efforts to make events "smaller" refers to reducing the number of customers impacted by each event given the event's weather footprint. The intent of

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1 See Resolution Extending De-Energization Reasonableness Notification, Mitigation and Reporting Requirements in D.12-04-024 to all Electric investor-owned utilities (IOU).

2 https://www.fire.ca.gov/incidents/2020/.

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"shorter" is to reduce the power restoration time after the weather "All Clear". The "smarter" objective is to reduce the impact to customers and communities that are de-energized, along with executing PSPS with excellence, keeping in mind lessons learned.

At the time of this filing, there is significant outstanding uncertainty about the scope of PSPS in 2021 as a result of recent proposed conditions under consideration as it pertains to how we implement the PSPS program. This uncertainty impacts PG&E's ability to set specific targets around reducing the size and length of PSPS events in 2021. Notwithstanding this uncertainty and potential scope increase, PG&E's intent – as outlined throughout the PSPS portions of this 2021 WMP – is to reduce the impact of PSPS on our customers and communities wherever possible consistent with overall public safety. Throughout this document there are references to ongoing initiatives to make PSPS smaller and shorter and that work and intent will continue unabated. However, the ability to achieve overall reductions in PSPS size and duration across the 2021 fire season is uncertain at this time for the reasons outlined above, and should not be confused with the intent of or language describing these various initiatives to lessen the impact on customers by striving to make events "smaller" or "shorter."

In this section, PG&E describes our progress in reducing overall PSPS impact to customers and communities in 2020 and identifies actions and areas for improvement in 2021. PG&E also describes the specific short, medium and long-term actions we will take to reduce the impact of, and need for, de-energization events to mitigate wildfire risk as directed by CPUC Decision D.20-05-051[3]. Additionally, this section also addresses Action PGE-16 (Class A).

Smaller PSPS Events

Smaller PSPS Events in 2020

In 2020, PG&E used improved scoping techniques and mitigation strategies to significantly reduce the size of our PSPS events. We reduced the number of customers impacted by each PSPS event by approximately 55 percent on average in 2020, when compared to the number of customers that would have been impacted by the same weather conditions under our 2019 PSPS program and infrastructure. For instance, October 25th was PG&E's largest PSPS event in 2020. It had a weather footprint similar to the large weather events that drove the use of PSPS in October 2019. However, our 2020 PSPS improvements resulted in PG&E de-energizing approximately 47 percent less or more than 300,000 fewer customers on during the October 25, 2020 event than we would have de-energized for the same weather event in 2019.

Key PSPS impact mitigation initiatives that PG&E deployed to achieve these results included the following:

- **Transmission Line Sectionalizing:** PG&E installed 54 Supervisory Control and Data Acquisition (SCADA) switches on transmission lines in 2020, 36 before

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3 This information will also be made available and easily accessible on PG&E's public website at www.pge.com/wildfiremitigationplan.

September 1st, to minimize the number of customers impacted by PSPS outages. More information is provided in Section 7.3.3.8.2.

- **Transmission Scoping Tools:** PG&E refined our transmission scoping tools and completed transmission line repairs and Vegetation Management (VM) in 2020. The overall impact of this activity was that approximately 80 percent of transmission lines in the High Fire-Threat District (HFTD) had a reduced likelihood of coming into scope for a PSPS event. More information can be found in the following sections: Section 4.5.1(f) (Transmission Operability Assessment), Section 7.3.3.17.2 (Transmission Hardening), and Section 7.3.5.3 (Right of Way Expansion within "Detailed Inspections of Vegetation Around Transmission Electric Lines and Equipment" section).

- **Meteorology Models and Scoping Guidance Updates:** Improved granularity in meteorological guidance tools enabled PG&E to predict severe fire weather risks on more focused (smaller) areas and to identify those areas which exceeded risk guidance with better geographic precision. More information on these improvements to the meteorological models and scoping guidance is provided in Section 7.3.2.1. The discussion of PG&E's protocols and thresholds for PSPS implementation can be found in Section 8.2.2.

- **Distribution Line Sectionalizing:** PG&E installed 603 automated distribution sectionalizing devices, which enabled customers outside of the weather footprint of an event to remain energized. More information is provided in Section 7.3.3.8.1.

- **Temporary Substation Microgrids:** PG&E prepared 62 substations to receive temporary generation, with 18 substations having generation actively interconnected and tested on site in preparation for PSPS events. More information is provided in Section 7.3.3.11.1.

- **Islanding:** For the 2020 fire season, PG&E reconfigured the Humboldt Bay Generating Station and the Caribou Island plant to be able to operate in island mode, separated from the larger grid. Island mode was used during multiple PSPS events to maintain service to customers when the transmission lines normally supplying them were de-energized. PG&E kept as many as 74,800 customers energized in a single PSPS event through these transmission islands. More information is provided in Section 7.3.3.17.2.

- **Temporary Distribution Microgrids:** PG&E prepared six distribution microgrids to support communities by energizing "main street corridors" with shared services and critical facilities when the distribution line serving those areas was de-energized. In 2020, PG&E operated four distribution microgrids, thereby energizing over 2,000 unique service points (customers) for as many as four PSPS events per service point. More information is provided in Section 7.3.3.11.1 (Generation for PSPS Mitigation).

Efforts to Make PSPS Smaller in 2021

Even as we continue to execute PSPS events into January 2021 as part of this extraordinary "2020" fire season, PG&E is in the process of planning for how to continue to reduce the size of PSPS events for the 2021 fire season. PG&E's strategy for 2021 is to target our mitigations to the locations that are most likely to be impacted by PSPS events while also focusing towards the suite of activities that will enable continued PSPS scope reduction in the long-term.

The foundational data set that PG&E is using to identify locations most likely to be impacted by PSPS is an analysis of 10 years of historical weather events. This "historical lookback" evaluates actual weather events and models the associated PSPS events that would have occurred, including both transmission and distribution system impacts. This analysis identifies approximately 30 weather events across the past 10 years that would have triggered a PSPS event under the 2020 PSPS decision-making protocols.

Although a valuable planning tool, the historical lookback is based on experienced climatology and is not a forecast of the locations for future PSPS events. It is not possible to forecast PSPS events more than a week ahead of time, but this lookback provides the best data set to use for planning purposes. Our planning therefore assumes that these locations have a higher likelihood of again experiencing weather conditions that may trigger a PSPS event in the future. However, weather is highly variable year to year, which drives variability in not only the location of events, but also the number of events and their size and duration.

The historical lookback is a computationally-intensive analysis that we completed in the Fall of 2020. It does not include updates to the PSPS scoping models anticipated to be incorporated before the 2021 fire season, based on work our PG&E meteorologists and data scientists will be performing over the coming months. These include re-calibrating the Fire Potential Index (FPI) Model and incorporating Technosylva wildfire consequence data if and where it provides value for PSPS. A more granular climatology lookback and additional studies are still underway and are not expected to be complete until the end of summer. While our data and analysis are constantly improving and evolving, waiting for an improved data set was not feasible given the lead times required for work execution on most of our PSPS impact reduction initiatives.

PG&E is using the historical lookback in conjunction with actual PSPS events to project locations most likely to be impacted by PSPS in 2021. PG&E is prioritizing circuits that show up most frequently in the lookback and in actual events, while also considering the number of addressable customers that a mitigation at that location might serve. PG&E is currently still in the process of identifying and vetting locations for mitigations as we seek to deploy mitigations that maximize scope reduction. While the likelihood of an area being impacted and addressable customer counts are the key criteria, each PSPS mitigation program also must consider its technology-specific site selection criteria and work execution constraints. Most mitigation initiatives also support other objectives besides PSPS scope reduction and must also balance PSPS mitigation with those objectives.

Based on the lookback and 2020 actuals, approximately 100 transmission lines in the HFTD have a higher likelihood than other transmission lines in the HFTD of being within

the weather scope of a PSPS event. Based on an initial review of these lines, PG&E has identified at least 50 transmission lines where transmission VM, repairs, or switches could significantly reduce the likelihood of a line being in scope for a PSPS event or enable customers to remain energized if a line must be de-energized. PG&E points out that under the most extreme weather conditions it is not possible to entirely rule out the possibility of a transmission line being de-energized during a PSPS event, even if mitigation activities like VM, repairs, or switches have been performed. Lines where work is performed could still be included in PSPS under stronger weather conditions or "Black Swan" (worst case scenario) conditions. Furthermore, whether a line with mitigation is included in PSPS scope depends on exactly where the event-specific weather falls relative to the location of the mitigation.

For locations in the lookback and PSPS actuals where transmission mitigation is not possible or is deemed to be insufficient as a stand-alone PSPS mitigation, temporary generation at substations may be a good PSPS mitigation alternative. Substation temporary generation may also be a good fit for substations that otherwise would be de-energized because they are indirectly affected due to the need balance the overall Electric Transmission grid. For these indirectly impacted substations, transmission mitigations such as VM would not address the underlying issue.

PG&E is expecting to prepare at least eight substations to receive temporary generation in 2021. All of these substations served by temporary generation have historically served some customers who are safe-to-energize, which refers to customers that are outside of the weather footprint or served by lines hardened such that they meet the distribution descoping criteria (see Action PGE-16 (Class A) below). The significant work completed in 2020 on transmission lines, improvements in PSPS modeling and tools, and the additional work expected to be completed in 2021 has reduced the number of substations for which PG&E expects temporary generation to be needed in 2021 relative to 2020. For 2021, PG&E also plans to pursue at least one clean substation temporary generation pilot that will use diesel-alternative technologies. We are also exploring potential behind-the-meter and demand response opportunities at substations that are likely to need temporary generation.

At the distribution level, PG&E will focus in several areas in 2021 to reduce the scope of PSPS. PG&E's key mitigations at this level are sectionalizing devices, temporary distribution microgrids, and distribution hardening.

In 2021, PG&E plans to install at least 250 more distribution sectionalizing devices. These devices enable PG&E to segment distribution circuits near the HFTD area boundary to reduce the scope of PSPS events. PG&E plans to focus efforts primarily on counties and specific areas that are repeatedly impacted by PSPS and show up repeatedly in the 10-year historical lookback. This includes but is not limited to Butte, Yuba, Sonoma, Napa, Nevada, and El Dorado counties.

PG&E is planning to develop at least five additional temporary distribution microgrids with pre-installed interconnection hubs (PIHs) in 2021 to energize "main street corridors" with shared services (i.e., services involving food, fuel, healthcare and shelter) and critical facilities during PSPS events. These distribution microgrids will be located on circuits most likely to be impacted by PSPS events. One example of a planned 2021 temporary distribution microgrid location is Magalia in Butte County, which, when completed, will energize approximately 40 customers, including a medical clinic, water district pumps, sheriff station, gas station, and grocery store. This temporary distribution

microgrid in Magalia is on a circuit that was impacted by PSPS 5 times in 2020 and is also frequently impacted in the historical lookback.

PG&E plans to exclude circuits from PSPS that have been undergrounded as part of PG&E's broader wildfire distribution hardening program. Three of PG&E's underground distribution grid hardening projects with direct PSPS benefits are expected to be completed in 2021 or early 2022, though the exact timing is uncertain. The Frogtown 1702 project in Calaveras County consists of 1.09 miles and could reduce the numbers of customers exposed to PSPS on this circuit from approximately 4,000 to approximately 2,100. The Rincon 1101/1103 project in Santa Rosa (Sonoma County) consists of 1.48 underground miles and could reduce the numbers of customers exposed to PSPS on this circuit from approximately 6,300 to approximately 2,700. The Rincon 1102/1104 project consists of 1.78 miles and could reduce the numbers of customers exposed to PSPS on this circuit from approximately 8,600 to approximately 1,150. Note that the exact customers benefits associated with any single PSPS event for each of these projects depends on the precise boundaries of the PSPS weather polygon. Furthermore, if the upstream electricity source serving these circuits is de-energized, these PSPS benefits may not be realized at all.

In addition to executing on the mitigation programs described above, PG&E is also focusing efforts in 2021 in key programs that will reduce PSPS event size over the next few years and the long-term. These include the Butte Rebuild project and incorporation of distribution descoping criteria into the PSPS tools.

PG&E will provide PSPS mitigation to the town of Paradise and some surrounding areas that were destroyed in the 2018 Camp Fire as part of the Butte Rebuild project. As this project to rebuild utility infrastructure is executed over the next several years, undergrounded areas of Paradise can remain energized during PSPS events. Scoping for the Butte Rebuild is prioritizing PSPS mitigation while working with the community to align with their rebuild plans. More information is provided in Section 7.3.3.17.6.

Another key effort in 2021 will be incorporating modified PSPS criteria for distribution facilities that have been overhead hardened into the PSPS scoping tools. The goal of this effort is to enable hardened lines that meet certain criteria to remain energized during PSPS events. In 2020, PG&E developed distribution PSPS descoping criteria to identify candidate distribution circuit segments for de-scoping from PSPS events. We are currently in the process of seeking third party validation for the criteria that has been developed. In preparation for the 2021 PSPS season, the criteria are being evaluated through application to circuit segments for which hardening projects have been completed. More information is provided in Action PGE-16 (Class A) below.

Despite the activities described above, PG&E has not set a "smaller" target for 2021 because it is evaluating conditions not currently included in the scoping of PSPS events that may drive an expansion in the scope of 2021 PSPS. As the underlying purpose of PSPS is to prevent catastrophic wildfire ignitions during severe weather conditions, PG&E is reviewing what conditions warrant calling a PSPS to prevent catastrophic wildfires, in alignment with external feedback on this issue. Specifically, we are assessing how to incorporate the presence of known, high-risk vegetation conditions adjacent to powerlines into PSPS decision making. This assessment may result in

PG&E executing PSPS in 2021 for powerlines where high priority vegetation tags[4] have been identified, including on lines that may not have met the 2020 PSPS event criteria. PG&E is still working to determine what changes to the PSPS decision making criteria may be needed to account for this risk. Following that activity over the next few months, PG&E will need to analyze the likely impact of that updated criteria in making PSPS events larger and compare that impact to the actions being taken to make PSPS events smaller.

Planning to Make PSPS Smaller in the Long-Term

In the three and ten-year horizons, solely continuing to implement PG&E's 2020 PSPS mitigations will not enable PG&E to continue realizing the significant gains in reducing PSPS scope made in 2020. The large reduction in size of PSPS events in 2020 relative to 2019 are mainly attributed to significant improvements in meteorology tools, transmission scoping tools, reconfiguration of generating stations to provide significant islanding opportunities, and distribution switch installations. While further decreases to PSPS scope are anticipated every year as PG&E continues with tool improvement and existing infrastructure deployment mitigations, these mitigations cannot yield the large, step-function improvement in PSPS footprints as was achieved in 2020. Further improvements are expected to be more incremental in enabling PG&E to execute smaller events. As an example, PSPS size reduction gains from distribution sectionalizing tools will be less significant, even beginning this year. With the addition of at least 250 switches in 2021, PG&E will have installed over a thousand SCADA-enabled sectionalizing devices in three years. While more switches are anticipated to be added annually, further devices may have diminishing returns in terms of the volume of PSPS scope reduction relative to the switches already installed. In the foreseeable future, PG&E expects further segmentation benefits to be greatly reduced. Within the ten-year time frame, PG&E expects that all HFTD areas will be fully sectionalized where beneficial.

To continue to significantly reduce the number of customers that are within the scope of PSPS in the ten-year horizon, PG&E has identified a set of activities it must carry out in the following few years: 1) Descope hardened distribution circuits; 2) Improve mitigation coordination across transmission and distribution; and 3) Transition to operational technologies that enable lines to remain energized during PSPS weather conditions.

PG&E is refining how to maximize the PSPS mitigation value of distribution circuit hardening while continuing to reduce wildfire risk. PG&E has already shifted our hardening program to evaluate an underground design alternative for high priority circuit segments where the meteorology lookback data indicates that an area is likely to be impacted by PSPS or has a certain number of addressable customers. PG&E will

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[4] Namely "Priority 1" and "Priority 2" vegetation tags which are created when trained vegetation inspectors identify trees or limbs that currently present elevated risk and must be worked on an expedited basis. Inspectors use Priority 1 tags for vegetation (i) in contact or showing signs of previous contact with a primary conductor; (ii) actively failing or at immediate risk of failing and which could strike PG&E's facilities; or (iii) presenting an immediate risk to PG&E's facilities. Inspectors use Priority 2 tags for vegetation that does not rise to the level of Priority 1 but has encroached within the PG&E minimum clearance requirements or has an identifiable potential safety issue requiring expedited work.

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continue on our current path of incorporating descoping criteria for overhead distribution circuits into our PSPS scoping tools while also consider how to optimally incorporate PSPS benefits into our prioritization of locations for system hardening. As PG&E continues to evolve the models that support distribution hardening and PSPS scoping, we are looking at how to maximize our system hardening program to deliver more PSPS benefits.

To achieve maximum benefit from our PSPS mitigations, PG&E also needs to improve our mitigation planning process to further increase coordination of PSPS transmission and distributions mitigations. For a customer to be protected from any particular PSPS event, both the transmission and distribution circuits serving them must remain energized. Although a customer may experience a lower likelihood of PSPS if the distribution line serving them is hardened or the transmission line primarily serving them is descoped, it is only when both of these lines, and thus the primary power flow path to serve that customer is hardened or protected that the greatest reduction in PSPS likelihood can occur. Improving our planning process to consider the number of customers "fully mitigated"[5] from PSPS will be essential for continuing to reduce PSPS event size in the long-term.

Finally, significant reduction in the size of PSPS events in the long-term will require PG&E to adopt technology that enables more lines to be safely energized during PSPS weather conditions. Promising new technologies currently being piloted, deployed and tested in this area will be accelerated and scaled, if they prove to be reliable at preventing utility ignitions during high wind events. These line-sensing and operational technologies, two of which are highlighted below, may enable lines that would otherwise be within a PSPS event footprint to remain energized.

Distribution, Transmission, and Substation: Fire Action Schemes and Technology (DTS-FAST) is a PG&E-developed technology currently in the pilot phase that uses fraction-of-a-second technologies to detect objects approaching energized power lines and responds quickly to shut off power, before object impact (see Section 7.1.D.3.4). In addition, DTS-FAST may detect elevated fire risk conditions associated with energized power lines, quickly shutting off power when such risks occur, including downed power lines, downed and leaning towers and poles, and equipment failures. PG&E completed a proof of concept for DTS-FAST in 2020 and is moving forward with this technology in 2021, constructing a pilot on a 115kV transmission circuit and evaluating the possibility of piloting it on a 12 kV distribution circuit as well. If proven, DTS-FAST is potentially a game-changer for PSPS because it can be deployed far more rapidly, widely, and at lower cost relative to some of PG&E's other PSPS mitigation technologies (like undergrounding).

Another promising technology is Rapid Earth Fault Current Limiter (REFCL), which mitigates ignitions from line to ground faults such as wire down or tree contacts using technology that detects such faults and limits the fault current to below ignition thresholds (see Section 7.3.3.17.4). PG&E has a pilot project for REFCL technology installed in Calistoga, an area with wildfire risk and historical line-ground outage events.

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5 Note that under extreme weather conditions it is still possible that even circuits and customers that have been identified as "fully mitigated" from PSPS events may still need to be de-energized.

PG&E finished construction on the pilot in 2020 and has begun functional testing to determine the overall effectiveness of the technology. Final results from the pilot project are expected in 2021. If the result of the pilot supports additional deployment, a long-term strategy will be developed to install REFCL in PSPS-prone, HFTD areas.

The strategies described above may be adjusted as PG&E continues to evaluate viable opportunities and technology continues to evolve. The absolute number of customers impacted in the 1-, 3- or 10-year time frames is unknown and will be dependent largely on the weather in a given year, including the growth or drying out of vegetation (fuels), the amount of snow and rain received during the rainy season, and the number and scope of high-risk fire weather wind events.

Shorter PSPS Events

Shorter PSPS Events in 2020

While PG&E cannot control the duration of the weather conditions that require a PSPS event, we do have the ability to shorten PSPS events for customers through control of the post-event patrol and re-energization processes. In 2020, PG&E significantly scaled and improved our restoration operations. PG&E undertook the following activities to shorten restoration times once weather events were cleared:

- **Aerial inspection equipment and personnel:** PG&E nearly doubled the number of dedicated helicopters and trained aerial inspection personnel available for aerial patrols. By September 1, 2020, PG&E had procured 65 dedicated helicopters – an increase from 35 dedicated helicopters in 2019. More information is provided in Section 7.3.6.7.

- **Fixed-wing aerial inspections:** PG&E commissioned two fixed-wing aircraft with MX-15 cameras and infrared technology for use during day-and-night-time transmission line patrols. More information is provided in Section 7.3.6.7.

- **New standards and procedures**: PG&E implemented new standards and procedures to improve operational management of PSPS Estimated Time of Restoration (ETOR) and associated customer notifications. More information is provided in Section 8.2.4.

- **Pre-Season helicopter patrols:** To improve restoration planning, crew allocation and ETOR forecasting, PG&E conducted helicopter circuit patrols in Tier 2 and Tier 3 areas to collect data and identify the optimum air or ground patrol methods and requirements before potential 2020 PSPS events.

- **Weather "All-Clear" Targeting:** In 2020, PG&E also leveraged our improved meteorology granularity to begin declaring weather "all clear" on a more granular level, which allowed patrols to being sooner and customers to be restored earlier.

On an aggregate basis, average outage duration after weather "all clear" for the 2020 PSPS events improved by over 40 percent compared to PSPS events in 2019, from an average of about 17 hours in 2019 to an average of around 10 hours in 2020. As noted above, PG&E implemented all of the planned improvements to support faster

restoration times and substantially complete the PSPS restoration commitment from the 2020 WMP.

However, PG&E did not fully achieve one ambitious goal within our PSPS restoration commitment: restoring 98 percent of customers impacted by a PSPS event within 12 daylight hours after the weather "all clear." Our cumulative restoration performance for 2020, 96 percent within 12 daylight hours, was hampered primarily by to the inability to fly helicopters due to smoke caused by wildfires during the first PSPS event of 2020, beginning on September 7th. Substantial smoke during this event from ongoing, non-utility-related wildfires from the August lightning complex obscured visibility such that it prevented PG&E from safely flying more than half of the helicopters we had staged and ready to support PSPS restoration. To complete the necessary restoration inspections, PG&E needed to rely more heavily on ground patrols, which are slower than aerial inspections. The cumulative impact is that 91 percent of customers during that one large event were restored within 12 daylight hours, bringing down our performance for the full year.

Planning to Make PSPS Shorter in 2021 and the Long-Term

The "shorter" PSPS goal is largely related to the "smaller" PSPS goal described above. While PG&E has some ability to flex the size of our patrol and restoration resources through mutual aid and other mechanisms, restoration times are largely correlated with the number of circuit-miles PG&E needs to patrol prior to restoring power. Because event size is a major driver of the time it takes to complete restoration, the potential changes to PSPS decision-making criteria described above could also impact restoration time.

For 2021, our restoration goal is to restore all customers as soon as possible and within 24 hours from the termination of the de-energization event, unless it is unsafe to do so. For any circuits that require more than 24 hours for restoration, we will provide an explanation in our post event reports.

Typical safety exclusions based on past events have been (but are not limited to):

- No access due to:
  - Police activity (i.e., security)
  - Fire activity (i.e., fire agency requests not to re-energize)
  - Road closure (i.e., public/private roadway closed/blocked and requires agency/customer response)

- Customer equipment damaged (i.e., requires customer repairs prior to energizing)

Some additional reasons why circuits may require more than 24 hours to restore include:

- Inability to utilize planned helicopter resources due to smoke / fog / other visibility concerns
- Lack of resources to patrol all the overhead conductors that were de-energized
- Restoration delayed due to repairs / correction of PSPS hazard or damage found on assets to be restored

- Equipment issues encountered when restoring circuit segment - not caused by PSPS damage

Despite the uncertainty with respect to the PSPS event sizes and therefore overall restoration times, PG&E will leverage our three years of restoration experience and data to continue improving our ability to quickly restore customers after the severe weather has passed. PG&E has identified opportunities via tool improvement, patrol boundary refinements, process improvements, and customized restoration plans. PG&E describes each of these areas below.

First, PG&E will refine the internal tools that we use to forecast the resource need based on event specifics and size. This effort includes updating our understanding of what types of resources are needed and the capabilities of each resource. Based on lessons learned from this year, we will also incorporate conditions that could affect helicopter availability for patrolling (e.g., smoke and fog) into our forecasts.

Second, PG&E plans to use enhanced event weather information to improve patrol boundaries. During PSPS events, some portions of distribution circuits are de-energized not because they are in the defined event weather boundary, but because they are downstream from other parts of the circuit that are within the event weather boundaries. The PG&E assets along these parts of the circuit do not require a patrol in order to be re-energized.

Third, PG&E plans to continue reducing event durations through event process improvements. We will improve and streamline the way we develop the restoration playbook during PSPS events. The quicker this restoration playbook is developed, the quicker resources can be pre-staged so that work can begin as soon as the “all clear” is called. As an example, one particular area for improvement is better aligning and prioritizing transmission and distribution patrol and restoration activities to maximize customer restoration. In addition, we will continue to improve the process of declaring weather “all clears” on a more granular level, further enabling more customers to be restored more quickly.

Finally, PG&E will focus directly on the circuits that have posed restoration challenges in the past. These are often longer circuits in more rugged terrain. We will evaluate the options PG&E has for restoring these circuits and develop customized restoration plans to support meeting the 24-hour target.

In the long-term, restoration times will continue to shorten as PG&E continues to shrink the size of our PSPS footprint through the various mitigations discussed above. PG&E will also continue to track technology and laws related to inspecting with drones in order to potentially leverage this technology for post-PSPS patrols. While drones are presently used for some types of asset inspections, we currently do not use drones for PSPS inspections because they require a flight path beyond visual line of sight (BVLOS). We will continue to explore BVLOS operations for PSPS and other enterprise initiatives over the next few years. More information regarding this issue is available in Section 7.3.6.7.

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More information on PG&E's PSPS re-energization operations is also provided in Section 7.3.6.4.

Smarter PSPS Events

PG&E's "smarter" PSPS event goal refers broadly to our execution of PSPS events. In this WMP filing, PG&E separates this goal into two key components: (1) better community and customer awareness, coordination and support; (2) improving our PSPS execution, processes and tools based upon lessons learned from 2020. Progress in both of these areas are described below.

Better Community and Customer Awareness, Coordination and Support

In 2020, PG&E delivered on many of the CPUC's and PG&E's goals to make PSPS events less burdensome for our customers. We supported de-energized customers and communities with better communications, resources, and assistance. The accomplishments described below would not have been possible without extensive input over the past year from PG&E's advisory councils, regional councils, customer input and state and local officials.

- **Customer Notifications:** PG&E notified over 99 percent of the affected customers prior to de-energization, despite in-event weather shifts that caused PSPS footprint changes in every event. These notifications included improved content that was tested for usability and accessibility. More information is provided in Section 8.2.4.

- **Medical Baseline (MBL) Customer Notifications:** PG&E notified over 99 percent of impacted MBL customers through automated notifications and in-person door visits, if needed. More information is provided in Section 8.2.4.

- **Access and Functional Needs (AFN) customers:** PG&E developed partnerships with 56 Community-Based Organizations (CBO) to support customers with AFN with resources before, during and after PSPS events. Together with these CBOs, PG&E provided 30,000 food boxes to vulnerable customers, delivered approximately 4,000 batteries to qualifying customers, and served approximately 4,500 customers with services including food replacement, gas vouchers, hotel stays, grocery delivery and accessible transportation. More information is provided in Section 7.3.10.1.

- **Translated information:** Through new partnerships with multicultural media organizations and in-language CBOs, PG&E shared PSPS preparedness, awareness and status information broadly across PSPS-affected areas in 20 non-English languages and American Sign Language (ASL), using a variety of social media, news, and written materials.

- **Community Resource Centers (CRCs):** PG&E provided as many as 106 CRCs during a single event to support customers in affected local and tribal communities, providing snacks and a variety of resources and information at each CRC. Nearly 50,000 customers visited our CRCs during the 2020 PSPS events.

- **Website and call center:** Making considerable improvements from the 2019 PSPS season, PG&E maintained a stable and continuous website and responsive call center support throughout events. More information is provided in Section 8.2.4.

- **PSPS Portal Tool**: PG&E unveiled our updated PSPS Portal tool for 2020, providing maps, situation reports, critical facility lists and MBL customer lists to local and state agencies and first responders (cities, counties, and tribes) at the time of the initial notification of PSPS events and throughout events.

Customers have noticed these efforts; In a recent survey of customers impacted by PSPS events in 2020, 60 percent reported that PG&E improved the handling of PSPS events over 2019 and only 10 percent reported our handling to be worse[6]. In 2021, PG&E will continue to build on these customer efforts, grounding our outreach, programs and services in customer and stakeholder feedback, research, and data to continuously improve. PG&E discusses these various efforts in Section 8.2.1 and 8.2.4. A few areas targeted for improvement in 2021 are highlighted below.

- **CRC strategy:** PG&E will refine our CRC strategy working in close collaboration with our county, tribal and CBO partners.

- **Customer Contact Information:** PG&E will improve data collection so that we have the right customer contact information including information on our master-meter customers and other non-account holders (e.g., renters), know our customers' language preferences, and allow opportunities for customers to self-identify as vulnerable without impinging on data privacy laws.

- **Customer Notifications:** PG&E will refine our communications and notifications to make them as clear and accessible as possible for customers and community members (e.g., ETOR accuracy, shortened phone messages, etc.). This includes a focus on customer segmentation to ensure our communications meet the needs of specific customer segments (e.g., customers responsible for multiple premises).

- **Electric Vehicle (EV) Charging Network Support and Resiliency:** PG&E's planned additional enhancements for the 2021 wildfire season include updates to EV charging station maps to show which stations are potentially impacted by PSPS events and direct outreach to EV customers with information on PSPS impacts to EV drivers.

Finally, PG&E anticipates the COVID-19 situation to remain dynamic for much or all of 2021. As we did in 2020, PG&E will continue to monitor the public health situation and adjust plans and programs as necessary, in alignment with the communities we serve.

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6 The remaining responses were 24 percent responding "about the same" and 6 percent being "unsure". The survey featured responses from just over 1,000 customers who experienced at least one PSPS event in 2020, half of which were residential and half business customers.

PSPS Execution, Operations and Lessons Learned From 2020 PSPS Events

PG&E is expanding our "smarter" goal to include efforts to improve PSPS execution with the appropriate infrastructure and systems. These efforts, which include both technology and process improvements, contribute to smooth PSPS event operations, reduce the possibility for errors, allow PG&E to shift as the weather changes and drive towards a more seamless community, partner and customer experience. Below, PG&E describes its significant strides in these areas in 2020.

- **Information Alignment and Availability:** PG&E implemented a new PSPS situation report process in 2020, which leveraged a new data management technology platform. The platform provided increased functionality through a centralized data foundation which allowed PG&E to manage PSPS data and business logic. This has increased organization collaboration, driven new analyses and enhanced organizational knowledge. In 2020, improvements were made to the PSPS situation report by centralizing data so the latest information about the PSPS event through the planning, de-energization and restoration phases of the PSPS event was in one location and accessible to the whole team. The platform also allowed PG&E to automate many elements of PSPS scope creation and playbook analysis for 2020. Additionally, PG&E launched an improved information sharing 'PSPS Portal' to share maps and the latest incident information with our Public Safety Partners. This allowed PG&E to communicate with our Public Safety Partners and keep them informed of any changes to the key incident information before and throughout the PSPS event.

- **Scoping Process Enhancements:** In 2020, PG&E significantly reduced the time it took to 'scope' or translate the impacts of the weather system onto PG&E's assets. This was accomplished by tool enhancements and automation which allowed PG&E to quickly update our event scope during PSPS events. This in turn allowed more time for customer notifications and for the planning of PSPS mitigation activities such as CRCs and temporary generation.

- **Virtual Emergency Operations Center (EOC):** Due to the impacts of COVID-19, PG&E adjusted our EOC operations to be entirely remote and virtual in 2020. PG&E and partner organizations exercised simulated PSPS events in the virtual EOC environment three times prior to the PSPS season in 2020 and then applied learnings from those simulations during actual PSPS events. PG&E was able to operate all the PSPS events in 2020 through the utilization of the Virtual EOC and built many tools and processes to keep the team members aligned throughout events.

PG&E will continue to improve our planning and preparedness with respect to data, training, tools, and EOC operations. The key lessons learned from PSPS events in 2020, especially from an operational perspective, are described in PG&E's De-energization Report submissions to the CPUC in compliance with Resolution ESRB-8. Based on the cumulative lessons learned, PG&E has identified the following areas to prioritize continued improvement to the processes, infrastructure and systems that support PSPS.

1. **Scoping Process and Tools:** PG&E will continue focusing our efforts on reducing the amount of time the scoping process takes to be able to further handle late weather changes and the subsequent downstream effects (e.g., customer notifications and mitigation enablement).

2. **External Communications and Notifications Process:** Similar to the scoping process, PG&E's external communications and customer notification processes showed large improvements in 2020. PG&E will prioritize this as an area for further improvement in 2021 focusing primarily on decreasing the amount of time required to send customer notifications and further automating the processes for issuing cancellation notifications.

3. **PSPS Data Management and Alignment:** While PG&E successfully shifted EOC activities to a virtual environment in 2020, we found that ensuring alignment with and access to the latest event data was critical to having clear team alignment and smooth execution. This is an area where we can improve further in the future. In 2021, PG&E will improve our tools to support improved data clarity and focus on formalizing our training around our in-event data access and availability.

4. **Other Utility/Independent Power Producer (IPP) Coordination:** PG&E has identified a small number of locations where we have customers downstream of distribution lines operated by other utilities, as well as locations where customers of other utilities are downstream of PG&E's distribution powerlines. An example is where PG&E and SCE's service territories connect along the I-5 corridor. PG&E will coordinate with these other utilities to build a stronger understanding of how to operationally manage these situations during PSPS events, with a particular focus on providing accurate customer notifications.

5. **EOC Staffing and Training:** The unpredictable nature of PSPS events make EOC staffing and training a challenge. In 2021, PG&E plans to clarify the EOC on-call schedule and further utilize role-specific live, virtual and recorded trainings to improve the overall level of preparedness for the employees responding to PSPS events.

6. **Virtual EOC:** As mentioned above, PG&E was largely successful in our virtual EOC rollout. However, we have identified additional opportunities to further build out the virtual EOC tools and tailor our EOC operations and process to a virtual environment. PG&E will pursue opportunities to further improve the virtual EOC environment in 2021.

Below, PG&E highlights 1, 3, and 10-year PSPS goals.

Given the ongoing analysis into how to incorporate the presence of known, high-risk vegetation conditions adjacent to powerlines into PSPS decision-making (see above,

"Planning to Make PSPS Smaller in 2021"), we have not set overall 2021 PSPS targets, but we are taking substantial actions to make PSPS events in 2021 smaller, shorter, and smarter.

Within the 1-year timeframe, PG&E will execute actions that will drive further reductions in the extent of PSPS impacts, in alignment with the strategies used in 2020 and described above. PG&E also plans to continue piloting new technologies to pave the way for further customer reductions in future years.

- Before the next annual WMP submission:
  - PG&E's activities supporting the "smaller" objective will include continuing with programs to sectionalize our Transmission and Distribution systems undertaking transmission VM and repairs, installing more distribution microgrids, and incorporating modified criteria for overhead hardened lines into our PSPS scoping models. PG&E will also pilot new technologies to pave the way for further customer impact reductions in future years.
  - PG&E's activities supporting "shorter" PSPS events will include undertaking in-event restoration process improvements and developing customized restoration plans for circuits that have posed restoration challenges in the past.
  - PG&E's activities supporting "smarter" PSPS execution will leverage lessons learned in 2020 to more effectively communicate with state, local, and tribal partners; refine our CRC strategy in close collaboration with local partners; ensure that our customer communications are timely, accessible, and accurate, and further partner with CBOs and others to provide services to PSPS-impacted customers, particularly those with AFN or other needs.
  - Please also see Section 8.3 for the subset of all 2021 WMP commitments that have the potential to impact PSPS in the 1-year time frame.
- Within the next three years:
  - PG&E expects to see further PSPS scope reductions as we continue to increase the maturity of our PSPS program and tools. With the incorporation of descoping criteria into our PSPS tools, PG&E will also begin to see more reductions from system hardening activities. In this time frame, newer technologies currently in pilot phases, such as REFCL and DTS-FAST, may also allow some lines to remain energized during high wind conditions, contributing to event size reductions.
  - Additionally, further development of tools may allow for more accurate and faster scoping of PSPS events to improve execution, communications and mobilization of customer support resources.
- Within the next 10 years:
  - PG&E expects a significant reduction in PSPS impacts as technologies currently in pilot phases are deployed at scale and significant portions of our long-term distribution hardening program are completed.

PG&E has learned a lot since we first executed PSPS in 2018 and expects to continue to learn, adapt and evolve this critical risk-mitigation program in the coming years. In addition to expected advances in technology and utility approaches, stakeholder input and Commission direction through various proceedings[7] may also drive changes to PG&E's PSPS program.

ACTION PGE-16 (Class A)

In its 2021 WMP update, PG&E shall: (1) provide the timeline for which it expects "hardened" circuits to be "reflected" in future PSPS events, (2) define what "hardened" circuits consists of, (3) explain how "hardened" circuits will be "reflected" in future PSPS events (i.e., scope, location, thresholds for initiating), (4) explain how long it takes to perform the analysis to determine the impact of "hardened" circuits on PSPS, and (5) explain the factors that PG&E is monitoring and analyzing to determine the impact of "hardened" circuits on PSPS.

Response:

1) In 2020, PG&E developed the Distribution PSPS descoping criteria to identify candidate distribution circuit segments for de-scoping from PSPS events This development followed the Risk Framework outlined in Section 4.5.1. In Q1 2020, the Scope and Data Intake steps were completed. Building on these first two steps, in Q2 2020, the Risk ID and Risk Assessment steps were completed by applying Failure Effect Mode Analysis (FEMA) to develop effectiveness factors for each mitigation type. Utilizing these effectiveness factors, the de-scoping criteria was established, and circuit segments were reviewed to identify candidate circuit segments in Q3 of 2020 as part of the Risk Management step. Through Q3 and Q4 of 2020, the performance of the identified candidate circuit segments was monitored as part of the Risk Mitigation step. In 2021, the Distribution PSPS de-scoping criteria will be integrated into the PSPS tools for the 2021 fire season. In Q1 2021, another review of circuit segments will be conducted to identify candidate circuit segments. In Q2 2021, candidate circuit segments sites will be inspected to confirm vegetation, line, and fuel conditions. These candidate circuit segments will be presented to the Wildfire Risk Governance Steering Committee before being flagged in the PSPS tools as candidate circuit segments for de-scoping. As such, PG&E expects to incorporate hardened circuit segments into PSPS scoping decisions for the 2021 PSPS season.

2) As outlined in Section 7.3.3.17.1, PG&E's System Hardening Program focuses on the mitigation of potential catastrophic wildfire risk caused by distribution overhead assets. This program targets the highest wildfire risk miles and applies various mitigations such as line removal, conversion from overhead to underground, application of remote grid alternatives, mitigation of exposure through relocation of overhead facilities, and overhead system hardening in place such as covered conductor. A hardened circuit is any combination of these alternatives along an entire circuit segment within the PSPS event footprint.

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7 Examples of PSPS-related proceedings include the Order Instituting Investigation, Investigation 19-11-013 and Rulemaking 18-12-005

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3) In order to be considered for de-scoping, circuit segments will be pre-identified as meeting the criteria. The Distribution PSPS de-scoping criteria is met when a circuit segments has an adjusted Distribution Large Fire Potential ($LFP_{D)}$ value below the PSPS threshold and there are no strike potential trees or open maintenance tags on the segment. As detailed in Section 4.2.A(c) – 4.2.A(g), the probability of the distribution line failing during a given weather event is based on historical performance of the line. For pre-identified lines, effectiveness factors to account for the improvement from hardening are determined. For example, if covered conductor is installed on a circuit segment this mitigation will reduce the probability of certain failure modes causing an ignition. The effectiveness factor represents the improvement to historical probability of ignition. These effectiveness factors are applied to the circuit segment within the PSPS tools. If the effectiveness factor reduces the historical probability of a catastrophic fire below the PSPS threshold, it is identified for de-scoping. The second part of the criteria concerning the absence of strike potential trees and open maintenance tags is confirmed by a review of LiDAR data and a site visit by Public Safety Specialists and Arborists.

4) PG&E interprets this question to request how much empirical evidence is needed to determine the impact or effectiveness of hardened circuit segments. After a hardening mitigation type is installed, performance data and analysis of any failure events will be used to supplement the effectiveness factors for each mitigation type each year. As learnings are applied to refine the effectiveness factors, it is anticipated that a period of 3 to 5 years will be needed to form a solid basis of empirical data from which to determine the impact or effectiveness of hardening mitigations.

5) During the time period described in the response to item #4, PG&E is monitoring the performance of hardened circuit segments and analyzing any failure events to refine the effectiveness factors developed as part of the PSPS de-scoping criteria.

Instructions for Table 8-1: Anticipated characteristics of PSPS use over next 10 years

Rank order the characteristic of PSPS events (in terms of numbers of customers affected, frequency, scope, and duration) anticipated to change the most and have the greatest impact on reliability (be it to increase or decrease) over the next ten years. Rank in order from 1 to 9, where 1 means greatest anticipated change or impact and 9 means minimal change or impact on ignition probability and estimated wildfire consequence. To the right of the ranked magnitude of impact, indicate whether the impact is to significantly increase reliability, moderately increase reliability, have limited or no impact, moderately decrease reliability, or significantly decrease reliability. For each, include comments describing expected change and expected impact, using quantitative estimates wherever possible.

TABLE 8-1: ANTICIPATED CHARACTERISTICS OF PSPS USE OVER NEXT 10 YEARS

Rank order 1-9.	PSPS characteristic	Significantly increase; increase; no change; decrease; significantly decrease	Comments
1	**Number** of customers affected by PSPS events (**normalized** by fire weather, e.g., Red Flag Warning line mile days)	Significant Decrease	PG&E has a suite of mitigations that potentially reduce customers affected through microgrids, segmentation, and resiliency zones in the short term, and we continue to implement and explore new opportunities to remove customers from PSPS scope through system hardening, undergrounding and technology pilots in the long term.
2	**Scope** of PSPS events in circuit-events, measured in number of events multiplied by number of circuits targeted for de-energization (**normalized** by fire weather, e.g., Red Flag Warning line mile days)	Significant Decrease	PG&E views the accuracy of the scope of a PSPS event based on how well we forecast weather conditions that meet the criteria for PSPS and the number of circuits that will be adversely affected by the elevated fire weather threat. While a significant reduction in "circuit-events" is expected going forward, there will still be circuits impacted, just in smaller portions. Reducing circuit-events can be influenced by system hardening and segmentation investments in targeted locations. PG&E's objective is to enact smaller and more surgical PSPS events.
3	**Duration** of PSPS events in customer hours (**normalized** by fire weather, e.g., Red Flag Warning line mile days)	Decrease	PG&E interprets this as the total number of hours an average

			customer is de-energized in a PSPS event.[8] The duration of a PSPS event is generally attributed to two parts, the weather duration and the restoration duration. PG&E is enacting actions to further optimize the post-PSPS patrol & re-energization processes, but we cannot control the duration of an elevated fire weather event.
4	**Number** of customers affected by PSPS events (total)	Decrease	While an absolute decrease is expected in the number of customers affected for the reasons described above (1), long-term climate models point to a higher probability of more frequent fire weather conditions. The total number of customers impacted by PSPS in any given year is dependent on the weather patterns and events experienced in that year.
5	**Scope** of PSPS events in circuit-events, measured in number of events multiplied by number of circuits targeted for de-energization (total)	Decrease	While an absolute decrease is expected in circuit events for the reasons described above (2), long-term climate models point to higher probability of more frequent fire weather conditions. The total number of PSPS circuit-events in any given year is dependent on the weather patterns and events experienced in that year.
6	**Duration** of PSPS events in customer hours (total)	Decrease	While an absolute decrease is expected in customer hours for the reasons described above (3), long-term climate models point to higher probability of more frequent fire weather conditions. The total customer hours driven by PSPS in any given year is dependent on the weather patterns and events experienced in that year.
7	**Frequency** of PSPS events in number of instances where utility operating protocol requires de-energization of a circuit or portion thereof to reduce ignition probability (**normalized** by fire weather, e.g., Red Flag Warning line mile days)	No Change	No change in the frequency of events compared to all fire weather days or red flag warnings could occur as PSPS may not be required for marginal weather events based on reasons described above (1) and (2). In order to reduce the number of PSPS events, the area of the system under threat of adverse weather would need to be either: 1) built to hardened standards to withstand extreme weather, or 2) mitigated by PSPS impact reduction equipment and services. Other alternatives such as switching or sectionalizing equipment may not be fully effective in reducing frequency of events.

[8] Note: This interpretation is different from PG&E's 2020 WMP submission based on re-interpretation of the PSPS characteristic designations and cross-referencing our interpretation with other large California IOUs. PG&E's 2020 WMP submission interpreted "duration in customer hours" as the product of customers impacted, average event duration, and the total number of events per year.

8	**Frequency** of PSPS events in number of instances where utility operating protocol requires de-energization of a circuit or portion thereof to reduce ignition probability (total)	No Change	While PG&E strives to reduce the frequency of PSPS events, given that long term climate models point to a higher probability of more frequent fire weather conditions, it is expected that the absolute number of PSPS events will not change, or may even increase. The actual number of PSPS events in any given year is dependent on the weather patterns and events experienced in that year.
9	Other	N/A	N/A
Note: External factors include but are not limited: urban expansion in the wildland urban interface, fuels treatment programs performed by state and federal agencies, changes in bark-beetle tree damage and tree mortality (e.g., sudden oak death), fuel loading, general population changes, changes in regulatory requirements, climate change, droughts, and frequency and duration of dry wind events ***The absolute number of customers, scope, frequency, and duration during this timeframe is unknown and dependent on numerous external factors.***			

8.2 Protocols on PSPS

Describe protocols on PSPS (PSPS or de-energization), to include:

1. *Strategy to minimize public safety risk during high wildfire risk conditions and details of the considerations, including but not limited to list and description of community assistance locations and services provided during a de-energization event;*

2. *Outline of tactical and strategic decision-making protocol for initiating a PSPS/de-energization (e.g., decision tree);*

3. *Strategy to provide for safe and effective re-energization of any area that was de-energized due to PSPS protocol;*

4. *Company standards relative to customer communications, including consideration for the need to notify priority essential services – critical first responders, public safety partners, critical facilities and infrastructure, operators of telecommunications infrastructure, and water utilities/agencies. This section, or an appendix to this section, shall include a complete listing of which entities the electrical corporation considers to be priority essential services. This section shall also include description of strategy and protocols to ensure timely notifications to customers, including AFN populations, in the languages prevalent within the utility's service territory; and*

5. *Protocols for mitigating the public safety impacts of these protocols, including impacts on first responders, health care facilities, operators of telecommunications infrastructure, and water utilities/agencies.*

In this section, PG&E describes our: (1) strategy to minimize public safety risks during high wildfire risk conditions; (2) PSPS decision making protocols (3) re-energization strategy; (4) customer, agency, and external communications; and (5) protocols for mitigating the public safety impacts of these protocols.

8.2.1 Strategy to Minimize Public Safety Risk During High Wildfire Risk Conditions

- *Strategy to minimize public safety risk during high wildfire risk conditions and details of the considerations, including but not limited to list and description of community assistance locations and services provided during a de-energization event.*

A) Strategy to Minimize Public Safety Risk

As outlined in Section 8.1, PG&E will continue to initiate and improve programs to reduce the impacts of PSPS on customers, while decreasing catastrophic wildfire risks.

B) Mitigating Impacts on De-energized Customers

PG&E recognizes the customer and community impacts that result from a PSPS, and understands, in many cases, the same customers may be impacted by multiple events. PG&E aims to minimize PSPS impacts through a variety of customer services and programs.

In 2021, PG&E will continue to ground programs and services in customer and stakeholder feedback, research, and data to continuously improve efforts to support customers and communities. PG&E will use this feedback and research to:

- Refine CRC strategy, working in close collaboration with county, tribal and CBO partners.
- Enhance solutions for customers frequently impacted by PSPS events (e.g., Butte County).

To further explain how PG&E mitigates impacts on de-energized customers, we have broken up this section into the following categories:

1. CRCs

2. Customer Resiliency Programs and Continuous Power Solutions:

    - Disability Disaster Access and Resources (DDAR) Program;
    - Portable Battery Program (PBP);
    - Self-Generation Incentive Program (SGIP);
    - Well-Pump Generator Program;
    - Backup Power Education through Online Marketplace and Safety Action Center;
    - EV Charging Network Support and Resiliency;
    - Community Microgrid Enablement Program (CMEP);
    - Individual Critical Customer Back Up Power Support; and

- Other Resource Programs.

PG&E also conducts extensive proactive education and outreach (outlined in Section 7.3.10.1), as well as sends customer and community notifications, during a PSPS event to assist with mitigating PSPS impacts (which are described in Section 8.2.4).

1. Community Resource Centers

To minimize public safety impacts during a PSPS event, PG&E opens CRCs in potentially impacted counties and tribal communities. CRCs provide customers and residents a safe location to meet their basic power needs, such as charging medical equipment and electronic devices.

PG&E developed the CRC strategy in consultation with regional, local and tribal governments, advisory councils, public safety partners, representatives of the disability and AFN communities, senior citizen groups, business owners, CBOs and public health and healthcare providers.

Resources

CRCs open the day PG&E de-energizes until the day electric service is fully restored. CRC standard operating hours are from 8 a.m. – 10 p.m.

PG&E adapted the 2020 CRC approach to reflect appropriate public health considerations due to COVID-19. In some cases, indoor CRCs were replaced with Micro CRCs (smaller, open air tents) and Mobile CRCs (vans) to accommodate physical distancing and COVID-19 guidelines. See the Figure PG&E-8.2-1 outlining the different CRC types and resources available at PG&E's CRCs.

FIGURE PG&E-8.2-1: CRC TYPES AND RESOURCES

Details/Resources	**Indoor**	**Tent**	**Micro**	**Mobile**
CRC Overview	Indoor site (i.e., Community Center)	Soft-sided tent at outdoor site	Open air tents at outdoor site	Sprinter van and tents at outdoor site
If Physical Distancing Required	**Grab-and-go bags*; metering and physical distancing**	**N/A; due to size limits of tent, will not use**	**Grab-and-go bags*; metering and physical distancing**	
COVID-19 Health and Safety Measures	X	X	X	X
ADA-Accessible Restroom and Hand-Washing Station	X	X	X	X
Heating and Cooling	X	X		
Device Charging	X	X	X**	X**
Wi-Fi Service	X	X	X	X
Bottled Water	X	X	X	X
Non-Perishable Snacks	X	X	X	X
Tables and Chairs	X	X	X***	X***
Bagged Ice	X	X		
Blankets (quantities limited)	X	X	X	X
Security Personnel	X	X	X	X
Wind/Weather-Resistant	X	Limited		

*Bag contains device charger, water, snacks and info card. **On-site charging for medical devices only. ***Tables and chairs for customers charging medical devices.

To keep PG&E customers and communities safe, all CRCs reflect appropriate COVID-19 health considerations and state and county guidelines:

- Facial coverings, physical distancing and limits on the number of visitors at any time are required;
- Temperature checks are administered before entry into indoor facilities;
- Supplies are handed out so customers can "grab and go." At outdoor sites, seating is available for medical equipment charging only;
- Surfaces are regularly sanitized; and
- For the health and safety of the community, we ask customers not to visit a center if sick with a fever, cough, sore throat or runny nose

As the COVID-19 situation evolves, PG&E will implement these same safety protocols during the 2021 wildfire season and modify as needed.

Site Criteria/Locations

When identifying potential CRC locations, PG&E consults with regional, local and tribal governments, advisory councils, public safety partners, representatives of the disability and AFN communities, senior citizen groups, business owners, CBOs and public health and healthcare providers.

PG&E's planned indoor CRCs are locations known to the public and identified in coordination with local and tribal agencies, such as community centers, libraries, schools, churches and senior centers. Outdoor CRCs (Tent, Micro and Mobile) are set

up in local lots in similar locations.

PG&E takes into consideration the below criteria when identifying and reviewing potential CRC locations:

Indoor CRC Site Criteria:

- Compliant with safety requirements (i.e., earthquake/fire codes, occupancy limits, meets all local codes, possesses interior and exterior lighting);
- ADA-accessible, meeting all associated facility and parking guidelines;
- Backup generation capabilities;
- Approximately 1,800+ square feet;
- Outfitted with restroom(s) and indoor plumbing or portable ADA-compliant restroom(s) and handwashing station(s);
- Able to accommodate off-street paved parking; and
- Equipped with a level-loading area for loading and unloading.

Outdoor CRC Site Criteria:

- Approximately half acre or more in size;
- Paved, accessible lot; and
- Able to accommodate portable ADA-compliant restroom and handwashing station.

As of December 2020, PG&E has secured 362 indoor and outdoor event-ready locations with site agreements executed between PG&E and landowners.[9] Note that these are PG&E-operated. See 2021WMP_Section 8.2.1_Atch01 for a list of these sites.

In-Event Coordination

During PSPS events, PG&E's dedicated Agency Representatives coordinate with potentially impacted counties and tribes to review the proposed scope of the event. Agreement on the selected locations for the CRCs is based on the anticipated areas of de-energization.

PG&E begins with pre-identified county and tribe-vetted CRC locations. In some cases, PG&E may procure additional locations during a PSPS event when unable to open a pre-identified site (e.g., unable to contact property owners, CRC is needed closer to impacted customer areas). In these instances, PG&E seeks feedback from counties and tribes to open additional approved locations for the event.

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9 As of December 16, 2020.

PG&E may decide not to open a CRC due to agency requests, faster than anticipated restoration, safety concerns or other factors.

PG&E shares CRC site locations on our website, social media and media press releases. These locations are shared with state and county officials as well, in addition to California Foundation for Independent Living Centers (CFILC) and other CBOs to reach our AFN customers.

Disability and Aging/AFN Communities and MBL Considerations

To meet a variety of safety needs for disability and aging/AFN communities, as well as MBL customers, PG&E has taken the following steps to base the CRC Plan on local demographic data:

- ADA-evaluation and remediation investment at indoor sites, along with compliance checklists for onsite personnel;
- Consultation with counties and tribes via Local Public Affairs (LPA) Representatives, Public Safety Specialists and Tribal Representatives regarding CRC locations based on county and tribal-specific and/or local demographics;
- Public transit evaluation of distance and accessibility for indoor and outdoor sites;
- Evaluation of accessible parking either through restriping, signage and/or cones; and
- Provision of:
  - ADA-compliant, portable restroom(s) and handwashing station(s) at all CRC sites;
  - Information cards with in-language resources;
  - Clear face shields for customers who are hard of hearing and/or read lips for accessible communication;
  - Signage compliance; and
  - Medical equipment charging at all CRC sites.

PG&E will continue site reviews and improvements at additional CRC sites as needed.

2. Customer Resiliency Programs and Continuous Power Solutions

PG&E offers solutions to reduce adverse impacts of PSPS events to customers, including those with medical and independent living needs, such as low-income customers. In advance of wildfire season and throughout 2021, PG&E will continue to work with partner organizations to provide outreach and support to vulnerable customers through programs such as the ones listed below.

See Section 7.3.3.11.1, which describes in detail PG&E efforts to support critical facilities and other customers' generation needs during PSPS events.

- **DDAR Program:** In April 2020, PG&E and CFILC[10] launched the DDAR Program, a joint effort to aid people living with disabilities, who have medical and independent living needs and older adults.

  CFILC administers the program through partnerships with participating Independent Living Centers (ILCs)[11] in local communities throughout PG&E's service territory. DDAR enables local ILCs to provide qualifying customers who use electrical medical devices with access to backup portable batteries through a grant, lease-to-own, or the FreedomTech[12] low-interest financial loan program. DDAR focuses on understanding customer needs through conversation, discussing emergency plan preparedness and assessing the best resiliency solution for each customer during a PSPS event. It also provides accessible transportation resources, lodging, food and gas vouchers, emergency planning, education and outreach about PG&E programs, such as the MBL Program.

  Table PG&E-8.2-1 showcases the resources provided to customers through DDAR in 2020 (as of January 19, 2021).[13]

TABLE PG&E-8.2-1: RESOURCES PROVIDED TO CUSTOMERS THROUGH DDAR PROGRAM IN 2020 (AS OF 01/19/21)

Resources/Engagement with Customers Before, During and After 2020 PSPS Events	Approximate Resources Provided to Customers in 2020
Customer Energy Assessments	1,750
Batteries Delivered	1,000
Food Vouchers	900
Hotel Stays	550
Gas Cards	50
Transportation	30

  In 2021, PG&E anticipates the DDAR Program will continue to offer a variety of resources to customers including batteries, hotel stays, food vouchers, gas cards and transportation.

- **PBP:** Launched in August 2020, the PBP provides free portable backup battery solutions to low-income[14] MBL customers in Tier 2 and 3 HFTD areas to support

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10 CFILC is a 501(c)(3) non-profit organization that provides a wealth of programs and coalitions to support individuals with disabilities and older adults and offers PG&E a connection with this community to ensure their safety during power shutoffs.

11 The Find an ILC tool lists participating ILCs. https://www.pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/independent-living-centers.page?WT.mc_id=Vanity_disabilityandaging.

12 https://freedomtech.org/.

13 As of January 19,2021.

14 Enrolled in CARE or Family Electric Rate Assistance Program (FERA).

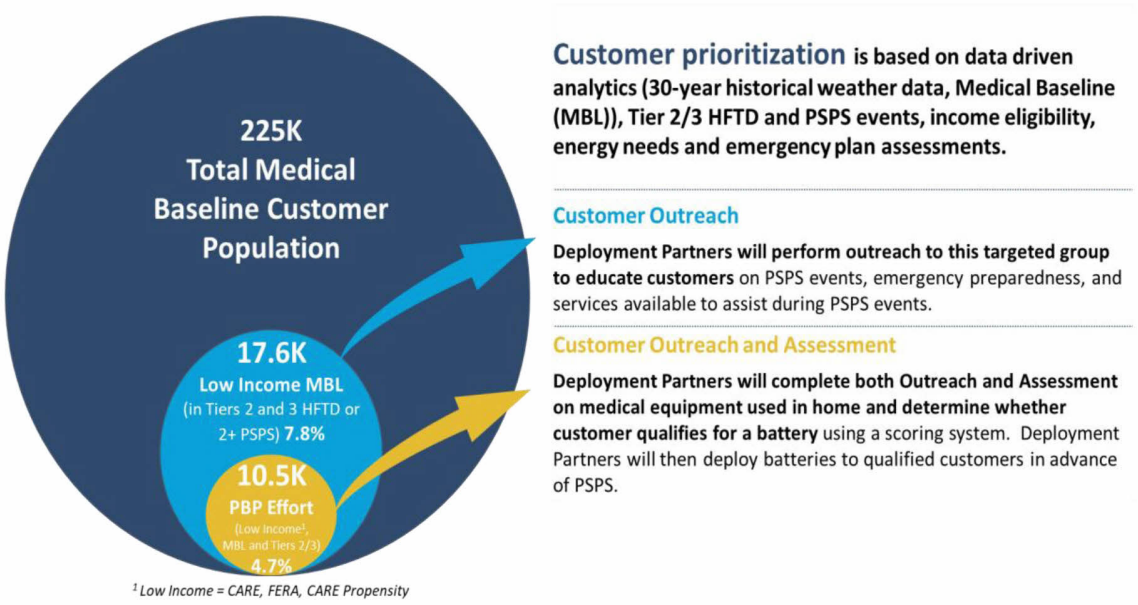
resiliency during PSPS events.

Five Low-Income Home Energy Assistance Program (LIHEAP) providers administer the PBP: Butte Community Action Agency, Central Coast Energy Services, Community Resource Project, North Coast Energy Services and Redwood Community Action Agency. Richard Heath & Associates, a third-party energy program implementer focused on underserved communities, is also working with PG&E on the program. These PG&E partner organizations actively reach out directly via mail and phone to all customers who meet the criteria. The delivery partner then completes an assessment of the power needs of the customer's medical equipment and provides a battery, if appropriate. Customers do not need to apply for the program. Like the DDAR Program, PBP focuses on understanding customers' needs through conversation, discussing emergency plan preparedness and assessing the best resiliency solution for each customer during a PSPS event. PBP partners conduct outreach, assess the customers' energy needs[15] for medical devices and the household's overall preparedness for a PSPS event and deliver a right-sized battery to qualified customers.

Figure PG&E-8.2-2 describes the PBP program model, with data as of July 2020, which includes customer prioritization, outreach and assessment approaches.

15 The number of completed energy assessments and battery deliveries depend on customers who respond to outreach, are willing to participate, and have medical devices that are eligible to be supported by a battery.

FIGURE PG&E-8.2-2: PBP MODEL



The PBP provides a range of batteries from smaller lightweight batteries to larger batteries (such as 5000 watt-hour (Wh) batteries), which can weigh over 300 pounds. The larger batteries have been delivered to higher energy needs residential customers, as well as some non-residential customers in HFTD, such as Food Banks and Meals on Wheels, without backup power to keep appliances powered for bulk perishable food items and communications to support operations.
PG&E worked with each of the delivery organizations to design the assessment and develop prioritization guidelines. Final customer prioritization is at the discretion of the local organization with consultation with PG&E, as needed. This approach provides a simple, streamlined customer experience that meets local community needs and does not require capital outlay from participating customers.[16]
Throughout 2020, PBP implementers offered over 8,800 assessments and delivered over 5,550 batteries to PG&E's medically sensitive customers (as of January 19, 2021).

In 2021, PG&E and partner organizations plan to continue delivering portable batteries to qualifying customers.

- **SGIP:** SGIP provides incentives for permanent battery systems for backup power. Over the last several years, SGIP has evolved, with a focus on vulnerable customer resiliency. Under SGIP's equity resiliency budget category, incentives can cover up to 100 percent of funding, including battery cost, installation and rewiring to eligible customers.

  In 2020, the majority of SGIP funding was reserved for customers who met equity

16 Customers are responsible for the costs of charging the batteries, but all efforts are made to deliver the battery with a full charge whenever possible.

and/or equity resiliency criteria,[17] with a focus on MBL customers and customers who rely on electric well pumps at their primary residence. Higher base incentives are reserved for those who are both vulnerable to PSPS outages and provide critical functions for customers during the outage(s).[18]

PG&E also received approval for the residential component of our SGIP Financial Assistance pilot. This pilot adjusts the timing of SGIP incentive payment structures to provide a fifty percent (50 percent) upfront payment to approved contractors installing SGIP-eligible measures for qualifying residential customers applying for equity and equity resiliency SGIP incentive funds. This payment structure removes cost barriers to enable vulnerable residential customers in improving their energy resiliency before PSPS events and other emergencies.

PG&E recognizes the need to help support critical facilities, like schools, that serve customers with AFN to adopt continuous power solutions. Because schools are currently ineligible for equity resiliency SGIP incentives, PG&E is seeking approval for a SGIP on-bill financing program to support schools' backup generation and storage needs, with an anticipated launch date of Q2 2021.[19]

- **Well-Pump Generator Program:** PG&E recognizes the challenges that PSPS events pose for rural customers who rely on well-water powered by electricity. To support these customers during PSPS events, low-income residential customers on PG&E's California Alternate Rate for Energy (CARE)/FERA (those who rely on pumped wells for water service and reside in a Tier 2 or 3 HFTD) can receive a $500 rebate for qualifying backup generators. Eligible customers that are not enrolled in the CARE/FERA program can qualify for a $300 rebate. The rebate is available to eligible customers who have purchased a qualifying generator after May 1, 2020.

- **Backup Power Education through Online Marketplace and Safety Action Center:** It is important for all customers to be prepared for different types of outages, whether they are PSPS events called by PG&E, wildfire-related outages initiated at the request of first responders such as California Department of Forestry and Fire Protection or rotating outages initiated by the California Independent System Operator (CAISO). PG&E is supporting customer preparedness and resiliency outreach by providing information and resources to customers interested in backup power solutions. This includes tools for comparing backup power options and an online marketplace (marketplace.pge.com) to find vendors. PG&E

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17 Commission D.19-09-027 established a new "equity resiliency budget" set-aside for customers participating in one of two low-income solar generation programs or vulnerable households that are located in Tier 2 and Tier 3 HFTD, as well as for critical service facilities serving those areas. D.20-01-021 authorized statewide annual ratepayer collections of $166 million annually through 2024 for the SGIP program. This decision prioritized allocation of funds to benefit customers affected by PSPS events or located in areas with extreme wildfire risk, including adopting a resiliency adder and a renewable generation adder to promote critical resiliency needs during PSPS events.

18 Customers eligible for the equity resiliency incentive will receive a $1 per-watt-hour incentive for energy storage projects.

19 PG&E Advice Letter 4360-G/6052-E.

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Marketplace currently hosts Portable Power Stations and Portable Generator categories to provide customers with the vendor options and retail purchase options. Through our online Safety Action Center (safetyactioncenter.pge.com), PG&E offers customers tools and tips to learn more about backup power safety. PG&E plans to provide information on backup power options during virtual webinars and other outreach events throughout our service territory.

PG&E will continue to explore additional continuous power-related program offerings to support backup power needs for potentially impacted customers.

- **EV Charging Network Support and Resiliency:** During PSPS events, PG&E's website defaults to a PSPS information site. Customers looking for information on EV charging stations are redirected to mapping resources found on PG&E's "Locate an EV Charger" page (ev.pge.com/charging-stations), which allows customers to find charging locations near them or along their route. Customers can confirm the charging station's status by visiting the network provider's page, which is linked on PG&E's EV savings calculator.

  PG&E's planned additional enhancements for the 2021 wildfire season include updates to EV charging station maps to show which stations are potentially impacted by PSPS events, direct outreach to EV customers with information on PSPS impacts to EV drivers, and continued collaboration with EV Service Providers to support communication efforts with EV owners.

  PG&E continues to explore emerging technologies and possible turn-key solutions to deploy L3 fast charging for areas affected by PSPS events.[20] PG&E is leveraging an existing research-based subscription service to expedite the search for EV charging solutions to inform the forthcoming Request for Information in early 2021. PG&E is on track to deploy one or more mobile DC (i.e., L3) fast-charge solutions by the 2021 fire season.

- **CMEP:** PG&E's CMEP provides incremental technical and financial support to communities seeking resilience for critical facilities and vulnerable customer groups. The program helps communities plan and implement a resilience solution so that they can power critical resources when the utility grid is shut down due to extreme weather or PSPS events. The support includes technical expertise and cost offsets to pay for the cost of distribution system upgrades to enable the safe islanding of a microgrid.

  The program consists of four elements:

  1. **Enhanced Utility Technical Support** – Serves to facilitate the development of a multi-customer microgrid from initial concept exploration, through solution assessment, to solution execution.

  2. **Enhanced Self-Service Information and Project Tools** – PG&E's Community Resilience Guide (www.pge.com/resilience) will provide updated financial,

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20 D.20-05-051.

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technical, and interconnection resources for community resilience projects.

3. **Community Microgrid Enablement Tariff** – PG&E submitted a pro forma tariff as part of our CMEP Advice Letter 5918-E to govern the eligibility, engineering studies, development, and island and transitional operation of community microgrids.

4. **Cost Offsets** – PG&E will offset the cost of that equipment necessary to enable the safe islanding of a community microgrid, up to $3 million per project.

PG&E expects to launch the CMEP in 2021, once the final program details are approved by the CPUC. Finally, PG&E also notes that a new Microgrid Incentive Program was adopted in D.21-01-018. PG&E looks forward to working with the other investor-owned utilities and stakeholders in 2021 through a collaborative workshop process to further define this program to support resilience for our customers.

- **Individual Critical Customer Back Up Power Support:** See Section 7.3.3.11.1, which describes in detail PG&E's efforts to support critical facilities and other customers' generation needs during PSPS events.

- **Other Resource Programs:** See Section 8.4 for information on PG&E's in-event support (e.g., foodbanks, grocery delivery programs etc.) for AFN customers.

  See Section 8.2.4 for information on in-event customer coordination, communications and notification processes.

8.2.2 PSPS Decision-Making Protocols

- *Outline of tactical and strategic decision-making protocol for initiating a PSPS/de-energization (e.g., decision tree).*

This section describes PG&E's 2020 process for determining when to initiate a PSPS event. This section also addresses Action PGE-66 (Class B).

A PSPS cannot eliminate all wildfire risks and is utilized as a last resort measure to reduce the risk of catastrophic fires and maintain public safety. At this time, there is no singular algorithm for criteria that yields an objective result. Thus, PG&E evaluates PSPS decision-making criteria on an ongoing basis. This ongoing evaluation may result in changes to PG&E's PSPS criteria and decision-making process in 2021 and beyond.

PG&E initiates a PSPS when the weather forecast is for such severe weather that people's safety, homes and businesses may be in danger of wildfires. As each weather situation is unique, PG&E carefully reviews a combination of factors when deciding if power must be turned off.

Key factors that determine PSPS is weather and the fuel moisture in living and dead vegetation. Weather models inform many operational decisions throughout PG&E to prepare for forecast conditions and to mitigate fire risk, including PSPS. PG&E has tested and deployed high-resolution weather models and built high-resolution historical datasets by partnering with external experts. These high-resolution historical datasets and forecasts drive the what is known as the Large Fire Probability (LFP) model. The LFP model (Distribution), represented as LFP_D, is the product of our Outage Producing Winds (OPW) and Utility FPI Models, which are the main inputs into the framework PG&E utilizes to make the decision to execute a PSPS event.

The OPW Model is based on an analysis of windspeeds for every unplanned sustained and momentary outage that occurred over the last decade and forecasts the probability of unplanned outages associated with wind events occurring in PG&E's service area. The OPW Model is driven by PG&E's high-resolution weather modeling output. The OPW Model is trained through an analysis of wind speeds during approximately 400,000 outages on PG&E's distribution grid. For every sustained and momentary outage, the wind speed was extracted from PG&E's historical dataset based on the time and location that each event occurred. This extraction allowed PG&E data scientists to develop wind-outage relationships and models that can then be run in forecast-mode. The OPW Model forecasts the probability of a wind-driven outage based on forecast windspeed for each grid cell for every hour of the forecast. Outage-producing winds vary across PG&E's system based on differences in topography, vegetation and climatological weather exposure in different parts of PG&E's service territory.

The Utility FPI Model uses logistic regression to predict the probability of a fire growing to 1,000 acres or more in a given geographic location based on three decades of meteorological data (including weather, fuel moisture and climatology data) and 26 years of historical wildfire data from the United States Forest Service (USFS) in PG&E's service territory. Similar to the OPW Model, PG&E extracted the

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weather data and dead and live fuel moisture data for each historical fire in the USFS fire occurrence dataset in California. PG&E's data scientists constructed over 4,000 Utility FPI Model variants to determine the optimal combination of the fire weather parameters, dead and live fuel moisture, and other factors. The Utility FPI Model takes the forecast meteorological and fuel conditions for each grid cell as an input and provides, for each forecast hour, the probability of a fire growing to 1,000 acres or more.

Using the outputs from the OPW and Utility FPI Models together as well as other criteria listed below, the LFP_D Model indicates for each two kilometer (km)-by-two km and three km-by-three km grid cell each hour, a categorization relating to the probability of a large fire originating from PG&E distribution equipment. The 6.0 LFP_D threshold is the product of PG&E's OPW and Utility FPI models. The LFP_D Model categorizes each grid cell over the forthcoming 104-hour period into one of four categories (called "dx_conditions"):

- "Below_Guidance" indicates that the grid cell fails to meet minimum fire-potential conditions which are the minimum atmospheric and fuel conditions present during the vast majority of large fires in California history based on the USFS fire occurrence data, and so the model does not recommend de-energization.

- "Fire_Potential" indicates that the grid cell meets the minimum fire-potential conditions that must be exceeded for de-energization to be considered. However, the product of the OPW and the Utility FPI Models (LFP_D) does not exceed 6.0, indicating that the forecast probability of a large fire occurring, while possible, is insufficient for the model to recommend de-energization based on the set threshold. This value was chosen after a detailed historical study by back-casting the LFP_D through our historical weather datasets to determine what value captures the significant wind-driven wildfires of the past while also carefully balancing customer impacts to limit the size of PSPS events. Based on this historical review of LFP_D values, verification of the weather scenarios where LFP_D exceeds 6.0, and also considering customer impacts due to PSPS, a LFP_D value of 6.0 was chosen as the quantitative guidance value to consider for PSPS on the distribution system.

- "Dx_Fire_Potential" indicates that the grid cell meets the minimum fire-potential conditions and that the product of the OPW and the Utility FPI Models (LFP_D) exceeds 6.0, PG&E's threshold for recommending de-energization.

- "Black_Swan" indicates that the grid cell meets the minimum fire-potential conditions and the product of the OPW and the Utility FPI Models does not exceed 6.0, but that the potential consequences of a fire igniting are severe enough that, regardless of the likelihood of such a fire, de-energization is still recommended.

The PG&E meteorology team is not limited to only analyzing or considering for de-energization the grid cells that meet the 6.0 LFP_D threshold or the Black Swan criteria. Members of PG&E's meteorology team are able to review those grid cells that are below the recommended guidance (e.g., on the border) and utilize their expertise and knowledge of past weather events to recommend areas that do not

satisfy the 6.0 threshold or the Black Swan criteria for de-energization based on the totality of the meteorological data available. For example, the team can review earlier model run outputs because the LFP_D Model is run four times a day—at 00:00, 06:00, 12:00 and 18:00 UTC. Because weather forecasts constantly change, this look-back can identify areas that are not currently satisfying the criteria but that may have previously exceeded guidance or that may be on the cusp of satisfying the criteria and could exceed criteria if there are relatively small weather shifts. Trends in the forecast are also considered. For example, in the event the forecast has been trending stronger or weaker in the past few model simulations. In addition, PG&E meteorologists utilize other public and proprietary weather forecast model data to help put PG&E's weather forecast model in perspective and better understand the forecast uncertainty.

While the primary initial driver of the scope of a de-energization decision is the algorithmic output of the two km-by-two km LFP_D Model and its application of the Black Swan criteria based on objective weather data, PG&E also considers additional factors in deciding on the recommended de-energization scope. The decision is ultimately a judgment by the meteorology team based on all the available data. These data include the LFP_D model run on three km-by-three km grid cells and weather forecasts generated by other weather models.

The meteorology department cannot begin scoping specific areas for de-energization until approximately four days before a potential de-energization event when our high-resolution forecast model data become available. Once inside that time window, the meteorology department begins the process of analyzing the LFP_D Model on each of those grid cells and analyzing the results on a grid cell-by-grid cell basis. The LFP_D Model estimates the probability of a large fire originating in each grid cell that traverses the geographical scope of a potential PSPS event. When the LFP_D Model's output indicates that the forecast weather conditions in certain grid cells exceed guidance values, or when the output approaches those guidance values, PG&E's meteorology team considers whether to recommend de-energizing those grid cells and any surrounding area. To convey the geographical and temporal recommendation for the scope of de-energization, PG&E's meteorology department develops polygons in our ArcGIS Pro mapping program based on the LFP_D and passes the GIS data and associated metadata on to the PSPS Viewer Team to determine which of PG&E's distribution assets traverse that area of the map—in essence, converting the geographical/temporal polygon into a list of distribution circuits to be de-energized. PG&E's meteorology team has to make the initial recommendation for the scope of any de-energization 72 hours in advance and again 24-48 hours in advance of the de-energization window because PG&E needs time to operationally prepare for the shut-off and the subsequent re-energization and because PG&E is required to notify public safety partners and affected customers in advance of an anticipated de-energization.

Timing of the Decision to De-energize

As indicated above, the PG&E Meteorology team begins scoping grid cells for possible de-energization approximately four days before a potential de-energization event because that is when the high-resolution forecast model data becomes available. Once the model data is available, PG&E meteorologists begin to run and

analyze the results of the LFP_D Model on a grid cell-by-grid cell basis using Geographic Information System (GIS) technology.

During this time, PG&E meteorologists also compare internal fire risk forecasts with forecasts from external agencies to validate observations of high fire risk across the California meteorology community including:

- Model data from public weather models, including pressure gradient forecasts that are known indicators of Offshore/Diablo winds and severe fire weather for Northern California;
- NWS issuance of Fire Weather Watches and RFWs;
- Northern and Southern CA Predictive Services units of the Geographic Area Coordination Centers (GACC) forecasts of "High Risk" zones with Critical Burn Environment factors and Dry Wind Triggers; and
- The National Oceanic and Atmospheric Administration's (NOAA) Storm Prediction Center's Fire Weather Outlooks indicating Elevated, Critical and Extreme fire-weather conditions across California.

Once PG&E's Fire Science and Meteorology team has identified an upcoming severe weather event (typically a period of adverse weather combined with dry fuels), it is monitored for an increased potential of a PSPS event. At this point, PG&E issues an "Elevated" forecast in the PG&E 7-day PSPS Potential (pge.com/weather). The "Elevated" forecast also triggers an internal transition to PSPS readiness posture, wherein select PG&E employees take on roles to prepare for an EOC activation. PSPS readiness posture allows PG&E to better prepare for EOC activities and potential PSPS, enhancing operational execution. Readiness posture activities are intended to be completed on an as-needed basis, driven by forecasted PSPS potential and dependent on the timing and amount of advanced warning required for the event.

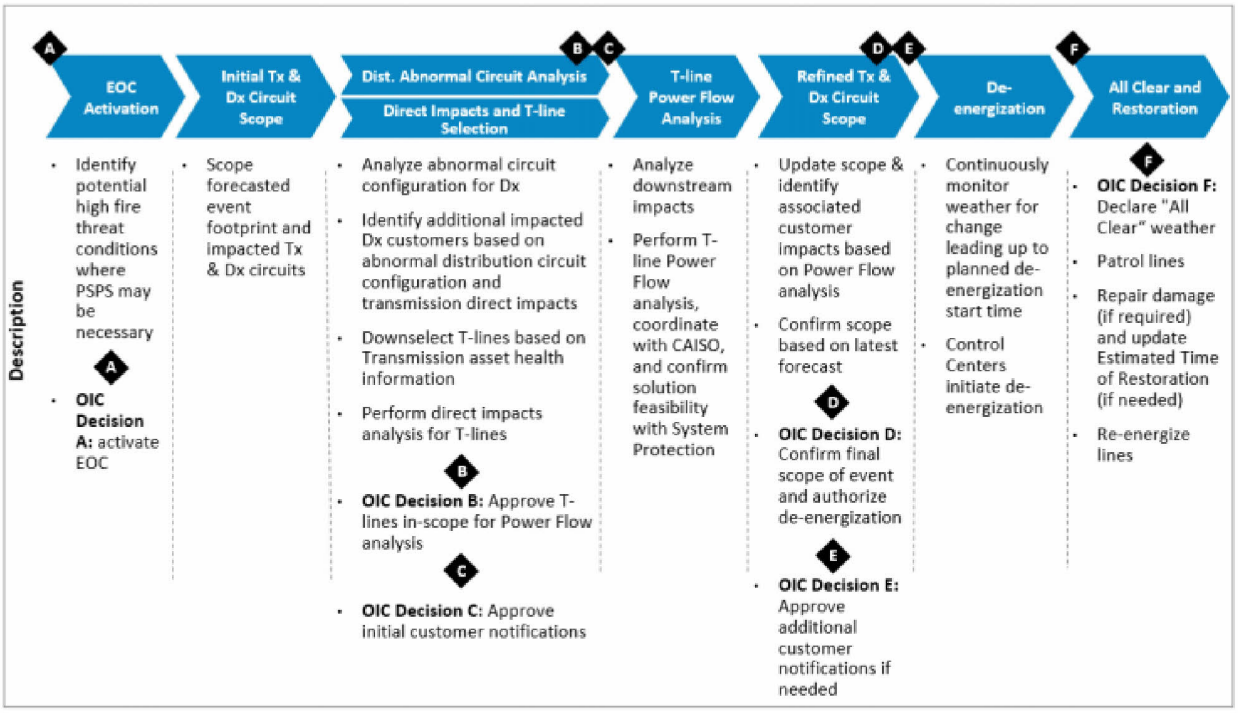
Once the PG&E meteorology team determines that forecast weather and fire potential conditions meet or may meet (if the forecast becomes more severe) the required thresholds for a PSPS event, PG&E activates our EOC, with a designated Officer-in-Charge (OIC). PG&E's meteorology team then issues a "PSPS Watch" on PG&E's public facing weather website (pge.com/weather). Under the EOC structure, PG&E Planning and Intelligence, Operations and other Incident Command System (ICS) teams continually monitor weather forecasts and update the OIC on the real-time status of the factors listed above.

During a PSPS event, the OIC is responsible for making the following decisions, which are also depicted in Figure PG&E-8.2-3 below:

- Activating the PG&E EOC in response to a forecasted PSPS event;
- Approving the list of transmission lines determined to be directly within the scope of the PSPS event;

- Approving initial customer notifications;
- Approving de-energization of distribution and transmission lines within the final event scope (including indirectly affected transmission circuits outside the weather polygon); and
- Approving weather "all clear" announcements after weather conditions subside and beginning the process of patrols and restoration.

FIGURE PG&E-8.2-3: PSPS DECISION-MAKING PROCESS WITH OIC DECISION POINTS (SUBJECT TO CHANGE AS REQUIRED BY PROGRAM EVOLUTION)



During a PSPS event, the PG&E meteorology team continually evaluates the latest available forecast data for changes and provides updates to the EOC command staff and OIC regarding how the weather event may be changing and if there are any changes to the timing of the event. The meteorology team bases these updates on their expertise, comparative plots from several forecast models to evaluate confidence and uncertainty, PG&E's LFP_D Model forecasts, and any changes to external forecasts like Fire Weather Watches and RFWs issued by NOAA and forecasts from Northern and Southern California GACC Predictive Services as well as the Storm Prediction Center. The PG&E EOC, Distribution Control Center, and Transmission Grid Control Center (GCC) then coordinate to ensure customers have been identified, notified, and that work is underway to identify and alternatives or mitigations to for possible de-energization.

Before the weather and PSPS event is expected to begin in a local to regional area, which is called the weather start time, a confirm/abort meeting is held by the EOC

Incident Commander (IC) to review the latest set of meteorological and field observation data before switching operations begin. PG&E positions our crews and control centers to be able to perform the switching operations needed to deenergize areas before dangerous conditions arrive. PG&E Meteorology reviews with the EOC IC the latest forecast model data, the model trends, forecast uncertainty and confidence by comparing against other model data, as well as verifying the event is arriving as scheduled, later or weaker than expected. If the event is arriving weaker than expected, by evaluating forecasted pressure gradients and wind speeds versus actuals, a decision may be made to delay in order to continue monitoring.

On an event-by-event basis, PG&E considers the health of each transmission structure, vegetation risk near each structure, the local area wind speed and Utility FPI Model forecasts. Given the specific forecast and factors listed above, PG&E determines which structures exceed a risk guidance value outputting a preliminary scope of transmission lines to be de-energized. The primary drivers of determining which structures and lines should be considered for PSPS is the LFP model (Transmission) or LFP_T Model, which is the combination of the Utility FPI Model and Operability Assessment (OA) Model. The model produces outputs for every transmission structure on an hour-by-hour basis. A Vegetation LiDAR Risk Score Model is also considered. This takes advantage of LiDAR information of trees surrounding transmission lines and is used to prioritize those lines that have higher risk of vegetation impacts. Black Swan criteria is also considered. This represents the situation where minimum fire-potential conditions are exceeded to the point that, regardless of the likelihood of asset failure leading to ignition, de-energization is recommended. Based on the relative wildfire risk calculated for each transmission structure in the footprint, PG&E will exercise expert judgment to identify which transmission lines, if any, should be considered for de-energization. The transmission lines identified during this evaluation process drive the initial transmission PSPS scope.

PG&E will then conduct a total impact analysis, in coordination with the CAISO, to ensure the initial transmission PSPS scope is feasible and will not compromise reliable bulk power system operations. This step is critical to support compliance with the Federal Energy Regulatory Commission, the North American Electric Reliability Corporation Reliability Standards and to ensure de-energizations will not negatively impact the integrity of bulk power systems.

This assessment process identifies the total count of customers who are likely to be impacted by a transmission PSPS event, including any publicly owned utilities (POU)/electric cooperatives, adjacent jurisdictions, small/multi-jurisdictional utilities, as well as other facilities interconnected at the transmission level. This step may also result in the identification of additional downstream PG&E distribution customers that would be impacted by transmission de-energization. Because of networked configuration of the transmission system, customers and entities impacted by a transmission PSPS event may not be directly located within the weather event footprint itself or in a HFTD area.

If a potential transmission PSPS scope is feasible from a grid operations standpoint, while maintaining compliance with regulatory standards, the benefits of de-energizing the potential transmission lines will be weighed against the public safety risks. If it is determined that the benefits of de-energization outweigh the risks, PG&E will

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de-energize the identified transmission lines in coordination with the CAISO, following approval by PG&E's OIC.

ACTION PGE-66 (Class B)

1) Provide the percent reduction to transmission de-energization during PSPS events associated with Transmission Vegetation Management (TVM), including a description and supporting data of how such was calculated.

2) Describe how PG&E factors in areas that have not undergone TVM when determining transmission de-energization during PSPS events, including all supporting procedures and models used.

3) Describe all instances in which a transmission line stayed energized due to TVM being completed, where it otherwise would have been subject to PSPS.

Response:

1) For 2020, PG&E targeted vegetation right-of-way clearing on seven PSPS circuits, based on the 2019 Transmission PSPS criteria. During the 2020 PSPS events, eight occurrences were avoided because of TVM, which represents an approximate 11 percent reduction in what could have occurred without this vegetation right-of-way clearing. This was calculated based on all lines where completed right-of-way clearing allows the line to not exceed 2020 transmission line vegetation scoping criteria, divided by the total 2020 transmission line PSPS de-energization occurrences due to vegetation. The final time where the line had to remain in the direct scope was due to extreme weather conditions rather than vegetation risk.

2) For 2020, transmission lines were scoped into PSPS due to vegetation exceeding the following thresholds:

- Meeting fire potential conditions;
- Meeting at least 40 mph wind gusts; and
- Meeting at least 1 tree in the 99.7th percentile of LiDAR risk and/or meeting at least 50 trees in the 95th percentile of LiDAR risk.

These thresholds applied to all transmission lines. LiDAR data for transmission is captured annually, providing up to date vegetation data for PSPS decision making. This data is used to develop the vegetation LiDAR Risk Score Model (see Section 7.3.5.8), which informs the PSPS transmission line scoping process (see Section 8.2.2) at the thresholds described above. In 2021, PG&E will continue to refine our vegetation risk model and update the model with new LiDAR data.

3) The vegetation management right-of-way clearing work has been ongoing since approximately 2017, prior to PG&E's implementation of PSPS events for transmission. Based on 2020 PSPS criteria, there were 8 occurrences that would have been de-energized if not for completed TVM work.

During the 9/7/2020 Event, PG&E was able to leave energized 3 transmission lines that

would have been de-energized if not for completed TVM work.

During the 9/26/2020 Event, PG&E was able to leave energized 1 transmission line that would have been de-energized if not for completed TVM work.

During the 10/14/2020 Event, PG&E was able to leave energized 2 transmission lines that would have been de-energized if not for completed TVM work.

During the 10/21/2020 Event, PG&E was able to leave energized 1 transmission line that would have been de-energized if not for completed TVM work.

During the 10/25/2020 Event, PG&E was able to leave energized 1 transmission line that would have been de-energized if not for completed TVM work.

8.2.3 Re-Energization Strategy

- *Strategy to provide for safe and effective re-energization of any area that was de-energized due to PSPS protocol.*

When restoring customers during PSPS events, PG&E's main objective is to re-energize our electric facilities safely and in a timely manner. When possible, PG&E prioritizes re-energizing critical infrastructure and transmission lines.

Once PG&E's meteorology team has determined the weather event has passed, PG&E's OIC provides the weather "all clear" approval. This provides the field team with approval to begin the steps listed below on the impacted assets within the PSPS footprint:

- Preparation for re-energization
- Patrol
- Mitigate hazards/repairs

Preparation for re-energization

When PG&E opens our EOC for a PSPS event, the restoration team (including Control Centers and Field personnel) conducts the following activities leading up to re-energization:

- Prepare an event-specific restoration plan based on the weather data;
- Identify restoration resources needed, including helicopters, planes, company personnel, contractors and mutual aid;
- Provide distribution circuit segment guides to field personnel listing the devices used to segment circuits for patrolling;
- Print distribution circuit segment maps, with a circuit map and individual maps for each segment that needs to be patrolled;
- Distribute switching logs to the field for the de-energization operations; and
- Following de-energization, segment impacted distribution circuits into sections, which are prioritized based on the critical nature of the infrastructure and the number of affected customers.

Patrols

Per PG&E's PSPS-1000P-01 (*Utility Procedure: Public Safety Power Shutoff for Electric Transmission and Distribution*), all impacted transmission and distribution overhead lines that are identified as "event-specific assets at risk" in High Fire Risk Areas (HFRA), as directed by the EOC, must be patrolled in their entirety. Additionally, all hazards must be cleared and/or damages repaired prior to re-energization. Hazards include tree branches entangled in the conductor; damages include fallen lines or poles.

For transmission circuits, patrols occur on the de-energized sections of all lines with identified "event-specific assets at risk", as directed by the EOC. For distribution circuits, patrols occur on all impacted primary (and secondary that extends beyond primary) overhead lines identified as "event-specific assets at risk", as directed by the EOC. Secondary does not include service drops.

Patrols are accomplished by a combination of the following methods:

- **Ground Patrols:** Conducted by Qualified Electrical Workers (QEW) from PG&E, contractors and mutual aid utilities

- **Aerial Patrols:** For distribution and transmission patrols performed by helicopters or planes during flyable daytime hours. Aerial patrols are used to cover a large amount of circuit miles when the terrain cannot be safely patrolled by ground in a reasonable period

  – **Night Aerial Patrols:** These can be completed using InfraRed (IR) technology on helicopters or planes. Night Aerial patrols are currently only conducted on transmission lines.

Following the weather "all clear", a distribution circuit segment is patrolled and re-energized starting at the source, then systematically patrolled and re-energized out towards the end of the circuits. Equipment that requires repair is isolated. The field patrol hierarchy typically consists of the following for a given distribution circuit:

- **Task Force Lead:** The single point-of-contact (POC) for a given PSPS impacted distribution circuit(s) who is responsible for ensuring PSPS patrols are completed and who works with the Control Center to safely re-energize distribution circuit segment(s). This single POC methodology promotes increased safety and efficiency due to more focused attention of patrol personnel (both aerial and ground) engaged in the PSPS restoration process. This ensures the Control Center is only providing/receiving direction to/from one person

- **Segment Lead:** Personnel responsible for oversight of assigned patrol personnel (both aerial and ground) on given segment(s) of a distribution circuit, reports to their assigned Task Force Lead

- **Patroller:** Individuals (internal, contract and mutual aid) responsible for patrolling assigned portions of a distribution circuit, reports to their assigned Segment Lead

The transmission line patrol prioritization strategy is driven by electrical system stability. This includes ensuring adequate transmission facilities are in service to support the overall grid and accompanying local loads, ensuring the system protection component is addressed and reviewing customer impacts associated with each line impacted in the event.

When both transmission and distribution assets (including substations) are involved, and it is operationally feasible, PG&E conducts patrols during the re-energization process on all types of assets simultaneously. In some cases, re-energization of the transmission line is prioritized to ensure that system stability (including the system protection component) is accounted for and to provide a source for substations and

associated distribution circuits that could be impacted.

Mitigate Hazards/Repair Damages

Due to severe weather events, PG&E may find hazards or damages to our facilities during patrols. Prior to restoring power, these hazards need to be removed and damages need to be repaired in order to mitigate the following risks:

- Arcing or sparks being created from damaged equipment when re-energized
- The public getting too close to, or needing access around, damaged equipment
- Electrocution or shock from damaged or unsecured equipment
- Additional equipment damage if circuit is re-energized while faulted
- Increasing the size or duration of the outage if damage is not isolated or repaired prior to re-energizing

For reference, examples of hazards and damages found during the 2020 PSPS events include:

- Damaged cross-arms on poles
- Damaged insulators and wire connectors
- Damaged splices or sections of conductors
- Vegetation intertwined with the electrical lines
- Trees falling onto assets

If damage is found in an individual segment due to a weather event, PG&E may be able to adjust the restoration order to allow for the overall restoration process to continue while repairs to the affected segment are initiated. This is supported with the visibility provided by the custom distribution circuit maps detailing both the circuit's individual segment(s) and overall circuit connectivity.

Some hazards, like a small tree limb found resting across the conductors, can be removed by the QEW performing the patrol using appropriate high voltage tools and Personal Protective Equipment.

Re-Energization

PG&E's Control Centers coordinate with other centers and field resources to manage all the information related to re-energizing the facilities and then direct the re-energization processes concisely. Many of the customer updates are automatically created by the computer applications being used by the Control Centers while re-energizing. The Control Centers can also operate remote control devices Supervisory Control and Data Acquisition (SCADA) to re-energize once the segment or transmission line has been patrolled and released for re-energization.

If no issues or concerns are found, or repairs are completed, the Task Force Lead will coordinate with the Control Center to re-energize a segment up to the next open device (segment boundary). This restoration sequencing is based on the "step restoration" methodology which allows for re-energizing customers in a safe, controlled and efficient manner, rather than waiting to patrol the entire circuit and then re-energizing. This process typically follows the pre-identified segmenting alphabetical sequence (i.e., A-B-C-D, etc.).

Re-energization information (i.e., segment guides, switching logs and maps) is provided to both the field and control center personnel prior to executing the PSPS restoration activities.

To support the re-energizing activities, resource needs are identified for the scale and scope of the event footprint during the event pre-planning. Resources typically include helicopters, company personnel, contractors and mutual aid. These resources are then provided to the impacted areas and staged to support the event.

2021 Restoration Goal

For 2021, our restoration goal is to restore all customers as soon as possible and within 24 hours from the termination of the de-energization event, unless it is unsafe to do so. For any circuits that require more than 24 hours for restoration, we will provide an explanation in our post event reports.

Typical safety exclusions based on past events have been (but not limited to):

- No access due to:
    - Police activity (i.e., security)
    - Fire activity (i.e., fire agency requests not to re-energize)
    - Road closure (i.e., public/private roadway closed/blocked and requires agency/customer response)
- Customer equipment damaged (i.e., requires customer repairs prior to energizing)

Some additional reasons why circuits may require more than 24 hours to restore include:

- Inability to utilize planned helicopter resources due to smoke / fog / other visibility concerns
- Lack of resources to patrol all the overhead conductors that were de-energized
- Restoration delayed due to repairs / correction of PSPS hazard or damage found on assets to be restored
- Equipment issues encountered when restoring circuit segment - not caused by PSPS damage

To further enhance PG&E's restoration process, two areas that will be improved upon during the planning phase of the PSPS restoration process are:

- Developing forecasts that identify flying conditions that could affect helicopter availability for patrolling (ex: wildfire smoke, fog, storm, etc.)

- Utilizing enhanced event weather information to identify patrol boundary opportunities. These opportunities typically consist of portions of distribution circuits de-energized during a PSPS event (due to connectivity) that are not in the defined event weather boundary "event-specific assets at risk" area, and as such do not require a patrol in order to be re-energized.

For more information on PG&E's 2021 plans related to standards, trainings and circuit guides and maps, please see Section 7.3.9.5.

8.2.4 Customer, Agency, and External Communications

- *Company standards relative to customer communications, including consideration for the need to notify priority essential services – critical first responders, public safety partners, critical facilities and infrastructure, operators of telecommunications infrastructure, and water utilities/agencies. This section, or an appendix to this section, shall include a complete listing of which entities the electrical corporation considers to be priority essential services. This section shall also include description of strategy and protocols to ensure timely notifications to customers, including AFN populations, in the languages prevalent within the utility's service territory.*

PG&E understands how disruptive it is for our customers, agencies and communities to be without power. In this section, PG&E outlines the outreach and engagement conducted during PSPS events to ensure customers, agencies and the general public are notified ahead of a power shutoff and have the information they need until power is fully restored. This section is broken up into the following categories:

A) Automated Notifications (Calls, Texts, Emails)

B) Additional Outreach and Engagement by Customer Type

- Local and State Agencies and First Responders;
- General Customers;
- MBL Customers;
- Communications to Customers with Limited English Proficiency and Other Needs;
- CBO In-Event Support and Resources;
- Critical Facilities and Infrastructure;
- Telecommunications and Water Providers;
- Transmission-level Entities;
- Third-Party Commodity Suppliers; and
- General Public/Media.

PG&E's in-event communications are in accordance with the CPUC PSPS Guidelines (D.19-05-042).

Based on feedback from agencies and customers on the 2019 PSPS events, PG&E focused our efforts in 2020 on key initiatives to enhance the communications during an event. This includes, but is not limited to:

- Providing alerts and notifications with more information about when power will be turned off and back on. These notifications include improved content tested for

usability and accessibility with simple and straightforward messaging on relevant event information (e.g., location of impact(s), estimated time of shutoff and restoration);

- Working more collaboratively with cities, counties, tribes, critical service providers and other public safety partners through advisory committees and other forums. This was to gather their feedback, identify their needs during PSPS events and update PG&E's policies and procedures to reflect and act upon the feedback received;
- Expanding the PSPS EOC staffing plan to have dedicated Agency Representatives that can work with local agencies and address issues in real-time. An Agency Representative is typically a member of the Public Safety Specialist or LPA teams who have existing relationships with these local agencies;
- Enhancing website capacity to manage higher bandwidth during activated PSPS events. PG&E's main website (pge.com) is prepared to handle 400 million hits per hour and our emergency website, which maintains the PSPS event update information, can serve 240 million hits per hour. During PG&E's largest event of 2020 (October 25), top traffic to these websites only reached 1.3 million hits per hour and 2 million hits per hour, respectively. PG&E's call center answer PSPS-related calls with an average speed of answer within 5 seconds;
- Partnering with the CFILC and other CBOs to conduct outreach and provide resources for individuals reliant on power for medical or independent living needs; and
- Providing emergency information in 15 non-English languages on our website, in-event PSPS customer notifications and select print material.

For more information on outreach that PG&E conducts on an ongoing basis on wildfire mitigation efforts, see Section 7.3.10.1. Additional information on outreach related to emergency planning and preparedness, see Section 7.3.9.2.

A) Automated Notifications (Calls, Texts, Emails)

When PG&E's EOC activates for a potential PSPS event, PG&E sends notifications to public safety partners[21] and customers at key milestones throughout the event, typically once a day. These are automated notifications via calls, texts and emails and are supplemented by additional outreach activities. Timing of notifications is subject to change based on weather conditions and other factors.

- **Advanced Notification:** After PG&E's EOC is activated, direct contact is made to California Office of Emergency Services (Cal OES, Public Safety Answering Points (PSAP) and county Office of Emergency Services (OES)/tribal contacts. PG&E also sends automated notifications to all public safety partners that may be impacted by the event. This is to provide public safety partners with advanced notice so they can begin implementing their emergency response plans, ahead of customer notifications;

- **Potential De-Energization (Watch Notification):** When weather allows, PG&E sends Watch Notifications two days ahead, one day ahead and on the day-of de-energization to public safety partners and customers. The notifications include potentially impacted addresses, estimated window of de-energization, estimated duration of the weather event, ETOR[22] and resource links (e.g., PSPS updates webpage with CRC information, resources for customers with AFN, maps and other updates needed for agency emergency response efforts);

- **De-Energization Initiated (Warning/Imminent Notification):** PG&E sends Imminent (Warning) notifications to public safety partners and customers when forecasted weather conditions confirm that a safety shutoff will happen soon. Whenever possible, Warning notifications are sent four to 12 hours in advance of power being shut off; these serve as PG&E's De-Energization Initiated notifications. These notifications give an estimated time when the customer's power will be shut off and the ETOR;

- **Restoration in Progress (weather "all clear" notification):** PG&E sends notifications to public safety partners and customers after the weather event has passed and the area is declared "all clear" to safely begin patrols and restoration (called the weather "all clear" notification). Customers can opt out of receiving event update notifications after de-energization has occurred; and

- **Restoration in Progress:** After the weather "all clear" notifications, PG&E sends event update notifications to customers if their ETOR changes from the original ETOR provided based on two scenarios:

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21 Public safety partners are defined by the CPUC as "first/emergency responders at the local, state, tribal and federal level, water, wastewater and communication service providers, affected community choice aggregators, POU/electrical cooperatives, the CPUC, the California Governor's OES and the California Department of Forestry and Fire Protection."

22 The initial ETOR provided to customers prior to de-energization is based on the forecasted timing of the end of the weather event and PG&E's goal to restore power within 12 daylight hours of weather clearing.

- **Once the weather event is over and PG&E begins patrolling:** Customers receive an updated ETOR based on field or meteorology conditions, which may be sooner or later than original ETOR provided; and

- **The weather event is over, and damage found during patrols of equipment:** Customers receive an updated ETOR accounting for repair time.

By providing individualized updates at the segment level on a circuit, PG&E gives customers more timely and accurate information about how much longer they might be out of power.

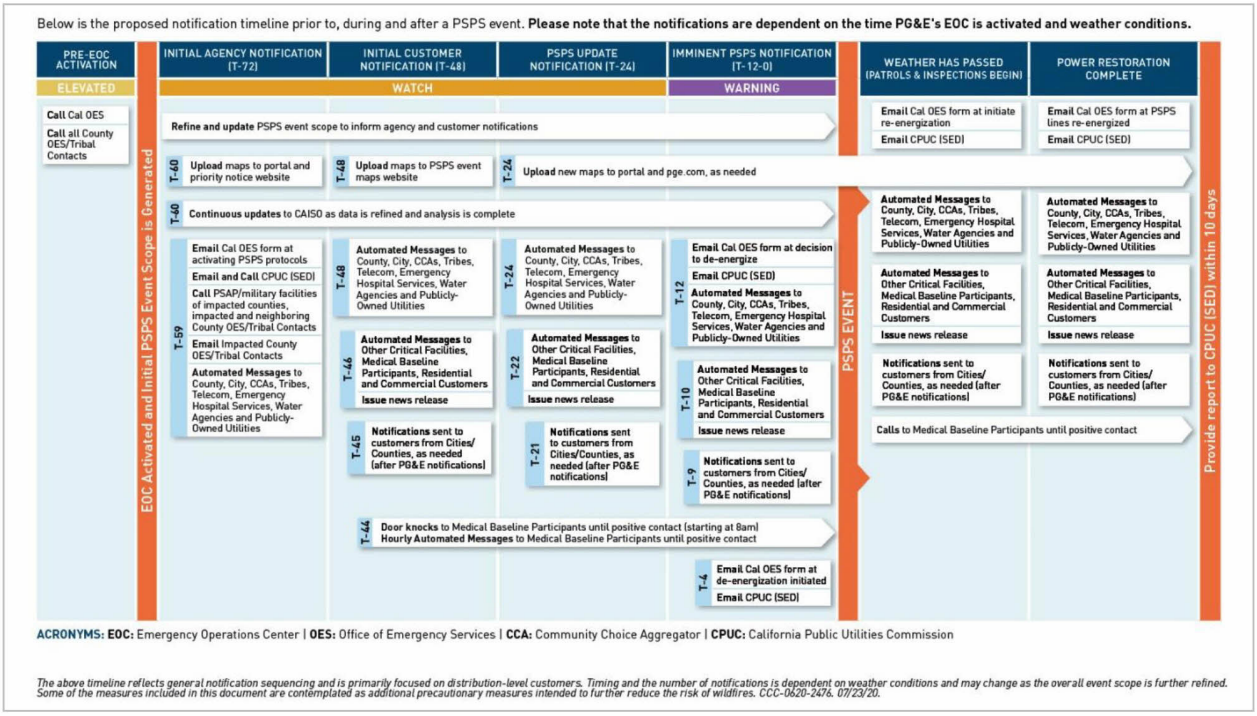
Additionally, when a microgrid is determined that the microgrid is safe and ready to operate during a PSPS event and is planned for a community, PG&E sends notifications to customers served by the microgrid to indicate that they might experience an outage for up to four hours as we re-configure their service from backup power to the electric grid.

- **Restoration Complete Notification:** Restoration Complete notifications are sent automatically to customers when customers are safely restored. This is done using an automated process that issues customer notifications every 15 minutes upon restoration of service. For cities, counties and tribes, Restoration Complete notifications are sent once all customers within the jurisdiction have been restored; and

- **Cancellation Notification:** Anticipated PSPS events may be avoided altogether if weather conditions improve. In such instances, PG&E will notify public safety partners and customers that weather conditions have improved in their area, and PG&E does not anticipate the need to turn off power for safety. PG&E also encourages customers to visit safetyactioncenter.pge.com for tips on putting together an emergency preparedness plan for their home or business.

Figure PG&E 8.2-4 outlines the PSPS notification process explained above.

FIGURE PG&E-8.2-4: PSPS NOTIFICATION PROCESS FLOWCHART



In 2021, PG&E will continue to identify opportunities to improve the notifications, such as:

- Conducting new message testing with customers and attempting to shorten the automated phone calls (while still complying with the required content);
- Streamlining non-PSPS-related outage notifications that can overlap with PSPS-related notifications (e.g., rotating outages); and
- Emphasizing our data collection efforts so that PG&E (1) has accurate customer contact information, including information on master-meter customers and other non-account holders (e.g., renters), (2) knows customers' language preferences, (3) allows opportunities for customers to self-identify as vulnerable (e.g., self-certified vulnerable, self-identified disabled, alternate format communications) without impinging on any HIPAA and CCPA data privacy laws.

B) Additional Outreach and Engagement by Customer Type

- **Local and State Agencies and First Responders:** In addition to the automated notifications noted above, PG&E's Liaison EOC Team is dedicated to conducting outreach and supporting local and state agencies. During emergency events, PG&E follows the ICS of the National Incident Management System structure and protocols to ensure that public safety partners receive timely and appropriate information during PSPS events and other emergencies. This is to ensure that local and state agencies receive timely updates as PSPS event conditions evolve. It is imperative that local and state agencies receive timely updates so

that they can initiate their own preparedness efforts to serve their communities. Examples of these locally driven preparedness efforts include, but are not limited to locally sponsored CRCs, procurement of temporary generation for targeted customers and facilities, enhanced public safety personnel resources in impacted areas, and other efforts. The Liaison Team's outreach is supported by the Incident Commander, as well as the Public Information Officer (PIO), Customer Strategy Officer and Planning Team. The outreach includes, but is not limited to:

- Submitting the PSPS State Notification Form to Cal OES with the latest event information and sending emails to the CPUC at the key event milestones identified by Cal OES;

- Conducting live calls to PSAP or dispatch centers when PG&E's EOC is first activated to inform them ahead of customers of a potential event, as their call volume may increase as customers' notifications begin;

- Hosting daily State Executive Briefings with state agencies to provide the latest event information and to answer questions. PG&E's Liaison Officer facilitates the call with updates from the IC, Assistant Customer Strategy Officer and Public Information Officer;

- Hosting daily Systemwide Cooperators Calls, where all Public Safety Partners in the service territory are invited to join and hear the latest event information. PG&E's Liaison Officer facilitates the call and provides event updates, along with a member of the Meteorology Team, the Assistant Customer Strategy Officer and Public Information Officer;

- Hosting Tribal Cooperators Calls with potentially impacted tribes to provide the latest event information and answer unique, local questions in real-time. PG&E's Tribal Liaison Branch Manager facilitates the call and provides event updates;

- Conducting ongoing coordination with local County OES and tribal contacts through dedicated Agency Representatives. Each Agency Representative works with the agency to determine a set cadence and communication type for event updates. These Agency Representatives are directly connected to PG&E's EOC during a PSPS event and coordinate internally to gather critical, timely, and location-specific information requested. During a PSPS event, PG&E's Liaison EOC Team aims to address requests for localized information in a timely manner to complement the standard cadence of notifications to all impacted communities described in this section;

- Embedding a PG&E Agency Representative into the Cal OES State Operations Center to answer questions in real-time, at the request of Cal OES; and

- Providing PSPS-related maps, situation reports, critical facility lists and MBL customer lists by jurisdiction via the PSPS Portal at the time of the initial notification and as event scope changes. During an activated PSPS event, PG&E's PSPS Portal Team is also available 24/7 to assist public

safety partners with access or technical support.

- **General Customers:** PG&E aims to share what we know about the weather and our equipment as soon as we can, keeping in mind weather conditions can be uncertain. Our goal, whenever the forecast will allow, is to send automated notifications to potentially impacted customers two days ahead before shutting off power and at least once a day until power has been restored.

  Customers who have selected their language preference receive in-language (translated) notifications. PG&E provides notifications to customers in English, with information on how to get event information in 15 non-English languages.[23]

  PG&E will continue to look for opportunities to optimize the frequency and accuracy of notifications and will also explore new solutions and improved technologies to best communicate PSPS event updates and impacts with customers in the channel of their choice. Example approaches include, but are not limited to, considering new approaches for translated notifications or web technologies, and/or exploring options to provide a more personalized customer experience on the web, call center and/or direct notifications. PG&E continues to pursue feedback from customers, agencies, CBO, tribal leaders and other relevant stakeholders to inform and improve the customer notification experience;

- **MBL Customers:** During PSPS events, MBL customers receive automated calls, text and emails at the same intervals as the general customer notifications. PG&E provides unique PSPS Watch and PSPS Warning notifications[24] to MBL program customers[25] and additional calls and texts at hourly intervals until the customer confirms receipt of the automated notifications by either answering the phone, responding to the text or opening the email. If confirmation is not received, a PG&E representative visits the customer's home to check on the customer (referred to as the "door knock" process) while hourly notification retries continue.[26] If the customer does not answer, the representative leaves a door hanger at the home to indicate PG&E had visited. In each case, the notification is considered successful.[27] At times, PG&E may also make Live Agent phone calls in parallel to the automated notifications and door knocks, as an additional

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23 Spanish, Chinese (Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese

24 All notifications include reference to resources available to customers including a link to www.pge.com/disabilityandaging.

25 Including MBL Program customers who are master-metered tenants (e.g., renters or tenants in mobile home park).

26 Until late evening (approximately 9 pm) or PG&E suspends outreach for the night.

27 For MBL customers, the in-person door knock visit where a door hanger is left, but no contact made with the customer is considered "successful contact," but not confirmed as "received." If the representative makes contact with the customer, this is considered "received."

attempt to reach the customer prior to and/or after de-energization.

PG&E shares MBL customer lists with appropriate county, city and tribal agencies via the PSPS Portal. The MBL customer lists identify individuals who have not confirmed receipt of their notifications. PG&E notifies agencies that the data is available on the PSPS Portal, encouraging them to inform these customers of available resources. Please note that agencies are required to accept the PSPS Portal online agreement to receive confidential customer information. PG&E also only provides agencies information to customers within their jurisdiction;

- **Communications to Customers with Limited English Proficiency and Other Needs:** Please see Section 8.4 for a detailed description of our services for limited English proficiency customers and AFN populations;

- **CBO In-Event Support and Resources:** Please see Section 8.4 for details on CBO in-event support and resources; and

- **Critical Facilities and Infrastructure[28]:** Critical facilities and critical infrastructure[29] are those that are essential to public safety and that require additional assistance and advance planning to ensure resiliency during de-energization events. Critical facilities will receive the following notifications and support by PG&E during a PSPS event:

  – Notification in advance of customers for preparedness efforts;

  – Maps of potentially impacted areas in advance of customer notifications; and

  – A dedicated single point of contact to communicate frequently via live calls for situation awareness updates and operational support.

Before a PSPS event, PG&E sends automated notifications to potentially impacted critical facilities and asks them to confirm receipt of the notifications. If these customers do not confirm receipt of the automated notification, PG&E representatives from local Operations Emergency Centers (OEC), Customer Relationship Managers (CRM) or Critical Infrastructure Lead (CIL) make direct calls to the critical facility contacts to ensure they are aware of the potential PSPS event, and they provide localized support for other public safety partners such as water agencies and emergency hospitals.

When PG&E's EOC is activated for a PSPS event, a single POC at PG&E will provide timely updates with event scope and status and answer individual questions for facilities that meet the requirements of being both a critical facility and public safety partner.

During PSPS events, PG&E leverages a dedicated team of Customer Relationship Managers to support critical facilities and other business customers. In addition to the CIL, PG&E's CRMs act as dedicated points-of-contact available 24/7 to conduct direct outreach, provide event updates and answer individualized questions for these

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28 D.19-05-042, Appendix A and D.20-05-051, Appendix A.

29 PG&E uses the terms 'critical facilities' and 'critical infrastructure' synonymously.

customers.

In 2020, PG&E held listening sessions with critical facility customers and established the Telecommunications Resiliency Collaborative to enhance information sharing and wildfire season preparedness. This forum helped PG&E set realistic service expectations and planning needs, better coordinate during emergency and disaster events and promote overall resiliency with Telecommunication providers in support of mutual communities served. These forums are described in detail in Section 7.3.10.1.

- **Telecommunications and Water Providers:** When weather allows, PG&E sends advanced notifications (approximately 72-48 hours in advanced of de-energization) via automated calls, texts and emails to impacted communications and water providers ahead of general customers, as they are considered public safety partners.

  These customers are also invited to PG&E's daily Systemwide Cooperator Call for situational updates and have access to the PSPS Portal that contains maps and other event information (e.g., impacted site lists, situation reports).

  Communications providers receive support from PG&E's CIL, and water providers receive escalated support through PG&E's local OECs.

- **Transmission-level Entities:** PG&E's CIL notifies impacted transmission-level entities, including POUs, of the event as soon as practically possible. Transmission-level entities receive automated notifications through PG&E's customer notification system once transmission-level impacts are officially determined, which is typically 36 hours in advance of de-energization. PG&E's GCC operators make live calls to these transmission-level entities before both de-energization and re-energization.

  POUs are invited to PG&E's daily Systemwide Cooperator Call to receive situational updates and have access to the PSPS Portal that contains maps and other event information (e.g., maps, impact lists, situation reports).

- **Third-Party Commodity Suppliers:** When PG&E's EOC is activated for a PSPS event, Community Choice Aggregator (CCA) Relations Managers directly contact the affected CCAs to warn of the possibility of the impending PSPS event. Throughout an event, PG&E's CCA Relations Managers give CCAs dedicated support, fielding questions, sharing situational updates and handling miscellaneous requests. PG&E send CCAs automated notifications at the same cadence as other public safety partners, invite them to PG&E's daily Systemwide Cooperators Call for situational updates and provide access to the PSPS Portal that contains maps and other event information (e.g., customer impact lists, situation reports).

- **General Public/Media:** In addition to direct customer notifications and communications, PG&E uses multiple platforms to communicate through the various stages of an event including PG&E's website and contact center, media outlets, including radio and social media channels and alternative customer notification methods.

– **Alerts:**[30] Customers and non-account holders can sign up for pre de-energization alerts (automated calls[31] and texts[32]) based on specified addresses outside of their permanent residence (anticipated by September 2021). Anyone can use PG&E's PSPS Address Alerts including CBOs, tenants of a master meter, renters, and others. This important communication tool allows customers to track certain locations, such as their children's school or place of work. The functionality is similar to that which is sent to the account holder for that address and replaces previous alerts that customers were able to receive by ZIP Code.

– **Website:** PG&E's website allows customers to have access to 24/7 information before, during and after a PSPS event. During a PSPS event, PG&E's website tools and resources include, but are not limited to:

  - Customer impact address lookup tool;
  - PSPS event maps and information;
  - Weather awareness updates;
  - PSPS collateral (including translated materials);
  - Media engagement and links to social media; and
  - Short informational or event-specific videos (e.g., process after a weather "all clear" is called, PSPS decision making process, ASL and translated videos).

  Before the first PSPS event of 2020, PG&E significantly improved our website, including pge.com, and established a new emergency website with better scalability and stability. PG&E's main website pge.com, currently has the capacity to serve 400 million hits[33] per hour and PG&E's emergency website, which maintains the PSPS event update information, can serve 240 million hits per hour. Both sites use a cloud-based provision solution.

  During PSPS events, PG&E places banners on multiple pages on pge.com to drive traffic to PG&E's PSPS event site. In addition, upon entering pge.com, users are taken to a splash screen on the PSPS event site giving the user a

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30 See pgealerts.alerts.pge.com/outages/psps-address-alert.

31 By June 2021, available in 16 spoken languages - Spanish, Mandarin, Cantonese, Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.

32 By June 2021, available in 15 written languages - Spanish, Chinese (Mandarin and Cantonese) Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi, and Portuguese.

33 Website hits measure requests for data sent to a server when a user accesses a webpage (e.g., images viewed, data downloaded). One-page visit or page view can result in one or more hits.

choice of visiting pge.com or the PSPS updates web pages. PG&E updates the website with information on CRCs as soon as sites are confirmed (up to two days before de-energization for some locations), including locations listed by county, resources available at each center, type of CRC (e.g., indoor, outdoor) and operating hours. CRC locations are also indicated on the PSPS impact map.

In addition to the PSPS-related websites, which are accessible and translated in 15 non-English languages, PG&E also maintains a special resources webpage[34] that highlights PSPS impact mitigation resources available during an event, including an overview of the services provided through PG&E's partnership with CFILC as described in Section 8.4, and a list of local ILCs to contact. The site also includes a video of an ASL interpreter that provides an overview of the resources available through local ILCs.

– **Contact Centers:** PG&E operates four contact centers in the state of California and provides 24/7 emergency live-agent service for customers to report emergencies, or obtain PSPS-related updates, as needed. PG&E's Contact Center agents are trained in how to handle customers dealing with natural gas and electric emergencies with specific procedures to escalate life-threatening situations, which is available for translation services in 240 languages. PG&E may implement the "PSPS call strategy,"[35] as needed, to increase call center staffing to help ensure elevated service with minimal wait times for customers during a PSPS event.

– **Social Media:** During an event, PG&E provides event updates on social media to provide awareness and updates on the event. These tactics include:

  - Posting information and event updates at regular intervals on a variety of channels (i.e., Twitter, Facebook, Nextdoor, Instagram);
  - Varying the information to reflect the current status of the PSPS event;
  - Producing social media content in English, Chinese and Spanish; and
  - Sharing an event recap from the public briefings across social channels.

– **Advertising:** During an event, PG&E secures spot advertisements on local radio and print media outlets, including in-language publications. Information includes but is not limited to:

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34 www.pge.com/disabilityandaging.

35 During an event, PG&E will consider implementing the PSPS call strategy, as needed, to ensure elevated service with minimal wait times for customers potentially affected by an active PSPS event customers. The PSPS call strategy includes maintaining full staffing across Contact Center Operations and training Credit and Billing representatives to be able to handle PSPS call types, and only accepting emergency-related calls (including calls related to downed wires, gas leaks, outages and PSPS) when notifications are sent to over 100,000 customers for an active PSPS event.

- Event information and resources for customers in need, including the PSPS Disability and Aging website and recommendations for calling 211 for a full list of support services; and

- Backup communication channels should cell service be unavailable for direct customer notifications.

– **Media Engagement:** During an event, PG&E proactively and reactively engages with local media to provide awareness, event updates and general education on PSPS events. These engagements include:

  - Issuing news releases one to two times a day to update customers and the media on the latest developments;

  - Holding evening public briefings which are live streamed with an ASL translator for customers and the media where press outlets are invited to ask questions;

  - Distributing morning video updates on social media to provide customers with the latest event updates and ways to prepare; and

  - Reaching out for interviews and responding to local media outlet questions and requests for interviews throughout the service territory.

See 2021WMP_Section 8.2.4_Atch01 for a confidential list of priority essential service entities, as defined by the CPUC. Note that the entity name is created by the customer through the account setup process and entities could have multiple accounts, separated by facility location or operational function. Because of this, the attachment may appear to have duplicate listings.

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8.2.5 Protocols for Mitigating Public Safety Impacts of PSPS

Protocols for mitigating the public safety impacts of these protocols, including impacts on first responders, health care facilities, operators of telecommunications infrastructure, and water utilities/agencies.

Between 2021-2023, PG&E will mitigate public safety impacts of PSPS activities on public safety partners (i.e., first responders, health care facilities, operators of telecommunications infrastructure and water utilities/agencies) by engaging in the following:

- Adopting PSPS impact mitigation efforts as described in Section 8.2.1;
- Coordinating with public safety partner(s) to collectively plan and prepare for emergencies, as described in Section 8.2.4;
- Effectively communicating with public safety partners in advance of a potential PSPS event, as described in Section 8.2.4;
- Effectively communicating information regarding planning and preparation (i.e., more detailed planning maps, improvements to the impact map-sharing process, weather conditions and other situational awareness updates, insight into impacted MBL customers, etc.), as described in Section 8.2.4;
- Developing COVID-19 considerations following state and county guidelines, if shelter-at-home and physical distancing requirements are in place during PSPS events, as described in Section 8.2.1; and
- Deploying temporary backup generation sources to energize substations and temporary microgrids for services supporting community normalcy, standalone facilities serving public safety, hospitals supporting emergency response, vote tabulation centers and CRCs, as described in Section 8.2.1.

PG&E will continue improving our PSPS protocols and the resources we provide based on feedback from relevant stakeholders. PG&E will also continue to refine its protocols and procedures based on lessons learned after each PSPS event, as described in the Post Event De-Energization Reports filed by PG&E following PSPS events.

8.3 Projected changes to PSPS impact

Describe organization-wide plan to reduce scale, scope and frequency of PSPS for each of the following time periods, highlighting changes since the prior WMP report and including key program targets used to track progress over time,

1) *By June 1 of current year;*

2) *By September 1 of current year; and*

3) *By next Annual WMP Update.*

As described in Section 8.1, PG&E has developed, and will continuously refine, our PSPS mitigation plan in order to reduce PSPS impacts over the 10-year planning horizon. Please see Section 8.1 for a detailed discussion regarding PG&E's recent and future efforts to make PSPS events smaller, shorter, and smarter.

Table PG&E-8.3-1, Table PG&E-8.3-2 and Table PG&E-8.3-3 provides a high-level summary of PG&E's planned deliverables – in way of advancing PSPS mitigation programs – over the next WMP cycle. While many of these program advancements are targeted to immediately further reduce PSPS impacts, some are designed to advance PG&E's capabilities to accelerate PSPS impact reduction in the future.

1. By June 1 of current year

TABLE PG&E-8.3-1: PSPS IMPACT MITIGATION COMMITMENTS TO BE COMPLETED BY JUNE 1, 2021

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Situational Awareness and Forecasting	B.02	7.3.2.1.2	Enhancements to Fuel Moisture Sampling and Modeling efforts	Expand the historical Dead Fuel Moisture (DFM) and LFM Live Fuel Moisture (LFM) climatology at 2 x 2 km resolution to back-fill all of 2020.	6/1/2021
Situational Awareness and Forecasting	B.03	7.3.2.1.2	Enhancements to Fuel Moisture Forecasting	Evaluate extending the deterministic DFM and LFM forecast to provide another 24 hours of forecast data.	6/1/2021
Situational Awareness and Forecasting	B.07	7.3.2.1.6	Information Sharing	Make adjustments to the public 7 day forecast to provide more granularity and clarity around the potential for a PSPS event.	6/1/2021

2. By September 1 of current year

TABLE PG&E-8.3-2: PSPS IMPACT MITIGATION COMMITMENTS TO BE COMPLETED AFTER JUNE 1, 2021, AND PRIOR TO SEPTEMBER 1, 2021

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Situational Awareness and Forecasting	B.11	7.3.2.4	Enhancements to Fire Potential Index (FPI) Model	Enhance the FPI Model by September 1, 2021 using additional data and an enhanced fire occurrence dataset. PG&E also plans to incorporate the new Technosylva fuel mapping layer into FPI calculations if it provides more predictive skill of large fires.	9/1/2021
Situational Awareness and Forecasting	B.13	7.3.2.6	Enhancements to Outage Producing Wind (OPW) Model	Recalibrate the OPW Model using the 2 km climatology that will be extended to capture all events in 2020, including sustained and momentary outages, as well as damages found in PSPS events of 2020.	9/1/2021
Grid Design and System Hardening	C.03	7.3.3.11.1 B	Generation for PSPS Mitigation (Substation Distribution Microgrids)	Prepare at least 8 substations to receive temporary generation for 2021 PSPS mitigation.	8/1/2021
Grid Design and System Hardening	C.07	7.3.3.8.2	Transmission Switches	Install 29 SCADA transmission switches to provide switching flexibility and sectionalization for PSPS events.	9/1/2021
Grid Design and System Hardening	C.10	7.3.3.17.4	Rapid Earth Fault Current Limiter (REFCL) Pilot	PG&E plans to have the final results from this pilot project by September 2021 to inform the long term REFCL strategy.	9/1/2021

3. Next Annual WMP Update

TABLE PG&E-8.3-3: PSPS: MITIGATION COMMITMENTS TO BE COMPLETED AFTER SEPTEMBER 1, 2021 AND PRIOR TO THE NEXT ANNUAL UPDATE

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Risk Assessment and Mapping	A.01	7.3.1.5	Match drop simulations (24 additional hours of forecast data)	Enhance the wildfire spread project in 2021 by expanding the forecast horizon from three to four days.	12/31/2021
Risk Assessment and Mapping	A.02	7.3.1.5	Match drop simulations (update fuel model layers)	Update the fuel model layers on annual basis (Technosylva).	12/31/2021
Risk Assessment and Mapping	A.03	7.3.1.3	Re-Train Vegetation and Equipment Probability of Ignition Models	PG&E's Vegetation Probability of Ignition and Equipment Probability of Ignition Models will see more improvements with another year of data (2020) incorporated.	12/31/2021
Risk Assessment and Mapping	A.04	7.3.1.1 / 4.5.1	Risk Mapping Improvements (Transmission)	Improve Transmission Risk Modeling to provide more standardized wildfire risk mapping/ranking between the various controls and mitigations.	12/31/2021
Risk Assessment and Mapping	A.05	7.3.1.1 / 7.3.1.4	Risk Mapping Improvements (Distribution)	Improve Distribution Risk Modeling to include: 1) ability to compare wildfire risks for different risk drivers, 2) ability to measure the risk reduction of specific mitigations, 3) add wildfire risk values for distribution line locations beyond the HFTD and High Fire Risk Areas (HFRA) areas to include all of PG&E's distribution lines.	12/31/2021
Risk Assessment and Mapping	A.06	4.5.1 / 4.1	Model PSPS customer impacts at circuit level	Develop a more granular, circuit level model, to assess PSPS customer impacts.	9/30/2021
Situational Awareness and Forecasting	B.01	7.3.2.1.1	Numerical Weather Prediction	Make enhancements to numerical weather prediction program.	12/31/2021

TABLE PG&E-8.3-3: PSPS: MITIGATION COMMITMENTS TO BE COMPLETED AFTER SEPTEMBER 1, 2021 AND PRIOR TO THE NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Situational Awareness and Forecasting	B.04	7.3.2.1.3	Enhancements to Weather Station Project (Installations and Optimization)	Install or optimize the location of 300 weather stations throughout PG&E's territory.	12/31/2021
Situational Awareness and Forecasting	B.05	7.3.2.1.3	Enhancements to Weather Station Project (Wind Gust Model)	Develop a weather-station specific wind gust model based on machine-learning or statistical techniques.	12/31/2021
Situational Awareness and Forecasting	B.06	7.3.2.1.6	Medium- to Seasonal-Range Diablo Wind Forecasting	Develop and deploy a seasonal Diablo wind event forecasting system to obtain longer lead-times of upcoming Diablo wind events.	12/31/2021
Grid Design and System Hardening	C.01	7.3.3.8.3	Assess Motorized Switch Operator (MSO) switches	Assess various alternatives to address the ignition risk associated with MSO switches. Explore several pilot options to inform the best alternatives and select the appropriate corrective action for MSO's for the next WMP update.	12/31/2021
Grid Design and System Hardening	C.02	7.3.3.11.1 C	Generation for PSPS Mitigation (Temporary Distribution Microgrids)	Develop at least 5 additional distribution microgrid Pre-installed Interconnection Hubs (PIH).	12/31/2021
Grid Design and System Hardening	C.04	7.3.3.11.3	Emergency Back-up Generation – PG&E Service Centers & Materials Distribution Centers	Equip at least 23 PG&E Service Centers & Materials Distribution Centers to receive permanent or temporary generation.	12/31/2021
Grid Design and System Hardening	C.05	7.3.3.17.5	Remote Grid	Begin operations of the first Remote Grid site by the end of 2021.	12/31/2021

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TABLE PG&E-8.3-3: PSPS: MITIGATION COMMITMENTS TO BE COMPLETED AFTER SEPTEMBER 1, 2021 AND PRIOR TO THE NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Grid Design and System Hardening	C.06	7.3.3.8.1	Distribution Sectionalizing (automated devices)	Install at least 250 more distribution sectionalizing devices integrating learnings from 2020 PSPS events, 10-year historical look-back of previous severe weather events, and feedback from county leaders and critical customers.	12/31/2021
Grid Design and System Hardening	C.08	7.3.3.9.1	Distribution line legacy 4C controllers	Replace all remaining (~84) distribution line legacy 4C controllers that are in Tier 2 and Tier 3 HFTD areas.	12/31/2021
Grid Design and System Hardening	C.09	7.3.3.9.2	Fuse Savers (Single phase reclosers)	Install 70 sets of single phase reclosers.	12/31/2021
Grid Design and System Hardening	C.13	7.3.3.17.1	System Hardening (line miles)	Harden 180 highest risk miles.	12/31/2021
Grid Design and System Hardening	C.14	7.3.3.17.6	Butte County Rebuild	Underground 23 miles.	12/31/2021
Grid Design and System Hardening	C.15	7.3.3.17.2	System Hardening - Transmission Conductor	Replace approximately 92 miles of conductor on lines traversing HFTD, including associated asset hardware.	12/31/2021
Vegetation Management and Inspections	E.01	7.3.5.15	EVM (line miles)	Complete 1,800 circuit miles and mitigate approximately 190,000 trees.	12/31/2021
Vegetation Management and Inspections	E.03	7.3.5.3	VM Transmission Right of Way Expansion	Perform Transmission ROW expansion on approximately 200 miles within HFTD areas.	12/31/2021
Emergency Planning and Preparedness	I.01	7.3.9.1	Staffing to Support Service Restoration	Hire approximately 40 Linemen and 100 Apprentices.	12/31/2021
Emergency Planning and Preparedness	I.02	7.3.9.1	Trained Workforce for Service Restoration	All required personnel complete identified trainings to improve PSPS event execution (including SEMS, Access and Functional Needs and other critical training).	12/31/2021

TABLE PG&E-8.3-3: PSPS: MITIGATION COMMITMENTS TO BE COMPLETED AFTER SEPTEMBER 1, 2021 AND PRIOR TO THE NEXT ANNUAL UPDATE (CONTINUED)

Plan Area	Unique ID	Section Reference	Activity	Commitment Description	Commitment Date
Stakeholder Cooperation and Community Engagement	J.01	7.3.10.1 / 8.4	Community Based Organizations (CBOs) Coordination	Partner with CBOs in targeted communities to increase their capacity to serve AFN communities, such as medically sensitive customers, low-income, limited- English speaking and tribal customers.	12/31/2021
Stakeholder Cooperation and Community Engagement	J.02	7.3.9.2 / 7.3.10.1	Community Engagement	Engage community stakeholders through offering: Wildfire Safety Working Sessions, workshops that review PG&E's PSPS Policies and Procedures document, listening sessions, and Energy and Communications Providers Coordination Group meetings.	2/1/2022
Stakeholder Cooperation and Community Engagement	J.03	7.3.9.2 / 7.3.10.1	Customer and Community Outreach	Continue to enhance communications and engagement efforts with a focus on wildfire safety and preparedness for PSPS events - including Webinars/Community Meetings, Direct-to-Customer Outreach, developing and delivering informational video resources.	12/31/2021
Protocols on Public Safety Power Shutoff	K.01	8.4 / 8.2.4	Customer and Agency Outreach During PSPS Events	Improve Customer and Agency Outreach During PSPS Events by: developing opt-in address alerts, conducting new message testing, promoting enrollment, hosting briefings, hosting cooperator calls.	12/31/2021
Protocols on Public Safety Power Shutoff	K.02	8.2.1	Mitigate Impacts on De-Energized Customers	Work with partner organizations to provide outreach and support to vulnerable customers through programs such as the Disability Disaster Access and Resources Program (DDAR) and the Portable Battery Program (PBP).	12/31/2021

8.4 Engaging Vulnerable Communities

Report on the following:

1. *Describe protocols for PSPS that are intended to mitigate the public safety impacts of PSPS on vulnerable, marginalized and/or at-risk communities. Describe how the utility is identifying these communities.*

2. *List all languages which are "prevalent" in utility's territory. A language is prevalent if it is spoken by 1,000 or more persons in the utility's territory or if it is spoken by 5 percent or more of the population within a "public safety answering point" in the utility territory (D.20 03-004).*

3. *List all languages for which public outreach material is available, in written or oral form.*

4. *Detail the community outreach efforts for PSPS and wildfire-related outreach. Include efforts to reach all languages prevalent in utility territory.*

One of PG&E's highest priorities during wildfire-related emergencies, including PSPS events, is to protect the health and safety of our vulnerable/AFN customers and communities.[36] PG&E conducts outreach related to emergency preparedness, provides an improved notification experience during PSPS events and offers additional services and resources to these customers in advance of and during PSPS events – either directly or in partnership with CBOs.

Throughout 2020, PG&E delivered on many of the CPUC's and PG&E's goals to make PSPS events less burdensome for our customers. These accomplishments include, but are not limited to:

- Developed partnerships with 61 resource CBOs to help support AFN customers with resources before, during and after PSPS events or wildfires. These partnerships included 21 food banks, 18 Meals on Wheels organizations, 16 ILCs, five LIHEAP providers, and one grocery delivery organization. Together, PG&E provided 30,000 food boxes to vulnerable customers, conducted more than 11,000 customer energy assessments for backup power support, delivered approximately 6,000 batteries to qualifying customers through the PBP and DDAR Program combined, served approximately 4,500 customers with services including food replacement, gas vouchers, hotel stays, grocery delivery and accessible transportation.

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36 In D.19-05-042, p. 28, the Commission adopted a definition that comports with that used by Cal OES, and henceforth referred to vulnerable populations as populations with AFN (AFN populations). The term "AFN populations" refers to those populations with AFN as set forth in Government Code § 8593.3. Government Code § 8593.3 lists 'AFN populations as follows: …the "AFN population" consists of individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking, older adults, children, people living in institutionalized settings, or those who are low income, homeless, or transportation disadvantaged, including, but not limited to, those who are dependent on public transit or those who are pregnant.

- Increased MBL program enrollment by 26 percent since the start of 2020 – from approximately 193,400 to over 243,400 customers, enabling us to send additional communications and PSPS notifications among other benefits.

- Established and leveraged new partnerships with 36 multicultural media organizations and five in-language CBOs. PG&E was able to amplify our support for customers with limited English-speaking proficiency by sharing PSPS preparedness, awareness and status information broadly across PSPS-affected areas in 20 non-English languages and ASL, using a variety of forums such as social media, news outlets, written material and more.

PG&E was able to better serve customers by receiving and updating the program to include the extensive input received over the past year from PG&E's advisory councils, regional councils, customer input and state and local officials.

In 2021, PG&E plans to continue our partnerships with CBOs and ensure we are fully integrated into our PSPS operations. PG&E wants to make sure the right programs and services are in place to support our vulnerable/AFN customers. More specifically, PG&E is working to ensure that we know our customers' language preferences and offering more opportunities for customers to self-identify as vulnerable (e.g., self- certified vulnerable, self-identified disabled, alternate format communications) without impinging on any HIPAA and/or CCPA data privacy laws. PG&E's work in this space will be grounded in customer and stakeholder feedback, research and data so that our solutions align with PG&E's vulnerable customers' needs. As part of this focus, PG&E plans to perform a gap analysis of current CBO resource partners to better target recruitment for additional partners and drive consistency of resources and services across the service territory.

For this initiative, PG&E has four sub-initiatives: (1) protocols to mitigate public safety impacts during PSPS events (Section 8.4.1); (2) prevalent languages in PG&E's territory (Section 8.4.2); (3) translated public outreach materials (Section 8.4.3) and community outreach efforts for Project Specific Safety Plan and wildfire-related outreach (Section 8.4.4)

Note that PG&E addresses the specific reporting requirements from Resolution WSD-011. PG&E's 2021 PSPS AFN Plan, filed February 1, 2021, provides more details on PG&E's goals, strategies and tactics to support AFN customers and communities before, during and after PSPS events.

8.4.1 Protocols to Mitigate Public Safety Impacts during PSPS Events

Describe protocols for PSPS that are intended to mitigate the public safety impacts of PSPS on vulnerable, marginalized and/or at-risk communities. Describe how the utility is identifying these communities.

PG&E implements a variety of tactics to mitigate the public safety impacts of PSPS on our most vulnerable customers, including low-income, medically sensitive and/or limited English proficiency customers. To further explain, this section has been broken up into the following categories:

A. PSPS Protocols to Mitigate Public Safety Impacts

B. Additional Resources and Services

C. Identifying Vulnerable Customers

A) PSPS Protocols to Mitigate Public Safety Impacts

The information below provides a summary of PG&E activities:

- **Notifications During PSPS Events:** See Section 8.2.4 and the discussion on notifications for MBL customers and customers who self-identify as requiring additional support. PG&E also includes more details in the 2021 PSPS AFN Plan, filed February 1, 2021. PG&E also goes into more details about in-language support during PSPS events later in this section.

- **Media Engagement:** Before and during PSPS events, PG&E engages with the **media**, including multicultural news organizations to issue press releases, augment paid advertising, issue radio spot advertisements, conduct live streaming news conferences with ASL translators, and participate in media interviews. In turn, these media organizations may provide communications on the radio, broadcast, TV and online.

PG&E continues to enhance our social media communications to AFN communities, which are currently conducted via Facebook, YouTube, Instagram, Nextdoor and Twitter. For example, during the 2020 PSPS events, PG&E provided translated event update videos on our social media platforms in ASL, Spanish and Chinese.[37] Leading up to and during PSPS events, PG&E promotes PSPS awareness and preparedness on TV, radio, pre-roll video (advertising videos that play before watching a featured video) and digital banner ads in Spanish,

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37 See examples of translated social media posts:

- PSPS Alert Banner: https://twitter.com/PGE4Me/status/1321169776014667779/photo/1.
- PSPS Event Update in Chinese: https://twitter.com/PGE4Me/status/1321220048791334912?s=20.
- PSPS Update in Spanish: https://twitter.com/PGE4Me/status/1321219692392968193?s=20.
- PSPS Warning Alert in ASL: https://twitter.com/PGE4Me/status/1320423102866542593?s=20.

Cantonese and Mandarin.

- **In-Event CBO and Community Partnerships:** PG&E has a dedicated team during PSPS events to engage with resource CBOs (e.g., CFILC, food banks, Meals on Wheels and CBOs that provide translations in indigenous languages), as well as information-only CBOs, to manage two-way communication leading up to and during each PSPS event.

During PSPS events, PG&E invites all CBOs to participate in the daily Systemwide Cooperators Call hosted by EOC staff to share PSPS situational updates. CBOs are also provided courtesy email notifications and access to a dedicated email box during events.

To ensure CBO Resource Partners are prepared to support PG&E customers during an event, they are sent PSPS advance notifications to prepare resources for deployment. PG&E's EOC team hosts a CBO Resource Partner coordination call which allows resource CBOs supporting the PSPS event to ask questions and share best practices. In addition, PG&E will refer MBL customers who call the PG&E Contact Center and request assistance to participating regional ILCs to coordinate the appropriate support through the DDAR Program described in Section 8.2.1.2.

- **In-language CBO and Multicultural Media Partnerships:** PG&E holds contracts with six CBOs and 36 multicultural media partners to provide in-language communication support before and during PSPS events to support customers who come from indigenous communities that occupy significant roles in California's agricultural economy.

- **Information Sharing with CBO/Multicultural Partnerships**: During events, PG&E leverages our network of over 250 CBOs to support customers. For example, PG&E provides courtesy notification updates, e-mails with links to PG&E's PSPS information toolkit and/or one-on-one direct e-mail communications. The toolkit can include press releases, fact sheets and other relevant information that partners could share with their constituents, including videos with relevant PSPS updates in 15 non-English languages and ASL. Many CBOs and multicultural media partners help PG&E provide customers with resources (e.g., in-language support, food replacement partnerships) during PSPS events. Additionally, PG&E provides maps of impacted counties, the number of total customers and MBL customers impacted and impacts by ZIP Code to CBOs.

- **Resource Partnerships:** PG&E formed partnerships with more than 50 CBOs to offer additional resources (e.g., food replacement) during and after a PSPS event or wildfire, as more fully described in the *Additional Resources and Services* section below.

B) <u>Additional Resources and Services</u>

PG&E provides AFN customers with a suite of resources and services before, during and after PSPS events. Figure PG&E-8.4-1 outlines the PG&E programs.

FIGURE PG&E-8.4-1: PG&E CUSTOMER RESOURCES AND SERVICES PROGRAMS

Program	Description
Disability Disaster Access and Resource Program	Enables ILCs to provide qualifying customers who use electric medical devices with access to portable batteries
Portable Battery Program	Leverage Low Income Home Energy Assistance Program (LIHEAP) providers and Richard Health and Associates (RHA) to support targeted residential customers
Self-Generation Incentive Program	Financial Incentives for targeted customers to install permanent battery storage
Well Pump Generator Rebate Program	Rebate program for low-income residential customers who have well water for their water service
Food Bank Resource Partnership	Provide customers experiencing food loss with food replacements
Community Food Bank Grants	Provide grant funds to Food Banks to support the services they provide during emergencies
Meals on Wheels Partnerships	Additional meal to impacted PSPS seniors per day of shutoff
Grocery Delivery Services	Grocery bag for homebound individuals due to medical conditions
Medical Baseline Program	Additional notifications before and during PSPS events and pre-qualification to resiliency programs
Energy Savings Assistance Program	Free home weatherization, energy-efficient appliances, and energy education services to income-qualified PG&E customers
Community Resource Center	Location where community members can access basic resources, including charging stations
211	Informational services to assist customers in locating resources

- **Battery and Generator Programs:** See Section 8.2.1 for a description of battery programs and other resources for AFN customers during a PSPS event. This includes a full description of the DDAR Program, PBP, SGIP and Well Pump Generator Rebate Program. In addition, please refer to PG&E's 2021 PSPS AFN Plan, filed February 1, 2021, that also details these battery programs.

- **Food Bank Partnerships and Grants:** We recognize food replacement is a critical need for some individuals with AFN, particularly those who are low income. PG&E plans to continue efforts made during the 2020 PSPS event season to establish agreements with food banks[38] throughout our service area. This is to provide food replacement to customers who experience food loss as the result of a PSPS event.

Additionally, PG&E will continue to offer grants to food banks[39] to provide critical services to vulnerable customers during emergencies, including wildfires, power outages and PSPS. PG&E includes more details in our 2021 PSPS AFN Plan, filed February 1, 2021.

- **Meals on Wheels Partnerships:** PG&E has partnered with Meals on Wheels providers throughout our service area to provide seniors who are impacted by a PSPS event with one or two additional meal(s) per day for the duration of the power shutoff. In addition to the meal, the provider completes an in-person

38 PG&E is actively working toward executing agreements with two additional foodbanks.

39 Approximately $220,000 of the $675,000 total was provided in Q4 2020.

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wellness visit that includes messaging about the potential PSPS event and guidance to additional resources available through PG&E. During the PSPS events executed in 2020, PG&E served almost 2,900 seniors with an additional meal (or two) and wellness check through the services offered by the Meals on Wheels organizations throughout the territory. PG&E currently has agreements with 18 providers and will explore opportunities for additional partnerships in 2021. PG&E includes more details in the 2021 PSPS AFN Plan, filed February 1, 2021.

- **Grocery Delivery Services:** Food for Thought, based in Sonoma County, provides groceries to customers who are impacted by a PSPS event and are homebound due to advanced medical conditions (e.g., COVID-19, congestive heart failure, HIV/AIDS). Groceries provide the participating individual enough food for three meals a day for a week. Through this program, during the PSPS events implemented in 2020, PG&E provided food delivery to over 100 customers in Sonoma County. In 2021, PG&E will seek to identify similar resource providers in other regions of our service area. PG&E includes more details in the 2021 PSPS AFN Plan, filed February 1, 2021.

- **MBL Program**: The MBL Program, also known as MBL Allowance, is an assistance program for residential customers who have special energy needs due to qualifying medical conditions. The program includes two different kinds of help for customers (1) a lower rate on the customer's monthly energy bill;[40] and (2) unique notifications in advance of a PSPS event.[41]

- **Energy Savings Assistance (ESA) Program:** PG&E's ESA program provides free home weatherization, energy-efficient appliances and energy education services to income-qualified PG&E customers[42] throughout our service territory. PG&E's ESA contractors share information about emergency preparedness, PSPS and the MBL Program. In 2020, PG&E completed over 65,000 education sessions.[43] Some of these sessions were done virtually due to COVID-19. Others were done through in-home educational activities, following all public safety protocols. PG&E plans to continue to leverage ESA contractors to help support our income-qualified customers' PSPS readiness.

- **CRC:** See Section 8.2.1 for a description of CRCs and information on how PG&E tailors CRCs to meet the needs of our vulnerable customers. In addition, refer to PG&E's 2021 PSPS AFN Plan, filed February 1, 2021.

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40 All residential customers receive an allotment of energy every month at the lowest price available on their rate, called the Baseline Allowance. Customers who are eligible for MBL receive an additional allotment of electricity and/or gas per month (approximately 500 kilowatt-hours of electricity and/or 25 therms of gas per month. This helps ensure that more energy to support qualifying medical devices is available at a lower rate.

41 See Section 8.2.4 for details on PSPS event notification process for MBL customers.

42 To qualify for the ESA program, a residential customer's household income must be at or below 200 percent of Federal Poverty Guidelines, as required in D.05-10-044.

43 Through October 31, 2020.

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- **2-1-1 Referral Services:** Through our charitable grant program, PG&E provides funding to 2-1-1 so that 2-1-1 service providers refer individuals to social services available in their community. This is to help minimize the hardships associated with PSPS. PG&E includes more details in the 2021 PSPS AFN Plan, filed February 1, 2021.

C) Identifying Vulnerable Customers

PG&E understands the importance of identifying vulnerable/AFN customers to ensure that such populations receive the education and notification they need to maximize resiliency during a PSPS event. Using a variety of data sources (e.g., internal PG&E data like the Customer Care and Billing (CC&B) database, and publicly available data such as United States (U.S.) census data), PG&E has determined that, based on the CPUC's definition of AFN populations, over 80 percent of residential PG&E customers may have one or more AFN attributes. To identify and calculate specific customers and/or households that are considered AFN, PG&E uses the following categories for which data is available in our internal databases (e.g., CC&B and others):

- Customers enrolled in the MBL program;
- Customers enrolled in CARE or FERA;
- Customers that self-identify to receive an in-person visit before disconnection for non-payment (e.g., vulnerable)[44];
- Customers that self-identify as having a person with a disability in the household (e.g., disabled)[45];
- Customers who self-select to receive utility communications in non-standard format (e.g., in braille or large print); and
- Customers who indicate a non-English language preference.

In 2021, PG&E plans to promote customer enrollment in the vulnerable categories (e.g., self-certified vulnerable, self-identified disabled, alternate format communications, etc.) without impinging on any HIPAA and CCPA data privacy

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44 In accordance with D.12-03-054, customers that are not enrolled or qualify for the MBL Program can "certify that they have a serious illness or condition that could become life threatening if service is disconnected." PG&E uses this designation to make an in-person visit prior to disconnection. This designation remains on their account temporarily for 90 days, and can be extended to 12 months if the customers submits an application. The customer characteristic vulnerable senior is no longer included in the Disconnect OIR based on D.20-06-003, p. 14, and therefore not included in this metric.

45 Customers can self-identify with PG&E that they have a person in the household with a disability. This customer designation currently has no end date. In accordance with D.12-03-054, if customers have previously been identified as disabled and identified a preferred form of communication, the utility shall provide all information concerning the risk of disconnection in the customer's preferred format (e.g. phone, text, email, TDD/TTY).

laws, as well as continue to encourage customers with limited English proficiency to update their account information by selecting their language preference.

- **MBL Program:** As the vulnerable/AFN customer definition is quite broad[46] and extensive, PG&E uses the MBL program as the primary source of data to identify customers that require additional notifications and support during PSPS events.[47] Using this designation, PG&E is able to ensure that those customers dependent upon life-sustaining medical equipment that requires electricity are identified so that PG&E and our public safety partners can ensure they are notified of an impending PSPS event, as well as assist them in developing a de-energization and/or emergency preparedness action plan.

  PG&E also coordinates with local and state agencies to ensure medically-sensitive customers have the right information to ensure their safety.[48] For example, as discussed in Section 8.2.4, PG&E shares lists of the MBL customers who have not confirmed receipt of their notifications with local and tribal agencies twice-daily during PSPS events. Due to customer privacy concerns, this information is only provided via the PSPS Portal to users that have accepted PG&E's online agreement. PG&E also only provides agencies information for customers within their jurisdiction;

- **Customer Self-Identified as Vulnerable:** For other disabled and vulnerable customers not enrolled in the MBL program,[49] PG&E encourages customers to self-identify if they require an in-person visit before a disconnection, if they have a person with a disability in the household and/or if they prefer to receive utility communications in non-standard format (e.g., in braille or large print).

  These designations allow PG&E to provide in-event PSPS notifications that meet these customers' diverse needs. PG&E is working to expand the types of customers included in enhanced notification process (i.e., hourly retries, door knocks or live call outs) to additional self-identified categories in 2021.

  All notifications include, and will continue to include, a reference to resources available to customers including a link to pge.com/disabilityandaging. Customers that self-identify as vulnerable are also eligible for assistance as part

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46 D.19-05-042, pp. 77-78.

47 Recognizing privacy concerns, the Commission does not require the electric IOUs to develop a comprehensive contact list of AFN customers nor to share individual customer information with local jurisdictions; rather, the Commission encourages that, through local agency partnerships, the electric IOUs and local jurisdictions can together provide up front education and outreach before and communication during a de-energization event in formats appropriate to individual AFN populations…" D.19-05-042, p.82

48 D.19-05-042, p.81

49 "each electric IOU shall identify, above and beyond those in the MBL population, households that self-identify to receive an in-person visit before disconnection for nonpayment or receive utility communications in a non-standard format or self-identify as having a person with a disability in the household, to help provide support for those with medical needs during a de-energization event." D.20-05-051, Appendix A, p.7

of CFILC's DDAR program, as enrollment in the MBL program is not a requirement to obtain resources; and

- **Additional PG&E Measures to Identify Vulnerable Customers:** PG&E understands that using the MBL and self-certification designations may not go far enough in ensuring that PG&E's vulnerable customers receive up front education and outreach before, during, and after a PSPS event. Customers who select a non-English language as their preference for communications and notifications, and low-income customers,[50] are also part of PG&E's vulnerable customer identification and outreach efforts. In addition to targeted outreach efforts to these groups, PG&E will continue to leverage partnerships with CBOs, tribes, and local and state agencies to create outreach materials and implement events appropriate to these populations, as discussed in more detail below.

[50] Enrolled in the CARE and/or FERA program, and/or are eligible for enrollment.

8.4.2 Prevalent Languages in PG&E's Territory

List all languages which are "prevalent" in utility's territory. A language is prevalent if it is spoken by 1,000 or more persons in the utility's territory or if it is spoken by 5 percent or more of the population within a "public safety answering point" in the utility territory (D.20-03-004).

PG&E considers the following as prevalent languages[51] in our territory: English, Spanish, Chinese (Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi and Portuguese.[52]

Throughout 2020, PG&E expanded the list of languages used for Community Wildfire Safety Program (CWSP) and PSPS communications and notifications from six non-English languages to 15 non-English-languages. This includes the translation of in-event PSPS notifications, as well as PG&E's website.

PG&E recognizes the importance of communicating with customers that occupy significant roles in California's agricultural economy and speak indigenous languages, such as Mixteco and Zapoteco. These languages are served and supported through varying channels such as CBO communications and multi-cultural media outlets, discussed in Section 8.4.

In addition, in the ALJ Ruling, the Commission asked IOUS to investigate languages that might be considered minority languages in particular counties but have more than 1,000 speakers in one or more large IOU territories.[53] As explained in PG&E's Compliance Filing,[54] based on the Public Use Microdata Sample U.S. Census data, PG&E finds that Filipino languages Ilocano and

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51 A language is prevalent if "It is spoken by 1,000 or more people in the affected service territory (based on identified data sources); It is spoken by indigenous communities that occupy significant roles in California's agricultural economy, regardless of prevalence, such as Mixteco and Zapoteco; and

It is required by statute, regardless of prevalence, which include English, Spanish, and top three languages: Chinese, Tagalog and Vietnamese, as well as Korean and Russian (where prevalent). To note, these languages PG&E has already adopted for translated support for wildfire and PSPS communications. D.20-03-004, OP 1 and 2.

52 In our CWSP Outreach Workplan *Section 2.2 Identification of Language Prevalence*, filed on May 15, 2020, PG&E explained the methodology we use to determine language prevalence in our service territory. *Administrative Law Judge's Ruling Regarding Compliance Filings Submitted in Response to Decision 20-03-004 Related to In-Language Outreach Before, During and After a Wildfire and Surveys of Effectiveness of Outreach* (Administrative Law Judge (ALJ) Ruling) further expanded the requirements.

53 ALJ Ruling, p.5.

54 Pacific Gas and Electric Company's Compliance Filing per ALJ's Ruling Regarding Compliance Filings Submitted in Response to D.20-03-004 Related to In-Language Outreach Before, During and After a Wildfire and Surveys of Effectiveness of Outreach, December 31, 2020.

Cebuano; Indian subcontinent languages[55] Gujarati, Bengali, Tamil and Telugu; Pashto; and Min Nan Chinese are prevalent languages in our territory. PG&E provides outreach to speakers of these languages through call center translation services via vendor Language Line Services and through CBO partners.

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55 PG&E has included Punjabi as one of the prevalent languages in our Community Outreach Budget and Workplan compliance filing.

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8.4.3 Translated Public Outreach Materials

List all languages for which public outreach material is available, in written or oral form.

To explain PG&E's translation approach of public outreach materials, this section is broken up into the following categories:

A. In-Event PSPS Notifications and Communications for Customers with Limited English Proficiency and Other Needs

B. Website

C. Printed Material

A) <u>In-Event PSPS Notifications and Communications for Customers with Limited English Proficiency and Other Needs</u>

PSPS customer notifications are available in the following 15 non-English languages [56], Spanish, Chinese (Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi and Portuguese.

PG&E also has contracts with five CBOs to provide in-language communications to customers in a variety of indigenous languages both for preparedness outreach and in-event communications during a PSPS event. These CBOs provide in-language outreach using social media, in-person communications, and one-on-one phone calls in one or more of the following languages: Mixteco, Tlapaneco, Triqui, Zapoteco, Maya, Nahuatl, Chatino, Chinanteca and Katz el.

As for an option for in-language support, PG&E directs customers to call the Contact Center. PG&E's Contact Center will continue to be equipped to provide translation support in over 250 languages.

PG&E expanded in-language support services through a new, in-language tool for customer-facing employees to use in the field during customer interactions, such as door knocks to MBL customers during PSPS events. The Insight App helps bridge the communication gap by allowing employees to converse and interact with customers who do not speak English or are deaf or hard-of-hearing in the field by providing video and/or audio translation for customers.

To support customers that are deaf or hard of hearing, PG&E has also published a video in ASL to explain the PSPS process. PG&E collaborates with NorCal Services for Deaf and Hard of Hearing to record PG&E's PSPS event notifications in ASL and messaging directing customers to pge.com for a current list of affected counties. A PSPS overview video recorded in ASL also directs customers to PG&E's address look-up tool during PSPS events. PG&E shares these PSPS ASL recordings on our social media channels

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56 In accordance with the ALJ Ruling.

(e.g., Facebook and Twitter). PG&E also includes NorCal Services for Deaf and Hearing and other Deaf agencies in PSPS CBO communications so that the information and links can be shared within the Deaf community.

B) Website

A focused set of "critical" pages, including PG&E's PSPS webpage and the alert site, is translated in the following written languages: English, Spanish, Chinese (Mandarin and Cantonese), Vietnamese, Korean, Tagalog, Russian, Arabic, Farsi, Punjabi, Japanese, Khmer, Hmong, Thai, Hindi and Portuguese.[57] In addition, tools such as the address lookup tool and the outage map are available in-language. Table PG&E-8.4-1 is a list of critical webpages that have been translated.

[57] See example translated sites for the PSPS Updates page, which can also be found by clicking the language icon at the top of the screen on the English page: Spanish: www.pge.com/pspsupdates-es'; Chinese: www.pge.com/pspsupdates-zh; Korean: www.pge.com/pspsupdates-ko; Russian: www.pge.com/pspsupdates-ru; Tagalog: www.pge.com/pspsupdates-tl; Vietnamese: www.pge.com/pspsupdates-vi.

TABLE PG&E-8.4-1: CRITICAL PG&E WEBPAGES THAT ARE TRANSLATED

Webpage	URL	Languages Available
PSPS Landing Page	pge.com/psps	16
PSPS Event Updates Page	pge.com/pspsupdates	16
Wildfire Safety Landing Page	pge.com/wildfiresafety	16
PSPS Language Resources Page	pge.com/pspslangaugehelp	16
MBL Program	pge.com/medicalbaseline	16
PSPS Updates and Alerts	pge.com/en_US/residential/outages/public-safety-power-shuttoff/psps-updates-and-alerts.page	16
PSPS Address Alert Signup	pge.com/pspsalerts	16
PG&E Disability and Aging (AFN) Page	pge.com/disabilityandaging	16 + ASL
Open House Webinar Schedule & Presentations	pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/community-wildfire-safety-open-house-meetings.page	16 + ASL
PSPS Support	pge.com/en_US/residential/outages/public-safety-power-shuttoff/psps-support.page	16
Prepare for PSPS	pge.com/en_US/residential/outages/public-safety-power-shuttoff/prepare/prepare-for-psps.page	16
Why PSPS Events Occur	www.pge.com/en_US/residential/outages/public-safety-power-shuttoff/why-psps-events-occur.page	16
Minimizing PSPS Events	pge.com/en_US/residential/outages/public-safety-power-shuttoff/minimizing-psps-events.page	16
Wildfire Recovery & Support	pge.com/en_US/residential/outages/public-safety-power-shuttoff/psps-support.page	16
Consumer Protections	pge.com/en_US/safety/emergency-preparedness/natural-disaster/wildfires/consumer-protection.page	16
PSPS Event Reports	pge.com/pspsreports	16

- **Accessibility of Communications:** PG&E's online customer communications, including our website and PSPS customer notification emails, are tested for usability and accessibility to meet Web Content Accessibility Guidelines (WCAG) 2.0 AA accessibility standards. Before any new feature is introduced or code change is made to an existing feature, the communications content is tested by our accessibility partner, Level Access. They test the page(s) for functional usability and technical conformance using both automated tools and a manual process, including:

  – Running the site through their automated Accessibility Management Platform (AMP) tool to identify defects; and

  – Testing using Job Access with Speech, a popular computer program that allows visually impaired or blind users to read the screen either with a text-to-speech output or by a refreshable Braille display.

Any severe defects found are fixed and the updated code is resubmitted for testing to ensure there are no severe defects when the code is deployed to production. Videos published online also meet WCAG 2.0 AA accessibility standards, with audio description, closed captioning and written transcripts.

C) Printed Material

PG&E translates "critical information/documents", which include resources focused on wildfire safety, emergency preparedness and PSPS preparedness in 15 prevalent non-English languages. PG&E's CWSP/PSPS customer information and materials are available in alternate formats, including Braille and large print, upon request. PG&E provides fully translated educational collateral to support in-person education efforts for customers in their preferred language (where prevalent), and to share with partners that help PG&E socialize their messages.

PG&E takes three approaches when translating collateral material, such as brochures and fact sheets, and web content, including:

1. Full translations of "critical information/documents"

2. Tagline translations in 15 languages for non-critical information/documents (unless the primary content has been covered in a key critical document)

3. Language icon and text in English that points customers to PG&E's Language Services Line for non-critical documents (if space is limited)

The criteria for each approach are described below:

- **Full Translation of Critical Information/Documents:** Critical information/documents are defined as materials focused on wildfire and PSPS preparedness and available resources, as well as PSPS notifications;

  PG&E reviews collateral materials to ensure items deemed as "critical information/documents" are available in collateral catalog in all 15 prevalent

languages. These materials can be downloaded as PDFs for electronic distribution (shared with CBOs, affinity groups, etc.) and/or printed-on-demand where PG&E or third-party representatives can order printed versions for events, presentations, among other engagements.

- **Tagline Translations for Non-Critical or Supplemental Information/Documents:** For non-critical materials, or materials that supplement those that already exist, and where space is available, PG&E includes a translated sentence referencing customers to call PG&E and/or view translated content online.

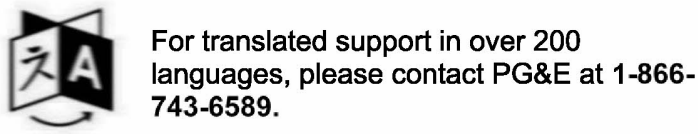
  Additionally, PG&E points customers to the contact center that can provide support in 250 languages using a universally recognizable language translation icon. PG&E has conducted benchmarking to determine the most appropriate and recognizable universal language icon to leverage in these instances. Figure PG&E-8.4.2 illustrates an example of the tagline translations.

FIGURE PG&E-8.4-2: SAMPLE TAGLINE TRANSLATION FOR NON-CRITICAL OR SUPPLEMENTAL INFORMATION/DOCUMENTS

- **Language Icon for Non-Critical or Supplemental Information/Documents**

  Items that are classified as non-critical or supplemental and have space constraints contain a universal “icon” and short message in English to inform customers that PG&E can provide in-language support. As mentioned above, PG&E conducted benchmarking to determine a universally recognizable language translations icon to use in these instances as seen in Figure PG&E-8.4-3.

FIGURE PG&E-8.4-3: SAMPLE ICON FOR NON-CRITICAL OR SUPPLEMENTAL INFORMATION/DOCUMENTS



The number that is included on these translated materials directs customers

to one of four PG&E Contact Centers in California. Support from live agents is available 24/7 and can support customers in over 250 languages, including almost 10 indigenous languages, such as Mixteco, Zapoteco and Triqui. PG&E will continue to leverage the Contact Centers to handle customer inquiries and additional translation services as needed.

8.4.4 Community Outreach Efforts for PSPS and Wildfire-Related Outreach

Detail the community outreach efforts for PSPS and wildfire-related outreach. Include efforts to reach all languages prevalent in utility territory.

PG&E provides a variety of outreach and education for vulnerable customers and communities in advance of wildfire season, and before, during, and after PSPS events. These outreach efforts are critical so that these customers can be prepared to address the unique impacts of wildfire, de-energization and other natural disaster emergencies. PG&E makes a considerable effort to use a diversity of channels to best reach customers in the format of their choice.[58] PG&E intends to continue to explore additional channels and technologies for communications, while also refining details and scope of implementation to improve content, accessibility, awareness and effectiveness.

In this section, PG&E provides a summary of the community outreach efforts for PSPS and wildfire-related outreach, including efforts to reach all languages prevalent in utility territory. The section is broken up by the following categories:

A. Website;

B. Media Engagement;

C. Community Events;

D. PSPS and Wildfire Preparedness Regional Open Houses (Webinars);

E. Community Based Organization Engagement;

F. MBL Customer Outreach;

G. Tribal Community; and

H. Advisory Boards.

Details on wildfire and PSPS-related outreach are included in Section 7.3.9.2 and Section 7.3.10.1. Further, PG&E detailed specific customer and community outreach efforts for AFN populations in the 2021 PSPS AFN Plan.[59]

A) Website

PG&E's website allows customers to have access to a wide variety of information ranging from wildfire preparedness to PSPS event-specific information 24/7, providing customers with convenience and flexibility.

In 2020, PG&E also updated content and navigation of the AFN-targeted web page, http://www.pge.com/disabilityandaging, based on feedback received by members of the People with Disabilities and Aging Advisory Council (PWDAAC).

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58 D.20-03-004, OP 3.

59 D.20-05-051, Conclusion of Law 36.

The goal of the update was to make the page more intuitive for customers seeking information. The webpage is organized by four categories of need, with applicable resources for each category. The categories include:

1) If you rely on power for medical/and or independent living needs;

2) If you need financial assistance;

3) If you are disabled or an older adult; and

4) If you need language support.

PG&E updates this webpage during each PSPS event as new resource partners are added. Please see the above section, *Translated Public Outreach Materials*, where PG&E discuss in-language offerings as they relate to the website.

PG&E will continue to explore and identify improvements for the website based on continued user and messaged testing, feedback from surveys and more.

B) Media Engagement

PG&E works closely with external media outlets, including both paid and earned media, to provide broad awareness to Californians to share tips related to wildfire and PSPS preparedness, socialize available resources and communicate PSPS event information. PG&E is also focused on enhancing and formalizing coordination with multicultural media organizations for both preparedness outreach and in-event communications.

- **Earned Media:** To serve non-English speaking customers, PG&E engages with over 150 multicultural media outlets throughout the year in an effort to promote safety initiatives, including PSPS, to monolingual or difficult-to-reach populations that may not have access to mainstream television media and/or read/speak English.

  PG&E shares news releases and coordinates interview opportunities with media outlets to help educate non-English speaking customers on various PG&E programs, including the CWSP, PSPS, emergency preparedness, public safety, consumer protections and income qualified programs, to name a few. PG&E also schedules media visits with these organizations to discuss other partnership opportunities (e.g., Public Service Announcements, advertising, event sponsorships). In 2020, PG&E identified 36 multicultural media outlets to partner with on PSPS and wildfire safety education.

  PG&E also staffs bilingual and multilingual employees to serve in the EOC to support the PIO multimedia engagement function. These employees provide urgent translation support, such as verification and approval of ad hoc written translations during emergencies. These staff assist PG&E with avoiding delays that can occur when engaging outside vendors for translation needs during an active event or wildfire.

- **Paid Media and Advertising:** To supplement PG&E's outreach efforts during

PSPS events, PG&E runs PSPS emergency messages to reach customers via paid media channels. PG&E purchases a combination of English and in-language radio ads, as well as digital banners in English and multiplate languages based on targeted ZIP Codes. PG&E is in the process of identifying available media outlets to cover the 12 identified languages and the associated costs, which are variable based on geography and season.

In 2021, PG&E will run a series of print ads across our service territory highlighting in-language support available via the website and Call Center.

- **Social Media:** PG&E uses social media, including Facebook,[60] Twitter,[61] Nextdoor[62] and Instagram to direct users to the website where they can access important emergency preparedness information, as well as PSPS event resources in their supported language of preference. Using PG&E's social media accounts, PG&E posts key messages from news releases, such as the launch of the DDAR Program,[63] invitations to wildfire safety and preparedness webinars,[64] promoting the MBL program[65] and PSPS event updates including CRCs[66] information. PG&E's social media efforts also include publishing content, including informational preparedness and/or event-specific videos, such as PSPS, processes and insight into frequently asked questions. During PSPS events, PG&E also creates event-specific morning video updates, translated in Spanish and Chinese, and shares on social media to provide event updates in additional languages.

- **Videos:** PG&E creates a variety of informational videos ranging from 30 seconds to 30 minutes. These videos provide a high-level overview of expectations and protocols for PSPS for the territory. Additionally, PG&E covers content discussed during PG&E webinars, including approaches to mitigate for wildfire risk and how customers can prepare for emergencies. These videos are available for customers at pge.com/pspsvideos, YouTube and on social media. PG&E also creates PSPS event-specific morning video updates in English, Spanish and Chinese to share on social media.

C) **Community Events**

PG&E plans to host and/or participate in community events focused on customers with disabilities, seniors and low-income customers. The format and timing of community events will depend on COVID-19. PG&E anticipates that the bulk of community events will occur virtually, like many 2020 events. When

60 www.facebook.com/pacificgasandelectric/.

61 www.twitter.com/PGE4Me.

62 www.nextdoor.com/agency-detail/ca/san-francisco/pacific-gas-and-electric-company-13/.

63 www.twitter.com/PGE4Me/status/1255636675939708931.

64 www.twitter.com/PGE_Paul/status/1255562436230381570.

65 www.twitter.com/PGE4Me/status/1204900971505209344.

66 www.twitter.com/PGE4Me/status/1197530202735296513.

it becomes safe for PG&E's customers, communities and employees to gather, PG&E plans to pivot to in-person events.

In 2020, as part of the State Council on Developmental Disabilities Virtual Conference, PG&E produced a three-minute video starring Christina Mills, CFILC Executive Director, to highlight available resources for the AFN population including DDAR and MBL. The video is posted on PG&E's YouTube channel.[67]

PSPS and Wildfire Preparedness Regional Open Houses (Webinars)

PG&E plans to host wildfire safety and PSPS preparedness webinars for representatives of people and communities with AFN. The preparedness webinars include subtitles in English, Spanish and Chinese, and has an ASL interpreter.

During these webinars, PG&E plans to share a summary of PG&E's efforts to mitigate wildfire risk, engage with local organizations during events and information on event notifications. In addition, PG&E will share an overview of resources available to customers, including the MBL Program, CRC overview (including COVID-19 contingencies), funding and incentives for backup power resources through the PBP and SGIP, as well as PG&E's DDAR Program offerings (transportation, backup power, hotel and food vouchers).

To facilitate residential customer participation, PG&E plans to host the webinars after standard working hours. For customers who are deaf or hard of hearing and those with limited English proficiency, PG&E will ensure that each webinar includes closed captioning in English and translated closed captioning in Spanish and Chinese. PG&E will record the presentation portion of the webinar in 16 languages, including ASL, and make the recordings available on PG&E's website at pge.com/openhouse.

D) Community Based Organization Engagement

PG&E recognizes the important roles that CBOs play in the community because of their established relationships and ability to serve as trusted communication channels to customers.

PG&E is actively engaged with 250+ CBOs to provide education and awareness information to customers through a variety of channels including the contractors that serve PG&E's income qualified. PG&E coordinates with CBOs that have existing relationships and serve disadvantaged and/or hard-to-reach communities to conduct outreach to customers proactively and/or communicate with customers to provide in-language/translated education and/or PSPS event updates.

Through these partnerships, CBOs help amplify our wildfire and PSPS preparedness messaging and provide event updates with their constituents.

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67 https://www.youtube.com/watch?v=uvukoac8cYg.

PG&E engages with these organizations in one or more of the following ways:

- Conducting bi-annual trainings with contractors that serve PG&E's customers in the CARE program, which include information on relevant PG&E programs, including the CWSP and PSPS, so the contractors can assist with educating their clientele throughout the year;

- Providing CWSP/PSPS literature for sharing through CBO communication channels and ESA contractor networks;

- Offering the CBO Direct program to empower non-profits with resources to assist in the distribution of important safety messaging to their networks of customers in Tier 2 and Tier 3 areas;

- Providing PSPS webinars tailored to the needs of AFN organizations;

- Providing in-person PSPS presentations at local events; and

- Providing a PG&E exhibitor booth at events supporting AFN populations.

PG&E will build on the successes with these CBOs to further support these communities in 2021.

E) MBL Customer Outreach

PG&E encourages customer participation and enrollment in the MBL Program through direct-to-customer outreach, CBO promotion, and building strong relationships with the health care industry. This outreach aims to help individuals with AFN prepare for PSPS and connect with relevant resources for support.

PG&E plans to implement direct-to-customer outreach tactics, such as sending PSPS preparedness brochures to all MBL, self-certified vulnerable and disabled customers. The brochure will feature focused resources and preparedness tips for AFN. Additionally, PG&E will send PSPS notification reminders and resource postcards and emails to MBL, self-certified vulnerable senior or disabled customers in areas likely to experience PSPS events. Postcards and emails will include focused information and tips for individuals with AFN.

In addition to the direct-to-customer mail and email campaigns, PG&E employees in the Customer Service Offices will continue to proactively contact customers who have self-identified as having a disability, seniors and other vulnerable populations to promote the MBL Program. This outreach will also verify contact information and communication preferences, review emergency preparedness plans and promote other programs and services that could help during a PSPS event. This customer call campaign also promotes our Customer Programs such as the DDAR Program, PBP and SGIP.

Throughout 2020, PG&E implemented an MBL acquisition campaign to drive program enrollment. PG&E's marketing efforts led to nearly a 30 percent

increase in enrollments in 2020. PG&E plans to continue extensive outreach in 2021 and to find more ways to make it easier for eligible customers to enroll in the program, as described in the 2021 PSPS AFN Plan and Advice Letter 4293-G/5916-E.

One of the main outcomes of PG&E's MBL customer research was to engage directly with the health care industry to enlist healthcare providers' assistance in informing customers of the MBL Program and encouraging enrollment. PG&E is engaging with a variety of healthcare providers, medical associations and durable medical equipment suppliers to build relationships and provide education about the relevant programs that can help the clients we mutually serve. PG&E is providing these stakeholders with PSPS preparedness information and toolkits, including MBL Program applications and fact sheets.

PG&E has joined health care industry conferences and meetings to present information about the program and provided training on the program to health care industry staff. We are asking these partners to promote the MBL Program and encourage customer enrollment by adding a link to PG&E's MBL Program on their website.

F) Tribal Community

PG&E assists tribal members throughout our service area to mitigate the impacts of PSPS events, and other emergency situations such as the COVID-19 pandemic, wildfires and rolling blackouts. PG&E provides grants to tribes impacted by wildfires and COVID-19 and conducts e-mail outreach to tribal leaders and staff to increase awareness of available assistance options. This assistance options include:

- Suspending disconnections for non-payment for all residential and small business customers;
- Offering flexible payment plans;
- Supporting online bill payment while local offices are temporarily closed;
- Providing bill reductions for income-qualified customers through the CARE and FERA programs;
- Offering free energy-efficiency programs to help reduce home energy use;
- Suspending MBL re-certifications;
- Providing online tools to assist tribes in preparation for a PSPS;
- Working with local regional organizations to provide support for AFN community members during PSPS events;
- Providing backup battery suitcases to the Hopland Tribe and conducting an online training for tribal staff and elders on proper use and maintenance; and

- Engaging tribal governments to help them prepare their tribal memberships for PSPS events and other potential outages.

PG&E continues to refine the customer database for tribal lands to facilitate real-time reporting of tribal-specific impacts. For example, PG&E added the Pit River Tribe, Montgomery Creek Reservation, Roaring Creek Reservation and Burney Reservation to our customer database. For additional information related to the PSPS support that PG&E provides tribal leaders, see Section 8.2.4.

G) **Advisory Boards**

PG&E understands the importance of engaging with interested parties and advisory councils to gain feedback on approaches for serving customers before, during and after PSPS events. PG&E has instituted advisory boards at the suggestion of representatives of AFN and other stakeholders to inform our wildfire safety and PSPS-related initiatives.

- **PWDAAC:** PWDACC ("Council") provides a forum to gather insight on the needs of AFN populations related to emergency preparedness and to facilitate co-creation of solutions and resources to serve customers reliant on power for medical needs in relation to a PSPS event. The PWDAAC is a diverse group of recognized CBO leaders supporting people with developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries and older adult communities, as well as members and advocates from within these communities.

  The Council provides independent expertise to help ensure that PG&E's customer programs, operations and communications incorporate best practices to support these populations now and in the future. The Council:

  – Actively identifies issues, opportunities and challenges related to PG&E's ability to minimize the impacts of wildfire safety including PSPS, and other emergencies to Northern and Central California over the long term;

  – Serves as a sounding board and offers insights, feedback and direction on PG&E's customer strategy, programs and priorities; and

  – Shares experiences, perspectives and best practices for improving PG&E's customer performance.

  In 2020, PG&E met with PWDACC nine times to facilitate a quick and productive ramp up. At a minimum, in 2021, PG&E will convene the Council for four in-person meetings per year, COVID-19 restrictions permitting. We will use online fora (e.g., WebEx) until in-person meetings are safe to conduct.

- **Statewide IOU AFN Advisory Council:** The Joint IOUs established the Statewide IOU AFN Advisory Council to engage with members, advocates and leaders across all populations identified as vulnerable, to inform a more

holistic and strategic view on how to help the many constituencies served by the utilities. The Joint IOUs will convene the Council no less than four times per year, but likely monthly, consistent with 2020 practices. Ideally the meetings will be in-person, however, given the current COVID-19 pandemic conditions, online forums (e.g., Microsoft Teams) will be used until in-person meetings are safe to conduct. In addition to the quarterly and/or monthly Advisory Council meetings, the Joint IOUs plan to host interim sessions with stakeholders to make meaningful progress in implementing the various recommendations.

- **Other Advisory Groups:** PG&E will also continue to engage with and solicit feedback on wildfire and PSPS-related outreach from other existing advisory groups, including:

  – **Disadvantaged Communities Advisory Group:** An advisory group that meets quarterly led by the CPUC and California Energy Commission (CEC), with representatives from disadvantaged communities. The purpose of this group is to review and provide advice on proposed clean energy and pollution reduction programs and determine whether those proposed programs will be effective and useful in disadvantaged communities. PG&E engages with this group to provide information and gain input about wildfire mitigation activities, including PSPS;

  – **Low Income Oversight Board (LIOB):** A board established to advise the CPUC on low-income electric and gas customer issues and programs. PG&E also engages with this group to provide information and gain input about wildfire mitigation activities, including PSPS;

  – **Local Government Advisory Councils and Working Groups:** PG&E includes representatives from the AFN community on both the PSPS Regional Working Groups. Additionally, PG&E hosts local wildfire safety sessions with each County OES in advance of wildfire season. PG&E's plans to ensure AFN populations are included in these sessions for awareness and opportunity for feedback; and

  – **Communities of Color Advisory Group:** PG&E will continue to solicit input from Communities of Color Advisory Group which assists PG&E in crafting outreach and engagement with communities on color on a broad spectrum of issues impacting diverse communities.

  PG&E provides more details on Advisory Boards in the 2021 PSPS AFN Plan.

8.5 PSPS-Specific Metrics

PSPS data reported quarterly. Placeholder tables below to be filled in based on quarterly data.

Instructions for PSPS Table 11:

In the attached spreadsheet document, report performance on the following PSPS metrics within the utility's service territory over the past five years as needed to correct previously-reported data. Where the utility does not collect its own data on a given metric, the utility shall work with the relevant state agencies to collect the relevant information for its service territory, and clearly identify the owner and dataset used to provide the response in the "Comments" column.

PG&E has enclosed the Table 11 data in Attachment 1 – All Data Tables Required by 2021 WMP Guidelines.xlsx. In addition, PG&E is providing the following comments below on the Table 11 data.

Comments for Table 11:

PG&E has outlined the past and forecasted PSPS metrics in Table 11, which is utilizing historic recorded data for actuals and an analysis of the past ten years of weather data to provide the forecasted metrics. The forecasted numbers are largely weather dependent and do not include any event size or length reductions from the 2020 planned work. Further information historical lookback of the last ten years of weather data and its uses and limitations can be found in Section 8.1.

In addition, PG&E projected PSPS metrics in 2021, and Table 11 keeps those values static for 2022. PG&E anticipates continued improvement from 2021 to 2022, but we do not yet have analysis on the value of those improvements. Thus, for the purposes of this table, no improvements have been assumed.

PACIFIC GAS & ELECTRIC COMPANY

SECTION 9

APPENDIX

PGE-DIXIE-NDCAL-000005324

9.1 Definitions of Initiative Activities by Category

These definitions were provided by the California Public Utilities Commission (CPUC or Commission) Wildfire Safety Division (WSD) for the purposes of the utilities in categorizing wildfire mitigation activities into initiatives in Section 7.3. These initiative definitions have been reproduced here for ease of cross-referencing and to maintain consistent organization for Section 9.

Category	Initiative activity	Definition
A. Risk mapping and simulation	A summarized risk map that shows the overall ignition probability and estimated wildfire consequence along the electric lines and equipment	Development and use of tools and processes to develop and update risk map and simulations and to estimate risk reduction potential of initiatives for a given portion of the grid (or more granularly, e.g., circuit, span, or asset). May include verification efforts, independent assessment by experts, and updates.
	Climate-driven risk map and modelling based on various relevant weather scenarios	Development and use of tools and processes to estimate incremental risk of foreseeable climate scenarios, such as drought, across a given portion of the grid (or more granularly, e.g., circuit, span, or asset). May include verification efforts, independent assessment by experts, and updates.
	Ignition probability mapping showing the probability of ignition along the electric lines and equipment	Development and use of tools and processes to assess the risk of ignition across regions of the grid (or more granularly, e.g., circuits, spans, or assets).
	Initiative mapping and estimation of wildfire and PSPS risk-reduction impact	Development of a tool to estimate the risk reduction efficacy (for both wildfire and PSPS risk) and risk-spend efficiency of various initiatives.
	Match drop simulations showing the potential wildfire consequence of ignitions that occur along the electric lines and equipment	Development and use of tools and processes to assess the impact of potential ignition and risk to communities (e.g., in terms of potential fatalities, structures burned, monetary damages, area burned, impact on air quality and greenhouse gas, or GHG, reduction goals, etc.).
B. Situational awareness and forecasting	Advanced weather monitoring and weather stations	Purchase, installation, maintenance, and operation of weather stations. Collection, recording, and analysis of weather data from weather stations and from external sources.
	Continuous monitoring sensors	Installation, maintenance, and monitoring of sensors and sensorized equipment used to monitor the condition of electric lines and equipment.
	Fault indicators for detecting faults on electric lines and equipment	Installation and maintenance of fault indicators.
	Forecast of a fire risk index, fire potential index, or similar	Index that uses a combination of weather parameters (such as wind speed, humidity, and temperature), vegetation and/or fuel conditions, and other factors to judge current fire risk and to create a forecast indicative of fire risk. A sufficiently granular index shall inform operational decision-making.

Category	Initiative activity	Definition
	Personnel monitoring areas of electric lines and equipment in elevated fire risk conditions	Personnel position within utility service territory to monitor system conditions and weather on site. Field observations shall inform operational decisions.
	Weather forecasting and estimating impacts on electric lines and equipment	Development methodology for forecast of weather conditions relevant to utility operations, forecasting weather conditions and conducting analysis to incorporate into utility decision-making, learning and updates to reduce false positives and false negatives of forecast PSPS conditions.
C. Grid design and system hardening	Capacitor maintenance and replacement program	Remediation, adjustments, or installations of new equipment to improve or replace existing capacitor equipment.
	Circuit breaker maintenance and installation to de-energize lines upon detecting a fault	Remediation, adjustments, or installations of new equipment to improve or replace existing fast switching circuit breaker equipment to improve the ability to protect electrical circuits from damage caused by overload of electricity or short circuit.
	Covered conductor installation	Installation of covered or insulated conductors to replace standard bare or unprotected conductors (defined in accordance with GO 95 as supply conductors, including but not limited to lead wires, not enclosed in a grounded metal pole or not covered by: a “suitable protective covering” (in accordance with Rule 22.8), grounded metal conduit, or grounded metal sheath or shield). In accordance with GO 95, conductor is defined as a material suitable for: (1) carrying electric current, usually in the form of a wire, cable or bus bar, or (2) transmitting light in the case of fiber optics; insulated conductors as those which are surrounded by an insulating material (in accordance with Rule 21.6), the dielectric strength of which is sufficient to withstand the maximum difference of potential at normal operating voltages of the circuit without breakdown or puncture; and suitable protective covering as a covering of wood or other non-conductive material having the electrical insulating efficiency (12kV/in. dry) and impact strength (20ft.-lbs) of 1.5 inches of redwood or other material meeting the requirements of Rule 22.8-A, 22.8-B, 22.8-C or 22.8-D.

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Category	Initiative activity	Definition
	Covered conductor maintenance	Remediation and adjustments to installed covered or insulated conductors. In accordance with GO 95, conductor is defined as a material suitable for: (1) carrying electric current, usually in the form of a wire, cable or bus bar, or (2) transmitting light in the case of fiber optics; insulated conductors as those which are surrounded by an insulating material (in accordance with Rule 21.6), the dielectric strength of which is sufficient to withstand the maximum difference of potential at normal operating voltages of the circuit without breakdown or puncture; and suitable protective covering as a covering of wood or other non-conductive material having the electrical insulating efficiency (12kV/in. dry) and impact strength (20ft.-lbs) of 1.5 inches of redwood or other material meeting the requirements of Rule 22.8-A, 22.8-B, 22.8-C or 22.8-D.
	Crossarm maintenance, repair, and replacement	Remediation, adjustments, or installations of new equipment to improve or replace existing crossarms, defined as horizontal support attached to poles or structures generally at right angles to the conductor supported in accordance with GO 95.
	Distribution pole replacement and reinforcement, including with composite poles	Remediation, adjustments, or installations of new equipment to improve or replace existing distribution poles (i.e., those supporting lines under 65kV), including with equipment such as composite poles manufactured with materials reduce ignition probability by increasing pole lifespan and resilience against failure from object contact and other events.
	Expulsion fuse replacement	Installations of new and CAL FIRE-approved power fuses to replace existing expulsion fuse equipment.
	Grid topology improvements to mitigate or reduce PSPS events	Plan to support and actions taken to mitigate or reduce PSPS events in terms of geographic scope and number of customers affected, such as installation and operation of electrical equipment to sectionalize or island portions of the grid, microgrids, or local generation.
	Installation of system automation equipment	Installation of electric equipment that increases the ability of the utility to automate system operation and monitoring, including equipment that can be adjusted remotely such as automatic reclosers (switching devices designed to detect and interrupt momentary faults that can reclose automatically and detect if a fault remains, remaining open if so).
	Maintenance, repair, and replacement of connectors, including hotline clamps	Remediation, adjustments, or installations of new equipment to improve or replace existing connector equipment, such as hotline clamps.
	Mitigation of impact on customers and other residents affected during PSPS event	Actions taken to improve access to electricity for customers and other residents during PSPS events, such as installation and operation of local generation equipment (at the community, household, or other level).

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Category	Initiative activity	Definition
	Other corrective action	Other maintenance, repair, or replacement of utility equipment and structures so that they function properly and safely, including remediation activities (such as insulator washing) of other electric equipment deficiencies that may increase ignition probability due to potential equipment failure or other drivers.
	Pole loading infrastructure hardening and replacement program based on pole loading assessment program	Actions taken to remediate, adjust, or install replacement equipment for poles that the utility has identified as failing to meet safety factor requirements in accordance with GO 95 or additional utility standards in the utility's pole loading assessment program.
	Transformers maintenance and replacement	Remediation, adjustments, or installations of new equipment to improve or replace existing transformer equipment.
	Transmission tower maintenance and replacement	Remediation, adjustments, or installations of new equipment to improve or replace existing transmission towers (e.g., structures such as lattice steel towers or tubular steel poles that support lines at or above 65kV).
	Undergrounding of electric lines and/or equipment	Actions taken to convert overhead electric lines and/or equipment to underground electric lines and/or equipment (i.e., located underground and in accordance with GO 128).
	Updates to grid topology to minimize risk of ignition in HFTDs	Changes in the plan, installation, construction, removal, and/or undergrounding to minimize the risk of ignition due to the design, location, or configuration of utility electric equipment in HFTDs.
D. Asset management and inspections	Detailed inspections of distribution electric lines and equipment	In accordance with GO 165, careful visual inspections of overhead electric distribution lines and equipment where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.
	Detailed inspections of transmission electric lines and equipment	Careful visual inspections of overhead electric transmission lines and equipment where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.
	Improvement of inspections	Identifying and addressing deficiencies in inspections protocols and implementation by improving training and the evaluation of inspectors.

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Category	Initiative activity	Definition
	Infrared inspections of distribution electric lines and equipment	Inspections of overhead electric distribution lines, equipment, and right-of-way using infrared (heat-sensing) technology and cameras that can identify "hot spots", or conditions that indicate deterioration or potential equipment failures, of electrical equipment.
	Infrared inspections of transmission electric lines and equipment	Inspections of overhead electric transmission lines, equipment, and right-of-way using infrared (heat-sensing) technology and cameras that can identify "hot spots", or conditions that indicate deterioration or potential equipment failures, of electrical equipment.
	Intrusive pole inspections	In accordance with GO 165, intrusive inspections involve movement of soil, taking samples for analysis, and/or using more sophisticated diagnostic tools beyond visual inspections or instrument reading.
	LiDAR inspections of distribution electric lines and equipment	Inspections of overhead electric distribution lines, equipment, and right-of-way using LiDAR (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).
	LiDAR inspections of transmission electric lines and equipment	Inspections of overhead electric transmission lines, equipment, and right-of-way using LiDAR (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).
	Other discretionary inspection of distribution electric lines and equipment, beyond inspections mandated by rules and regulations	Inspections of overhead electric transmission lines, equipment, and right-of-way that exceed or otherwise go beyond those mandated by rules and regulations, including GO 165, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.
	Other discretionary inspection of transmission electric lines and equipment, beyond inspections mandated by rules and regulations	Inspections of overhead electric distribution lines, equipment, and right-of-way that exceed or otherwise go beyond those mandated by rules and regulations, including GO 165, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.
	Patrol inspections of distribution electric lines and equipment	In accordance with GO 165, simple visual inspections of overhead electric distribution lines and equipment that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.

Category	Initiative activity	Definition
	Patrol inspections of transmission electric lines and equipment	Simple visual inspections of overhead electric transmission lines and equipment that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.
	Pole loading assessment program to determine safety factor	Calculations to determine whether a pole meets pole loading safety factor requirements of GO 95, including planning and information collection needed to support said calculations. Calculations shall consider many factors including the size, location, and type of pole; types of attachments; length of conductors attached; and number and design of supporting guys, per D.15-11-021.
	Quality assurance/quality control of inspections	Establishment and function of audit process to manage and confirm work completed by employees or subcontractors, including packaging QA/QC information for input to decision-making and related integrated workforce management processes.
	Substation inspections	In accordance with GO 175, inspection of substations performed by qualified persons and according to the frequency established by the utility, including record-keeping.
E. Vegetation management and inspection	Additional efforts to manage community and environmental impacts	Plan and execution of strategy to mitigate negative impacts from utility vegetation management to local communities and the environment, such as coordination with communities to plan and execute vegetation management work or promotion of fire-resistant planting practices
	Detailed inspections of vegetation around distribution electric lines and equipment	Careful visual inspections of vegetation around the right-of-way, where individual trees are carefully examined, visually, and the condition of each rated and recorded.
	Detailed inspections of vegetation around transmission electric lines and equipment	Careful visual inspections of vegetation around the right-of-way, where individual trees are carefully examined, visually, and the condition of each rated and recorded.
	Emergency response vegetation management due to red flag warning or other urgent conditions	Plan and execution of vegetation management activities, such as trimming or removal, executed based upon and in advance of forecast weather conditions that indicate high fire threat in terms of ignition probability and wildfire consequence.
	Fuel management and reduction of “slash” from vegetation management activities	Plan and execution of fuel management activities that reduce the availability of fuel in proximity to potential sources of ignition, including both reduction or adjustment of live fuel (in terms of species or otherwise) and of dead fuel, including "slash" from vegetation management activities that produce vegetation material such as branch trimmings and felled trees.
	Improvement of inspections	Identifying and addressing deficiencies in inspections protocols and implementation by improving training and the evaluation of inspectors.

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Category	Initiative activity	Definition
	LiDAR inspections of vegetation around distribution electric lines and equipment	Inspections of right-of-way using LiDAR (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).
	LiDAR inspections of vegetation around transmission electric lines and equipment	Inspections of right-of-way using LiDAR (Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure variable distances).
	Other discretionary inspections of vegetation around distribution electric lines and equipment	Inspections of rights-of-way and adjacent vegetation that may be hazardous, which exceeds or otherwise go beyond those mandated by rules and regulations, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.
	Other discretionary inspections of vegetation around transmission electric lines and equipment	Inspections of rights-of-way and adjacent vegetation that may be hazardous, which exceeds or otherwise go beyond those mandated by rules and regulations, in terms of frequency, inspection checklist requirements or detail, analysis of and response to problems identified, or other aspects of inspection or records kept.
	Patrol inspections of vegetation around distribution electric lines and equipment	Visual inspections of vegetation along rights-of-way that is designed to identify obvious hazards. Patrol inspections may be carried out in the course of other company business.
	Patrol inspections of vegetation around transmission electric lines and equipment	Visual inspections of vegetation along rights-of-way that is designed to identify obvious hazards. Patrol inspections may be carried out in the course of other company business.
	Quality assurance/quality control of vegetation inspections	Establishment and function of audit process to manage and confirm work completed by employees or subcontractors, including packaging QA/QC information for input to decision-making and related integrated workforce management processes.
	Recruiting and training of vegetation management personnel	Programs to ensure that the utility is able to identify and hire qualified vegetation management personnel and to ensure that both full-time employees and contractors tasked with vegetation management responsibilities are adequately trained to perform vegetation management work, according to the utility's wildfire mitigation plan, in addition to rules and regulations for safety.
	Remediation of at-risk species	Actions taken to reduce the ignition probability and wildfire consequence attributable to at-risk vegetation species, such as trimming, removal, and replacement.
	Removal and remediation of trees with strike potential to electric lines and equipment	Actions taken to remove or otherwise remediate trees that could potentially strike electrical equipment, if adverse events such as failure at the ground-level of the tree or branch breakout within the canopy of the tree, occur.

Category	Initiative activity	Definition
	Substation inspection	Inspection of vegetation surrounding substations, performed by qualified persons and according to the frequency established by the utility, including record-keeping.
	Substation vegetation management	Based on location and risk to substation equipment only, actions taken to reduce the ignition probability and wildfire consequence attributable to contact from vegetation to substation equipment.
	Vegetation inventory system	Inputs, operation, and support for centralized inventory of vegetation clearances updated based upon inspection results, including (1) inventory of species, (2) forecasting of growth, (3) forecasting of when growth threatens minimum right-of-way clearances ("grow-in" risk) or creates fall-in/fly-in risk.
	Vegetation management to achieve clearances around electric lines and equipment	Actions taken to ensure that vegetation does not encroach upon the minimum clearances set forth in Table 1 of GO 95, measured between line conductors and vegetation, such as trimming adjacent or overhanging tree limbs.
F. Grid operations and protocols	Automatic recloser operations	Designing and executing protocols to deactivate automatic reclosers based on local conditions for ignition probability and wildfire consequence.
	Crew-accompanying ignition prevention and suppression resources and services	Those firefighting staff and equipment (such as fire suppression engines and trailers, firefighting hose, valves, and water) that are deployed with construction crews and other electric workers to provide site-specific fire prevention and ignition mitigation during on-site work
	Personnel work procedures and training in conditions of elevated fire risk	Work activity guidelines that designate what type of work can be performed during operating conditions of different levels of wildfire risk. Training for personnel on these guidelines and the procedures they prescribe, from normal operating procedures to increased mitigation measures to constraints on work performed.
	Protocols for PSPS re-energization	Designing and executing procedures that accelerate the restoration of electric service in areas that were de-energized, while maintaining safety and reliability standards.
	PSPS events and mitigation of PSPS impacts	Designing, executing, and improving upon protocols to conduct PSPS events, including development of advanced methodologies to determine when to use PSPS, and to mitigate the impact of PSPS events on affected customers and local residents.
	Stationed and on-call ignition prevention and suppression resources and services	Firefighting staff and equipment (such as fire suppression engines and trailers, firefighting hose, valves, firefighting foam, chemical extinguishing agent, and water) stationed at utility facilities and/or standing by to respond to calls for fire suppression assistance.

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Category	Initiative activity	Definition
G. Data governance	Centralized repository for data	Designing, maintaining, hosting, and upgrading a platform that supports storage, processing, and utilization of all utility proprietary data and data compiled by the utility from other sources.
	Collaborative research on utility ignition and/or wildfire	Developing and executing research work on utility ignition and/or wildfire topics in collaboration with other non-utility partners, such as academic institutions and research groups, to include data-sharing and funding as applicable.
	Documentation and disclosure of wildfire-related data and algorithms	Design and execution of processes to document and disclose wildfire-related data and algorithms to accord with rules and regulations, including use of scenarios for forecasting and stress testing.
	Tracking and analysis of near miss data	Tools and procedures to monitor, record, and conduct analysis of data on near miss events.
H. Resource allocation methodology	Allocation methodology development and application	Development of prioritization methodology for human and financial resources, including application of said methodology to utility decision-making.
	Risk reduction scenario development and analysis	Development of modelling capabilities for different risk reduction scenarios based on wildfire mitigation initiative implementation; analysis and application to utility decision-making.
	Risk spend efficiency analysis	Tools, procedures, and expertise to support analysis of wildfire mitigation initiative risk-spend efficiency, in terms of MAVF and/or MARS methodologies.
I. Emergency planning and preparedness	Adequate and trained workforce for service restoration	Actions taken to identify, hire, retain, and train qualified workforce to conduct service restoration in response to emergencies, including short-term contracting strategy and implementation.
	Community outreach, public awareness, and communications efforts	Actions to identify and contact key community stakeholders; increase public awareness of emergency planning and preparedness information; and design, translate, distribute, and evaluate effectiveness of communications taken before, during, and after a wildfire, including Access and Functional Needs populations and Limited English Proficiency populations in particular.
	Customer support in emergencies	Resources dedicated to customer support during emergencies, such as website pages and other digital resources, dedicated phone lines, etc.
	Disaster and emergency preparedness plan	Development of plan to deploy resources according to prioritization methodology for disaster and emergency preparedness of utility and within utility service territory (such as considerations for critical facilities and infrastructure), including strategy for collaboration with Public Safety Partners and communities.

Category	Initiative activity	Definition
	Preparedness and planning for service restoration	Development of plans to prepare the utility to restore service after emergencies, such as developing employee and staff trainings, and to conduct inspections and remediation necessary to re-energize lines and restore service to customers.
	Protocols in place to learn from wildfire events	Tools and procedures to monitor effectiveness of strategy and actions taken to prepare for emergencies and of strategy and actions taken during and after emergencies, including based on an accounting of the outcomes of wildfire events.
J. Stakeholder cooperation and community engagement	Community engagement	Strategy and actions taken to identify and contact key community stakeholders; increase public awareness and support of utility wildfire mitigation activity; and design, translate, distribute, and evaluate effectiveness of related communications. Includes specific strategies and actions taken to address concerns and serve needs of Access and Functional Needs populations and Limited English Proficiency populations in particular.
	Cooperation and best practice sharing with agencies outside CA	Strategy and actions taken to engage with agencies outside of California to exchange best practices both for utility wildfire mitigation and for stakeholder cooperation to mitigate and respond to wildfires.
	Cooperation with suppression agencies	Coordination with CAL FIRE, federal fire authorities, county fire authorities, and local fire authorities to support planning and operations, including support of aerial and ground firefighting in real-time, including information-sharing, dispatch of resources, and dedicated staff.
	Forest service and fuel reduction cooperation and joint roadmap	Strategy and actions taken to engage with local, state, and federal entities responsible for or participating in forest management and fuel reduction activities; and design utility cooperation strategy and joint stakeholder roadmap (plan for coordinating stakeholder efforts for forest management and fuel reduction activities).

9.2 Citations for relevant statutes, proceedings and orders

Throughout the WMP, cite relevant state and federal statutes, Commission directives, orders, and proceedings. Place the title or tracking number of the statute in parentheses next to comment, or in the appropriate column if noted in a table. Provide in this section a brief description or summary of the relevant portion of the statute. Track citations as end-notes and order (1, 2, 3…) across sections (e.g., if section 1 has 4 citations, section 2 begins numbering at 5).

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
1.2 Initial Explanatory Notes and Comments	1. CPUC Resolution WSD-011 2. CPUC A.20-06-012 3. CPUC R. 08-11-005, D. 14-02-015	1. Resolution Implementing the Requirements of PUC 8389(d)(1), (2) and (4), Related to Catastrophic Wildfire Caused by Electrical Corporations 2. Application of PG&E to Submit its 2020 Risk Assessment and Mitigation Phase Report (RAMP) 3. Decision Adopting Regulations to Reduce the Fire Hazards Associated with Overhead Electric Utility Facilities
2. Adherence to Statutory Requirements	1. Public Utilities Code § 8386(c) 2. Public Utilities Code § 768.6 3. CPUC R.18-12-005, D.20-05-051	1. Duties of Electrical Corporations Relating to Wildfire Risk Mitigation 2. Emergency and Disaster Preparedness Plans 3. Decision Adopting Phase 2 Updated and Additional Guidelines for De-Energization of Electrical Facilities to Mitigate Wildfire Risk
3.2 Summary of Ratepayer Impact	1. CPUC R.18-10-007, D.19-05-037 2. CPUC I.19-06-015, D.20-05-019 3. CPUC A.20-09-019 4. CPUC A.15-09-001, D.17-05-013 5. PG&E's twentieth Transmission Owner rate case at the Federal Energy Regulatory Commission (FERC), Docket No. ER19-13-000 (TO20) 6. CPUC A.18-12-009, D.20-12-005 7. CPUC R.19-09-009 8. CPUC A.18-03-015 9. CPUC A.17-07-011, D.18-06-029 10. CPUC A.20-02-004 11. Assembly Bill 1054	1. Decision on PG&E's 2019 Wildfire Mitigation Plan Pursuant to SB 901 2. Decision Approving Proposed Settlement Agreement with Modifications 3. PG&E Application for Recovery of Recorded Expenditures Related to Wildfire Mitigation and Catastrophic Events 4. Decision Authorizing PG&E GRC Revenue Requirement for 2017-2019 5. PG&E's rate case for FERC-jurisdictional transmission rates 6. Decision Addressing the Test Year 2020 GRC of PG&E

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WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
		7. OIR re: Microgrids Pursuant to SB 1339 8. Application of PG&E to Recover Costs Recorded in the Catastrophic Event Memorandum Account Pursuant to PUC 454.9 and Res. ESRB-4 9. Alternate Decision Authorizing Establishment of Wildfire Expense Memorandum Account 10. Application of PG&E to Recover Insurance Costs Recorded in the Wildfire Expense Memo Account 11. Public Utilities: Wildfires and Employee Protection
4.1 Lessons Learned: How Tracking Metrics on the 2020 Plan has Informed the 2021 Plan	1. CPUC A.20-06-012	1. Application of PG&E to submit its 2020 Risk Assessment and Mitigation Phase Report (RAMP)
4.2 Understanding Major Trends Impacting Ignition Probability and wildfire Consequence	1. CPUC General Order 95, Rule 31.1 2. CPUC A.15-05-002, D.18-12-014 3. CPUC A.15-05-002, D.16-08-018 4. CPUC R.08-11-005, D.14-02-015 5. CPUC R.96-11-004, D.98-07-097	1.Overhead electric/telecom line construction (Rule 31.1) 2. Phase Two Decision Adopting S-Map Settlement Agreement with Modifications 3. Interim Decision Adopting the Multi-Attribute Approach Directing Utilities to Uniform Risk Management Framework 4. Decision Adopting Regulations to Reduce the Fire Hazards with Overhead Electric Utility Facilities & Aerial Communications Facilities 5. Opinion Adopts Final Rules to Govern Major Power Outages
4.4.2 Research Findings	1. Public Resources Code § 4292	1. Firebreak Maintenance
4.5.1 Additional models for ignition probability, wildfire and PSPS risk	1. CPUC A.15-05-002, D.18-12-014 2. CPUC General Order 95, Rule 18	1. Phase Two Decision Adopting S-Map Settlement Agreement with Modifications 2. Maintenance Programs and Resolution of Potential Violations of General Order 95
4.5.2 Calculation of key metrics	1. Government Code § 8593.3 2. CPUC R.18-12-005, D.19-05-042 3. CPUC A.18-01-004, D.20-04-003 4. CPUC R.10-02-005, D.12-03-054	1. Integration of Access and Functional Needs Population into County Emergency Plan

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
	5. CPUC R.18-07-005, D.20-06-003 6. 38 Code of Federal Regulations § 17.701 7. CPUC General Order 165	2. Decision Adopting De-Energization Guidelines (Phase 1 Guidelines) 3. Order Correcting Error 4. Decision on Phase II Issues: Adoption of Practices to Reduce the number of Gas and Electric Service Disconnections 5. Phase I Decision Adopting Rules and Policy Changes to Reduce Disconnections 6. Definitions of Highly Rural 7. Inspection Requirements for Electric Distribution and Transmission Facilities
4.6 Progress Reporting on Past Deficiencies	1. CPUC WSD-002 2. CPUC WSD-003	1. Guidance Resolution on 2020 Wildfire Mitigation Plans 2. Resolution Ratifying Action of the WSD on PG&E's 2020 WMP
5.2 The Objectives of the Plan	1. Public Utilities Code § 8386(a)	1. Duties of Electrical Corporations Relating to Wildfire Risk Mitigation
5.4 Planning for Workforce and Other Limited Resources	1. CPUC General Order 95	1. Rules for Overhead Electric Line Construction
5.4.1: Target Role: Vegetation Inspections	1. CPUC General Order 95	1. Rules for Overhead Electric Line Construction
5.4.2 Target Role: Vegetation management projects	1. CPUC General Order 95 2. Title 29, Code of Federal Regulations, Part 1910, Subpart R, § 1910.269 3. California Code of Regulations, Title 8 § 2950	1. Rules for Overhead Electric Line Construction 2. Electric Power Generation, Transmission, and Distribution 3. Line Clearance Tree Trimming Operations Application
5.4.3 Target Role: Asset Inspections	1. California Code of Regulations, Title 8 2. Title 29, Code of Federal Regulations, Part 1910, Subpart S	1. Industrial Relations 2. Electrical Safety Requirements
5.4.4 Target Role: Grid Hardening	1. California Code of Regulations, Title 8	1. Industrial Relations
5.4.5 Target Role: Risk Event Inspections	1. California Code of Regulations, Title 8	1. Industrial Relations
6.2 Recent Performance on Outcome Metrics, Annual and Normalized for Weather, Last 5 Years.	1. CPUC R.18-12-005, D.19-05-042 2. CPUC R.18-12-005, D.20-05-051 3. CPUC R.08-11-005, D.14-02-015	1. Decision Adopting De-Energization Guidelines (Phase 1 Guidelines) 2. Decision Adopting Phase 2 Updated and Additional Guidelines

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
		for De-Energization of Electric Facilities to Mitigate Wildfire Risk 3. Decision Adopting Regulations to Reduce the Fire Hazards w/overhead Electric Utility Facilities & Aerial Communications Facilities
6.7 Recent and Projected Drivers of Ignition Probability	1. CPUC R.08-11-005, D.14-02-015	1. Decision Adopting Regulations to Reduce the Fire Hazards w/overhead Electric Utility Facilities & Aerial Communications Facilities
7.1.A PG&E's Approach to Managing Wildfire Risk	1. CPUC A.15-05-002, D.18-12-014	1. Phase Two Decision Adopting S-Map Settlement Agreement with Modifications
7.1.D.1 Impact on Strategies	1. CPUC R.11-10-003, D.12-05-037	1. Phase 2 Decision Establishing Purposes and Governance for Electric Program Investment Charge and Establishing Funding Collections for 2013-2020
7.1.D.2 Implementation Approach and Integration of New or Emerging Technologies	1. CPUC R.11-10-003, D.11-12-035 2. CPUC R.19-10-005	1. Phase 1 Decision Establishing Interim Research, Development and Demonstration, and Renewables Programs Funding Levels 2. CPUC Rulemaking to Consider Renewal of the Electric Program Investment Charge Program
7.1.D.3 New or Emerging Technologies – Project Details	1. CPUC Resolution WSD-003 2. D.15-09-005, Advice Letter 6043-E	1. Resolution Ratifying Action of the WSD on PG&E's 2020 WMP 2. Request Approval of New Electric Program Investment Charge (EPIC) Projects
7.2.A Monitor and Audit WMP Implementation	1. Public Utilities Code § 8386.3(c) 2. CPUC, I. 19-06-015	1. The Wildfire Safety Division shall oversee compliance with the WMP. 2. Order Instituting Investigation and Order to Show Cause
7.2.D Report in a Format that matches across WMPs, Quarterly Reports, Quarterly Advice Letters, and annual compliance assessment	1. CPUC General Order 96-B	1. Rules that Govern Advice Letter Submittals
7.3.1.2 Climate Driven Risk Map and Modeling Based on Various Relevant Weather Scenarios	1. Senate Bill 100 2. Calif. Executive Order N-79-20	1. California Renewables Portfolio Standard Program: Emissions of Greenhouse Gases 2. Zero Emission Executive Order

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
7.3.2.1.3 Weather Stations	1. CPUC General Order 95	1. Rules for Overhead Electric Line Construction
7.3.3.3 Covered Conductor Installation	1. CPUC General Order 95, Rule 22.8 2. CPUC General Order 95, Rule 21.6	1, Protective Covering Standards 2. Definition of Insulated
7.3.3.4 Covered Conductor Maintenance	1. CPUC General Order 95, Rule 22.8 2. CPUC General Order 95, Rule 21.6 3. CPUC General Order 165	1, Protective Covering Standards 2. Definition of Insulated 3. Inspection Requirements for Electric Distribution and Transmission Facilities
7.3.3.5 Crossarm Maintenance, Repair, and Replacement	1. CPUC General Order 95 2. CPUC General Order 165	1. Rules for Overhead Electric Line Construction 2. Inspection Requirements for Electric Distribution and Transmission Facilities
7.3.3.6 Distribution Pole Replacement and Reinforcement, Including with Composite Poles	1. CPUC General Order 165	1. Inspection Requirements for Electric Distribution and Transmission Facilities
7.3.3.11.1 Generation for PSPS Mitigation	1. CPUC R.19-09-009, D.21-01-018 2. CPUC R.19-09-009 3. Senate Bill 100	1. Decision Adopting Rates, Tariffs, and Rules Facilitating the Commercialization of Microgrids 2. CPUC Rulemaking Order Regarding Microgrids 3. California Renewables Portfolio Standard Program: Emissions of Greenhouse Gases
7.3.3.12.4 Maintenance, Distribution	1. CPUC General Order 165	1. Inspection Requirements for Electric Distribution and Transmission Facilities
7.3.3.13 Pole Loading Infrastructure Hardening and Replacement Program Based on Pole Loading Assessment Program	1. CPUC General Order 95 2. CPUC General Order 95, Rule 44	1. Rules for Overhead Electric Line Construction 2. Safety Factors
7.3.3.14 Transformers Maintenance and Replacement	1. CPUC General Order 165	1. Inspection Requirements for Electric Distribution and Transmission Facilities
7.3.3.16 Undergrounding of Electric Lines and/or Electric Equipment	1. CPUC General Order 128	1. Rules for Construction of Underground Electric Supply and Communication Systems
7.3.3.17.5 Remote Grid	1. PG&E Advice Letter 6017-E	1. Remote Grid SPS Supplemental Provisions Agreement

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
7.3.4 Assets Management and inspections	1. CPUC General Order 165 2. CPUC General Order 174	1. Inspection Requirements for Electric Distribution and Transmission Facilities 2. Rules for electric substations
7.3.4.1 Detailed Inspections of Distribution Electric Lines and Equipment	1. CPUC General Order 165 2. CPUC General Order 95, Rule 18	1. Inspection Requirements for Electric Distribution and Transmission Facilities 2. Maintenance Programs and Resolution of Potential Violations of General Order 95 and Safety Hazards
7.3.4.2 Detailed Inspections of Transmission Electric Lines and Equipment	1. CPUC General Order 165	1. Inspection Requirements for Electric Distribution and Transmission Facilities
7.3.4.6 Intrusive Pole Inspections	1. CPUC General Order 165	1. Inspection Requirements for Electric Distribution and Transmission Facilities
7.3.4.9 Other Discretionary Inspection of Distribution Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations	1. CPUC General Order 165	1. Inspection Requirements for Electric Distribution and Transmission Facilities
7.3.4.10 Other Discretionary Inspection of Transmission Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations	1. CPUC General Order 165	1. Inspection Requirements for Electric Distribution and Transmission Facilities
7.3.4.11 Patrol Inspections of Distribution Electric Lines and Equipment	1. CPUC General Order 165 2. CPUC General Order 95, Rule 18	1. Inspection Requirements for Electric Distribution and Transmission Facilities 2. Maintenance Programs and Resolution of Potential Violations of General Order 95 and Safety Hazards
7.3.4.12 Patrol Inspections of Transmission Electric Lines and Equipment	1. CPUC General Order 165 2. CPUC General Order 95, Rule 18	1. Inspection Requirements for Electric Distribution and Transmission Facilities 2. Maintenance Programs and Resolution of Potential Violations of General Order 95 and Safety Hazards
7.3.4.13 Pole Loading Assessment Program to Determine Safety Factor	1. CPUC General Order 95 2. CPUC A.13-11-003, D.15-11-021 3. CPUC General Order 95, Rule 44 4. CPUC R.08-11-005, D 09-08-029	1. Rules for Overhead Electric Line Construction 2. Decision on Test Year 2015 General Rate Case for SCE

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WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
		3. Safety Factors 4. Decision in Phase 1 – Measures to Reduce Fire Hazards in California Before the 2009 Fall Fire Season
7.3.4.14 Quality Assurance/Quality Control of Inspections	1. CPUC General Order 95, Rule 18	1. Maintenance Programs and Resolution of Potential Violations of General Order 95 and Safety Hazards
7.3.4.15 Substation Inspections	1. CPUC General Order 174	1. Rules for Electric Utility Substations
7.3.5 Vegetation Management and Inspections	1. Public Resources Code § 4292 2. Public Resources Code § 4293 3. CPUC General Order 95, Rule 35 4. NERC FAC-003-4 5. CPUC R.08-11-005, D.14-02-015	1. Firebreak Maintenance 2. Fire Protection Responsibility 3. Vegetation Management Requirements 4. Transmission Vegetation Management 5. Decision Adopting Regulations to Reduce the Fire Hazards w/overhead Electric Utility Facilities & Aerial Communications Facilities
7.3.5.2 Detailed Inspections of Vegetation Around Distribution Electric Lines and Equipment	1. CPUC General Order 95, Rule 35 2. Public Resources Code § 4292 3. Public Resources Code § 4293	1. Vegetation Management Requirements 2. Firebreak Maintenance 3. Fire Protection Responsibility
7.3.5.3 Detailed Inspections of Vegetation Around Transmission Electric Lines and Equipment	1. NERC FAC-003-4 2. CPUC General Order 95, Rule 35 3. Public Resources Code § 4292 4. Public Resources Code § 4293	1. Transmission Vegetation Management 2. Vegetation Management Requirements 3. Firebreak Maintenance 4. Fire Protection Responsibility
7.3.5.9 Other Discretionary Inspection of Vegetation Around Distribution Electric Lines and Equipment, Beyond Inspections Mandated by Rules and Regulations	1. CPUC Resolution ESRB-4	1. Directs Investor Owned Electric Utilities to take Remedial Measures to Reduce the Likelihood of Fires Started by or Threatening Utility Facilities
7.3.5.17.1 Substation Inspections, Distribution	1. Public Resources Code § 4291	1. Defensible Space
7.3.5.17.2 Substation Inspections, Transmission	1. Public Resources Code § 4291	1. Defensible Space

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
7.3.5.18.1 Substation Vegetation Management, Distribution	1. Public Resources Code § 4291	1. Defensible Space
7.3.5.18.2 Substation Vegetation Management, Transmission	1. Public Resources Code § 4291	1. Defensible Space
7.3.5.20 Vegetation Management to Achieve Clearances Around Electric Lines	1. CPUC General Order 95, Table 1	1. Basic Minimum Allowable Vertical Clearance of Wires above Railroads, Thoroughfares, Ground or Water Surfaces
7.3.6.3 Personnel Work Procedures and Training in Conditions of Elevated Fire Risk	1. Public Resources Code § 4427 2. Public Resources Code § 4428 3. Public Resources Code § 4430	1. Operation of Fire Causing Equipment 2. Use of Hydrocarbon Powered Engines Near Forest, Brush, or Grass Covered Lands Without Maintaining Firefighting Tools 3. Steam Operated Equipment, Force Pump or Water Under Pressure
7.3.7.4 Tracking and Analysis of Near Miss Data	1. CPUC Resolution WSD-011 2. CPUC R.19-06-015, D.20-05-019 3. CPUC R.18-10-007	1. Resolution implementing the requirements of PUC 8389(d)(1), (2) and (4), related to catastrophic wildfire caused by electrical corporations 2. Decision Approving Settlement 3. CPUC Rulemaking to Implement the Provisions of Senate Bill 901
7.3.9.2 Community Outreach, Public Awareness, and Communications Efforts	1. CPUC R.18-12-005, D.20-05-051 2.PG&E's Advice Letter 5882-E, D.20-06-017 3. CPUC R.19-09-009, D.20-06-017 4. CPUC I. 19-06-15 5. CPUC General Order 166 6. CPUC R.18-03-011, D.19-07-015	1. Decision Adopting Phase 2 Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk 2. PG&E's Plans to Conduct Semi-Annual Public Safety Power Shutoffs (PSPS) Grid Resiliency Workshops 3. Decision Adopting Short-Term Actions to Accelerate Microgrid Deployment and Related Resiliency Solutions 4. CPUC Order Instituting Investigation Into the Maintenance, Operations, and Practices of PG&E with Respect to its Electric Facilities 5. Standards for Operation Reliability, and Safety During Emergencies and Disasters

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
		6. Decision Adopting an Emergency Disaster Relief Program for Electric, Natural Gas, Water and Sewer Utility Customers
7.3.9.3 Customer Support in Emergencies	1. CPUC R.18-03-011, D.19-07-015 2. CPUC R.18-03-011 3. CPUC R.18-07-005, D.20-06-003 4. PG&E Advice Letter 4014-G/5378-E, D.18-08-004 5. PG&E Advice Letter 4145-G/5643-E, D.19-05-037 6. CPUC R.18-10-007, D.19-05-037 7. CPUC Resolution M-4842 8. Public Utilities Code § 8386(c)(18) 9. PG&E Advice Letter 5404-E, D.18-08-004 10. PG&E Advice Letter 5744-E	1. Decision Adopting an Emergency Disaster Relief Program for Electric, Natural Gas, Water and Sewer Utility Customers 2. Emergency Disaster Relief Program. 3. Phase I Decision Adopting Rules and Policy Changes to Reduce Residential Disconnections 4. Expansion of Emergency Consumer Protection Plan 5. Revision to the Emergency Consumer Protection Plan 6. Decision on PG&E's 2019 Wildfire Mitigation Plan Pursuant to Senate Bill 901 7. Emergency Authorization and Order Directing Utilities to Implement Emergency Customer Protections to Support California Customers During the COVID-19 Pandemic 8. Duties of Electrical Corporations Relating to Wildfire Risk Mitigation 9. Proposed Changes to NEM Tariff and the NEM Successor Tariff (NEM 2) to Revise the Provisions for Customers Impacted by Natural or Man-Made Disasters 10. Request for Pilot Pedestal Program
7.3.9.4 Disaster and Emergency Preparedness Plan	1. Public Utilities Code § 768.6 2. CPUC General Order 166	1. Emergency and Disaster Preparedness Plans 2. Standards for Operation, Reliability and Safety During Emergencies and Disasters
7.3.9.6 Protocols in Place to Learn from Wildfire Events	1. CPUC General Order 166	1. Standards for Operation, Reliability and Safety During Emergencies and Disasters
7.3.10.1 Community Engagement	1. CPUC R.18-12-005, D.20-05-051 2. CPUC I.19-06-015 3. CPUC R.18-10-007, D.20-03-004	1. Decision Adopting Phase 2 Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
	4. PG&E Advice Letter 4244-G/58136-E, Res. M-4842 5. PG&E Advice Letter 4244-G-A/5816-E-A, Res. M-4842 6. PG&E Advice Letter 4244-G-B/5816-E-B, Res. M-4842	2. CPUC Order Instituting Investigation Into the Maintenance, Operations, and Practices of PG&E with Respect to its Electric Facilities 3. Decision on Community Awareness and Public Outreach Before, During and After a Wildfire, and Explaining Next Steps for Other Phase 2 Issues 4. PG&E Emergency Consumer Protection Plan to Support Customers During COVID-19 5. Supplemental PG&E Emergency Consumer Protection Plan to Support Customers During COVID-19 6. Second Supplemental PG&E Emergency Consumer Protection Plan to Support Customers During COVID-19
8.1 Directional Vision for Necessity of PSPS	1. CPUC Resolution ESRB-8 2. CPUC R.18-12-005, D.19-05-042 3. CPUC I. 19-11-013 4. CPUC R.18-12-005 5. CPUC R.18-12-005, D.20-05-051	1. Resolution Extending De-Energization Reasonableness Notification, Mitigation, and Reporting Requirements in Decision 12-04-024 2. Decision Adopting De-Energization Guidelines (Phase 1 Guidelines) 3. CPUC Order Instituting Investigation on the Commission's Own Motion on the Late 2019 Public Safety Power Shutoff Events 4. CPUC Order Instituting Rulemaking to Examine Electric Utility De-Energization of Power Lines in Dangerous Conditions 5. Decision Adopting Phase 2 Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk
8.2.1 Strategy to Minimize Public Safety Risk During High Wildfire Risk Conditions	1. CPUC R.12-11-005, D.19-09-027 2. CPUC R.12-11-005, D.20-01-021 3. PG&E Advice Letter 4360-G/6052-E 4. CPUC R.18-12-005, D.20-05-051	1. Decision Establishing A Self-Generation Incentive Program Resiliency Budget etc. 2. Self-Generation Incentive Program Revisions Pursuant To Senate Bill 700 and Other Program Changes

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
	5. PG&E Advice Letter 5918-E, D.20-06-017 6. CPUC R.19-09-009, D.21-01-018	3. Proposal to Implement an On-Bill Financing Resiliency Pilot for K-12 Schools 4. Decision Adopting Phase 2 Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk 5. Implementation Plan for Community Microgrid Enablement Program 6. Decision Adopting Rates, Tariffs, and Rules Facilitating the Commercialization of Microgrids
8.2.4 Customer, Agency, and External Communications	1. CPUC R.18-12-005, D.19-05-042 2. CPUC R.18-12-005, D.20-05-051	1. Decision Adopting De-Energization Guidelines (Phase 1 Guidelines) 2. Decision Adopting Phase 2 Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk
8.4 Engaging Vulnerable Communities	1. CPUC R.18-10-007, D.20-03-004 2. CPUC R.18-12-005, D.19-05-042 3. Government Code § 8593.3 4. CPUC Resolution WSD-011	1. Decision on Community Awareness and Public Outreach Before, During and After a Wildfire 2. Decision Adopting De-Energization (PSPS) Guidelines (Phase 1 Guidelines) 3. Integration of Access and Functional Needs Population into County Emergency Plan 4. Wildfire Safety Division Implementing the Requirements of PUC 8389(d)(1), (2) and (4), Related to Catastrophic Wildfire Caused by Electrical Corporations
8.4.1 Protocols to Mitigate Public Safety Impacts During PSPS Events	1. CPUC R.04-01-006, A.05-06-005, D.05-10-044 2. CPUC R.10-02-005, D.12-03-054 3. CPUC R.18-07-005, D.20-06-003 4. CPUC R.18-12-005, D. 19-05-042 5. CPUC R.18-12-005, D.20-05-051	1. Interim Opinion Approving Various Emergency Program Changes 2. Decision on Phase II Issues: Adoption of Practices to Reduce Disconnections 3. Phase I Decision Adopting Rules and Policy Changes to Reduce Customer Disconnections 4. Decision Adopting De-Energization Guidelines (Phase 1 Guidelines) 5. Decision Adopting Phase 2 Updated and Additional Guidelines

WMP Section/Category	State and Federal Statutes, Commission Directives, Orders and Proceedings	Description
		for De-Energization of Electric Facilities to Mitigate Wildfire Risk
8.4.2 Prevalent Languages in PG&E's Territory	1. CPUC R.18-10-007, D.20-03-004	1. Decision on Community Awareness and Public Outreach Before, During and After a Wildfire
8.4.4 Community Outreach Efforts for PSPS and Wildfire-Related Outreach	1. CPUC R.18-10-007, D.20-03-004 2. CPUC R.18-12-005, D.20-05-051 3. PG&E Advice Letter 4293-G/5916-E, D.20-06-003	1. Decision on Community Awareness and Public Outreach Before, During and After a Wildfire 2. Decision Adopting Phase 2 Updated and Additional Guidelines for De-Energization of Electric Facilities to Mitigate Wildfire Risk 3. Plan to Implement SB 1338's Requirements in Support of the Medical Baseline Program

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9.3 Wildfire Safety Division Glossary of Defined Terms

Term	Definition
10-hour dead fuel moisture content	Moisture content of small dead vegetation (e.g., grass, leaves, which burn quickly but not intensely), which can respond to changes in atmospheric moisture content within 10 hours.
Access and functional needs populations	Per Government Code § 8593.3 and D.19-05-042, individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking, older adults, children, people living in institutionalized settings, or those who are low income, homeless, or transportation disadvantaged, including, but not limited to, those who are dependent on public transit or those who are pregnant.
Authority Having Jurisdiction	AHJ, party with assigned responsibility, depending on location and circumstance.
Asset (utility)	Electric lines, equipment, or supporting hardware.
At-risk species	Species of vegetation that are particularly likely to contact power lines in the event of high winds and/or ignite if they catch a spark.
Baseline (ignition probability, maturity)	A measure, typically of the current state, to establish a starting point for comparison.
Carbon dioxide equivalent	Tons of greenhouse gases (GHG) emitted, multiplied by the global warming potential relative to carbon dioxide.
Circuit mile	The total length in miles of separate circuits regardless of the number of conductors used per circuit
Contractor	Any individual in the temporary and/or indirect employ of the utility whose limited hours and/or time-bound term of employment are not considered as "full-time" for tax and/or any other purposes.
Critical facilities and infrastructure	For brevity in the 2021 WMP, "critical facilitates and infrastructure" may be shortened to "critical infrastructure" and/or "critical facilities" throughout the WMP. Critical facilities and infrastructure is defined in accordance with the definition adopted in D.19-05-042 and modified in D.20-05-051: those facilities and infrastructure that are essential to the public safety and that require additional assistance and advance planning to ensure resiliency during de energization events. Namely: Emergency Services Sector Police Stations Fire Station Emergency Operations Centers Public safety answering points Government Facilities Sector Schools Jails and prisons Healthcare and Public Health Sector Public Health Departments Medical facilities, including hospitals, skilled nursing facilities, nursing homes, blood banks, health care facilities, dialysis centers and hospice facilities (excluding doctor offices and other non-essential medical facilities)

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Term	Definition
	Energy Sector Public and private utility facilities vital to maintaining or restoring normal service, including, but not limited to, interconnected publicly-owned utilities and electric cooperatives Water and Wastewater Systems Sector Facilities associated with the provision of drinking water or processing of wastewater including facilities used to pump, divert, transport, store, treat and deliver water or wastewater Communications Sector Communication carrier infrastructure including selective routers, central offices, head ends, cellular switches, remote terminals and cellular sites Chemical Sector Facilities associated with the provision of manufacturing, maintaining, or distributing hazardous materials and chemicals (including Category N-Customers as defined in D.01-06-085) Transportation Sector Facilities associated with automobile, rail, aviation, major public transportation, and maritime transportation for civilian and military purposes
Customer hours	Total number of customers, multiplied by the average number of hours (e.g., of power outage).
Data cleaning	Calibrating raw data to remove errors (including typographical and numerical mistakes).
Dead fuel moisture content	Moisture content of dead vegetation, which responds solely to current environmental conditions and is critical in determining fire potential.
Detailed inspection	In accordance with GO 165, an inspection where individual pieces of equipment and structures are carefully examined, visually and through use of routine diagnostic test, as appropriate, and (if practical and if useful information can be so gathered) opened, and the condition of each rated and recorded.
Enhanced inspection	Inspection whose frequency and thoroughness exceeds the requirements of the detailed inspection, particularly if driven by risk calculations.
Evacuation impact	Number of people evacuated, with the duration for which they are evacuated, from homes and businesses, due to wildfires.
Evacuation zone	Areas designated by CAL FIRE and local fire agency evacuation orders, to include both “voluntary” and “mandatory” in addition to other orders such as “precautionary” and “immediate threat”.
Fuel density	Mass of fuel (vegetation) per area which could combust in a wildfire.
Fuel management	Removing or thinning vegetation to reduce the potential rate of propagation or intensity of wildfires.
Fuel moisture content	Amount of moisture in a given mass of fuel (vegetation), measured as a percentage of its dry weight.
Full-time employee	Any individual in the ongoing and/or direct employ of the utility whose hours and/or term of employment are considered as “full-time” for tax and/or any other purposes.
GO 95 nonconformance	Condition of a utility asset that does not meet standards established by General Order 95.
Greenhouse gas (GHG) emissions	Health and Safety Code 38505 identifies seven greenhouse gases that ARB is responsible to monitor and regulate in order to reduce emissions: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), sulfur hexafluoride (SF6),

Term	Definition
	hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and nitrogen trifluoride (NF3).
Grid hardening	Actions (such as equipment upgrades, maintenance, and planning for more resilient infrastructure) taken in response to the risk of undesirable events (such as outages) or undesirable conditions of the electrical system in order to reduce or mitigate those events and conditions, informed by an assessment of the relevant risk drivers or factors.
Grid topology	General design of an electric grid, whether looped or radial, with consequences for reliability and ability to support de-energization (e.g., being able to deliver electricity from an additional source).
High Fire Threat District (HFTD)	Per D.17-01-009, areas of the State designated by the CPUC and CAL FIRE to have elevated wildfire risk, indicating where utilities must take additional action (per GO 95, GO 165, and GO 166) to mitigate wildfire risk.
Highly rural region	In accordance with 38 CFR 17.701, "highly rural" shall be defined as those areas with a population of less than 7 persons per square mile. For the purposes of the WMP, "area" shall be defined as census tracts.
High Wind Warning (HWW)	Level of wind risk from weather conditions, as declared by the National Weather Service. For historical NWS data, refer to the Iowa State University Iowa archive of NWS watch/warnings.[1]
HWW overhead (OH) Circuit Mile Day	Sum of overhead circuit miles of utility grid subject to High Wind Warnings (HWW, as defined by the National Weather Service) each day within a given time period, calculated as the number of overhead circuit miles that were under an HWW multiplied by the number of days those miles were under said HWW. For example, if 100 overhead circuit miles were under an HWW for 1 day, and 10 of those miles were under HWW for an additional day, then the total HWW OH circuit mile days would be 110.
Ignition probability	The relative possibility that an ignition will occur, probability is quantified as a number between 0% and 100% (where 0% indicates impossibility and 100% indicates certainty). The higher the probability of an event, the more certainty there is that the event will occur. (Often informally referred to as likelihood or chance).
Ignition-related deficiency	Any condition which may result in ignition or has previously resulted in ignition, even if not during the past five years.
Impact/consequence of ignitions	The effect or outcome of a wildfire ignition, affecting objectives, which may be expressed by terms including, although not limited to health, safety, reliability, economic and/or environmental damage.
Initiative	Measure or activity proposed or in process designed to reduce the consequences and/or probability of wildfire or PSPS.
Inspection protocol	Documented procedures to be followed in order to validate that a piece of equipment is in good condition and expected to operate safely and effectively.
Invasive species	Non-native species whose proliferation increases the risk of wildfires.
Level 1 finding	In accordance with GO 95, an immediate safety and/or reliability risk with high probability for significant impact.
Level 2 finding	In accordance with GO 95, a variable (non-immediate high to low) safety and/or reliability risk.
Level 3 finding	In accordance with GO 95, an acceptable safety and/or reliability risk.

1 https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml.

Term	Definition
Life expectancy	Anticipated years that a piece of equipment can be expected to meet safety and performance requirements.
Limited English Proficiency (LEP)	Populations with limited English working proficiency based on the International Language Roundtable scale.
Line miles	The number of miles of transmission and/or distribution line. Differs from circuit miles because individual circuits, such as the two circuits of a double-circuit line, are not counted separately in circuit miles but are counted as separate total miles of line.
Live fuel moisture content	Moisture content within living vegetation, which can retain water longer than dead fuel.
Lost energy	Energy that would have been delivered were it not for an outage.
Major roads	Interstate highways, U.S. highways, state and county routes.
Match drop simulation	Wildfire simulation method that takes an arbitrary ignition and forecasts propagation and consequence/impact.
Member of the public	Any individual not employed by the utility.
Multi-attribute value function	Risk calculation methodology introduced during CPUC's S-MAP and RAMP proceedings.
Near miss	Previously used to define an event with probability of ignition. Redefined under "Risk event."
Need for PSPS	When utilities' criteria for utilizing PSPS are met.
Noncompliant clearance	Rights-of-way whose vegetation is not trimmed in accordance with the requirements of GO 95.
Outages of the type that could ignite a wildfire	Outages that, in the judgement of the utility, could have ignited a wildfire.
Outcome metrics	Measurements of the performance of the utility and its service territory in terms of both leading and lagging indicators of wildfire, PSPS, and other consequences of wildfire risk, including the potential unintended consequences of wildfire mitigation work, such as acreage burned by utility-ignited wildfire.
Overcapacity	When the energy transmitted by utility equipment exceeds that of its nameplate capacity.
Patrol inspection	In accordance with GO 165, a simple visual inspection of applicable utility equipment and structures that is designed to identify obvious structural problems and hazards. Patrol inspections may be carried out in the course of other company business.
Percentile conditions	Top X% of a particular set (e.g., wind speed), based on a historical data set with sufficient detail. For example, "Top 95 percentile wind speeds in the last 5 years" would refer to the 5% of avg daily wind speeds recorded by each weather station. If 1,000 weather stations recorded average daily wind speeds over 10 days, then the 95th percentile wind speed would be the top 5% of weather station-days. In this example, there will be 10 days each with 1,000 weather station reports and a total of 10,000 weather station-days, so 50 observations will be in the top 5%. The lowest wind speed in this top 5% would be the "95th percentile wind speed".
Planned outage	Electric outage announced ahead of time by the utility.
Preventive maintenance (PM)	The practice of maintaining equipment on a regular schedule, based on risk, elapsed time, run-time meter readings, or number of operations. The intent of PM is to "prevent" maintenance problems or failures before they take place by

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Term	Definition
	following routine and comprehensive maintenance procedures. The goal is to achieve fewer, shorter, and more predictable outages.
Priority essential services	Critical first responders, public safety partners, critical facilities and infrastructure, operators of telecommunications infrastructure, and water utilities/agencies.
Program targets	Quantifiable measurements of activity identified in WMPs and subsequent updates used to show progress towards reaching the objectives, such as number of trees trimmed or miles of power lines hardened.
Progress metrics	Measurements that track how much utility wildfire mitigation activity has changed the conditions of utility wildfire risk exposure or utility ability to manage wildfire risk exposure, in terms of leading indicators of ignition probability and wildfire consequences.
Property	Private and public property, buildings and structures, infrastructure, and other items of value that were destroyed by wildfire, including both third-party property and utility assets.
PSPS event	Defined as the time period from the first public safety partner notified of a planned public safety de-energization to the final customer re-energized.
PSPS risk	The potential for the occurrence of a PSPS event expressed in terms of a combination of various outcomes of the event and their associated probabilities.
PSPS weather	Weather that exceeds a utility's risk threshold for initiating a PSPS.
Red Flag Warning (RFW)	Level of wildfire risk from weather conditions, as declared by the National Weather Service. For historical NWS data, refer to the Iowa State University Iowa archive of NWS watch/warnings.[2]
RFW OH Circuit Mile Day	Sum of overhead circuit miles of utility grid subject to Red Flag Warning each day within a given time period, calculated as the number of overhead circuit miles that were under an RFW multiplied by the number of days those miles were under said RFW. For example, if 100 overhead circuit miles were under an RFW for 1 day, and 10 of those miles were under RFW for an additional day, then the total RFW OH circuit mile days would be 110.
Risk event	An event with probability of ignition, including wires down, contacts with objects, line slap, events with evidence of heat generation, and other events that cause sparking or have the potential to cause ignition. The following risk events all qualify as risk event: Ignitions Outages not caused by vegetation Vegetation-caused outages Wire-down events Faults Other risk events with potential to cause ignitions
Risk event simulation	Simulation of what the consequence would have been of an ignition had it occurred.
Risk-spend efficiency (RSE)	An estimate of the cost-effectiveness of initiatives, calculated by dividing the mitigation risk reduction benefit by the mitigation cost estimate based on the full set of risk reduction benefits estimated from the incurred costs. For ongoing initiatives, the RSE can be calculated by determining the "marginal benefit" of additional spending in the ongoing initiative. For example, the RSE

[2] https://mesonet.agron.iastate.edu/request/gis/watchwarn.phtml.

Term	Definition
	of an ongoing initiative could be calculated by dividing the mitigation risk reduction benefit from a 5% increase in spend by the cost associated with a 5% increase in spend.
Rule	Section of public utility code requiring a particular activity or establishing a particular threshold.
Run-to-failure	A maintenance approach that replaces equipment only when it fails.
Rural region	In accordance with GO 165, "rural" shall be defined as those areas with a population of less than 1,000 persons per square mile as determined by the United States Bureau of the Census. For the purposes of the WMP, “area” shall be defined as census tracts.
Safety Hazard	A condition that poses a significant threat to human life or property.
Simulated wildfire	Propagation and impact/consequence of a wildfire ignited at a particular point ('match drop'), as simulated by fire spread software.
Span	The space between adjacent supporting poles or structures on a circuit consisting of electric lines and equipment. "Span level" refers to asset-scale granularity.
System Average Interruption Duration Index (SAIDI)	System-wide total number of minutes per year of sustained outage per customer served.
Third-party contact	Contact between a piece of electrical equipment and another object, whether natural (tree branch) or human (vehicle).
Time to expected failure	Time remaining on the life expectancy of a piece of equipment.
Top 30% of proprietary fire potential index	Top 30% of FPI or equivalent scale (e.g., “Extreme” on SCE’s FPI; “extreme”, 15 or greater, on SDG&E’s FPI; and 4 or above on PG&E’s FPI).
Trees with strike potential / hazard trees	Trees that could either 'fall in' to a power line, or have branches detach and 'fly in' to contact a power line in high-wind conditions.
Unplanned outage	Electric outage that occurs with no advance notice from the utility (e.g., blackout).
Urban region	In accordance with GO 165, "urban" shall be defined as those areas with a population of more than 1,000 persons per square mile as determined by the United States Bureau of the Census.
Utility-ignited wildfire	Wildfires ignited by utility infrastructure or employees, including all wildfires determined by AHJ investigation to originate from ignition caused by utility infrastructure. For the purposes of the WMP, “area” shall be defined as census tracts.
Vegetation management	Trimming and clearance of trees, branches, and other vegetation that poses the risk of contact with electric equipment.
Vegetation risk index	Risk index indicating the probability of vegetation-related outages along a particular circuit, based on the vegetation species, density, height, and growth rate.
Weather normalization	Adjusting metrics based on relative weather risk factors or indices
Wildfire impact/ consequence	The effect or outcome of a wildfire affecting objectives, which may be expressed, by terms including, although not limited to health, safety, reliability, economic and/or environmental damage.
Wildfire risk	The potential for the occurrence of a wildfire event expressed in terms of ignition probability, wildfire impact/consequence.
Wildfire-only WMP programs	Activities, practices, and strategies that are only necessitated by wildfire risk, unrelated to or beyond that required by minimum reliability and/or safety

Term	Definition
	requirements. Such programs are not indicated or in common use in areas where wildfire risk is minimal (e.g., territory with no vegetation or fuel) or under conditions where wildfires are unlikely to ignite or spread (e.g., when rain is falling).
Wildland urban interface (WUI)	A geographical area identified by the state as a “Fire Hazard Severity Zone”, or other areas designated by the enforcing agency to be a significant risk from wildfires, established pursuant to Title 24, Part 2, Chapter 7A.
Wire down	Instance where an electric transmission or distribution conductor is broken and falls from its intended position to rest on the ground or a foreign object.

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9.4 PG&E Glossary of Additional Defined Terms

Term	Definition
2017 GRC Decision	CPUC decision in PG&E's 2017 GRC proceeding (D.17-05-013).
2020 GRC Decision	CPUC decision in PG&E's 2020 GRC proceeding (D.20-12-005).
2020 RAMP Report	PG&E's 2020 Risk Assessment Mitigation Phase Report filed on June 30, 2020 in CPUC Application 20-06-012.
Buffer Zone	An extension of the HFTD Tier 2 or Tier 3 boundary into non-HFTD areas to allow for complete deployment of a mitigation program in the HFTD to account for any deviations in GIS layers or circuit diagrams.
Distribution	Electric facilities that have a voltage below 60kV.
First Quarterly Report	The Quarterly Report submitted by PG&E on September 9, 2020 for the period May to July 2020.
HFRA Map	The HFRA Map considers catastrophic fire risk factors and utility infrastructure and was developed by considering incremental changes to the HFTD map boundaries to add areas where risk factors for the potential of catastrophic fire from utility infrastructure ignition during offshore wind events is higher. The HFRA Map is described in Section 4.2.1.
Long-Term Grid Architecture Study	The Long-Term Grid Architecture Study aims to identify how certain externalities will impact load and capabilities to help determine what an optimal grid design should look like to safely and reliably provide electricity to customers in a 30-year lookahead.
Remedial Compliance Plan or "RCP"	The Remedial Compliance Plan submitted by PG&E on July 27, 2020.
Second Quarterly Report	The Quarterly Report submitted by PG&E on December 9, 2020 for the third quarter of 2020.
Transmission	Electric facilities that have a voltage that is 60 kV or above.
Wildfire OII	CPUC Investigation 19-06-015 initiated in June 2019.
WMCE Application	PG&E's application for its Wildfire Mitigation and Catastrophic Events cost recovery in A.20-09-019.

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9.5 PG&E Glossary of Models

PG&E is providing the follow glossary of models described in the 2021 Wildfire Mitigation Plan (WMP). For models with a date in the name, the date reflects what year prioritization and work will be informed by the model, rather than the year the model was developed.

Model Name	Description
2019-2020 Wildfire Risk Model	Model developed in 2018 to assist in prioritizing distribution circuits and circuits segments for wildfire mitigation programs and used in 2019 and 2020. Replaced by the 2021 Wildfire Risk Model.
2021 Wildfire Distribution Risk Model	Wildfire risk model based on the Maximum Entropy algorithm in developing the ignition probability and Technosylva for wildfire consequence. Composed of Vegetation Probability of Ignition Model and Equipment Probability of Ignition Model which, when combined with the Wildfire Consequence Model, produces a MAVF calibrated risk score. The 2021 Wildfire Distribution Risk Model will be used to prioritize and inform 2021 work. This model is used for electric distribution facilities.
2022 Wildfire Distribution Risk Model	Next wildfire risk model that is under development and will be used to prioritize and inform 2022 work. This model will have the added ability to compare wildfire risks for additional risk drivers as well as measuring the risk reduction for specific mitigations.
2022 Wildfire Transmission Risk Model	Wildfire risk model that is under development and will be used to prioritize and inform 2022 work for the electric transmission system.
2023 Wildfire Transmission Risk Model	Wildfire risk model that is under development and will be used to prioritize and inform 2023 work for the electric transmission system. This model will have the added ability to compare wildfire risks for additional risk drivers as well as measuring the risk reduction for specific mitigations.
Conductor Risk Model	A model to address conductor risk that is based on the Equipment Probability of Ignition Model and the Wildfire Consequence Model.
Enterprise Risk Model	The risk model developed for the RAMP proceeding that evaluates all RAMP risks and provides an enterprise-wide assessment and modeling. This model is used to calculate RSE scores at a program level for the WMP.
Equipment Probability of Ignition Model	MaxEnt machine learning probability model trained on 2015 – 2018 conductor related ignitions. Produces the odds of at least one ignition within each 100m x 100m grid pixel per fire season. When multiplied with the corresponding wildfire consequence for a location, produces the wildfire risk for that grid location. The Equipment Probability of Ignition Model currently only addresses risks associated with conductors, but will be expanded to include other electrical equipment.
Fire Potential Index Model, or **FPI Model, or** **Utility FPI Model**	The Fire Potential Index Model, also referred to as the FPI Model or the Utility FPI Model, combines several factors including a fire weather index (wind, temperature, and humidity) with fuel moisture data (10-hour dead fuel moisture and live fuel moistures), and landcover type (grass, shrub/brush, or forest). The FPI Model outputs the probability of a small fire becoming a large fire. The FPI forecast describes the potential for fires to spread rated on a scale from "R1" (lowest) to "R5" (highest). The FPI Model is run at 2 x 2 km resolution and provides hourly forecasts out 4 days.

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Model Name	Description
Fuel Conditions Models: DFM Model and LFM Model	Models used within the FPI Model to assess the moisture in living and dead vegetation. Includes the Dead Fuel Moisture (DFM) Model and the Live Fuel Moisture (LFM) Model.
Large Fire Probability Model (Distribution), or LFP_D Model	The Large Fire Probability Model for distribution is the product of the probability of an outage (OPW Model) and probability of large fires (FPI Model). This model is used for PSPS events.
Large Fire Probability Model (Transmission), or LFP_T Model	The Large Fire Probability Model for transmission is the product of the probability of an outage (OA Model) and probability of large fires (FPI Model). This model is used for PSPS events.
LiDAR Risk Score Model	The LiDAR Risk Score Model calculates the relative risk of individual trees within the HFTD that have strike potential to a transmission conductor.
MaxEnt	Short for Maximum Entropy. The name given to a family of models that seek to maximize the information entropy (i.e., instead of the likelihood or some other optimization criteria) of the probability distribution associated with a given set of conditions – in this case, ignition probability, given environmental and asset characteristics. It can also be interpreted as finding the least unique distribution that fits the underlying data.
Outage Producing Wind Model, or OPW Model	The OPW Model is based on an analysis of windspeeds for every unplanned outage that occurred over the last decade and forecasts the probability of unplanned outages associated with wind events occurring in PG&E's service area. The model is run in forecast mode at 2 km x 2 km resolution.
Pilot Probabilistic Risk Assessment	A model that PG&E is currently developing which will integrate other models into one electric system view for wildfire risk. PG&E is currently anticipating developing a reference model in 2021.
Pole Loading Model	During a pole's service life, pole loading calculations are performed when a load is added to a pole or if a suspected overload condition is observed during an inspection. Pole loading calculations are performed in O-Calc software during the design phase to ensure poles are sized correctly to satisfy GO 95 requirements.
POMMS	PG&E Operational Mesoscale Modeling System (POMMS) that provides a high-resolution numerical weather prediction system.
Future State of PSPS Consequence Model	PG&E is in the early stages of developing a model in 2021 to assess PSPS consequences to customers at a distribution circuit granularity level. This model will leverage our PSPS 30-Year Historical Climatology Model for probability of de-energization scope and estimate consequence scores using PG&E's MAVF framework.
Technosylva	Suite of wildfire simulation software applications whose propagation and consequence outcomes are based on available fuels, topography, and weather; as well as building and population locational data. Technosylva simulation outputs are used as the source of spatially resolved fire severity data that is the primary input into the spatial consequence calculations.
Storm Outage Prediction Program and Model (SOPP)	One of the primary tools PG&E uses to mitigate operational risk from all adverse weather drivers that create an increased volume of outages above "blue sky" weather days. These drivers are primarily

Model Name	Description
	heat, wind, rain, and snow. This model guides PG&E to be proactive and thus prepared for storm events of any type.
Transmission Operability Assessment Model, or **Transmission OA Model, or** **OA Model**	The OA Model was developed to assess physical condition of transmission facilities in windy conditions and is used primarily for PSPS events but was also used as a factor in making maintenance, operations, and asset strategy decisions.
Vegetation Probability of Ignition Model	MaxEnt machine learning probability model trained on 2015 – 2018 vegetation related ignitions. Produces the odds of at least one ignition within each 100m x 100m grid pixel per fire season. When multiplied with the corresponding wildfire consequence for a location, produces the wildfire risk for that grid location.
Vegetation Risk Model	A model to address vegetation risk that is based on the Vegetation Probability of Ignition Model and the Wildfire Consequence Model.
Wildfire Consequence Model	The spatial data set based on Technosylva fire simulations under dangerous fire conditions and calibrated to be compatible with PG&E's reported MAVF values. When multiplied with the corresponding ignition probability for a location, produces the wildfire risk for that grid location.

9.6 List of Acronyms and Abbreviations

Acronym	Term/Definition
A.	Application
AAR	After Action Reviews
ACC	Accumulated Critical Current
ACWA	Association of California Water Utilities
ACSR	Aluminum Conductor Steel Reinforced
ADA	Americans with Disabilities Act
ADF	Asset Data Foundation
ADMS	Advanced Distribution Management System
AFN	Access and Functional Needs
AGA	American Gas Association
AHJ	Agency Having Jurisdiction
AI	Artificial Intelligence
ALJ	Administrative Law Judge
amp	ampere
AMP	Asset Management Plans
ANSI	American National Standards Institute
API	Application Programming Interface
ARCOS	Automated Roaster Call Out System
ASL	American Sign Language
AUC	Area Under the Precision/Recall Curve
ATS	Applied Technical Services
AWS	Amazon Web Services

Acronym	Term/Definition
BLM	Bureau of Land Management
BOA	Breaker Oil Analysis
BVLOS	Beyond Visual Line of Sight
CA	California
CAISO	California Independent System Operator
CAL FIRE	California Department of Forestry and Fire Protection
Cal OES	California Governor's Office of Emergency Services
CAMP	California Association of Medical Product Providers
CANSAC	California and Nevada Smoke and Air Committee
CAP	Corrective Action Program
CARE	California Alternate Rate for Energy
CBA	Collective Bargaining Agreement
CBM	Condition-Based Maintenance
CBO	Community Based Organizations
CCA	Community Choice Aggregator
CC&B	Customer Care and Billing
CCPA	California Consumer Privacy Act
CEC	California Energy Commission
CEMA	Catastrophic Event Memorandum Account
CEQA	California Environmental Quality Act
CERP	Company Emergency Response Plan
CERT/NERT	Community/Neighborhood Emergency Response Teams
CFILC	California Foundation for Independent Living Centers
CHA	California Hospital Association

Acronym	Term/Definition
CIL	Critical Infrastructure Lead
CIM	Common Information Model
CIRT	Centralized Inspection Review Team
CLECA	California Large Energy Consumers Association
CMC	Canadian Meteorologist Centre
CMI	Customer Minutes Interrupted
CoRE	Consequence of Risk Event
COL	Conclusion of Law
County OES	County Office of Emergency Services
COVID-19	**C**oronavirus disease of 2019
CPUC or Commission	California Public Utilities Commission
CPZ	Circuit Protection Zone
CRCs	Community Resource Centers
CRESS	Corporate Real Estate Strategy & Services
CRM	Customer Relationship Manager
CSO	Customer Service Offices
CUEA	California Utilities Emergency Association
CWSP	Community Wildfire Safety Program
D.	Decision
DAC-AG	Disadvantaged Communities Advisory Group
DCC	Distribution Control Center
DCD	Downed Conductor Detection
DDAR	Disability Disaster Access and Resources
DER	Distribution Energy Resource
DERMS	Distributed Energy Resource Management System

Acronym	Term/Definition
DFM	Dead Fuel Moisture
DG	Distributed Generation
DGA	Dissolved Gas Analysis
DGEM	Distribution Generation Enabled Microgrid Services
DLT	Division Leadership Team
DM&A	Data Management and Analytics
DMS	Demand Management System
D-OH	Distribution-Overhead
DPAM	Dynamic Pattern and Analog Matcher
DRI	Desert Research Institute
DRPP	Distribution Routine Patrol Procedure
DRU	Data Response Unit
DTS-FAST	Distribution, Transmission, and Substation: Fire Action Schemes and Technology
EC	Electric Corrective
ECMWF	European Centre for Medium-Range Weather Forecasts
ECOP	Electric Corrective Optimization Program
EDA	Explanatory Data Analysis
EDF	Enterprise Data Foundation
EDGIS	Electric Distribution Geographic Information System
EDMP	Enterprise Data Management Program
EDPM	Electric Distribution Procedure Manual
EEI	Edison Electric Institute
EF	Equivalent Fatalities
EFD	Early Fault Detection
EFO	Emergency Forced Outages

Acronym	Term/Definition
EOC	Emergency Operations Center
EORM	Enterprise and Operational Risk Management
EP&R	Emergency Preparedness and Response
EPA	United States Environmental Protection Agency
EPIC	Electric Program Investment Charge
EPRI	Electric Power Research Institute
EPS	Ensemble Prediction System (from ECMWF)
ESA	Energy Savings Assistance
ETE	Evacuation Time Estimates
ETOR	Estimated Time of Restoration
ETPM	Electric Transmission Preventive Maintenance
EV	Electric Vehicle
EV	Expected Value
EVM	Enhanced Vegetation Management
EVSP	Electric Vehicle Service Providers
EQM	Electric Quality Management
FAA	Federal Aviation Administration
FAN	Field Area Network
FAS	Field Automation System
FDA	Facility Damage Action
FDAs	Fire Detection and Alert System
FEA	Finite Element Analysis
FERA	Family Electric Rate Assistance
FERC	Federal Energy Regulatory Commission
FF+	Fire Family Plus (aka Family Plus)

Acronym	Term/Definition
FFWI	Fosberg Fire Weather Index
FIA	Fire Index Area
FMEA	Failure Modes and Effects Analysis
FORCE	Field Operations Resource Calculation of Estimated Time of Restoration
FPI	Fire Potential Index
FRP	Fire Radiative Power
FSR	Field Safety Reassessment
ft lb	foot-pound
FTE	Full Time Equivalent
FWW	Fire Weather Warning
GACC	Geographic Area Coordination Centers
GADI	Geospatial Asset Data Improvement
GCC	Grid Control Center
GDAT	Grid Data Analytics Tool
GEFS	Global Ensemble Forecast System
GFN	Ground Fault Neutralizer
GFS	Global Forecast System
GIS	Geographic Information System
GO	General Order
GPR	Ground Potential Rise
GRC	General Rate Case
HD	High-Definition
HHW	High Wind Warning
HIPAA	Health Insurance Portability and Accountability Act

Acronym	Term/Definition
HFRA	High Fire Risk Area
HFTD	High Fire Threat District
HN	Hazard Notification
HREF	High Resolution Ensemble Forecast
HRRR	High Resolution Rapid Refresh
HTRS	Hazard Tree Rating System
IA	Internal Audit
	International Brotherhood of Electrical Workers
IC	Incident Commander
ICS	Incident Command System
IEEE	Institute of Electrical and Electronic Engineers
IID	Imperial Irrigation District
ILCs	Independent Living Centers
ILIS-ODB	Integrated Logging Information System-Operations Data Base
IMT	Incident Management Teams
IOU	Investor-Owned Utility
IPP	Independent Power Producer or Independent Power Production
IPP	Integrated Planning Process
IR	Infrared
IRWIN	Integrated Reporting of Wildland-Fire Information
IVM	Integrated Vegetation Management
IVR	Interactive Voice Recording
IWRMC	International Wildfire Risk Mitigation Consortium
JATC	Joint Apprentice and Training Committee

Acronym	Term/Definition
JAWS	Jobs Access with Speech
Km	Kilometer
kV	Kilovolt
kV/in	kilovolts per inch
LADWP	Los Angeles Department of Water & Power
LC	Line Corrective
LDSP	Light Duty Steel Pole
LEP	Limited English Proficiency
LF 2.0.0	LANDFIRE Remap 2016
LIOB	Low Income Oversight Board
LFM	Live Fuel Moisture
LFP_D	Large Fire Probability Model - Distribution
LFP_T	Large Fire Probability Model - Transmission
LiDAR	Light Detection and Ranging
LIHEAP	Low-Income Home Energy Assistance Program
LIOB	Low Income Oversight Board
LMS	Learning Management System
LNO	Liaison Officers
LOB	Line of Business
LoRE	Likelihood of a Risk Event
LPA	Local Public Affairs
MAA	Mutual Assistance Agreements
MADIS	Meteorological Assimilation Data Ingest System
MARAC	Mutual Aid Regional Advisory Council
MARS	Multi-Attribute Risk Scores

Acronym	Term/Definition
MAVF	Multi-Attribute Value Function
MBL	Medical Baseline
MEDs	Major Event Days
MEO	Miscellaneous Equipment Operator
MET	Model Evaluation Tools
MODIS	Moderate Resolution Imaging Spectroradiometer
MOU	Memorandum of Understanding
mph	Miles Per Hour
MSO	Motorized Switch Operator
MW	megawatt
NAM	North American Mesoscale Model
NARR	North American Regional Reanalysis
NCAR	National Center for Atmospheric Research
NCEP	National Center for Environmental Prediction
NDC	National Diversity Coalition
NEETRAC	National Electric Energy Testing Research and Applications Center
NEM	Net Energy Metering
NEPA	National Environmental Protection Act
NERC	North American Electric Reliability Corporation
NFDRS	National Fire Danger Rating System
NFMDB	National Fuel Moisture Database
NIC	Network Interface Card
NIMS	National Incident Management Systems
NOAA	National Oceanic and Atmospheric Administration
NPP	National Polar-orbiting Partnership

Acronym	Term/Definition
NPS	National Park Service
NWA	Non-Wires Alternative
NWCG	National Wildfire Coordinating Group
NWS	National Weather Service
O&M	Operations and Maintenance
OA	Operability Assessment
OBF	On-Bill Financing
OEC	Operational Emergency Centers
OES	Office of Emergency Services
OH	Overhead
OIC	Officer-in-Charge
OII	Order Instituting Investigation
OIR	Order Instituting Rulemaking
OJT	On the job training
OMS	Outage Management System
OMT	Outage Management Tool
OP	Ordering Paragraph
OPW	Outage Producing Wind
OSA	Office of Safety Advocates
OSHA	Occupational Safety and Health Administration
PCORP	PacifiCorp
PBP	Portable Battery Program
PD	Partial Discharge
PDAC	Primary Distribution Alarm and Control
PEV	Post Enrollment Verification

Acronym	Term/Definition
PG&E or the Company	Pacific Gas and Electric Company
PHMSA	Pipeline and Hazardous Materials Safety Administration
PIH	Pre-installed Interconnection Hubs
PIO	Public Information Officer
Plan	Wildfire Mitigation Plan
PLDB	Pole Landing Database
PLDN	PG&E Lighting Detection Network
PMD	Project Management Database
PMO	Project Management Office
PO	Purchase Order
POC	Point-of-Contact
POMMS	PG&E Operational Mesoscale Modeling System
POU	Publicly-Owned Utilities
PPE	Personal Protective Equipment
PPF	Portfolio Prioritization Framework
PRC	Public Resources Code
PSAP	Public Safety Answering Points
PSIP	PSPS Situational Intelligence Platform
PSPS	Public Safety Power Shutoff
PSS	Public Safety Specialists
PSSP	Project Specific Safety Plan
PT&T	Pole Test & Treat
PTZ	Pan/Tilt/Zoom
PUC	Public Utilities Code
PV	Photovoltaic

Acronym	Term/Definition
PWAS	PG&E Wind Alert System
PWDAAC	People with Disabilities and Aging Advisory Council
QA	Quality Assurance
QC	Quality Control
QA/QC	Quality Assurance/Quality Control
QCR	Qualified Company Representative
QEW	Qualified Electrical Workers
R.	Rulemaking
RAMP	Risk Assessment and Mitigation Phase
RCA	Root Cause Analysis
REACH	Relief for Energy Assistance through Community Help
REFCL	Rapid Earth Fault Current Limiter
Res.	Resolution
RF	Radio Frequency
RFI	Request for Information
RFW	Red Flag Warning
RH	Relative humidity
RIBA	Risk Informed Budget Allocation
RMAR	Risk Mitigation Accountability Reporting
ROC	Receiver Operating Characteristic
ROW	Right-of-Way
RPS	Renewable Portfolio Standard
RSAR	Risk Spend Accountability Reporting
RSE	Risk Spend Efficiencies
RW	Request for Work

Acronym	Term/Definition
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SB 209	Senate Bill 209
SB 247	Senate Bill 247
SBUA	Small Business Utility Advocates
SCADA	Supervisory Control and Data Acquisition
SCCD	State Council on Developmental Disabilities
SCE	Southern California Edison Company
SDG&E	San Diego Gas & Electric Company
SED	Safety Enforcement Division
SEMS	Standardized Emergency Management System
SF6	Sulfur Hexafluoride
SGF	Sensitive Ground Fault
SGIP	Self-Generation Incentive Program
SI	Smart Inverter
SIPT	Safety and Infrastructure Protection Teams
SJSU	San Jose State University
SLP	Structured Learning Path
S-MAP	Safety Model and Assessment Proceeding
SmartMeter™	Brand Name for Automated Metering Initiative (AMI)
SMEs	Subject-Matter Experts
SM&C	Substation Maintenance and Construction
SMUD	Sacramento Municipal Utility District
SOPP	Storm Outage Prediction Model
SOW	Statement of Work

Acronym	Term/Definition
SPC	Storm Prediction Center
SPD	Safety Policy Division
SPS	Standalone Power System
SSEC	Space Science and Engineering Center
STAR	System Tool for Asset Risk
TA	Tail Average
TAD	Temperature Alarm Device
TD&D	Technology Demonstration and Deployment
T&D	Transmission and Distribution
TG	Temporary Generation
T-OH	Transmission Overhead
TOTL	Transmission Operation Tracking and Logging
TVM	Transmission Vegetation Management
TVMR Program	Transmission Vegetation Management Reliability Program
UAS	Unmanned Aerial Systems
UCLA	University of California Los Angeles
U.S.	United States
USFS	United States Forest Service
USL	Uncoupled Surface Layer
UT	Ultrasonic
VFR	Visual Flight Rules
VIIRS	Visible Infrared Imaging Radiometer Suite
VM	Vegetation Management
VP	Vice President
VRI	Vegetation Risk Index

Acronym	Term/Definition
WAPA	Western Area Power Administration
WBT	Web Based Training
WCAG	Web Content Accessibility Guidelines
WECC	Western Electricity Coordinating Council
WEMA	Wildfire Expense Memorandum Account
WFA	Wildfire Analyst Enterprise
Wh	Watt-hour
WIV	Wild Incident Viewer
WMCE	Wildfire Mitigation and Catastrophic Events Application (A.20-09-019)
WMM	Wildfire Maturity Model
WPE	Work Procedure Error
WRF	Weather Research and Forecast
WRGSC	Wildfire Risk Governance Steering Committee
WRMAA	Western Regional Mutual Assistance Agreement
WSD	Wildfire Safety Division
WSOC	Wildfire Safety Operations Center
WUI	Wildland-Urban Interface
WV	Work verification
WSIP	Wildfire Safety Inspection Program
WMP	Wildfire Mitigation Plan
WRMAA	Western Region Mutual Assistance Agreement
XLPE	Crosslinked Polyethylene

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

DECLARATION SUPPORTING CONFIDENTIAL DESIGNATION
ON BEHALF OF
PACIFIC GAS AND ELECTRIC COMPANY (U 39 E)

1. I, Edlyn Louie, am the Data Response Unit Quality Control ("DRU QC") Supervisor, of Pacific Gas and Electric Company ("PG&E"), a California corporation. Debbie Powell, Interim Head of Electric Operations at PG&E, delegated authority to me to sign this declaration. My business office is located at:

   Pacific Gas and Electric Company
   77 Beale Street
   San Francisco, CA 94105

2. PG&E will produce the information identified in paragraph 3 of this Declaration to the California Public Utilities Commission ("CPUC") or departments within or contractors retained by the CPUC in response to a CPUC audit, data request, proceeding, or other CPUC request.

   Name or Docket No. of CPUC Proceeding (if applicable): N/A

3. Title and description of document(s):

Attachment	Title	Description
A	2021WMP_ClassA_Action-PGE-24_Atch01_CONF.pdf	Maintenance Manual
B	2021WMP_ClassA_Action-PGE-24_Atch02_CONF.pdf	Maintenance Manual
C	2021WMP_ClassA_Action-PGE-38_Atch01_CONF.xlsx	List of the current PG&E contacts and their primary counterparts
D	2021WMP_ClassB_Action-PGE-47_Atch01_CONF.xlsx	GIS File with replaced fuse locations
E	2021WMP_Section 8.2.4_Atch01_CONF.xlsx	Priority Essential Customers
F	2021WMP_ClassB_Action-PGE-43_Atch02_CONF.kmz	GIS File

G	2021WMP_ClassB_Action-PGE-43_Atch01_CONF.csv	Planned Camera Installations
H	PDF_WildfireMitigationPlans_Report_PGE_20210205-CONF.pdf	WMP Narrative

4. These documents contain confidential information that, based on my information and belief, has not been publicly disclosed. These documents have been marked as confidential, and the basis for confidential treatment and where the confidential information is located on the documents are identified on the following chart:

Check	Basis for Confidential Treatment	Where Confidential Information is located on the documents
☒	Customer-specific data, which may include demand, loads, names, addresses, and billing data (Protected under PUC § 8380; Civ. Code §§ 1798 et seq.; Govt. Code § 6254; Public Util. Code § 8380; Decisions (D.) 14-05-016, 04-08-055, 06-12-029)	Confidential information is outlined red/highlighted grey/marked on GIS file name on: Atch C. Sheet "Sheet1" Column C Atch D. Sheet "2020" Columns G, H, J Atch E. Sheet "CC List" Column A Atch F. The entire file is deemed confidential. Atch G. Sheet "2021WMP_ClassB_Action-PGE-43_At" Columns H, I
☐	Personal information that identifies or describes an individual (including employees), which may include home address or phone number; SSN, driver's license, or passport numbers; education; financial matters; medical or employment history (not including PG&E job titles); and statements attributed to the individual. (Protected under Civ. Code §§ 1798 et seq.; Govt. Code § 6254; 42 U.S.C. § 1320d-6; and General Order (G.O.) 77-M)	

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☐	Physical facility, cyber-security sensitive, or critical infrastructure data, including without limitation critical energy infrastructure information (CEII) as defined by the regulations of the Federal Energy Regulatory Commission at 18 C.F.R. § 388.113 and/or General Order 66-D ("The subject information: (1) is not customarily in the public domain by providing a declaration in compliance with Section 3.2(c) stating that the subject information is not related to the location of a physical structure that is visible with the naked eye or is available publicly online or in print; and (2) the subject information either: could allow a bad actor to attack, compromise or incapacitate physically or electronically a facility providing critical utility service; or discusses vulnerabilities of a facility providing critical utility service"). (Protected under Govt. Code § 6254(k), (ab); 6 U.S.C. § 131; 6 CFR § 29.2)	
☐	Proprietary and trade secret information or other intellectual property and protected market sensitive/competitive data (Protected under Civ. Code §§3426 *et seq.*; Govt. Code §§ 6254, *et seq*., e.g., 6254(e), 6254(k), 6254.15; Govt. Code § 6276.44; Evid. Code §1060; D.11-01-036)	
☐	Corporate financial records (Protected under Govt. Code §§ 6254(k), 6254.15)	
☐	Third-Party information subject to non-disclosure or confidentiality agreements or obligations (Protected under Govt. Code § 6254(k); see, e.g., CPUC D.11-01-036))	
☒	Other categories where disclosure would be against the public interest (Govt. Code § 6255(a): Due to sensitivity around names, LAN IDs and phone numbers for individual employees, the public interest in maintaining the confidentiality of this information outweighs the public interest in disclosure.	Confidential information is outlined red/highlighted grey on: Atch A. Pages 2, 63, 84, 92, 93, 175, 176 Atch B. Page 65 Atch C. Sheet "Sheet1" Column G Atch H. Pages 21-23

5. The importance of maintaining the confidentiality of this information outweighs any public interest in disclosure of this information. This information should be exempt from the public

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disclosure requirements under the Public Records Act and should be withheld from disclosure.

6. I declare under penalty of perjury that the foregoing is true, correct, and complete to the best of my knowledge.

7. Executed on the date indicated below at San Francisco, California.

Edlyn Louie

Digitally signed by Edlyn Louie
Date: 2021.02.05 13:27:42 -08'00'

Edlyn Louie
DRU QC Supervisor
Data Response Unit
Pacific Gas and Electric Company