
PACIFIC GAS AND ELECTRIC COMPANY

2020 WILDFIRE MITIGATION PLAN

REMEDIAL COMPLIANCE PLAN

RULEMAKING 18-10-007

JULY 27, 2020

PUBLIC VERSION



PACIFIC GAS AND ELECTRIC COMPANY
2020 WILDFIRE MITIGATION PLAN
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CONDITION GUIDANCE-3

LACK OF RISK MODELING TO INFORM DECISION-MAKING

Deficiency: Electrical corporations do not provide sufficient detail in their 2020 Wildfire Mitigation Plan (WMP) to demonstrate how they are leveraging risk models to target the highest risk portions of the grid. While most utilities indicate current progress and work on developing models to estimate risk across their service territories, there is a lack of focus on how these models can be used in practice to prioritize initiatives to address specific ignition drivers and geographies. Specifically, utilities fail to outline in detail how they determine where to prioritize to improve asset management or determine portions of circuits that would benefit the most from hardening and Vegetation Management (VM). By continuing to improve wildfire risk modeling and basing its wildfire mitigations on its wildfire risk modeling outputs, electrical corporations can potentially achieve a greater level of risk reduction with the same resources.

Condition: *Each electrical corporation shall submit in its remedial correction plan (RCP) the following:*

- i. how it intends to apply risk modeling and risk assessment techniques to each initiative in its WMP, with an emphasis on much more targeted use of asset management, VM, grid hardening and Public Safety Power Shutoff (PSPS) based on wildfire risk modeling outputs;*
- ii. identify all wildfire risk analyses it currently performs (including probability and consequence modeling) to determine which mitigation is targeted to circuits and assets where initiatives will provide the greatest benefit to wildfire risk reduction;*
- iii. a timeline to leverage its risk modeling outputs to prioritize and target initiatives and set PSPS thresholds, including at least asset management, grid operations, VM, and System Hardening (SH) initiatives;*

Consistent with the information provided in Pacific Gas and Electric Company's (PG&E) response to the Wildfire Safety Division (WSD) Guidelines Maturity Survey, PG&E is in the process of raising the maturity of our risk models from relative risk models at the circuit level with system-level risk reduction and Risk Spend Efficiency (RSE) capabilities to automated, quantitative risk models that include risk reduction and RSE evaluations at the asset level. The purpose of these models is to provide analytical insights to contribute to wildfire risk mitigation decisions by: (1) providing a measurement to communicate risk levels and track progress in improving grid safety by

drawing-down risk; (2) providing a measure of estimated risk reduction for proposed mitigations to inform optimization of workplans; and (3) contributing to situational awareness of risk.

At a high level, separate composite risk models each for the electric transmission (Tx) and distribution (Dx) systems are at different stages of development. As shown in the table below, each composite model consists of sub-models targeting specific WMP initiatives. The timeframes shown for implementing each of these modeling capabilities is based on PG&E's project plan as of the end of the second quarter of 2020. As the activities shown here involve creating and deploying new tools, revisions to this schedule are likely. Numerous factors including resource availability, confirmation of technological capabilities, and ongoing learnings and adjustments to program focus will influence the ultimate schedule under which these tools will be implemented and operational.

TABLE 1 – SUB-MODELS BY WMP INITIATIVE PROGRAM

| Programs | Asset Group | Current Capabilities | Planned Capabilities | Planned Timeframe |
|---------------------------|--------------------|---|---|--|
| Asset Management | Distribution | Separate models | Dx Risk Model - Composite model of the sub-models listed below | Q2 2021 |
| | Transmission | Separate models | Tx Risk Model - Composite model of the sub-models listed below | Q1 2022 |
| SH | Distribution | Relative risk of circuit segments at the protection zone level | Risk reduction values for SH mitigations near the asset level | Q4 2020 |
| | Transmission | Probability of failure as a function of wind speed | Additional granularity at the component level | Q3 2021 |
| Tag Prioritization | Distribution | Relative risk at the protection zone level within circuits | Risk reduction values by asset and tag type | Q2 2021 |
| | Transmission | Prioritization based on tag type and geographic risk | Prioritization based on tag type and updated fire potential condition data | Q1 2021 |
| VM | Distribution | Risk reduction values for Enhanced Vegetation Management (EVM) mitigations near the asset level | Improved model precision and detail on risk reduction values | Currently in use |
| | Transmission | LiDAR Risk Score at the line level & Pareto Analysis | Improved model precision of tree risk at the structure level | Q4 2020 |
| PSPS | Distribution | Outage Producing Winds (OPW) forecast combined with Fire Potential Index (FPI) | Improved precision and granularity | Currently in use |
| | Transmission | Tx Asset Health Model (Operability Assessment (OA)) multiplied by FPI at the structure level | Improved precision and granularity; addition of potential ignition consequence information (from Technosylva model) | Currently in use, next enhancement planned Q4 2020 |

As outlined in the table above, PG&E is developing advanced analytical risk models (at a high level referred to as composite risk models), including sub-models that represent specific failure modes, such as vegetation or equipment caused events. Using asset and environmental data (e.g., asset age, condition, manufacturer, meteorology, topology, vegetation) as inputs to the model, we are improving our ability

to predict the location and potential causes/failure modes of ignitions, outages, and wire-down events. These composite risk models are intended to be used to inform strategic decision-making around its asset management, VM, grid hardening and PSPS programs. For decision making purposes, these model-based insights will be complemented with understandings from internal and external subject matter experts (SME) and industry best practices.

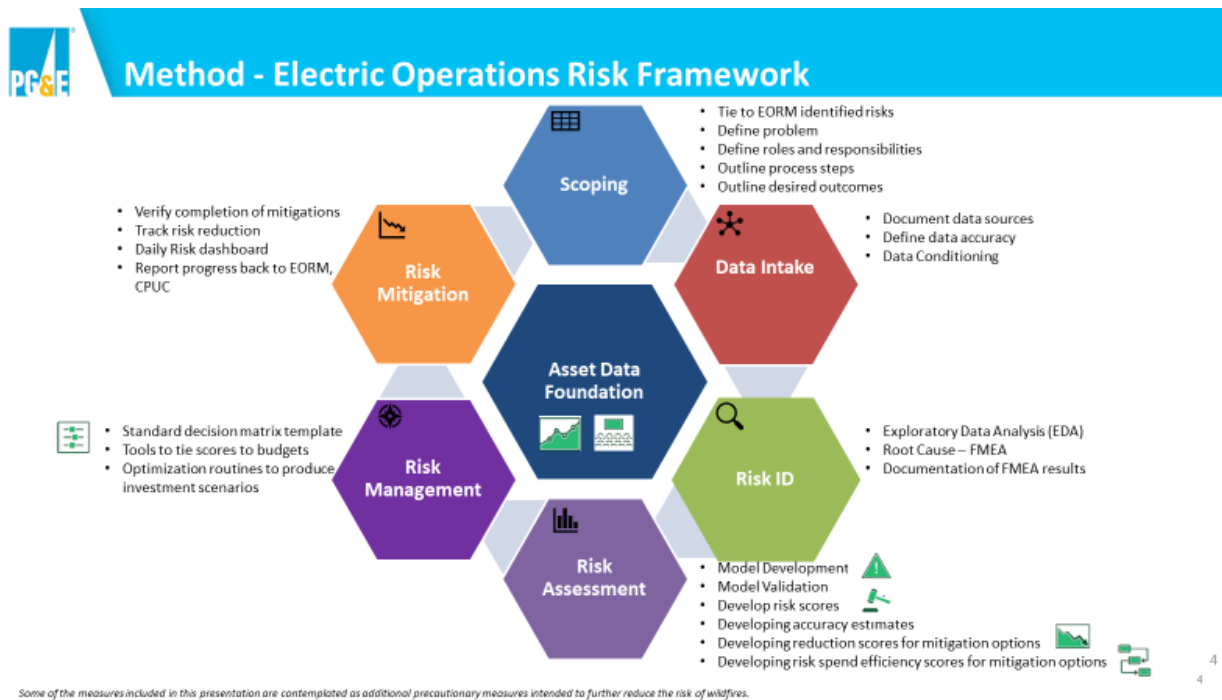
An important step in the preparation of these models is peer validation by SMEs (as to technical content) and analytical experts (as to modeling methods). Although model development inherently involves a continual process of review and validation, the initial models are scheduled for external peer review as part of the “Utility Analytics Week” conference in November sponsored by the Utilities Analytics Institute (<https://utilityanalytics.com/>). In addition to external peer review, the composite risk models will be reviewed and validated annually by comparing actual grid performance and model outputs and forecasts to improve their accuracy and relevance for use to inform wildfire mitigation decision-making.

PG&E’s composite risk models are ultimately focused on developing risk probabilities at a close to asset level granularity. Using annual probabilities at the asset level in combination with “consequence data inputs,” which represent the potential safety, reliability and financial consequences derived from the Multi-Attribute Value Function (MAVF) risk score, will produce MAVF risk scores close to the asset level. These asset level risk scores can then aggregate up to successively higher systematic layers (i.e., asset (most granular), span, protection zone, circuit, region, system (most aggregated)) to update the different initiatives in the WMP.

The following four slides capture PG&E’s current approach and plan to develop distribution composite risk models. The Distribution Risk Model is used to illustrate PG&E’s approach as we have a larger volume of distribution assets and expect to make progress on several key areas (asset management, VM and system hardening) over the next year. All the composite risk models and their components are a work in progress and may change at any time as new information is learned.

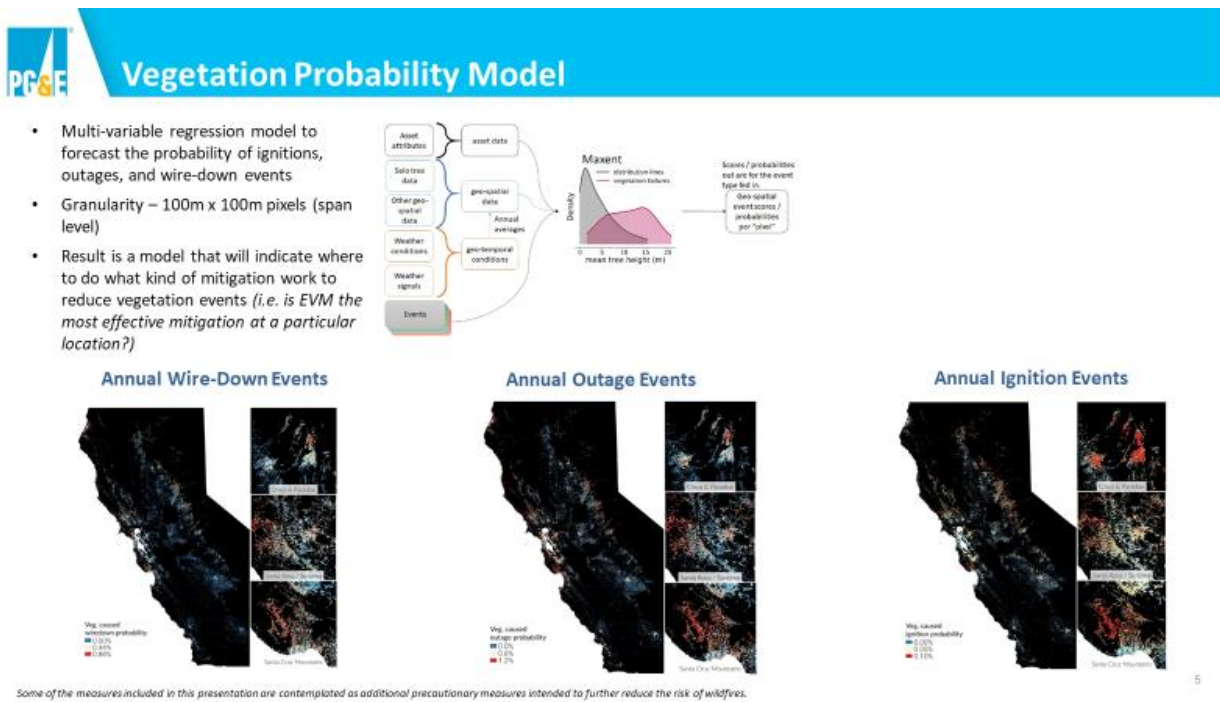
To effect these improvements, PG&E is following a systematic risk framework (below) that develops our capacity in alignment with the capabilities identified in the WSD Guidelines Maturity Survey (noted by the green icons).

FIGURE 1 – ELECTRIC OPERATIONS RISK FRAMEWORK



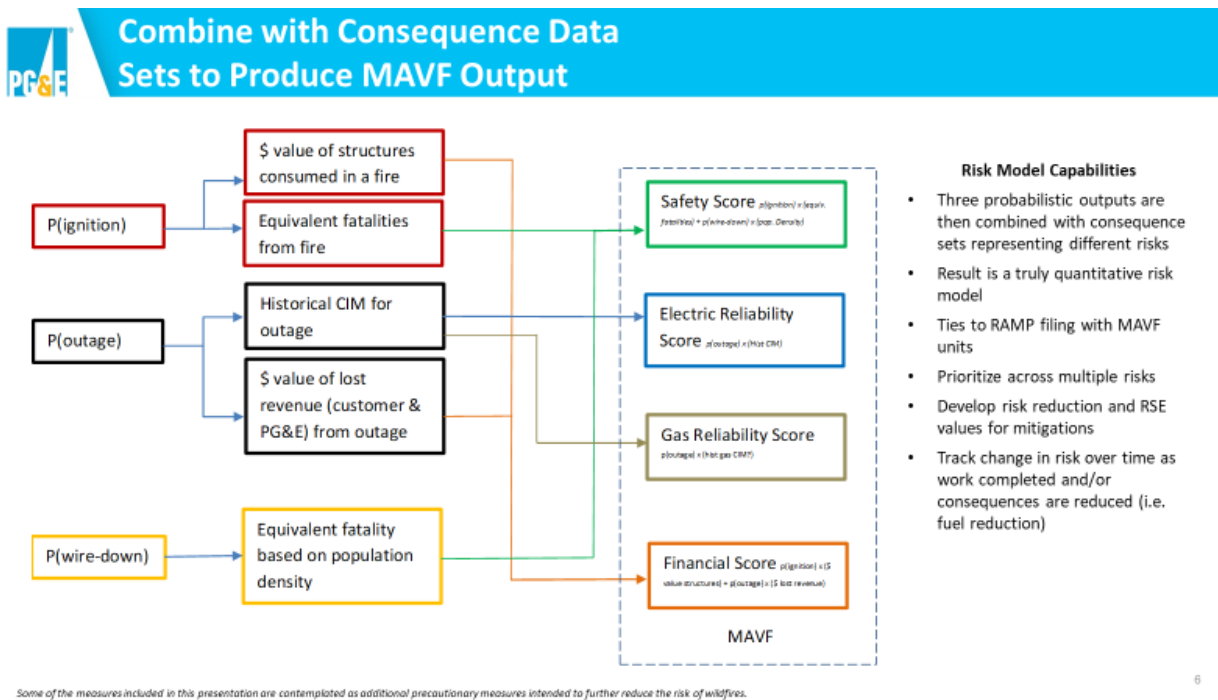
Our first composite risk model in development within this framework is the Distribution Vegetation model. This model is providing insights to the VM team to inform the targeting of work within the 2021 EVM workplan. For this model we use a multi-variable regression algorithm to forecast the annual probability of ignitions, outages and wire-down events at a 100m x 100m pixel level across our service territory. At this level of granularity, the result is a model that indicates not only where to do work but also what type of work will be most effective in reducing risk.

FIGURE 2 – VEGETATION PROBABILITY MODEL



The three annual probabilistic outputs from this model (wire-down events, outage events and ignition events) will be combined with consequence data sets to develop detailed MAVF risk scores to inform VM work targeting. This risk score will not be a relative ranking, like some prior models PG&E used, but instead a quantitative risk score that ties the risk associated with specific locations to the enterprise MAVF scores used in the Risk Assessment And Mitigation Phase (RAMP) filing. By combining safety, reliability and financial consequences, the MAVF risk score enables prioritization across multiple risks. Fed by this probabilistic model output, calculating more detailed risk reduction and RSE values for mitigations will be possible. As vegetation work is completed in the field, automated updates of the model will measure the risk drawn down over time.

FIGURE 3 – FACTORS OF MAVF RISK SCORES



Once these models have been developed and tested to assure that they are ready to inform electric operations and planning, the primary goals of implementing these models will include: (1) providing situational awareness of risk; (2) enhancing risk-informed decision making; and (3) allowing PG&E to quantify risk reductions from wildfire specific risk mitigation initiatives. To accomplish these goals, model users will need to view risk at different levels (or layers) of the electric system to enable a coordinated, one vision approach to risk management. The layers are shown here from the most granular asset layer up to the system layer.

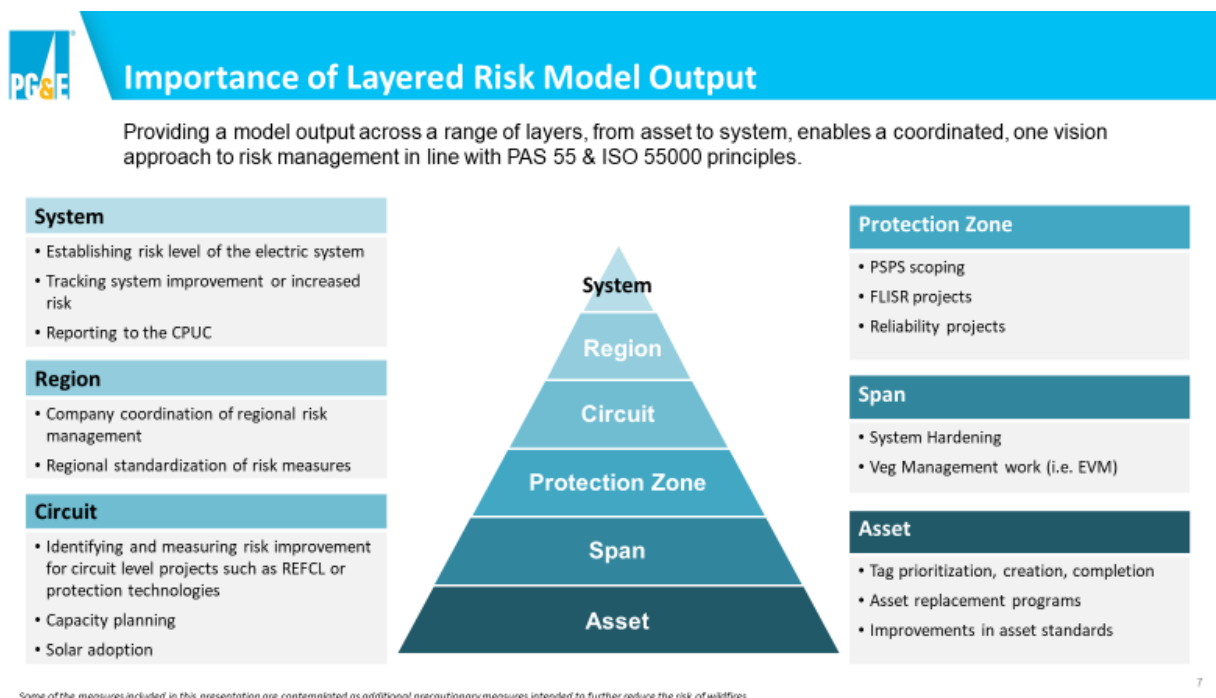
Once these models have been validated and calibrated at both the individual model level and in combination, we will be able to use these risk layers in different ways to inform and support expert technical and policy decisions:

- The system level will allow regulators and senior leadership to track risk improvement or view portfolio alternatives at a rate case level.
- The regional view will enable coordination and comparisons across geographic regions with standard risk measures.
- The circuit level can inform optimal locations for specific mitigations such as system protection technologies (like Rapid Earth Fault Current Limiter).
- The protection zone view is where PSPS scoping decisions or reliability projects can be identified.

- The span level will be used for system hardening or VM work targeting.
- The asset level could be used to inform tag prioritization, asset replacement programs and improvements in asset standards.

Using this range of model layers, PG&E should be able to explore the impacts of alternate asset management strategies and coordinate our multiple efforts to most effectively reduce system risk.

FIGURE 4 – LAYERED RISK MODEL OUTPUT



As referenced in Table 1 of this response, these risk models will be used to inform multiple work processes, as described below.

Asset Management

At the most granular asset level, the composite risk model would inform tag prioritization, maintenance, and asset replacement work. As mitigations are completed, the asset data represented in PG&E's Geographic Information System (GIS) records can be updated as part of the existing project completion process. Subsequent model updates will then draw on the refreshed asset data in GIS. Our goal is to see on-going work reduce the consequences and probabilities of future ignitions and asset failures, with those improvements reflected in updated risk scores.

System Hardening

Our goal is for risk scores at the span or circuit level to identify the highest risk spans or circuits to inform targeting of system hardening projects and be able to test the impacts of alternate strategies to reduce those risks. As hardening projects are completed, future composite risk model inputs (asset information) should reflect lower residual risk over time.

Tag Prioritization

As PG&E identifies corrective actions that require resolution, generally through asset inspections, those corrective actions are prioritized according to severity, as discussed in PG&E's response to Condition PG&E-15. Within severity levels PG&E is currently using a tag prioritization model to further inform the timing and priority of repairing tags. As noted above, PG&E will be enhancing that tag prioritization model using the risk scores at the span or circuit level. As corrective tags are completed, the composite risk model inputs (asset information) would be updated, informing real-time risk understanding at the various levels (span, circuit, region & system) of PG&E composite risk models.

Vegetation Management

PG&E is developing a vegetation risk sub-model that uses a portfolio of inputs to estimate an annual probability of ignitions, outages, and wire-down events. This is accomplished by way of a multi-variable regression trained on past such events. The goal of the vegetation risk sub-model is to predict where events are more likely to occur during the year down to the 100-square-meter level. As noted above, these probabilities will be combined with wildfire spread, reliability and other consequence data sets to create MAVF risk scores at that 100-square-meter (pixel) level along PG&E's circuits. We should be able to use these risk scores to calculate the RSE for program and investment options and target the correct vegetation mitigations for each location. Identified mitigations can then be grouped along circuits to maximize efficiency. Over time the model inputs should reflect the impact of on-going EVM work and allow us to track risk draw-down over time. However, factors such as continuing vegetation growth, further ecological changes and other factors may also influence residual, real-time quantified risk.

PSPS

PG&E has developed fire potential models and outage potential models using historical and meteorological datasets. PG&E's whitepaper "Calculating Meteorological and PG&E Fire Risk: PG&E PSPS Decision-Making" (see Attachment 1 for Guidance-3) details how the models were constructed and operationalized. These models are being used with live weather data today to determine the need and appropriate scope for PSPS events.

PG&E evaluates the potential need for PSPS when there is an increased risk for a catastrophic fire caused by PG&E equipment. This is viewed as an increased potential of an outage or failure leading to an ignition during a wind event, combined with the consequence or growth potential of a resulting fire. There are two key inputs of PG&E's analysis to determine PSPS criteria:

- PG&E's OPW model¹
- PG&E's Utility FPI (Utility FPI)

PG&E's Fire Science and Meteorology team developed the OPW forecast model, which is a location-specific model that tracks the historic frequency of outages at varying wind speeds. Wind speeds that lead to electric outages (including from vegetation falling into lines) are not uniform across PG&E's territory due to variations in the localized nature of grid assets, topography, vegetation around electric facilities, drought and climatological weather exposure. For example, in general, lower wind speeds cause outages in more heavily forested areas whereas in more barren areas, outages are seen at higher wind speeds.

PG&E's Fire Science and Meteorology team developed and calibrated PG&E's Utility FPI using a robust 30-year meteorological dataset combined with a fire occurrence dataset for PG&E's territory. The Utility FPI combines several factors including a fire weather index (wind, temperature, and humidity), fuel moisture data (10-hour dead fuel moisture and live fuel moistures), and landcover type (grass, shrub/brush, or forest). The Utility FPI estimates the probability of a small fire becoming a large fire.

¹ The OPW is used for PSPS decision making on Distribution circuits, for transmission lines a similar tool, called the OA model is used in the same way and combined with FPI as discussed.

The following two images describe these two tools in more detail and indicate the combination of factors that would contribute to the decision to execute a PSPS event (the red box on the second image).

FIGURE 5 – PSPS DECISION MAKING TOOLS



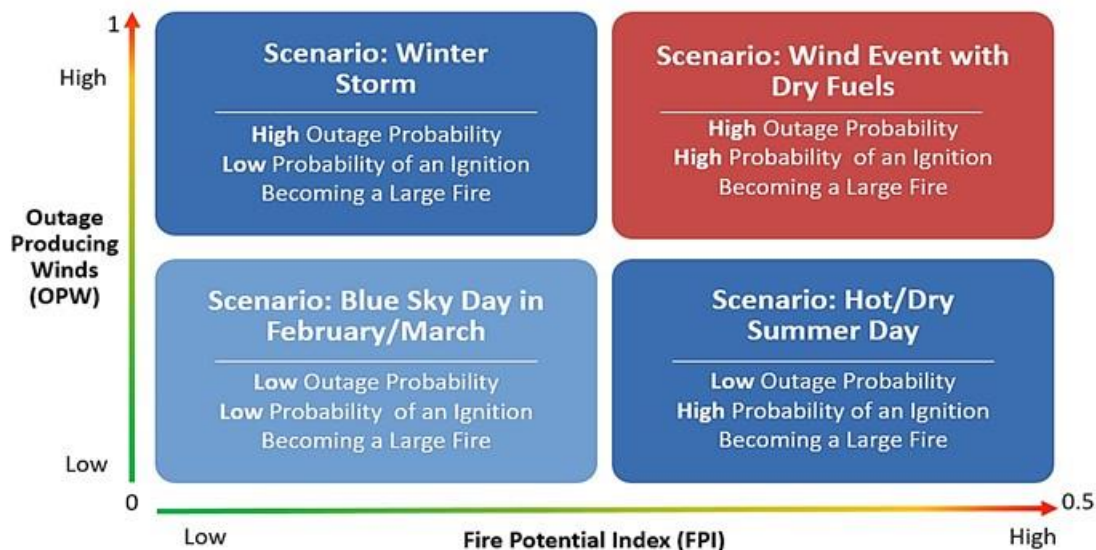
| |  “Outage Producing Winds” (OPW) |  “Utility Fire Potential Index” (FPI) |
|-----------------|---|---|
| PURPOSE | Forecasts when unplanned outages associated with wind events are more likely to occur. | Forecasts when a potential ignition is most likely to result in a catastrophic fire . |
| FACTORS | Analyzes wind speed for every unplanned outage that occurred over the last decade. | Analyzes 30 years of weather, fuel moisture and climatology data , as well as 26 years of wildfire data in our service territory. |
| FINDINGS | Wind-driven outages can create ignition sources for wildfires, from: <ul style="list-style-type: none"> • Vegetation or debris blowing into power lines • Wind-related damage to equipment • Lines coming into contact with one another | A fire’s growth potential increases as vegetation dries and wind speeds increase |

FIGURE 6 – PSPS DECISION MAKING SCENARIOS



As we continue to mature these PSPS decision-making tools we are evaluating additional tools including fire-spread modelling. A new model from Technosylva projects the potential consequence of fires from any ignition source. The model can produce a spatial forecast of wildfire spread based on topology, fuels, and meteorology and fuel moisture forecasts.

- iv. how it intends to incorporate future improvements in risk modeling into initiative prioritization and targeting processes; and***
- v. how it intends to adapt its approach based on learnings going forward.***

Learnings from peers, outside experts, consultants, regulators and others will be incorporated to refine and mature existing models and to inform the development of models in process. PG&E plans to improve the accuracy and capability of the individual and composite risk models described above, and adapt initiatives and processes based off these improvements, by assessing the precision of the models against actual outcomes (also called precision metrics). By monitoring these precision metrics and comparing the model output with actual results the modeling teams will continually improve the accuracy of models. To the extent that actual events and causes do not align with modeled outcomes, machine learning techniques will be employed to characterize these failure modes and incorporate them into the probabilistic models.

Benchmarking and peer validation will also be important for model development and maintenance as we drive for continuing improvement of both our models and our risk management processes. An example, as noted above, is that PG&E has plans to share initial models for external peer review later this year.

CONDITION PGE-1

**PG&E GROUPS INITIATIVES INTO PROGRAMS AND DOES NOT
PROVIDE GRANULAR INITIATIVE DETAIL**

Deficiency: PG&E groups initiatives into “programs,” making it difficult to assess the effectiveness as well as the cost of individual initiatives within these programs. For example, PG&E does not separately report undergrounding from its overall \$5.1 billion system hardening planned spend, making it impossible to determine how much PG&E spends on undergrounding and difficult to assess the various initiatives within this program. Furthermore, PG&E does not break down the outcomes or results of individual initiatives as required by the guidelines. For example, in Table 1, PG&E was required to break down results from inspections over the past five years into each of the following inspection types: Patrol inspections, Detailed inspections, and Other inspections. PG&E reported all inspection types together, providing no basis for comparison of PG&E to its peers by inspection type and making it difficult to determine the effectiveness of PG&E’s various inspection types.

Condition: *In addition to the requirements of the relevant Condition in the Guidance Resolution, PG&E shall develop and furnish an RCP that includes:*

- i. a detailed break-down of its programs outlined in Section 5.3 into individual initiatives, reporting planned spend on each individual initiative, describing the effectiveness of each initiative at reducing ignition risk, outlining outcomes (including providing results of detailed, patrol, and other inspections individually in Table 1, as required in the WMP Guidelines), and providing the information required for each initiative as required in Section 5.3 of the Guidelines; and*

Attached as 2020WMP_ClassA_RCP_PGE-1_Atch01 are the updated tables from Section 5.3 of the 2020 WMP Templates (Tables 21-30), referenced jointly as “Tables.” While the Tables now include planned spend for each individual initiative and a description of the effectiveness of each initiative at reducing ignition risks, we do not have the outline of outcomes for each initiative available at this time.

The Tables submitted include updated information for each initiative in the columns highlighted in orange in Table 2 below. As we have broken down our programs into individual initiatives, the updated information in the tables may not link precisely to the original WMP testimony. In addition, while we are enclosing updated data for the columns in orange, we continue to refine the information here with the goal of providing a finalized version in our first quarterly report on September 9, 2020.

The information that has not been updated or provided at this time are in gray columns. Included below is a Remedial Corrective Plan to address both the outline of outcomes and the requirements of Section 5.3 Templates not yet updated or included in the Tables.

TABLE 2 – COLUMNS OF SECTION 5.3 TABLES

| Table | | | | | | | | | | | | |
|---------------------|------|----------------------------|--|---|--------------------------|-------------------------------------|---------------------------------------|----------------|-----------------------|------------------------------|---------------|--|
| Initiative activity | Year | Total per-initiative spend | Subtotal A: Capital expenditure (\$1000's) | Subtotal B: Operating expenses (\$1000's) | Line miles to be treated | Spend (\$1000's)/ treated line mile | Ignition probability drivers targeted | Risk reduction | Risk-spend efficiency | Other risk drivers addressed | Existing/ new | Existing: What proceeding has reviewed program |
| | | | | | | | | | | | | If new: Memorandum account |
| | | | | | | | | | | | | In / exceeding compliance with regulations |
| | | | | | | | | | | | | Cite associated rule |
| | | | | | | | | | | | | Comments |
| | | | | | | | | | | | | Effectiveness of each initiative at reducing ignition risk (PGE-1) |

Reporting Actual & Planned Spend

A) Driver of change: PG&E's original method for mapping costs to the WSD's initiatives in the Section 5.3 templates was based upon how we manage our programs and track costs and files for cost recovery in rate cases: at the Maintenance Activity Type (MAT) code level. As explained in discussions with the WSD before the 2020 WMP submission date, in our 2020 WMP and in our comments on the Draft Resolutions, PG&E does not have these MAT codes and work activities organized by the WSD-defined initiatives. Given the direction provided in this condition, PG&E has undertaken analyses to estimate the cost, risk reduction benefit, and other details for each WSD-defined initiative. The methodologies used to estimate these details by WSD-defined initiatives are described below.

In general, because the list of WSD-defined initiatives is so granular, PG&E leveraged approach #1 below (subject matter expertise) to disaggregate individual initiatives from larger spending buckets and map costs to the initiative level. Therefore, some of the actual and forecasted amounts in the Tables will be different from the Section 5.3 tables provided in the initial, filed 2020 WMP. Additionally, some initiatives are related to effort or work activities that are not tracked in any budget or MAT code. To estimate the costs associated with these WSD-defined

initiatives, we leveraged approach #2 below, looking at employee effort level tracked within a Provider Cost Center (PCC).

B) Methodologies described

- 1) PG&E compiled feedback from numerous SMEs and program owners to gather more granular data at detailed levels (including the notification level showing location and asset type) to inform how to disaggregate costs from larger programs and estimate the appropriate costs to assign to each individual WSD-defined initiative in the WMP templates.
- 2) For any employee effort-driven activities or initiatives we do not separately track in a budget or MAT code, we analyzed personnel costs within PCCs to quantify the effort, and therefore approximate costs associated with that WSD-defined initiative. PG&E again compiled feedback from SMEs and program owners to vet any assumptions needed to analyze the PCC costs to create these cost estimates by WSD-initiative. The PCC costs captured for this exercise are primarily treated as “overheads” in PG&E’s cost model. These costs differ from costs captured in “programs” in that these types of overhead costs are not explicitly charged to specific orders or programs. Instead, these types of costs flow through our cost model and get captured downstream in our final MAT code recorded costs via overhead allocation mechanisms.

ii. if PG&E does not have the relevant data in its possession at the initiative level, it shall

1) explain the difference between what it reports and what the WMP

Guidelines require,

2) explain why it cannot meet the WMP Guidelines, and

3) develop a plan including a detailed timeline to obtain and share the required information at the initiative level rather than the program level

The details of the three remaining topics required by Condition PG&E-1, that are not provided at this time are described in 1-3 below:

- 1) **Section 5.3 Tables:** PG&E is currently conducting analysis and gathering data to complete or update the remaining Section 5.3 Template columns indicated in gray

in the Tables, and as denoted in Table 3 below. These remaining Section 5.3 Template columns are:

- Line miles to be treated
- Spend (\$1,000's)/treated line-mile
- Ignition probability drivers targeted
- Risk reduction
- Risk-spend efficiency
- Other risk drivers addressed

The above information was not available for each of the WSD-defined initiatives at the time of our 2020 WMP submission. Additionally, although we have been working diligently on compiling this information, a significant amount of time is needed to develop this data and analysis in an accurate and repeatable manner. We plan to provide, or update, this information in our first quarterly report on September 9, 2020.

TABLE 3 – COLUMNS OF SECTION 5.3 TABLES

| Table | | | | | | | | | | | | | |
|---------------------|------|----------------------------|--|---|--------------------------|-------------------------------------|---------------------------------------|----------------|-----------------------|------------------------------|---------------|--|--|
| Initiative activity | Year | Total per-initiative spend | Subtotal A: Capital expenditure (\$1000's) | Subtotal B: Operating expenses (\$1000's) | Line miles to be treated | Spend (\$1000's)/ treated line mile | Ignition probability drivers targeted | Risk reduction | Risk-spend efficiency | Other risk drivers addressed | Existing/ new | Existing: What proceeding has reviewed program | If new: Memorandum account |
| | | | | | | | | | | | | In / exceeding compliance with regulations | Cite associated rule |
| | | | | | | | | | | | | | Comments |
| | | | | | | | | | | | | | Effectiveness of each initiative at reducing ignition risk (PGE-1) |

- 2) **“Outlining outcomes”:** Condition PGE-1 requires that we outline outcomes for each of the WSD-defined initiatives. Our SMEs across the organization are currently reviewing this direction and working to gather these insights. PG&E plans to submit the information on “outlining outcomes” on each initiative by September 9, 2020.
- 3) **Table 1 (Results of detailed, patrol, and other inspections):** As Condition PG&E-1 stated, the 2020 WMP Guidelines required that we provide results of detailed, patrol, and other inspections individually by year initiated and by High Fire Threat District (HFTD) location in Table 1. In our 2020 WMP at Tables 1-1 and 1-2, PG&E provided a list of corrective notifications (Line Corrective (LC) for Transmission or Electric Corrective (EC) for Distribution) by year initiated and by

HFTD location. However, we cannot produce a split of those historic corrective notifications by source, e.g., patrol or inspection activity type (initiative level), to fully align with the WMP Guidelines. PG&E does not have meaningful historic data that specifies the initiating patrol or inspection activity (initiative) for each tag in its system of record. Before we instituted the Wildfire Safety Inspection Program (WSIP) in 2019, PG&E records did not uniformly identify specific distinctions for routine patrol, routine inspection, nonroutine patrol or inspection, infrared inspection, or other patrol or inspection types when creating a Corrective Notification. PG&E's system of record has no way to trace back to the source activity (initiative) for a corrective notification if it was prior to 2019 (although the date, initiator name, and other details are available).

During the WSIP in 2019, PG&E began a practice of manually assigning keywords to transmission corrective notifications to designate them as WSIP-related. This practice relies on manual record adjustments to attach a prefix of EI (enhanced ground inspection) or DI (drone / aerial inspection) to flag the initiating inspection activity type. For the 2019 Transmission WSIP PG&E can therefore split the EI (ground) and DI (aerial) corrective findings for transmission inspections, we will provide that data with our first quarterly report on September 9th. For distribution WSIP inspections, only ground inspections were performed so no further split of corrective findings is possible.

A new mobile application (the "Inspect App") adopted in 2020 for detailed overhead inspections (which follows the enhanced inspection process developed in 2019 as part of WSIP) enables our inspectors to automatically assign a descriptor for the detail inspection records and associated corrective notifications for both transmission and distribution [see Inspect App screenshot below].

FIGURE 7 – INSPECT APP – “IDENTIFIED DURING” FIELD

The screenshot shows a mobile application interface for the 'Electric Corrective' screen. At the top, the status bar shows 'Verizon', signal strength, time '12:57 PM', and battery '67%'. Below the status bar, the title 'Electric Corrective' is displayed with a 'Close' button to its right. The main section is titled 'Identified During (required)' and contains a list of ten selectable options, each in a rounded rectangular button: 'Compliance Inspection', 'Compliance Patrol', 'Crew Work', 'Equipment Inspection', 'Pole Test & Treat', 'PS&R Work Verification', 'PSPS Patrol', 'Supervisor Work Verification', 'Trouble Work', and 'Wildfire Safety Inspection Program (WSIP)'. At the bottom of the screen, there are two buttons: 'Save as Draft' on the left and 'Next' on the right.

Going forward, corrective notifications records generated from Detailed Overhead Inspections, Climbing Inspections, Aerial Inspections and PSPS Patrols will have an indicator facilitating the required initiative-level reporting. The following patrol and inspection programs will begin using the mobile, digital platform (Inspect App) during 2021 and 2022: Routine Overhead Patrols (2021), Nonroutine (Emergency) Patrols (2021), Pole Test & Treat, Substation Enhanced Ground Inspections, Underground Patrols and Underground Inspections. While Pole Test & Treat and Substation Enhanced Inspections currently use existing mobile/electronic software solutions, they will be converted to the unified mobile inspection software (the Inspect App) during 2022. Electronic solutions for other programs (such as Underground Patrol and Inspection) will depend on the successful release of mobile technology for the above-mentioned overhead inspection programs, which have priority due to their greater alignment with wildfire risk. Once a program has been integrated into the mobile, digital platform and the process has stabilized, PG&E will be able to report the corrective actions identified from that inspection type from that point forward.

CONDITION PGE-3
HIGH INCIDENCE OF CONDUCTOR FAILURE

Deficiency: As shown in Appendix B, Figure 2.6a, relative to peer utilities PG&E has approximately 50 percent more conductor failure ignitions as a percentage of total ignitions, and nearly 2.5 times the number of “conductor failure”- driven ignitions per overhead circuit mile. Since PG&E has the most overhead circuit miles and conductors compared to peer utilities, this high rate of conductor failure poses a serious risk.

Condition: *In its RCP, PG&E shall present a plan for the following:*

i. Presenting the results of a study or analysis showing the root causes of conductor failures on its grid;

Since 2012, PG&E has performed internal investigations on distribution primary wire down events reported as either conductor or splice failure. The investigation is not considered a formal “root cause” analysis but key data is obtained to identify trends and failure modes. The data obtained to date shows elevated failure rates for two classes of primary overhead conductor: (1) Aluminum Conductor Steel-Reinforced (ACSR) within a designated corrosion zone; and (2) small copper (Size #6 & #4). The data collected since 2012 is substantial in terms of size and volume.¹

In addition to the internal investigation described above, in 2017, PG&E commissioned an Overhead Primary Conductor study performed by the National Electric Energy Testing, Research and Applications Center (NEETRAC) and submitted by PG&E in its 2020 General Rate Case (GRC) filing in December 2018)(see Attachment 1 for PGE-3). The study provided insight into four issues: (1) expected conductor service life; (2) understanding asset vintages; (3) factors driving the need for conductor replacement; and (4) a near and long-term replacement rate. NEETRAC used the Weibull statistical analysis method on various PG&E data systems to provide the insight into the four categories. Takeaways from the study include: (1) average conductor lives varied by geographic region; (2) all-aluminum conductor had the shortest calculated service life; and (3) replacement rates must be accelerated to reduce failure rates over time.

As a result of this study, PG&E is currently considering additional funding to increase our rate of conductor replacement. In addition to our routine conductor

¹ PG&E was not clear from Condition PGE-3 whether WSD wants the underlying data from any study or analysis. To the extent WSD does want the data from these investigations, PG&E is happy to provide it and will coordinate with WSD to transfer the substantial amount of data gathered.

replacement program, we are also replacing a substantial amount of conductor in HFTD areas through its system hardening program, as described in subpart (iii) below.

ii. Listing the specific locations and assets that are most likely to experience conductor failure based on: (1) the root cause analysis,

The data obtained since 2012 in the distribution primary wire-down events investigations, described above in subpart (i), shows elevated failure rates for the following two classes of conductor and their locations:

- 1) Aluminum conductor steel-reinforced (ACSR) located within a designated corrosion zone. The corrosion zones are boundaries adjacent to the Pacific Ocean where fog and salt is most prevalent(see Attachment 2 for PGE-3). PG&E has approximately 1,400 circuit miles of ACSR conductor within a designated corrosion zone. Most prevalent is #4 ACSR which represents 94 percent of the total within the corrosion zone. Our calculated annual #4 ACSR wire down rate at the system level is 0.78 per 100 circuit miles. The #4 ACSR wire down rate in a corrosion zone is 3.7 per 100 circuit miles.
- 2) Small copper (Size #4 & #6). The elevated failure rate is calculated at the system level and not specific to locations. There are approximately 19,300 circuit miles of small copper (#4 & #6) in the PG&E service territory that was installed before 2015, at which time PG&E stopped using Small copper (Size #4 & #6). This represents 24 percent of the system total.

The failure rates for #4 ACSR and Small copper (Size #4 and #6) as well as other classes of conductors are identified in the Tables below.

FIGURE 8 – CONDUCTOR ANNUAL WIRE-DOWN RATE

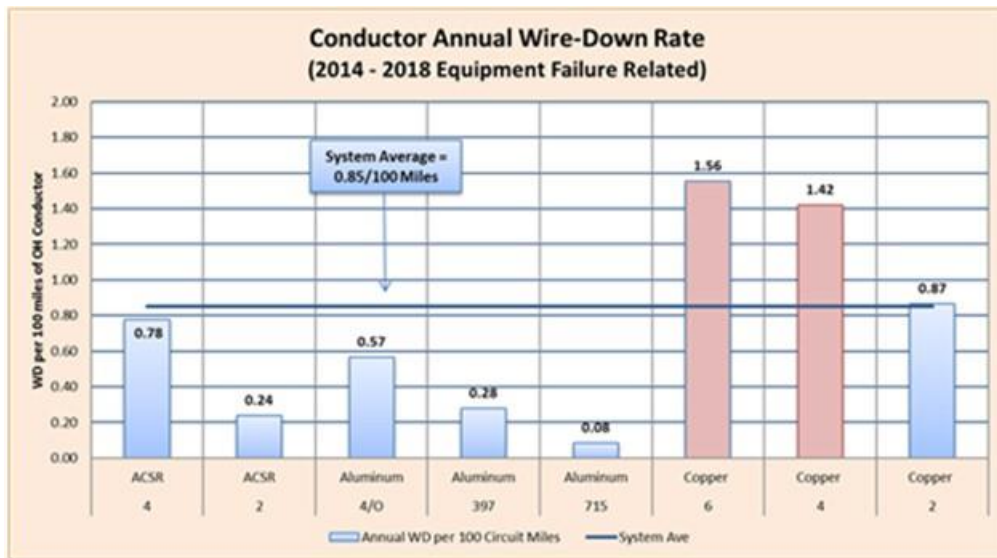
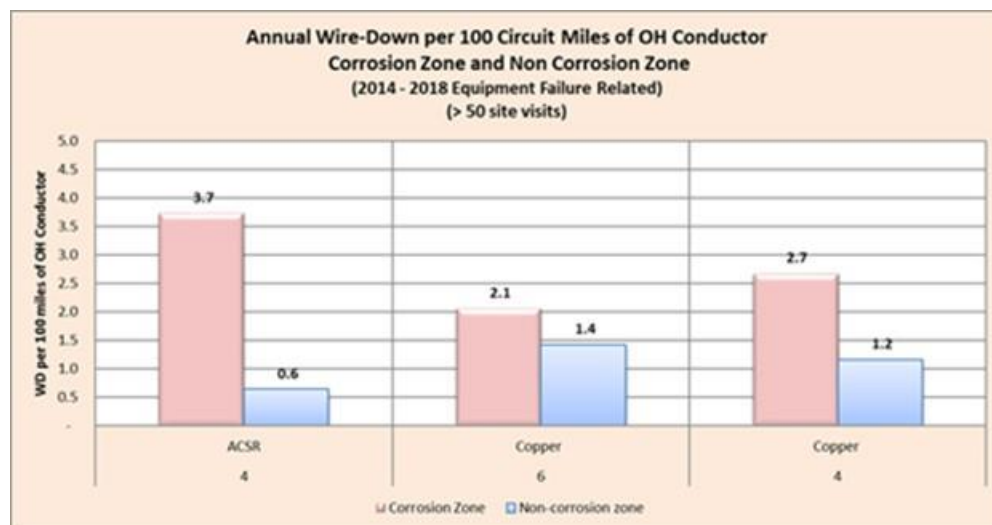


FIGURE 9 – ANNUAL WIRE-DOWN PER 100 CIRCUIT MILES



Based on the analysis described above, in 2015, PG&E removed #4 ACSR and Small Copper (Size #4 and #6) from our approved conductor installation standard. The smallest conductor we install now is as follows:

- Non-HFTD Areas: #2 ACSR (non-corrosion zone) and #2 copper (corrosion zone).
- HFTD Areas: 1/0 ACSR Tree wire (non-corrosion zone) and #2 copper Tree wire (corrosion zone)

This data described above, as well as data described below in subpart (2), is also used to evaluate the health of conductors and make replacement decisions.

(2) attributes of PG&E's conductors (i.e., age, type, condition, etc.) and

The data obtained through the distribution primary wire-down events investigations, in combination with the system splice inventory, provides guidance into the health of the conductor and replacement decisions. The attributes used include: (1) conductor type, age and size; (2) environmental zones (corrosion and snow loading); (3) number of splices in the span; (4) number of past failures; and (5) calculated I^2t^2 compared to the conductor's damage curve. The attributes of the conductors most likely to fail are described above in response to subpart (1).

(3) other relevant factors (e.g., peak wind speeds);

For purposes of this Condition, PG&E prepared an analysis of historical meteorology data and combined it with our distribution wires-down outage data. The meteorology data assigns the following designations to each day depending on the impact to our reliability metrics:

- Blue Sky
- Gray Sky
- Storm Day

Gray sky and storm day have sub-categories related to the type of weather observed. The following weather types were used to generate the graph below:

- Northeast wind
- Northwest wind
- Winter Storm (usually includes south wind)

The following graph shows the wire-down rate per Blue Sky Day (no significant weather conditions) and Gray Sky/Storm Day involving Wind:

2 I^2t is a calculated value based on available fault current on the distribution system. When this value exceeds the conductor I^2t rating and the conductor experiences a fault condition, damaged or failure will occur. The units for I^2t are expressed in ampere-squared-seconds.

FIGURE 10 – CONDUCTOR WIRE DOWN RATES



The data does not include Major Event Days (MED, generally severe weather days). These days can have significant impacts on facilities. Although the count of wire-down incidents are available for MEDs, the cause of failure is not always confirmed through detailed investigations due to the high number of outage events that occur on MEDs. Thus, information regarding MEDs was excluded from this analysis. A recent audit performed on outage reporting identified gaps in the reporting process, including with MEDs, and PG&E will improve and expand MED reporting.

The analysis shows an increased rate in equipment failure caused wire-down events on documented wind days. While substantial analysis has been performed on the wind speeds that drive outages (the OPW analysis), that analysis has not to date correlated the actual wind speed with wire down events (a small subset within the population of all outages). We intend to further evaluate wind speed and how it contributes to wildfire risk, as we develop our distribution risk model.

iii. Reporting the specific work plan that PG&E plans to undergo (including circuits being addressed, timeline, cost, etc.) to reduce incidents of conductor failure, including the expected impact of this work plan on PSPS and wildfire risk reduction.

Overhead primary conductor replacement will occur in the following locations:

- 1) HFTD Areas: In 2019, PG&E began the System Hardening Program with a target of completing 150 circuit miles by the end of the year, 171 were actually completed. In 2020-2022, PG&E forecasts completing approximately 1,000 distribution circuit miles (about 200 miles in 2020, approximately 350 in 2021 and 440 in 2022). PG&E ultimately intends to complete work on 7,100 (out of 25,200) distribution circuit miles in Tier 2 and Tier 3 HFTD areas; as described in the WMP, our plan is to do system hardening on 7,100 miles in the highest risk Circuit Protection Zones over the next 12-14 years. Incidents of conductor failure will be reduced significantly on these hardened line miles with larger conductor, corresponding replacement of distribution poles, removal of splices, and the reduction of transient faults that often degrade the life of overhead lines. As we harden infrastructure, with the upgraded system hardening standard, we expect lower wildfire risk and reduced vegetation-related outages.

Before a hardened line segment would be deemed safe to energize during a dry windstorm, we must validate engineering-based performance expectations with actual field performance data in order to manage wildfire risk today. Consequently, we will not be reducing 2020 PSPS event scopes based on the system hardening work conducted in 2019 and 2020 while field performance data is gathered. But we expect that in subsequent years, circuits that have been hardened with new conductor and poles will be reflected in future PSPS events. Because the public safety risks associated with conductor failure are greater in HFTD areas, PG&E has prioritized conductor replacement work in HFTD areas.

- 2) Non-HFTD Areas: This portion of the service territory includes approximately 55,300 circuit miles. The program goal is to replace 87 circuit miles in 2020 with the focus on replacing ACSR in a designated corrosion zone and small copper conductor with known splice counts in the span. The goal of this work is to prevent the reoccurrence of a conductor failure leading to a wire-down event which poses a risk to public safety. PG&E has prioritized conductor replacement in HFTD areas given the wildfire risk, so work in non-HFTD areas is being driven primarily by reliability factors.

For detailed workplans, please see the following attachments:

- a) HFTD workplan – PGE-3 subpart iii (see Attachment 3 for PGE-3)
- b) Non-HFTD workplan – PGE-3 subpart iii(see Attachment 4 for PGE-3)

CONDITION PGE-8

ANNUAL RISK RANKING IS QUICKLY OUT OF DATE

Deficiency: In its response to the WSD's data request 43895-C-321, PG&E states that the wildfire risk ranking for distribution lines is only calculated on an annual basis. The ranking thus may incorporate repairs or other maintenance that occur after the annual ranking. Risks are mitigated by corrective action, and if a static annual calculation of risk causes PG&E to scope PSPS events based on incorrect information, PSPS decision making will be erroneous. For instance, PG&E tags assets requiring repairs with a "Tag Risk Score" in its effort to comply with General Order (GO) 95, Rule 18. Needed repairs with an "A" Tag are of immediate risk and require immediate response; "B" Tag items require corrective action within 3 months. By contrast, "E" and "F" Tag items pose lower risk according to PG&E and require correction for "E" Tags in 12 months (6 months if in HFTD Tier 3), and for "F" Tags require action within five years (distribution) and two years (transmission). Because "A" and "B" Tags require mitigation immediately ("A" Tags) and within three months ("B" Tags), repairs made after PG&E's annual risk calculation will not show up. Given that the highest risk tags may be corrected before the subsequent fire season, the risk of a particular circuit may be different from PG&E's annual risk calculation. That is, assets along the circuit should not fail due to recent repairs or replacement. However, PG&E may make PSPS decisions based on a "high risk" score of a circuit that may already be largely mitigated. According to PG&E's responses in the Utility Survey, it is currently updating condition assessments on an annual basis but expects to increase the frequency to quarterly by 2023.

Condition: *PG&E shall file an RCP that:*

i. lists and describes all plans related to timely incorporation of maintenance status across its grid;

PG&E currently incorporates, or is actively working on incorporating, the maintenance and repair status of assets into risk analysis and modelling in the following ways:

- **Transmission:** PG&E uses the transmission OA asset risk model to determine the need for de-energizing a transmission line during a PSPS event. This model uses recent maintenance status and inspection data, which is currently updated in the model on a weekly basis. During a PSPS event, this data can be refreshed daily and thus should reflect recent transmission repairs and maintenance or damages identified in determining which lines are safe to remain energized within a PSPS

area. Within this model, the presence of certain open (unrepaired) maintenance tags (i.e., open tags to address fire ignition potential concerns) on a transmission structure should affect the threshold for whether and when that line must be deenergized during a PSPS event.

- **Distribution:** PG&E is developing a refined tag prioritization sub-model that will be part of the composite distribution risk models described in the response to Condition Guidance-3. This tag prioritization sub-model will quantify the increased risk impact of an identified tag and the passage of time since the last inspection and the change in risk associated with closure of the tag through a completed repair or asset replacement. The model will be improved over time to capture failure modes and consequences associated to each tag level and type (for example, the risk increase and subsequent risk reduction modeled for the identification of a 'B' tag for a broken cross-arm and the replacement of that cross-arm will likely differ from an 'E' tag for a guy-wire).

This model could be used in the future to prioritize repair work among outstanding tags. The model can be updated regularly with changes in tag status to recognize changes in risk for relevant portions of the electric distribution system, and aggregated from the individual asset level up to the circuit, region, or system. Eventually, this tag prioritization sub-model with regular distribution activity updates can be used to test and prioritize PG&E's wildfire risk reduction work, including system hardening, EVM, and PSPS impact reduction efforts.

Going forward, as PG&E's asset risk modeling matures, as described in detail in our response to Condition Guidance-3, asset health information, including maintenance tag status, will become further integrated into risk quantification, risk analysis and decision making for other programs and workstreams beyond the two discussed above.

ii. includes a timeline and sequence of activities that will be required to increase the frequency of these updates; and

PG&E is utilizing and developing multiple risk models which currently have different frequencies of updating.¹ One aspect of our current risk analysis and modeling efforts is to apply consistency in terms of frequency of update cycles, data relied on, etc. At

¹ Please see PG&E's answer to Condition Guidance-3.

present PG&E does not have a single update cycle for our risk models. As noted above the transmission asset risk model (OA) is updated weekly, while our current distribution risk prioritization model is updated annually.

Consistent with PG&E's response to the WSD's Guidelines for the Maturity Model Survey, PG&E will continue to improve risk modeling work through 2023, and standardize the frequency and consistency of inputs and model updates.

The first version of the tag prioritization model within the advanced analytical distribution risk model, described in subpart i, will be developed over the course of 2020 and will form the basis for more frequent updates of the risk scoring of electric system. As described above, as more failure modes are better related to types of repair tags, the ability of the model to distinguish levels of risk for different tags will improve.

While PG&E has a general roadmap and approximate timeline for the maturation of our risk modeling, we recognize that this process is iterative. Learnings from one step in the process will influence and even change the direction of future steps or may require revisions to previous steps or developed tools. Therefore, while the primary steps and approximate timeline for improving the frequency of our risk modeling are outlined below, this timeline is directional and will be updated as progress is made and lessons are learned over the coming years.

- Develop tag prioritization model to quantify impact of maintenance tags (open and complete) on asset risk – end of 2020
- Develop consistent data pipelines and Asset Data Foundation to support more frequent updates of the risk models described above – end of 2021
- First instance of composite risk model representing vegetation and tag risk in one composite risk score viewable across system layers – end of 2021
- Launch composite risk model viewer with periodic update on system risk, tracking risk draw-down as mitigations are put in place – end of 2021
- Integration of composite risk model output with business operations planning tools in developing 2022 work portfolio – end of 2021
- Add individual models for distribution assets to the composite distribution risk model – end of 2022
- Update on tag risk reduction values based individual distribution asset models – end of 2022
- Determine risk model update frequency that will add value for the identified use cases – targeting end of 2022

iii. explains why it will take until 2023 to increase the frequency of its updates from condition assessments to a quarterly basis.

As noted in the response to subpart ii, PG&E is working to incorporate better granularity into our risk models and more consistency across models. One aspect of this improvement effort will be increasing the frequency of updates and inputs into the risk models, including maintenance status and condition assessments. Progress will be made in 2020, 2021 and 2022. Consistent with the Maturity Model Survey submission, PG&E expects to have standardized more frequent risk model updates by the end of 2022/start of 2023 (the maturity model survey time window), if not earlier than that.

CONDITION PGE-15

**IT IS UNCLEAR HOW PG&E CLASSIFIES FINDINGS AT THE
APPROPRIATE LEVEL**

Deficiency: PG&E classifies inspection findings as primarily lower-risk Level 3 findings. PG&E's inspection programs have resulted mostly in lower-risk Level 3 findings. It is unclear how PG&E classifies findings at the appropriate level. Furthermore, inspections are costly and the effectiveness of each of these inspections should be demonstrated to support PG&E's spend on them.

Condition: *PG&E shall develop and furnish an RCP that includes:*

- i. a description of the value and effectiveness of these enhanced inspections in identifying GO 95 violations and safety hazards that present greater than "low" risk of potential impact, including quantitative metrics, and a detailed explanation of how it classifies findings by Level and how it plans to ensure that front-line inspection staff are properly classifying findings; and*

Value and Effectiveness in Identifying greater than "low" risk safety issues

PG&E's enhanced inspection program provides both value and effectiveness in identifying GO 95 violations and potential current and future safety hazards. PG&E understands that the large volume of Priority "E" and "F" findings in 2019, were significantly higher than in previous years. One aspect of this increase was that inspectors during the 2019 WSIP were given operational guidance during orientation to report compelling abnormal conditions that might fail within five years. Prior practice generally asked inspectors to report conditions that might fail within one year. Expanding the time horizon from one to five years, even with no other changes, would necessarily lead to an increase in findings, specifically at the lower urgency levels, which PG&E classifies as "E" or "F" priority. PG&E does not view a high percentage, or overall find rate, of "lower" priority findings as an indicator of ineffective inspections or prioritization. An inspection finding prioritized as an "E" or "F" level merely indicates that the item of concern is safe to operate for some period of time (e.g., 12 months or longer) before it is anticipated to create an imminent safety hazard and must be repaired or replaced.

Findings at this level are important and valuable. Similar to the widely known value of preventive health screenings and early cancer detection, a highly effective, long-term inspection and maintenance program should identify primarily "lower priority" findings of these type (i.e., "medium," "low," "E" or "F"). Alternatively, if an inspection program is primarily identifying asset issues that require urgent or near-term action (i.e., "high" or

“medium” grade findings), that inspection program may not be identifying and catching items early enough. Much like early cancer detection increases the options for a patient and likelihood of a full recovery, early identification of potential failures in the form of “E” or “F” tags allows for increased visibility towards potential upcoming failures and increased time and flexibility to schedule the most prudent repair.

Before diving deeper, PG&E wishes to clarify the grouping of the data provided in 2020 WMP Tables 1-1 and 1-2. Metrics found in PG&E’s 2020 WMP at Tables 1-1 and 1-2, refer to Level 1, 2 and 3 findings in alignment with GO 95, Rule 18 levels. However, PG&E does not internally prioritize inspection findings by Levels 1, 2 & 3. PG&E prioritizes tags into the levels of “A,” “B,” “E” and “F,” so for the tables in the 2020 WMP, PG&E made simplifying assumptions to translate our internal prioritization levels to the GO 95 levels. Specifically, in these WMP tables PG&E classified all Priority “E” tags as Level 3, which does not completely include all tags in Priority “E.” Instead, Priority “E” tags can meet either GO 95 Rule 18 Level 2 or 3 criteria and are managed appropriately in alignment with the timeline implied by those levels. That said, to reduce confusion going forward, since PG&E’s 2020 WMP filing, we have continued to prepare to adopt the explicit GO 95 Rule 18 priority levels (1/2/3), rather than the historic designations PG&E has leveraged (A/B/E/F) (see Attachment 1 for PGE-15).

Building off of the clarification that a portion of the “E” priority tags actually align with “medium” or “Level 2” priority, PG&E below addresses this Condition by describing the effectiveness and value in the enhanced inspection at identifying Priority “A,” “B” and “E” tags. The details below describe the prioritization of Priority “E” tags from the 2019 WSIP enhanced inspection program.

PG&E identified 189,305 Distribution EC and 100,878 Transmission LC tags from the 2019 WSIP overhead inspection program (see Attachment 2 for PGE-15). Collectively, 93.7 percent were in the A/B/E priority category and 254,603 tags (87.7%) were in Priority “E” status. See Table 4 below for the details of the Priority “E” tags. Since Priority “E” tags can meet either GO 95 Rule 18 Level 2 or 3 criteria, the risk associated with each tag and the prioritization of completing the necessary corrective was determined using the following components:

1. **Asset failure ignition risk:** Relative risk of an asset’s failure causing an ignition
2. **Historical asset ignition frequency:**
 - a) For Distribution, PG&E’s 2014-2019 ignition frequency.

b) For Transmission, PG&E's 2013-2018 ignition frequency.

3. **Likelihood of wildfire spread and consequence score:** Relative ability for an ignition to spread, and quantity of homes or timber affected if ignition occurs
4. **Egress score:** Ease of access to a community exit and extent of exit, for a mass evacuation
5. **Time-dependent:** Time-dependent tags represent conditions that potentially could worsen over time. PG&E will monitor and perform periodic field safety re-assessments (FSR) for time-dependent tags that will remain open.

Every EC tag is categorized by the Facility/Damage/Action (F/D/A) associated with that tag. These characteristics define (in high level terms) the:

- Facility: the piece of equipment in question
- Damage: the problem identified
- Action: what is required to resolve the issue

Examples of higher risk "E" tags that meet GO 95, Rule 18 Level 2 criteria include F/D/A combinations such as: pole/broken/replace, conductor/damaged/replace or transformer/leaking/replace. Examples of lower risk "E" tags (F/D/A) that meet Level 3 criteria include: high voltage sign/missing/install, marking/missing/install or OH facilities/idle facilities/remove.

The data in Table 4 below illustrates the number of "E" tags that met the higher risk criteria described above and have therefore been scheduled and completed to date. Collectively 62 percent of the "E" tags are planned to be completed in 2020. The prompt action to resolve these corrective actions shows the effectiveness of the enhanced inspection program to identify valuable findings, including "greater than 'low' risk" safety issues."

TABLE 4 – PRIORITY "E" ONLY CORRECTIVE TAGS TO BE RESOLVED BY THE END OF 2020

| Corrective Tag Type | 2019 | | 2020 ^(a) | 2020 | Total to Close by end of 2020 | % Closed |
|------------------------|----------------|---------------|---------------------|------------------------------------|-------------------------------|------------|
| | Open | Closed | Planned to Close | FSR (E to B) ^(b) Closed | | |
| Distribution (EC) | 174,795 | 38,026 | 34,923 | 7,508 | 80,457 | 46% |
| Transmission (LC) | 79,808 | 56,321 | 20,323 | 84 | 76,728 | 96% |
| Total (EC + LC) | 254,603 | 94,347 | 55,246 | 7,592 | 157,185 | 62% |

- (a) Forecast of tags to be completed in 2020
- (b) FSR (E to B) means that a Field Safety Reassessment of an open corrective notification reprioritized the repair from an “E” to a “B” for follow up and timely repair

Quantitative Value of Enhanced Inspections

As noted at the top, an effective and mature inspection and repair program should identify lower priority findings before the underlying asset issue requires urgent, critical or high priority repairs. In response to this Condition, PG&E performed the following RSE analysis to quantify the value of the findings from the 2019 enhanced inspections. PG&E used the following method to quantify the value and the risk reduction provided:

- Used the number of identified tags from 2018 routine and 2019 enhanced inspections
- Estimated the outage-to-tag ratio, aligned on the priority of the tag. For Priority “A” tags, PG&E assumes that there is a 70 percent likelihood of a Priority “A” tag leading to an outage within one year. For Priority “B” tags, PG&E assumes that there is a 50 percent likelihood of a Priority “B” tag leading to an outage within one year. While identification of Priority “E” and “F” tags are important for preventing failures, outages and ignitions in the long run, they are not anticipated to contribute to failures or outages within one year and therefore are estimated at 1 percent likelihood in this analysis.
- By identifying and addressing higher priority findings, PG&E estimates the number of outages prevented per year due to inspection work identifying corrective tags.
- Based on historical ignition and outage data, PG&E determined an ignition-to-outage ratio. The ignition-to-outage ratio for is approximately ~1.25 percent for distribution and ~2.5 percent for transmission.
- With this methodology, PG&E attributes the number of tags at varying priorities to the outage-to-tag ratio and ignition-to-outage rate to estimate a given corrective tag’s impact in minimizing ignitions on the system.

**TABLE 5 – FORECAST INSPECTION REDUCTIONS ATTRIBUTED TO ENHANCED INSPECTION
CORRECTIVE FINDINGS**

| 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 |
| *Costs only include inspection / identification and do not include the costs of the corrective maintenance | | | | |

Overall, despite the significantly higher cost of the 2019 enhanced inspection program, the number of higher priority corrective tags identified significantly reduced the number of potential equipment failures and subsequent ignitions on PG&E's system. Given that, the RSEs of both inspection programs are very high. This analysis confirms that enhanced inspections have slightly higher RSEs than traditional, "Routine" inspections and provide significantly more risk reduction for the electric transmission and distribution systems.

ii. a detailed explanation of how it classifies findings by Level and how it plans to ensure that front-line inspection staff are properly classifying findings;

How PG&E Classifies Findings by Level

Currently, PG&E classifies field findings by levels of corrective Priority "A," "B," "E," "F" as defined in the Electric Distribution Preventive Maintenance Manual (EDPM, TD-2305M, provided as part of the 2020 WMP at https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/wildfire-mitigation-plan/reference-docs/TD-2305M.pdf) and Electric Transmission Line Inspection and Preventive Maintenance Program (ETPM, TD-1001M, provided as part of the 2020 WMP at https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/wildfire-mitigation-plan/reference-docs/TD-1001M.pdf).

In 2020 PG&E issued internal guidance to begin transitioning the classification of tags to align explicitly with GO 95 Rule 18 Levels 1, 2, 3 (in TD-8123S: Electric System (T/S/D) Patrol, Inspection, and Maintenance Program (see Attachment 1 for PGE-15). PG&E defines “Priority” as the urgency to perform the repairs or replacements identified in a notification. This priority is assigned to facilities to indicate a degree of importance, aligned with the assessment of impact and probability “of equipment and/or facilities failure and/or exposure”. For example, see the EDPM TD-2305M Chart: Impact/Probability Matrix on page 188 of the EDPM pdf linked above. As described above, PG&E’s 2020 WMP filing grouped all “E” Priority tags into Level 3 for Tables 1-1 and 1-2, which is not reflective of PG&E’s actual treatment of “E” priority tags.

In general, most field conditions can be submitted by the field inspection with any priority code (A/B/E/F), but the centralized gatekeeper function and guidelines of the EDPM (Electric Distribution Preventative Maintenance) Manual, ETPM (Electric Transmission Preventative Maintenance) Manual, and Job Aids exist to calibrate priority levels across Inspectors. Additionally, the centralized SAP “Gatekeeper” screen where notifications are reviewed has programming and controls that do not allow certain categories of work to be assigned an incorrect priority. As an example, for a Priority “E,” EC notification in a Tier 3 area, the Gatekeeper screen has programming that does not allow the Gatekeeper to assign a duration longer than 6 months, as defined in GO 95 Rule 18.

PG&E continues to improve process controls to deliver consistent prioritization of field corrective findings. The assessment of potential impact (or priority) of field condition findings is guided in the field by the inspector personnel, with references to their training, professional experience, mobile inspection checklist application, and published guidance in the ETPM and EDPM. PG&E endeavors to drive consistency in the corrective findings reports by front line staff (Inspectors). Front line staff (Inspectors) are: (1) verified to be Qualified Electrical Workers (also referred to as journeymen linemen) by training and professional experience, (2) trained on how to assess facilities according to PG&E standard, and (3) provided preselected priority options in the mobile app. Inspectors are also given access via their mobile device to references that clarify how to classify field conditions.

Validation

In addition to guiding the Inspectors directly, initial Corrective Notification reports are validated by centralized gatekeepers. A Centralized Gatekeeper is a person responsible for the review and validation of all new, non-emergency Notifications to confirm they meet the requirements as per the EDPM manual and all associated Job Aids. Within the gatekeeping function (also called Centralized Inspection Review Team or CIRT), prioritization is again guided by the ETPM and EDPM, with additional examples (including photographs) contained within Job Aids. To support early identification of inconsistencies, rates of field condition finding are tracked weekly, as are the rates of gatekeeper upgrades/downgrades/cancellations of preliminary field findings.

PG&E is actively deploying desk-based and field sampling of inspector reports for quality management purposes and to create statistical analysis of inspector findings data. Similar oversight of gatekeeper trends is also being deployed in 2020. Ongoing process improvement includes annual program reviews with asset strategy and standards teams to clarify electronic inspection checklist wording, provide real world examples, or enhance any aspect of the issue identification and documentation practice.

ii. and a description of whether it is more effective in terms of findings per dollar spent to incorporate the enhanced inspection processes and tools into its routine inspection and maintenance program given the program's results.

As noted above, in the section on “Quantitative Value of Enhanced Inspections,” the enhanced inspection program has a higher RSE than the “routine” inspection program, driven by the findings of the programs. Beginning in 2020, detailed overhead inspections in transmission and distribution have been expanded to include the WSIP-type guidance, tools, and methods into routine programs. As a result, the “routine” GO 165 detailed inspection and the “enhanced” inspection are no longer running in parallel but have merged.

PG&E is now applying the “enhanced” overhead inspection approach from WSIP 2019 consistently across all areas and is the only approved means of completing detailed overhead inspections. The analysis of cost per finding for two representative years of the distribution overhead inspection program is below. The costs included for the WSIP inspections include ground and aerial inspections as well as the CIRT and

other process steps. Even though the cost per finding is higher for enhanced inspections, the risk mitigation value of the increased findings captured by the enhanced inspections program, as performed in the “Quantitative Value of Enhanced Inspections” section above, supports the integration of these programs as being to reduce wildfire risk to the communities we serve. The cost of not finding potential failures has motivated the universal application of the Enhanced Inspection approach, with a risk-informed cycle time for the different geographic areas of our service territory.

Cost Per Finding Details

TABLE 6 – COST AND FINDINGS COMPARISON FOR DISTRIBUTION INSPECTIONS

| Cost Comparison - 2018 Routine vs. 2019 WSIP | | |
|---|----------------------------------|------------------|
| Distribution OH Inspections | 2018 Routine (GO 165) | 2019 WSIP |
| Poles Inspected | 456,008 | 694,250 |
| Total Inspection Spend | \$ 10,787,076 | \$149,263,750 |
| Inspection Unit Cost | \$ 23.66 | \$ 215.00 |
| Total Tags generated | 37,946 | 176,949 |
| Tag Find Rate (per pole inspected) | 8.3% | 25.5% |
| Inspection Cost per Finding | \$ 284.27 | \$ 843.54 |
| Total A Tags | 724 | 738 |
| Total B Tags | 1,752 | 7,920 |
| Total E Tags | 18,834 | 162,958 |
| Total F Tag | 16,636 | 5,333 |

TABLE 7 – COST AND FINDINGS COMPARISON FOR TRANSMISSION INSPECTIONS

| Cost Comparison - 2018 Routine vs. 2019 WSIP | | |
|---|--------------------------------------|------------------------|
| Transmission OH Inspections | 2018 Ground Inspections (all) | 2019 WSIP (all) |
| Structures Inspected | 70,278 | 99,520 |
| Total Inspection Spend | \$ 7,965,294 | \$ 237,331,454 |
| Inspection Unit Cost | \$ 113.34 | \$ 2,384.76 |
| Total Tags generated | 9,307 | 97,090 |
| Tag Find Rate (per structure inspected) | 13.2% | 97.6% |
| Inspection Cost per Finding | \$ 855.84 | \$ 2,444.45 |
| Total A Tags | 30 | 125 |
| Total B Tags | 469 | 8,013 |
| Total E Tags | 7,989 | 77,214 |
| Total F Tag | 819 | 11,738 |

CONDITION PGE-25

**LACK OF DETAIL ON PLANS TO ADDRESS PERSONNEL
SHORTAGES**

Deficiency: PG&E has experienced personnel shortages that have had an impact on its wildfire mitigation initiatives, and particularly on VM. During the February 2020 workshops and in its WMP, PG&E has expressed concern regarding talent/workforce shortages for VM. Considering its extensive VM work scale and scope, PG&E does not explicitly discuss a recruitment strategy, which will be critical to its completion of these initiatives. It is important for PG&E to document that it is not trying to mitigate its personnel shortages simply by hiring away workers from other electrical corporations; such a practice will not reduce the state's overall personnel shortages.

Condition: *PG&E shall develop and furnish an RCP that includes:*

- i. a description of its recruitment and training for VM talent and how it plans to address this constraining factor in scaling its VM programs;*

RECRUITING

In the 2020 WMP, PG&E described the increase in pre-inspection workforce to complete its 2019 goals and the subsequent training given to all pre-inspectors brought onboard. PG&E was able to increase contract staff, both pre-inspectors and tree crews, in 2019 from approximately 2,000 to over 5,000 people. PG&E was able to recruit qualified, contract personnel and not only complete, but exceed, the 2019 Enhanced Vegetation Management (EVM) goal. PG&E has continued to utilize these contract personnel to stay ahead of pace for the 2020 EVM goal. We have scrutinized the workforce to identify the most effective contract employees to be successful for subsequent years. PG&E has also worked to build more effective EVM work processes and management to limit the future need to ramp up the workforce so drastically and allow the current workforce to be more efficient. PG&E VM has increased its internal workforce from approximately 75 people in 2018 to over 115 in 2020, with a constant focus on the most appropriate workforce, in skills and volume, to meet all VM goals.

To maintain the long-term workforce necessary to meet PG&E's VM goals we have several efforts underway. PG&E, in partnership with International Brotherhood of Electrical Workers and educational institutions, including the Butte-Glenn Community College District, has established a training program designed to provide the skills and knowledge necessary to perform tree crew work safely and competently. The Tree Crew Training Program will provide both classroom and in-the-field instruction, which will focus on safety, climbing, and line clearance qualifications. The pilot class started

on June 22, 2020 and should help build interest in the program for subsequent courses scheduled later in 2020 and 2021. The goal of this training program is to increase the availability of certified tree crew workers in the industry to help PG&E's VM-related wildfire risk mitigation efforts, and to create a curriculum that could be given by any educational institution for higher learning.

PG&E is also working on a Pre-Inspector Training and Certificate Program, in partnership with educational institutions of higher learning (our first partnership is with the University of Wisconsin) and the Utility Arborist Association. It will establish a training program designed to provide the skills and knowledge necessary to perform pre-inspector work safely and competently. The Pre-Inspector Training Program will provide both classroom and in-the-field instruction and should begin building curriculum in July 2020 with classes to start near the beginning of 2021. Those who successfully complete the program will receive a certificate and support in obtaining International Society of Arboriculture certification. The goal of this initiative is to increase the availability of certified pre-inspectors in the industry to help PG&E's VM-related wildfire risk mitigation efforts.

PG&E's VM works with its internal Human Resources (HR) team to recruit the appropriate personnel and develop bench strength to support the team. This includes working with our HR team to develop job descriptions, define responsibilities and qualifications for the appropriate job levels, post positions internally and externally, and ensure a panel review of prospective candidates. PG&E's VM department regularly sources qualified talent for internal positions from the current contract staff who usually have been working in the industry and for PG&E for some time. The Tree Crew and Inspector Training programs should ensure that a pipeline of qualified personnel are being trained appropriately to eventually be join PG&E's VM efforts as either contractors or internal support.

TRAINING

Pre-Inspectors

PG&E has implemented a nine-course, comprehensive pre-inspector training program (see Attachment 1 for PGE-25) for all pre-inspectors that includes web-based training, scenario-based skills assessments, on-the-job training, and mentoring relationships with experienced pre-inspectors. Pre-inspectors are required to pass scenario-based skills assessments that test key concepts covered in the training

program, and experienced pre-inspectors will be paired with new pre-inspectors to provide on-the-job trainings and serve as mentors and resources during the pre-inspector's first year of training. This training includes a module devoted entirely to PG&E's EVM program and is thus also a requirement for contractors performing EVM inspections. Contract pre-inspectors must also pass an assessment in order to work as a pre-inspector contractor for VM within PG&E.

Tree workers

PG&E expects its tree work contractors to provide training to their staff on all things necessary to be successful and safe in the tree worker industry. PG&E offers training to individuals who will be utilizing PG&E's inventory system to ensure they understand how to utilize the tools they are expected to employ, as well as allow the contractors to better understand the process in which to ask follow-up questions or receive technical support. PG&E also ensures yearly compliance and training for Contractor Safety Program Requirements (SAFE-0101).

Tree work—which generally involves tree pruning, tree removal and brush removal—is a highly dangerous line of work that requires extensive training and on-the-job experience to perform properly and safely, even without the threats posed by energized powerlines. To minimize these risks, federal and California law prescribe comprehensive safety, training and knowledge requirements for tree workers generally, as well as specific requirements for tree workers performing work around energized lines, including requirements to possess and know how to use specialized equipment, to adhere to specific safety procedures and to maintain minimum approach distances from energized lines. [See 8 [CCR §§ 2940.2, 2950 2951, 3420 3428](#); 29 C.F.R. §§ [1910.269](#)(a)(2), (r) for examples.] Particular kinds of removal and trimming operations that involve climbing trees or the use of cranes may require additional levels of training and experience. [See, e.g., 8 CCR 3427(a)(1)(B).]

PG&E's contractors have expended significant resources to identify, train, manage, equip and deploy appropriately qualified personnel who can perform tree work safely and meet the line clearance needs of PG&E and other electric utilities. PG&E requires in its contracts that tree workers be appropriately trained and meet all regulations to perform tree work activities in proximity to high voltage conductors (see Attachments 2 and 3 for PGE-25). PG&E also utilizes safety personnel to perform assessments on tree crew employees to ensure all safety measures are followed and will shut crews

down if deficiencies are found. In these cases, tree crew employees will not be allowed to return to work until the contractor can demonstrate the deficiencies have been remedied by training or another means to mitigate the issue.

ii. a description of its strategy for direct recruiting and indirect recruiting via contractors and subcontractors; and

With the passage of Senate Bill 247 and the continued steady workload in 2020, PG&E has retained the appropriate amount of qualified tree crew personnel with no current staffing challenges. PG&E's direct recruiting is described above in subpart (i).

With regard to contractors and subcontractors, in 2020, PG&E was able to recruit more contract pre-inspectors and tree crew personnel than it has ever had and currently maintains the appropriate personnel to meet the resource demands to achieve all VM programs for the remainder of 2020 and subsequent years.

When additional contract resources or skills are needed the VM team works with its Sourcing and other line of business partners to ensure that Requests for Proposals are well-defined and communicated to a wide group of industry leading VM contractors.

For VM services, PG&E works with the contractors to ensure their performance enables compliance with GO 95, California Public Resources Code Sections 4292 and 4293, Resolution ESRB-4 and Federal Agency Code 003-4. PG&E also directly recruits contractors that have significant industry experience and good standing with both State and Federal Environmental laws. PG&E reviews and approves any subcontractors, that a prime contractor would like to hire, in order to give authority for that subcontractor to work on any of PG&E's VM programs.

PG&E is in the midst of changing the contracting model it uses for its VM program. The new model will be a "Defined Scope" model where a single VM company will be responsible for all routine patrols and tree work along a specific circuit or grouping of circuits, and a separate VM company will be responsible for CEMA work across PG&E's whole distribution system. This new contractor strategy will ensure that PG&E aligns its contractor capabilities with its VM program strategies and needs.

Under the Defined Scope model, both pre-inspection and tree work will be completed by a single vendor that will apply its expertise to determine the most efficient and effective way to complete the work along its assigned circuit(s). This will allow the responsible vendor the flexibility to determine the level of resources needed to complete

the work, as well as the best method to complete the work, instead of PG&E requiring an assumed resource level.

In addition, PG&E's VM team routinely attends industry conferences and participates with industry leaders to share ideas about what PG&E is doing and gather best practices from others. PG&E leverages networking opportunities to meet qualified vendors and assess potential partnerships. PG&E's VM team works closely with its counterparts at the other California utilities and shares numerous best practices, including those related to the recruitment and management of contractors.

iii. Metrics to track the effectiveness of its recruiting programs, including metrics to track the percentage of recruits that are newly trained, percentage from out of state, and the percentage that were working for another California utility immediately prior to being engaged by PG&E. PG&E may file confidential information under seal so long as PG&E justifies its claim that the material requires such protection.

PG&E was able to increase both pre-inspection and tree crew contract staff in 2019 from approximately 2,000 to over 5,000 personnel, thereby illustrating recruiting effectiveness. In terms of the additional metrics specified in this subpart:

- All pre-inspector contractors must complete the Structured Learning Path Program starting in March of 2020. All tree crew vendors confirmed all new personnel (100%) are trained on PG&E SAFE-0101 (Contractor Safety Program Requirements) before starting work for PG&E. Starting in August 2020, PG&E will track all Occupational Safety and Health Administration requirements in a third-party tracking program known as ISNetWorld.
- As of June 2020, approximately 8 percent of pre-inspector and tree crew contract employees are from out of state.
- As of June 2020, approximately 24 percent of contract employees had been or were working for another California utility prior to being hired by PG&E.

CONDITION PGE-26
EFFECTIVENESS OF INCREASED VEGETATION CLEARANCES

Deficiency: PG&E has numerous VM programs focused on complying with existing requirements as well as “enhanced” VM focused on “at-risk” species and fuel management work. Based on its responses to the Utility Survey, PG&E plans to increase the frequency of vegetation inspections while continuing to schedule them as schedule- and static-map based, and inspection checklists will remain compliance-based. As PG&E’s VM programs grow in scope, it provides little discussion or evidence of the effect of increased vegetation clearances on utility ignitions

Condition: *PG&E shall submit an RCP with a plan for the following:*

- i. Comparing areas with and without enhanced post trim clearances to measure the extent to which post-trim clearance distances affect probability of vegetation caused ignitions and outages.*

PG&E faces significant wildfire challenges because of the size and geography of its service area. PG&E serves approximately 5.5 million electric customers across a service territory of approximately 70,000 square miles, more than half of which is included in HFTD areas.

Before and After Comparison

PG&E will perform an analysis to compare circuit span ignitions and outages prior to EVM work and ignitions after EVM work was completed. The plan is for ignition and outage data used prior to EVM work performed to go back to 2014 and consider HFTD areas only. The plan will consider outages and ignitions that happen year-round, instead of assuming a fire season timeline, and the focus will be on distribution circuits.

Geospatial analysis will be performed by overlaying outages and ignitions over completed EVM clearance work. Pre-enhanced analysis will be done to determine quantifiable outage/ignition baseline data in current and potential EVM affected areas. After EVM work has been completed, the plan is to compare results of outage/ignition data between pre and post to determine effectiveness probability of enhanced clearance work. The plan is for the analysis to be a multi-year study with ongoing implementation to understand results and make necessary changes if needed. The study started in January 2019, and it is expected to take three years before there is sufficient data to determine effectiveness probability of enhanced clearance work.

EVM Effectiveness Model

In addition to the analysis described above, as part of PG&E's RAMP filing, PG&E conducted an analysis to estimate the potential effectiveness of the EVM program looking at five years of data (2015-2019). Over the last five years, there has been an average of 451 ignitions per year associated with PG&E's facilities, the vast majority of which have been small and did not result in damage to structures. The leading causes of these ignitions have been equipment failure, vegetation contact with overhead lines, animal contact, and third-party contacts (such as vehicles running into utility poles). Overall, the vegetation risk driver accounted for approximately 26 percent of the average annual number of ignitions systemwide, and 45 percent of the average annual number of ignitions in HFTD areas.

Leveraging subject matter expertise evaluating five years of data, our analysis indicates with EVM, PG&E's vegetation-caused outage and ignition risk has been reduced by just over 20 percent, depending on the relevant sub-driver type and the proportion of past outages attributed to them (see highlighted sub-drivers below).

EVM continues to be a prudent investment in mitigating vegetation-based ignitions, the largest ignition cause in the HFTD areas of PG&E's service territory. EVM can be deployed more quickly and over a wider area than System Hardening. The EVM program continues to evolve as PG&E evaluates the effectiveness of the various activities that make up the program. As a result, PG&E may adjust the proposed scope and pace of the program in future WMP proceedings and/or the 2023 GRC.

TABLE 8 – VEG CAUSED OUTAGES & REDUCTION EFFECTIVENESS OF EVM

| Vegetation -Subdriver | Outages Count | Weight (%) | Effectiveness | Wt * Effectiveness |
|--|---------------|----------------|---------------|--------------------|
| Branch (Not overhanging, > 12ft) | 200 | 1.34% | 0% | 0.00% |
| Branch (Not overhanging, 4-12ft) | 90 | 0.60% | 50% | 0.30% |
| Branch (Not overhanging, Distance Unknown) | 703 | 4.72% | 0% | 0.00% |
| Branch (Not overhanging, within 4ft) | 38 | 0.26% | 90% | 0.23% |
| Branch (OverHanging) | 1,810 | 12.16% | 90% | 10.94% |
| Dead | 733 | 4.92% | 0% | 0.00% |
| Fell into (Moderate-Severe defect) | 771 | 5.18% | 95% | 4.92% |
| Fell into (No defect) | 5,160 | 34.66% | 0% | 0.00% |
| Fell into (slight defect) | 1,027 | 6.90% | 50% | 3.45% |
| Grow Into | 75 | 0.50% | 50% | 0.25% |
| Other/Unknown | 4,281 | 28.75% | 0% | 0.00% |
| Grand Total | 14,888 | 100.00% | | 20.09% |

Notes on Table

- Table includes vegetation-caused overhead sustained outages from last five years (2015-2019) year-round, and not just summer months.
- Weight Percent = The proportion of outage count attributed to the driver (e.g., 4.92% of vegetation-caused outages were caused by dead trees).
- Effectiveness = The estimated percent of outages in each sub-driver that would have been prevented had EVM been performed on that line segment (e.g., EVM will reduce the 1,810 Branch Overhanging outages to just 181).

Vegetation risk sub-model

Finally, PG&E has been working on developing a Vegetation risk sub-model (as referenced in our response in Condition Guidance-3), which employs a portfolio of variables as inputs to produce an annual probability of ignitions, outages, and wire-down events. This is accomplished by way of a multi-variable regression trained on past ignitions, outages, and wire-down events. The goal of this vegetation risk sub-model is to predict where events are more likely to occur during the year and provides granularity at the 100-square-meter level.

These probabilities are then combined with wildfire spread consequence, outage reliability and other consequence data sets at the same granularity. This results in MAVF risk scores at the 100-square-meter pixel level along the circuit. At this level, the aim is to develop mitigations based on failure mode modeling insights, risk reduction, and RSE calculations to target the correct vegetation mitigations for the location. Identified mitigations can then be grouped along circuits to maximize efficiency. As EVM work is completed, the model inputs are adjusted, allowing for the measure of the risk draw-down over time for each span, and for the circuit, region and electric system as a whole.

ii. Collaborating with Southern California Edison Company (SCE) and San Diego Gas & Electric Company (SDG&E) in accordance with SCE-12 and SDG&E-13 to develop a consensus methodology for how to measure post-trim vegetation clearance distance impacts on the probability of vegetation caused ignitions and outages.

Initial meetings were conducted between SCE, PG&E, and SDG&E on June 19, 2020 and June 26, 2020 to discuss a strategy and potential timetable for determining a methodology for how to measure post-trim vegetation clearance distance impacts on

the probability of vegetation caused ignitions and outages. The initial meeting revealed at a high-level, the strategies for evaluating pre and post enhanced clearances was very similar across all three utilities and all agreed it would be a multi-year effort to determine a consistent and sustainable methodology. Meetings will continue on a weekly basis to share results from each utility and continue to refine the process. The weekly meetings will continue at least until the Class A RCP has been delivered and then subsequent meetings will occur at less frequent intervals further refining the consensus approach to turn plans into action.

The plan is detailed below:

- The three utilities have agreed upon a Plan to utilize the Before and After Comparison model for measuring pre- and post-enhanced clearance data (see above “Before and After Comparison” model for details):
 - Pre enhanced clearance data analysis of outage and ignition data;
 - Plan is to have data going back to 2014 across all utilities;
 - Post enhanced clearance data analysis to reveal any outages or ignitions:
 - Plan is to have data going back to 2019 across all utilities;
 - Compare results of outages/ignitions pre enhanced clearance work and post:
 - Plan is to identify quantifiable results to illustrate effectiveness probability;
 - Percentage calculated on interval basis and/or composite score generated:
 - Plan is a 6-month frequency trending analysis shared across all utilities;
 - Plan is to also share lessons learned across three utilities as well;
- Agreement that this will be a multi-year analysis before results accurately quantifiable
- Agreed upon assumptions by all utilities for:
 - Plan is for data to be year-round, instead of “fire-season” only;
 - Plan is to only utilize the HFTD Tier 2 and 3 areas only; and
 - Plan is to focus on Distribution, but Transmission can be added where appropriate.

The plan is to focus on clearances only to satisfy the condition, but additional tree work can be included as well to illustrate effectiveness (e.g., hazard tree removals).

CONDITION PGE-27
PUBLIC SAFETY PARTNER COORDINATION

Deficiency: Poor preparedness and interaction with cities, counties, tribal governments and first responders are areas of continued weakness for PG&E, before, during and after a wildfire and during the 2019 PSPS events. In one sentence, PG&E states it does coordinate, but additional explanation is needed on how its Public Safety Specialists (PSS) work with counties and incident management teams.

Condition: *PG&E shall submit an RCP that does the following:*

i) *Provide an updated “coordination with public safety partners” plan that details precisely how PG&E works with cities, counties, tribal governments, incident management teams, and other first responders;*

PG&E’s response to this subpart of Condition PG&E-27 focuses on the specific stakeholder groups identified in the Condition (cities, counties, tribal governments, incident management teams, and other first responders), recognizing that the definition of public safety partner is broader than the entities identified in the Condition (e.g., public safety partners can include water, wastewater and communication service providers, affected community choice aggregators, and publicly-owned utilities/electrical cooperatives).

We are working closely with local and tribal officials, including emergency managers and first responders, to better coordinate on PSPS preparedness efforts. Following the 2019 PSPS events, we have engaged with public safety partners through a variety of outreach channels. This includes, but is not limited to:

- PSPS Listening Sessions
- Wildfire Safety Working Sessions
- PSPS Advisory Committee Meetings
- Regional Working Groups
- PSPS Full-Scale Exercises
- Ongoing Outreach and Coordination

Below is an overview of each part of our outreach plan, which is also, in part, discussed in *PG&E’s Bi-weekly Corrective Action Report in Compliance with January 30,2020 Assigned Commissioner’s Ruling* (Corrective Action 2: Coordination with Counties and Tribal Governments) submitted in Rulemaking 18-12-005, as well as PG&E’s 2020 WMP (Section 5.3.9 Emergency Planning and Preparedness, pp. 5-235 – 5-237; and Section 5.3.9.2 Community Outreach, Public Awareness, and Communications Efforts, pp. 5-240 – 5-241).

PSPS Listening Sessions

In November 2019, PG&E began outreach to the local and tribal governments impacted by the 2019 PSPS events to schedule in-person listening sessions with PG&E leadership. These sessions provided an open forum for PG&E to listen to concerns, gather important feedback and identify ways to improve coordination and partnership with local communities going forward. The feedback is being used to guide improvements to our PSPS processes and procedures and helped prioritize key focus areas for 2020 (see Attachment 1 for PGE-27).

In all, we have completed 36 listening sessions with counties, cities and tribal governments. Eleven counties that were invited declined to participate and six counties (Lassen, Sacramento, San Francisco, San Luis Obispo, Santa Barbara, and Tulare) were not impacted by a 2019 PSPS event.

Wildfire Safety Working Sessions

Following the PSPS Listening Sessions, starting in May 2020, we began reaching out to tribes and the 47 counties in our service territory to partner with us to host Wildfire Safety Working Sessions for local agencies and organizations. The purpose of these 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 for 2020. During these sessions, we reviewed the following:

- The steps PG&E is taking to reduce the risk of wildfire and PSPS impacts in 2020
- PG&E's 30-year weather analysis and what it means for the local community
- PG&E's improved PSPS information sharing, coordination tools and resources

These sessions also provided an opportunity for local officials to discuss their needs and suggest any further improvements to the Community Wildfire Safety Program (CWSP) and PSPS program prior to wildfire season.

As of July 7th, we have completed sessions with 31 counties with four additional sessions scheduled. Three counties declined to meet. We anticipate completing these sessions in mid-July (see Attachment 2 for PGE-27).

PSPS Advisory Committee

PG&E also established a PSPS Advisory Committee comprised of six rural and urban counties, two tribal agencies, and representatives from the League of California Cities and California State Association of Counties (CSAC). Through the Committee, PG&E obtains focused input, solicits recommendations and gathers feedback regarding

PSPS improvements from a targeted group of county/tribal agencies impacted by the 2019 PSPS events.

The advisory committee has met five times to date on March 5, April 1, April 8, May 27, and July 2nd. Representatives of the Committee include:

TABLE 9 – PSPS ADVISORY COMMITTEE

| JURISDICTION | INVITEE |
|-----------------------------|---------|
| Butte County | |
| Kern County | |
| Placer County | |
| Placer County | |
| Santa Cruz County | |
| Sonoma County | |
| Sonoma County | |
| Sonoma County | |
| City of Santa Rosa | |
| Marin County | |
| Marin County | |
| Hopland Tribe | |
| Robinson Rancheria | |
| League of California Cities | |
| League of California Cities | |
| CSAC | |

Regional Working Sessions

Following the Wildfire Safety Working Sessions, PG&E will establish Regional Working Groups that include local government entities, public safety partners, representatives of Access and Functional Needs and other communities. These sessions will be hosted quarterly to provide agencies with an opportunity to share lessons learned and provide PG&E with feedback on how to refine the process for future PSPS events.

Full-Scale PSPS Exercises

We are hosting three regional, full-scale PSPS planning exercises with participation from local and tribal emergency managers between June and August to test our procedures and tools. Below is a list of the regions, dates and counties for each exercise.

TABLE 10 – FULL-SCALE PSPS PLANNING EXERCISES

| REGION | DATE | COUNTIES |
|----------------|----------------------------|---|
| South | 06/24-06/26 (completed) | Fresno, Kern, Kings, Monterey, San Benito, San Luis Obispo, Santa Barbara, Tulare |
| Central | 07/15-07/17 (completed) | Alameda, Alpine, Amador, Calaveras, Contra Costa, Madera, Mariposa, Merced, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, Stanislaus, Tuolumne |
| North | 08/03-08/07 | Butte, Colusa, El Dorado, Glenn, Humboldt, Lake, Lassen, Marin, Mendocino, Napa, Nevada, Placer, Plumas, Shasta, Sierra, Siskiyou, Solano, Sonoma, Sutter, Tehama, Trinity Yolo, Yuba |

We are using the Homeland Security Exercise and Evaluation Program framework and support from a third-party vendor, CADMUS, to design the PSPS exercises.

Ongoing Outreach and Coordination

In addition to the outreach listed above, PG&E conducts ongoing outreach and engagement with local and tribal emergency managers and other first responders through a myriad of actions.

Local PSS conduct outreach efforts through a variety of engagements with members of law enforcement, fire response agencies, and county emergency managers. These efforts include a variety of activities, such as professional group meetings, gas/electric safety training, emergency preparedness exercises, and Agency Representative support at field-based emergencies and PSPS events. PSS members also regularly work in close collaboration with their respective County Fire Chief's Associations, attend California Office of Emergency Services (Cal OES) coordinated Mutual Aid Regional Advisory Committee meetings and regularly participate in California Department of Forestry and Fire Protection (CAL FIRE) and Federal Incident Management Team annual workshops.

Additional PG&E Representatives also regularly support outreach and engagement efforts with their respective stakeholders, including but is not limited to, local and tribal elected and staff, customers, access & functional needs advocacy organizations, regulatory stakeholders and other utilities.

ii) Include the experience level of its employees that conduct the interaction in emergency management or other public safety functions;

As of June 15, there are 26 PSS and three supervisors assigned to PG&E's Emergency Preparedness and Response, Field Operations organization. Each team member has extensive public safety experience, prior to having been employed by PG&E. Twenty-five (25) of the team members were members of a fire agency, three (3) were members of law enforcement and one (1) was an emergency services manager. All served within the state of California and the average tenure of their professional public safety experience is 30 years before joining PG&E. Several are former CAL FIRE and Federal Incident Management Team members with years of experience functioning in Type 1 Command and General Staff positions. These experiences are in addition to the respective gas, electric and wildfire safety training and engagement PSS Representatives have participated in since becoming employed with PG&E.

PG&E can provide brief biographic information for each member of our team upon request.

All PG&E employees with an assigned role during a PG&E Emergency Operations Center (EOC) activation are required to complete the following five courses on Standardized Emergency Management System (SEMS):

- IS-100.C – Introduction to Incident Command
- IS-200.C – Basic Incident Command System for Initial Response
- IS-700.B – An Introduction to the National Incident Management System
- IS-800.C – National Response Framework, an Introduction
- SEMS G606 – Standardized Emergency Management Introduction

iii) 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;

Every PG&E representative has a specific role and audience they engage with. Below is a description of the types of engagement the Public Safety Specialist, Tribal and Local Public Affairs Representatives are responsible for before, during and after a PSPS event:

TABLE 11 – PSPS INTERACTIONS BY ROLE

| Public Safety Specialist | | |
|---|--|---|
| <i>Planning</i> | <i>During a PSPS</i> | <i>After a PSPS</i> |
| <ul style="list-style-type: none"> • Lead outreach to County OES and other emergency responders • Schedule and host Wildfire Safety Working Sessions, tabletop/full-scale exercises, etc. • Coordinate closely with Local Public Affairs and Tribal Agency Reps | <ul style="list-style-type: none"> • Serve as agency representative (single point of contact) for each impacted County OES • Execute and track live calls • Complete twice-daily operational areas cooperators communications • Distribute situation reports/materials • Resolve local issues • If an OEC opens in response to another emergency, takes lead in communicating with the agency • Attend PG&E EOC Liaison prep call for updates • Deploy to local EOCs, if requested | <ul style="list-style-type: none"> • Schedule and attend listening sessions with impacted counties • Conduct ongoing outreach to County OES |
| Tribal Representatives | | |
| <i>Planning</i> | <i>During a PSPS</i> | <i>After a PSPS</i> |
| <ul style="list-style-type: none"> • Lead outreach to Tribal Emergency Managers/ contacts and leadership • Invite tribes and attend Wildfire Safety Working Sessions, tabletop/full-scale exercises, etc. • Coordinate closely with Local Public Affairs and PSS | <ul style="list-style-type: none"> • Serve as agency representative (single point of contact) for each impacted tribal emergency manager/contact and leadership • Execute and track live calls • Complete once-daily tribal cooperators call • Distribute situation reports/materials • Resolve local issues • Attend Liaison Field Rep Prep-Call for updates • Deploy to local tribal EOCs, if requested | <ul style="list-style-type: none"> • Schedule and attend listening sessions with impacted tribes • Conduct ongoing outreach to tribes |

**TABLE 12 – PSPS INTERACTIONS BY ROLE
(CONTINUED)**

| Local Public Affairs |
|-----------------------------|
|-----------------------------|

| <i>Planning</i> | <i>During a PSPS</i> | <i>After a PSPS</i> |
|--|---|--|
| <ul style="list-style-type: none"> • Lead outreach to government elected officials and staff • Attend and support Wildfire Safety Working Sessions and other meetings, as needed • Coordinate closely with PSS and Tribal Agency Reps | <ul style="list-style-type: none"> • Serve as single point of contact for government elected officials and staff (excluding County OES) • Serve as single point of contact for city emergency management leads • Provide backup support to agency reps (ex: if there are multiple events at the same time) • Attend Liaison Field Rep Prep-Call for updates | <ul style="list-style-type: none"> • Attend listening sessions with impacted counties • Conduct ongoing outreach to government elected officials and staff |

For a list of these PG&E Representatives and their contact information, see Attachment 3 for PGE-27.

iv) Provide any existing logs or other documents PG&E keeps of its interactions with cities, counties, tribal governments and first responder entities dating back to the beginning of 2020 and on a continuing basis, without redactions. To the extent PG&E does not track this information, PG&E shall provide the following dating back to the beginning of 2020 and on a continuing basis: date of contact, name of department or organization in which individual(s) work, purpose of contact and content of contact. PG&E may file confidential information under seal so long as PG&E justifies its claim that the material requires such protection;

PG&E tracks the engagements of our Public Safety Specialist, Tribal and Local Public Affairs Representatives with cities, counties, tribes and first responders, as well as all requests for information received by PG&E Representatives from stakeholders, through the trackers listed below. Please note that the trackers include information as of January 1, 2020.

- **Community Wildfire Safety Program (CWSP) Master Engagement Tracker:**
This tracking document contains information regarding engagements conducted by all PG&E Representatives that are related to CWSP with cities and counties. This includes one-on-one meetings, conference calls, events, workshops and other functions where PG&E Representatives have a main or substantial role in educating, answering questions or coordinating with stakeholders (see Attachment 4 for PGE-27).

- **Response Tracker:** This tracking document contains information regarding responses to a stakeholder. Stakeholders may request information during meetings with PG&E Representatives through meetings, calls, emails and formal letters (see Attachment 5 for PGE-27).
- **Emergency Management and Public Safety Team Engagement:** This tracking document contains information regarding engagements conducted by PSS with emergency management representatives (see Attachment 6 for PGE-27).
- **Local Public Affairs City/County Engagement Tracker:** This tracking document contains information regarding engagement conducted by Local Public Affairs Representatives with city and county elected and staff such as one-on-one meetings, conference calls, events, workshops and other functions where PG&E representatives have a main or substantial role in educating, answering questions or coordinating with stakeholders (see Attachment 7 for PGE-27).
- **Community Resource Center (CRC) Coordination:** In January and February 2020, PG&E Representatives began communicating with county OESs and tribes to identify potential CRC sites and continue coordinating on CRC operations. The tracking document found in the appendix contains the outreach status. This differs from general CWSP meetings in that PG&E Representatives are specifically communicating with partners regarding CRCs only (see Attachment 8 for PGE-27).
- **PSPS Information Coordination:** In May 2020, PG&E Representatives began communicating with cities, counties and tribes to: (1) confirm we have the correct contact information for agency notifications during a PSPS event; (2) review the list of PSPS Portal users; and (3) verify PG&E's critical facilities lists for their jurisdictions. This coordination is ongoing, and the tracking document found in the appendix contains the outreach status. This differs from general CWSP outreach in that PG&E Representatives are specifically coordinating with county OES and tribes regarding PSPS operations (see Attachment 9 for PGE-27).
- **Temporary Microgrid Substation Engagement:** In June 2020, PG&E Representatives began communicating with cities, counties and tribes with PG&E substations in their jurisdiction that currently being prepared to receive temporary generation. This outreach is to inform the communities and coordinate on project logistics. This tracking document contains the outreach status (see Attachment 10 for PGE-27).

- **Meeting Summary Forms:** The attached meeting summaries contain information regarding participants, organizations, titles, purpose of contact and summary of the contact made. Correspondence such as emails, letters or verbal requests for information or resources are also tracked and the content is recorded, along with the jurisdictional contact's information and eventual response (see Attachment 11 for PGE-27).

PG&E also utilized meeting summary forms to track feedback and action items from the PSPS Listening Sessions and Wildfire Safety Working Sessions. Meeting summary forms for larger events typically include attendance sheets, such as the attendance sheets from our Wildfire Safety Working Sessions (see Attachments 1 and 2 for PGE-27).

- v) ***Detail its process for logging all complaints by PG&E employees or their public sector counterparts about poor or problematic interactions between PG&E and their counterparts;***

There are multiple avenues through which PG&E encourages employees and public sector counterparts to provide feedback regarding its engagement and outreach. This includes:

- **CPUC Proceedings:** As the CPUC is the chief regulatory agency with oversight over PG&E activities, formal complaints regarding PG&E's programs and actions can be filed with the CPUC and resolved through formal hearings.
- **PG&E Employee Inbox:** PG&E employees can send any type of feedback (i.e., comments, questions, concerns, complaints) to a dedicated employee email address.
- **After Action Reviews:** PG&E conducts an internal After-Action Review with employees after each PSPS season to discuss what improvements need to be made for future PSPS events.
- **Letters/Emails:** Stakeholders may submit feedback to PG&E regarding outreach and engagement, among other issues, through letters or email transmittals. All letters/transmittals are recorded, logged and responded to, as needed (see Attachment 5 for PGE-27).
- **Listening Sessions/Working Sessions:** The PSPS Listening Sessions we held and Wildfire Safety Working Sessions we are currently holding are also avenues for

our public sector counterparts to provide feedback to PG&E (see Attachments 1 and 2 for PGE-27).

vi) Provide a description of all complaints logged to date that meet the criteria in (iv); and

For a log of feedback received from letters and emails from public sector counterparts about interactions between PG&E and their counterparts, please see Attachment 12 for PGE-27. In addition, please see Attachment 13 for PGE-27, re: PG&E Outreach for feedback received from employees. Please note that both logs include data as of January 1, 2020.

vii) Provide a description of how PG&E surveys public safety partners to ensure its interactions are constructive and useful.

PG&E uses several methods of communication to ensure our interactions with public sector counterparts are constructive and useful. With counties, incident management teams and first responders in particular, PSS members maintain ongoing, interpersonal dialogues with their respective public sector counterparts and are assigned regionally to provide optimal outreach accessibility, relationship consistency and local-issue familiarity. Ongoing engagement and collaboration enable PSS members to become aware of issues and concerns of our partners while providing opportunities for timely process improvement.

From November 2019 through the beginning of 2020, we surveyed our public safety partners during the PSPS Listening Sessions about any and all improvements we could make to better communicate and coordinate with them before and during PSPS events (see Attachment 1 for PGE-27). We continue to survey impacted counties regarding any and all improvements to coordination, communications and processes related to the PSPS program via the PSPS Advisory Committee meetings, Wildfire Safety Working Sessions and regular interactions conducted by PG&E Representatives with their designated city, county, tribe or agency.