Pacific Gas and Electric Company

2022 Wildfire Mitigation Plan

Response to Revision Notice

RN-PG&E-22-04
RN-PG&E-22-09

July 26, 2022

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Critical Issue RN-PG&E-22-04

Critical Issue Title: PG&E does not provide planned undergrounding locations beyond 2023 and does not adequately demonstrate that it is currently prepared to meet its ambitious undergrounding goals

Required Remedies:

1. *PG&E must provide an update of its planned undergrounding projects in 2024, following a similar format as PG&E-21-14 from the 2021 WMP Final Action Statement. This should be in the form of a spreadsheet with the following information:*

    - *Location*
    - *Status of the project (scoping, design permitting, etc.)*
    - *Relevant Circuit Protection Zones (CPZs)/Risk Score*
    - *Circuit ranking based on 2021, 2022, and 2023 risk model output*
    - *Measured effectiveness of ignition risk reduction projected to result from undergrounding at that circuit segment*
    - *Planned length*
    - *Risk-type identified for prioritization of the project (top 20 percent of risk buydown curve, fire rebuild, PSPS mitigation, public safety specialist identified, or non-risk related, or combination of the proceeding).*

Response to Critical Issue RN-PG&E-22-04 Remedy #1

Please see Attachment 2022-07-26_PGE_22-04_RNR_R3_Atch01CONF or 2022-07-26_PGE_22-04_RNR_R3_Atch01_Redacted for our response to Critical Issue RN-PG&E-22-04 Remedy #1.

The attachment provides data from our updated 2023 undergrounding workplan, as well as data for the undergrounding work that we anticipate completing from 2024-2026.[1] The data is accurate as of June 13, 2022, which is when the information was pulled from our internal databases to create the attachment.

[1] Attachment 2022-07-26_PGE_22-04_RNR_R3_Atch01CONF or 2022-07-26_PGE_22-04_RNR_R3_Atch01_Redacted also identifies a small amount of overhead hardening and line removal work contained in hybrid system hardening projects involving undergrounding work.

Below, we provide an overview of each of the requested categories of information in the attachment and provide additional context regarding the information. We also provide a description of the undergrounding work that is planned for execution from 2023-2026.

(a) Summary of Attachment Information

1. Location: Columns M-Q provide the location information for these undergrounding projects. We include the PG&E region as well as the cities, counties, and latitude and longitude coordinates.

2. Status of Project: Column E provides the status of each project, as defined in Tab 2 of the spreadsheet. Please note that most of the mileage planned for 2024-2026 is in the pre-scoping phase. PG&E will take into account locations where constructability, including but not limited to, permitting, land rights and community impacts are most optimal, when scoping undergrounding work projects in the 2024-2026 tranche of mileage.

3. Relevant CPZ and Risk Score: Columns R and U provide the CPZ for each undergrounding project identified. Columns T and W provide the mean risk score for each circuit segment based on Version 2 or Version 3 of the Wildfire Distribution Risk Model (WDRM).

4. Circuit Ranking: Based on guidance from Energy Safety, we understand that this subpart asks for the CPZ risk ranking for each project for the year the work is planned to be completed. Undergrounding work planned for 2021-2023 was based on the 2021 WDRM v2 and the 11-year PSPS lookback. For purposes of this response, we provide the 2021 WDRM v2 risk rankings for the years 2021-2023 in Column S. Work planned for 2024-2026 was primarily informed by the 2022 WDRM v3 and a simplified risk spend efficiency (RSE)[2] to help prioritize and bundle undergrounding projects.[3] We provide the risk ranking from the 2022 WDRM v3 in Column V.

5. Measured Effectiveness: PG&E's subject matter experts estimate that placing overhead lines underground reduces ignition risk by approximately 99%in that location.[4] Accordingly, in Column X we have provided 99% as the

[2] Simplified Wildfire RSE = Wildfire Risk / (Standard Cost * Feasibility Cost Multiplier), where Wildfire Risk is from the 2022 WDRM v3, and feasibility cost multiplier ranges from 1-3 accounting for hardness of rock, size of water crossing, and gradient.

[3] Bundling segments at a circuit level is important to capture operational efficiencies within the area such as mobilization, permit acquisition, community engagement, lay down areas, clearances, and coordinated design decisions.

[4] The minimal remaining ignition risk stems from failure risks associated with vaults and pad mounted equipment. To prevent this unlikely type of ignition, a detailed inspection (including infrared) of subsurface underground equipment would be performed on a 3-year cycle. Currently, PG&E performs detailed inspection (including infrared) of pad-mounted equipment

measured effectiveness for the undergrounding projects identified.

6. Planned Length: Columns F, J, and K provide the planned underground miles for each location from 2023-2026. These lengths are subject to change as specific projects are scoped and engineered in advance of execution. Factors impacting the final length may include route changes due to accessibility or environmental conditions as well as opportunities to remove existing idle infrastructure.

7. Risk-type Identified for Prioritization: Column Y provides the risk (project) type for each of these projects. Tab 3 provides more detailed explanations for each risk type.

(b) Undergrounding Work Planned for 2023

At a high level, undergrounding work planned for 2023 was primarily designed to address the highest wildfire risk miles and areas where PSPS impacts have been the most significant based on the 2021 WDRM v2 and the 11-year PSPS lookback. More specifically, the work includes undergrounding miles within the top 20% of risk-based circuit segments, fire and major emergency rebuild areas within high-fire risk areas, undergrounding as part of PSPS mitigation projects, and locations identified by PG&E's Public Safety Specialist (PSS) team as presenting elevated wildfire risk.[5]

In Attachment 2022-07-26_PGE_22-04_RNR_R3_Atch01CONF or 2022-07-26_PGE_22-04_RNR_R3_Atch01_Redacted, we have identified over 560 miles of planned undergrounding work for 2023.[6] The number of miles purposely exceeds the undergrounding program target for 2023 to ensure that there are sufficient miles in the queue to meet mileage targets. We also recognize that not all of these miles will be executable for a variety of reasons including, but not limited to, environmental challenges, permitting, and coordination with local agencies and government entities. Therefore, we anticipate targeting 400 miles for undergrounding in 2023 from within that larger group of projects. This yield of available planned miles being executed is generally consistent with PG&E past and current experience as well as input from subject matter experts inside and outside of PG&E.

These undergrounding projects/locations are a priority and are in our draft plan for

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every three years, instead of every five years as required by GO 165. Patrols would continue to be performed on an annual basis.

[5] *See* 2022 WMP, p. 537 (discussion of these categories for work planned for 2022).

[6] The 2023 undergrounding mileage in Table RN-PG&E-22-03-02 in response to Critical Issue RN-PG&E-22-03 is greater than the 2023 undergrounding mileage in Attachment 2022-07-26_PGE_22-04_RNR_R3_Atch01CONF or 2022-07-26_PGE_22-04_RNR_R3_Atch01_Redacted because some 2022 portfolio mileage that is unlikely to be completed this year was included in 2023 in the Table. The attachment also contains fewer 2023 Butte County rebuild miles due to the date the data was pulled.

2023. As we finalize the plan for 2023, the timing of some projects may move within the 2023 calendar year, some other projects may pull forward (from 2024 to 2023) while others may push back (from 2023 to 2024). We are conducting analysis on several fronts to finalize the plan, including PSPS and EPSS mitigation and project-specific underground routing.

(c) Undergrounding Work Planned for 2024-2026

Our 2024-2026 undergrounding workplan is primarily based on the 2022 WDRM v3, which includes an underground feasibility component that creates a simplified RSE for each circuit segment. This simplified RSE is used to prioritize circuit segments that will then be bundled into project areas and then separated into three tranches.

Tranche 1 of this planned undergrounding work is targeted for execution from 2024-2026, and data for this tranche is provided in Attachment 2022-07-26_PGE_22-04_RNR_R3_Atch01CONF or 2022-07-26_PGE_22-04_RNR_R3_Atch01_Redacted. There are three key categories of work currently feeding the 2024-2026 tranche of undergrounding:

1. Undergrounding work on the highest risk ranked circuits that is informed by the 2022 WDRM v3 and a high level RSE to help prioritize and bundle.

2. Carry-over underground work that has been forecasted in 2024 due to identified dependency constraints. These projects were informed by the 2021 V2 WDRM and the 11-year PSPS lookback.

3. Community Rebuild projects identified for construction in 2024.

In Attachment 2022-07-26_PGE_22-04_RNR_R3_Atch01CONF or 2022-07-26_PGE_22-04_RNR_R3_Atch01_Redacted, we have identified over 3,000 miles of planned undergrounding work for 2024-2026.[7] This is the portfolio before any additional PSPS, PSS and Fire Rebuild miles are incorporated. We recognize that not all of these miles will be executable for a variety of reasons including, but not limited to, environmental challenges, permitting, and coordination with local agencies and government entities. Therefore, we anticipate targeting a subset of this amount for undergrounding work in future WMPs.

(d) Additional Undergrounding Plan Information

For additional information regarding how PG&E designed our undergrounding plans for 2022-2023 and 2024-2026, please see our response to Critical Issue RN-PG&E-22-03. That response includes a table summarizing our future undergrounding workplans, and highlights that we have taken a substantially more aggressive approach toward the goal

[7] The 2024-2026 undergrounding mileage in Table RN-PG&E-22-03-02 is less than the total 2024-2026 undergrounding mileage shown in Attachment 2022-07-26_PGE_22-04_RNR_R3_Atch01CONF or 2022-07-26_PGE_22-04_RNR_R3_Atch01_Redacted due the date the data was pulled.

of focusing undergrounding in our top 20 percent risk-ranked circuits.

Required Remedies:

2. *PG&E must include a timeline for the frequency with which it will determine undergrounding mileage and locations based on updated risk model output, factoring in RSE comparison with other initiatives.*

    a. *The timeline must continue past 2024.*

    b. *If the above information for the targeted 400 miles in 2023 and 800 miles in 2024 is not available, PG&E must*

        i. *provide justification as to why it is unable to provide any of the missing information and*

        ii. *provide a timeline for when the information will be available.*

Response to Critical Issue RN-PG&E-22-04 Remedy #2(a)

(a) PG&E's Timeline for Updating Undergrounding Mileage and RSE Consideration

In Attachment 2022-07-26_PGE_22-04_RNR_R3_Atch01CONF or 2022-07-26_PGE_22-04_RNR_R3_Atch01_Redacted, we are providing updated undergrounding mileage through 2026. The data from our workplan includes more mileage than the targeted 400 miles in 2023 and 800 miles in 2024.

PG&E does not anticipate updating the 2024-2026 undergrounding mileage, or re-prioritizing the work, based on updated risk model outputs or using additional RSE comparisons. As explained above, we have utilized our most current risk model (2022 WDRM v3) to identify the planned undergrounding locations for 2024-2026. The locations consider the highest risk miles from the 2022 WDRM V3 and feasibility constraints. PG&E selected undergrounding location candidates through a simplified RSE framework, in which each circuit segment was measured based on its 2022 WDRM V3 risk score and a feasibility multiplier that factored in the presence of things like hard rock, gradients, and water crossings. By taking the wildfire risk and dividing by a feasibility index multiplier, PG&E incorporated a simplified RSE framework into our selection criteria to identify the most appropriate circuit segments for the risk reducing mile per dollar.[8]

[8] PG&E estimates an approximately 90% overlap in miles and 94% overlap in risk reduction when comparing workplans based on risk rank alone and risk rank feasibility using this simplified RSE. For the remaining approximately 10% of miles, which are expected to be a lower portion of the high-risk miles, alternative mitigation initiatives (like overhead system hardening) are considered more appropriate solutions based on the concepts of RSE.

As described in Section 4.5.1 of the 2022 WMP Update, we currently plan to improve our risk modeling to account for climate/fuel changes, modifications to the electric system, and improvements on probability and consequence modeling. When we update our WDRM, we expect that the updated risk model outputs will be used to prioritize and plan our undergrounding work from 2027-2031. Approximately 7,000 miles of undergrounding mileage has already been identified for work during 2027 - 2032 but it has not yet been scoped and prioritized. As part of the risk model update, we anticipate targeting the highest risk miles, while also using the simplified RSE to identify the most appropriate circuit segments for the risk reduction mile per dollar.

(b) Not applicable

Critical Issue RN-PG&E-22-09

Critical Issue Title: PG&E has failed to provide plans to mature in certain vegetation management capabilities

Required Remedies:

1. *PG&E must benchmark its use of predictive and risk modeling in VM with SCE and SDG&E.*

    a. *PG&E should also consider benchmarking with at least one electric utility outside California.*

Response to Critical Issue RN-PG&E-22-09 Remedy #1

In response to the direction provided by Energy Safety, PG&E benchmarked with Southern California Edison Company (SCE), San Diego Gas & Electric Company (SDG&E), and Portland General Electric (Portland General) to explore the predictive and risk modeling areas addressed in the 2022 Wildfire Mitigation Plan Maturity Model Assessment Survey (Survey) for vegetation management. To conduct this benchmarking, we utilized the benchmarking framework used by our Diablo Canyon Power Plant team, which structures the conversation around purpose and issues, feedback and input from the entity that we are benchmarking with, and a discussion and review of any potential gaps, deficiencies, or enhancements. The last step in the benchmarking process is to capture lessons learned and to develop next steps on any actions that would enhance our processes, procedures, and maturity.

One objective of the benchmarking was to request further information and clarification on SCE's and SDG&E's responses to the Survey. Specifically, we discussed information regarding predictive modeling in their Survey responses for their Vegetation Management programs. The three Survey capabilities discussed were:

- Capability 22: E.II.b: How are vegetation inspections scheduled
- Capability 23: E.II.b: Inputs into Vegetation Inspection effectiveness by way of procedural changes, checklists and how often they are reviewed and modified
- Capability 24: E.IV.C: What modeling is used to guide clearances around lines and equipment, including grow-in and overhang[9]

PG&E found that for these capabilities, we were more aligned with the other utilities than our scores indicate. PG&E, SCE, and SDG&E are aligned in the:

- Use of Light Detection and Ranging (LiDAR) to identify areas of concern and as

[9] These are the three capabilities identified in the Revision Notice. *See* Revision Notice, pp. 23-25.

a modeling input;

- Evaluation of fire footprints for targeted patrols or additional patrols;
- Evaluation of ignitions and PSPS events to minimize events through additional patrols;
- Use of annual and mid-cycle field inspections within Tier 2 and Tier 3 HFTDs; and,
- Use of risk modeling on the enhanced vegetation management programs for an annual scope of work based on highest risk ranked circuits.

We also noted during benchmarking areas where the utilities had varying approaches to certain aspects of the three capabilities identified above. Areas that we identified for further internal evaluation and consideration include:

- Steps that can be taken to improve the maturity and use of predictive modeling to guide schedule sequencing and clearances;
- Approach to mid-cycle patrol and annual reviews for potential resequencing based on results from annual field inspections, LiDAR, fire footprints and tree species;
- Incorporation of information from targeted tree species in risk modeling; and,
- The procedures and checklists used by field inspections to make determinations around tree removals, overhang, and growth.

In response to Remedy #2 below, we provide more detail regarding the specific items we have identified and initial actions we will be taking as a result of benchmarking with SCE, SDG&E, and Portland General.

The remainder of this response to Remedy #1 describes the results of our benchmarking and observations from benchmarking. To provide a consistent summary of the benchmarking discussion with each utility, we are using as a framework the three capabilities identified by Energy Safety in this Critical Issue:

- Vegetation Inspection Cycles
- Procedures and Checklists
- Modeling and approach to guiding vegetation clearances

Table RN-PG&E-22-09-01 below provides the Survey questions regarding the three capabilities:

Table RN-PG&E-22-09-01: Summary of Survey Questions

Capability	Question
22: Vegetation inspection cycle	How are vegetation inspection cycles scheduled?
23: Vegetation inspection effectiveness	How are procedures and checklists determined?
24: Grow-in Mitigation	What modeling is used to guide clearances around lines and equipment?

a. Southern California Edison

PG&E met with SCE senior vegetation management personnel on June 7, 2022, and again on June 13, 2022, to discuss SCE's approach to scheduling vegetation inspections, creating procedures and checklists, and how predictive modeling is used to guide clearances around lines and equipment.

(1) Vegetation Inspection Cycle

SCE sets its annual inspection cycle based on the previous year's schedule, then factors in anticipated work volume across the inventory, periods where work is limited, County/City requirements and risk factors such as Areas of Concern (AOC) that SCE has identified. AOC information is based on several factors including fire history, weather conditions, fuel type, exposure to wind and egress among others. On a limited scale, the inspections are adjusted on an annual basis. Adjustments are then made to grid maps that could be moved forward based on risk factor(s) to ensure the optimal time for inspection and tree work. SCE estimated that approximately 10% of the annual plan is revised each year based on risk factor adjustments.

SCE utilizes its Tree Risk Index (TRI) to categorize the grid and system for inspection purposes. SCE's TRI uses outage data history, tree inventory data, SCE Probability of Ignition (POI) data and risk layers such as Wildfire Risk Reduction Model using Tecnosylva consequence values. The TRI future state will be more granular and would enable future adjustments to the existing annual plans.

(2) Procedures and Checklists

There are two components in how SCE establishes procedures and checklists: (1) utilizing species list growth rates; and (2) equipment information.

(3) Modeling to Guide Clearances

Based on our benchmarking, we understand that SCE uses LiDAR data, inspections, and tree growth data in determining clearances. Our understanding is that SCE does

not use predictive modeling for clearances. SCE is at the starting phase of expanding clearances based on tree species with high growth and high failure rates and continues to explore capability to determine clearances from the TRI in 2023.

b. San Diego Gas & Electric

PG&E met with SDG&E senior vegetation management personnel on June 14, 2022. SDG&E is currently reviewing their predictive modeling of vegetation growth.

(1) Vegetation Inspection Cycle

Currently, SDG&E's risk modeling informs when to conduct certain types of inspections based on geographical location, and the tracking of attributes such as tree species, height, and pruning history. Inventory tree data are updated annually. In addition to its annual, routine tree inspection cycle, SDG&E performs additional, incremental inspections within the HFTD prior to September 1, the beginning of peak fire season in southern California. SDG&E also performs additional inspection activities in spring, summer, and fall for fast-growing and unpredictable species such as Century plant and bamboo.

SDG&E schedules inspections by grid polygons known as Vegetation Management Areas (VMA). SDG&E's Vegetation Risk Index (VRI) was developed initially for Public Safety Power Shutoff (PSPS) events using meteorology, tree inventory, targeted species, and outage history data. The VRI can also inform on when to schedule additional preventive tree inspections in advance of peak wildfire season. Additionally, the VRI can be used to identify where additional tree pruning and removal activities may be prudent as a preventative measure. To this end, the VRI is more of an index than a true predictive modeling tool.

SDG&E reviews operational data to enhance its existing inspections. SDG&E is currently building a machine learning model with the San Diego Super Computing Center which will help inform their risk modeling capabilities. However, field data such as tree species, growth, and hazard assessments will always be a factor in determining the timing, priority and location of inspection activities. SDG&E indicated that a hybrid approach of combining modeling data and field data requires both art and science to be applied in the dynamic environment of vegetation.

(2) Procedures and Checklists

SDG&E has significantly increased vegetation clearances in the last 10 years and has developed an inventory and history of all of the trees in their service territory that create potential risk for SDG&E's facilities. SDG&E uses this information to develop and improve its checklists and procedures and to guide clearances. SDG&E reviews operational data to enhance its existing inspections and is currently building a machine learning model which informs their risk modeling to inform the mid-cycle patrol locations and timing. However, field data such as tree species will always be a factor to determine the timing and locations of re-inspections.

(3) Modeling to Guide Clearances

Contracted pre-inspectors and a small workforce of in-house SDG&E Patrollers determine which trees require pruning, whereas the contracted tree crews determine how a tree is to be pruned and the appropriate clearance based on species, compliance, growth rate, proper cuts, tree health, etc. Due to the dynamic nature of tree growth and conditions, SDG&E indicated that visual inspections are necessary and superior to modeling outputs to determine mitigation timing and needs at the tree and site-specific level. This same dependency applies to the portions of SDG&E's system where models help inform the requirement for subsequent or redundant annual inspections.

c. Portland General Electric

In response to Energy Safety's suggestion that PG&E consider benchmarking with a utility outside of California, PG&E selected Portland General for additional benchmarking because of its similarity with vegetation types and growth within its service territory and the close working relationship developed between the utilities that formed the International Wildfire Risk Management Consortium (IWRMC).

PG&E met with Portland General senior vegetation management personnel on June 15, 2022. The discussion focused on Portland General's approach to scheduling vegetation inspections, creating procedures and checklists, and if any modeling is used to guide clearances around lines and equipment.

(1) Vegetation Inspection Cycle

Portland General performs line-clearance inspections based on an annual line clearance maintenance schedule with limited adjustments to its inspection cycle. Within Portland General's HRFZ's (High Risk Fire Zones), incremental, off cycle, annual inspections are performed prior to Portland General's declaration of fire season. Portland General uses some modeling of trees based on LiDAR data and tree inventory to guide decisions on where additional inspections are needed.

If adjustments to schedule are made, they are primarily done with consideration of the results of the mid-cycle patrols or overall adjustments to trim cycles, areas of focus, and tree removal targets. Portland General has found tree growth predictability is not as accurate as desired and is looking to improvements in technology and data quality. Future improvements will allow for greater reliance on modeling to determine when and where to augment the set annual inspection schedule.

(2) Procedures and Checklists

Portland General's procedures are primarily based on regulatory requirements, but Portland General does factor in the tree species growth rates into its prescribed trim cycles and general equipment and/or crew compliment needs. Portland General captures details outside the standard provided by field inspectors and historical data. In the future, Portland General believes it will develop better analytics incorporating the field data (tree limbs overhang and vegetation related ignitions) to better inform the annual inspection cycle and targeted trimming/removals.

(3) Modeling to Guide Clearances

As indicated above, Portland General discussed the limitations with predictive modeling. Portland General does use overhead line clearance modeling based on fall-in and over strike risk for hazard/danger trees inside its high risk fire zones, but primarily uses field data from field inspections to guide the trim / removal work and to guide clearances. Like SDG&E, Portland General also has determined that the dynamic nature of tree conditions change quickly and the importance of a visual inspection to determine mitigation needs is important.

d. Pacific Gas and Electric

(1) Vegetation Inspection Cycle

PG&E's routine inspection procedures and inspection cycles are primarily based on regulatory requirements. The annual inspection follows the calendar year to ensure optimal time and safety for our workers to perform their work. For example, higher elevations are scheduled at times in the year to complete inspections before annual snow fall while the lower elevations are scheduled before significant summer heat occurs. In 2022, PG&E performed routine vegetation inspections on certain circuits in HFTD areas as early as possible in the year in advance of fire season and in coordination with our EPSS program.

Mid-Cycle patrols are primarily focused on HFTD/HFRA areas, as well as State Responsibility Areas (SRA), wildland urban interface (WUI), and Fire Hazard Severity Zones (FHSZ). Additional inspections are scheduled when inspectors note a special condition that requires further monitoring, such as a higher tree mortality in a specific area.

For EVM, inspections are scheduled based on the risk ranking from the EVM tree-weighted prioritization list that we have used to develop the 2022 EVM Scope of Work.[10]

(2) Procedures and Checklists

[10] The EVM Scope of Work is described in our 2022 WMP on pages 51-52.

PG&E's routine vegetation management procedures and checklists are based on regulatory requirements for vegetation management. Our EVM program has a separate procedure which identifies the specific scope of work for EVM, which are above regulatory requirements. The EVM program also uses the Tree Assessment Tool (TAT) as an EVM digital checklist and provides input on the clearances as discussed below.

(3) Modeling to Guide Clearances

PG&E uses statutory requirements and inspections to establish its clearances. Tree removal for EVM is based on PG&E's TAT which incorporates regional tree species data. Our Mid-cycle/Tree mortality programs focus on dead/dying tree mitigation, while our routine maintenance program targets smaller diameter trees, fast growing tree species, and hazard trees for removal.

For our EVM program, we have expanded the clearances beyond the regulatory requirements and have included the removal of overhang. In addition, we are currently evaluating the recommendations for potential implementation from our Targeted Tree Species Study completed in March 2022 to guide clearances.

e. Observations from Benchmarking

We have the following observations based on the benchmarking with SCE, SDG&E, and Portland General.

Vegetation Inspection Cycle:

- SDG&E and SCE have developed processes of review that inform and influence their inspection cycles beyond regulatory or statutory requirements and, where possible trimming beyond requirements.
    - SCE has a designated cross functional team that meets annually to review prior year's inspection data, PSPS, ignitions to develop Areas of Concern to sequence mid-cycle or additional patrols
    - SDG&E has the same process, but also includes a 10 year historical data per tree species with a focus on tree species that are highest growth and greatest potential for failure. The historical data review includes what clearance SDG&E achieved in the previous year and should the current year inspection prescribe an additional clearance.
- Portland General and PG&E have inspections that follow the calendar year and make some variations.
- All utilities use some level of LIDAR to guide decision making for additional inspections.

- SCE, SDG&E, and Portland General have developed tree inventories at varying levels of maturity that guide the additional inspections or mid-cycle inspections variations.

- SDG&E has the most comprehensive approach as it relates to inspections, dividing its service territory in to separate Vegetation Management Areas and developing a 10 year historical view of each tree. Tree species combined with the historical view drive inspections for greater clearances beyond statutory requirements. Depending on tree species, SDG&E has created through its inspections, clearances far beyond statutory requirements and in some cases up to 20 feet.
- SCE is developing a similar approach as SDG&E for SCE's inspections, by creating Areas of Concerns, historical cataloguing of each tree and depending on species inspections dictate clearances beyond statutory requirements. SCE inspections identify trees that are, where possible, trimmed to 18' clearance to maintain a minimum 12' clearance annually.

- All utilities use PSPS and/or ignitions data to guide and influence inspections.

Checklist and Procedures:

- PG&E and Portland General procedures and guidance are primarily based on regulatory requirements. However, Portland General does capture details outside of these requirements such as procedures that call out identification of higher risk locations and tree species to consider additional clearances

- SDG&E has mature processes and checklists that support inspections, which is driven by historical data collecting and inventory over the last 10 years for each tree. SDG&E reviews the operational data to enhance and inform risk modeling to influence timing and sequencing to mid-cycle patrols. SDG&E has also developed a process, which combines modeling and field data to guide process maturity and initiatives.
- SCE has developed a process and procedures into its checklist that includes equipment information, such as type of equipment and useful life. SCE is in the process of developing this checklist which works collaboratively with their system hardening group.
- SCE has created a checklist in field inspections guided by tree species with a special emphasis on high growth. The inspection requires a checklist to these species noting it has high growth and potential for greater clearances.

Modeling for Clearances:

- Portland General uses overhead line clearance modeling based on fall-in and over strike risk potential, but primarily relies on inspections for actual clearances.

- SCE uses Lidar, inspections, tree growth data, and AOC to determine clearances and does not have a predictive modeling input.

- SDG&E divides the approach to guide clearances. Inspections determine which trees require pruning and recommended clearances, but the tree crews determine how a tree is to be pruned and the appropriate tree clearance based on species and the tree's health to survive additional clearances.

- PG&E uses the Tree Assessment Tool to guide decisions on strike tree potential for the EVM program. PG&E uses a risk model in identifying and prioritizing work for its EVM program and focuses mid-cycle patrols on HFTD/HFRA areas, as well as SRA, WUI, and FHSZ. PG&E does not use risk modeling to determine clearances for Routine or Tree Mortality.

Additional Observations:

- There was an inconsistency in the interpretation of "predictive modeling" between the utilities responding to the Survey (*i.e.*, PG&E, SCE, and SDG&E). In future surveys, it may be helpful to define terms such as "predictive modeling" so that all of the utilities filling out the survey have a common understanding.

- PG&E's vast service territory, including the geography and types of tree species, results in substantially more complexity for vegetation management as compared to the other utilities.

- SDG&E's Survey rankings were higher than SCE and PG&E because SDG&E has mature informed processes, procedures and checklists to guide their vegetation management programs. SCE is in the process of developing the same approach as SDG&E.

- SCE has taken the approach to outline development similar to SDG&E's process and checklist, historical data and begun to create their own development, through AOCs, changes in their mid-cycle, species specific targeted areas for greater clearances.

- PG&E has more work to do to further mature our processes in vegetation management but also have the largest and most diverse service territory. Our proposal to mature in the three capabilities identified are described below in response to Remedy #2.

- Portland General did not participate in the maturity survey, however, when we reviewed it with them, they responded they would have rated themselves similar as SCE as they are looking to include and expand their approaches to inspection, mid-cycle sequencies and tree species.

Required Remedies:

2. *PG&E must report on practices learned from benchmarking regarding the use of predictive and risk modeling in VM and discuss the initial steps that it will take to incorporate those practices into its VM programs.*

Response to Critical Issue RN-PG&E-22-09 Remedy #2

The discussions with the three utilities provided PG&E with a good understanding on how each utility utilizes information and modeling (where applicable) to inform their scheduling, checklists and procedures, and clearances.

Based on our benchmarking discussions, PG&E has identified initial steps to further mature our inspection scheduling, procedures and checklists, and development of clearances.

- Identify one or two of the highest risk regions in PG&E's service territory to implement a pilot process for inspections and to guide clearances. Given the substantial efforts being undertaken by our vegetation management team in multiple areas, we are proposing to implement this pilot in Q2 2023.
    - The pilot process would use our Targeted Tree Species Study to identify the tree species with the highest growth and highest failure potential. Using this information, through the inspection process, identify additional clearances and begin inventory of tree by species and considerations (growth and highest failure rates).
    - Based on the results of the pilot process, implement in other regions once developed and mature in the pilot regions.
- Develop a collaborative, cross-functional team similar to SCE in creating Areas of Concern and having the cross-functional team develop guidelines to inform inspections to include tree species, fire footprint, ignitions and to consider re-sequencing mid-cycle inspections, potentially increasing clearances, and enhancing prioritization of vegetation management work that is identified during inspections.
- Review the Process and Procedures for collecting and enhancing checklists for field inspections and current clearance guidance.
- Develop a process to guide optimal clearance beyond statutory requirements by species and region.
- Evaluate how mid-cycle inspections sequence can be adjusted to align with Areas of Concerns in highest risk regions.
- Evaluate the feasibility of developing a multi-year historical tree data set.