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UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
SAN FRANCISCO DIVISION

UNITED STATES OF AMERICA,

Plaintiff,

v.

PACIFIC GAS AND ELECTRIC COMPANY,

Defendant.

Case No. 14-CR-00175-WHA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION FOLLOWING PG&E'S NOVEMBER 18 BRIEFING

Judge: Hon. William Alsup

Question 1: State the full extent to which PG&E itself (as opposed to its contractors and/or subcontractors) maintains records with respect to individual distribution lines in Tier 2 and Tier 3 areas:

a. Setting forth the reports of inspections identifying trees or limbs for removal and the data thereof;

b. Setting forth the full extent to which the work identified in such inspections was accomplished and dates accomplished

c. Setting forth the full extent to which the work identified in such inspections has NOT been performed.

PG&E Response:

PG&E's vegetation management ("VM") program consists of several types of VM activities focused on identifying trees or limbs for removal. PG&E is setting forth below the current recordkeeping practices and records for each of PG&E's core VM programs that include tree removal or tree trimming in Tier 2 and Tier 3 High-Fire Threat District ("HFTD") areas. All of the records and databases described below are maintained in PG&E's possession, not in the possession of PG&E's contractors or subcontractors.

Routine/CEMA Patrols: PG&E's routine and Catastrophic Emergency Memorandum Account ("CEMA") VM programs generally use similar methods to create and maintain records of trees identified for work. PG&E uses its Project Management Database ("PMD") to manage the scheduling of routine and CEMA VM patrols. PMD records the start and end dates of routine and CEMA VM patrols as well as the number of tree units identified by pre-inspectors and the number of tree units worked by tree trimmers.

While in the field, pre-inspectors who perform routine and CEMA pre-inspections use ruggedized tablet computers to input information about trees identified for work directly into PG&E's Vegetation Management Database ("VMD"). These devices also provide pre-inspectors information about trees identified during prior VM patrols. The information pre-inspectors input into VMD for a tree identified for work using their devices typically includes:

(i) the location of the tree identified for work (including latitude and longitude coordinates for the tree and a description of the tree's location relative to PG&E's facilities);

(ii) the species, diameter and height of the tree;

(iii) the type of work prescribed for the tree (if any);

(iv) the priority assigned to that tree work; and

(v) other clarifying comments about the tree or work prescribed.

If a given tree requires work, the pre-inspector will assign a work type code and a priority to that request in VMD. If a tree requires immediate work to address an imminent threat to PG&E facilities, the pre-inspector will generate a priority tag to remove or trim that tree on an expedited basis. For a given tree, pre-inspectors can also indicate exceptions to the normal flow of VM work using PG&E's Issue Tracking System ("ITS") within VMD. Such exceptions may include, for example, situations where a tree identified for work is subject to a customer refusal or environmental permitting constraint. VMD records the date and time this information is entered by the pre-inspector. In addition to the inspection records stored on VMD, pre-inspectors who perform routine and CEMA VM patrols sign hard copy index maps indicating the start and end date for their pre-inspection of a given section of a distribution circuit. PG&E retains these hard copy index maps.

After a pre-inspector has performed a routine VM or CEMA inspection, the local VM office responsible for a given distribution line will use VMD to generate work requests listing any trees the pre-inspector identified for work that do not have restrictions (such as customer refusals). These work requests are assigned through VMD to tree trimming contractors, who receive PDF versions of the work requests via email. After tree trimming contractors complete tree work prescribed on a work request, they use a program that communicates with VMD to input and record the work that was completed. Any trees identified for work by pre-inspectors that tree trimming contractors have not completed will appear in the VMD as incomplete.

EVM Program: PG&E's Enhanced Vegetation Management ("EVM") program uses PG&E's ArcGIS database to store data generated during EVM inspections and associated tree work. For each line mile subject to the EVM program, pre-inspectors perform two phases of inspections. During a Phase 1 inspection, pre-inspectors identify for removal or trimming any vegetation that encroaches on a 12-foot radial clearance of PG&E's power lines or that overhangs above the conductor or within the 4-foot zone extending on either side of the conductor, as well as any dead, dying, or diseased trees that pose a risk to PG&E's facilities as vegetation points in Collector, an application further described below. During Phase 2 pre-inspections, pre-inspectors inventory and perform a tree assessment of any tree that has the potential to strike PG&E equipment and also assess whether there are any trees or branches requiring work that the first pre-inspector may not have identified. EVM pre-inspectors use the Collector app on their cell phones or tablets to identify and input information about trees in the vicinity of PG&E power lines. Data input through the Collector app is stored in PG&E's ArcGIS database. Collector is primarily a map-based application that allows pre-inspectors to identify trees by creating points on a map called vegetation points. For each vegetation point identified using Collector, EVM pre-inspectors are trained and instructed to record, among other things, the tree species, diameter, height, health, prescribed work (or whether no work is prescribed) and the status of that work. After identifying a vegetation point and inputting the requisite information, EVM pre-inspectors are instructed to use the Tree Assessment Tool ("TAT") within the Collector app to determine whether and what work should be prescribed for that tree. EVM pre-inspectors are instructed to update their prescription in Collector based on the results of the TAT analysis.

After a segment of a line has been patrolled by an EVM pre-inspector and information inputted into the Collector app, that segment is assigned to a tree trimming contractor, who uses the Collector app to locate trees that have been identified for work by the pre-inspector. After work has been performed, tree trimming crews are instructed to record the status of that work as complete using Collector. Tree trimming crews can also use Collector to

note when they are unable to complete work due to a customer refusal or other delay, such as environmental issues. Using Collector, tree trimming crews input for each vegetation point they work the name of the tree trimming company, the tree trimming subcontractor (if applicable), the tree trimming foreman, the code for the tree work performed, the date the tree work was completed and any comments about the tree work. PG&E can track the status of work on any given line segment or for any tree identified by EVM pre-inspectors through the Collector app or by running a query of the ArcGIS database where PG&E stores and maintains data input through Collector for its EVM program. These records can be accessed and exported as necessary from PG&E's ArcGIS database.

All work prescribed under EVM is subject to PG&E's 100% work verification process. Please see PG&E's response to Question 2 below for a description of EVM work verification and the associated record management process.

Non-Routine/Emergency VM Work: Beginning with the Camp Fire, PG&E implemented its own version of the ArcGIS database and Collector app for use in post-fire and emergency VM work. The version of Collector used for emergency VM work is functionally similar to the version used to record EVM work, but the information required for each vegetation point is tailored to the emergency.[1,2]

[1] PG&E's VM program also includes its Vegetation Clearing ("VC") program in addition to routine, CEMA, EVM and wildfire/emergency VM work. The VC program is aimed at ensuring compliance with Public Resource Code § 4292, which requires utilities to maintain clearance of no less than 10 feet around a subset of utility poles to which certain equipment is attached. The results of VC inspections are inputted through PCD2, an application specifically designed for VC inspectors and are recorded in VMD.

[2] PG&E's VM programs are also subject to Quality Assurance ("QA") and Quality Verification ("QV") reviews. A typical QA review consists of a field audit of line segments selected through a statistically valid random sampling process, during which a QA inspector (a PG&E employee) inspects the line segments for any regulatory non-compliance. The results of these field audits are recorded on a spreadsheet saved to the QA shared drive. That information is ultimately published in a report by the QA department on their overall findings for a given region. The QA department publishes the report on its SharePoint site and notifies the local VM supervisor whose territory was audited as well as VM program leadership via email. In addition, any regulatory compliance issue identified by a QA inspector results in a Corrective Action

Question 2: In its response dated November 3, 2020, PG&E stated on page two its intention to improve contractor fidelity to the EVM program and stated that mid-2019 improvements "included 100% work verification, increased contractor training, contractor competency tests, and numerous changes to improve EVM recordkeeping." State in plain terms what each of these changes are, the date of their implementation, and contractor compliance since that implementation.

PG&E Response:

100% Work Verification: PG&E's EVM program consists of two phases of pre-inspections. No line mile is claimed as complete under PG&E's EVM program until that mile has been subject to both phases of pre-inspection and tree work under the EVM program scope and has been verified as complete to EVM standards by PG&E's Work Verification ("WV") team. The final step of this process is referred to as "100% work verification." Under 100% work verification, the WV team confirms both that the pre-inspections performed under the EVM program satisfy the scope and standards of the EVM program (including identification and assessment of any trees with the potential to strike PG&E's power lines) and that all tree work has been completed in accordance with EVM standards. This verification is performed only after both phases of EVM patrols are complete and the tree crew has reported that it has completed the identified EVM work.

To verify EVM work, the WV team uses Survey123, a survey-based application that overlays a map on top of the Collector app, to view every vegetation point associated with a

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Program ("CAP") report being generated for that nonconformance and issued to the local VM supervisor. At the conclusion of each audit, a separate CAP report is issued to the local VM supervisor to assign corrective actions to any significant findings from the audit. A CAP report must be closed by the individual to whom it is issued with comments explaining the resolution to the issue identified in the CAP. Similarly, PG&E's QV department performs field audits to check the quality of both pre-inspections and tree trimming work performed by contractors. Findings made by the QV inspectors are stored in the Quality Control Database ("QCD"). QV emails findings directly to the VM operations team. As with the QA process, any regulatory compliance issue identified at a sample location by a QV inspector results in a CAP report being generated and issued to the local VM supervisor.

given line segment and to input any findings during their patrol. Survey123 is a survey-based application which guides users through a series of questions, such as whether all trees tall enough to potentially strike the line were assessed using the TAT. The WV inspectors walk the line segments to ensure that (1) the primary overhead conductor is present in the field (*e.g.*, is not underground), (2) all trees along the span meet EVM requirements for tree work (*i.e.*, vegetation trimmed for 12-foot radial clearance and 4-foot conductor-to-sky clearance, and all dead or dying trees with potential to strike PG&E power lines have been identified and removed), and (3) all trees with potential to strike PG&E's power lines are captured as vegetation points in Collector. WV inspectors document their findings using Survey123 to identify whether each vegetation point has "passed" or "failed" its inspection. Additionally, at the end of a WV inspection, WV inspectors submit a work verification survey identifying any trees that do not meet the EVM scope or were not captured in Collector as vegetation points, if any.

Absent any findings by the WV inspector, that line segment is assigned a status of "Work Verification Pass". If any one vegetation point in the line segment is given a "fail," then the entire line segment will be given a work verification status of "Work Verification Fail". Collector will then automatically update the "Inspection Status" field to "Inspection Needed", automatically reverting the line segment to the pre-inspection and tree work phase to address the issues discovered during the WV inspection. After another round of pre-inspections and tree work for that line segment, the WV process will repeat. This process continues until the line segment achieves a "Work Verification Pass" status. The line segment is not counted toward PG&E's completed EVM miles until it acquires the "Work Verification Pass" status.

PG&E committed to and implemented 100% work verification at the start of 2019. In mid-2019, in response to the contractor confusion issues that arose in the EVM program's first year, PG&E instituted what was referred to as "Double Work Verification" for the remainder of 2019. This Double Work Verification process was implemented to ensure that the pre-inspections and tree work were being performed consistently with the revised scope. Double Work Verification required two separate WV inspectors to "pass" the line segment for it

to be considered complete. If a WVI failed the line segment, two subsequent WV inspectors would need to "pass" the line in consecutive WV patrols for a conductor segment to be considered complete. The Double Work Verification process continued through the end of 2019. At the beginning of 2020, after the contractor workforce had been re-trained on the revised EVM scope and the EVM process had stabilized, PG&E returned to 100% work verification and the process as it is described above. PG&E and its contractors have met the goal of 100% work verification for 2020.

Increased Contractor Training and Testing: At the start of 2019, PG&E implemented a centralized in-person introductory training course for all pre-inspectors, called Veg-0100 and a corresponding course for tree crews called Veg-0200. Approximately 2,600 pre-inspectors and tree crews participated in these courses in 2019.

In mid-2019, to address contractor confusion in the EVM program's first year, PG&E introduced a three-day in-person training course for EVM pre-inspectors called Veg-0400. This course provided pre-inspectors with classroom instruction on the scope of EVM, techniques for tree identification and use of the Collector app, as well as field training with the forester who would supervise their EVM work once they passed the training. Veg-0400 also included knowledge testing and field assessments to ensure the pre-inspectors adequately understood the information taught in the course. The Federal Monitor attended several of these training sessions, which continued from July 2019 through October 2019. Beginning in December 2019, PG&E transitioned the Veg-0400 course to its centralized training program for the pre-inspectors performing EVM work. As with the three-day program, on the final day of this Veg-0400 course, participating contractors were given a competency test which measured their knowledge of the EVM scope and inspection process.

By mid-2020, due in part to the Covid-19 pandemic preventing in-person trainings, PG&E transitioned from the three-day Veg-0400 course to a series of web-based training courses. Pre-inspectors are required to take the series of web-based trainings sequentially before they can access the Collector app and other EVM technological tools and

begin performing EVM work. As part of this series of courses, PG&E introduced two web-based trainings, an introductory level course called Veg-0100: Vegetation Management for Inspectors and an EVM-specific course called Veg-0410: EVM Scope – Experienced Vegetation Patrollers. Both of these courses are still active today. Veg-0100 consists of nine web-based courses and culminates in a skill assessment whereby pre-inspectors participate in a simulated VM inspection. The Veg-0100 course is designed to review safety protocols, introduce contractors to PG&E procedures and to educate the contractors on the role they play in reducing wildfire risk. Contractors must pass the skills assessment portion of Veg-0100 before they are eligible to enroll in and complete Veg-0410, an EVM-specific training course. Veg-0410 is designed to explain the scope of the EVM program, the process of conducting an EVM inspection and how to use the Collector App. When a pre-inspector has completed both Veg-0100 and Veg-0410, the pre-inspector is permitted to perform EVM work. PG&E records indicate that approximately 1,700 contractors have completed the Veg-0100 course and 175 contractors have completed the Veg-0410 course since the courses were rolled out at the beginning of 2020.

Improvements to EVM Recordkeeping: The changes to improve EVM recordkeeping noted in PG&E's November 3, 2020 submission refers to three updates to the Collector application that were deployed in May 2019, September 2019 and March 2020 to improve the EVM data collection process. The updates included changes to Collector aimed at improving data accuracy—for example, converting the field for identifying the diameter of the tree from a range input to an integer input, allowing pre-inspectors to note the precise diameter of a given tree. The update also included a change that locked users from editing any vegetation points and conductor segments that had already passed work verification, avoiding confusion that would arise if pre-inspectors inadvertently edited a vegetation point that had already been addressed and confirmed by work verification. The updates were also aimed at making the data entry process more efficient and uniform for pre-inspectors and tree crews by, for example, converting a number of fields from manual text entries to dropdown menus, removing extraneous

data fields and requiring that users operate the app on an iOS product (*i.e.*, an iPhone or iPad) for added stability. These updates also added to the pre-inspector maps the locations of trees identified during a 2019 LiDAR survey to assist with the pre-inspector identification of trees that have strike potential or need to be removed or worked under EVM and introduced and incorporated into Collector the Tree Assessment Tool ("TAT")[3] to replace the Hazard Tree Rating System ("HTRS").

Question 3: Explain each type of consequence that PG&E considers when evaluating a region for the Black Swan criteria. Also explain the source of the information informing each consequence. (For example, if potential loss of life is a "consequence" factored in, explain how the estimated potential loss of life is calculated and from what source the underlying population figures are derived).

PG&E Response:

In terms of inputs, a grid cell satisfies the Black Swan criteria if its forecast sustained wind speed is greater than 30 mph; Fire Potential Index ("FPI") is greater than 0.3; relative humidity is less than 20%; and Nelson Dead Fuel Moisture ("DFM") 10-hour, 100-hour, and 1000-hour are less than 8%, 10%, and 14%, respectively, as listed in footnote 9 to PG&E's November 18, 2020 response.

The primary source of each of these criteria is the PG&E Operational Mesoscale Modeling System ("POMMS") model that forecasts the weather conditions for each grid cell in PG&E's service territory. The primary source of data input to the POMMS model is weather forecasts at approximately 22 kilometer resolution from the Global Forecast System ("GFS"), a model produced by the U.S. National Centers for Environmental Prediction ("NCEP"), part of

[3] PG&E developed the TAT in collaboration with third-party experts—a team of International Society of Arbocultural Certified Utility Arborists—to evolve its risk-based criterion and further reduce the level of subjectivity inherent in determining whether a tree should be removed.

the National Weather Service.[4] Utilizing an instance of NCEP's Weather Research and Forecast ("WRF") model, the POMMS model analyzes the GFS model's 22 kilometer resolution forecasts to produce more granular 2 kilometer and 3 kilometer resolution forecasts. To do so, the POMMS model relies on recent real-world weather observations reported in resolutions smaller than GFS's 22 kilometer resolution forecasts, including recent temperature observations from NCEP's Sea Surface Temperature ("SST") database and air and wind observations from NCEP's Meteorological Assimilation Data Ingest System ("MADIS"). Using this data from the GFS, SST and MADIS, the POMMS model provides weather forecasts for each grid cell in PG&E's service territory.

A grid cell's forecast values for each of the Black Swan criteria either comes from, or is derived from, the POMMS model.

The forecast windspeed and forecast relative humidity of a grid cell are outputs of the POMMS model. The forecast sustained wind speed is 10 meter above ground level in mph and the forecast relative humidity is two meters above ground level.

Dead-fuel moisture represents the forecast moisture content within that type of dead vegetation and, specifically, it is the percentage of the fuel's forecast water weight divided by the fuel's forecast weight without any water. While POMMS does not forecast values for the DFM 10-hour, 100-hour and 1000-hour, these values are a function of weather conditions forecast by POMMS at a two-by-two kilometer resolution: air temperature, relative humidity, solar radiation and accumulated precipitation. Using the POMMS forecasts, a DFM is then calculated for each of three types of dead fuels. Dead fuels are divided into various time-lag classes, including 10-hour, 100-hour and 1000-hour. The shorter the time lag, the more responsive the fuel is to changing weather conditions. For example, 10-hour fuels typically only

[4] The GFS model forecasts at a ¼° resolution, which, at the equator, results in a 28 kilometer-by-28 kilometer resolution. However, further from the equator, due to the curved nature of the Earth, that ¼° resolution becomes smaller and results in a resolution of approximately 28 kilometers-by-22 kilometers in the Bay Area.

take on the order of 10 hours to respond to changing weather conditions, while 100-hour fuels typically take on the order of 100 hours to respond to changing weather conditions.[5]

Similarly, while the POMMS model does not provide the FPI output itself, it provides the inputs that feed into the Utility FPI model. The Utility FPI model was described in PG&E's November 18 response and is further described below in response to Question 4.

Question 4: Please provide a real-life example of calculations using the equations described in footnote seven of PG&E's November 18 response. In responding, please re-state the equations, identify an example from the real world of values associated with each variable, and perform the calculation while "showing your work."

PG&E Response:

The Utility FPI model output for a grid cell is based on that grid cell's Land Use ("LU") categorization, as well as the forecast values for the grid cell's Live Fuel Moisture ("LFM"), Dead Fuel Moisture of 10-Hour Fuels ("DFM_{10hr}") and the Fosberg Fire Weather Index ("FFWI"). The formula is provided below.

$$\text{FPI} = \frac{1}{1+e^{-y}}$$

Here, *y* is the log odds and is calculated as:

$$y = -1.68 - 0.24 * \text{LFM} - 0.26 * \text{DFM}_{10\text{hr}} + 0.22 * \text{FFWI} + 0.06 * \text{LU}_{\text{Shrublands}} + 0.47 * \text{LU}_{\text{Forest}}$$

A grid cell's LFM represents the forecast moisture content within living vegetation fuel and, specifically, it is the percentage of the fuel's forecast water weight divided by the fuel's forecast weight without any water. The forecast LFM for a grid cell is derived from the grid cell's soil type, the forecast length of the day and the Julian day of year in conjunction with the forecasts from PG&E's POMMS model for the grid cell's temperature, irradiance, soil moisture and soil temperature.

[5] Specifically, each time lag is the amount of time it takes for that category of dead fuel to reach 63% of the difference between initial and equilibrium moisture contents given constant environmental conditions. The equilibrium moisture content is the moisture content that a fuel particle will attain if exposed for an infinite period in an environment of specified constant temperature and humidity.

The forecast DFM_{10hr} for a grid cell is also calculated using inputs from PG&E's POMMS model, as described above in response to Question 3.

A grid cell's land-use categorization is based on the Land Use Index from the International Geosphere-Biosphere Programme ("IGBP") Modified MODIS 17-Category Land Use Categories, a global vegetation class map developed based on data from the Moderate Resolution Imaging Spectroradiometer ("MODIS") instrument aboard NASA satellites. The land-use category can be grassland, shrubland or forest. The variable $LU_{Shrublands}$ has a value of 1 when the land-use category is shrubland, and is otherwise 0. The variable $LU_{Forests}$ has a value of 1 when the land-use category is forest, and is otherwise 0.

The FFWI is a non-linear model of fire potential that aids modeling small-scale and short-term weather variations on fire danger. Inputs to the FFWI for a grid cell are the forecast temperature in Fahrenheit, *T*, the forecast wind speed in mph, *U*, and the forecast relative humidity, *RH*. Each of these three inputs is provided by PG&E's POMMS model. The formula for FFWI is listed below:

$$\text{FFWI} = \frac{\eta * \sqrt{1+U^2}}{0.3002}$$

The variable η is a function of the equilibrium moisture content (M_{eq}) content:

$$\eta = 1 - 2 * \left(\frac{M_{eq}}{30}\right) + 1.5 * \left(\frac{M_{eq}}{30}\right)^2 - 0.5 * \left(\frac{M_{eq}}{30}\right)^3$$

The variable M_{eq} is calculated by one of the three equations below, depending on the forecast relative humidity and, after the forecast relative humidity identifies the correct equation to use, that equation uses the forecast temperature and relative humidity:

$$M_{eq} = \begin{cases} 0.03229 + 0.28 * RH - 0.00058 * RH * T & for\ RH < 10\% \\ 2.22749 + 0.16 * RH - 0.0148 * T & for\ 10\% \leq RH < 50\% \\ 21.0606 - 0.483199 * RH + 0.005565 * RH^2 - 0.00035 * RH * T & for\ RH \geq 50\%. \end{cases}$$

After the initial values for each of the five inputs to the Utility FPI model—LFM, DFM_{10hr}, $LU_{Shrublands}$, LU_{Forest} and FFWI—are calculated, they are standardized based on that input's mean and standard deviation observed in the fire occurrence dataset used to train the

Utility FPI model.[6] Because the Utility FPI model was developed using a regularization methodology to improve interpretability, each input is standardized using the below equation, where *z* is the standardized value, *x* is the initial value, μ is the mean of that input and *s* is the standard deviation of the input:

$$z = \frac{x-\mu}{s}$$

The mean and standard deviation observed in the fire occurrence dataset for each input is listed below.[7]

Input	**Mean (μ)**	**Standard Deviation (s)**
LFM	80.46	18.11
DFM_{10hr}	0.05350	0.02471
FFWI	38.13	13.91
$LU_{Shrublands}$	0.07547	0.2642
LU_{Forest}	0.4316	0.4953

In light of the Court's request for a real-world example of calculations using the Utility FPI model equations, PG&E has selected as an example the two kilometer-by-two kilometer grid cell 128_377 at 00:00 PT on September 28, 2020 using the forecast data provided by the September 27, 2020, 00:00 UTC model run.

[6] As discussed in PG&E's November 18 filing, the Utility FPI model looks to two historical fire datasets: the U.S. Forest Service's Fire Program Analysis—Fire-Occurrence Database and a database compiled by PG&E of large fires and their associated perimeters from the Visible Infrared Imaging Radiometer Suite. Further, the Utility FPI model looks to weather, fuels, and associated information for the fire occurrences in such datasets, which it gets from state and federal fire agencies, including the USDA Forest Service, the Bureau of Land Management, the Bureau of Indian Affairs, the National Park Service and CAL FIRE.

[7] The values in this table and in the following equations have been rounded.

The relevant data that feed into the Utility FPI model for that grid cell, at that time, are listed below:

Input	**Value**
Temperature, *T*	71.19°F
Windspeed, *U*	13.17 mph
Relative Humidity, *RH*	18.58%
Land Use Type	Forest
DFM_{10hr}	0.06146
LFM	61.76%

These are the initial values for each of the inputs to the Utility FPI Model other than FFWI, which is a function of certain of these variables, as discussed above. Because the *RH* is between 10% and 50%, the first step in determining the FFWI is calculating the M_{eq} as seen here:

(1) $M_{eq} = 2.22749 + 0.16 * RH - 0.0148 * T$

(2) $M_{eq} = 2.22749 + 0.16 * 18.58 - 0.0148 * 71.19$

(3) $M_{eq} = 4.151$

The next step is to calculate the variable *n* using this M_{eq} value:

(1) $\eta = 1 - 2 * \left(\frac{M_{eq}}{30}\right) + 1.5 * \left(\frac{M_{eq}}{30}\right)^2 - 0.5 * \left(\frac{M_{eq}}{30}\right)^3$

(2) $\eta = 1 - 2 * \left(\frac{4.151}{30}\right) + 1.5 * \left(\frac{4.151}{30}\right)^2 - 0.5 * \left(\frac{4.151}{30}\right)^3$

(3) $\eta = 0.7505$

FFWI is then calculated based on this η value and forecast windspeed, *U*:

(1) $\text{FFWI} = \frac{\eta * \sqrt{1+U^2}}{0.3002}$

(2) $\text{FFWI} = \frac{0.750 * \sqrt{1+13.17^2}}{0.3002}$

(3) $\text{FFWI} = 33.03$

The equations in the below table show step-by-step how the FFWI, as well as the other four initial inputs to the Utility FPI model, are standardized into the final values that are used by Utility FPI model.

Feature Name	**Initial Value**	**Standardization Equation**
LFM	61.76%	(1) $\text{LFM} = \frac{LFM_x - LFM_\mu}{LFM_s}$ (2) $\text{LFM} = \frac{61.76 - 80.457}{18.11}$ (3) $\text{LFM} = -0.34$
$\text{DFM}_{10\text{hr}}$	0.06146	(1) $\text{DFM}_{10\text{hr}} = \frac{\text{DFM10hr}_x - \text{DFM10hr}_\mu}{\text{DFM10hr}_s}$ (2) $\text{DFM}_{10\text{hr}} = \frac{0.06146 - 0.0535}{0.0247}$ (3) $\text{DFM}_{10\text{hr}} = 0.3221$
FFWI	33.03	(1) $\text{FFWI} = \frac{FFWI_x - FFWI_\mu}{FFWI_s}$ (2) $\text{FFWI} = \frac{33.03 - 38.13}{13.91}$ (3) $\text{FFWI} = -0.3670$
$\text{LU}_{\text{Shrublands}}$	0	(1) $\text{LU}_{\text{Shrublands}} = \frac{\text{LUShrublands}_x - \text{LUShrublands}_\mu}{\text{LUShrublands}_s}$ (2) $\text{LU}_{\text{Shrublands}} = \frac{0 - 0.07547}{0.264}$ (3) $\text{LU}_{\text{Shrublands}} = -0.02857$
$\text{LU}_{\text{Forest}}$	1	(1) $\text{LU}_{\text{Forest}} = \frac{\text{LUForest}_x - \text{LUForest}_\mu}{\text{LUForest}_s}$ (2) $\text{LU}_{\text{Forest}} = \frac{1 - 0.4316}{0.495}$ (3) $\text{LU}_{\text{Forest}} = 1.148$

The log odds *y* for the Utility FPI model is then calculated using the value of the standardized variables:

(1) $y = -1.68 - 0.24 * \text{LFM} - 0.26 * \text{DFM}_{10\text{hr}} + 0.22 * \text{FFWI} + 0.06 * \text{LU}_{\text{Shrublands}} + 0.47 * \text{LU}_{\text{Forest}}$

(2) $y = -1.68 - 0.24 * (-1.032) - 0.26 * 0.3221 + 0.22 * (-0.3670) + 0.06 * (-0.2857) + 0.47 * 1.147$

(3) $y = -1.68 - (-0.2477) - 0.0841 + (-0.0813) + (-0.0172) + 0.5387$

(4) $y = -1.080$

The value of the log odds *y* is then inserted into the FPI equation, resulting in a raw FPI output of 0.2535:

(1) $\text{FPI} = \frac{1}{1+e^{-y}}$

(2) $\text{FPI} = \frac{1}{1+e^{-(-1.080)}}$

(3) $\text{FPI} = \frac{1}{1+2.945}$

(4) $\text{FPI} = 0.2535$

PG&E notes that, following the above-demonstrated application of the equations from footnote 7 of PG&E's November 18 filing, two additional steps are performed to calculate the FPI input that is used by the LFP_D model and Black Swan criteria. *First*, for two kilometer-by-two kilometer grid cells, to increase the alignment of PG&E's identification of fire risk with agency forecasts and warnings, if a Red Flag Warning ("RFW") has been issued by the National Weather Service ("NWS") for the grid cell during the forecast hour, the FPI is raised to 0.23 if the above equations resulted in a raw value below 0.23. *Second*, to capture fire conditions before they occur, the FPI is then averaged with the FPI for each of the following two forecast hours to arrive at the FPI input for the LFP_D model and Black Swan criteria.

Question 5: Explain the ArcGIS and Collector App systems in detail. Specifically:

a. Explain how the ArcGIS records operate with respect to the "TC_Worked" field. When and how is the TC_Worked field generated? Do any alternative field(s) account for tree(s) or portions of line that were inspected but where inspectors did not identify any hazard trees/limbs?

b. Explain whether these system(s) allow and/or require workers to upload evidence of tree removal or trimming along with an indication that work was completed. Explain how the ArcGIS and Collector App systems communicate, if at all, with PG&E's PMD system, including the degree to which the PSPS decision-makers including the meteorology team have access to tree inspection and removal/trimming data from the ArcGIS and Collector App systems.

PG&E Response:

The ArcGIS database and Collector app used to support the post-Carr Fire restoration efforts were maintained by a PG&E contractor, Mountain G Enterprises, Inc.

("Mountain G"). The Mountain G version of ArcGIS and Collector is different from the versions currently maintained by PG&E to support post-fire VM work and PG&E's EVM program (described above in PG&E's responses to Questions 1 and 2). PG&E's version of Collector used to support its EVM program does not have a "TC_WORKED" field and instead has several fields used to indicate the status of work for a given vegetation point.

With respect to Mountain G's version of Collector used for the post-Carr Fire restoration efforts, PG&E presently understands that information in the "TC_WORKED" field was intended to be filled in by tree trimming contractors who performed tree work prescribed by pre-inspectors, along with other fields listing the name of the tree crew company, the date the work was completed and whether any additional tree units were identified and worked by the tree crew contractor. As noted in PG&E's prior submission, the post-Carr Fire response work was an early implementation of Mountain G's Collector system, and PG&E understands that tree removal contractors were not consistent in recording this information regarding completed trees using the Collector app. PG&E further understands that, in response to the inconsistent usage of Collector by tree removal crews, the team managing the post-Carr Fire restoration effort began to provide paper work order packets to tree crews, to provide an alternative means of tracking tree work.

PG&E's current version of the Collector app used for EVM work has a function to allow inspectors and tree crews to upload photos of vegetation associated with each vegetation point, but this function is currently disabled because the bandwidth it would require may destabilize the data upload process. PG&E notes that the 100% work verification process for EVM work, as described in PG&E's response to Question 2, provides in-field verification that tree crews have completed the work identified by pre-inspectors.

PG&E understands that the version of Collector used during the post-Carr Fire restoration effort did not allow pre-inspectors or tree crews to upload photos of vegetation associated with each vegetation point.

Mountain G's versions of ArcGIS and the Collector app do not communicate with any PG&E database systems.

PG&E's versions of ArcGIS and the Collector app do not communicate with PG&E's Project Management Database ("PMD") or its Vegetation Management Database ("VMD").

PSPS decision-makers do not currently access tree inspection and removal/trimming data from vegetation management systems. PG&E refers to its response to Question 9 for additional information in response to this Question.

Question 6: Is the gray pine now in PG&E's possession, a portion of which was removed by CalFire, marked by any spray paint?

a. PG&E shall ask CalFire and/or the Shasta County District Attorney's office to answer, *first*, whether the portions of the gray pine that CalFire removed show any spray paint and, *second*, whether the portion of tree that it removed contained burn marks that could obscure such paint.

PG&E Response:

PG&E did not observe any spray paint that had been applied to the sections of the Gray Pine that had been left in the area of interest by CAL FIRE.

On December 1, 2020, PG&E submitted letters to CAL FIRE and the Shasta County District Attorney's Office relaying the questions in Subpart a of this Question. A PG&E representative subsequently spoke with the Shasta County District Attorney, who referred PG&E to CAL FIRE because it is conducting a criminal investigation in which CAL FIRE is the lead investigating agency. CAL FIRE's response to PG&E's letter is attached as Exhibit A to this submission.

Question 7: The declaration dated November 18, 2020, attached to the response as Exhibit A states at paragraph 23:

"[A]t times in 2019, PG&E's vegetation management team gave guidance not to perform separate CEMA inspection and to close the CEMA project in PG&E's PMD following the commencement of the routine patrol in situations where, as a

result of risk-based prioritization changes to the routine patrol schedule, the CEMA patrol (the scope of which is subsumed in a routine patrol) had been scheduled close in time to the routine patrol."

How many CEMA inspections, required by the 2019 Wildlife Mitigation Plan, were NOT conducted as a result of these schedule changes during PG&E's pre-inspection annual calendar, November 16, 2019, to November 15, 2020?

PG&E Response:

PG&E tracks completion of its vegetation management patrols in its PMD. Vegetation management patrols of circuits or segments thereof are assigned unique project numbers based on certain operational considerations, such as location, anticipated duration, terrain, weather, access and permitting requirements. By way of example, vegetation management patrols along the Girvan 1101 Circuit are broken into multiple projects within PG&E's PMD, with the routine and CEMA patrols along the portion of the circuit that includes the Zogg Mine Road area both having unique project numbers.

In total, there were 2,520 unique CEMA patrol projects in PG&E's PMD, totaling 43,568 line miles, scheduled to occur between November 16, 2019 and November 15, 2020 (the "2020 CEMA projects"). As of December 14, 2020 PG&E's PMD indicated that 203 of the 2020 CEMA projects, totaling 6,084 line miles, were not completed or otherwise closed[8] prior to November 15, 2020. This represents 8.1% of the projects and 14.0% of the line miles associated

[8] PG&E's PMD indicates that as of December 14, 2019, 54 of the 2020 CEMA projects were closed without a separate CEMA patrol having occurred. Eleven of these projects were closed after they were determined to be duplicate or combined projects. Ten of these projects were closed after the circuits or circuit segments associated with those projects were patrolled as part of PG&E's enhanced vegetation management ("EVM") program. Four of these projects were in fire footprints and were closed after post-fire patrols of the circuits or circuit segments associated with those projects were conducted. Twenty-nine of these projects were closed after PG&E determined that the circuits or circuit segments associated with those projects were not within the scope of PG&E's CEMA program for 2020.

with PG&E's CEMA program in 2020. PG&E is on track to complete these remaining 2020 CEMA projects by December 31, 2020.[9]

The mid-year adjustments in 2019 to PG&E's vegetation management patrol schedule were unique to 2019, when PG&E transitioned to a risk-prioritized basis for scheduling routine vegetation management patrols. For 2020, as noted above, PG&E is on track to complete the 2020 CEMA projects by year end.

Question 8: Update PG&E's response to this question based on any new information, investigation, or conclusions reached since the filing of the November 18 response: "Is there specific evidence that the particular gray pine [removed by CalFire] was trimmed or removed prior to the Zogg fire? Was this tree identified for work by any patrol?"

PG&E Response:

PG&E is providing the Court with certain additional facts PG&E has learned in the course of its investigation since its November 18 submission relating to whether the Gray Pine of interest was identified for work prior to the Zogg Fire. PG&E's preliminary investigation into these matters is ongoing, and its understanding of the facts may change as the investigation continues. The information below is based on PG&E's understanding of the facts as of December 16, 2020.[10]

As discussed in PG&E's November 18 submission, following the Carr Fire in July 2018, PG&E engaged a number of contractors to perform vegetation management work in the Carr Fire footprint, which included the portions of the Girvan 1101 Circuit that served the

[9] If, for operational reasons, a patrol is not completed by year end, it will be completed in early 2021.

[10] In its November 18 submission, PG&E stated that it would submit a declaration, as requested by the Court, regarding the vegetation management work performed in the area of interest following the Carr Fire once it had analyzed further records and advanced its investigation. (Dkt. 1265 at 2.) PG&E is attaching to this submission as Exhibit B, a declaration attesting to facts included in PG&E's initial response to this Question and its updated response herein.

Zogg Mine Road area.[11] PG&E's review of the records indicates that tree work was performed in the Zogg Mine Road area between August and October 2018 to remove or trim trees identified for work by pre-inspectors as part of the post-Carr Fire response effort.[12] Based on its investigation, PG&E understands that tree removal work in that area was interrupted at least twice by a resident opposed to tree work on Zogg Mine Road. Each incident involved the brandishing of a firearm or the threat to brandish a firearm.

After the first work interruption by this resident, in September 2018, PG&E contractors working on the post-Carr Fire response effort asked the contractor-employed arborist who had performed or participated in the routine inspection of the Zogg Mine Road area on PG&E's behalf since 2015 to speak with the resident to secure the resident's agreement to allow workers to resume work without being threatened. Because this arborist had previously performed PG&E's routine VM patrols of the Zogg Mine Road area, he had experience interacting with this resident of Zogg Mine Road successfully. Following that conversation in late September 2018, the arborist reported that tree crews could resume tree work.

However, a second work interruption occurred on October 8, 2018. During that incident, workers reported that the resident of Zogg Mine Road had covered the paint used to mark a tree for work with black paint and told the contractors that no tree crew would touch the tree the resident blacked out. This tree was not on the resident's property. According to the report from the contractors, this resident would brandish a firearm again if they touched the tree.

[11] As used herein, the "Zogg Mine Road area" refers to the entire length of Zogg Mine Road that runs from the intersection of Zogg Mine Road and S. Fork Road through and beyond Jenny Bird Lane to the terminus of Zogg Mine Road.

[12] In September 2018, members of the post-Carr Fire team began to transition from the fire restoration effort to support the Accelerated Wildfire Risk Reduction ("AWRR") program (a precursor to PG&E's Enhanced Vegetation Management program) in the Paradise and Magalia areas. When the Camp Fire started on November 8, 2018 additional resources were transitioned from the post-Carr Fire restoration effort to the Paradise area to support the post-Camp Fire restoration work. PG&E understands that some tree work continued on the post-Carr Fire restoration effort until at least November 15, 2018.

The following day, on October 9, 2018, a supervisor for the contractor that handled routine patrols on the Girvan 1101 Circuit stated to one of the individuals managing the post-Carr Fire response work that he would coordinate to have an arborist perform a routine vegetation management patrol of the Zogg Mine Road area in order to minimize the impact to residents, and that the routine patrol arborists with experience working the Zogg Mine Road area would reach out to coordinate working with the Zogg Mine Road resident that was threatening to brandish a firearm at tree crews and interrupting work.

The day after that, on October 10, 2018, an arborist—specifically, the arborist who had previously performed routine patrols on Zogg Mine Road and had a history of successful interactions with the resident of Zogg Mine Road who was threatening tree crews—began the routine patrol of the Zogg Mine Road area for 2018. At the time of this patrol, PG&E understands that this arborist was ISA-certified and had four years of experience patrolling utility lines, including multiple prior patrols of Zogg Mine Road area.

PG&E currently understands the following about the October 2018 routine vegetation management patrol. The arborist was aware that a fire had just come through the area and had burned, to varying degrees, many trees; he was aware that certain trees had been marked for work as part of the post-Carr Fire response work but had not been worked as of the time of his routine inspection, and he was further aware that work stoppages had occurred because of threats from the armed resident of Zogg Mine Road. PG&E understands the arborist performed an independent review of the route he inspected and marked for work any tree that, in his professional opinion, posed a risk to PG&E facilities, regardless of whether that tree had been marked or not marked for work during post-Carr Fire restoration patrols.

PG&E understands that when the arborist identified a tree that required work, he would record the tree in PG&E's Vegetation Management Database ("VMD") and would mark the tree with spray paint with a color distinct from the paint color used to mark trees identified during the post-Carr Fire restoration patrols. PG&E further understands that if the arborist identified a tree for work that had already been marked with the spray paint used by the

post-Carr Fire pre-inspectors, the arborist would re-mark the tree with the routine-colored paint to ensure the tree trimmers scheduled to perform tree work for the trees identified during the routine patrol would know to work these trees. If the arborist identified a tree that had spray paint or markings from the post-Carr Fire work, his practice was to examine that tree carefully, and if he judged that it would not pose a risk to PG&E's facilities at least until the tree would be re-evaluated during the next year's routine vegetation management patrol, then he would not mark the tree for work as part of the routine program. PG&E records indicate that, during his October 2018 routine patrol, while the arborist marked several Gray Pines for work, he did not mark any Gray Pines for work during the routine patrol in October 2018 with locations consistent with the location of the Gray Pine from which CAL FIRE appears to have collected sections after the Zogg Fire. Based on PG&E records, the October 2018 routine patrol occurred between October 10 and October 26, 2018. In addition to the trees that had already been worked as part of the Carr Fire response, the arborist marked approximately 250 additional trees for work during his routine patrol in October 2018, and those trees were subsequently worked. Specifically in the area of interest,[13] during the routine patrol that occurred after the Carr Fire in October 2018, the arborist marked four trees for removal and one tree for trimming. PG&E records indicate that this work was subsequently performed.

[13] The "area of interest" refers to the area from which CAL FIRE has collected evidence, specifically, the area surrounding the three spans between pole 103320099 and pole 101457898 about a quarter mile southeast of the intersection of Jenny Bird Lane and Zogg Mine Road, as depicted in Exhibit C to PG&E's October 26, 2020 submission. (Dkt. 1250-003.)

Question 9: In its response dated November 3, 2020, PG&E states that it utilizes a risk model to select areas to be worked for EVM. Why can't the system for determining whether a distribution line will be de-energized in a PSPS event operate on a risk model, which takes into account the extent to which the relevant distribution lines are in compliance with Public Resource Code Sections 4292 and 4293 and PG&E's own Wildfire Mitigation Plan?

PG&E Response:

PG&E's distribution-line scoping model for PSPS events, the Large Fire Probability ("LFP_D") model, does not take into account the extent to which vegetation in an area had been cleared or trimmed. PG&E understands the Court's question to be why PG&E does not modify PSPS decision-making to account for line sections where a vegetation management patrol has identified trees for work pursuant to Public Resource Code Sections 4292 and 4293 but the completion of that work (which happens after the pre-inspection patrol) remains pending.

As noted below, PG&E will undertake an assessment of whether that would reduce risk and is practicable. PG&E preliminarily notes the following: Whether there is outstanding vegetation management work on a circuit is not necessarily indicative of risk. Routine vegetation management patrols typically happen once a year and are typically intended to prescribe work that will keep the line in compliance for at least the next year—in other words, they include in a sense preventative maintenance, and pending work does not necessarily suggest elevated risk at the time of the findings. A line that has not yet been inspected in a given year may not have any outstanding vegetation management work pending, but may present more risk than a recently inspected circuit where tree work is ongoing.

Notably, the vegetation that PG&E views as highest risk are trees that present a "Priority 1" risk designation under PG&E's procedures, which require mitigation within 24 hours of being entered into PG&E's system. Even if such work were outstanding at the time PSPS scoping decisions were made, the work should be completed before a PSPS event occurred.

PG&E will evaluate whether and how the existence of outstanding vegetation management work would be incorporated into PG&E's scoping, and whether the data shows that such an approach would reduce risk in an operationally executable manner. PG&E will share with the Court its evaluation and any proposed steps by June 2021, in advance of next year's peak fire season.

Dated: December 16, 2020

Respectfully Submitted,

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