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May 26, 2021 VIA ELECTRONIC FILING

Caroline Thomas Jacobs, Director
Office of Energy Infrastructure Safety
California Natural Resources Agency
715 P Street, 20th Floor
Sacramento, CA 95814

RE: MUSSEY GRADE ROAD ALLIANCE COMMENTS ON 2023-2025 WILDFIRE MITIGATION PLANS OF PG&E, SCE, AND SDG&E

Dear Director Thomas Jacobs:

The Mussey Grade Road Alliance (MGRA or Alliance) files these comments pursuant to the 2023 Wildfire Mitigation Plan Schedule[1] provided by the Office of Energy Infrastructure Safety (OEIS or Energy Safety) which authorizes public comment on the Large Utility Wildfire Mitigation Plans (WMPs) by May 26, 2022.

The Mussey Grade Road Alliance is pleased to be able to continue to participate and provide substantive feedback on the Large IOU Wildfire Mitigation Plans. Review of this year's WMPs were especially challenging due to the fact that this is the beginning of the three year cycle, which calls for comprehensive plans. Additionally, Energy Safety has introduced a new suite of guidelines which considerably increased the detail and the uniformity of the WMPs. This effort has been largely successful, in that it makes direct comparison between utility plans much more approachable, and has brought out additional technical detail that previously required numerous data requests to obtain. Energy Safety and other regulators should view this WMP cycle as a victory of a more prescriptive approach to utility safety and reporting.

[1] 2023-2025-WMPs; Office of Energy Infrastructure Safety; 2023 Wildfire Mitigation Plan Schedule; p. 3; TN11750_20221207T144222_2023_WMP_Schedule. (2023 Schedule)

A more detailed history of how the Mussey Grade Road Alliance, a grass-roots citizen-based organization located in Ramona, California, has striven in its efforts over 16 years to improve power line fire safety in California was provided in MGRA's comments on the 2020 Wildfire Mitigation Plans.[2] As we stated then, the Alliance was the first party to call for wildfire prevention plans in 2009 at the California Public Utilities Commission (CPUC or Commission) and to advocate for this proposed rule through to Commission adoption.[3] The original "WPPs" were cursory and not particularly useful documents that utilities obligatorily filed with the Commission, and did not update. The filings comprising the 2023-2025 WMPs are orders of magnitude more comprehensive and actionable, and show a much more serious attention to wildfire safety on behalf of the State of California, for which Energy Safety deserves much credit.

The wealth of information provided in the 2023-2025 WMPs, associated documents, and data request responses also have a serious downside when coupled with the short legislative timeline allocated for WMP review. The MGRA expert has reviewed well over 5,000 pages of highly technical documentation. Providing serious analysis of all this material within a two month timeframe is well beyond the ability of any single stakeholder. Fortunately, Energy Safety staff, Cal Advocates, TURN, and GPI are also rising to the occasion and will be providing feedback on numerous topics that MGRA will not be able to address. We once again respectfully request that Energy Safety continue to acknowledge stakeholder contributions when it finds them helpful in its final review, as it has in past years.

The Alliance comments are authored by the Alliance expert, Joseph W. Mitchell, Ph.D.[4] Many of the topics he raised in the previous years – wind and wildfire risk, power shutoff and shortcomings in utility modeling tools – remain active topics of discussion within both Energy Safety and CPUC frameworks. Dr. Mitchell presents additional data and information this year.

The most daunting task facing Energy Safety over the next years will be addressing the current utility proposal to shift to undergrounding of lines as their primary mitigation. The utilities are in lock-step with each other in regard to this radical change in their approach and seek to quash

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[2] MUSSEY GRADE ROAD ALLIANCE COMMENTS ON 2020 WILDFIRE MITIGATION PLANS OF SDG&E, PG&E, SCE; April 7, 2020; pp. 1-3. (MGRA 2020 WMP Comments)
[3] D.12-01-032; pp. 45-55.
[4] M-bar Technologies and Consulting, LLC; http://www.mbartek.com; Email: jwmitchell@mbartek.com. Dr. Mitchell is also a board member of the Mussey Grade Road Alliance.

all serious discussion of alternatives. While undergrounding is *safe* for the residents of the wildland urban interface and those affected by power shutoff, it is so extraordinarily expensive that those who have trouble paying their bills now will be significantly more insecure and *unsafe* as their electric bill eats into the money they need for safe and healthy living. The MGRA expert showed last year and in this year's filing that the effect on lower income communities could potentially be more deadly than the wildfires and shutoffs California is trying to prevent.

The goal of the monopoly utilities is clear – to reap huge profits through investment in big capital projects (10% guaranteed rate of return), and to make the ratepayers pay the bill. While it is the California Public Utilities Commission's job to control reasonableness and spending, Energy Safety has in the past insisted on showings that utility choices of wildfire mitigations are reasonable and have been vetted with regard to efficiency. Energy Safety's admonishments and guidance laid out in the previous years' WMPs have been blatantly ignored or sidestepped in the current WMPs. The Alliance therefore urges Energy Safety to make the hard choices this year that will be necessary to bring the utilities back on track and committed to risk-based decision making.

As will be shown in Alliance Comments, the WMPs cannot be reasonably accepted in their current form.

Energy Safety has in the past shown that it is committed to obtaining a wildfire-safe California at a cost that Californians can afford. We ask that Energy Safety hold to its commitment through the coming years and to stick to the values it has so far served so well.

Respectfully submitted this 26th day of May, 2022,

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WILDFIRE MITIGATION PLAN COMMENTS ON BEHALF OF THE MUSSEY GRADE ROAD ALLIANCE

The Mussey Grade Road Alliances' (MGRA or Alliance) Wildfire Mitigation Plan comments are authored by MGRA's expert witness Joseph W. Mitchell, Ph.D.[5]

1. INTRODUCTION AND SUMMARY

The Mussey Grade Road Alliance provides comment on the 2023-2025 Wildfire Mitigation Plans (WMPs) for Pacific Gas and Electric Company (PG&E),[6] Southern California Edison (SCE),[7] and San Diego Gas and Electric Company (SDG&E).[8] For the sake of comparison between utilities, all comments are provided in one document that for the most part uses the structure laid out in the templates approved in the 2023-2025 Wildfire Mitigation Plan Technical Guidelines.[9]

The full update of the 2023-2025 Wildfire Mitigation Plans has greatly expanded and improved upon the previous iterations of the Wildfire Mitigation Plans and Updates. This is due largely to the much more detailed and prescriptive Process and Technical Guidelines provided by Energy Safety. The response by the utilities is massive, detailed and far more uniform than in previous years, for which Energy Safety deserves much credit.

From a 10,000 foot overview of the 2023-2025 large IOU WMPs, I am reminded of the first line of Dickens' "A Tale of Two Cities": *"It was the best of times, it was the worst of times…"*. There are a considerable number of "bests" in the current WMPs, and these need to be acknowledged. Utilities continue to add expert staff and gain expertise in areas of wildfire behavior, data science, and power engineering. New technologies such as REFCL, Falling

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[5] M-bar Technologies and Consulting, LLC; http://www.mbartek.com; Email: jwmitchell@mbartek.com. Dr. Mitchell is also a board member of the Mussey Grade Road Alliance.
[6] 2023-2025-WMPs; Pacific Gas and Electric Company; Wildfire Mitigation Plan; March 27, 2023; TN11965-1_20230327T160416_PGE's_20232025_Wildfire_Mitigation_Plan.pdf. (PG&E WMP).
[7] 2023-2025-WMPs; Southern California Edison Company; 2023-2025 WILDFIRE MITIGATION PLAN; March 27, 2023; TN11952-2_20230327T125844_20230327_SCE_2023_WMP_R0.pdf. (SCE WMP)
[8] 2023-2025-WMPs; San Diego Gas & Electric Company; 2023-2025 Wildfire Mitigation Plan; March 27, 2023; TN11948_20230327T160734_20232025_SDGE_WMP_with_Attachments-1.pdf. (SDG&E WMP)
[9] 2023-2025-WMPs; Office of Energy Infrastructure Safety; 2023-2025 WILDFIRE MITIGATION PLAN TECHNICAL GUIDELINES; December 6, 2022; TN11745_20221207T142120_20232025_WMP_Technical_Guidelines.pdf. (OEIS Templates)

Conductor Detection, Downed Conductor Detection, and others that will prove to substantially mitigate wildfire risks have move past the early pilot stages and are now being deployed in the field. Utilities are fine-tuning their fault settings to be more sensitive during periods of high fire danger, while still moderating reliability impacts. Improved forecasts and weather station data allow more targeted power shutoff when this is deemed necessary. SCE has proved both that covered conductor can be deployed rapidly at scale and also that REFCL is a feasible technology for much of California's distribution infrastructure. Indeed, the progress that is being made is impressive enough that were it to continue at its current pace, one of the major IOUs could likely eliminate the risk of utility caused wildfire within the next decade, and perhaps sooner. With highly effective covered conductor coupled with complimentary technologies such as REFCL, the risk of catastrophic wildfire could be brought to nearly the level promised by undergrounding, and PSPS impacts could likewise be substantially reduced.

However, the last year has also shown a dramatic and disturbing retrenchment and rearrangement of utility priorities. As discussed in last year's WMP Comments, PG&E had announced a 10,000 mile undergrounding program, "*throwing the entire premise of risk-based decision-making into question*."[10] In the past year, PG&E has been joined by SDG&E and Edison, which have both proposed their own greatly expanded undergrounding programs. This should not be surprising given the substantial revenue that utilities earn from capital investments. Indeed, from the utility management standpoint undergrounding is a no-brainer: it offers the utility protection from liability from wildfire, high reliability, and a 10% guaranteed return on investment so long as the regulators go along with it. The problem with undergrounding, also discussed in MGRA's 2022 WMP Comments, is that it is extremely expensive – so expensive in fact that it potentially threatens the health and safety of low income ratepayers.[11] Further complicating the problem, the California legislature and Governor became involved, passing into law Senate Bill 884, which calls for an expedited planning process for utility undergrounding.

What appears to be happening is that the entire edifice of risk-based planning, careful wildfire prediction and modeling, deployment of advanced situational awareness technologies, development of a portfolio of effective mitigations, new technologies, and wildfire mitigation planning, are being pushed aside in a brute-force attempt to "get 'er done". Even if undergrounding

[10] MGRA 2022 WMP Comments; pp. 13, 72-77.
[11] MGRA 2022 WMP Comments; pp. 57-59.

weren't so cripplingly expensive, it is also slow to deploy – it doesn't "get 'er done" very fast – meaning that customers who have been selected to be protected by undergrounding can be at an elevated exposure to wildfire for many years, while other mitigations could protect them much sooner. The regulatory framework as well is being pushed aside by utilities, with an apparent disregard for any potential consequences. Take for an example Energy Safety's utility actions RN-PG&E-22-04 and SDGE-22-15, which require utilities to show that undergrounding is a cost-effective solution compared to other mitigations. These comments (and doubtless comments of other stakeholders) will clearly demonstrate that the utilities have failed to adhere to this guidance, and are pushing ahead with undergrounding as their default solution.

These comments will also demonstrate other things that call the current utility approach into question. They will show that utility risk modeling, for all of the advances that it has made over the past years, still retains a number of key flaws. What is new this year is that the utilities seem to be acknowledging those flaws. But rather than fixing them (which is admittedly hard), each utility has adopted its own bespoke and elaborate "hacks" to its risk analysis and prioritization processes to address issues that MGRA, Energy Safety, and other stakeholders have been raising over the past years. While it is good that longstanding problems are at least being implicitly acknowledged, the solutions generally lack transparency, objectivity, rigor, and validation.

Utility risk modeling, therefore, is in a rapid state of flux and change. The implication that the use of these models for long-term planning and prioritization must be understood as provisional. As time passes, risk models will undergo additional major changes. At the same time, technologies will continue to advance and data will continue to be collected. Of particular interest will be SCE's experience with its now vast deployment of covered conductor. Utilities have completed further evaluation of covered conductor through their consultant Exponent, and have concluded that its effectiveness in preventing ignition is 70%. Data and analysis in these comments will indicate that the effectiveness in stopping catastrophic utility wildfires is substantially higher than this. Covered conductor in conjunction with advanced technologies is still being studied by utilities, but because these technologies have strengths that compliment covered conductor, combinations are likely to be extremely effective.

Taking all of these factors under consideration, any plan that would lock in an expensive long-term solution or a rigid set of prioritizations would be unwise and would show a callous

disregard for the needs of ratepayers and WUI residents. Energy Safety should therefore carefully consider the data and analysis presented in these and other stakeholder comments apply its own technical expertise to carefully probe utility claims. Energy Safety should also, where necessary, apply the powers it has been granted as a regulator to show that utilities are not at liberty to simply ignore mandatory guidance from OEIS and the CPUC.

The preparation and analysis of these massive Wildfire Mitigation Plans has been and will be a challenge to all involved. These WMPs are very rich veins, and their contents contain information that can shape the next decade of the California experience. Whether the problem of utility wildfire be solved, and whether Californians can bear the cost of their electrical utilities – the answers lay in the careful scrutiny of these utility plans. We thank Energy Safety staff for their efforts in this formidable undertaking, our fellow stakeholders, and those utility staff who remain committed to achieving a rigorous, scientific, and technically advanced approach to the elimination of utility wildfire in California.

1.1. Organization

The Mussey Grade Road Alliance provides comment on the 2023-2025 Wildfire Mitigation Plans (WMPs) for Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE),[12] and San Diego Gas and Electric Company (SDG&E).[13] For the sake of comparison between utilities, all comments are provided in one document that for the most part uses the structure laid out in the templates approved in the 2022 Wildfire Mitigation Plan Update Guidelines Template.[14]

The Office of Energy Infrastructure Safety (OEIS or Energy Safety) has continued to expand the depth and breadth of its requirements for utility reporting, and as a result the document load remains voluminous and is difficult to review in the short statutory window allowed. We are grateful for the 2 month review period, but it is impossible in that time to do a thorough and adequate review of 4,000 pages of primary documents and several thousand more pages of secondary documents. These comments will therefore be highly focused on specific topics.

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[12] Southern California Edison Company; 2022 WILDFIRE MITIGATION PLAN UPDATE; FEBRUARY 18, 2022. (SCE WMP)
[13] San Diego Gas & Electric Company; 2020-2022 WILDFIRE MITIGATION PLAN UPDATE; February 11; 2022. (SDG&E WMP)
[14] ATTACHMENT 2; 2022 Wildfire Mitigation Plan Update Guidelines Template; December 13, 2021.

MGRA is including utility data request responses as Appendix A of these comments. Even when we are not fully able to explore every issue that these cover in the comments, we hope that Energy Safety will review these responses from the utilities as well in order to inform its own evaluation. The CPUC also conducted a number of wildfire-related proceedings in 2022 and 2023, some of which produced filings and data of direct relevance to the 2022 WMP reviews. These are discussed in Section 3.1.

MGRA Workpapers can be found at:
https://github.com/jwmitchell/Workpapers/tree/main/WMP23

1.2. Comparison with 2022 WMPs

MGRA made a number of recommendations as part of its 2022 WMP comments.[15] MGRA commented on the WMPs of the three major IOUs, PG&E,[16] SCE,[17] and SDG&E.[18] Many of these were acted upon by WSD and later OEIS, either in its review of the WMP or in its comments on the utility quarterly report. Other recommendations were in one way or other implemented by utility actions. Some of MGRA's recommendations were not addressed but remain valid concerns in the 2022 WMP reports. MGRA's 2022 recommendations are summarized below:

Recommendation	**WSD/OEIS Action**	**Utility Action**	**Status**
Utilities should evaluate cost effectiveness of alternatives to undergrounding.	RN-PG&E-22-04, SDGE-22-15.	PG&E has ignored OEIS guidance. SDG&E has increased its proposed undergrounding.	Undergrounding is default mitigation for PG&E, SCE and SDG&E. No utility is comparing against combinations of hardening alternatives.

[15] 2022-WMPs; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON 2022 WILDFIRE MITIGATION PLANS OF PG&E, SCE, AND SDG&E; April 11, 2022. (MGRA 2022 WMP Comments)
[16] 2022-WMPs; 2022 Wildfire Mitigation Plan Update; Pacific Gas and Electric Company; February 25, 2022. (PG&E 2022 WMP)
[17] 2022-WMPs; Southern California Edison Company; 2022 WILDFIRE MITIGATION PLAN UPDATE; FEBRUARY 18, 2022. (SCE 2022 WMP)
[18] 2022-WMPs; San Diego Gas & Electric Company; 2020-2022 WILDFIRE MITIGATION PLAN UPDATE; February 11, 2022. (SDG&E 2022 WMP)

A working group should be established to investigate REFCL implementation.	SCE-22-11	Meetings on advanced technologies.	Still active. PG&E REFCL work slowed, SDG&E rejects REFCL, SCE implementing pilots.
Utilities should incorporate wildfire smoke risk.	Agreement. PG&E Draft Decision, p. 26.[19] SCE Draft Decision, p.13.	Energy Safety working group.	Still active, but dormant. SDG&E still using flawed calculation.
Utility risk models do not adequately represent correlation between ignition and spread.	PG&E Draft Decision, p. 64, SDGE-22-09.	PG&E adopts v3 model, SDG&E adds wind correction for risk, SCE uses high winds for Severe classification. SDG&E collaborates with SDSC.	Still active. Utility models still do not show wind as a significant predictive variable, but utilities have adopted workarounds to incorporate wind effects.
Technosylva fire spread model does not model larger fires and does not account for suppression effects.	Issue PG&E-22-05, SDG&E-22-06	Energy Safety working group.	Still active. PG&E and SCE no longer use 8 hour fire spread for prioritization. New models require further validation.
PG&E should report EPSS outages and compare their impact with PSPS.	PG&E-22-32	PG&E monthly EPSS updates.	Complete.
Egress issues and wooden poles	None	Utilities incorporating egress issues. Technosylva studying inclusion.	SCE using egress as a criterion for Severe classification.
Bias of utility ignition models by PSPS	None	PG&E incorporates PSPS damage events.	Active for SCE. SDG&E plans to incorporate.

Table 1 - MGRA recommendations made as part of the 2022 WMP review, Energy Safety and utility action on these topics, and current status.

Recommendations that have not been acted upon or have not been adequately implemented in the 2023-2025 WMPs are reiterated in the Summary of Recommendations in Section 13.

[19] 2022-WMPs; OFFICE OF ENERGY INFRASTRUCTURE SAFETY'S DRAFT DECISION ON 2022 WILDFIRE MITIGATION PLAN UPDATE PACIFIC GAS AND ELECTRIC COMPANY; October 2022.

1.3. Significant Findings in the 2023 WMPs

There have been a number of significant developments since the issuance of last year's Wildfire Mitigation Plans. The 2023 WMPs are far more comprehensive than any that have come before, and utilities are providing more detailed data and analysis than in any previous filing at Energy Safety or the Commission. These have been accompanied by major changes in utility focus and direction, specifically a move away from risk-based decision making and toward a zero-incident goal with undergrounding as a means to achieve that goal.

1.3.1. Significant advances in wildfire safety

There have been a number of advances that have been made over the last year:

- Firstly, 2022 was a low intensity fire year, providing a much needed break in the previous decade of severe drought and wind events, allowing utilities to move forward with risk mitigation events.
- SCE has now hardened over 3,800 miles of its HFRA territory, mostly with covered conductor.[20]
- SCE has run additional successful pilots of Rapid Earth Fault Current Limiter (REFCL) technology, which in conjunction with covered conductor eliminates nearly all ignition sources.[21] SCE plans to have 373 miles of REFCL protected circuits in place by the end of 2023 and 650 miles in place by the end of 2024.[22]

These items will be discussed in subsequent sections with regard to OEIS supporting best utility practices.

[20] SCE 2023 WMP p. 32.
[21] SCE WMP; p. 217-218.
[22] SCE 2023 WMP; p. 750.

1.3.2. Major issues identified in the 2023 Wildfire Mitigation Plans

A number of significant issues were identified in the 2023 WMPs and will be addressed at length in the remainder of these comments. To summarize some of these issues:

- PG&E, SDG&E, and SCE have all proposed greatly expanded undergrounding proposals. Despite guidance from Energy Safety, the WMPs do not justify the cost effectiveness of undergrounding by comparing it to alternative mitigations such as the combination of covered conductor and technology solutions such as REFCL, downed conductor detection, falling conductor protection, and high impedance fault detection.
- Utilities have adopted an "undergrounding first" approach, in which undergrounding is assumed to be the primary mitigation for future wildfire risk reduction, with other mitigations only to be used in the event that undergrounding is infeasible for the segment to be mitigated.
- SDG&E and SCE are still using consequence models that underrepresent the contributions of catastrophic fires due to the 8 hour limitation of Technosylva fire spread simulations.
- Utility risk models used for planning still do not correctly predict the drivers that are responsible for catastrophic fires, overweighting ignitions from external agents (animals, vehicles, balloons, 3rd parties) at the expense of equipment damage and vegetation contact.
- Utilities reject suppression modeling as a complex and intractable problem. In the larger sense, MGRA agrees, but suggests that by breaking off the initial attack component (responsible for stopping ~98% wildfires) into a separate piece it should be straightforward to solve as a ML problem based on local condition covariates.
- SDG&E's risk model tends to be "urbanized", i.e. risk is found higher closer to population centers rather than in remote areas where the most catastrophic wildfires in San Diego have been ignited. This bias is caused primarily by the 8 hour run time and possibly the building loss model of Technosylva, which does not generate wildfires of the size typical for San Diego historical catastrophic fires.
- SDG&E's "weighted-sum modeling and factor-adjustment parameterization" provides a mechanism for "correcting" for known effects that influence ignition

probability, and shows promise as a replacement for or supplement to machine learning models. However SDG&E needs to do more to validate its models.

- SDG&E and PG&E have made no effort to identify limited egress areas or areas with no secondary egress, much less include them in their wildfire risk modeling. SCE alone creates a model for identifying areas of limited egress that are at risk, but has not incorporated this information into its consequence model, instead identifying these areas as automatically qualifying for undergrounding.
- Utilities are beginning to use the Technosylva building loss model. In SDG&E's case, this change apparently amplifies the "urbanization" effect resulting from 8 hour fire spread limitations.
- PG&E has developed a consequence model that is no longer limited by the 8 hour Technosylva fire spread duration. However it makes questionable assumptions, such as using a limited number of consequence bins and using the mean to characterize a power law distribution. However, its consequence results no longer display the "urbanization" effect seen in consequence models relying on Technosylva model with 8 hour duration, so in that way may be "less incorrect".
- While SCE's MARS risk model has undergone modest changes, SCE has adopted an entirely new "IWMS Risk Framework" which by definition isn't a risk framework at all because it lacks a probability component. SCE proposes that based on certain criteria (egress issues, high potential consequence, high wind) areas will be designated for undergrounding mitigation.
- SCE's approach, and to some extent that of the other utilities, is to beg the question of what constitutes "acceptable" risk, and whether there are risks that should be mitigated at all costs. This question is under consideration at the CPUC, but OEIS faces it as well as it considers these WMPs.
- Utilities do not adequately address extreme weather scenarios as required by OEIS.
- SDG&E's WiNGS-Planning model uses a "decision-tree" that automatically prefers undergrounding as a result of SDG&E inputs, including a very low estimate for the effectiveness of alternative mitigations and an arbitrary risk reduction target.
- Based on updated analysis and Exponent testing results, SCE has increased its overall estimate of covered conductor in reducing ignition to 72%. Drivers related to catastrophic fire ignitions are reduced by 77-82%. This is higher than the 65% used

by SDG&E and PG&E in their comparisons of covered conductor to undergrounding.

- MGRA analysis of SCE wire down and ignition data for covered conductor and bare wire show a conservative reduction of 80% and 90%, respectively, without even adjusting for wires down due to 2022-2023 winter storms.
- Three ignitions reported on covered conductor segments (two from PG&E and one from SCE) were caused by tree fall-ins.
- SCE has had successful REFCL installations that reduce fault energy by a factor of 1,000, and is installing others. REFCL installations are complex, subject to supply chain issues, and require significant knowledge and training.
- SCE has provided estimates for the effectiveness of REFCL and the combination of REFCL and covered conductor at reducing ignitions. Both estimates bear further scrutiny, because they make assumptions that would lead to underestimation, and are additionally lower than those expected from Australian results.
- SDG&E's Advanced Protection Program (APP), and particularly its Falling Conductor Protection (FCP) can be extremely effective in preventing ignition for wire down events with broken conductor, such as might occur in a tree strike. SDG&E, however, is only deploying this technology in areas where it has decided not to underground lines.
- Both SDG&E and SCE are deploying radio frequency sensors that are very effective at detecting incipient faults before they occur. SDG&E estimates it is 72% effective in detecting damaged components.
- SCE has adjusted its power shutoff threshold for covered conductor circuits to 58 mph, and is the only utility to adjust PSPS threshold based on mitigation.
- The report from San Diego Computing Center performed at the behest of SDG&E does not use standard wind speed and gust definitions and requires additional meteorological validation before it should be used for planning purposes.

3. STATUTORY AND REGULATORY REQUIREMENTS

3.1. Wildfire mitigation activity at the California Public Utilities Commission

MGRA continues to be involved in a number of Commission proceedings that have been operating in parallel with Energy Safety's WMP review process. Many of these proceedings have overlapping areas of interest where close coordination between OEIS and the CPUC is needed to ensure that utilities are not presented with conflicting requirements. Throughout the year, CPUC staff (often through Cal Advocates) have attended OEIS meetings and workshops, while OEIS staff have sometimes attended CPUC workshops. This continued cooperation is critical, because in order to implement the measures laid out in the WMPs, the utilities must obtain funding for them through the CPUC's General Rate Case (GRC) process.

Some of the current CPUC proceedings that have scope overlapping with the Wildfire Mitigation Plans are:

3.1.1. R.20-07-013 – The "Rate-Based Decision-Making Framework" (RDF)

The RDF proceeding is tasked with devising the guidelines and standards for risk evaluation in the Risk Assessment and Mitigation Phase prequel to each General Rate Case (GRC). While the S-MAP/RDF and RAMPs are designed to quantify all enterprise risks and mitigations, the risk from wildfire dwarfs all other risks combined.

2022-2023 Developments – The Commission has made a major change in the way that the MAVF functions are calculated, now specifying that the MAVF function represent monetized risk, and replacing attributes with a dollar value.[23] This should aid in the direct comparison of risk scores between utilities.

Overlap – Energy Safety has adopted the CPUC-mandated risk models as the standard way for utilities to quantify risks and risk/spend efficiencies. Going forward, risk/spend efficiencies will become cost/benefit ratios.[24]

[23] D.22-12-027; pp. 12-41.
[24] Id.; p. 12.

Comment – Over the last year in particular, utilities have been publicly pushing back on the notion of risk/spend efficiencies informing their mitigation decisions. The CPUC has allowed utilities flexibility as far as application of RSEs and cost/benefit ratios,[25] however the utilities have pushed this to the limit of not including RSE/cost-benefit in any transparent way into their mitigation choices. This has happened largely in the context of "risk-tolerance": the IOUs have declared that wildfire risk is intolerable and they therefore are justified in using any means to address it.[26] "Risk tolerance" is a subject currently under consideration in R.20-07-020. As MGRA stated in that proceeding "utility-determined risk tolerance is a trap",[27] and that "tolerance" must be the accepted definition of "Societal Tolerable Risk Limit",[28] not as one defined by electrical utilities. As MGRA stated in comments: "*We are witnessing utility-controlled risk tolerance in practice and if approved it will lead to many tens of billions of dollars in added utility spending*."[29]

Recommendation*:*

- Energy Safety should reject assertions within the WMP that certain mitigation choices have been made on the basis of risk tolerance or risk deemed "unacceptable". The CPUC has as yet made no determinations regarding risk tolerance, and still requires that utilities consider cost-effectiveness when choosing mitigations. Energy Safety should likewise require utilities to choose prioritizations consistent with their risk models, and to correct their risk models if these models fail to take into account critical safety or cost efficiency considerations.

3.1.2. A.21-06-021 – PG&E's General Rate Case

2022 Developments – PG&E's evidentiary and briefing phase has been completed with regard to issues relevant to wildfire spending, and a proposed decision is pending. MGRA introduced its WDRM v3 model late in the proceeding, so it could only be included as cross-

[25] D.18-12-014, Attachment A, Appendix A, p. A-14, No. 26.
[26] WMP workshop; April 28, 2023. SCE referred to the "ALARP" (As Low As Reasonably Practicable) risk tolerance standard in its discussion of its mitigation choices.
[27] R.20-07-013; MUSSEY GRADE ROAD ALLIANCE PHASE II STAFF PROPOSAL REPLY; September 6, 2022; p. 8.
[2828] R.20-07-013; SOUTHERN CALIFORNIA EDISON COMPANY'S (U 338-E) OPENING COMMENTS ON STAFF PROPOSAL ADDRESSING PHASE II ISSUES; August 29, 2022; p. A-18. (SCE RDF Phase 2 Comments)
[29] Op. Cite; p. 9.

examination exhibit. MGRA's testimony showed that PG&E's WDRM v2 had a number of inconsistencies and flaws, previously discussed in MGRA WMP comments, and that this is of particular relevance to the rate case because PG&E is using its models to choose mitigation and to prioritize its circuits for mitigation. For instance, PG&E does not include wildfire smoke as a risk, although it is likely that wildfire smoke presents the largest public safety risk from wildfire. As their witness Paul McGregor candidly stated under cross-examination: "*I think quite frankly if you were introducing wildfire smoke to all of the utilities in California's risk modeling, it would change their outputs for prioritization."*[30]

Regarding PG&E's proposal for a massive expansion of its undergrounding program, one of the reasons that PG&E gave is that such a program and its concomitant reduction of risk is required by Energy Safety. Cross of examination of witness Carla Peterman by MGRA produced the following exchange:

"*Q. So must wildfire be mitigated at any cost, or is there a limit to how much it's reasonable to spend to mitigate wildfire?*

Yeah. As you are aware, we submit our wildfire mitigation plan to the Office of Energy Infrastructure and Safety, and they have a very decisive role in saying what they think is sufficient mitigation. So with anything – you know, we are not in a position to spend as much as we would want to spend to mitigate this risk, but our team has prioritized our risk mitigation portfolio to address as much risk as we can. And again, it's really a part of that litigated outcome that comes out of energy safety about ultimately what we are required to do over the next few years."[31]

MGRA also raised the issue regarding affordability that it raised in the 2022 WMPs,[32] showing that the rate increases necessary for PG&E's undergrounding plan could lead to the loss of longevity among the lowest income PG&E ratepayers equivalent to 900 75 year lifespans annually.[33] Notably, PG&E did not refute this assertion in its rebuttal, or briefing, and it waived cross-examination of the MGRA witness, merely making vague statements that affordability is important to PG&E and that fire safety helps low-income ratepayers too.[34]

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[30] A.21-06-021; MUSSEY GRADE ROAD ALLIANCE OPENING BRIEF ON PACIFIC GAS AND ELECTRIC COMPANY'S 2023 GENERAL RATE CASE; p. 21. (MGRA PG&E GRC Brief)
[31] Id; p. 51; Quotes:
A.21-06-021; Evidentiary Hearings; August 15, 2022; p. 578.
[32] pp. 57-60.
[33] MGRA PG&E GRC Brief; p. 8.
[34] Id.; pp. 9-11.

Numerous parties opposed PG&E's plan. PG&E failed to make the case that it has properly evaluated undergrounding against other alternative mitigations, or quantitatively taken cost into consideration.[35] The most common recommendation, shared by MGRA, was that PG&E should re-divert its efforts into developing a viable REFCL mitigation and should increase their deployment of covered conductor.[36]

Overlap – PG&E is moving forward full speed with its undergrounding plan but has not yet had approval from the Commission, and it has provided no substantial evidence that it has quantitatively made efforts to choose its mitigations based on cost efficiency. In doing so, PG&E has ignored OEIS's action RN-PG&E-22-04 and other Energy Safety guidance.

Comment – Undergrounding and alternatives to undergrounding will be discussed at length in these comments, as will PG&E's lack of progress with REFCL. Continuing uncertainties regarding the stability of PG&E's risk model will also be raised, which have implications for PG&E's choices of mitigation and prioritization.

3.1.3. A.22-05-015/6 – SDG&E General Rate Case

SDG&E has also filed its rate case and it is currently in the evidentiary phase. MGRA has issued testimony in this proceeding.[37] SDG&E has followed PG&E's lead and has proposed a drastic increase in its undergrounding program to $609 million between 2022 and 2024, with an additional expenditure of $1.7 billion on wildfire mitigation (primarily undergrounding) between 2025 and 2027.[38]

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[35] Id; pp. 42-44.
[36] Id; pp. 44-46.
[37] A.22-05-015/6; DIRECT TESTIMONY OF THE MUSSEY GRADE ROAD ALLIANCE SAN DIEGO GAS AND ELECTRIC COMPANY 2024 GENERAL RATE CASE; March 27, 2023. (MGRA SDG&E GRC Testimony)
https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2205015/5854/504801910.pdf
[38] A.22-05-015/6 (SDGE GRC); Exh. SDG&E-13-2R; SECOND REVISED PREPARED DIRECT TESTIMONY OF JONATHAN T. WOLDEMARIAM (WILDFIRE MITIGATION AND VEGETATION MANAGEMENT); October 2022; Table JW-39; pp. JTW-106-7

Based on SDG&E's predicted costs for undergrounding and covered conductor, and its estimated effectiveness for undergrounding and covered conductor, one would expect covered conductor to have a higher RSE than undergrounding:

Mitigation	**CC**	**UG**
Pre-mitigation risk score	1.0	1.0
Risk Reduction	.65	.98
Cost/mile ($M)	1.2	2.3
RSE	0.54	0.42

Table 2- SDG&E estimates of cost and effectiveness for undergrounding and covered conductor.[39] The RSE assumes a pre-risk mitigation score of 1.0 for 1 mile of conductor.

However, SDG&E presents a apparently conflicting result that for the highest risk tranches, RSE is three to four times greater for undergrounding than it is for covered conductor.[40] MGRA testimony asserts that this differences arises from the fact that SDG&E's WiNGS Planning model is a decision tree model, and not merely a risk calculator. It implements the algorithm shown below:

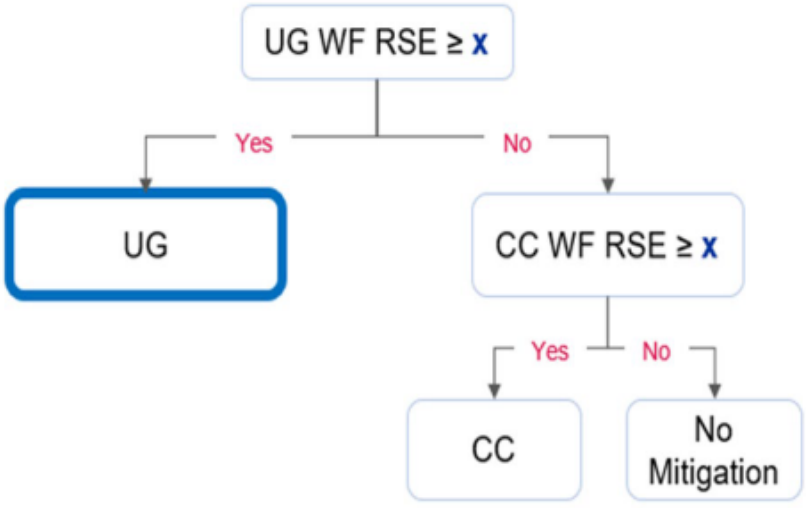

Figure 1 – Diagram of SDG&E's WiNGS Planning decision tree.[41]

[39] MGRA Testimony; p. 43; citing:
SDG&E DR Response MGRA-1-6a,
Exh. SDG&E-13-2R; pp. JTW-109-110,
Exh. SDG&E-13-2R; p. JTW-132,
SDG&E DR Response TURN-SEU-015-24i.

[40] SDG&E GRC Testimony; SDG&E-13-WP-2R; p. 42, 46.
[41] MGRA GRC Testimony; p. 47, citing SDG&E DR Response MGRA-3-13.

In this model, if the RSE is above a threshold value, then the undergrounding is planned for the circuit, and no comparison is done with covered conductor (the only other mitigation formally considered). Otherwise, covered conductor is chosen if it provides an RSE greater than the threshold value. SDG&E chose its threshold value in order to achieve an overall risk reduction of 83%.[42] Because this is higher than the claimed effectiveness of covered conductor, SDG&E's proposed solution would need to rely heavily on undergrounding in order to achieve this risk reduction level. Thus SDG&E automatically assigns higher risk circuits to be undergrounded, leaving those with lower risk to covered conductor, and thereby achieving a lower RSE for circuits mitigated with covered conductor.

MGRA's testimony questions whether the accepted value of covered conductor effectiveness is an underestimate,[43] and also asserts that some technical innovations such as SDG&E's Falling Conductor Protection (FCP) will complement covered conductor for ignition sources likely to cause catastrophic wildfires.[44] SDG&E has not calculated an effectiveness for covered conductor in conjunction with complementary technologies.

One positive element in SDG&E's Enterprise risk analysis is that it has adopted a power law distribution (Generalized Pareto) to properly incorporate catastrophic tail risk events.[45]

Overlap – SDG&E discusses the WiNGS-Planning portfolio and its decision to rely heavily on undergrounding extensively in its current WMP.[46] SDG&E's Advanced Protection Program (APP) which includes FCP, is also discussed in its WMP.[47]

Comment – The effectiveness of covered conductor as a mitigation and the potential for combining covered conductor with other technical innovations that are complementary to covered conductor will be discussed at length.

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[42] Id.; p. 48, citing SDG&E DR Response TURN-SEU15-5.
[43] Id; pp. 38-43.
[44] Id.; pp. 55-59.
[45] Id.; pp. 11-12.
[46] SDG&E WMP; pp. 9, 104.
[47] Id; p. 163-165.

Recommendations:

- SDG&E should be required to calculate the effectiveness of its Advanced Protection Program in combination with covered conductor as a mitigation alternative, and create an alternative WiNGS-Planning portfolio based on this alternative.
- SDG&E should be required to validate that its risk reduction target (currently 83%) is an optimization that balances costs and safety.

3.1.4. A.22-05-013 SCE RAMP Proceeding

SCE's RAMP proceeding has been completed and its GRC application has been filed. SCE's RAMP describes its risk model, the elements of which remain the same as those described in its 2020 and 2021 WMP filings. Consequently, it retains the same weaknesses: The lack of incorporation of extreme winds in the ignition model, incorrect weighting of risk drivers due to the incorrect coupling of probability and consequence due to reliance on "worst case" weather days. SCE remains the only utility not to use a power law (Generalized Pareto) distribution to calculate tail risk in its Enterprise risk model but instead uses 8 hour Technosylva runs, which are known to inadequately describe historical catastrophic losses.[48]

SCE's rapid deployment of covered conductor continued in 2021 and 2022. While predicting that SCE's covered conductor program is 65% effective in reducing ignitions (85% against contact from object (CFO),[49] SCE had observed an anomalously low number of ignitions and wires-down compared to what would be expected for an equivalent length of bare wire.[50] The effectiveness of covered conductor will be further analyzed in these comments.

SCE also announced a drastically expanded undergrounding program for 2025-2028.[51]

Overlap: SCE's covered conductor program, REFCL program, and undergrounding proposal are important parts of its WMP submission.

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[48] A.22-05-013; MUSSEY GRADE ROAD ALLIANCE RESPONSE TO SOUTHERN CALIFORNIA EDISON COMPANY 2022 RISK ASSESSMENT AND MITIGATION PHASE REPORT; June 13, 2022; pp. 3-8.
[49] Id; Appendix A; Data Request Responses MGRA-SCE-004-Q1-Q7.
[50] Id.; pp. 9-10.
[51] Id; p. 11.

3.2. Legislative Activity

3.2.1. SB 884 – Expedited utility undergrounding plans

In the late summer of 2022, Senate Bill 884,[52] which provides for an expedited review of 10 year utility undergrounding plans, was passed into law, further tilting the balance in favor of undergrounding. For those focused on cost efficient mitigation of utility wildfire risk, this raised additional concerns. In particular, work I had performed and presented for the 2022 Wildfire Mitigation Plans showed how even "modest" annual rate increases of a few hundred dollars per year, when applied to a large enough population, could lead to impacts on public health that are larger than potential safety. risks from wildfire and PSPS, due to the steep dependency of life expectancy on income in the US.15 A similar presentation will be made in this testimony.

SB884 however, contains a number of safeguards. First, utilities must show that there are no other more cost effective alternatives than undergrounding. As will be seen in these WMPs, utilities are currently unable to do a reasonable comparison between undergrounding and alternative mitigations. Specifically, the plan needs to contain:
"*A comparison of undergrounding versus aboveground hardening of electrical infrastructure and wildfire mitigation for achieving comparable risk reduction, or any other alternative mitigation strategy, such as covered conductor and rapid earth fault current limiter devices, for those prioritized undergrounding projects, evaluating the scope, cost, extent, and risk reduction of each activity, separately and collectively, over the duration of the plan. The comparison shall emphasize risk reduction and include an analysis of the cost of each activity for reducing wildfire risk, separately and collectively, over the duration of the plan*."[53]

One factor that remains to be worked out in the plan is that utility risk models have been and will continue to shift substantially over time, so any prioritization made in one year will be out of

[52] McGuire, 2022. SB-884 Electricity: expedited utility distribution infrastructure undergrounding program; California Public Utilities Code Section 8385. https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220SB884
[53] Id.; 8388.5(c)(4).

date several years later. OEIS and the CPUC are currently coming up with mechanisms to resolve these potential conflicts.

It must also be pointed out that both the OEIS and CPUC have the ability to deny these plans if the utilities do not fully adhere to the requirements of the statue.

Overlap: The expanded undergrounding initiatives described in the WMPs are a precursor to utility applications both in the short term with their General Rate Cases, and in the longer term with SB 884 undergrounding plan applications. Because the purpose of SB 884 will be to "expedite" plan review, Energy Safety must do all of the technical review it can on the current WMPs since there may not be sufficient time to fully review utility 10 year plans.

Recommendation:

- Energy Safety should review fully review utility plans and estimates that extend beyond the 2025 timeframe of this major WMP to the extent that longer term plans have been presented, with the reasonable expectation that these reviews may inform long term utility undergrounding plans developed under the new legislation adopted as SB 884, and future review under that plan will be expedited.

3.3. Confidentiality

In its 2022 WMP comments, MGRA took issue with SCE's claim that utility risk calculations, ignition probabilities, or consequence models should be considered Critical Energy Infrastructure Information (CEII). As MGRA stated: "*The ignition probability component measures the threat from utility infrastructure, not to it. As far as the consequence component of risk, this has nothing whatsoever to do with utility infrastructure. Consequence is a product of vegetation, weather, slope, population distribution, and numerous other factors that are properties of the landscape itself, not the infrastructure overlaid on it. All of this information is based upon public datasets*.[54]

SCE still maintains this position, as now does PG&E.[55]

[54] MGRA 2022 WMP Comments; p. 62.
[55] For example; PG&E DR Response MGRA-001-Q09.

MGRA was able to obtain risk data from both SCE and PG&E at a sufficient level of detail to perform enough of its planned analysis and obtain acceptable results without full access to the segment-level risk detail that SCE and PG&E assert is CEII. Nevertheless, MGRA continues to contend that SCE and PG&E are over-applying confidentiality designations, and have done so with regard to segment-level data in the current WMPs. MGRA reserves its right to challenge these designations at some point in the future through the process developed by OEIS.

Recommendations:

- Risk data, probability of ignition, and consequence analysis for utility distribution systems should not be considered to be CEII by OEIS because they represent risk from, not to, utility infrastructure and are developed from non-confidential data sets.

4. OVERVIEW OF WMP

4.4. Risk-Informed Framework

Energy Safety Guidelines require that electrical corporations "*must adopt a risk-informed approach to developing its WMP*".[56] Among the goals that a risk-informed framework is intended to achieve are :

- "*an optimal level of life safety, property protection, and environmental protection, while also being in balance with other performance objectives (e.g., reliability and affordability*)"
- Prioritization of mitigations and planning
- Prioritization of highest risk equipment, and
- A clear and transparent decision-making process.[57]

As will be made evident in the following sections of these comments, the risk-informed framework is currently in peril, with utilities now choosing undergrounding as a default mitigation, and other mitigations only considered in the case where undergrounding is not possible.[58] Risk

[56] Technical Guidelines; pp. 11-12.
[57] Id.
[58] Examples; PG&E WMP, p. 340; SCE WMP, p. 256.

analyses may also be designed to achieve an outcome favorable to undergrounding, as will be shown is the case for SDG&E's WiNGS Planning model.

In fact, the utilities appear to be advocating for a shift to a model in which utility ignitions and shutoffs are deemed to be "intolerable". Having a societally agreed set of intolerable risks and working to mitigate them to a level of tolerability can be a reasonable approach and for some time was under consideration at the CPUC.[59] While the basic tenets of risk tolerance provide a valuable lens for viewing and analyzing risk, one of the key issues in such a discussion is *whose* tolerance – who gets to decide how much risk is tolerable to someone else? Unfortunately the CPUC has not yet revisited this question although it is once again being considered for the RDF rulemaking (R.20-07-020). The IOUs have stepped in to fill this void, rolling forward with substantial and expensive undergrounding programs before alternatives have been fully evaluated.

These comments will also show that while utilities have been targeting mitigations to the highest risk circuits, this is effectively a moving target. Analysis of utility wildfire models shows drastic differences between risk model results in this year's WMPs versus last year's, and last year's risk models were drastically different than the year before. There is no reason to think that this pace of change will slow with the release of this year's results. As will be discussed, many of the issues raised by MGRA and others in previous years still exist in the models, and there are additionally new features that have not been fully evaluated.

The most notable change since last year is that utilities, at least SCE and PG&E, have backed away from Technosylva wildfire modeling as the primary basis for their consequence model. As MGRA noted in its 2022 and 2021 WMP comments, the 8 hour limitation on accurate fire modeling puts an effective cap on wildfire size, and since the vast majority of catastrophic utility wildfire losses come from very large fires, a consequence model based on a wildfire spread with a limited run time will tend to amplify the risk of ignitions near population centers, and artificially reduce risk in remote areas with high winds where catastrophic utility fires often germinate. PG&E has introduced a completely new methodology that uses Technosylva to calculate wildfire intensity but otherwise incorporates satellite data from historical fires and historical daily wind data to determine a consequence value. While PG&E's predicted risk drivers

[59] CPUC D.16-08-018; p. 62. See "ALARP".

now more closely correspond to those historically responsible for catastrophic fires (rather than external agents such as vehicles, animals, and balloons), the mechanism is not transparent and there it is not evident whether it represents actual risk. SCE, on the other hand, has set aside its risk model entirely for undergrounding priorities and is instead using a number of selected criteria to determine whether infrastructure imposes (in its opinion) a "severe" risk. Criteria include any of high winds, limited egress, or large fire potential – all worthy considerations for inclusion in a risk model, but in SCE's case chosen on an arbitrary basis to *replace* its risk model.

As justification for sidelining input from risk and cost models, utilities rely on the CPUC determination that risk and risk spend efficiency need not be the *only* contributor to utility mitigation choices and prioritization. As SCE stated in its comments on the most recent proposed decision in the RDF rulemaking:

"*SCE agrees with the PD's express confirmation that 'we do not intend that the Cost-Benefit Ratios produced using this method must serve as the sole determinants of IOU proposals or Commission decisions on risk Mitigations' and statement that Cost-Benefit Ratios 'need not be the only consideration in the final selection of Mitigations.' Management of critical risks by the utility cannot be viewed simply from the lens of dollars. There are absolute risk issues that may not be captured by the Ratios, as well as a host of ethical, socioeconomic, compliance, and physical and resource constraints which are not readily translatable to dollar values, but which are crucial to the sophisticated process of actually managing resources, risks, and service*."[60]

Unfortunately, the utilities have been interpreting this latitude and flexibility as to how to incorporate costs and efficiencies to as a license to resist incorporating costs and efficiencies into their decisions in any clear or transparent manner. MGRA, in its opening brief in the PG&E rate case summarized this dilemma:

"*Essentially, then, the current proceeding is a referendum on the risk-based decision-making framework. Either companies are required to use risk/spend efficiencies, or cost/benefit*

[60] R.20-07-020; SOUTHERN CALIFORNIA EDISON COMPANY'S (U 338-E) OPENING COMMENTS ON PROPOSED DECISION REGARDING PHASE II DECISION ADOPTING MODIFICATIONS TO THE RISK-BASED DECISION-MAKING FRAMEWORK ADOPTED IN DECISION 18-12-014 AND DIRECTING ENVIRONMENTAL AND SOCIAL JUSTICE PILOTS; November 23, 2022; p. 4.

analysis, in a transparent manner to inform their risk mitigation choices, or the effort that has gone into developing the S-MAP framework and its Settlement Agreement has been a waste of time. If risk-based decision making should no longer have direct and mandatory implications for utility risk planning, the Commission should say so. Then the considerable resources that utilities, intervenors, and the Commission have committed to that area can be deployed elsewhere. If the Commission does not require utilities to meaningfully incorporate mitigation cost and effectiveness, the utilities will be ceded unrestricted control over their prioritization and decision-making, and the Commission's role will merely be to ratify their requests."[61]

This is now Energy Safety's dilemma as well. Energy Safety has been in alignment with the CPUC in its view that analytical, objective, and transparent risk and cost analysis should form the basis of utility mitigation and prioritization decisions. Energy Safety's and the CPUC's guidance in this matter has been virtually ignored. Undergrounding appears to be an unstoppable juggernaut with what appears to be the implicit support of the California government. In order to fulfill its role, also granted to it by the California legislature and government, Energy Safety must insist that its guidance and requirements be followed. It should insist that utilities provide a full comparison of risks and costs of undergrounding and realistic viable alternatives before approving Wildfire Mitigation Plans. The remainder of these comments will indicate where more information will be required before Energy Safety can make an informed decision.

Recommendation:

- Energy Safety should ensure that major programs and initiatives, mitigation decisions, and prioritization are "*in balance with other performance objectives (e.g., reliability and affordability*)".

6. RISK METHODOLOGY AND ASSESSMENT

MGRA has been active in the analysis of utility risk methodologies throughout the development of the Wildfire Mitigation Plans. In fact, analysis and discussion of risk has taken up a large fraction of our previous WMP comments.[62] While there have been various improvements and

[61] A.21-06-021; MUSSEY GRADE ROAD ALLIANCE OPENING BRIEF ON PACIFIC GAS AND ELECTRIC COMPANY'S 2023 GENERAL RATE CASE; November 4, 2022; pp. 12-13.
[62] MGRA 2021 WMP Comments; pp. 14-55.
MGRA 2022 WMP Comments; pp. 17-52.

changes to utility models, the basic premises of MGRA's previous comments remain relevant and valid. Rather than repeat the previous comments, they will be cited as appropriate. In the Methodology section, a brief summary of the current state of utility wildfire risk modeling will be presented. Additionally, the analysis that has gone into the 2021 and 2022 WMPs as well as the GRC and RDF proceedings has been summarized in a research paper that has been submitted for publication by the author in his capacity as a researcher, and the preprint has been made available for review.[63]

6.1. Methodology

This section discusses general issues with regard to utility risk model methodology.

6.1.1. Coupling of probability and consequence

By adopting the MAVF framework, utilities have been applying a simplistic model in which the risk for a given event is equal to the product of the probability and consequence of the event. In fact, however, probability and consequence are not independent for some risk drivers. Extreme fire weather can cause outages due to wind, either from equipment failure or from vegetation or contact with other objects. If these outages cause ignition, the consequence can potentially be large because of the increased rate of fire spread. This relationship is responsible for the well-known observation[64] that electrically caused wildfires are over-represented in the lists of the destructive wildfires for their relative frequency (less than 10% of wildfires in California[65]). For example, the CAL FIRE "Top 20" lists as of November 2022 shows the following:

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[63] PREPRINT: Analysis of Utility Wildfire Risk Assessments and Mitigations in California; Joseph W. Mitchell (Mitchell Preprint)
https://easychair.org/publications/preprint/Zkld

[64] OSFM, CDF, USFS, PG&E, SC Edison, SDG&E; Power Line Fire Prevention Field Guide; Mar 27, 2001: "The very same weather conditions that contribute to power line faults also lead and contribute to the rapid spread of wildfire. The most critical of these weather factors is high wind, which is commonly accompanied by high temperatures and low humidity."

[65] D.19-04-042; p. 3. See also R.18-12-005; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON PROPOSED DECISION ADOPTING DE-ENERGIZATION GUIDELINES; May 16, 2019; pp. 2-5.

Wildfires	Number of Electrical Caused (out of 20)	Fraction of Losses Due to Electrically Caused Wildfires
Deadliest	4	39%
Most Destructive	8	66%
Largest	3	21%

Table 3 - CAL FIRE "Top 20" deadliest (by fatalities), most destructive (by structures), and largest (by acres burned) as of November 2022 showing relative contribution of electrically ignited wildfires to total numbers and total losses. Fractions were calculated as the relative contribution to the Top 20.

None of the 2023 WMPs adequately and transparently take into account the linkage between probability and consequence. SDG&E has added a "Wind Gust" adjustment factor to its LoRE[66], applies a correction for the maximum annual wind gust. While this is a step in the right direction, but the adjustment factor is not filtered for fire weather, and so includes winter storm events.[67]

6.1.2. Utility-caused wildfires and catastrophic utility-caused wildfires are different beasts

There is a distinct difference between wildfires that ignite under low-wind conditions and high wind conditions, though dangerous wildfires are possible under both scenarios. Under drought conditions with low plant moisture, low humidity, and high temperature it is possible to ignite a fuel-driven high intensity wildfire without wind as a significant contributing factor. The Butte and Dixie fires fit this pattern. The risk models used in the 2023 WMPs are well honed for this scenario.

The problem with the utility risk models in general is that catastrophic wind-driven wildfires have caused by far the most harm historically, and these wildfires are not well described by utility risk models. They have entirely different drivers. While "normal" wildfires can be ignited by a variety of drivers, all basically occurring randomly in time (what is called a "Poisson" process), catastrophic wildfires tend to have causes that are triggered by external conditions during specific time periods. This is

illustrated by data taken from last year's WMPs.

[66] SDG&E WMP; p. 66:
[67] A.22-05-015; Data Request Response MGRA-SDGE-003-8d:
"The max wind speed recorded at the weather station. The measurement window is the in-service period of the weather station."

Ignition Driver	Percentage		
	SDG&E	SCE	PG&E (RFW)
Vehicle	17	7	
Balloon	17	13	
Veg Contact	15	11	59
Other Contact	8	6	4 (all external)
Animal	5	13	
Wire Contact	3	5	1
Vandalism	2	5	0
Equipment	33	42	33

Table 4 - Percentage of enterprise ignition risk represented by different risk drivers as per SCE and SDG&E's 2022 Wildfire Mitigation Plans (SDGE 2022 WMP, p. 46; SCE 2022 WMP, pp. 55-56; PGE 2022 WMP, p. 61, MGRA-2022 WMP Comments, pp. 32--34. PG&E's analysis is limited to National Weather Service Red Flag Warning (RFW) days. All PG&E external agent contact (vehicle, balloon, animal, other) is listed under "Other Contact"

As evident from this data, ignitions from "external agents" (vehicles, balloons, animals, third-party contact) provides a sizeable contribution to the ignition component, and thereby to the predicted ignition risk, at least for SCE and SDG&E data. PG&E had already begun to do things a little differently, at least for its Enterprise risk model, and it provided ignitions filtered by presence of a Red Flag Warning. During a Red Flag Warning, the contribution from "external agents" becomes much smaller and wind-related drivers come to the fore: vegetation contact and equipment failure. A look at the causes of recent catastrophic utility fires demonstrates this assertion.

SCE and PG&E provided lists of major utility caused fires (>100 acres for SCE,[68] >500 acres for PG&E[69]) between 2015 and 2020. SCE and PG&E datasets were combined and binned into driver categories of "external agent" (balloon, vehicle, animal, 3rd party), and "non-agent" (vegetation and equipment failure) to increase statistical power. These were analyzed using a Pearson Chi-squared goodness of fit (with/without Yates correction) to compare them against the probabilities that would be expected for the "normal" ignition drivers in Table 4. The analysis is shown below:

[68] Workpaper SCE-Ignitions-2015-2020.xlsx
[69] 2022-WMPs; TN11043_20220627T144350_PGE_30Day_Revision_Notice_Responses; pp. 1-13

Driver	Observed	Expected	Chi2	Yates
Non-Agent	31	24.09	1.98	1.71
Agent	4	10.91	4.38	5.03
Total	35	35	6	7
P - Chi2	0.01168126			
P - Yates	0.00943576			

Table 5 - Statistical analysis of combined SCE and PG&E ignition data binned into Agent (balloon, 3rd party, vehicle, and Non-Agent (vegetation, equipment) to improve statistical power. Probabilities were calculated with the Excel function CHISQ.DIST.RT, using 2 degrees of freedom.[70]

The low chi squared value implies that the general distribution of ignition drivers responsible for utility ignited wildfires is statistically different ($p < 0.05$) than the drivers that cause catastrophic fires. Because catastrophic fires are responsible for the majority of deaths and economic losses, this implies that utility risk models that rely solely on "raw" distributions of outages or ignitions will mis-assign risk both in magnitude and location.

There's no evidence that the 2023 WMPs are different in this regard than those than the 2021 and 2022 WMPs, since they continue to use the same form of Machine Learning statistical model that were used in previous WMP iterations. However, there is at least apparently some implicit acknowledgment that the risk models need to change, and each utility has adapted its own unique way of adjusting its model to account for extreme events. This will be discussed in the sections on the individual risk models.

Recommendation:

- Utilities should properly couple consequence to ignition in order to properly weight outage sources that occur during extreme weather. One way to do this is to treat extreme weather events as a separate risk, for instance by filtering on Red Flag Warning days.

6.1.3. Wildfire consequence modeling

In the 2020 and 2021 WMPs, all three major IOUs had coalesced around a wildfire consequence model based on Technosylva wildfire spread simulations. These match drop simulations are run at every point on the utility grid using a portfolio of historical "worst case"

[70] Op. Cite.

weather conditions.[71] While such simulations are extremely useful for short term forecasting, they become inaccurate due to uncertainties the longer the wildfire is simulated, and so utilities limit their consequence model simulations to 8 hours. As MGRA has pointed out in previous comments, this methodology has two major weaknesses.

1. Some ignition drivers are more likely to occur on "worst case" weather days than others, specifically equipment damage and vegetation contact. This means that the risk from drivers that are *not* more likely on "worst case" weather days (such as animal, vehicle, and balloon contact) will be artificially amplified by "pretending" they occur on worst-case weather days. This will lead to suppressed predicted risk in areas where vegetation contact and equipment damage are more likely (high wind areas).
2. Eight hour Technosylva wildfire simulations grow to a maximum size between 10,000 and 30,000 acres.[72] Catastrophic utility fires historically responsible for most of the losses in California have been much larger than this. Therefore, these simulations substantially underpredict overall risk. Additionally, they will also artificially increase predicted risk near population centers (where losses occur), and decrease risk further out in high wind areas where many catastrophic utility fires ignite and grow before descending into Wildland-Urban Interface communities.

These cut-offs are illustrated in the figure below:

[71] MGRA 2022 WMP Comments; p. 31; MGRA 2021 WMP Comments; pp. 48-55.
[72] PG&E: MGRA 2021 WMP Comments; p. 51.
SDG&E: A.22-05-016; Data Request Response TURN-SEU-031-6 – "the data provided in TURN-4, Attach 10b_AC_5804, shows the highest 2 number of acres burned under Technosylva models was 33,000 acres"
SCE: Workpaper MGRA_001_01_wf_acre_dist_jwm.xlsx.

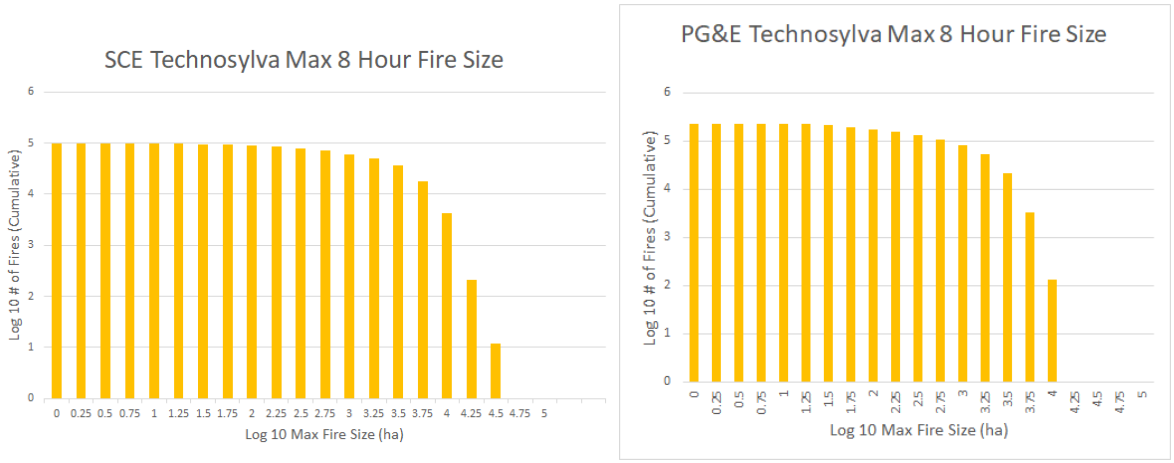

Figure 2 - Raw Technosylva simulation data was provided by SCE and PG&E in response to MGRA data requests, and the logarithm of maximum wildfire size for each set of 8-hour runs was accumulated into histograms.[73]

Actual wildfire size distributions follow a power law relationship over several orders of magnitude. The exponent of the cumulative power law distribution is smaller than one, meaning that the relative contribution increases with wildfire size, as shown below.

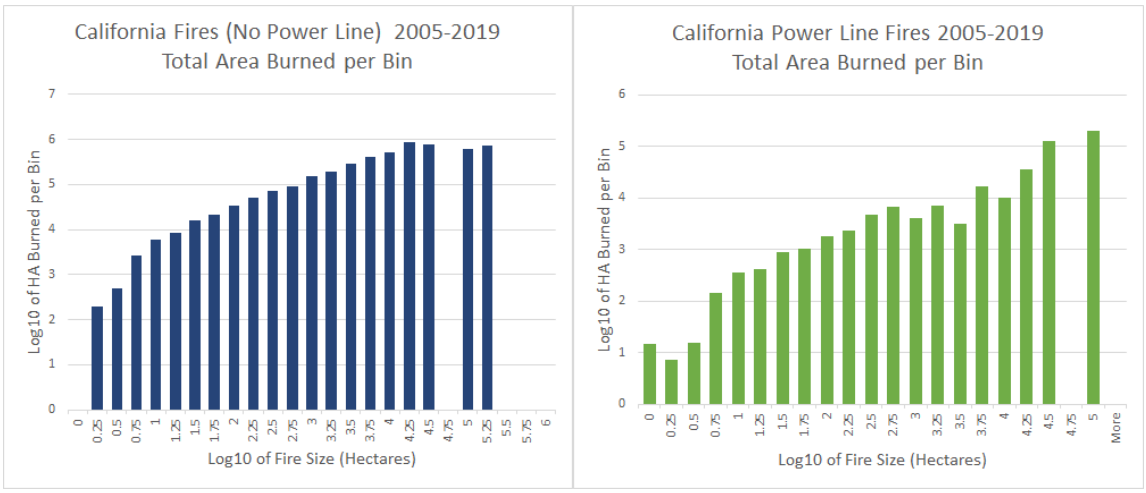

Figure 3 - Total area burned per logarithmic bin for California wildfires 2005 to 2019, calculated by multiplying logarithmic mean of bin by number of wildfires in the bin. Power line related wildfires are compared against full sample with non-power line wildfires removed.[74]

Figure 3 shows clearly why a truncated wildfire size distribution will fail to adequately represent consequences. Energy Safety has recognized these shortcomings and raised areas for improvement PG&E-22-05 and SDG&E-22-06 in its review of the 2022 WMPs.

[73] Workpapers: Technosylva-sizes-2021WMP_ClassB_Action-PGE-15_Atch01-jwm.xlsx MGRA_001_01_wf_acre_dist_jwm.xlsx.
[74] Workpapers; perimeters_19_1.xlsx

In the 2023 WMPs, PG&E, SDG&E, and SCE have reacted to this problem in different ways. PG&E has adopted an entirely new method which will be discussed in the following sections. It no longer relies solely on the Technosylva model to calculate maximum wildfire size but instead relies on data from large historical fires.[75] SCE still uses 8 hour fire spread simulations for its risk model, but has now developed an alternative risk model (IWMS) that it uses for what it deems "Severe Risk Areas".[76] Characteristics that SCE includes in IWMS determination are high winds, egress, and community vulnerability. SDG&E continues to use the Technosylva model which has been modified in 2023 to include building loss,[77] and as will be shown this new modification exacerbates the existing bias.

6.1.4. Wildfire suppression

Most wildfires receive a wildfire suppression response and this affects 1) the likelihood that "initial attack" will be successful and that the wildfire will not become significant and 2) fire growth and the shape of the fire perimeter. None of these effects is currently modelled by utilities.

As SDG&E explains in a data request response to Cal Advocates:

"*Due to the number of variables that would go into accurate suppression modeling and that these variables would be significantly impacted by human and other factors it has been determined that incorporating suppression into operational models can create issues when applying model outputs to real world outcomes. WFA does model what is named their Initial Attack Index and is referenced in the CalAdvocates-SDG&E-2022WMP-13, from available inputs which may enable a SME to estimate the effectiveness of suppression. Factors that are considered by a SME include but are not limited to staffing levels, location relative to responding resources, other active incidents, and the accessibility of the incident. By excluding suppression, model outputs can more effectively be compared to each other because of consistent assumptions*."[78]

[75] PG&E WMP; p. 22.
[76] SCE WMP; p. 95.
[77] SDG&E WMP; p. 54.
[78] Data Request Response CALADVOCATES-SDGE-2023WMP-05-Q2.

Likewise SCE states that "*at this time, SCE does not extend the simulation duration beyond 8 hours and does not directly include a probabilistic assessment of suppression based on historical suppression data, as there are inherent risks associated with over-representing the availability of suppression resources*."[79]

PG&E and SCE are examining Technosylva's Terrain Difficulty Index (TDI) as a proxy for a suppression component. PG&E plans only to use this to estimate structures destroyed using Technosylva's RAVE model or WRRM simulations.[80] SCE is also examining whether to include TDI as a consideration for mitigation decisions.[81]

There is general consensus that modeling wildfire suppression for a sizable fire is a multivariate, complex, and likely intractable problem. However, a much simpler model can be derived to incorporate the initial attack success probability. Large databases of ignitions are supported by the US (NFIRS) and CalFire, and these can be compared against "significant" fires (say larger than 10 or 100 acres) to determine an initial attack success probability. This approach was taken in Mitchell 2009, which did a limited study of Southern California wildfires showing that while the initial attack success rate was over 98% generally, it fell to 80% when nearby weather stations measured wind gusts of over 30 mph during fire weather (low humidity, season).[82]

What effect does ignoring suppression have on the utility risk models? The utility consequence models do not take into account suppression, which acts to reduce fire size and change the perimeter shape. However, we know that currently the fire spread modeling used is an approximation and underestimate anyway, since it has an 8 hour limit that does not allow it to accurately model catastrophic losses. Adding an adjustment to fire spread modeling to account for suppression would therefore add little value, since the final result is already significantly distorted.

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[79] SCE WMP; p. 100.
[80] PG&E WMP; p. 212, 217.
[81] OEIS Risk Modeling Working Group; May 10, 2023; SCE presentation and comments.
[82] Reimer, J., Thompson, D.K., Povak, N., 2019. Measuring Initial Attack Suppression Effectiveness through Burn Probability. Fire 2, 60. https://doi.org/10.3390/fire2040060
Los Angeles Times; Op-Ed: Wildfires have changed. Firefighting hasn't.; Adriana Petryna; July 10, 2022.
Mitchell, J.W., 2009. Power lines and catastrophic wildland fire in southern California, in: Proceedings of the 11th International Conference on Fire and Materials. Citeseer, pp. 225–238. (Mitchell 2009)

In the sense of initial attack modeling, however, suppression has an extremely significant role in stopping fires before they even need to be modelled. We know that 98% of ignitions, under normal circumstances are suppressed before they become significant. During the "worst case" weather days used in utility fire spread modeling, this percentage will be lower. But it is not zero, and the current utility modeling assumes it is zero. Probability of suppression also varies across the landscape, as do utility weather conditions in their historical "worst case" portfolios. By ignoring these variations, and "pretending" all match drops lead to unconstrained wildfire, utilities add yet another bias to their risk models. This particular bias will act to amplify the risk of simulations run on ***less*** severe fire weather days with respect to the worst case fire weather days, since it ignores the greater likelihood of suppression on less severe fire days.

Determining what variables should be used to estimate initial attack success will require additional work. Mitchell 2009 showed that local wind gust speed at the time of ignition was a significant variable in predicting initial attack success, but there are other variables that are likely predictive as well, such as FPI or Technosylva's TDI, or distance to nearest fire station. Which of these variables is the most predictive can be most appropriately explored by a Machine Learning analysis.

The addition of an initial attack success rate could be handled as an additional probability component:

*Risk = P(outage) * P(ignition_given_outage) * P(initial_attack_fail(current wind speed, FPI, TDI, etc)) * Consequence*

Splitting the suppression model into two pieces: the initial attack phase and the far more difficult large scale fire suppression phase, would provide a handle on the likelihood of propagation of a wildfire ignition. Incorporating an initial attack element would very likely have a suppressive effect on ignitions occurring in populated areas where firefighting assets are likely to be readily available, and might moderate some of the risk urbanization effects that SDG&E and Technosylva are seeing in their 2023 Consequence model (Section 6.2.1.2).

Recommendation:

- OEIS should work with utilities to create an "initial attack" fire suppression model using historical data (CAL FIRE, NFIRS) to determine the probability that an ignition escapes initial attack and becomes a damaging fire, based on covariates such as wind speed, FPI, distance to fire station, etc., using a machine learning model.

6.2. Risk Analysis Framework

6.2.1. San Diego Gas and Electric WiNGS Model

SDG&E's WiNGS v3 model used in the 2023-2025 WMPs has undergone several substantive changes since WiNGS v2 was presented in the 2022 WMPs.

6.2.1.1. Limitations due to 8 hour Technosylva runtime

Since the adoption of Technosylva's Wildfire Analyst as a modeling tool, SDG&E's model has been subject to limitations due to the utility-specified 8 hour duration of the fire spread modeling time.

This effect of this limitation is displayed graphically in the following figures, which show the ignition points and final perimeters of the three largest wildfires to impact San Diego County: the Witch/Guejito fire (2007), the Cedar fire (2003), and the Laguna fire(1970). Of these, the Witch/Guejito fire and the Laguna fire were attributed to electrical infrastructure. Superimposed on these wildfire perimeters are the risk scores and consequence scores generated by WiNGS v3.

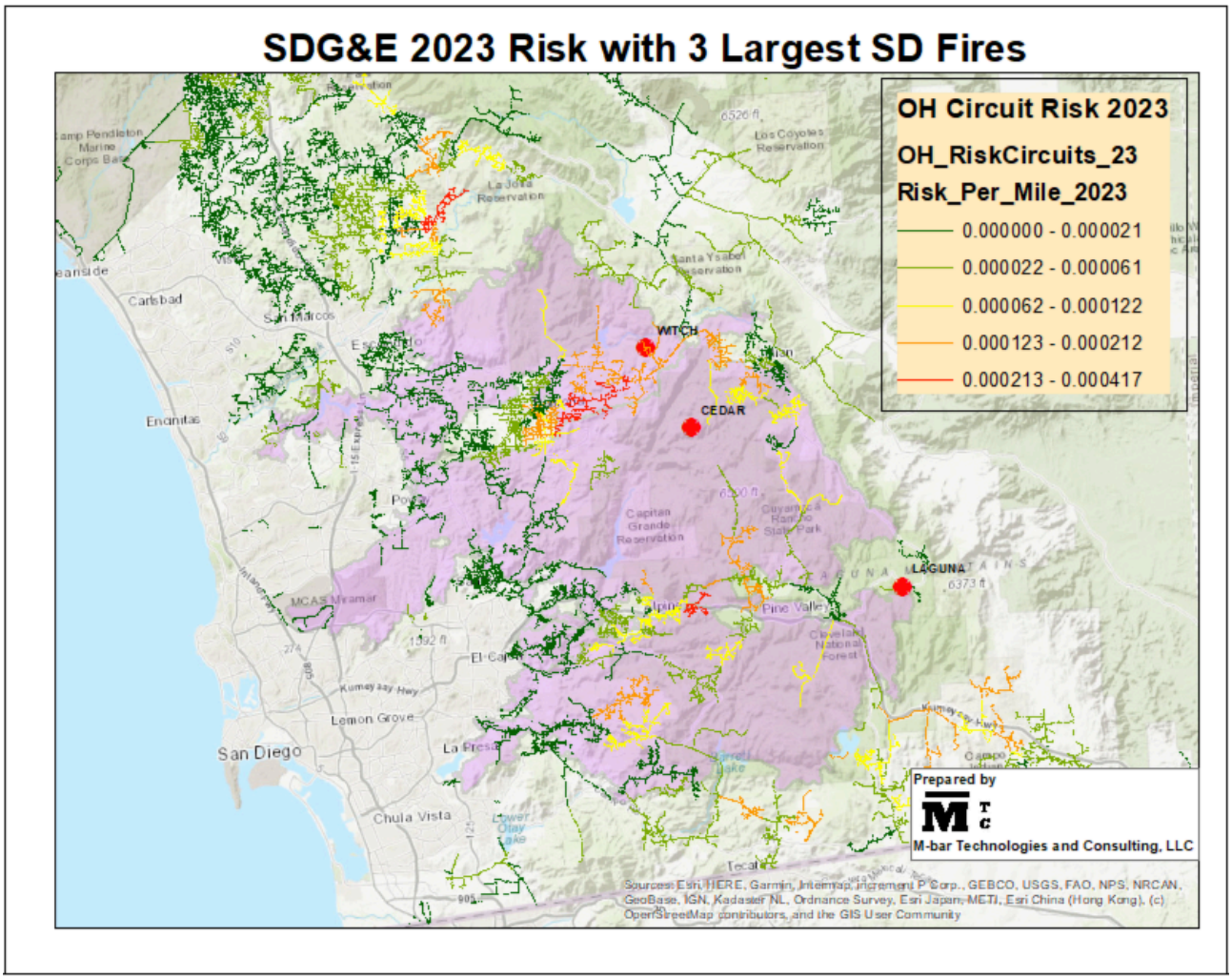

Figure 4 - SDG&E WiNGS v3 risk scores for overhead circuits, on a scale of green for lower risk to red for higher risk. Superimposed are the ignition points and final perimeters for the Witch/Guejito, Cedar, and Laguna fires.[83]

Figure 4 shows that the greatest circuit risk (in red) is predicted by SDG&E to be within and directly east of the population centers of Ramona, Alpine, and Valley Center. More remote areas tend to have lower relative risk. The ignition points for the Laguna, Cedar, and Witch/Guejito fires, however, can be seen to much further to the east of these areas. Circuits near these ignition points have relatively lower risk values. The losses from these three fires exceed all other historical San Diego County wildfire losses combined. These wildfires *are* the consequences for San Diego County for remote wildfire ignition.

The following figure shows that it is the consequence model that is responsible for elevating predicted wildfire risk near population centers.

[83] Ignition and perimeter data from Cal Fire. SDG&E circuit risk data from Data Request Response CalAdvocates-5-Q4.

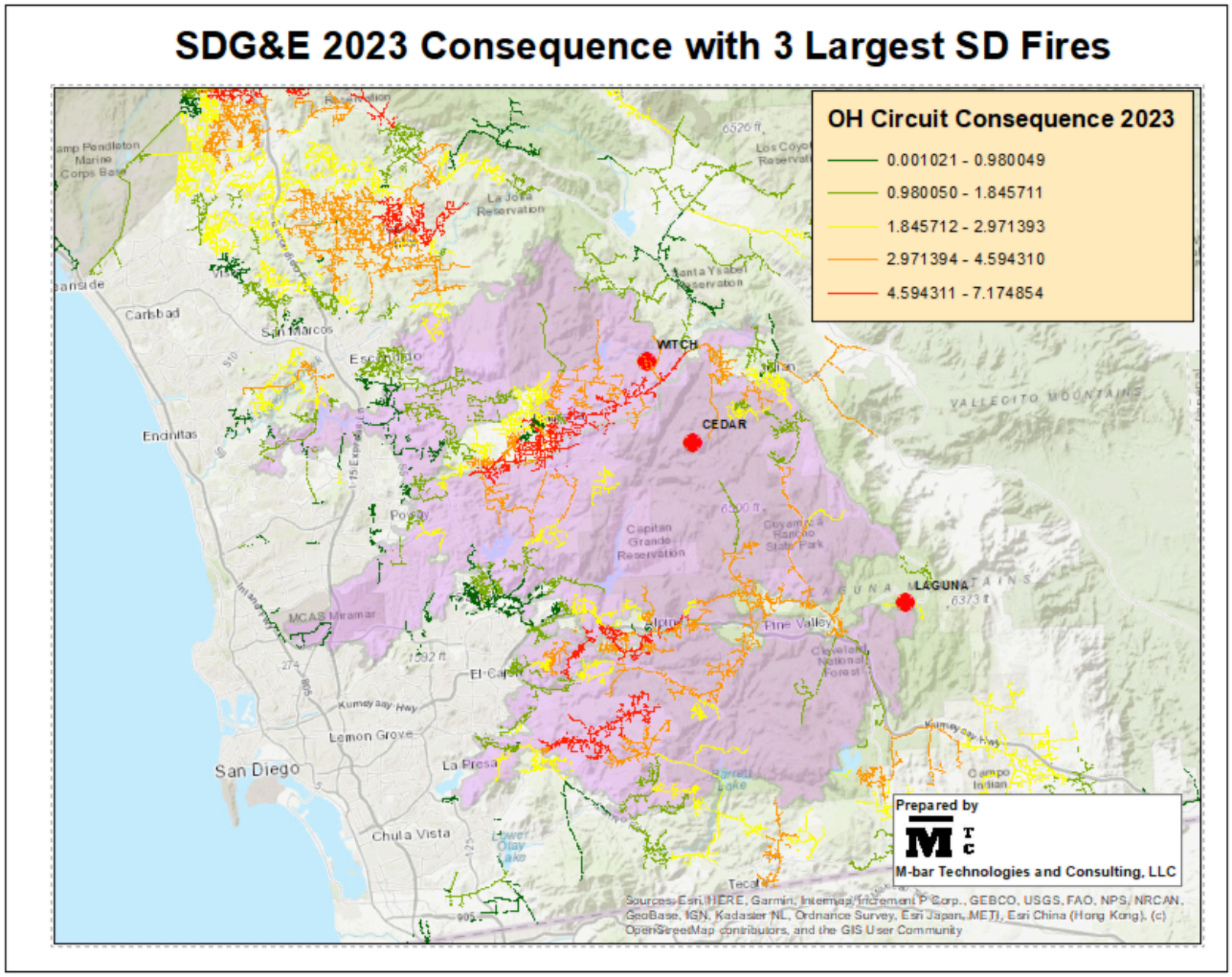

Figure 5 - SDG&E WiNGS v3 consequence scores for overhead circuits, on a scale of green for lower risk to red for higher risk. Superimposed are the ignition points and final perimeters for the Witch/Guejito, Cedar, and Laguna fires.[84]

It is clear from Figure 5 that it is the consequence model, in other words the eight-hour run of Technosylva Wildfire Analyst, that is responsible for predicted risk being concentrated closer to population centers. While the Witch fire ignition point rates as very high consequence, circuits near the Cedar and Laguna ignition points do not. This is important because it will lead to incorrect prioritizations of wildfire risk mitigation. SDG&E's quality check on its result, comparing its circuits against those in coastal canyon areas,[85] is not an adequate validation of its model, since coastal circuits are not within the HFTD and are not high priority for SDG&E mitigation.

[84] Id.
[85] OEIS-2023-01 Attachment Q1 & Q2; Technical Model Documentation EFFECTIVE DATE: 4/12/2023 WiNGS-Planning; p. 29.

Recommendation:

- SDG&E and other IOUs must modify their consequence models in a way that realistically incorporates tail-risk from very large fires and is not limited to 8 hour fire simulation spread times.

6.2.1.2. SDG&E WiNGS-Planning ignition model

The most serious source of bias that has persisted in the SDG&E ignition model over the years is the wide application of power shutoff, which removes all outage and ignition data from areas most likely to be affected by power shutoff, and which not coincidentally are at the highest risk of wildfire. This causes underestimation of risk in the most dangerous areas. To date, only PG&E adjusts for this bias by including damage events from its post-PSPS patrols as risk events.[86] SDG&E's WiNGS-Ops model now adjusts for this bias as wels, but its planning model does not. SDG&E plans to incorporate this adjustment soon.[87] Energy Safety should encourage this remediation prior to SDG&E's next WMP update.

SDG&E has provided additional detail regarding its ignition model as part of its WiNGS 3.0 documentation.[88] WiNGS 3.0 model does not use only ignition events but applies a number of "adjustments" to the likelihood score. These include:

- "*Overhead Mileage – Overhead circuit miles per circuit segment.*
- *Wind Speed – Max wind speed based on past events.*
- *Tree Strike – Potential number of trees that have the ability to contact overhead conductors based on the tree inventory, where the tree point is buffered by the height of its canopy and intersected with the circuit segment to determine the number of potential contacts.*
- *CHI – Circuit Health Index (CHI) model developed to determine the robustness of a circuit based on a range of criteria.*
- *Conductor Age – Average conductor age per circuit segment.*

[86] MGRA 2022 WMP Comments; p. 9.
[87] MGRA SDG&E GRC Testimony; p. 14; citing Exh. SDG&E-03-2R; pp. RSP/GSF-B-8,10,14,16.
[88] SDG&E Technical Model Documentation EFFECTIVE DATE: 4/12/2023 WiNGS-Planning. (WiNGS-Planning)

- *Significant Wildfire – An adjustment based on the probability of a large fire*
- *Hardening State – Miles and percentage of underground and overhead hardened based on traditional hardening approaches and installation of covered conductor.*"[89]

These adjustments are applied multiplicatively to the LoRE, and then multiplied by a normalization factor for each adjustment to maintain the correct overall ignition rate,[90] what it calls "weighted-sum modeling and factor-adjustment parameterization."[91] While OEIS required a full technical description of SDG&E's risk models,[92] SDG&E's WiNGS-Planning documentation does not provide any technical detail regarding the adjustments, including mathematical and physical foundation, formulae, or validation. MGRA therefore asked for specific technical detail of how these adjustment rates are calculated. SDG&E responded in MGRA-SDGE-2023WMP-04, which is included in Appendix A of these comments. Briefly summarizing:

Wind Speed

SDG&E's wind speed ignition adjustment factor is defined according to wind speed tiers:

1. < 40 mph = 0.025
2. 40 – 50 mph = 0.075
3. 50 – 60 mph = 0.225
4. > 60 mph = 0.675

One known problem with SDG&E's wind adjustment model is that it uses the maximum recorded wind speed at each segment location,[93] thus potentially including winter storm events. SDG&E should instead obtain its maxima based on a humidity and temperature filter to ensure that any adjustment factor is based upon fire weather.

Vegetation Adjustment

SDG&E's vegetation adjustment is based on tree-strike probability:

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[89] Id.; p. 4.
[90] WiNGS-Planning; pp. 10-11, 20-21; DR Response: GREENPOWER-SDGE-2023WMP-02
[91] DR Response MGRA-SDGE-2023WMP-04-01.
[92] DR OEIS-01-01.
[93] A.22-05-015; Data Request Response MGRA-SDGE-003-8d:
"The max wind speed recorded at the weather station. The measurement window is the in-service period of the weather station."

"The tree strike ignition adj. factor = $(Segment\ tree\ strike\ potential\ count)/(segment\ OH\ miles)$
where a potential tree strike is a tree that is within contact-range proximity of the OH line."[94]

Asset Health Adjustment

The Asset Health adj. factor =

$$2 * (Segment\ avg\ conductor\ age)/avg_i(Segment\ avg\ conductor\ age_i, i = 1, n) + (Segment\ CHI/\{Segment\ CHI_i\ , i = 1, n\}$$

where CHI = Circuit Health Index[95]

It is not clear what SDG&E's mathematical nomenclature means in this instance. Energy Safety should request additional information.

Significant Wildfire Adjustment[96]

Significant Wildfire Adjustment Factor =

$$1/(Wildfire\ Frequency\ \times\ Annual\ HFTD\ Ignition\ Rate)$$

This apparently adjusts for the wildfire return interval at the location of the segment in question.

Hardening Adjustment[97]

According to SDG&E's data request response,

Hardening Adjusted Wildfire Rate =

$$Initial\ Wildfire\ Rate\ \times\ Percent\ Hardening_i\ \times\ (1 - Ignition\ Effectiveness\ Rate_i)$$

where *i* represents a hardening type.

This does not appear to be correct in its presented form. SDG&E probably intended:

$$Initial\ Wildfire\ Rate\ \times \sum_i (Percent\ Hardening_i\ \times\ (1 - Ignition\ Effectiveness\ Rate_i))$$

[94] DR Response MGRA-SDGE-2023WMP-04-02.
[95] Id; Question 3.
[96] Id; Question 4.
[97] Id; Question 5.

Third-party assessment of WiNGS-Planning

In its response to MGRA Data Request #4, SDG&E stated that "*a thorough third-party review has been performed on the WiNGS-Planning model and completed in 2023, which reviewed and evaluated the validity of the modeling steps within the model, including the Ignition Rate Normalization Factor Sub-Model and found that the model is a robust model which meets user needs and performs the function for which it was designed*."[98]

In response to SDG&E's claim, MGRA requested and received a non-confidential version of the third party review of WiNGS-Planning.[99] The file received is named WiNGS-Planning_Report_Final_2023_5_23.pdf. The report is titled "WiNGS-Planning Assurance Report" (Report), is by P A Consulting Group, Inc., and is dated May 23, 2023. A cursory review of this document reveals that SDG&E's claim in its DR 4 response is overstated. The Report appears to be primarily a review of SDG&E's model from a software engineering, data management, and process standpoint. The Report indeed finds generally that SDG&E's modeling, engineering, and process used for WiNGS-Planning were reasonable and met requirements. However, the Report does *not* appear to review the scientific, mathematical, algorithmic, or statistical basis of SDG&E's modeling steps, and so Energy Safety should probe deeper into these areas. It is therefore incorrect for SDG&E to state that the "validity" of the modeling steps has been verified by the Report.

The Report does find a number of specific issues with regard to model validation that are relevant to the accuracy of SDG&E's approach. Findings include:

- Suggestion for "*…a sensitivity analysis to validate RSE and mitigation sections of the WiNGS-Planning model*" [100]
- Suggestion for "*a sensitivity analysis should be performed on the results of the customer type weight multipliers to evaluate if any unintended bias has resulted by adding weights to certain types of customers. This could include understanding the distribution of medical baseline and urgent customers relative to certain areas that may result in lower priority of hardening*."[101]

[98] DR Response MGRA-SDGE-2023WMP-04-01.
[99] DR Response MGRA-SDGE-2023WMP-06-01.
[100] Report; p. 21.
[101] Report; p. 21.

- Some data is outdated, specifically the Conductor Health Index (CHI) of 2020.[102]
- It is likely that there is double-counting between CHI and conductor age.[103]
- Validation of vegetation and wind data on highest risk segments is performed in an ad-hoc manner.[104]

The Report makes numerous other recommendations in many areas of SDG&E's WiNGS-Planning lifecycle and process, and Energy Safety should carefully review this document to incorporate relevant findings into its own review.

General Assessment

SDG&E's ignition model still has a serious bias that underestimates risk in high risk areas by failing to account for the effect of PSPS. Its "weighted sum" approach on first analysis appears valid as long as each of the adjustments is soundly grounded in data and theory. Additionally, SDG&E needs to demonstrate that these "corrections" are not coupled in any way. SDG&E's approach allows effects that are known but hidden in the data to be incorporated, and can serve as an alternative (and possibly correction to) machine learning models. In particular, the SDG&E approach helps to correct for the fact that extreme wind areas will be underweighted by the PSPS bias. Energy Safety should validate that the wind/damage adjustment used by SDG&E is accurate. One correction that needs to be made is to use only peak winds observed during times of fire potential. Otherwise areas with weather stations prone to winter storms will have overestimated risk values. One validation SDG&E should do to test whether its corrections are independent is reverse the order in which the corrections are applied and validate whether the end result is the same.

Recommendations:

Prior to the next WMP update,

- Energy Safety should require SDG&E to include PSPS bias adjustment through inclusion of PSPS damage events in its WiNGS-Planning model.
- SDG&E's wind adjustment model should filter its maximum recorded wind speed based on humidity and temperature threshold to capture only fire-weather events.

[102] Report; p. 14.
[103] Id.
[104] Report; p. 21.

- Energy Safety should require additional detail regarding SDG&E's asset health adjustment factor.
- SDG&E should be asked to validate its "weighted sum" approach by applying its corrections in reverse order to ensure that each correction is independent of the others.
- Energy Safety should carefully review the A P Consulting Group Report and incorporate relevant findings into its WMP review.
- As per the A P Consulting Group Report, SDG&E should conduct sensitivity analyses for its RSE, mitigations, and PSPS customer type models.
- As per the A P Consulting Group Report, SDG&E should eliminate double counting of conductor age and CHI.
- Energy Safety should require SDG&E to provide scientific, mathematical, and statistical support for its ignition model components.

6.2.1.3. Comparison of 2022 and 2023 wildfire risk models

The Technosylva model that SDG&E is running this year contains an updated model for acres burned and buildings destroyed.[105] As will be seen, these changes have major impacts on SDG&E's consequence calculation.

SDG&E has provided risk model data from 2022 and 2023 and these can be compared to ascertain how the changes affected its risk model across its service area. The figures below compare the *ratio* of the 2023 risk score (or risk component) to the 2022 risk score (or component). Where the risk has been reduced, the line segment is shown in a shade of lighter green (moderate reduction) or darker green (deep reduction). A moderate increase is yellow, large increase in orange, and dramatic increase in red. Starting with the risk scores themselves:

[105] WiNGS-Planning; p. 4.; SDG&E representative at WMP Workshop.

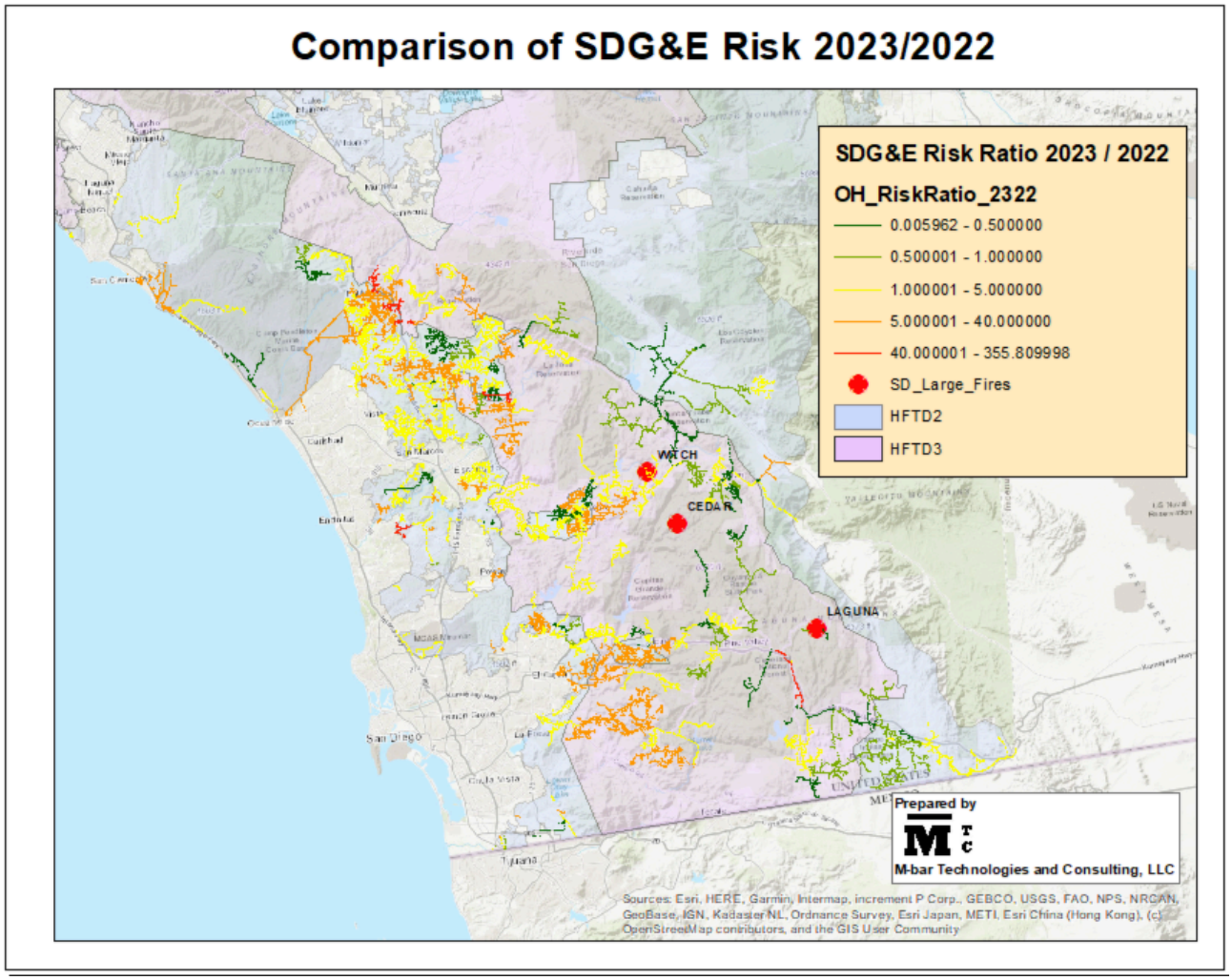

Figure 6 - Ratio of SDG&E's 2023 risk score to its 2022 risk score. HFTD areas are shown in pastels.

The interesting features in this map: 1) areas in and to the east of San Diego's mountains are seeing risk reduction, possibly due to SDG&E hardening efforts in these areas, 2) a net increase in risk values has been calculated 3) Largest risk increases in eastern canyon areas, particularly those proximate to and even in population centers.

The next map shows the ratio of SDG&E's calculated 2023 versus 2022 ignition probability, incorporating its various wind, asset, and vegetation adjustments.

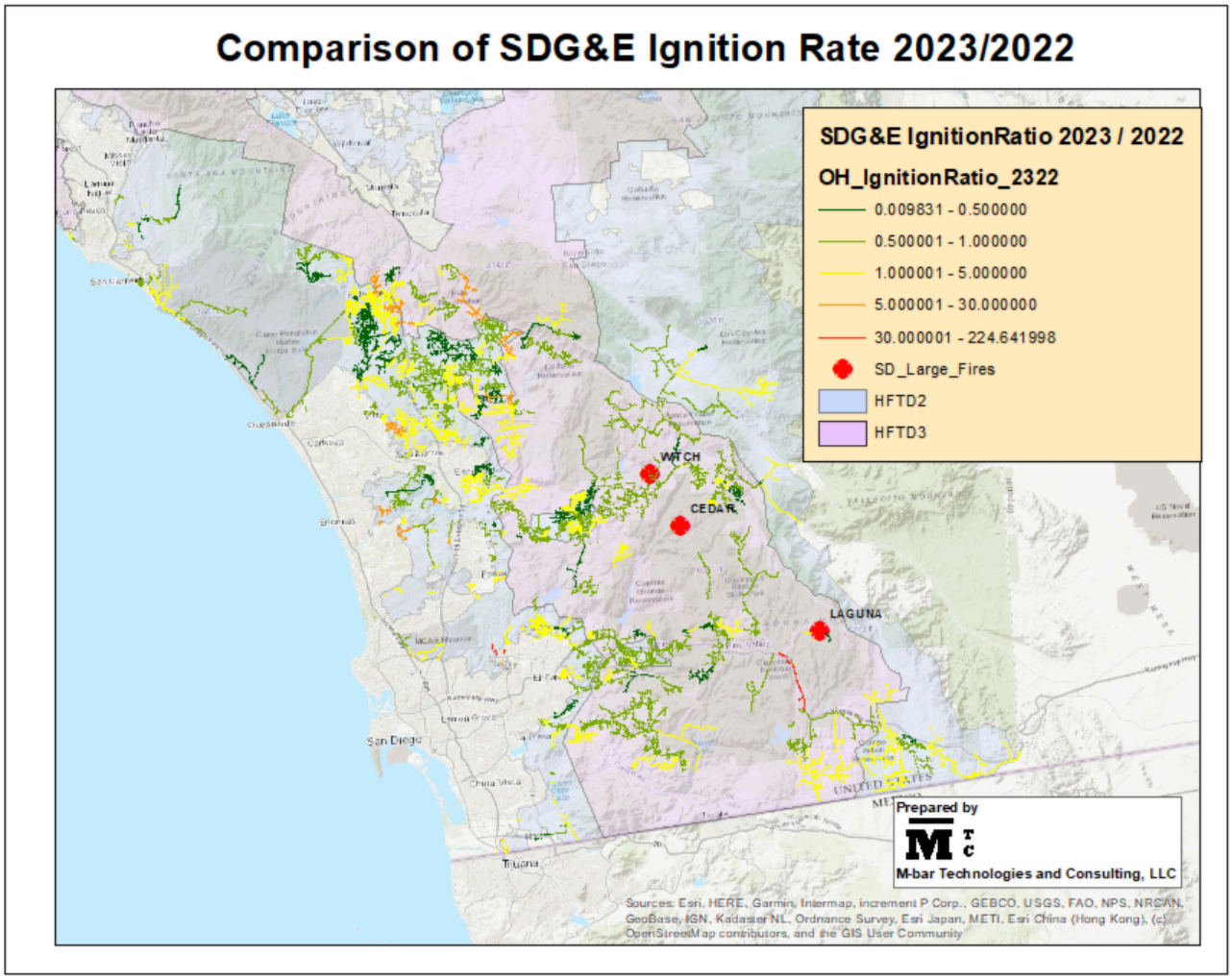

Figure 7 - Ratio of SDG&E's 2023 calculated ignition rate to its 2022 ignition rate.

The results of this analysis are mixed, with the mountainous areas of San Diego generally seeing a decrease in ignition rate and the eastern margins of the HFTD seeing moderate increases. It is not obvious what would account for any trends.

The difference in the consequence scores show the most dramatic difference between 2023 and 2022, as seen below:

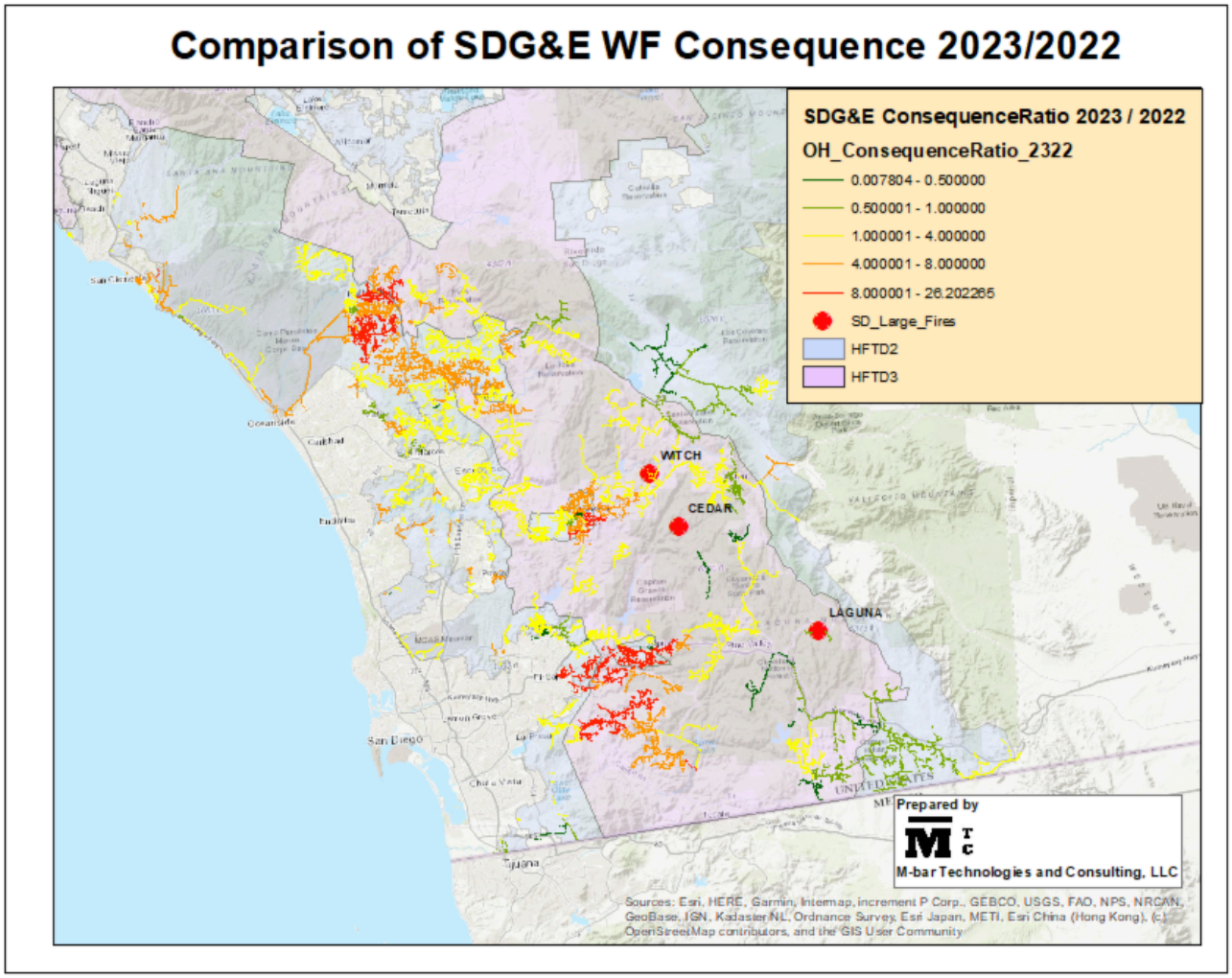

Figure 8 – Ratio of 2023 SDG&E Consequence scores to 2022 SDG&E Consequence scores.

Figure 8 shows a dramatic difference increase in calculated consequences between the 2022 and 2023 risk models in most areas. A critical observation is that the most dramatic increases in consequence are centered around and in population centers: Fallbrook (to the northwest), Ramona (central), and Alpine/El Cajon (south). Decreases were only seen in the mountains and foothills, which were the sites of the three most damaging fires in San Diego County history.

During the April 28/29th workshops, an SDG&E representative explained that the changes in SDG&E's consequence calculations were likely due to the inclusion of Technosylva's building loss model in the 2023 calculation.

The conclusion that must be reached from looking at these maps is that whatever changes Technosylva and SDG&E have made over the last year have made the problems arising from the limitations of their 8 hour fire spread time worse. MGRA has been warning about the 8 hour fires

spread limitation since 2021, and has repeatedly noted that it creates a bias that overweights risk areas that are near population centers and underweights the risk of remote high-wind areas where historically large fires have incubated and spread into the wildland urban interface.[106] It appears that the Technosylva building loss model leads to an increase in consequence associated with building loss as compared with its previous consequence model. This merely amplifies the existing urban bias shown by previous Technosylva consequence models. While urbanized areas and surroundings are where the heaviest losses occur, the question that needs to be answered in the consequence model is where the ignitions will be that are most likely to lead to the urbanized areas being threatened. Historically we know these come from large fires, much larger than those generated in the 8 hour simulations and with ignition points further from the urban areas.

This problem is further exacerbated by the fact that vegetation fires starting in or around settled areas will usually receive a quick and vigorous fire-fighting response. Fire suppression is not yet included in the fire models because no widely accepted model has been adopted.

Recommendation:

- Technosylva's building loss model needs additional scrutiny by OEIS. It seems to amplify the "urbanization" of wildfire risk calculations, and therefore reduce predicted risk in remote high-wind areas where historical catastrophic fires have ignited and grown before descending onto the Wildland Urban Interface.
- SDG&E must find a mechanism to reduce the "8 hour" bias introduced by the Technosylva 8 hour run time limitation and thereby include the potential for larger fires in its consequence model.

6.2.1.4. Egress issues

Egress is another factor that needs to be incorporated when determining risk and mitigation strategies. MGRA raised this issue in its 2020 WMP comments,[107] specifically noting that wooden poles along an evacuation route could be a hazard during a wildfire if they burn and fall into the

[106] MGRA 2021 WMP Comments; pp. 48-55.
[107] R.18-10-007; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON 2020 WILDFIRE MITIGATION
PLANS OF SDG&E, PG&E, SCE; pp. 28-29. (MGRA 2020 WMP Comments)

evacuation route, as happened in the Camp fire.[108] Another egress issue is if a utility wildfire ignites and blocks access to a single egress area, putting those trapped in the area at risk.

MGRA also raised the egress issue specifically with regard to SDG&E in its comments on SDG&E's 2021 RAMP proceeding.[109] At that time, MGRA noted an excess of PSPS damage events and ignitions in an area to the northeast of the Mussey Grade Road corridor. Mussey Grade Road itself is a single-egress community, so this was of direct concern to us as a personal safety issue. SDG&E's 2023 WMP states that its "*Undergrounding Program (WMP.473) considers egress during design and construction in case of any emergencies*,"[110] but this is only during the construction phase to ensure that the undergrounding itself does not interfere with an evacuation. When specifically asked by Cal Advocates whether it considers asset failure interfering with ingress or egress, SDG&E stated that "*corridors in SDG&E's service territory where asset failure could limit egress/ingress during an emergency have not been identified. SDG&E is prepared to support the needs of first responders through participation in the County Evacuation Committee, the staffing of 24/7 response staff to respond to incidents, and regular training with first responder agencies*."[111]

SDG&E's most recent risk calculations, if they are to be trusted, indicate that the egress issue for the Mussey Grade corridor remains a pressing concern. Below is a more detailed map of SDG&E's 2023 risk scores for the Ramona area, which provides a vivid illustration of the egress issue.

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[108] Los Angeles Times; "Must Reads: Here's how Paradise ignored warnings and became a deathtrap"; December 30, 2018; Page St. John, Joseph Serna, Rong-Gong Lin II; https://www.latimes.com/local/california/la-me-camp-fire-deathtrap-20181230-story.html

[109] A.21-05-014; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON SAN DIEGO GAS AND ELECTRIC COMPANY'S RAMP FILING AND THE SAFETY POLICY DIVISION REPORT; December 6, 2021; p. 16.
A.21-05-014; Safety Policy Division Staff Evaluation Report on SDG&E's and SoCalGas' Risk Assessment and Mitigation Phase (RAMP) Application Reports; November 5, 2021; Appendix: pp. 239-242/295, containing:
MUSSEY GRADE ROAD ALLIANCE INFORMAL COMMENTS TO THE SAFETY POLICY DIVISION REGARDING SAN DIEGO GAS AND ELECTRIC COMPANY'S RAMP FILING; October 22, 2021; pp. 31-36. (MGRA Informal SDG&E RAMP Comments)

[110] SDG&E WMP; p. 42.

[111] DR Response: CALADVOCATES-SDGE-2023WMP-05-Q1; March 10, 2023.

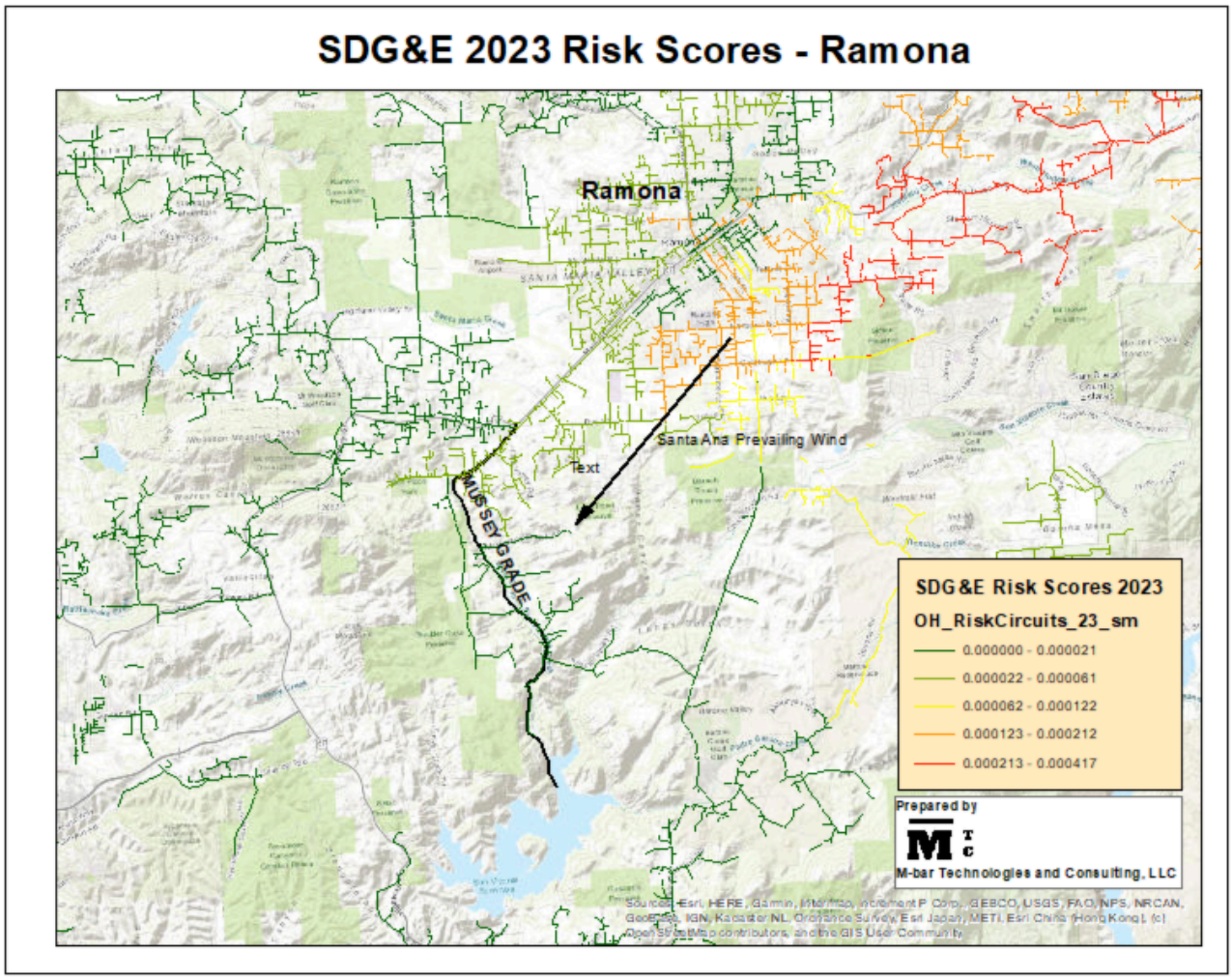

Figure 9 - SDG&E 2023 risk scores for the Ramona area. SDG&E's model predicts that the greatest risk from an ignition on its system would be for assets to the east and south of the town center. This area is to the northeast of the Mussey Grade Road corridor, which is a single-egress community, which could be rapidly put at risk if an ignition occurs during a Santa Ana wind event.

SDG&E was asked by MGRA to provide a Technosylva simulation of an ignition in the area of southern Ramona during its RAMP proceeding, and refused.[112] However, the County of San Diego had prepared a fire simulation when doing an environmental review of a project near the community, and it selected a "worst case" ignition point for the Mussey Grade Road corridor in approximately the same area designated by SDG&E as elevated risk. The County simulation is shown below:

[112] MGRA Informal SDG&E RAMP Comments.; p. 33-34.

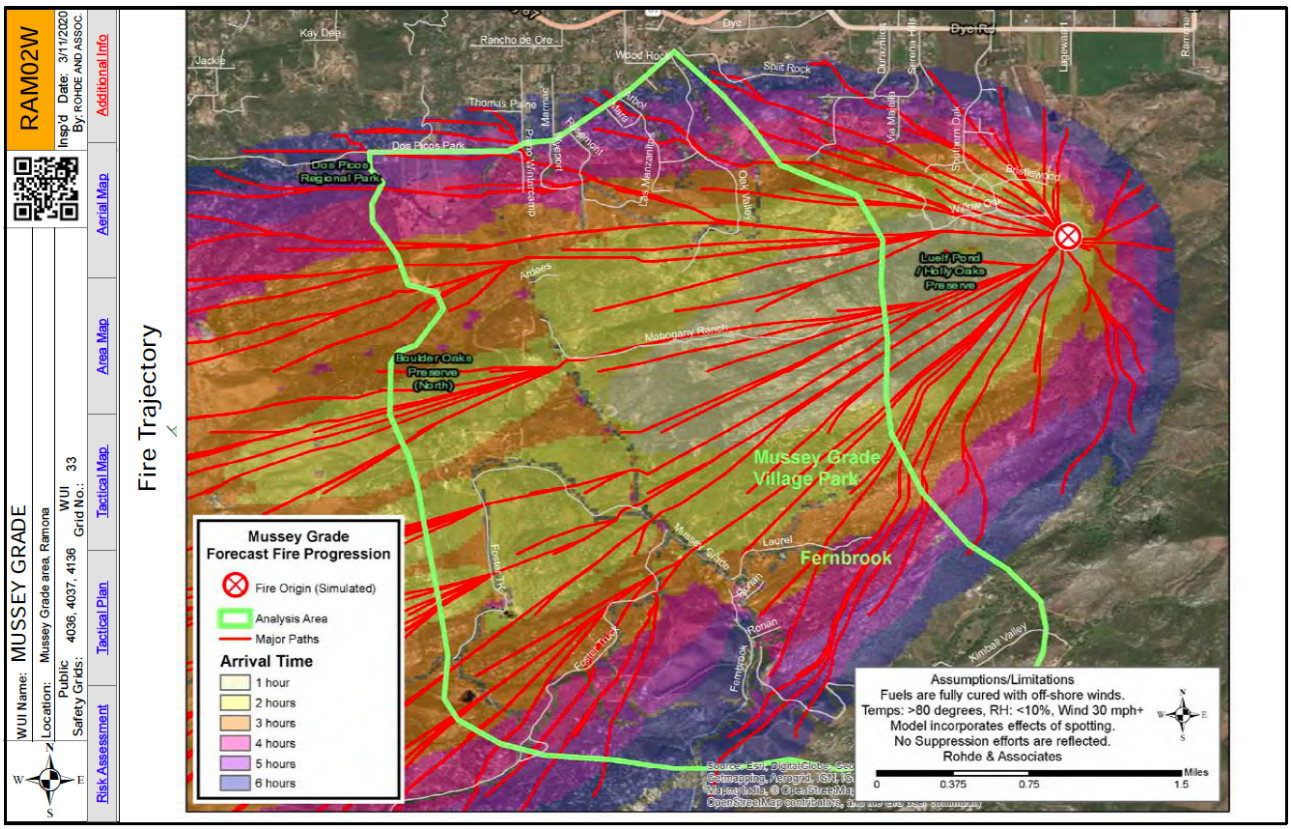

Figure 10 - Fire spread modeling for an ignition in the Dye Road area of Ramona, California, performed by Rohde and Associates at the behest of San Diego County.[113] As can be seen, the Mussey Grade Road corridor can be impacted by the fire front in as little as an hour after ignition. The southern Mussey Grade Road corridor is home to hundreds of people and is a single-egress neighborhood depending on Mussey Grade Road for evacuation. This model does not take the effect of smoke into account, which could severely limit visibility along the evacuation route before the fire front arrives.

As is evident in Figure 10, an ignition in the area that SDG&E designates has elevated risk could reach the Mussey Grade Road corridor in as little as an hour. However, this model does not take smoke effects into account, which could severely limit visibility during evacuation. The inability of a community to evacuate could lead to a mass casualty event such as the Camp fire. This risk ultimately needs to be accurately reflected in consequence modeling.

Energy Safety's Technical Guidelines in Section 5.4.3.3, Sub-Divisions with Limited Egress or No Secondary Egress, specifes that "*The electrical corporation must provide a brief narrative*

[113] BOULDER OAKS PRESERVE; Improvement Project; FIRE SERVICES OPERATIONAL ASSESSMENT; Prepared for the Fire Marshal, San Diego County Fire Authority, by: Rohde & Associates Emergency Management; March 11, 2020; p. 25. https://files.ceqanet.opr.ca.gov/255399-3/attachment/RoCw4UBieJabVxwD17qEFEgtaDfVVUZDJBkYn0n0nCMP5oee4U5QZTiblg509QlYUWMRtidLAvA6bb0m0. Downloaded 10/18/2021.

overview (one to two paragraphs) describing sub-divisions with limited egress or no secondary egress, per CAL FIRE data, across the electrical corporation's service territory."[114]

While this is a minimal requirement, SDG&E's 2023 WMP fails to meet it. Energy Safety should require all utilities to analyze egress data, identify areas at risk, and properly summarize results in their WMPs. Ultimately OEIS should require utilities to incorporate risk to single egress communities in their consequence models and their mitigation prioritization.

Recommendation:

- Energy Safety should require all utilities to identify single egress and limited egress communities and areas in its service area as per Section 5.4.3.3 of the Technical Guidelines Urgency: Required for WMP approval.
- Energy Safety should require all utilities to incorporate single egress and limited egress communities in their future consequence modeling. A workshop should be organized to explore the most appropriate way to include this risk.

6.2.1.5. Building loss

Further information is necessary regarding Technosylva's building loss model. Based on Technosylva's presentation at the April 27th / 28th workshops and question and answer session, it was stated that the building loss model was based solely on fire, weather and landscape characteristics, and had nothing to do with the specific characteristics of the structures, their age, arrangement, or adherence to building codes, in spite of research supporting such relationships.[115]

However, information subsequently provided to MGRA in response to a data request indicated that some building characteristics will be included:

"*SCE understands the current state of the model, it is a Machine Learning (ML) algorithm which considers building conditions based on historical damage inspection data on buildings*

[114] Technical Guidelines; p. 28.
[115] Syphard, A.D., Keeley, J.E., 2019. Factors Associated with Structure Loss in the 2013–2018 California Wildfires. Fire 2, 49. https://doi.org/10.3390/fire2030049
Syphard, A.D., Keeley, J.E., Massada, A.B., Brennan, T.J., Radeloff, V.C., 2012. Housing Arrangement and Location Determine the Likelihood of Housing Loss Due to Wildfire. PLOS ONE 7, e33954. https://doi.org/10.1371/journal.pone.0033954

affected by fires over the past 13 years. These data include CAL FIRE Damage Inspection Specialist (DINS) post wildfire report information. DINS data contains information regarding damage to certain aspects of building structures and partial information regarding building material composition but does not contain information containing lot size or building codes."[116]

While any building loss model is likely an advancement over a simple count of structures within a perimeter, the building loss model results should be validated against historical losses and also be shown to be consistent with (or superior to) the published literature on structure losses.

Recommendations:

- OEIS should require utilities considering or using the Technosylva building loss model to provide validation that the model is predictive when compared to historical losses and consistent with the published literature on structure losses.

6.2.2. PG&E WDRM

6.2.2.1. Changes in WDRM from v2 to v3

PG&E has introduced numerous changes to its Wildfire Risk Distribution Model (WDRM), upgrading it from version 2 last year to version 3 this year. A version 4 is under development but has not been released for PG&E's 2023-2025 WMP, and will likely not undergo final validation until Q3 of this year.[117]

WDRM v3 was released immediately after the 2022 WMP review process, but was available for the Revision Note review process. MGRA plotted the relationship between v2 and v3 risk scores and prioritization rankings in its Comments on the PG&E Revision Notice Responses.[118] This analysis demonstrated that there was virtually no correlation between v2 and v3:

[116] DR Response MGRA-SCE-004-04.
[117] DR Response PGE_OEIS_003_Q15.
[118] 2022-WMPs; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON PG&E RESPONSES TO 2022 WILDFIRE MITIGATION PLAN REVISION NOTICES; August 10, 2022; pp. 10-12.

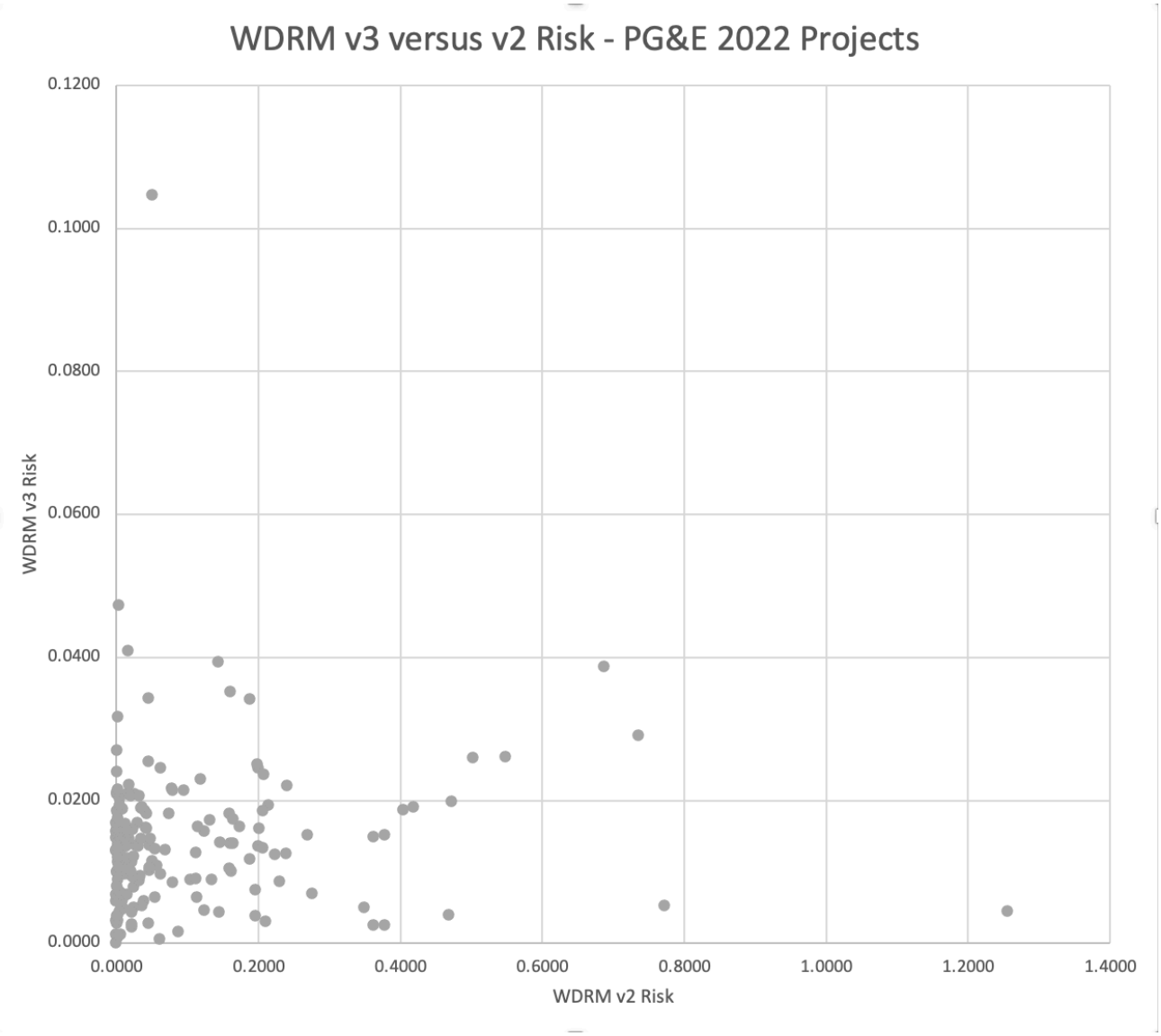

Figure 11 - PG&E risk values as determined by WDRM v2 and WDRM v3.

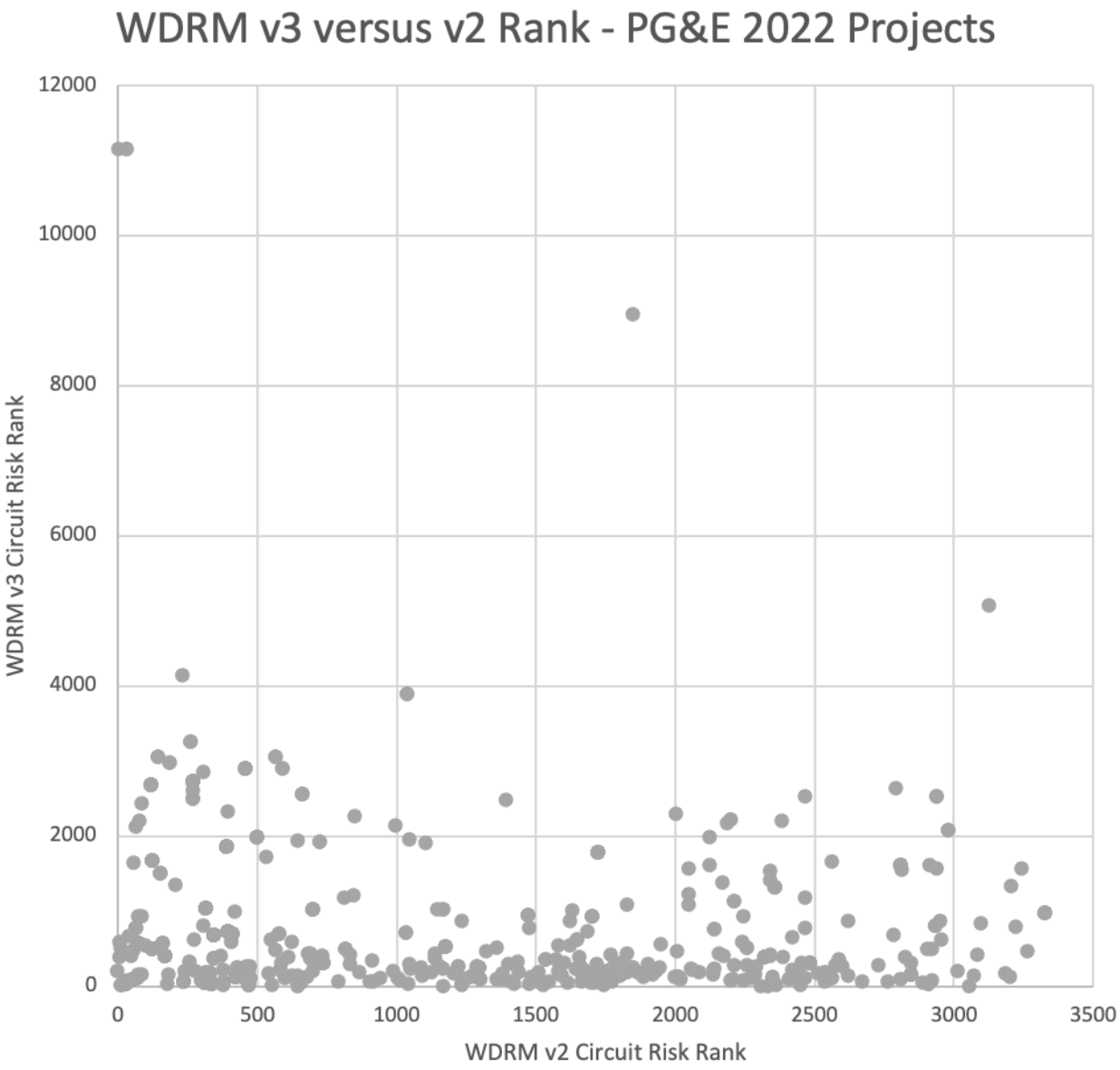

Figure 12 - PG&E circuit risk rankings as determined by WDRM v2 and WDRM v3, as shown by data in PG&E's 60 day revision response

The point that MGRA stressed in its comments and in its PG&E GRC testimony is that PG&E's risk models are in flux and rapidly developing. However, PG&E is using these risk models to plan billions of dollars' worth of infrastructure changes, particularly undergrounding.

MGRA had used PG&E's risk model as an example of how areas proximate to population centers had artificially amplified circuit risk while areas in more remote areas where catastrophic fires tend to ignite had a suppressed risk score. This was effect was shown in the figure below:

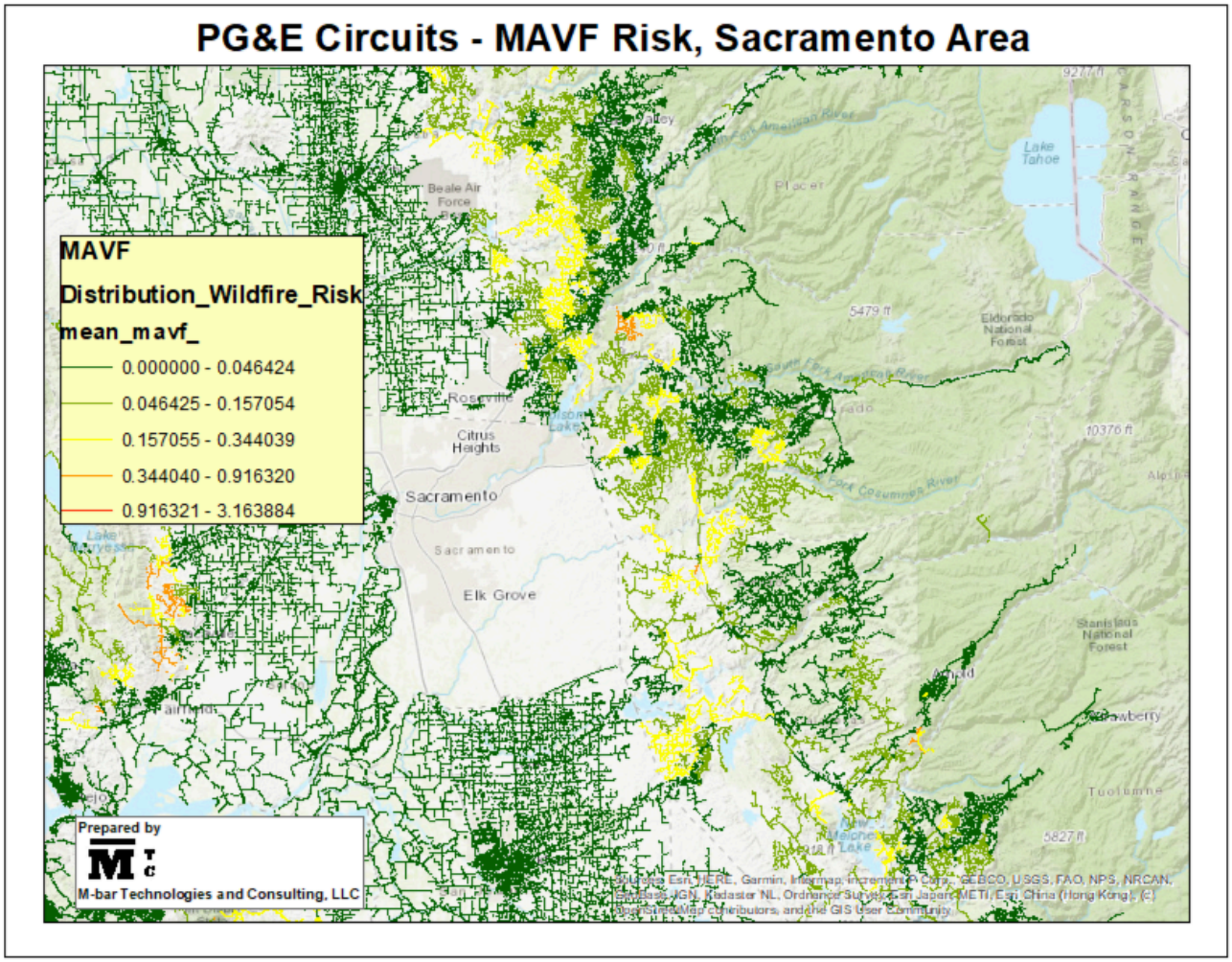

Figure 13 - PG&E's calculated risk scores using its WDRM v2 in the Sacramento / Lake Tahoe area.[119]

PG&E's v3 consequence model is substantially different its v2 model. Specifically PG&E has developed a complex model that no longer relies solely on Technosylva fire spread modeling to calculate consequences. As PG&E explains:

"*In v3 of the model, PG&E has moved from exclusively using consequence outputs from Technosylva and CalFire to using Technosylva, PG&E's FPI R-score (which is used to call PSPS events), and public satellite data from the Visible Infrared Imaging Radiometer Suite (VIIRS). This updated approach leverages real and observed fire behavior and consequence outcomes, which is an improvement over v2. However, while these outcomes are actually ranges, PG&E is using the mean consequence from each range in their risk modeling. The current structure of the consequence model uses VIIRS observed fires and Technosylva simulations to classify fires or simulations as either destructive, or potential conditions, or not destructive potential conditions by ignition point.*

[119] MGRA 2022 WMP Comments; p. 46.

The probability of a destructive or non-destructive fire for each ignition point is then determined to be the number of days within the sample window, 2014-2020, where conditions matched those defined for a destructive or non-destructive fire, over the total number of days in the timeframe."[120]

This appears to be a crude approach, since:

1) there are a very limited number of classifier bins,

2) all fires of note will be in the destructive potential conditions bin

3) rather than use the range, PG&E uses the same average for the bin for all points.

This is not to imply that every point will have the same consequence, since PG&E will run weather history for each of those points at it will fall into different bins on different historical days. PG&E claims that by utilizing this method it is properly incorporating "worst case" weather days.[121] This approach appears to address the counterintuitive result shown in Figure 13, as shown in Figure PG&E-6.2.2-9:

[120] PG&E WMP; p. 22.
[121] PG&E WMP; pp. 164-169.

FIGURE PG&E-6.2.2-9:
WILDFIRE CONSEQUENCE PIXEL MAP

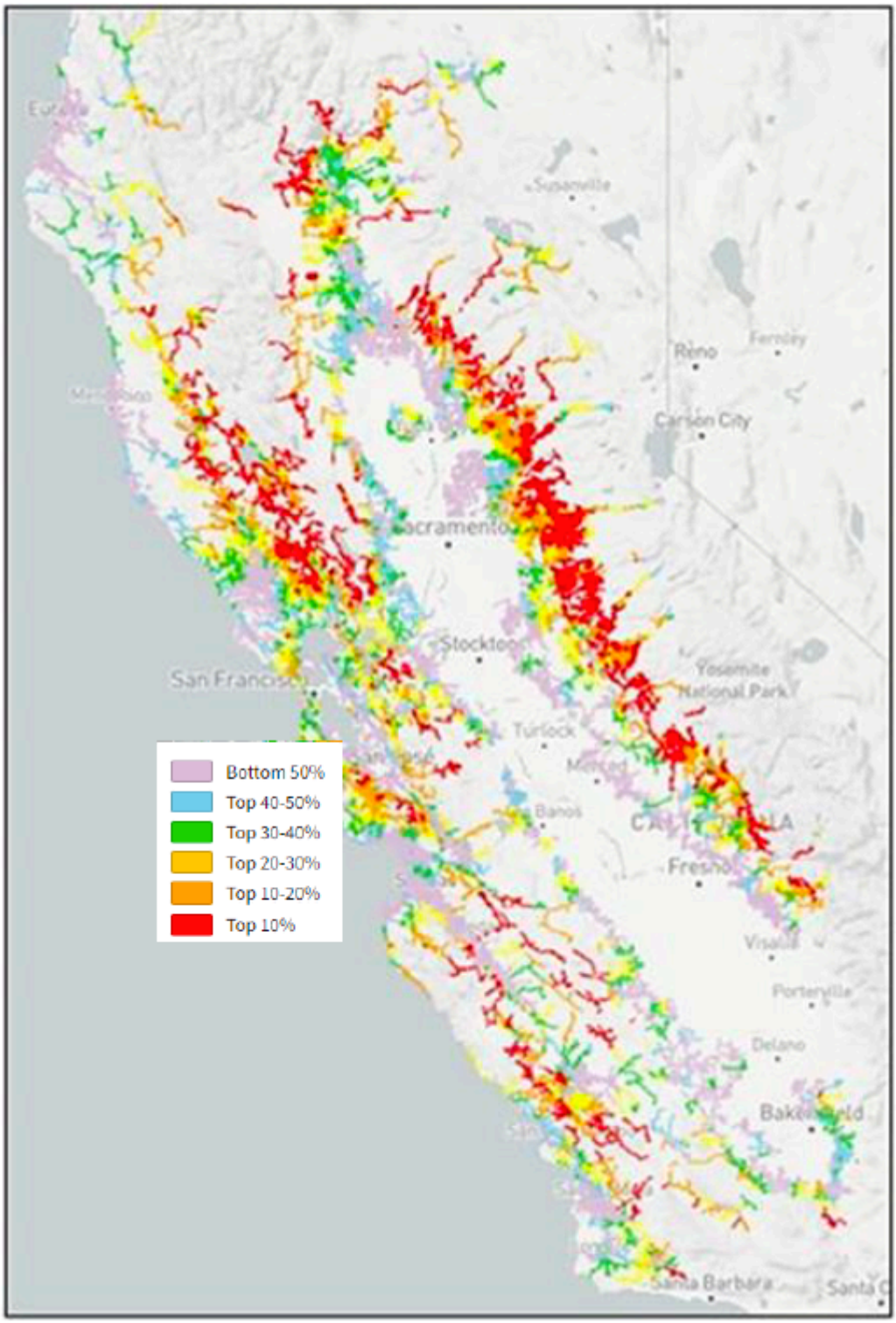

Figure 14 - Figure PG&E-6.2.2-9 showing WDRM v3 consequence scores for the PG&E service area[122]

[122] Id; p. 169.

While the PG&E consequence map "looks" better, in that it shows that the most consequential ignition points occur in vegetated areas of elevation where ignitions can grow into catastrophic wildfires before descending onto wide WUI fronts, there are elements that are troubling.

Using an average to represent consequences for wildfires is not a valid practice. Wildfires have been repeatedly shown to follow a power law distribution over orders of magnitude,[123] and because the absolute value of the cumulative distribution power law exponent is less than 1.0, the moments of the distribution cannot be determined, including the mean.[124] In other words, the more data one collects the higher the mean becomes because the worst fire is always in the future.

PG&E's independent review by E3 made a related observation: "*The use of the mean for prioritization may poorly characterize risks in areas with large ranges of consequence. The use of the mean cost to calculate total risk could overlook areas with potentially very high risk or prioritize them lower. Using the mean to calculate risk-spend-efficiency could also improperly overlook areas with high mitigation efficiency and promote smaller scale mitigations in areas that actually require more fundamental changes. The reverse is true if the mean is obviating a very low range*."[125]

PG&E's consequence model likely continues not to fully incorporate tail risk, though it would appear to do so better than models relying solely on an 8 hour Technosylva wildfire spread simulation. Instead of using mean values, PG&E may benefit from using a statistical model, in which large fires in its categories are fit to a distribution incorporating the known power law size dependencies of wildfire. PG&E does this in its enterprise risk model, which uses a Generalized

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[123] Malamud, Turcotte, 1998. Forest fires: An example of self-organized critical behavior. Science 281, 1840–1842.
Newman, M.E.J., 2005. Power laws, Pareto distributions and Zipf's law. Contemporary Physics 46, 323–351. https://doi.org/10.1080/00107510500052444
Clauset, A., Shalizi, C.R., Newman, M.E.J., 2009. Power-Law Distributions in Empirical Data. SIAM Rev. 51, 661–703. https://doi.org/10.1137/070710111
Moritz, M.A., Morais, M.E., Summerell, L.A., Carlson, J.M., Doyle, J., 2005. Wildfires, complexity, and highly optimized tolerance. Proceedings of the National Academy of Sciences 102, 17912–17917. https://doi.org/10.1073/pnas.0508985102
[124] Taleb, N.N., 2020. Statistical Consequences of Fat Tails: Real World Preasymptotics, Epistemology, and Applications. STEM Academic Press. https://arxiv.org/abs/2001.10488; pp. 27-28.
[125] E3 Review of PG&E's Wildfire Risk Model Version 3; May 2022; p. 22.

Pareto Distribution. PG&E could then use this distribution to generate Monte Carlo data from the distribution to estimate consequences, thus capturing tail risk using a physically supported model.

With regard to the ignition probability, PG&E's predicted ignition risk is highly localized, as shown in the figure below:

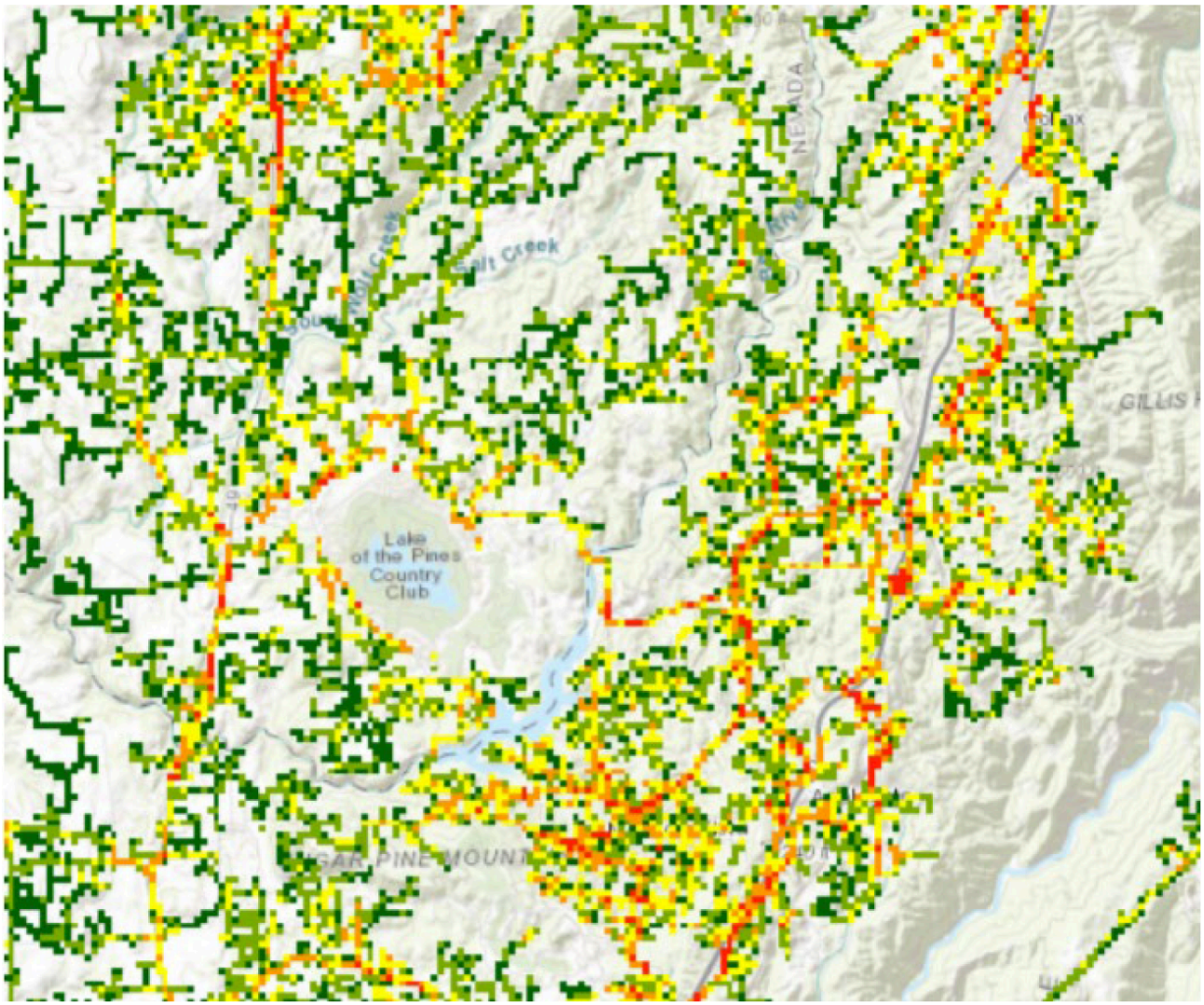

Figure 15 - Fine grained detail of PG&E's POI model from a typical location. Pixels range from green (low risk) to red (high risk).

As can be seen, there is considerable variation over very short distances. As PG&E explains, "*Fine grained localization may result where locations of significant covariate variability exist in PG&E's service territory (e.g. a heavily forested area next to a non-forested area).*"[126] PG&E also

[126] PG&E DR Response MGRA_005-Q003.

notes that its "*workplan development is generally guided by circuit segment level aggregations that provide an improved indication of risk level*."[127]

PG&E's covariates still do not contain time-dependencies and therefore its POI model remains only weakly predictive of where high winds will induce outages, as noted by MGRA in its 2021 and 2022 WMP comments. Temporal granularity was also suggested by PG&E's 2022 E3 review.[128] WDRM v3 consequently still overpredicts ignitions from "agents" such as balloons, animals, and vehicles which historically have not been responsible for catastrophic wildfire ignition.[129] PG&E could remedy this issue by running a separate probability of ignition analysis for high fire danger periods, such as Red Flag Warnings (RFW), and approaching this as a separate risk.

Recommendations:

- The full technical details and results of third-party validation for PG&E's WDRM v4 model must be provided in its next WMP Update. This should include a full comparison of WDRM v4 risk, ignition probability, and consequence calculations at the circuit or segment level with the results of WDRM v2 and WDRM v3.
- PG&E should provide data showing that its analysis, when run simulating known historical fires, produces consistent results with historical data with regard to fire size and which drivers are responsible for catastrophic wildfires.
- PG&E should not use average category values for its consequence model but rather use a statistical model that captures tail risk such as a truncated Generalized Pareto distribution.
- PG&E should separate out wind-driven wildfire events through analyzing Red Flag Warning data (including PSPS damage events) as a risk driver.

[127] PG&E DR Response MGRA_004-Q004.
[128] MGRA 2022 WMP Comments; p. 23.
[129] PG&E WMP; p. 154.

6.2.3. Southern California Edison risk model

6.2.3.1. Changes in the SCE risk model from 2022 to 2023

SCE continues to refine its MARS framework to calculate wildfire and PSPS risk. The model framework is essentially the same as it was in the 2022 WMPs.[130] Consequently, SCE's MARS model continues to have the same issues and biases as noted in previous MGRA WMP comments, including:

- 8 hour fire spread simulation maximum. In fact, SCE notes that: "*Fires that burn over 10,000 acres in the first 8 hours on average burn over 100,000 acres*."[131]
- Failure to include PSPS damage events in its risk events, thus creating bias reducing risk in areas where PSPS is frequent.
- Failure to compensate for the coupling of ignition probability and consequence, thus amplifying risk from external agent drivers (vehicles, animals, balloons) and depressing risk from wind-aggravated drivers (vegetation, equipment failure).[132]

Nevertheless, there have been some changes in SCE's MARS risk estimations since last year, and these will be shown below.

SCE's MARS risk map for 2023 is shown below:

[130] SCE WMP; p. 98.
[131] Id; p. 108.
[132] DR Response MGRA DR2, Q3; attachment 03_MGRA-SCE-002-03.xlsx

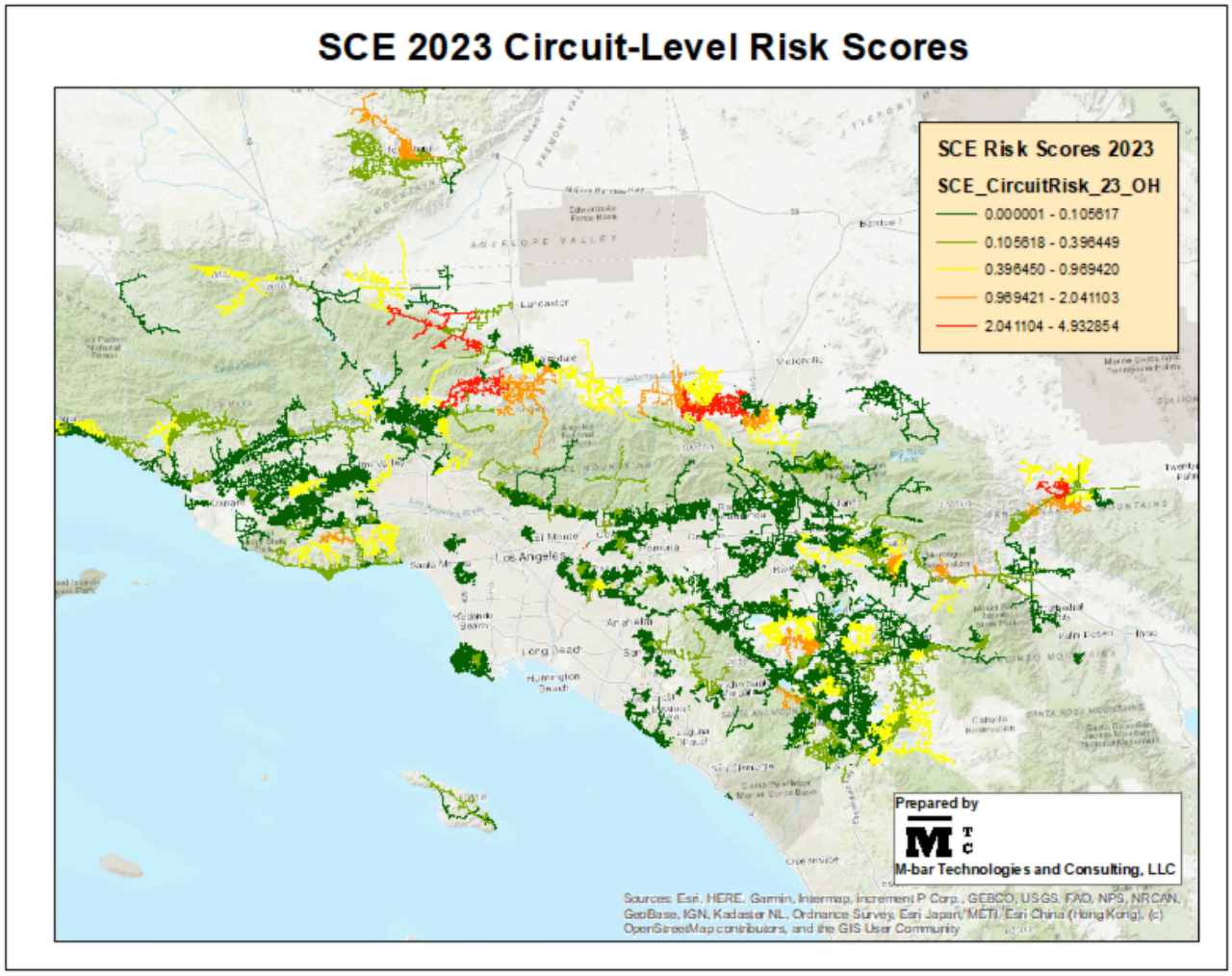

Figure 16 - SCE circuit-level risk scores based upon SCE's response to MGRA Data Request 2 Question 2. SCE has aggregated its segment-level risk scores into averaged circuit-level risk scores.

For this figure, MGRA used a geodatabase provided as SCE's response to its Data Request 2, Question 2. This database aggregates segment-level risk into averages for each SCE circuit, and provides general insight into what areas SCE considers to be highest risk. The area is shown in the figure is the greater Los Angeles, Ventura, and Orange County areas. As can be seen, SCE finds its highest risk in this area on the northern slopes of the San Gabriel mountains. This makes sense, since Foehn wind events starting in these areas could spread widely before descending into the LA basin and foothill communities.

SCE provided risk data from both 2022 and 2023, allowing a comparison to be made. The figure below shows the ratio of the ignition probability component of SCE's risk score in 2023 to that of 2022.

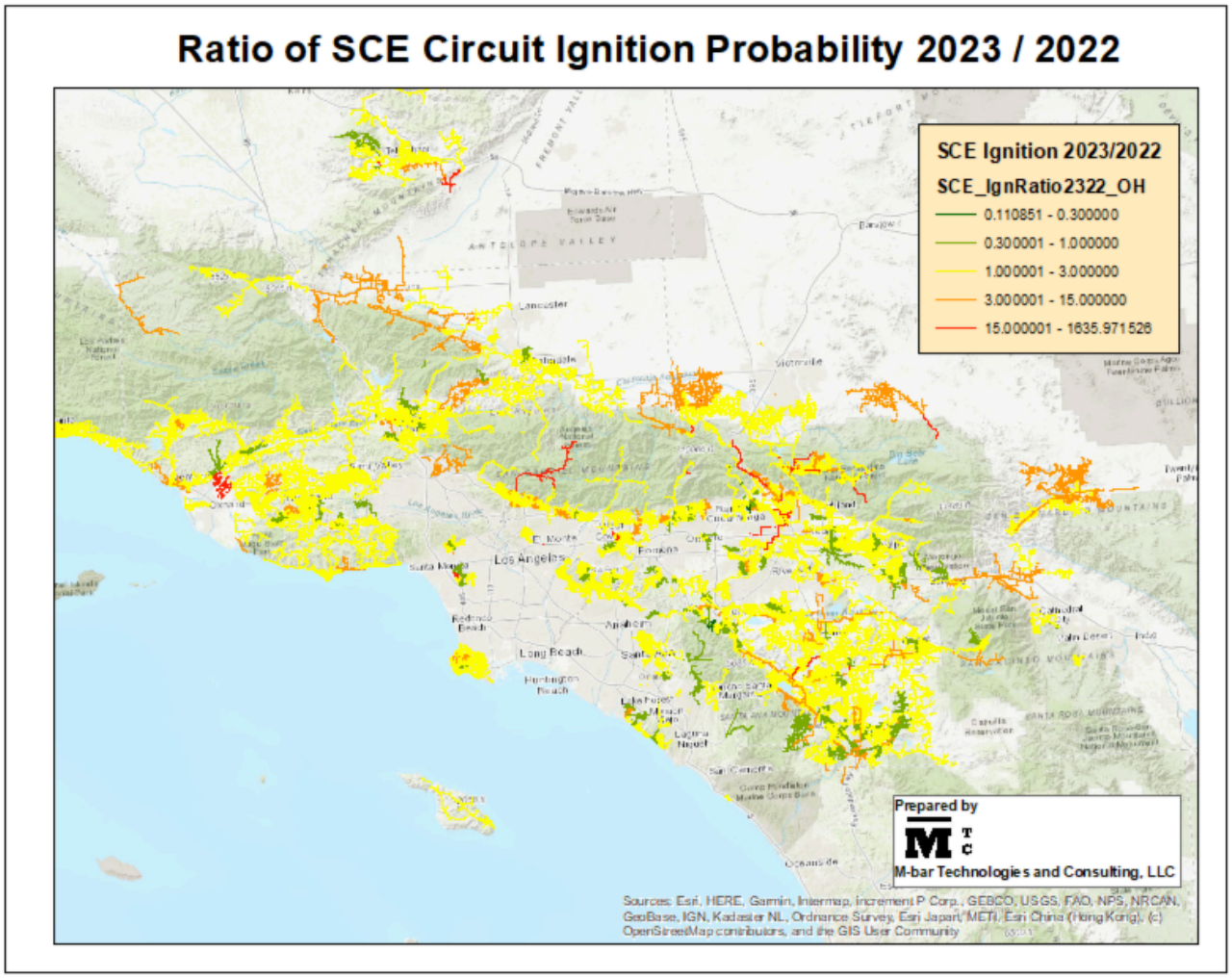

Figure 17 - The ratio of SCE circuit-level ignition probability in 2023 to the ignition probability for 2022. Green circuits indicate a reduction in ignition probability, while yellow, orange, and red circuits indicate an increase in the estimated ignition probability.

Figure 17 shows that overall, the ignition probability calculated by MARS increased over the SCE service area. The greatest increases shown in the figure were in the San Gabriel mountains and on their northern slopes and foothills.

Likewise the following figure shows the ratio of the consequence risk component for 2023 to the same value in 2022.

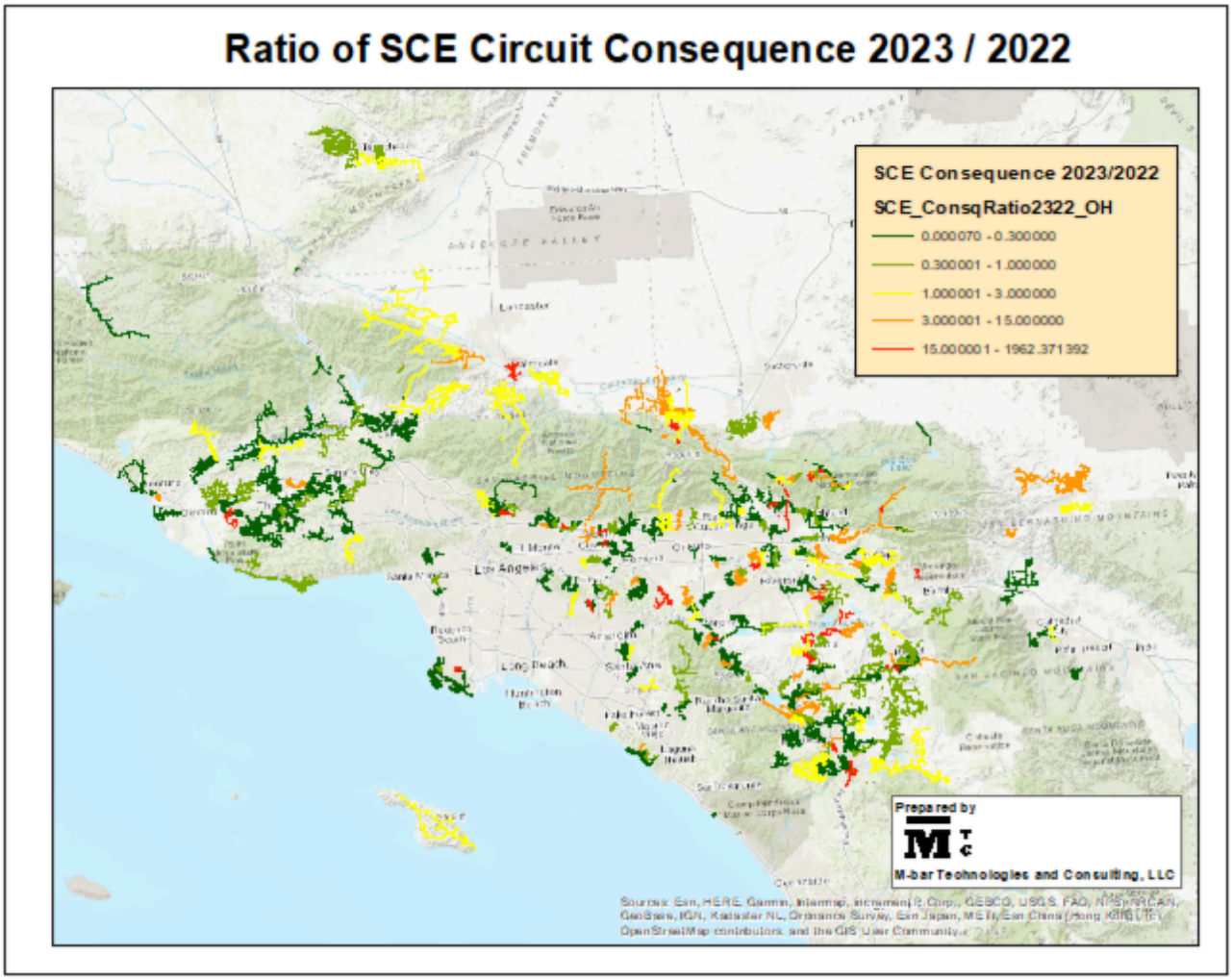

Figure 18 - The ratio of SCE circuit-level consequence in 2023 to the consequence for 2022. Green circuits indicate a reduction in consequence, while yellow, orange, and red circuits indicate an increase in the estimated ignition probability. Note that certain circuits that did not have a calculated consequence value in 2022 are not shown. It is not known whether this is an artifact of the data file provided by SCE or whether these values were actually not calculated.

As readily apparent, some circuits visible in the other figures are missing. This is likely an artifact of the file provided by SCE, which had 2022 consequence values set to zero for a number of circuits. Nevertheless, some trends can be noted. In general, while many consequence circuit values changed substantially, increases and decreases were fairly balanced and do not show obvious geographical distributions. However, the area of the San Gabriel mountains and northern foothills shows more substantial increases, further reinforcing the elevated risk in these areas indicated in Figure 16.

So generally there are not remarkable or odd changes to SCE's 2023 MARS risk distribution or the changes made since 2022. In fact, however, SCE's approach to mitigation and prioritization

has profoundly and utterly changed since its 2022 WMP filing: The MARS risk calculation has ceased to be the basis for SCE's most ambitious and expensive risk mitigation project.

6.2.3.2. SCE's IWMS Risk Framework

What SCE calls its IWMS (Integrated Wildfire Mitigation Strategy) Risk Framework, is an alternative planning framework to MARS (Multi-Attribute Risk Score).[133] As SCE describes it: "*The IWMS Risk Framework defines three risk tranches within SCE's HFRA based on potential consequences should an ignition occur at a specific utility asset location. This analysis includes elements such as potential egress constraints and Communities of Elevated Fire Concern (CEFC). The IWMS Risk Framework is anchored on wildfire consequence should an ignition occur and does not adjust consequences based on the probability of ignition. SCE takes this approach because probability of ignition changes over time due to many variables such as age, loading, etc. Furthermore, in some locations the consequences of an ignition that leads to a wildfire may be so extreme that it is prudent to mitigate ignition risk regardless of probability*."[134]

The classical definition of risk, particularly in terms of the CPUC S-MAP Settlement Agreement is[135]

Risk = Probability of Risk Event X Consequences of Risk Event

Under this definition, IWMS is not a risk framework at all, because it has no probability component. IWMS constitutes a dramatic rejection of the risk framework set up by the CPUC and agreed to by numerous stakeholders.

As justification, SCE cites a number of potential overriding concerns that merit specific SCE infrastructure in certain locations, which it terms an "SCE High Fire Risk Area (HFRA)" as being subject to IWMS and not the standard MARS framework. Specifically:

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[133] SCE WMP; p. 89.
[134] Id; p. 90.
[135] D.18-12-014; Appendix A; p. A-3. (Settlement Agreement)

- Egress issues, specifically constrained evacuation, high fire frequency, or the potential for burn-in of an egress route,
- Areas for which an ignition can result in a fire significantly larger than 10,000 acres,
- High wind areas,
- Areas where smaller fast-moving fires have a potential to impact communities under "benign" weather conditions (CEFCs or Communities of Elevated Fire Concern).[136]

HFRAs are divided into three risk tranches: Severe Risk Areas, High Consequence Areas, and Other HFRA depending on the potential for large fires.[137] This process of classification is a manual process that SCE admits is "time consuming and labor intensive".[138] These tranches define SCE's preferred mitigation. For Severe Risk Areas, SCE proposes undergrounding when feasible, covered conductor plus REFCL when not. For High Consequence Areas, it proposes covered conductor plus REFCL. For other HFRA it proposes enhanced inspections and vegetation management.[139]

An outright rejection of risk-based decision-making framework and adoption of a subjective and ad-hoc consequence model should be reasons to be extremely wary of the IWMS approach. However, there are motivations and concerns raised by SCE that should be considered.

Acceptable Risk

As mentioned in Section 4.4, SCE is appealing to the philosophy that risk, particularly extreme risk, should be mitigated to the full extent possible. There is some philosophical and technical backing for such an approach with regard to tail risks. The ALARP (As Low As Reasonably Practicable) proposal from CPUC staff was a proposed framework for such an analysis that was well reasoned and was supported by MGRA.[140] The ALARP premise is that there is a societally acceptable level of risk, and conversely certain risks that are unacceptable and which

[136] Id.; pp. 101-103.
[137] Id.
[138] Id.; p. 113.
[139] Id; p. 205, and
DR Response 08_CalAdvocates-SCE-2023WMP-08 Q.08.
[140] A.15-05-002-5; COMMENTS OF THE MUSSEY GRADE ROAD ALLIANCE (MGRA) ON THE INTERVENOR SMAP WHITE PAPER; February 12, 2016.

should be mitigated – not necessarily to zero but to the level where the risk is again within the acceptable range.

Another factor is tail risk. As MGRA has repeatedly stated and shown in previous filings, wildfire sizes tend to follow a power law with an exponent with a slope of approximately -0.5, which causes the average to diverge as the sample becomes larger. This is true for all exponents of absolute value less than 1.0. Author Nassim Taleb writes of such distributions *"…there is no mean. We call it the Fuhgetaboudit. If you see something in that category, you go home and you don't talk about it*."[141] Moritz et. al.'s work and also Clauset, et. al.[142] suggest that there is a cutoff in maximum fire size, however, that would allow the average to converge. The physical basis for this limit is when the fire size becomes comparable with the scale of the physical landscape, i.e. almost everything available burns. Following this approach, PG&E and SDG&E have adopted a Type 2 Pareto distribution with a cutoff of 500,000 acres to calculate maximum risk.[143] SCE has resisted following this approach.

Another factor to be kept in mind is uncertainty: we don't know for a fact the maximum fire size cutoff and this very much influences the predicted maximum risk result. Taleb has the following perspective on this problem:

"… we do not realize the consequences of the rare event.

What is the implication here? Even if you agree with a given forecast you have to worry about the real possibility of significant divergence from it… I would go even further and, …state that it is the lower bound of estimates (i.e. the worst case) that matters when engaging in a policy — the worst case is far more consequential than the forecast itself. This is particularly true if the bad scenario is not acceptable."[144]

Does this justify SCE's approach? Possibly, under specific circumstances where it can show that risk is otherwise uncontrollable. But there are other considerations that need to be taken into account, particularly in SCE's case:

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[141] Taleb, N.N., 2020. Statistical Consequences of Fat Tails: Real World Preasymptotics, Epistemology, and Applications. STEM Academic Press. https://arxiv.org/abs/2001.10488; pp. 27-28.
[142] Clauset, A., Shalizi, C.R., Newman, M.E.J., 2009. Power-Law Distributions in Empirical Data. SIAM Rev. 51, 661–703. https://doi.org/10.1137/070710111
[143] MGRA SDG&E GRC Testimony; Appendices; DR Response MGRA-SDGE-004-3a.
[144] Taleb, Nassim Nicholas. The Black Swan - The Impact of the Highly Improbable. Second edition. New York: Random House, 2010; pp. 161-162.

- The decision of what constitutes *acceptable* risk is a ***societal*** decision, and not one that should be left to an interested party. This determination must be made by regulators, as proxies for the public, and not a utility acting in its own interest.
- SCE uses its IWMS Risk Framework, specifically its SRA designation, as a primary justification for its proposed greatly expanded undergrounding program. SCE and the other utilities make approximately 10% return on their capital investments, giving SCE incentive to make SRA designations.
- The risk of truly catastrophic fire is not solely from utility lines. In fact, as utilities argued for many years at the initiation of CPUC wildfire proceedings, utility ignitions represent a small fraction of ignitions, though a significant fraction of losses. If the goal is to protect the public from catastrophic wildfire loss then other more holistic mitigation need to occur outside of the utility sphere.
- As shown in MGRA's 2022 WMP filing[145] and repeated in a subsequent section, the costs of the rate increases necessary for undergrounding are potentially so burdensome on the poorest segment of the population that it will impact their life expectancy, possibly even exceeding the harm from catastrophic wildfire.
- Mitigation portfolios not relying on undergrounding can achieve a similar level of risk reduction. ALARP does not require that risk be reduced to zero but rather that it be brought back into the acceptable range.

Nevertheless, SCE has some justifications for deciding that certain situations are poorly represented by its MARS framework. These need to be examined as well.

IWMS Classification Criteria

SCE claims that the following categories are insufficiently prioritized by the MARS model and so require special treatment through the IWMS Risk Framework:

Fire Risk Egress

[145] pp. 57-60.

SCE uses a number of criteria to determine whether an area is fire risk egress constrained, starting with identifying communities with limited road access. SCE superimposes a polygon grid on these areas and estimates how long it would take the population in a specific polygon to evacuate given the given roads available. It then calculates which areas within 25 miles of the egress constrained areas could have fires that could reach the egress constrained area before evacuation is complete. These are defined as "burn-in" areas and are given special priority.

As MGRA noted in Section 6.2.1.4, egress is an issue that is very important to us personally, as the Mussey Grade corridor is risk egress constrained area that firefighters in the early 2000's used to refer to as the "Tunnel of Death".[146] Through our kitchen window, we see the Muth Valley neighborhood on the hills east of the San Vicente reservoir, another egress-restricted area in which several people died during the 2003 Cedar fire.

Ideally, these considerations should be part of SCE's risk model itself, with "burn-in" situations leading to potential mass casualty events that would greatly increase consequences. For SCE to handle these risks as a special case is not transparent to regulators or the public. As MGRA stated in SCE's RAMP proceeding:

"*The additional factors that SCE lists: egress, burn history, extreme winds, PSPS, are important – but these should be part of SCE's risk model. To add them afterwards in an arbitrary and ad-hoc manner that lacks transparency prevents any effective evaluation of SCE's prioritization model by the Commission or intervenors*."[147]

Nevertheless, SCE should be recognized for being the first to put significant effort into a quantitative model to determine egress risks. Because the consequences of events affecting these areas is likely to be very high, regardless of which framework is used, these areas are likely to be high priority for significant mitigation. The assertion that this should be undergrounding as a default mitigation is not apparent, and will be discussed in subsequent sections.

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[146] A.06-08-010; MUSSEY GRADE ROAD ALLIANCE AMENDMENT TO NOTICE OF INTENT TO CLAIM INTERVENOR COMPENSATION; January 8, 2007; p. 2.
[147] MGRA SCE RAMP Comments; p. 14, quoting:
MGRA Informal Comments; pp. 14-15.

High Winds

MGRA has been stating for years that utility risk models do not adequately account for high wind areas, which are particularly dangerous because of the coupled increase in outage frequency and fire spread potential. Rather than try to incorporate winds into its risk model as an adjustment, as SDG&E does (Section 6.2.1.2), or adequately incorporating conditional coupling of drivers and consequence, as MGRA has urged, SCE uses high wind as an overriding consideration to classify an area as SRA and prioritize undergrounding for its mitigation. SCE's high wind classification, additionally, is not that high: sustained winds of 40 mph and wind gusts above 58 mph.[148] This would lead to broad swathes of SCE's territory being subject to undergrounding when other mitigations could be used. SCE explains that "*Even if fully covered, these isolated conductor segments would likely experience some level of PSPS de-energization*."[149] However, as will be shown in Section 9, PSPS impacts reduce rapidly as thresholds are increased, and it is not clear that SCE's 58 mph threshold is necessary, particularly if technologies such as REFCL complement covered conductor.

High Consequence

SCE has recognized that the fire sizes generated by 8 hour Technosylva calculations are not adequate to simulate catastrophic wildfire losses. SCE presents the following graphic demonstrating that for historical fires, an eight hour fire spread is correlated with but much smaller than the final wildfire size:

[148] SCE WMP; p. 108.
[149] Id.

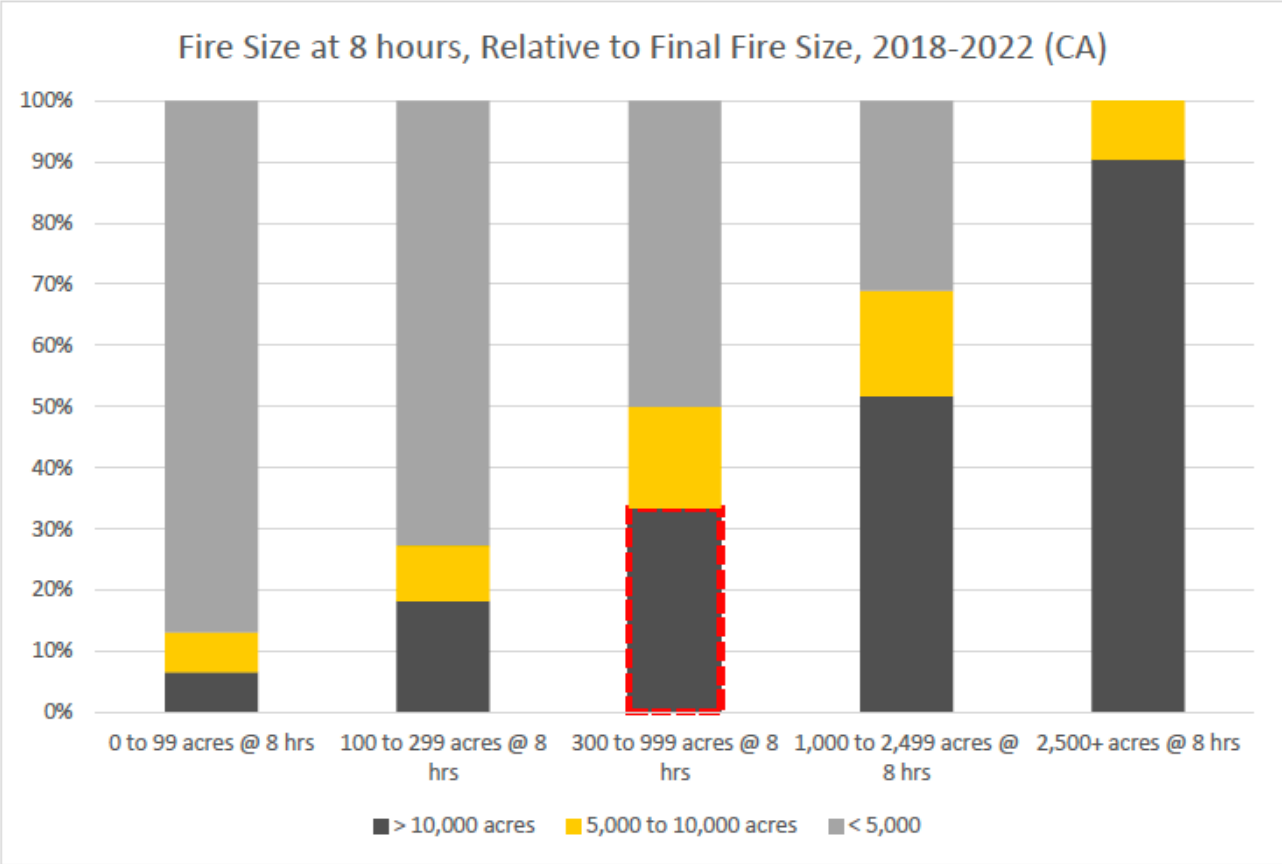

Figure 19 - Figure SCE 6-12 - Fire Size at 8 Hours Relative to Final Fire Size.[150]

Rather than incorporate this information as a binary classification criterion in its IWMS framework, SCE should work instead to generate correct consequences from its MARS framework. For instance, the distribution of the data in the graph above could be fit to power law distribution and used in a Monte Carlo to generate final consequences given the Technosylva 8 hour fire size as input.

Mitigation

Mitigation will be discussed in Sections 7 and 8. However for the sake of SCE's risk model and its justification for using IWMS rather than MARS for portions of its service area, SCE's assertions regarding appropriate mitigation should be closely scrutinized. While undergrounding is unquestionably the most complete wildfire mitigation, it takes much longer to apply. SCE plans to underground only a modest 100 miles of conductor through 2025.[151] The full output of its proposed

[150] SCE WMP; p. 111.
[151] SCE WMP; p. 6.

"Targeted Undergrounding" plan – 580 miles – will not be implemented until 2025-2028.[152] Meanwhile SCE has committed to deploying 2,850 miles of covered conductor by 2025.[153] If residents are at risk are not currently captured in SCE's MARS, the best option is to provide covered conductor protection as soon as possible, supplementing with REFCL when available, rather than make residents at risk wait until SCE can underground their circuits.

Recommendations:

- SCE should be required to integrate its IWMS Risk Framework into its MARS or other subsequent risk modeling in order to make its decisions quantitative and transparent.
- Energy Safety should make clear that determination of "acceptable" risk is a matter for the public, and not utilities to determine.
- SCE should be recognized for being the first utility to apply a quantitative egress model to its mitigation decisions and prioritization. Other utilities should be required to implement egress models similar to SCE's or demonstrably superior prior to the next WMP update.
- SCE's egress model should be validated by 3rd party review.
- SCE's high consequence classification should be incorporated into its MARS model and not used as a binary classifier in its IWMS model. It should utilize the known relationship between final fire size and Technosylva 8 hour burn size to generate a realistic consequence model.
- To the extent that IWMS is used to compensate for shortcomings of the MARS risk model, SCE should not assume that undergrounding is automatically the best mitigation for circuits prioritized through IWMS.

6.3. Risk Scenarios

6.3.1. Wind Load Condition 3 / 4 (Extreme, Worst Case)

OEIS was correct to include scenarios for worst case events, since the worst damage that has occurred historically has always been from unprecedented events. Nevertheless, SCE refuses to analyze these scenarios:

[152] SCE WMP; p. 110.
[153] Op. Cite.

SCE does not utilize Wind Loading Condition 3 because the composite wind loading map for peak wind speeds developed following the 2011 San Gabriel Windstorms represent reasonable weather scenarios for the design, construction, and maintenance of SCE's equipment, as prescribed by GO 95. SCE currently does not see the utility of the WL3 scenario and thus SCE does not anticipate developing or utilizing this design scenario

SCE does not utilize Wind Loading Condition 4 because the composite wind loading map for peak wind speeds developed in 2011 already represents credible weather scenarios as prescribed by GO 95. Because of this, SCE does not anticipate utilizing this design scenario.[154]

It should not be acceptable for a utility to simply ignore the guidance provided by a regulator. SCE's WMP should not be accepted unless this issue is remedied.

SDG&E, on the other hand, states that the extreme wind scenarios are not yet included in its WiNGS-Planning model but it plans to bring them in within the next few years.[155]

PG&E also sidesteps the requirements of Wind Loading Conditions 3 and 4. It says that locally relevant wind gusts are addressed, and refers the reader to Appendix B.[156] What PG&E actually addresses in Appendix B is its Remediation ACI PG&E-22-31 – PSPS Wind Threshold Change Evaluations, in which it describes dynamic wind loading simulations it is performing on a number of its components. PG&E does not say how what scenarios it intends to meet.

Repeating OEIS's Guideline:

Fundamental to any risk assessment is the selection of one or more relevant design basis scenarios (design scenarios). These scenarios will inform long-term mitigation initiatives and planning. In this section, the electrical corporation must identify the design scenarios it has prioritized from a comprehensive set of possible scenarios. The scenarios identified must be based on the unique wildfire and PSPS risk characteristics of the electrical corporation's service territory and achieve the primary goal and stated plan objectives of its WMP. At a minimum, the following

[154] SCE WMP; p. 153.
[155] SDG&E WMP; p. 72.
[156] PG&E WMP; p. 181.

design scenarios representing statistically relevant weather and vegetative conditions must be considered throughout the service territory.[157]

The IOU's neglect of Energy Safety guidelines in this section is particularly disturbing to us because of MGRA's history with this particular question. In fact, among the first wildfire safety rule proposals that MGRA put forward in 2009 contained proposed "contingency plans" for utilities.[158] Specifically MGRA suggested that "*Electric utilities shall have in place contingency plans for identifying foreseeable hazard conditions that exceed wind loadings of Rule 43 in Extreme and Very High Fire Threat Zones during periods of high fire danger*."[159]

As the rulemaking wore on, this requirement evolved into the more general requirement of a "Fire Protection Plan" (FPP), which had to be filed as per General Order 163. Years later after inadequate FPPs had been filed, further legislative action required utilities to produce Wildfire Mitigation Plans. So the question of what utilities are going to do about the potential for extreme conditions is in a sense the core question asked at the origin of the WMPs.

Even back in 2009, the answer to the problem of extreme events was apparent:

"*Fortunately, physical infrastructure hardening may not be necessary to meet this requirement – it could be that operational countermeasures (such as turning off the power) could effectively prevent the catastrophic scenario in which fires are started when winds greatly exceed design limits. It should be emphasized that operational countermeasures are no panacea and can cause physical and financial harm to residents and customers, and must only be used when much greater harm from power line fires would be the likely consequence if they are not*."[160]

Even if the utilities' most ambitious undergrounding plans roll forward, these are not going to cover the entire utility service area, nor will they cover secondary conductors. There will still be a substantial above-ground infrastructure exposed, and in the event of a worst feasible case event it should be assumed that the geographic extent of the event will extend beyond the normal boundaries of hardened areas and expose additional infrastructure.

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[157] Technical Guidelines; pp. 45-46.
[158] R.08-11-005; MUSSEY GRADE ROAD ALLIANCE PROPOSED PHASE 2 RULES; December 16, 2009; pp. 17-22.
[159] Id; p. 18.
[160] Id; p. 17.

The only manner in which a worst-case event can be safely addressed is through power shutoff. And because it would be an intense event, it should be assumed it would be extensive in geographical reach and also long in duration. Therefore, MGRA recommends that Energy Safety reframe these questions to ensure that it is not just the physical design that is being addressed for these scenarios but the operational processes that will go into place if such an event were to occur. Specifically, how are the IOUs equipped to help customers endure an unusually long period of power shutoff under fire weather conditions? What other government agencies would need to be pulled in to help cope with such a disaster? This type of planning needs to be on the shelf and run through table-top exercises to ensure that if and when extreme and near-worst case events arise the utilities, the public, and the government are sufficiently prepared.

Recommendations:

- Energy safety should require that all utilities provide reasonable answers for all extreme weather scenarios as a condition for WMP approval.
- Energy Safety should clarify the extreme wind loading condition plan to clarify that it is not only asking about physical design requirements but also operational processes, particularly in the case of extended and extensive power shutoff.

7. WILDFIRE MITIGATION STRATEGY DEVELOPMENT

7.1. Risk Evaluation

7.1.1. Hardening programs and their impact on the public

MGRA provided an analysis in its 2022 WMP comments that remains so far unchallenged after being presented in the PG&E GRC. Portions of this analysis are quoted at length below. In this analysis MGRA stated:

"While matters of affordability are in the CPUC domain, effects on the economic state of the population can also be expected to have significant impacts on their health and safety.

The following model for how a rate hike might impact the public health is put forward as an example for consideration by OEIS and stakeholders. Full disclaimer: I am not a public health scientist, economist, or sociologist. Therefore, no scientific or economic conclusions should be drawn for this example and it should be assumed that it can be subject to a wide range of valid criticisms. Nevertheless it makes a point.

It is widely accepted that income has an impact on public health. This can be observed in the following relationship between income and life expectancy in the US:

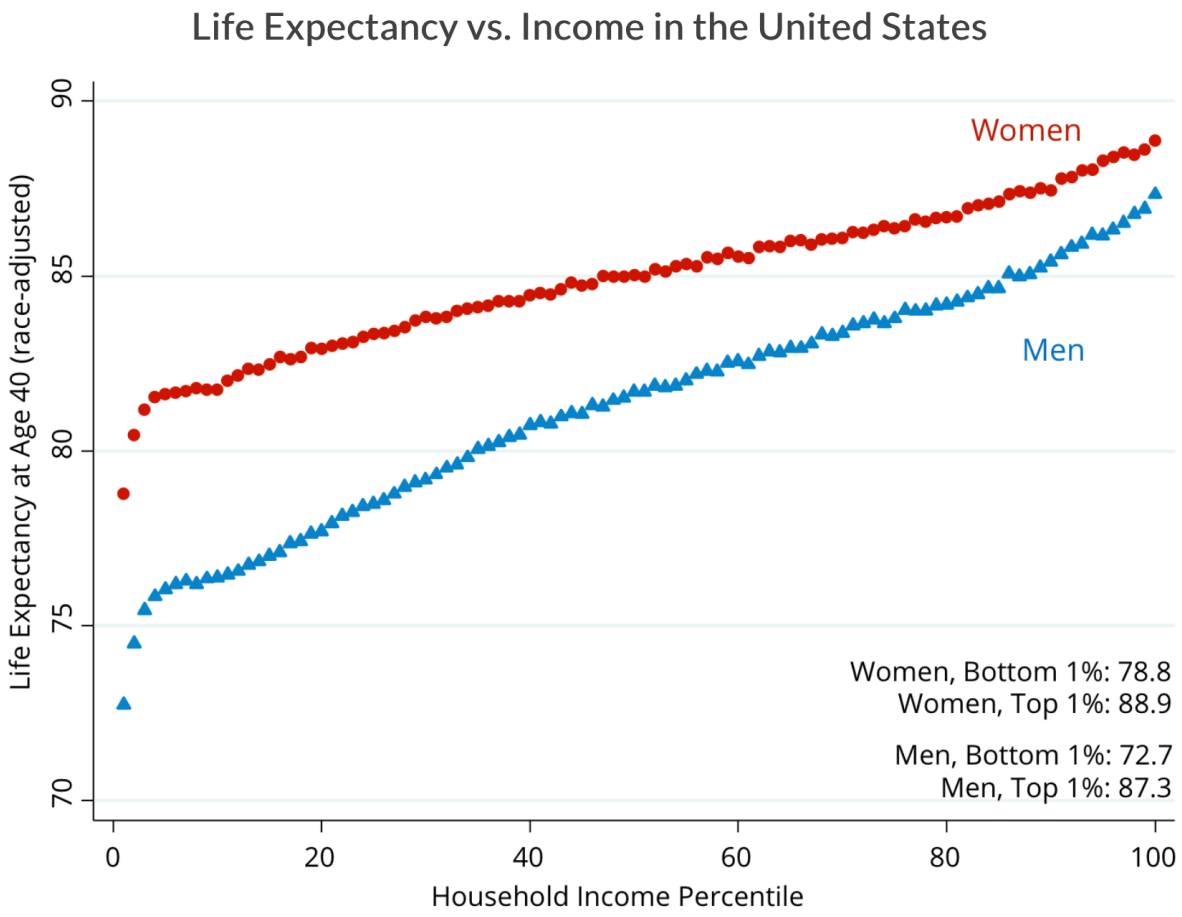

Figure 20 - Life expectancy versus household income in the US. Data from the Equality of Opportunity Project.[161]

[161] http://www.equality-of-opportunity.org/health/ and https://opportunityinsights.org/ citing
The Association Between Income and Life Expectancy in the United States, 2001-2014 | Health Disparities | JAMA | JAMA Network [WWW Document], n.d. URL https://jamanetwork.com/journals/jama/fullarticle/2513561?guestAccessKey=4023ce75-d0fb-44de-bb6c-8a10a30a6173 (accessed 4.6.22).

In California, the 20% quintile is equivalent to a household income of approximately $25,000 and a 40% quintile is equivalent to a household income of approximately $50,000.[162] *For men (chosen for this example due to greater sensitivity of life expectancy to income), there is approximately a three year life expectancy difference between the 20% quintile and the 40% quintile. Hence, in this income range, a difference of around $8000 a year is equivalent of an extra year of life expectancy.*

If this is the case, then a $300 per year permanent increase in utility rates would cause a $300 decrease in income. This would be correlated with a $300/$8000 or .038 year decrease in life expectancy for this portion of the population. If the poorest 10 million Californians were affected by this change, the number of equivalent years of life lost would be 380,000, or the equivalent of over 5,000 75-year lifespans."

It should be noted that since this analysis was done, some of activities have been undertaken by the Commission to control rate impacts on the lowest income customers. However, it is unclear at this time to what degree these will shield low-income ratepayers from the significant increases necessary to fund the massive rate increases required for extensive undergrounding programs.

7.2. Wildfire Mitigation Strategy

7.2.1. Utilities have adopted a default undergrounding strategy

In the time since the last WMPs were submitted, not only PG&E but now all three major IOUs have adopted undergrounding as their primary risk mitigation for high fire risk areas.

SCE has declared undergrounding or REFCL/CC++ as the default mitigation for its assorted "Severe Risk Areas".[163] However SCE explains that these choices are not equal: "*undergrounding is the preferred method to nearly eliminate risk in Severe Risk Areas. However, there are some locations that are not feasible to underground due to factors such as rocky terrain, etc. In those*

[162] https://statisticalatlas.com/state/California/Household-Income
[163] SCE WMP p. 203.

cases, SCE would instead consider other mitigation measures including covered conductor combined with other measures."[164]

PG&E likewise admits that "*we have shifted to using undergrounding as the preferred method of system hardening. This shift in strategy is contingent on the ramp-up of underground (UG) miles to drive lower unit costs, resource optimization, and longer-term contracts*."[165]

Note that this response was given to Energy Safety's 2022 ACI for PG&E:

"***ACI PG&E-22-34 – Revise Process of Prioritizing Wildfire Mitigations***

Description*:*

PG&E's current process of prioritizing wildfire mitigations assigns a high priority to undergrounding and does not demonstrate adequate weight to risk model outputs or RSE estimates."[166]

In other words, when called to task by OEIS for not taking risk model outputs or RSE estimates into account when prioritizing, PG&E simply ignores OEIS and states that it has decided that it is going to underground its infrastructure, without regard to RSEs.

Likewise, as discussed in Section 3.1.3, SDG&E has devised a "shell game" type of decision tree analysis that never evaluates undergrounding against other options unless undergrounding does not reach a minimum RSE (set by SDG&E based on its own determined risk target of 83%.[167]) or is unfeasible.

[164] Id.; p. 256.
[165] PG&E GRC; p. 967.
[166] Id.
[167] Id.; p. 48, citing SDG&E DR Response TURN-SEU15-5.

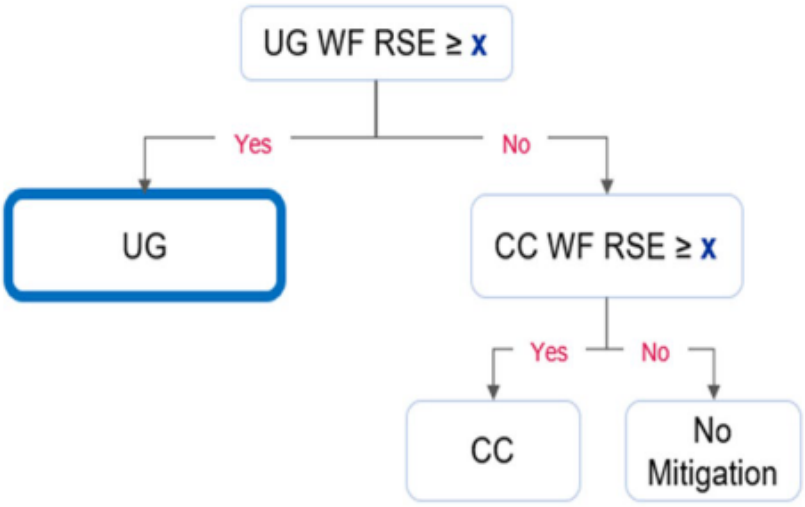

Figure 21 – Diagram of SDG&E's WiNGS Planning decision tree.[168]

By allocating all the riskiest circuits to UG, SDG&E reserves the lower-risk circuits for CC, thus ensuring that the remaining CC circuits have a poor RSE.

All three utilities have abandoned OEIS mandates to ensure cost effective mitigations. Energy Safety's 2023 Process Guidelines state that one of the WMP Evaluation criteria will be:

"***Resource use efficiency***: *The proposed initiatives are an efficient use of electrical corporation resources and focus on achieving the greatest risk reduction with the most efficient use of funds and workforce resources*."[169]

Minimal or no attempt has been made to validate the cost effectiveness of the undergrounding programs against other realistic portfolios of mitigation that can provide near equivalent protection. The requirement of cost-effective fire mitigation has been effectively abandoned.

[168] MGRA GRC Testimony; p. 47, citing SDG&E DR Response MGRA-3-13.
[169] OFFICE OF ENERGY INFRASTRUCTURE SAFETY; 2023-2025 WILDFIRE MITIGATION PLAN PROCESS AND EVALUATION GUIDELINES; December 6, 2022; p. 9. (Process Guidelines)

Recommendation:

- OEIS should not approve the 2023-2025 mitigation plans until and unless utilities create realistic mitigation portfolios in competition with undergrounding, since utilities have egregiously ignored OEIS guidance in this area provided in the 2022 WMP feedback and in the 2023 Process guidelines.

7.2.2. Utility undergrounding incentives

The utility motivation for such a sudden and dramatic about face is clear if one looks at recent history:

- Utilities have been held liable if their lines start wildfires and they have not been prudent.
- Utility wildfires cause reputational and financial damage to utilities.
- Utilities are under pressure from regulators and the public to reduce power shutoffs.
- Undergrounding is a capital project, so utilities gain approximately 10% on top of what it costs to underground.
- Utilities have conducted an effective public relations and political campaign to promote undergrounding as the solution to the wildfire problem.
- Undergrounding simplifies a number of other problems such as vegetation management and asset inspections.

From the utility perspective, it is foolish not to favor undergrounding, and we should not wonder that the WMPs and revenue requests are undergrounding-centric. However, undergrounding is not free, it is not fast, and the rate increases are so extreme that as shown in Section 7.1.1, they may well be killing people. It is therefore up to the regulators at the OEIS and CPUC to ensure that undergrounding requests are fully justified in terms of their costs, efficiencies, and risk reduction compared to other options. The utilities have no motivation to do an adequate comparison, and in fact their comparisons can be incomplete and even deceptive.

Recommendation:

- Energy Safety should maintain its 2022 position throughout this review and the upcoming SB884 undergrounding plan reviews and ensure that all comparisons of undergrounding to other mitigations are rigorous and unbiased.

- When comparing alternatives, time to implement the alternative and its impact on the residual risk of those waiting for mitigation should also be taken into account.
- Energy Safety should specify or define a process for developing a target level of risk or risk reduction that utility mitigation programs as a whole should achieve. Energy Safety should make clear that it is not the utilities' role to define "acceptable" risk.

8. WILDFIRE MITIGATIONS

8.1. Grid Design, Operations, and Maintenance

8.1.1. Undergrounding

Undergrounding has undergone a remarkable resurgence over the last year, moving from a "special case" mitigation which was used in specific circumstances to a "go-to" mitigation. The preference of the Commission was clear in 2019, when it wrote that: "*In future WMPs, PG&E should provide more information on the efficacy and cost-effectiveness of its proposed system hardening activities, along with more information on the costs and benefits of alternative options. This detail may strengthen PG&E's plan by allowing the Commission and parties to evaluate the relative merits of different potential activities*."[170]

This changed in 2021, when Pacific Gas and Electric Company (PG&E) suddenly introduced a major modification to its GRC in the aftermath of the Dixie fire, drastically expanding its undergrounding program to a ten year, 10,000 mile project. At the pre-hearing conference for PG&E's GRC, MGRA stated that "*Undergrounding is the most expensive mitigation strategy per mile, and the declaration of the solution without examination of the alternative[s] effectively negates seven years of effort at the Commission to formulate methods for risk-based decision-making. If PG&E succeeds in implementing its undergrounding plan, it must be anticipated that other 1 utilities around the state will adopt similar strategies. Even if PG&E's plan fails or is rejected, it will have a chilling effect on other wildfire mitigation efforts*."[171]

[170] D.18-07-037; p. 18.
[171] PG&E GRC Testimony MGRA-01; p. 4.

MGRA's 2021 prediction turned out to be correct in all details. SDG&E, for instance, drastically expanded its undergrounding proposal. Its initial GRC proposed spending $435 million on its covered conductor program between 2022 and 2024, and $955 million on its strategic undergrounding program during the same period, spending approximately double the amount on undergrounding as covered conductor.[172] In its revised testimony, released several months later, SDG&E scaled back its proposed hardening program, requesting $207 million for covered conductor and $609 million for undergrounding, a balance of nearly 3:1 in favor of undergrounding and hardening less of its infrastructure.[173] SDG&E further projects spending $1.7 billion on wildfire mitigation capital projects between 2025 and 2027, primarily on undergrounding.[174]

Even SCE, which made a huge commitment to deploying covered conductor, and has set a very modest target of 100 miles of undergrounding for the 2023-2025 period.[175] However, it seems that the attractions of the underground gravy train were irresistible. It has reserved 580 overhead circuit miles in "Severe Risk Areas" for 580 miles of "targeted" undergrounding in the 2025-2028 time frame.[176] What this plan leaves unsaid is that SCE will leave residents living near those 580 circuit miles designated as "Severe Risk Areas" at risk until it is able to deploy its undergrounding plan, rather than apply its demonstrably effective covered conductor program in conjunction with technological solutions to protect these areas on a much shorter timeframe. So we see here clearly the "killing off" of more immediate mitigations in favor of future undergrounding.

Recommendations:

- Energy Safety should reiterate its guidance that any significant undergrounding program must be justified by demonstrating that there are no more cost-effective mitigations that meet a regulator-defined level of safety.

8.1.2. Covered Conductor

[172] A.22-05-016; Exh. SDG&E-13; PREPARED DIRECT TESTIMONY OF JONATHAN T. WOLDEMARIAM (WILDFIRE MITIGATION AND VEGETATION MANAGEMENT); May 2022; Table JW-39; p. JTW-106.
[173] A.22-05-016; Exh. SDG&E-13-2R; SECOND REVISED PREPARED DIRECT TESTIMONY OF JONATHAN T. WOLDEMARIAM (WILDFIRE MITIGATION AND VEGETATION MANAGEMENT); October 2022; Table JW-39; pp. JTW-106-7
[174] Id.; Table JW-74; p. JTW-170.
[175] SCE WMP; p. 6.
[176] SCE WMP; p. 752.

There have been two major developments in the realm of covered conductor since the 2022 WMPs. First, the utilities have completed additional in-house testing and their second Exponent review of the technology. These analyses comprised many experimental tests that demonstrate the strengths and weaknesses of covered conductor. For scenarios such as phase-to-phase contact under test conditions, CCs are up to 100% effective in preventing ignition.[177] For contact from object, current flow was ordinarily reduced to less than 2.5 mA, showing that CC is extremely effective from preventing ignition from contact from object when the covering is intact.[178] After reanalysis of Joint IOU testing results and Exponent's report, SCE increased its estimated mitigation effectiveness for CC from 67% to 72%.[179]

The other major development is the continuing, active and successful deployment of covered conductor in the SCE service area. SCE claims to now have 2,900 miles hardened in its service area, and it plans to deploy an additional 1,250 miles of covered conductor before 2028.[180] The amount of covered conductor in the field allows direct comparisons to be made against bare wire and covered conductor performance and conclusions to be reached about effectiveness.

As shown in the figure below, SCE plots its faults per mile as a function of covered conductor coverage:

[177] SDG&E WMP; AttB-3.
[178] Id.; AttB-4.
[179] Id.; AttB-29.
[180] SCE WMP; p. 752.

Figure 1: SCE Faults Per Mile-Day as a Function of Covered Conductor

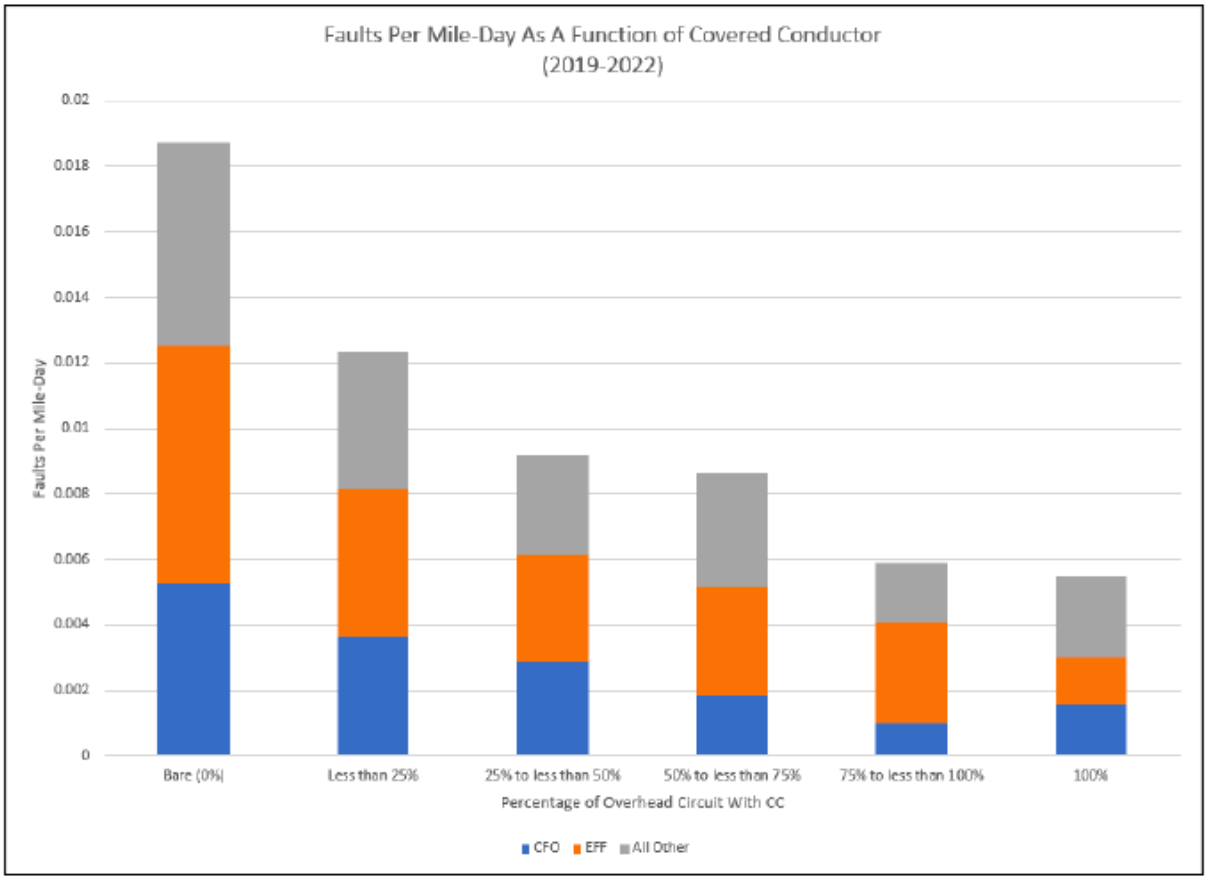

Figure 22 - SCE Faults per mile, 2019-2022.[181]

MGRA requested wires down and ignition data from SCE from its bare and covered conductor segments. This is presented in the table below:

[181] SDGE WMP; AttB-10.

	HFRA & Non-HFRA Events							
	Year End 2019	Year End 2020	Year End 2021	Year End 2022	2023 as of April 25, 2023	Totals	70% Eff	Reduction
a) Number of miles of fully covered conductor HFRA Circuits	0	366	429	728	810			
b) Number of miles of fully "bare wire" HFRA Circuits	8,973	6,092	4,135	2,534	2,291			
c) Number of wires down for fully covered conductor HFRA Circuits in the HFRA and Non-HFRA	N/A	0	0	5	11	16		
d) Number of wires down for fully "bare wire" HFRA Circuits in the HFRA and Non-HFRA	340	199	146	80	46	811		
e) Number reportable ignitions for fully covered conductor HFRA Circuits in the HFRA and Non-HFRA	N/A	0	0	1	0	1		
f) Number reportable ignitions for fully "bare wire" HFRA Circuits in the HFRA and Non-HFRA	58	44	28	16	1	147		
Yearly rate per mile for BW WD	0.03789	0.03267	0.03531	0.03157	0.04819	0.03712		
Yearly rate per mile for BW Ignitions	0.00646	0.00722	0.00677	0.00631	0.00105	0.00556		
Yearly rate per mile for CC WD		0.00000	0.00000	0.00687	0.03259	0.00987		
Yearly rate per mile for CC Ignitions		0.00000	0.00000	0.00137	0.00000	0.00034		
Expected CC WD	0.00000	11.95568	15.14728	22.98343	39.03274	89.11912	26.73574	82.05%
Expected CC Ignitions	0.00000	2.64347	2.90496	4.59669	0.84854	10.99365	3.29809	90.90%
Note 1: Miles provided in for a) and b) include non-HFRA miles								
			Events	95% CL (1 tail)	1 sigma	WD 95% CL		
			0	2.995732274	1.139434283	56.3%		

Table 6 - Comparison of wires down and ignitions for SCE segments that are completely covered conductor and completely bare.[182]

Some differences can be seen from the equivalent comparison that MGRA performed in 2022.[183] In the first 2 1/2 years of covered conductor deployment, there had been no ignitions at all from SCE's covered conductor and only 3 wires down incidents until the end of 2022. Then, at the end of 2022 and into early 2023, there were a number of incidents – one ignition and 13 additional wires down. SCE explains in a data request response that this surge of outages was due to the unusually rainy and snowy winter of 2022-2023, with the wires down due to trees toppling into lines due to wind, heavy snow loading, and eroded soil.[184] SCE explained that its overall number of wires-down increased 50% over normal during this period.

Based on last year's results, MGRA was able to place a 95% confidence level limit on the reduction of wires down at least 78.8%. If the 2022-2023 increase in wired down events is included, this result relaxes to 56.3%. This is an overly conservative estimate for wildfire reduction, since the 2022-2023 conditions were winter storm conditions and not conducive to wildfire. Even taking the winter storm events into account, however, the average reduction in wires down is 80% over bare wire and the average reduction in ignition is 90%.

[182] Workpaper 04_MGRA-SCE-002 Q4_CCFires-jwm.xlsx
[183] MGRA 2022 WMP Comments; pp. 70-72. MGRA SCE RAMP Comments; pp. 6-7.
[184] DR Response MGRA-SCE-003-04.

MGRA also requested SCE outage data from 2022, broken into categories of fully covered, partially covered, and bare overhead segments in order to determine how outage cause varies with covered versus bare conductor. This is shown in the table below:

Outage Cause	All outages	Completely Bare Wire		Completely Covered Wire		Partially Covered Wire	
		Count	Percent of Total	Count	Percent of Total	Count	Percent of Total
3rd Party	1,635	1,233	14.7%	8	6.7%	394	10.2%
Animal	571	413	4.9%	4	3.4%	154	4.0%
Equipment	6,744	4,399	52.4%	74	62.2%	2,271	58.9%
Operation	7	4	0.0%	-	0.0%	3	0.1%
Other	2,463	1,723	20.5%	21	17.6%	719	18.6%
Vegetation	33	14	0.2%	1	0.8%	18	0.5%
Weather	912	604	7.2%	11	9.2%	297	7.7%
Total	12,365	8,390	100.0%	119	100.0%	3,856	100.0%
Total/Mile		**2.52**		**0.21**			
	Bare 100% 2021	4,135		CC 100% 2021	429		
	Bare 100% 2022	2,534		CC 100% 2022	728		
	Bare Mean	**3,335**		**CC Mean**	**579**		

Table 7 - SCE outage statistics for 2022 based on cause for 100% bare, 100% covered, and partially covered overhead conductor. Mileage is obtained from Table 6. To get total outages per mile the mean of the 2021 and 2022 mileage values were used.[185]

As seen in Table 7, there do not seem to be extreme differences in outage causes between covered conductor and bare conductor. The largest difference is that equipment-related outages make up 52% of outages for completely bare wire segments and 62% for completely covered segments. Noteworthy, though, is that the total outages per mile appear to be reduced over 90% for completely covered segments versus bare wire segments, a larger fraction than was observed in earlier SCE data, such as in Figure 22.

[185] Workpapers; 01_MGRA-SCE-005- 01 FINAL OUTPUT v3 – jwm.xlsx

Pacific Gas and Electric Company, with its much smaller deployment of covered conductor (386 miles as of the end of 2022), sees an outage rate reduction in line with that observed by Edison:

Table 4: PG&E Recorded Effectiveness Snapshots

Snapshot	Category of OH HFTD circuit segments (downstream of SSDs)	Total CC miles in this category	Total OH HFTD miles in this category	% CC'ed	Average yearly HFTD outages	Outage / Total OH HFTD miles / year	Improvement compared to Category 1
1: CC miles % of total OH miles by the end of 2019	**Outages considered: 2020-2022**						
	Category 1: not covered at all	0	24,849	0%	9339.7	0.38	-
	Category 2: 1-80% (partial)	27	242	11%	53.7	0.22	**41%**
	Category 3: 80%+ (mostly)	36	38	95%	4.3	0.11	**69%**
2: CC miles % of total OH miles by the end of 2020	**Outages considered: 2021-2022**						
	Category 1: not covered at all	0	24,950	0%	9544	0.38	-
	Category 2: 1-80% (partial)	122	640	19%	157.5	0.25	**36%**
	Category 3: 80%+ (mostly)	178	185	96%	19.5	0.11	**72%**
3: CC miles % of total OH miles by the end of 2021	**Outages considered: 2022**						
	Category 1: not covered at all	0	24,942	0%	5978	0.24	-
	Category 2: 1-80% (partial)	148	877	17%	151	0.17	**28%**
	Category 3: 80%+ (mostly)	238	248	96%	18	0.07	**70%**

Table 8 - PG&E reported effectiveness of covered conductor in reducing outages.[186]

PG&E reports a reduction in outages of approximately 70% for circuit segments with more than 80% covered conductor deployed. Even with the smaller scale of PG&E's deployment, PG&E still reported one wire down incident and two ignitions.[187] All of these incidents shared the same cause: a large tree falls into a covered conductor and severs it, breaking the sheath and exposing the bare conductors, which come into contact with vegetation on the ground ignite a fire. This is also consistent with Exponent experimental results simulating wire downs.[188]

Because covered conductor is not completely effective in preventing ignition in the event of large tree strike, SCE performed an evaluation of the combination of covered conductor with other independent mitigations such as asset inspections, its Hazard Tree program, expanded brushing, and expanded line clearing.

Its results were presented in the Joint Covered Conductor Report, Table 6:

[186] SDG&E WMP; p. AttB-11.
[187] Id; pp. AttB-12-13.
[188] Id; p. AttB-5.

Table 6: SCE Independent Mitigation Effectiveness Values

Risk Driver Description	WCCP	Distr Ground Asset Inspections	VM - Hazard Tree	VM - Expanded Pole Brushing	VM - Expanded Line Clearing
Animal contact- Distribution	65%	48%	0%	0%	0%
Balloon contact- Distribution	99%	0%	0%	0%	0%
Other contact from object - Distribution	77%	0%	0%	0%	0%
Unknown contact - Distribution	80%	0%	0%	0%	0%
Veg. contact- Distribution	71%	77%	64%	33%	36%
Vehicle contact- Distribution	82%	0%	0%	0%	0%
Capacitor bank damage or failure- Distribution	20%	87%	0%	20%	0%
Conductor damage or failure — Distribution	82%	80%	0%	7%	0%
Switch damage or failure- Distribution	2%	76%	0%	20%	0%
Transformer damage or failure - Distribution	20%	66%	0%	20%	0%

Table 9 - SCE's estimation for covered conductor effectiveness for different risk drivers, compared to its standard vegetation management initiatives.[189]

Particularly noteworthy is that the drivers most likely to be involved in wind-driven catastrophic fires, specifically vegetation and "other" contact, and conductor damage or failure, are estimated to be reduced by 77%-82% by covered conductor. This is substantially higher than the canonical 65% used by PG&E and SDG&E in their comparisons of covered conductor to undergrounding.

The above table, however, neglects to take into account the combined effectiveness of the mitigation. SCE provides another table where these effects are taken into account.

[189] SDG&E WMP; p. AttB-19.

Table 7: SCE Combined Mitigation Effectiveness Values

Risk Driver Description	Combined Effectiveness	Annual Fault Frequency in HFRA (2015-2020 Avg)	Fault-Weighted Combined Effectiveness	Annual Ignition Frequency in HFRA (2015-2020 Avg)	Ignition-Weighted Combined Effectiveness
Animal contact- Distribution	71%	644	6%	4.8	12%
Balloon contact- Distribution	99%	866	11%	5.0	17%
Other contact from object - Distribution	77%	420	4%	1.7	4%
Unknown contact - Distribution	80%	0	0%	0.0	0%
Veg. contact - Distribution	99%	469	6%	4.7	16%
Vehicle contact - Distribution	82%	550	6%	3.7	10%
Capacitor bank damage or failure- Distribution	92%	382	4%	0.2	1%
Conductor damage or failure - Distribution	85%	2,280	24%	8.3	24%
Switch damage or failure - Distribution	82%	58	1%	0.0	0%
Transformer damage or failure - Distribution	78%	2,334	23%	1.3	4%
Total Estimated Combined Effectiveness			84%		86%

Table 10 - SCE's calculated combined effectiveness for covered conductor plus its suite of other vegetation management specific mitigations.[190]

Based on this analysis SCE's estimated ability to reduce vegetation contacts is 99%, and its overall effectiveness in reducing ignitions would be 86%. This is much higher than the 65% used by utilities as a "consensus value" for covered conductor effectiveness, and much more in line with the observed performance of covered conductor in the field shown in Table 6.

Whatever residual risk is left of tree fall-in to covered conductor after standard mitigations, this can be drastically reduced by several mitigations that have high effectiveness in preventing wire down ignitions. These are:

- REFCL (SCE, possibly PG&E)
- Falling Conductor Protection (FCP, SDG&E)
- Downed Conductor Protection (SCE)
- High Impedance Fault Detection (All utilities)

All of these mitigations drastically reduce the energy released before the conductor is de-energized, and thereby reduce ignition potential. Deployed in combination with covered conductor they compensate for its weakness and produce a highly effective mitigation.

Recommendations:

[190] Id.; p. AttB-20.

- Utilities should not be permitted to use 65% effectiveness for covered conductor as a "straw man" comparison for undergrounding, but must include at the least standard mitigations such as those estimated by SCE to raise the value to 80-85% or higher.

8.1.3. Advanced Technologies (REFCL, APP, DCP, Others)

Utility engineers have been active over the past years developing a slew of technologies to address the wildfire threat. Many of these can lead a significant drop in wildfire risk. While none of them eliminates wildfire risk on its own, many of them are suited to complementary deployments with other mitigation techniques that drive wildfire risk to very low levels.

8.1.3.1. Rapid Earth Fault Current Limiter (REFCL)

REFCL is a highly effective fast-acting mitigation that reduces the energy released by a line-to-ground fault that has been under discussion and consideration by California utilities for several years. While PG&E was the first to pioneer a REFCL installation, its equipment underwent a catastrophic failure and PG&E is still weighing options on how to proceed. PG&E has concluded that "*implementing it would require significant and costly changes to the grid. Instead of making costly changes to the grid, we are moving forward with more cost-effective solutions such as DCD and Partial Voltage Detection*".[191]

OEIS noted in 2022 that: "*SDG&E is not moving forward with its REFCL pilot and does not provide a plan for exploring new technologies that could increase effectiveness against ignition or wildfire risk.*"[192] SDG&E provides a explanation as to why REFCL is not appropriate to its service area in a data request response MGRA in its RAMP case:

"*SDG&E studied the implementation of REFCL at one substation in the HFTD for feasibility analysis. The key challenges in implementing the technology include balancing line-to-ground capacitance across all three phases of distribution circuitry, developing new protection schemes to identify and isolate the faults, reconfiguring circuits to remove all phase-neutral*

[191] PG&E WMP; p. 276.
[192] SDGE WMP; p. D-16.

connected loads and equipment, and upgrading equipment to withstand the higher voltages that result from line-ground faults in the new configuration. The study showed that implementing REFCL at this substation would cost approximately $26.1 million and only provided coverage for three 12kV distribution circuits. These costs included:

1. $3.5 million in substation equipment

2. $11.4 million in overhead system upgrades a. Upgraded surge arrestors and transformers

3. $10.6 million in underground system upgrades a. Upgraded cable and transformers

4. $0.6 million for capacitor balancing units and other miscellaneous equipment

SDG&E's service territory contains approximately 135 distribution substations with 1,054 distribution circuits. The costs and effort required to install the substation equipment and re-configure the distribution circuits associated with implementing a REFCL program was deemed a less desirable approach than further developing SDG&E's existing and future protection technologies such as Falling Conductor Protection, Sensitive Ground Fault Protection, and Sensitive Profile Settings which are already deemed sufficient in identifying and isolating electrical equipment failures."[193] (emphasis added)

SDG&E has a valid reason for resisting REFCL – an effective REFCL system requires a three-wire circuit configuration,[194] while the majority of SDG&E's HFTD circuits are four wire.[195] SDG&E claims it has other technologies that suit the same purpose, and these will be discussed in the following section.

Only SCE has had significant success with its REFCL program, as described in its superbly written report "Rapid Earth Fault Current Limiter (REFCL) Projects at Southern California Edison."[196] SCE has successfully implemented REFCL through both a Ground Fault Neutralizer (GFN) in the Neenach substation and an Arc Suppression Coil (ASC) at the Arrowhead substation.[197] SCE compares REFCL protection to its Fast Curve settings, and shows that while Fast

[193] A.22-05-015/6; DR Response SDG&E Data Request MGRA-37.
[194] Data Request Response PG&E CalAdvocates_011-Q003d.
[195] Data Request Response A2205015_016 SDG&E MGRA-006b,c
[196] 2022-2025WMPs; TN 11964-6; Rapid Earth Fault Current Limiter (REFCL) Projects at Southern California Edison; 12/29/2022. (SCE REFCL Report) https://efiling.energysafety.ca.gov/eFiling/Getfile.aspx?fileid=53545&shareable=true
[197] Id; p. 4.

Curve reduces fault energy by a factor of 5, their REFCL GFN reduces fault energy by a factor of 1,000.[198] Projects are also underway at the Acton and Phelan substations.[199]

The speed of REFCL deployments has been limited by a number of factors:

- Supply chain issues. Originally manufactured in Australia, the North American supply chain is new and SCE is working with a number of new vendors.[200]
- There are a number of technologies that can be defined as REFCL, and there is no "plug and play" configuration or set of equipment that can be added the network without significant experimentation and fine tuning.[201]
- The installation and maintenance of REFCL is complex and requires significant knowledge, training, and experience. Developing a work team capable of effectively deploying and managing REFCL will take some time.[202]

Challenges were encountered during the first deployments of REFCL in Australia as well, and there were significant cost overruns.[203] However, according to a white paper written by Australian power line fire specialist tony Marxen, the REFCL system is performing overall better than expected, with overall ignitions down 70% versus an expected 50%.[204] PG&E also refers to a technical report on REFCL written by an Australian consulting group in 2020.[205] It notes that "*Our overall assessment is that the operational performance of the installed REFCLs is meeting expectations in relation to bushfire risk mitigation. In some instances, the installed REFCLs have*

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[198] Id.
[199] Data Request Response MGRA-SCE-004-02.
[200] Op. Cite; p. 5.
[201] Id; pp. 18-28.
[202] Id; p. 77.
[203] Carey, A., 2018. Power companies warned MPs fire safety plan would blow out by millions. The Age. https://www.theage.com.au/politics/victoria/power-companies-warned-mps-fire-safety-plan-would-blow-out-by-millions-20181002-p507dl.html
[204] Marxen, T., 2019. How do Victoria's REFCLs deliver more fire-risk reduction than simple theory and experience elsewhere say they should? | LinkedIn [WWW Document]. URL https://www.linkedin.com/pulse/how-do-victorias-refcls-deliver-more-fire-risk-than-simple-marxsen%3FtrackingId=YoM4zpCp9cG1uYmCn5Lkcg%253D%253D/?trackingId=YoM4zpCp9cG1uYmCn5Lkcg%3D%3D (accessed 5.16.23).
[205] PG&E Data Request Response WMP-Discovery2023_DR_CalAdvocates_011-Q008g.
REFCL Functional Performance Review; Report for Energy Safe Victoria; PSC Reference: JA8648-0-0 REFCL Functional Performance Report.
https://www.esv.vic.gov.au/sites/default/files/2022-12/REFCL-Functional-Performance-Review.pdf

exceeded these expectations by responding to more complex faults and reducing bushfire risk. Each distributor has identified specific cases where a fire start is likely to have been prevented as a result of REFCL operation."[206] While noting that REFCL has had some reliability issues and ran into supply difficulties, it was effective at preventing ignitions. Australian companies AusNet and Powercor recorded 47 REFCL operations during high fire days with no ignitions, while Powercorp's REFCL detected 67 faults on high fire days with no ignitions. There was one small fire during on a non-fire day.[207]

Nevertheless, it is important to remember that REFCL is designed to mitigate phase-to-ground faults, and does not adequately mitigate phase-to-phase faults. This is why SCE's evaluation of REFCL mitigation appears so lackluster, with SCE SMEs estimating only a 50% effectiveness for drivers such as vegetation contact, object contact, balloon contact, and many types of equipment failure.[208] SCE concurs with Australian results that REFCL is 90% effective in mitigating phase to ground faults, but many of its faults are phase to phase, and SCE's lower values for REFCL effectiveness take this into account.[209] However, even for single phase distribution contacts, the SCE SME takes a more "conservative" approach. For example, for splice and/or conductor damage and failure, the estimate of 50% efficiency is given as:

"*Estimating 90% effectiveness for single phase down wire incidents. However, based on expert judgment, there is potential for the initial failure to result in dropped incandescent particles*."[210]

This justification makes little sense, because "incandescent particles" also fall from broken utility lines in Australia, where REFCL testing and validation was performed. It is likely that the SCE SME is double-counting the risk from falling incandescent particles which would already be in the REFCL benchmark estimates. Why would SCE SMEs have a tendency to come up with lower estimates than those accepted by Australian experts? A possible answer is provided in SCE's explanation of the estimation process:

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[206] Id; p. 4.
[207] Id; p. 28.
[208] SCE WMP; pp. 825-826.
[209] Data Request Response MGRA-SCE-003-01.
[210] Id.

"*SCE expert judgement, which typically involves multiple experts, is based on data and knowledge collected through benchmarking, testing, evaluation of risk in the field, calibration across mitigations, and other sources to determine reasonable mitigation effectiveness. Mitigation effectiveness percentages are also evaluated in a series of* ***robust challenge sessions*** *with internal experts* ***and management*** *to help ensure accuracy and reasonableness.*"[211] (Emphasis added)

So it would appear that if an SME comes up with a number that appears "unreasonable" to their management, they may be "robustly challenged" to come up with a number more akin to management's definition of "reasonable". And as shown in Section 7.2.1, the management of all three major utilities have expressed a preference for undergrounding as their primary mitigation option.

Multi-phase faults are adequately mitigated by covered conductor. In fact, in the combination of REFCL and covered conductor, each compensates for the weakness in the other, resulting in very high effectiveness for many fault drivers. Stakeholders have been trying to get estimates of the combined effectiveness of covered conductor and REFCL from utilities for some time, and with Data Request response MGRA-SCE-003-02, the SCE subject matter experts have now provided one. Based on the SME estimates for REFCL alone, the following should be regarded as a lower bound for effectiveness:

Driver Type	Subdriver Type	CC/REFCL ME
D-CFO	Veg. contact- Distribution	85%
D-CFO	Animal contact- Distribution	96%
D-CFO	Balloon contact- Distribution	99%
D-CFO	Vehicle contact- Distribution	85%
D-CFO	Unknown contact - Distribution	90%
D-UNK	Unknown - Distribution	82%
D-CFO	Other contact from object - Distribution	88%
D-WTW	Wire-to-wire contact / contamination- Distribution	99%
D-EFF	Anchor / guy damage or failure - Distribution	70%

[211] SCE WMP; p. 797.

D-EFF	Conductor damage or failure — Distribution	95%
D-EFF	Connection device damage or failure - Distribution	95%
D-EFF	Connector damage or failure- Distribution	95%
D-EFF	Crossarm damage or failure - Distribution	65%
D-EFF	Fuse damage or failure - Distribution	31%
D-EFF	Insulator and brushing damage or failure - Distribution	95%
D-EFF	Lightning arrestor damage or failure- Distribution	50%
D-EFF	Other - Distribution	57%
D-EFF	Pole damage or failure - Distribution	40%
D-EFF	Recloser damage or failure - Distribution	9%
D-EFF	Splice damage or failure — Distribution	95%
D-EFF	Tie wire damage or failure - Distribution	50%
D-EFF	Voltage regulator / booster damage or failure - Distribution	50%
D-CTM	Contamination - Distribution	30%
D-EFF	Capacitor bank damage or failure- Distribution	1%
D-EFF	Switch damage or failure- Distribution	2%
D-EFF	Transformer damage or failure - Distribution	88%
D-EFF	Tap damage or failure - Distribution	50%
D-EFF	Sectionalizer damage or failure - Distribution	70%
D-OTH	All Other- Distribution	50%
D-UTW	Utility work / Operation - Distribution	25%
D-VAN	Vandalism / Theft - Distribution	1%

Table 11 - SCE SME estimates for the combined effectiveness of covered conductor and REFCL.[212]

It is important to note that some ignition drivers are more important than others when discussing catastrophic utility wildfires. While fuse failure is a very common form of outage, for instance, it very rarely leads to major wildfires. Other drivers that can lead to wildfire ignitions, such as collisions or animals, are relatively less likely to be an ignition source on a severe fire weather day. The main sources of catastrophic wildfire ignition during fire weather are object (particularly vegetation) contact, equipment failure, and wire-to-wire contact. While wire-to-wire contact ignition risk is estimated to be negligible with covered conductor, the SME estimates still leave 15% chance for ignition for vegetation contact (most likely tree fall-in). For some equipment drivers the effectiveness is stated to be even lower, but some of these merit additional scrutiny. For

[212] Data Request response MGRA-SCE-003-02.

example, pole failure is estimated to only have a 40% mitigation effectiveness for REFCL, whether or not covered conductor is installed. These numbers, therefore, need to be further scrutinized. Regardless, these initial estimates demonstrate that the combination of covered conductor with other mitigations is potentially highly effective.

PG&E, which was the first to experiment with REFCL, is not planning to invest heavily in it going forward:

"*While PG&E is looking at opportunities for REFCL deployments in our distribution substations to mitigate wildfire risk and evaluating combinations of REFCL with EPSS and other mitigations, implementing it would require significant and costly changes to the grid. Instead of making costly changes to the grid, we are moving forward with more cost effective solutions such as DCD* [Downed Conductor Detection] *and Partial Voltage Detection*."[213]

Cal Advocates dug deeper into this answer:

"[Q]*Why did PG&E state that "REFCL could be applied to approx. 80% of PG&E HFTD distribution circuit miles (3-wire circuits)" while stating that 'implementing it would require significant and costly changes to the grid"*?

[A] *This distinction is based on the fact that REFCL is not a plug-and-play technology and requires supporting construction and equipment changes in the substation and on the distribution circuits to function. This is different from DCD and Partial Voltage Detection* [PVD]*, which are software-based features on existing hardware and require significantly less cost to implement*."[214]

The question not answered by PG&E is how effective is how effective, particularly in combination with covered conductor, are its proposed alternatives DCD and PVD? Which of these would be components of the portfolio of mitigations that should be put up against undergrounding as an alternative? These alternative mitigations will be discussed in a following section.

Recommendations:

- OEIS should require PG&E and SCE to include REFCL along with covered conductor in any alternative analysis that they perform for undergrounding.

[213] PG&E WMP; p. 275.
[214] PG&E DR Response CalPA_Set WMP-11_Q7.

- OEIS should require PG&E and SCE to gather experimentation data on important failure modes such as tree fall-in, cross-arm failure, pole failure, in order to validate combined effectiveness of covered conductor and REFCL.
- OEIS should require detailed damage and outage data for covered conductor and REFCL under conditions of 1) winter storms without ice loading 2) damage during periods of PSPS. This data would help to determine potential remaining vulnerabilities of portfolio systems.

8.1.3.2. Falling Conductor Protection (FCP)

Falling Conductor Protection is a technology that is owned by SDG&E[215] and is particularly noteworthy because it prevents phase-to-ground contact by de-energizing a conductor before it hits the ground. SDG&E has bundled several protection programs including Falling Conductor Protection, Sensitive Ground Fault Protection (SGF), Sensitive Profile Settings, and Electronic Fault Detection (EDF) into what it calls its "Advanced Protection Program" (APP) in its 2024 GRC. SDG&E estimates that its APP program has an RSE of 646, compared to 233 for undergrounding in HFTD Tier 3.[216] Most of the benefit of the APP derives from FCP.

FCP utilizes "intelligent" components of its distribution system that can measure various voltage, current and phase characteristics and can send these measurements via Ethernet radio or a fiber optic path to a substation controller. This data is analyzed continuously to detect anomalies that represent a conductor break. If a broken conductor is detected, trip commands are sent to the appropriate interrupting devices. Detection and trip occur within a few hundred milliseconds, less than the 1.4 seconds it takes for the conductor to reach the ground, thus eliminating the potential for ignition by downed conductor.[217] SDG&E has fully tested this technology but has yet to activate it.[218]

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[215] A.22-05-015/6; Data Request Response attachment MGRA-SDGE-002_ATTACH_Q4.pdf United States Patent; Patent No.: US 9.413,156 B2; Date of Patent: Aug. 9, 2016.
[216] MGRA GRC Testimony pp. 55-56; citing SDG&E DR Responses.
[217] Id.; citing MGRA-SDGE-002_ATTACH_Q3.pdf; O'Brien, et.al.; Catching Falling Conductors in Midair – Detecting and Tripping Broken Distribution Circuit Conductors at Protection Speeds; Texas A&M Conference for Protective Relay Engineers; 2016; IEEE.
[218] SDG&E WMP; p. 165.

SDG&E's WMP shows estimates that for wires down, APP is purportedly 100% effective in reducing ignitions.[219] However, SDG&E's main concern regarding APP currently is to ***reduce*** its deployment and impact: "*Teams meet on a recurring basis to review target circuits for FCP, strategic undergrounding and installation of covered conductor scope to ensure FCP is* ***not*** *deployed on segments of circuits planned to be undergrounded. FCP still provides effective protection of circuits converted to covered conductor, and when possible, both are deployed simultaneously*."[220]

So in other words, SDG&E extends the risk for residents of areas that it wishes to underground. When asked why it does not analyze its APP in combination with covered conductor as an ***alternative*** to undergrounding, SDG&E regularly refuses to answer the question:

"*SDG&E has evaluated the combined use of APP with covered conductor in areas where overhead facilities will remain and in lower risk areas not planned for undergrounding in the short term or in areas where undergrounding is not feasible. SDG&E considers multiple approaches to grid hardening, including APP with covered conductor, however, in certain areas the combination of covered conductor and APP does not achieve the necessary wildfire and PSPS risk reduction*."[221]

The combination of FCP and SGF[222] provide a good deal of the protection that REFCL could. FCP takes into account the scenario of a tree falling into a conductor and severing it, rapidly de-energizing the line before ground fault occurs. Sensitive Ground Fault will take into account the scenario of a tree fall-in that breaks the protective layer of the covered conductor and comes into contact with live conductor, but leaves the conductor intact. SDG&E expresses concern that the impedance of the tree may fall above that used for the SGF setpoints, but that this requires further testing.[223]

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[219] SDG&E WMP; pp. 164-165.
[220] Id.
[221] Appendix; Data Request Response A2205015_016-MGRA-SDGE-002-9a.

[222] Appendix; Data Request Response A2205015_016-MGRA-SDGE-002-6.
[223] Appendix; Data Request Response A2205015_016-MGRA-SDGE-002-8a.

Recommendation:

- FCP must be added to the list of technologies that will be evaluated in conjunction with covered conductor to determine an effectiveness and cost that can be compared against undergrounding.
- SDG&E should deploy its APP in all areas of the HFTD and calculate undergrounding value as an incremental improvement over covered conductor.
- SDG&E should be required to test its sensitive ground fault settings for the scenario of tree contact without conductor breakage.

8.1.3.3. Electronic Fault Detection

SDG&E and SCE have been implementing an electronic fault detection system using Advance Radio Frequency Sensors (ARFS) that detect anomalies in the radio frequency emissions emitted by arcing or discharging electrical equipment.[224] SDG&E estimates that this technology has a mitigation effectiveness of 72% in detecting damaged components that are likely to fail causing ignitions, and that they estimate a reduction of 0.6 ignitions per year based on their planned deployment between 2023 and 2025.

SDG&E is planning to cover 17% of its overhead network with EFD during the 2023-2025 WMP period, and bring this up to 36% over the next decade.[225] However, SDG&E plans to severely limit its deployment of EFD: "*ARFS and PQ hardware is being installed on older circuits that are not expected to be significantly hardened in the next few years*."[226]

This implies that residents in areas of the highest risk from utility wildfire, in areas SDG&E deems the most dangerous, will ***not*** be provided the additional protection this technology provides because SDG&E hopes to be able to underground their circuits someday. This shows again the disturbing tendency of utilities putting the cart before the horse – defining undergrounding as the primary driver of the utility risk program and considering safety (much less affordability) as a secondary consideration, and then leaving residents at risk until their undergrounding programs are completed.

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[224] SCE WMP; p. 455. SDG&E WMP; pp. 167-168.
[225] DR Response MGRA-SDGE-2023WMP-02-1
[226] Op. Cite.

It is also worth pointing out that EFD works in a complementary manner with REFCL and in fact may be the only means of finding faults accurately on a REFCL enabled circuit.[227]

While EFD is a preventative measure and does not provide a complete solution, as part of a comprehensive portfolio of risk management and hardening measures it offers extremely substantial reductions to risk. Utilities should accelerate the deployment of this tool to provide more immediate risk reduction and provide future options as risk estimates and choices of optimal mitigation technique change.

Recommendation:

- EFD has proven to be an effective and useful technology providing early warning of incipient faults, which can then be addressed by focused inspection. Utilities should be required to come up with plans to cover their HFTD infrastructure with appreciable risk by this technology within the next few years.

8.1.3.4. Downed Conductor (DCD) and Partial Voltage Detection (PVD)

Downed Conductor Detection (DCD) and Partial Voltage Detection (PVD) are technologies deployed by PG&E which it claims provide equivalent protection to REFCL, eliminating the need for REFCL installation. Both PVD and DCD detect high impedance faults. PG&E refers to these technologies as "defense in depth" strategy in conjunction with EPSS.[228] PG&E claims that DCD, which detects high impedance ground faults reduces fault current to 1 amp and trips within 1 second. PG&E states that DCD "*increases the ability to mitigate high impedance ground fault conditions, which can occur following vegetation contact with a powerline. These benefits have the potential to add extra protection or complement EPSS.*"[229] PG&E plans to have 21,000 circuit miles of its HFRA protected by DCD by the end of 2025.

[227] SCE REFCL Report; p. 63.
[228] PG&E DR Response CalPA_Set WMP-08_Q6.
[229] Id.

PG&E has not calculated the risk reduction of either DCD or PVD in conjunction with covered conductor. This is important because tree fall-in is the main covered conductor vulnerability and DCD seems particularly well-suited to mitigating this residual hazard.

Recommendation:

- PG&E should include DCD and PVD in the portfolio of mitigations it uses along with covered conductor when it analyzes alternatives to undergrounding.

8.1.3.5. Portfolio Risk Reductions versus Undergrounding

The risk of catastrophic utility wildfire can through the application of a portfolio of mitigation solutions. In SDG&E's case, which has deployed hardening, fast trip settings, and a sophisticated PSPS program, no major utility wildfires have occurred since 2007. SCE has deployed thousands of miles of covered conductor and has so far only encountered one ignition on CC protected segments, while for PG&E's EPSS program has reduced overall ignitions by over 60%. While considerable progress has been made, further reductions in risk are needed and desirable, as are substantial reductions in PSPS and EPSS reliance.

The utility solution – all three major utilities – is to underground all overhead infrastructure currently deemed to be a significant risk, wherever possible. While effective, this solution is extremely expensive and takes a long time. Utilities maintain that no other mitigation comes close to the effectiveness of undergrounding.

What all three major utilities ignore is the fact that when mitigation solutions are deployed *in tandem* their overall effectiveness is greatly increased, possibly even amplified in cases where one mitigation compensates for weaknesses in another (such as REFCL and covered conductor). Utility comparison analyses presented in the WMPs and those presented in the SDG&E and PG&E General Rate Cases only did a single "straw man" comparison of undergrounding against covered conductor, and using a very low (65%) effectiveness for CC. SCE has finally provided an SME-based initial analysis of the combined effectiveness of covered conductor and REFCL, and it does appear highly effective against most ignitions sources.

It is important to emphasize reduction of ignition sources that will be correlated with fire weather. Squirrels and bird's nests are significant sources of ignition but to date no recorded severe of damaging utility wildfire has been due to one. Likewise with balloons and vehicles. The vast majority of catastrophic utility-ignited wildfires occurred during high wind fire conditions, in which the wind played a role in both the ignition of and rapid spread of the fire. The exceptions, the Dixie and Butte fires, were both caused by tree fall-ins. When choosing mitigations, it is important to concentrate on those most effective at preventing the situation in which *catastrophic* fires are most likely to be ignited. While a fuel-driven fire ignited by a random ignition source is always possible, and should be reduced by reasonable mitigations, emphasis should be on the ignition sources that are correlated extreme fire weather and associated with the truly catastrophic fires that have been historically and will continue to be the greatest threat.

When comparing utility undergrounding against other mitigations, this comparison must always be with the ***full portfolio*** of reasonable mitigations. If undergrounding can be shown to be cost effective and meet regulator-defined risk reduction targets better than any other ***combination*** of mitigations for that segment, then that segment would be a good candidate for undergrounding. Otherwise more cost effective mitigation portfolios should be deployed.

Part of this portfolio should be PSPS, which is a mitigation as well as a risk. In Section 9 it will be demonstrated that increases in PSPS thresholds rapidly reduce the impacted areas and customers. A modest PSPS program can be used as a backstop for extreme weather events that might threaten to overwhelm other mitigations.

Recommendations:

- When comparing undergrounding against other mitigations, utilities should be required to compare undergrounding against the most cost-effective combination of mitigations that achieve any regulator-required risk reduction goals. Energy Safety should recommend against any major roll-out of undergrounding as a long term solution unless this comparison is made.
- OEIS should work with stakeholders to define a minimum risk reduction target, since this target can determine the appropriate mitigation.
- Stakeholders should be provided periodic review and input into utility-centric OEIS working groups so that they are kept apprised of status and have the ability to ask questions.

9. PUBLIC SAFETY POWER SHUTOFFS (PSPS)

9.1. Overview

The 2022 fire year was extraordinarily mild compared to some recent years, with power shutoff occurring only in very limited circumstances. We therefore do not have much additional data to analyze to state whether utility advances in operational risk management have had any effect. Consequently, most of the comments MGRA made in its 2022 WMP Comments remain relevant and valid.[230] Briefly summarizing:

- Cost/benefit incorporating both wildfire risk avoidance and harm from shutoff need to drive PSPS decisions.
- There should be a unified approach to PSPS consequence modeling.
- EPSS, or fast trip, is a valid way to reduce risks during times of elevated fire risks, but its impacts are less mitigable than PSPS and serious attention needs to be paid to how and when thresholds are set. Additionally, most outages associated with EPSS settings do not occur under times and locations of significantly elevated fire risks.
- Harm from PSPS should attempt to quantify less tangible risks that may be amplified during severe fire weather periods, such as risk from generators and cooking fires, and impacts of communication loss.

9.2. Protocols on PSPS

9.2.1. PSPS risk modeling

In utility risk assessments, PSPS is regarded only as risk rather and not mitigation, and its inclusion in justification to support undergrounding. Utility PSPS risk evaluation remains an idiosyncratic and dark art, and what relevance it has to actual customer harm is currently unknown. With Commission Decision D.22-12-027, California utilities will begin to work with the ICE tool group at Lawrence Berkeley Laboratory to develop a common mechanism to determine monetized

[230] MGRA 2022 WMP Comments; pp. 83-91.

losses from de-energization.[231] This will lead to a more uniform PSPS calculation between utilities and will allow the special characteristics typifying wildfire-prevention shutoffs to be formally incorporated, once the ICE model itself is adapted to the specific problem of utility wildfire prevention. Whether this will lead to a greater or lesser imputed risk from power shutoff than is currently assumed is unknown. However it should be expected that areas that are particularly subject to power shutoff will have greater changes to their calculated risk, which could potentially change the appropriate mitigation and mitigation priority.

Recommendation:

- OEIS should monitor and participate in the utility adaptation of the ICE model to the wildfire problem to ensure that non-direct impacts are included.

9.2.2. Effect of mitigations on PSPS thresholds and impacts

One of the justification made by all utilities for undergrounding is that a fully undergrounded circuit (i.e. with all feeding circuits undergrounded as well) can be kept energized during a PSPS event, and thereby mitigates all PSPS harm. While this is true, utilities fail to incorporate benefits from other types of mitigation in reducing PSPS harm. SCE is the only utility currently adjusting its wind speed threshold based on whether it has deployed covered conductor. Currently, its wind gust speed threshold for segments with covered conductor is 58 mph.[232] PG&E does not include covered conductor as a consideration when analyzing PSPS impacts.[233] SDG&E has stated that it is considering raising its threshold for PSPS for covered conductor segments to between 55 and 60 mph.[234] Currently, SDG&E's wind gust speed threshold for power shutoff is as low as 50 mph.[235]

As part of its SDG&E GRC testimony, MGRA analyzed SDG&E weather station data in order to ascertain the potential sensitivity of PSPS impacts to wind gust thresholds.[236] In response

[231] D.22-12-027; pp. 38-41, Appendix C
[232] SCE WMP; p. 108.
[233] PG&E DR Response TURN_003_Q3c.
[234] SDG&E WMP; p. 5.
[235] MGRA SDG&E GRC Testimony; p. 66.
Citing A.22-05-015/6; SDG&E DR Response TURN-SEU-015-8.
[236] MGRA SDG&E GRC Testimony; pp. 67-68.
Workpaper TURN-SEU-015_ATTACH_Q7_Q8_8584_Weather_jwm.xlsx

to an MGRA Data request, SDG&E stated that reports only 22 weather stations have measured wind gust speeds greater than 70 mph, while 65 measured windspeeds greater than 60 mph and 98 measured wind speeds greater than 55 mph.[237] However this does not fully represent the steepness of the PSPS risk decline with PSPS threshold increase. This is demonstrated in the table below:

Wind gust speed greater than (mph)	**Stations**	**Measurements**	**M – Sill Hill**
48	146	54030	46488
55	104	17499	13285
70	26	1391	482
85	6	133	5
111	0	0	0

Table 12 - Wind speed exceedance at SDG&E weather stations, 2015-2022. 'Stations' is the count of the stations exceeding threshold at least once during this period. 'Measurements' are the total number of measurements (usually 10 minute intervals), and is a measure of how much time is spent over threshold. 'M-Sill Hill' removes data from the anomalously high Sill Hill weather station, whose corresponding circuit has since been undergrounded.[238]

The "M-Sill Hill" column has the data from the "Sill Hill" weather station removed, which regularly experiences gusts over 85 mph, and whose corresponding circuit has been undergrounded. Otherwise, gusts over 85 mph have historically been rare, although that does not preclude them from occurring in the future. With this outlier removed, an increase of threshold from 55 mph to 70 mph would reduce the time experienced by all stations over threshold by 96%.

While this data is specific to the SDG&E service area it demonstrates the more general point that while individual weather stations may occasionally experience conditions above a wind speed threshold, the overall spatial extent and duration of conditions over threshold decrease far more steeply than counting the number of stations over threshold would suggest.

This implies that mitigations that allow the PSPS threshold to be raised – not only covered conductor but covered conductor paired with other technologies – can enable significant decrease in PSPS risk as well and may reduce PSPS to a acceptable level. Undergrounding should not be viewed as the only "cure" for PSPS risk.

[237] Id. Citing: Data Request Response A.22-05-015-6-MGRA-SDGE-003-12a.
[238] Op. Cite.

Recommendations:

- In future WMP updates, Energy Safety should require utilities to quantify the reduction in PSPS risk as a function of wind speed threshold.
- Energy Safety should not accept the utility assertion that PSPS risk reduction can only be achieved by undergrounding but should require that mitigations be evaluated singly or in combination for their effectiveness in changing PSPS thresholds and risk.

9.2.3. Safely changing PSPS thresholds and other mitigation programs

Current de-energization thresholds set by the utilities are designed to minimize wildfire risk. If a new mitigation is introduced, it may be appropriate to relax these thresholds to reduce PSPS risk. In order to ensure that the threshold change does not create additional wildfire risk these mitigations can be validated using data available to the utilities. For example:

- Damage reports from PSPS surveys can reveal what kind of damage is being done to covered conductor during windstorm events and whether this could have potentially led to an ignition had the circuit been energized.
- Operation of downed conductor detection, FCP, sensitive trip / high impedance fault detection, and REFCL can be verified during winter gales in order to gauge whether they are reducing fault energy sufficiently to prevent ignition during fire weather.

Recommendations:

- Utilities should be required to collect additional outage data specific to new mitigations and technologies in order to better estimate their effectiveness during fire weather conditions.
- Energy Safety should require that all outages resulting from fast trip / EPSS settings be identified via an additional field in the outage data.

9.2.4. PG&E's EPSS Program

Since PG&E instituted its Enhanced Powerline Safety Settings (EPSS) in 2021, it claims reductions in ignitions of up to 80%.[239] MGRA in its 2022 WMP called for stronger monitoring of this program, and OEIS imposed additional reporting requirements on PG&E's PSPS program.[240] Nevertheless, PG&E's EPSS remains strongly disliked by customers due to its reliability impacts – impacts that don't seem to be shared by SDG&E's or SCE's fast trip programs (which are active for a far shorter portion of the year.[241]). One question this raises is whether PG&E is preventing potentially damaging fires or whether the ignitions EPSS generally prevents have very low potential to be a serious fire.

To investigate, MGRA requested 1) PG&E's yearly outage data for 2022[242] and 2) A list of outages occurring when EPSS settings were in place. In response, PG&E provided a list of 2360 outages associated with PSPS.[243] As can be seen, EPSS can occur in any month of the year but is mostly enabled between May and November:

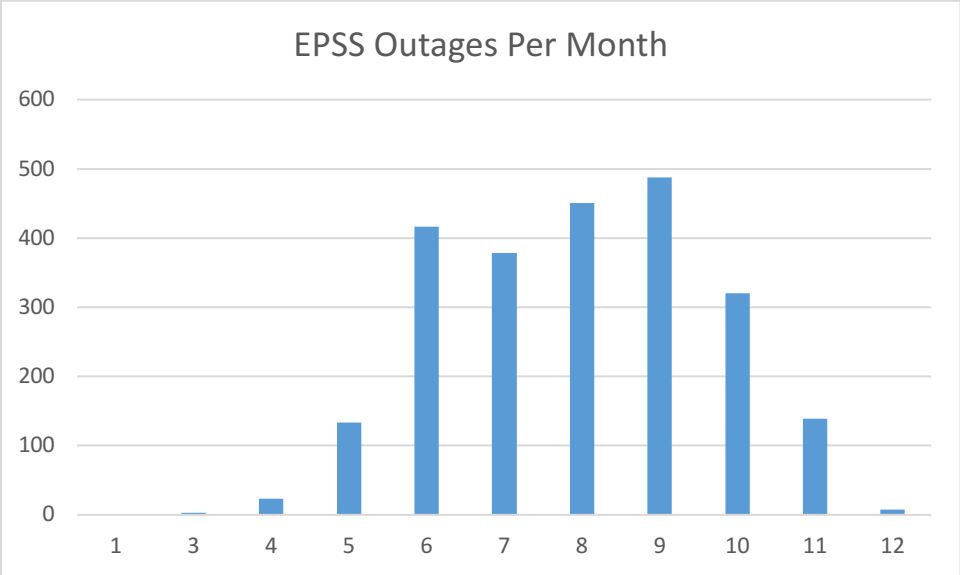

Figure 23 - PG&E EPSS outages per month for 2022.[244]

[239] PG&E 2022 WMP; p. 738.
[240] See Table 1.
[241] 2023 WMP Workshop. SCE and SDG&E stated their "fast trip" programs were imposed only a few days a year, while PG&E's program covers a substantial portion of the year.
[242] MGRA PG&E Data Request 1 requested all relevant GIS data.
[243] PG&E DR Response MGRA-006-01; Workpaper WMP-Discovery2023_DR_MGRA_006-Q001Atch01-EPSSOutages-jwm.xlsx
[244] Workpaper PGE_DistributionUnplannedOutage_2022_EPSS-final-jwm.xlsx

One other remarkable characteristic of EPSS outages is that they are not restricted to High Fire Threat Districts.

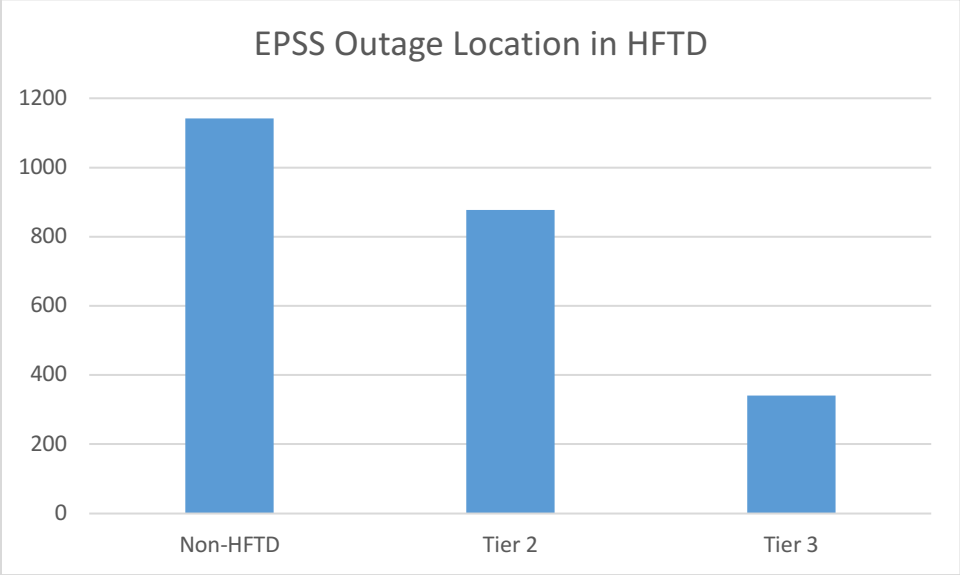

Figure 24 - PG&E EPSS outage locations with regard to High Fire Threat Districts, 2022 data.[245]

The fact that a sizable number of EPSS outages do not even occur in High Fire Threat Districts begs the question of whether the ignitions that they are preventing have potential for severe or catastrophic fire.

MGRA therefore has done a cursory weather analysis on the geographic locations at which outages were reported that were later identified by PG&E as being circuits with EPSS enabled. There was not sufficient time to complete a software program which would have allowed MGRA to analyze all PG&E outage data. Therefore a small random sample of PG&E's data was selected for an analysis.

The process for analysis was to obtain the latitude, longitude and time of a randomly selected EPSS outage using outage data. This was then used to obtain weather data using the Synoptic Data site.[246] A manual process rather than automated process was used due to lack of time. Weather data was returned from:

[245] Id.
[246] https://developers.synopticdata.com/mesonet/explorer/

- All reporting weather stations of any type
- Within 3 miles (5 km) of the reported outage location, and
- From the hour prior to the outage.

From this data the maximum temperature (C), maximum wind gust speed (mph), and minimum relative humidity(%) were found by a manual scan of the weather data output. Note that this is an extremely conservative approach in that 1) the values presented are the worst-case values found in the entire area, and 2) each value was collected independently and the extrema for each variable usually occurred at different weather stations and different times, not in coincidence.

An important fact to note is that many "normal" outages might have occurred even without EPSS settings. There is no data indicating which outages might not have been triggered but for EPSS, but those outages with a well-defined cause are more likely to have occurred regardless of EPSS settings. Nevertheless, the weather data from the areas generally shows that the weather conditions during which the outages occurred was not necessarily conducive to severe wildfire.

Below is a sample of 40 outages that have been analyzed for weather data.

Example query:
`GET https://api.synopticdata.com/v2/stations/timeseries?&token={Your API Token}&obtimezone=local&radius=38.99419846,-122.8630002,3&units=speed|mph&end=202209121511&start=202209121411`

FID	DoutageID	HFTDClass	District	Circuit	Outage_Sta	basic_caus	MaxT	MaxGust	MinRH
2100	1777746	Non-HFTD	Nevada	BRUNSWICK 1103	10/20/22 | 08:02	Animal	22	8	14
434	1746583	Tier 2	Fresno	KERCKHOFF 1101	06/22/22 | 07:07	Unknown Cause			
1521	1757418	Tier 2	Mission	NORTH DUBLIN 2103	08/04/22 | 04:21	Unknown Cause	24	5	47
675	1750047	Non-HFTD	Paso Robles	ATASCADERO 1102	07/05/22 | 15:41	Unknown Cause	18	5	77
1478	1768998	Tier 3	De Anza	LOS GATOS 1106	09/15/22 | 11:03	Unknown Cause	12	12	29
2153	1783987	Non-HFTD	Willow	LOGAN CREEK 2102	11/16/22 | 06:10	Unknown Cause	15	16	26
1773	1758844	Non-HFTD	Santa Maria	SANTA YNEZ 1101	08/09/22 | 13:17	Equipment Failure/Involved	15	6	88
2034	1779981	Tier 2	Diablo	SOBRANTE 1103	10/29/22 | 09:59	Unknown Cause	13	8	52
213	1742941	Non-HFTD	Mission	FREMONT 1104	06/08/22 | 17:07	Unknown Cause	20	23	47
486	1747581	Tier 3	Coast	POINT MORETTI 1101	06/24/22 | 12:30	Animal	22	3	24
2272	1775752	Non-HFTD	Coast	GREEN VALLEY 2101	10/12/22 | 07:25	Unknown Cause	13	4	95
1510	1754050	Tier 2	Fresno	AUBERRY 1102	07/21/22 | 12:25	3rd Party	29	7	22
1423	1765006	Tier 3	Nevada	BRUNSWICK 1105	09/01/22 | 10:01	Unknown Cause	26	2	26
742	1754256	Tier 2	San Luis Obispo	OCEANO 1104	07/22/22 | 08:40	Vegetation	13	8	95
1238	1768787	Tier 3	Coast	POINT MORETTI 1101	09/14/22 | 13:45	Vegetation	13	7	88
318	1744662	Tier 2	Yosemite	SAN JOAQUIN #3 1102	06/14/22 | 17:28	Unknown Cause	26	10	23
1784	1752889	Tier 2	Yosemite	BEAR VALLEY 2101	07/17/22 | 19:09	Equipment Failure/Involved	37	10	23
960	1765345	Tier 2	Santa Rosa	COTATI 1103	09/02/22 | 17:37	Unknown Cause	11	11	100
1249	1766398	Non-HFTD	Bay	FRANKLIN 1104	09/06/22 | 18:16	Unknown Cause	39	11	18
571	1749291	Non-HFTD	Coast	CAMP EVERS 2103	06/30/22 | 12:49	Animal	14	6	58
2192	1775046	Non-HFTD	Oroville	OROVILLE 1104	10/08/22 | 09:34	Animal	25	11	28
337	1745105	Tier 3	Vallejo-Napa	SILVERADO 2105	06/16/22 | 05:31	Unknown Cause	23	26	28
1119	1758906	Tier 2	Paso Robles	TEMPLETON 2113	08/09/22 | 21:29	3rd Party	34	22	24
2236	1780261	Tier 2	Peninsula	MENLO 1102	10/31/22 | 09:51	Unknown Cause	17	10	16
22	1724230	Non-HFTD	Willow	ELK CREEK 1101	04/10/22 | 07:08	Unknown Cause			
735	1765276	Tier 2	Fortuna	LOW GAP 1101	09/02/22 | 10:07	Unknown Cause			
1883	1765558	Non-HFTD	Salinas	CAMPHORA 1101	09/04/22 | 10:01	Unknown Cause			
1848	1755553	Tier 2	Quincy	HAMILTON BRANCH 1101	07/27/22 | 15:20	Unknown Cause			
2229	1780688	Tier 2	Mother Lode	WEST POINT 1102	11/01/22 | 20:11	Unknown Cause	14	16	60
1676	1749825	Tier 2	Diablo	SOBRANTE 1102	07/04/22 | 09:17	Animal	13	16	89
1368	1751181	Tier 2	Red Bluff	CORNING 1101	07/11/22 | 10:55	Unknown Cause	26	6	32
711	1770563	Tier 3	Yosemite	MARIPOSA 2102	09/21/22 | 01:52	Unknown Cause	20	9	49
1493	1765624	Tier 2	Ukiah	GUALALA 1111	09/04/22 | 18:55	Unknown Cause			
908	1761882	Tier 3	Coast	BIG BASIN 1101	08/20/22 | 14:20	Unknown Cause	27	4	16
750	1759245	Non-HFTD	Vallejo-Napa	SILVERADO 2105	08/10/22 | 19:48	Equipment Failure/Involved	27	13	39
1368	1751181	Tier 2	Red Bluff	CORNING 1101	07/11/22 | 10:55	Unknown Cause	26	6	32
896	1751262	Non-HFTD	San Jose	HICKS 2101	07/11/22 | 18:37	Unknown Cause	32	9	24
2056	1777273	Non-HFTD	De Anza	LOS GATOS 1107	10/18/22 | 11:39	Vegetation	18	7	52
1114	1768834	Tier 3	Santa Rosa	MIRABEL 1102	09/14/22 | 18:39	Unknown Cause	24	14	42
1820	1768107	Non-HFTD	Vallejo-Napa	PUEBLO 2103	09/12/22 | 15:11	Unknown Cause	18	5	71

Table 13 - Random sample of 40 EPSS outages, showing Outage ID, HFTD area, District, Circuit, Date and Time, Cause, Maximum Temperature (C), Maximum Wind Gust (mph), and Minimum Relative Humidity (%) from weather stations within 3 miles.[247] Color coding is based on whether weather condition is in effect: T >25 C, WG > 15 mph, or RH < 25%. Where one condition is in place, yellow coding is used, when two conditions are in place orange is used.

Color coding of the records is based on whether any weather condition is in effect: T >25 C, WG > 15 mph, or RH < 25%. These are conservative weather conditions and each on its own does not indicate highly elevated potential for large fires. Where one condition is in place, yellow coding is used, when two conditions are in place orange is used. Grey indicates no weather stations within three miles of the outage.

Of the forty events analyzed, only a few showed weather conditions commensurate with a potentially significant wildfire potential (specifically, hot and dry conditions). It may be that

[247] PG&E DR Response MGRA-006-01; Workpaper PGE_DistributionUnplannedOutage_2022_EPSS_SampleWindRH-final-jwm.xlsx

vegetation conditions (which were not analyzed) may have been a primary determinant in the decision to set EPSS conditions.

Weather Condition	
No Data	6
No Weather Condition Criteria	17
One Weather Condition Criterion	10
Two Weather Condition Criteria	7
Total	40

Table 14 - Summary of Table 13

The conclusion that can be reached from a cursory survey of EPSS data is that a substantial fraction of EPSS outages 1) do not occur in HFTD areas and 2) do not occur under weather conditions conducive to rapid wildfire growth. Hence PG&E likely has significant leeway to reduce and restrict its EPSS criteria and thereby reduce EPSS impact on customers.

Recommendations:

- PG&E, in its future EPSS reporting, should be required to include relevant fire weather data in the area nearest to its outages, including at least temperature, wind gust speed, and relative humidity.
- PG&E should be made to justify criteria that allow outages in the case where there are no significant weather conditions that would support the growth of large fires, and why many EPSS outages originate outside of HFTD areas. If it fails to adequately justify its criteria PG&E should be required to come up with a remediation plan using further sectionalization, changes in its EPSS thresholds, and more dynamic adjustments to its equipment based on weather station data.

11. CORRECTIVE ACTION PROGRAM AND IMPROVEMENTS

11.1. Areas for improvement (Appendix D)

11.1.1. SDG&E meteorological partnership with SDSC

SDG&E is partnering with the San Diego Supercomputing Center (SDSC) at the University of California at San Diego (UCSD). The SDSC performed an analysis of the effect of wind speeds on outages, which SDG&E summarizes as:

"*SDSC also presented a comparative analysis between outages and non-outages with respect to statistics of wind speeds and wind gusts. An analysis on wind speed/wind gust delta was performed. The main takeaways are as follows:*

• Higher deltas between wind speed and wind gust are observed for outages.

• For non-outages, the deltas are uniformly distributed. Additionally, the non-outage distribution has slightly higher peaks for lower delta values, indicating small changes in winds for nonoutages.

• A higher delta between wind speed and wind gust therefore indicates a sudden change in wind speed, which can lead to branch or tree failure."[248]

These claims need to be parsed carefully, because the language used by SDG&E and the researchers do not match standard definitions of "wind speed" and "wind gust". First, it is important to understand that the wind information used for this analysis is the Weather Research and Forecasting Model (WRF), and that this does not appear to be verified with SDG&E's extensive set of weather stations. Additionally, the researchers use a very unconventional definition "wind speed" and "wind gust". Generally, "wind speed" means a measurement of air flow over a given period, which depends on context. For example, for wind loading, a "basic wind speed" has been defined as a three second gust at 33 feet above the ground (ASCE-7-10).[249] Other measuring times such as "mean hourly wind" may be used. Generally the shorter the measurement period, the higher the ratio of the maximum wind to the hourly mean speed, a relationship known as the "Durst Curve".[250]

The SDSC white paper, on the other hand defines "wind speed" as either the average or maximum ***daily*** wind speed. WRF outputs are hourly, so no finer time scale can be used.[251] The standard meteorological definition of "gust" is the maximum three-second wind speed over the

[248] SDG&E WMP p. D-11.
[249] p.187.
[250] ASCE-7-10.; p. 516; Figure C26.5-1.
[251] DR Response MGRA-SDGE-2023WMP-03-01.

measurement period (usually ten minutes) for weather stations. The American Meteorological Society defines gust as "A sudden, brief increase in the speed of the wind",[252] usually lasting less than 20 seconds. The SDSC analysis on the other hand is determined by the WRF forecast and is given as "wind_gust = wind_speed + 7.71*UST"[253]. "UST" is a variable used in WRF to denote "friction velocity", and has been used by Fovell and Cao to estimate wind gusting.[254]

The SDSC predictions occur on an hourly basis, and therefore cannot predict "*a sudden change in wind speed*". Perhaps what the SDDC "wind delta" results actually measure is the onset of a gustier period, rather than "sudden" or more violent gusts. This would imply that the onset of a gusty *period* is more likely to be correlated with an outage, rather than "sudden" gust of wind.

Recommendations:

- The SDSC results used by SDG&E should be reviewed by meteorologists and couched in standard meteorological language before being applied to SDG&E planning or operations.
- The SDSC results should be validated using SDG&E weather station data.

12. CONCLUSIONS

The 2023 WMPs have achieved an unprecedented level of detail and complexity. As shown in these comments, however, the wildfire safety problem is far from solved and there remain a number of open issues for which Energy Safety should require additional action.

The most disturbing theme in the 2023 WMPs is not due to utility inaction or error. It is the deliberate decision on the part of all three major utilities to bypass Energy Safety and CPUC guidance requiring justification of expansion in their undergrounding programs by comparing undergrounding against other viable alternatives. SCE has created a new categorization based solely on consequence and not on risk for which undergrounding is the default alternative. PG&E states that undergrounding is its primary mitigation and is moving forward accordingly. SDG&E has created a decision tree model that is heavily biased in favor of undergrounding. None of the utilities

[252] https://glossary.ametsoc.org/wiki/Gust; Downloaded 5/18/23.
[253] Op. Cite.
[254] Cao, Y., Fovell, R.G., 2016. Downslope Windstorms of San Diego County. Part I: A Case Study. Monthly Weather Review 144, 529–552. https://doi.org/10.1175/MWR-D-15-0147.1

has as yet provided justification for undergrounding programs in terms of a real alternative consisting of a portfolio of optimal mitigations.

Energy Safety must now decide whether or not it will abide the utilities willfully ignoring its 2022 WMP guidance. To defend its position as a regulatory body, OEIS should take the bold but necessary step of denying the WMPs in their current form. Energy Safety should provide prompt guidance, instructing the utilities to recalculate their risks using more reasonable values for mitigation effectiveness using a combination of covered conductor and advanced technology choices suitable to that utility.

Utility risk models, while improving steadily, still have clear flaws and shortcomings. Most importantly, they are in flux and will remain so for the foreseeable future. Energy Safety should continue to press for improvements to these models. It is clear that long term projections that discuss specific circuits and their associated risk cannot be relied upon to hold steady – an important consideration given the prospects of utility undergrounding plans that may be submitted under the new regulations introduced by SB 884.

PSPS should also be considered as both a mitigation and a risk. Utilities will be collaborating on an ICE based consequence model, but Energy Safety should ensure that elements specific to utility power shutoff, including non-direct impacts, are properly included. At need, PSPS provides a backstop for the most extreme events, but application of effective mitigation (aside from undergrounding) should be recognized as having the potential for elevating PSPS thresholds and dramatically reducing the impact of PSPS during common seasonal events.

Finally, while OEIS is not directly responsible for utility rates and ensuring affordability, it has in the past made efforts to ensure that mitigations chosen by utilities are cost effective. With MGRA's showing in its 2022 WMP Comments and again this year, that the rate increases required for the proposed utility undergrounding programs are significant enough to affect the health and safety of the population, Energy Safety must continue to recognize that affordability cannot be decoupled from safety. While the CPUC may devise means to protect the most vulnerable ratepayers, the OEIS is not in a position to do this. The tool OEIS has within its mandate to protect the health of the poorest ratepayers is to ensure that the utility Wildfire Mitigation Plans contain the best and most cost efficient mitigations needed to achieve its risk reduction goals. It has used this

tool in past WMP reviews, and it must do so again – urgently – as utilities prepare for the largest expenditure of wildfire mitigation funds to date.

Respectfully submitted this 26th day of May, 2023,

By: __*/S/*____***Joseph W. Mitchell, Ph.D.***_____

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13. SUMMARY OF RECOMMENDATIONS

Recommendations:

- Energy Safety should reject assertions within the WMP that certain mitigation choices have been made on the basis of risk tolerance or risk deemed "unacceptable". The CPUC has as yet made no determinations regarding risk tolerance, and still requires that utilities consider cost-effectiveness when choosing mitigations. Energy Safety should likewise require utilities to choose prioritizations consistent with their risk models, and to correct their risk models if these models fail to take into account critical safety or cost efficiency considerations.
- SDG&E should be required to calculate the effectiveness of its Advanced Protection Program in combination with covered conductor as a mitigation alternative, and create an alternative WiNGS-Planning portfolio based on this alternative.
- SDG&E should be required to validate that its risk reduction target (currently 83%) is an optimization that balances costs and safety.
- Energy Safety should review fully review utility plans and estimates that extend beyond the 2025 timeframe of this major WMP to the extent that longer term plans have been presented, with the reasonable expectation that these reviews may inform long term utility undergrounding plans developed under the new legislation adopted as SB 884, and future review under that plan will be expedited.
- Energy Safety should ensure that major programs and initiatives, mitigation decisions, and prioritization are "*in balance with other performance objectives (e.g., reliability and affordability*)".
- Utilities should properly couple consequence to ignition in order to properly weight outage sources that occur during extreme weather. One way to do this is to treat extreme weather events as a separate risk, for instance by filtering on Red Flag Warning days.
- OEIS should work with utilities to create an "initial attack" fire suppression model using historical data (CAL FIRE, NFIRS) to determine the probability that an ignition escapes initial attack and becomes a damaging fire, based on covariates such as wind speed, FPI, distance to fire station, etc., using a machine learning model.

- Energy Safety should require SDG&E to include PSPS bias adjustment through inclusion of PSPS damage events in its WiNGS-Planning model.
- SDG&E's wind adjustment model should filter its maximum recorded wind speed based on humidity and temperature threshold to capture only fire-weather events.
- Energy Safety should require additional detail regarding SDG&E's asset health adjustment factor.
- SDG&E should be asked to validate its "weighted sum" approach by applying its corrections in reverse order to ensure that each correction is independent of the others.
- Energy Safety should carefully review the A P Consulting Group Report and incorporate relevant findings into its WMP review.
- As per the A P Consulting Group Report, SDG&E should conduct sensitivity analyses for its RSE, mitigations, and PSPS customer type models.
- As per the A P Consulting Group Report, SDG&E should eliminate double counting of conductor age and CHI.
- Energy Safety should require SDG&E to provide scientific, mathematical, and statistical support for its ignition model components.
- Technosylva's building loss model needs additional scrutiny by OEIS. It seems to amplify the "urbanization" of wildfire risk calculations, and therefore reduce predicted risk in remote high-wind areas where historical catastrophic fires have ignited and grown before descending onto the Wildland Urban Interface.
- SDG&E must find a mechanism to reduce the "8 hour" bias introduced by the Technosylva 8 hour run time limitation and thereby include the potential for larger fires in its consequence model.
- Energy Safety should require all utilities to identify single egress and limited egress communities and areas in its service area as per Section 5.4.3.3 of the Technical Guidelines Urgency: Required for WMP approval.
- Energy Safety should require all utilities to incorporate single egress and limited egress communities in their future consequence modeling. A workshop should be organized to explore the most appropriate way to include this risk.
- OEIS should require utilities considering or using the Technosylva building loss model to provide validation that the model is predictive when compared to historical losses and consistent with the published literature on structure losses.

- The full technical details and results of third-party validation for PG&E's WDRM v4 model must be provided in its next WMP Update. This should include a full comparison of WDRM v4 risk, ignition probability, and consequence calculations at the circuit or segment level with the results of WDRM v2 and WDRM v3.
- PG&E should provide data showing that its analysis, when run simulating known historical fires, produces consistent results with historical data with regard to fire size and which drivers are responsible for catastrophic wildfires.
- PG&E should not use average category values for its consequence model but rather use a statistical model that captures tail risk such as a truncated Generalized Pareto distribution.
- PG&E should separate out wind-driven wildfire events through analyzing Red Flag Warning data (including PSPS damage events) as a risk driver.
- SCE should be required to integrate its IWMS Risk Framework into its MARS or other subsequent risk modeling in order to make its decisions quantitative and transparent.
- Energy Safety should make clear that determination of "acceptable" risk is a matter for the public, and not utilities to determine.
- SCE should be recognized for being the first utility to apply a quantitative egress model to its mitigation decisions and prioritization. Other utilities should be required to implement egress models similar to SCE's or demonstrably superior prior to the next WMP update.
- SCE's egress model should be validated by 3rd party review.
- SCE's high consequence classification should be incorporated into its MARS model and not used as a binary classifier in its IWMS model. It should utilize the known relationship between final fire size and Technosylva 8 hour burn size to generate a realistic consequence model.
- To the extent that IWMS is used to compensate for shortcomings of the MARS risk model, SCE should not assume that undergrounding is automatically the best mitigation for circuits prioritized through IWMS.
- Energy safety should require that all utilities provide reasonable answers for all extreme weather scenarios as a condition for WMP approval.
- Energy Safety should clarify the extreme wind loading condition plan to clarify that it is not only asking about physical design requirements but also operational processes, particularly in the case of extended and extensive power shutoff.

- OEIS should not approve the 2023-2025 mitigation plans until and unless utilities create realistic mitigation portfolios in competition with undergrounding, since utilities have egregiously ignored OEIS guidance in this area provided in the 2022 WMP feedback and in the 2023 Process guidelines.
- Energy Safety should maintain its 2022 position throughout this review and the upcoming SB884 undergrounding plan reviews and ensure that all comparisons of undergrounding to other mitigations are rigorous and unbiased.
- When comparing alternatives, time to implement the alternative and its impact on the residual risk of those waiting for mitigation should also be taken into account.
- Energy Safety should specify or define a process for developing a target level of risk or risk reduction that utility mitigation programs as a whole should achieve. Energy Safety should make clear that it is not the utilities' role to define "acceptable" risk.
- Energy Safety should reiterate its guidance that any significant undergrounding program must be justified by demonstrating that there are no more cost-effective mitigations that meet a regulator-defined level of safety.
- Utilities should not be permitted to use 65% effectiveness for covered conductor as a "straw man" comparison for undergrounding, but must include at the least standard mitigations such as those estimated by SCE to raise the value to 85% or higher.
- OEIS should require PG&E and SCE to include REFCL along with covered conductor in any alternative analysis that they perform for undergrounding.
- OEIS should require PG&E and SCE to gather experimentation data on important failure modes such as tree fall-in, cross-arm failure, pole failure, in order to validate combined effectiveness of covered conductor and REFCL.
- OEIS should require detailed damage and outage data for covered conductor and REFCL under conditions of 1) winter storms without ice loading 2) damage during periods of PSPS. This data would help to determine potential remaining vulnerabilities of portfolio systems.
- FCP must be added to the list of technologies that will be evaluated in conjunction with covered conductor to determine an effectiveness and cost that can be compared against undergrounding.
- SDG&E should deploy its APP in all areas of the HFTD and calculate undergrounding value as an incremental improvement over covered conductor.

- SDG&E should be required to test its sensitive ground fault settings for the scenario of tree contact without conductor breakage.
- EFD has proven to be an effective and useful technology providing early warning of incipient faults, which can then be addressed by focused inspection. Utilities should be required to come up with plans to cover their HFTD infrastructure with appreciable risk by this technology within the next few years.
- PG&E should include DCD and PVD in the portfolio of mitigations it uses along with covered conductor when it analyzes alternatives to undergrounding.
- When comparing undergrounding against other mitigations, utilities should be required to compare undergrounding against the most cost-effective combination of mitigations that achieve any regulator-required risk reduction goals. Energy Safety should recommend against any major roll-out of undergrounding as a long term solution unless this comparison is made.
- OEIS should work with stakeholders to define a minimum risk reduction target, since this target can determine the appropriate mitigation.
- OEIS should monitor and participate in the utility adaptation of the ICE model to the wildfire problem to ensure that non-direct impacts are included.
- In future WMP updates, Energy Safety should require utilities to quantify the reduction in PSPS risk as a function of wind speed threshold.
- Energy Safety should not accept the utility assertion that PSPS risk reduction can only be achieved by undergrounding but should require that mitigations be evaluated singly or in combination for their effectiveness in changing PSPS thresholds and risk.
- Utilities should be required to collect additional outage data specific to new mitigations and technologies in order to better estimate their effectiveness during fire weather conditions.
- Energy Safety should require that all outages resulting from fast trip / EPSS settings be identified via an additional field in the outage data.
- PG&E, in its future EPSS reporting, should be required to include relevant fire weather data in the area nearest to its outages, including at least temperature, wind gust speed, and relative humidity.
- PG&E should be made to justify criteria that allow outages in the case where there are no significant weather conditions that would support the growth of large fires, and why many EPSS outages originate outside of HFTD areas. If it fails to adequately justify its criteria

PG&E should be required to come up with a remediation plan using further sectionalization, changes in its EPSS thresholds, and more dynamic adjustments to its equipment based on weather station data.

- The SDSC results used by SDG&E should be reviewed by meteorologists and couched in standard meteorological language before being applied to SDG&E planning or operations.
- The SDSC results should be validated using SDG&E weather station data.
- Stakeholders should be provided periodic review and input into utility-centric OEIS working groups so that they are kept apprised of status and have the ability to ask questions.
- SCE should adjust its enterprise risk modeling to correct for the bias introduced by using "worst" weather days in their consequence model. This may be done by applying a RFW filter (as PG&E has done), ignition rate adjustments (as SDG&E has done) or by other corrections. (Carryover from 2022 for SCE only)

  Urgency: Immediate. SCE's designation of "Severe" consequence areas does not eliminate its obligation to provide accurate and unbiased ignition rate risk estimates.
- OEIS should require follow-up on the wildfire smoke issue. This was discussed in the OEIS meetings but was never properly resolved. Wildfire smoke health impacts are severe, and are not taken into account by any utility risk model. Making progress in this area will require that OEIS find external consultants capable of suggesting scientifically viable models. SDG&E is currently the only utility to include a wildfire smoke component to its risk model, but its calculations are erroneous and uncorrected. (Carryover from 2022). **Urgency:** OEIS should provide guidance in this area prior to the next WMP cycle.
- SDG&E's mechanism for calculating risk from wildfire smoke is in error, though in their favor they are the only utility to even attempt to estimate this risk. SDG&E should come up with an alternative method for calculating the "Acres burned" normalization using measured and calculated public health effects from wildfire and wildfire sizes, using a range of values for fatalities and hospitalizations supported by recent studies. (Carryover from 2022)

  Urgency: SDG&E should at least correct the mathematical error in its model and preferably choose more recent references in order to calculate wildfire smoke safety impact in its next WMP update.
- All utilities should use outages with conditional ignition probabilities, and also merge PSPS damage events into their risk event samples to avoid suppressing risk indicators from areas often subject to PSPS. (Carryover from 2022)

  Urgency: PSPS damage should be included by next WMP update (SCE, SDG&E)

- Energy Safety should find that wildfire risk geographic data cannot be considered critical infrastructure under federal law and should not be classified as confidential based on California Government Code 6255. (Carryover from 2022)

.

APPENDIX A - MGRA DATA REQUESTS

A-1 - SDG&E Data Requests

SDG&E – MGRA – Data Request Response 1

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

GENERAL OBJECTIONS

1. SDG&E objects generally to each request to the extent that it seeks information protected by the attorney-client privilege, the attorney work product doctrine, or any other applicable privilege or evidentiary doctrine. No information protected by such privileges will be knowingly disclosed.

2. SDG&E objects generally to each request that is overly broad and unduly burdensome. As part of this objection, SDG&E objects to discovery requests that seek "all documents" or "each and every document" and similarly worded requests on the grounds that such requests are unreasonably cumulative and duplicative, fail to identify with specificity the information or material sought, and create an unreasonable burden compared to the likelihood of such requests leading to the discovery of admissible evidence. Notwithstanding this objection, SDG&E will produce all relevant, non-privileged information not otherwise objected to that it is able to locate after reasonable inquiry.

3. SDG&E objects generally to each request to the extent that the request is vague, unintelligible, or fails to identify with sufficient particularity the information or documents requested and, thus, is not susceptible to response at this time.

4. SDG&E objects generally to each request that: (1) asks for a legal conclusion to be drawn or legal research to be conducted on the grounds that such requests are not designed to elicit facts and, thus, violate the principles underlying discovery; (2) requires SDG&E to do legal research or perform additional analyses to respond to the request; or (3) seeks access to counsel's legal research, analyses or theories.

5. SDG&E objects generally to each request to the extent it seeks information or documents that are not reasonably calculated to lead to the discovery of admissible evidence.

6. SDG&E objects generally to each request to the extent that it is unreasonably duplicative or cumulative of other requests.

7. SDG&E objects generally to each request to the extent that it would require SDG&E to search its files for matters of public record such as filings, testimony, transcripts, decisions, orders, reports or other information, whether available in the public domain or through FERC or CPUC sources.

8. SDG&E objects generally to each request to the extent that it seeks information or documents that are not in the possession, custody or control of SDG&E.

9. SDG&E objects generally to each request to the extent that the request would impose an undue burden on SDG&E by requiring it to perform studies, analyses or calculations or to create documents that do not currently exist.

10. SDG&E objects generally to each request that calls for information that contains trade secrets, is privileged or otherwise entitled to confidential protection by reference to statutory protection. SDG&E objects to providing such information absent an appropriate protective order.

II. EXPRESS RESERVATIONS

1. No response, objection, limitation or lack thereof, set forth in these responses and objections shall be deemed an admission or representation by SDG&E as to the existence or nonexistence of the requested information or that any such information is relevant or admissible.

2. SDG&E reserves the right to modify or supplement its responses and objections to each request, and the provision of any information pursuant to any request is not a waiver of that right.

3. SDG&E reserves the right to rely, at any time, upon subsequently discovered information.

4. These responses are made solely for the purpose of this proceeding and for no other purpose.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

GIS Data:

Please provide the GIS data set provided to the Office of Energy Infrastructure Safety. This should be a complete and not incremental set, provided in geodatabase format. As per the WILDFIRE SAFETY DIVISION GEOGRAPHIC INFORMATION SYSTEM (GIS) DATA REPORTING STANDARD FOR CALIFORNIA ELECTRICAL CORPORATIONS – V2, February 4, 2021. Data should be current as of the last release prior to the WMP submission date.

Please remove any confidential attributes that may have been added to the requested records.

QUESTION 1

Please provide for Asset Point data for Camera, Fuse, Support Structure, and Weather Station.

RESPONSE 1

SDG&E has provided a compiled database inclusive of all 2022 data provided to Energy Safety. Please see "SDGE_MGRA_OEIS_2022.gdb.zip"

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

QUESTION 2

Provide Asset Line data for Transmission Line (as permitted as non-confidential), Primary Distribution Line, and Secondary Distribution Line.

RESPONSE 2

Please see "SDGE_MGRA_OEIS_2022.gdb.zip"

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

QUESTION 3

Provide PSPS Event data. Include Event Log, Event Line, Event Polygon data. Please exclude customer meter data. Provide all PSPS Event Asset Damage data including photos.

RESPONSE 3

SDG&E objects to the request on the grounds set forth in General Objections Nos. 1, 2, 5, 8 and 9. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

SDG&E did not have any PSPS events in 2022.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

QUESTION 4

Provide Risk Event Point data, including Wire Down, Ignition, Transmission unplanned outage (as classified non-confidential), Distribution Unplanned Outage data, Distribution Vegetation Caused Unplanned Outage, Risk Event Asset Log.

RESPONSE 4

Please see "SDGE_MGRA_OEIS_2022.gdb.zip"

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

QUESTION 5

Provide photo data for Risk Events.

RESPONSE 5

SDG&E objects to the request on the grounds set forth in General Objections Nos. 1, 2, 5, 8 and 9. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

SDG&E does not currently have or provide photo data for risk events to Energy Safety.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

QUESTION 6

Under Initiatives, please provide Grid Hardening data, including Hardening Log, Hardening Point, and Hardening Line data. Inspection data is not requested at this time.

RESPONSE 6

Please see "SDGE_MGRA_OEIS_2022.gdb.zip"

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

QUESTION 7

Under Initiatives, please provide Other Initiative data for point, line, polygon features and the Other Initiative Log.

RESPONSE 7

Please see "SDGE_MGRA_OEIS_2022.gdb.zip"

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

QUESTION 8

Under Other Required Data, please provide Red Flag Warning Day polygon data.

RESPONSE 8

Please see "SDGE_MGRA_OEIS_2022.gdb.zip"

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

QUESTION 9

Please provide a layer indicating calculated circuit-level risk using the methodology presented in the WMP.

a. If independent probability and consequence layers exist, please provide these independently as well.

RESPONSE 9

Objection

SDG&E objects to the request on the grounds set forth in General Objections Nos. 2, 5, 8 and 9. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

SDG&E does not currently have or provide circuit-level risk information in a geodatabase format to Energy Safety as it has not yet fully developed this capability for its quarterly submissions. SDG&E currently plans to include this data with the next QDR submission to Energy Safety.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-01

Date Received: March 29, 2023
Date Submitted: April 3, 2022

END OF REQUEST

SDG&E – MGRA – Data Request Response 2

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-02

Date Received: April 17, 2023
Date Submitted: April 20, 2022

GENERAL OBJECTIONS

1. SDG&E objects generally to each request to the extent that it seeks information protected by the attorney-client privilege, the attorney work product doctrine, or any other applicable privilege or evidentiary doctrine. No information protected by such privileges will be knowingly disclosed.

2. SDG&E objects generally to each request that is overly broad and unduly burdensome. As part of this objection, SDG&E objects to discovery requests that seek "all documents" or "each and every document" and similarly worded requests on the grounds that such requests are unreasonably cumulative and duplicative, fail to identify with specificity the information or material sought, and create an unreasonable burden compared to the likelihood of such requests leading to the discovery of admissible evidence. Notwithstanding this objection, SDG&E will produce all relevant, non-privileged information not otherwise objected to that it is able to locate after reasonable inquiry.

3. SDG&E objects generally to each request to the extent that the request is vague, unintelligible, or fails to identify with sufficient particularity the information or documents requested and, thus, is not susceptible to response at this time.

4. SDG&E objects generally to each request that: (1) asks for a legal conclusion to be drawn or legal research to be conducted on the grounds that such requests are not designed to elicit facts and, thus, violate the principles underlying discovery; (2) requires SDG&E to do legal research or perform additional analyses to respond to the request; or (3) seeks access to counsel's legal research, analyses or theories.

5. SDG&E objects generally to each request to the extent it seeks information or documents that are not reasonably calculated to lead to the discovery of admissible evidence.

6. SDG&E objects generally to each request to the extent that it is unreasonably duplicative or cumulative of other requests.

7. SDG&E objects generally to each request to the extent that it would require SDG&E to search its files for matters of public record such as filings, testimony, transcripts, decisions, orders, reports or other information, whether available in the public domain or through FERC or CPUC sources.

8. SDG&E objects generally to each request to the extent that it seeks information or documents that are not in the possession, custody or control of SDG&E.

9. SDG&E objects generally to each request to the extent that the request would impose an undue burden on SDG&E by requiring it to perform studies, analyses or calculations or to create documents that do not currently exist.

10. SDG&E objects generally to each request that calls for information that contains trade secrets, is privileged or otherwise entitled to confidential protection by reference to statutory protection. SDG&E objects to providing such information absent an appropriate protective order.

II. EXPRESS RESERVATIONS

1. No response, objection, limitation or lack thereof, set forth in these responses and objections shall be deemed an admission or representation by SDG&E as to the existence or nonexistence of the requested information or that any such information is relevant or admissible.

2. SDG&E reserves the right to modify or supplement its responses and objections to each request, and the provision of any information pursuant to any request is not a waiver of that right.

3. SDG&E reserves the right to rely, at any time, upon subsequently discovered information.

4. These responses are made solely for the purpose of this proceeding and for no other purpose.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-02

Date Received: April 17, 2023
Date Submitted: April 20, 2022

QUESTION 1

Advanced Technologies:

Regarding the Advance Radio Frequency Sensors (ARFS) that "officially kicked off in 2022 after completing a 2 year demonstration" (p. 9):

a. Provide technical documentation on the ARFS.

b. Provide results of internal testing that led to the conclusion that the demonstration was successful and merits further development.

c. Please provide best estimates as to the risk reduction that this technology provides for an instrumented circuit.

d. Please provide 3 and 10 year estimations for deployment of this technology, including:

a) Percent of HFRA covered by the technology,
b) Percent of non-UG HFRA covered by the technology,
c) Estimates of total fraction of risk mitigated in the HFRA.

RESPONSE 1

SDG&E objects to the request on the grounds set forth in General Objections Nos. 2 and 8. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

a. ARFS use radio frequency monitoring of partial discharge from primary conductors to find, replace, and/or repair damaged components before they ultimately fail. Sensors are installed for each phase at 4-km intervals along a circuit extending from just outside the substation to the end of its furthest branches. Data is collected every second and backhauled on commercial cell communication networks to web servers. Software analysis eliminates spurious signals and isolates signals which are generated by the electrical facilities. Comparing the timing of the arrival of the signals at two adjacent installations (nodes) allows the location of the equipment generating the signal to be determined within 10 meters on the path between the nodes. The developer analyzes the data and provides monthly reports showing low-medium-high risk ratings for each structure on the path, allowing targeted inspections of the facilities to find the damaged equipment generating the signal.

   ARFS are a proprietary solution procured from IND.t, technical documentation for these sensors may be referenced on https://ind-technology.com/

b. The following items are examples of damage found as a result of Early Fault Detection (EFD) technology:

i. Broken ceramic insulator found and replaced that was not identified during routine patrols.

ii. Burned insulator found and replaced.

iii. Multiple wire splices with internal partial discharge found and replaced.

iv. Damaged insulator leaking to crossarm found and replaced.

v. Bird nest on buck pole found and removed.

vi. Bird-caged jumper found and replaced.

vii. Damaged conductor, loose (not broken) strand, deemed no structural damage by QEW.

viii. Bird-caged conductor found that was not identified during routine patrols; deemed no structural damage by QEW.

ix. Animal damage to dead-end insulator found and replaced.

x. Multiple instances of cosmetic wire slap damage to conductor; deemed no structural damage by electric troubleshooter.

c. Below is the risk reduction estimation for Early Fault Detection as presented in SDG&E's 2023-2025 WMP in Section 8.1.2.8.2 Early Fault Detection.

Calculation Component	Component Value
Risk Events Tier 3-5 yr avg (2017-2021)	104
Risk Events Tier 2-5 yr avg (2017-2021)	114.8
Risk Events 5 yr avg Ignition Tier 3	2.91%
Risk Events 5 yr avg Ignition Tier 2	2.55%
5 yr Avg Ignition Rate Tier 3	104 x 2.91% = 3.02
5 yr Avg Ignition Rate Tier 2	114.8 x 2.55% = 2.93
Ignition reduction estimate Tier 3	3.02 x 72% = 2.1776
Ignition reduction estimate Tier 2	2.93 x 72% = 2.1082
Mitigation Effectiveness	72%
Total units In The Network Tier 3	420
Total units In The Network Tier 2	810
Actuals to be repaired or replaced Tier 3	64
Actuals to be repaired or replaced Tier 2	116
Ignition Reduced Tier 3	(64 , 420) x 2.1776 = 0.3318
Ignition Reduced Tier 2	(116 , 810) x 2.1082 = 0.3019
Total Ignitions reduced	0.3318 + 0.3019 = 0.6337

d. 3- and 10-year estimations for deployment of this technology are as follows:

a) For years 2023-2025, it is estimated that 17% of the HFTD will be enabled with EFD technology, and 36% enabled over the next ten years.

b) The EFD program primarily focuses on overhead conductors. If the circuit contains a mix of OH and UG conductors a small percentage of UG conductors may be enabled. For years 2023-2025 it is estimated 16% of EFD deployments will cover non-UG HFTD circuits. The ten-year estimated total percentage is approximately 34%.

c) Refer to table in response C above for estimate of the total fraction of risk mitigated in the HFTD.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-02

Date Received: April 17, 2023
Date Submitted: April 20, 2022

QUESTION 2

Risk Analysis:

In OEIS Table 601: Summary of Risk Models, what are:

a. Maximum buildings destroyed,

b. Maximum acres affected per segment,

c. Max wind gust (specifically over which period(s)),

d. Wildfire adjustment factor, including algorithm/code to compute it.

RESPONSE 2

a. For WiNGS Planning, max ignition simulation 100th percentile buildings destroyed tied to a segment. This comes as an input from the Technosyla WRRM model

b. For WiNGS Planning, max ignition simulation 100th percentile acres burned tied to a segment. This comes as an input from the Technosyla WRRM model

c. For WiNGS Planning, maximum wind gust recorded gust at weather station associated to segment. Period is over entire weather history for the given segment's associated weather station.

d. Ignition adjustment factor that converts the circuit-segment ignition rate to wildfire rate.

$$Wildfire\ adjustment\ factor = \frac{1}{Wildfire\ Frequency * Annual\ HFTD\ Ignitions}$$

Where *Wildfire Frequency* is the frequency in years of expected wildfires occurring.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-02

Date Received: April 17, 2023
Date Submitted: April 20, 2022

QUESTION 3

Risk Analysis:

Regarding the Wind Gust Annual ignition rate (p. 68),

a. Over what period of time is the wind gust annual rate recorded?

b. Are wind gusts in this model restricted to those occurring during fire weather events (Santa Ana), or year round?

c. What facts, analysis, data, or references does SDG&E use to assume a baseline of "one catastrophic event every 15 years"? (p. 80)

RESPONSE 3

a. Period is over entire weather history for the given segment's associated weather station
b. Year round.
c. The analysis behind the assumption are detailed and can be referenced in SDGE's 2019 Risk Assessment Mitigation Phase (Chapter SDG&E-1), Wildfires Involving SDG&E Equipment, Section IV 'Risk Quantification', Sub-section B 'Source of Input'.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-02

Date Received: April 17, 2023
Date Submitted: April 20, 2022

QUESTION 4

Risk Analysis:

For SDG&E's calculation of Number of Serious Injuries and Fatalities (SIFs) per structure destroyed (p. 73), what data set does SDG&E use to arrive at this number, and does it include territories outside of SDG&E's service area?

RESPONSE 4

SDG&E estimates the Number of Serious Injuries and Fatalities (SIFs) per structure destroyed based on CALFIRE dataset (2010-2020) for all of California including fires outside of SDG&E's service territory.

Reference:

https://www.fire.ca.gov/incidents/

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-02

Date Received: April 17, 2023
Date Submitted: April 20, 2022

QUESTION 5

Risk Analysis:

In its climate change modeling, SDG&E uses a "Wildfire frequency adjustment to ignition rate based on the effect that climate change has on wildfire frequency," and that this is: "Based on Monte Carlo analysis, not standard climate change scenarios." Please provide a description, the documentation and workpapers leading to SDG&E's Monte-Carlo based climate change scenarios.

RESPONSE 5

SDG&E objects to the request on the grounds set forth in General Objections Nos. 2, 3, and 9. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

As part of the calibration process for the ignition rate, the WiNGS-Planning model is adjusted to account for future climate change scenarios. SDG&E's "Top-down" Enterprise Risk model incorporates Climate Change impacts by simulating numerous scenarios of the potential effect of extreme weather conditions. SDG&E currently assumes a triangular distribution to increase the likelihood of ignitions in its service territory, where distribution parameters are Subject Matter Estimates based on the references listed below.

SDG&E is currently working with industry experts, academia, government agencies, and other stakeholders to better understand and quantify the impact of Climate Change in its Wildfire and PSPS risk models. SDG&E will update its modeling assumptions based on the knowledge gained and feedback received during these collaborations.

References:

- https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf
- https://www.energy.ca.gov/sites/default/files/2019-11/Projections_CCCA4-CEC-2018-014_ADA.pdf
- https://iopscience.iop.org/article/10.1088/1748-9326/ab83a7#erlab83a7s3
- https://amir.eng.uci.edu/publications/20_ERL_SoCal_Fire.pdf

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-02

Date Received: April 17, 2023
Date Submitted: April 20, 2022

QUESTION 6

Risk Analysis:

Please provide the GIS data set used showing categorized circuit risk in Figure 6- 12, p. 83.

If this has already been provided in another form by SDG&E please direct us to the correct source.

RESPONSE 6

SDG&E objects to the request on the grounds set forth in General Objections Nos. 9. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

The GIS data displayed in Figure 6-12 is in flux and from an application that is in development using non-production GIS data. A production application is expected within the year with solidified data pipelines. Geospatial data of the WiNGS Planning risk scores is available upon request.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-02

Date Received: April 17, 2023
Date Submitted: April 20, 2022

QUESTION 7

Risk Analysis:

For the table OEIS Table 6-5, the summary of Top-Risk Circuits, Segments, or Spans, please provide a full table containing all circuits in the HFRA in Excel spreadsheet format and showing risk ranking, segment ID, Overall Wildfire and PSPS Risk Score, Wildfire Risk Score, and PSPS Risk Score.

RESPONSE 7

See attachment named "table_6_5_full_table_Question 7"

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-02

Date Received: April 17, 2023
Date Submitted: April 20, 2022

END OF REQUEST

SDG&E – MGRA – Data Request Response 3

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-03

Date Received: April 25, 2023
Date Submitted: April 28, 2022

GENERAL OBJECTIONS

1. SDG&E objects generally to each request to the extent that it seeks information protected by the attorney-client privilege, the attorney work product doctrine, or any other applicable privilege or evidentiary doctrine. No information protected by such privileges will be knowingly disclosed.

2. SDG&E objects generally to each request that is overly broad and unduly burdensome. As part of this objection, SDG&E objects to discovery requests that seek "all documents" or "each and every document" and similarly worded requests on the grounds that such requests are unreasonably cumulative and duplicative, fail to identify with specificity the information or material sought, and create an unreasonable burden compared to the likelihood of such requests leading to the discovery of admissible evidence. Notwithstanding this objection, SDG&E will produce all relevant, non-privileged information not otherwise objected to that it is able to locate after reasonable inquiry.

3. SDG&E objects generally to each request to the extent that the request is vague, unintelligible, or fails to identify with sufficient particularity the information or documents requested and, thus, is not susceptible to response at this time.

4. SDG&E objects generally to each request that: (1) asks for a legal conclusion to be drawn or legal research to be conducted on the grounds that such requests are not designed to elicit facts and, thus, violate the principles underlying discovery; (2) requires SDG&E to do legal research or perform additional analyses to respond to the request; or (3) seeks access to counsel's legal research, analyses or theories.

5. SDG&E objects generally to each request to the extent it seeks information or documents that are not reasonably calculated to lead to the discovery of admissible evidence.

6. SDG&E objects generally to each request to the extent that it is unreasonably duplicative or cumulative of other requests.

7. SDG&E objects generally to each request to the extent that it would require SDG&E to search its files for matters of public record such as filings, testimony, transcripts, decisions, orders, reports or other information, whether available in the public domain or through FERC or CPUC sources.

8. SDG&E objects generally to each request to the extent that it seeks information or documents that are not in the possession, custody or control of SDG&E.

9. SDG&E objects generally to each request to the extent that the request would impose an undue burden on SDG&E by requiring it to perform studies, analyses or calculations or to create documents that do not currently exist.

10. SDG&E objects generally to each request that calls for information that contains trade secrets, is privileged or otherwise entitled to confidential protection by reference to statutory protection. SDG&E objects to providing such information absent an appropriate protective order.

II. EXPRESS RESERVATIONS

1. No response, objection, limitation or lack thereof, set forth in these responses and objections shall be deemed an admission or representation by SDG&E as to the existence or nonexistence of the requested information or that any such information is relevant or admissible.

2. SDG&E reserves the right to modify or supplement its responses and objections to each request, and the provision of any information pursuant to any request is not a waiver of that right.

3. SDG&E reserves the right to rely, at any time, upon subsequently discovered information.

4. These responses are made solely for the purpose of this proceeding and for no other purpose.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-03

Date Received: April 25, 2023
Date Submitted: April 28, 2022

QUESTION 1

MGRA-3-1 SDG&E provided as an appendix a report authored by the San Diego Computing Center, which it used as its basis for Area for Continued Improvement SDGE-22-09.

a. Please provide the definition of "wind gust" used in the SDSC analysis.

b. Please provide the definition of "wind speed max" used in the SDSC analysis, differentiating it from "wind gust".

c. Please provide the definition of "wind speed mean" used in the SDSC analysis.

d. When SDG&E refers to "deltas between wind speed and wind gust" is it referring to delta between "wind speed max" and "wind gust" or "wind speed mean" and "wind gust".

e. Please provide a tabular or spreadsheet form of figure "Outage v/s Non-Outage wind speed %ile - 24h buckets all time".

f. Please provide a tabular or spreadsheet form of the figure "Outage v/s Non-Outage wind gust max %ile - 24h buckets all time".

g. Please provide a tabular or spreadsheet form of the figure "Outage v/s Non- Outage wind gust mean %ile - 24h buckets all time".

h. Please provide a tabular or spreadsheet form of the figure "Outage v/s Non- Outage wind gust delta max %ile - 24h buckets all time".

i. Please provide a tabular or spreadsheet form of the figure "Outage v/s Non- Outage wind gust delta mean %ile - 24h buckets all time".

RESPONSE 1

a. Wind gust is calculated through the wind speed and the UST variable from the forecast: wind_gust = wind_speed + 7.71*UST , where the value 7.71 was previously discussed with SDGE. Note that the UST variable in the WRF data is updated every hour.
b. "Wind speed max" is the maximum value of the wind speed in a 24h bucket. For an hourly updated model, there are 24 values corresponding to each hour of the day. "wind speed max" corresponds to the maximum of these 24 values. Please see the complete description of the process for calculating wind speed aggregated values in the

Methodology section. For each hour of the day, we can calculate the "wind gust", which is simply another variable.

c. "Wind speed mean" is the average value of the wind speed in a 24h bucket. It is calculated the same way we calculated "wind speed max", but we used the "mean" aggregation for the "wind speed mean". Please see the complete description of the process for calculating wind speed aggregated values in the Methodology section of the attached "Wind Analysis Report for SDG&E – DISTRIBUTED – April 2023.pdf"
d. Delta(wind speed, wind gust) refers to the delta between the max and mean aggregations (for each 24h bucket) of wind speed and wind gust. In other words, delta max refers to the delta between wind speed max and wind gust max, and delta mean refers to the delta between wind speed mean and wind gust mean. Please see the detailed description in the Delta (wind speed, wind gust) Analysis section of the attached "Wind Analysis Report for SDG&E – DISTRIBUTED – April 2023.pdf."

For responses e-i, please see "Wind Analysis Report – Supplemental Materials.zip."

e. See figure 3 Figure 3 - Outage wind speed max %ile - 24h buckets all time.csv & Figure 3- NonOutage wind speed max %ile - 24h buckets all time.csv
f. Please see Figure 17 - Outage wind gust max %ile - 24h buckets all time.csv & Figure 17 - NonOutage wind gust max %ile - 24h buckets all time.csv
g. Please see Figure 19 - Outage wind gust mean %ile - 24h buckets all time.csv & Figure19 - NonOutage wind gust mean %ile - 24h buckets all time.csv
h. Please see Figure 14 - Outage wind gust delta max %ile - 24h buckets all time.csv & Figure 14 - NonOutage wind gust delta max %ile - 24h buckets all time.csv
i. Please see Figure 15 - Outage wind gust delta mean %ile - 24h buckets all time.csv & Figure 15 - NonOutage wind gust delta mean %ile - 24h buckets all time.csv. Additionally, please see Please see Figure 5 - Outage wind speed mean %ile - 24h buckets all time.csv & Figure 5 - NonOutage wind speed mean %ile - 24h buckets all time.csv for outage vs non-outage wind speed mean.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-03

Date Received: April 25, 2023
Date Submitted: April 28, 2022

QUESTION 2

What would the overall system PSPS risk reduction be reduced to if the minimum threshold for de-energization was raised to:

a. 60 mph

b. 65 mph

c. 70 mph

RESPONSE 2

SDG&E objects to the request on the grounds set forth in General Objections Nos. 2, 3, and 9. Further, the request calls for speculation. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

The PSPS probabilities are currently derived by subject matter experts using their knowledge of local terrain and weather conditions. As a result, bracketing the PSPS threshold cannot be done in an automated and timely manner at this time. Sensitivity analyses are in the WiNGS Planning roadmap available in the 2023 WMP. A programmatic method of determining the PSPS thresholds, which would allow for sensitivity analysis of the PSPS threshold effect on PSPS risk reduction, will be evaluated in conjunction with the sensitivity analyses specified in the roadmap.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-03

Date Received: April 25, 2023
Date Submitted: April 28, 2022

QUESTION 3

On page D-29, SDG&E states that it "is awaiting the final Exponent report to be completed in April 2023 prior to re-evaluating the effectiveness of its Covered Conductor Program."

a. Is the Exponent report included in SDG&E's WMP the "final" Exponent report?

b. If not, please provide the final Exponent report upon availability.

RESPONSE 3

SDG&E objects to the request on the grounds set forth in General Objections Nos. 2, 9 and 10. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

a. The Exponent report for the study being performed by SDG&E was not included in SDG&E's WMP.
b. The report is currently expected to be delivered to SDG&E by the end of May.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-03

Date Received: April 25, 2023
Date Submitted: April 28, 2022

QUESTION 4
On page D-8, SDG&E states that "SDG&E has begun collaborating with RMS, a Moody's Analytics Company, to model and quantify the impact of long-term duration fires. SDG&E will review RMS's outputs and will evaluate the inclusion of these outputs in the WiNGS-Planning and WiNGS-Ops models in the 2023 to 2025 WMP cycle."

When are the results of this analysis expected to be available?

RESPONSE 4
SDG&E objects to the request on the grounds set forth in General Objections Nos. 2, 9 and 10. Further, the request calls for speculation. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

SDG&E plans to evaluate the inclusion of these outputs during our 2023 to 2025 WMP cycle and intends to share the progress of the evaluation in the WMP filing each year.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-03

Date Received: April 25, 2023
Date Submitted: April 28, 2022

QUESTION 5

For Ignition Rate Reduction tables (Table 8-29, MGRA-SDGE-2023WMP-02 Response),

a. when "Ignition Rates" are given are these annual ignition rates or are these ignition rates per the entire measurement period (ex. 2017-2021)?

b. when "Ignitions Reduced" is given are these annual ignitions or ignitions through the entire measurement period?

RESPONSE 5

a. Ignition Rates are the average yearly ignitions for the time period between 2017-2021.
b. Ignitions Reduced represents the number of ignitions that are reduced during the current WMP cycle 2023-2025.

MUSSEY GRADE ROAD ALLIANCE DATA REQUEST:
MGRA-SDGE-2023WMP-03

Date Received: April 25, 2023
Date Submitted: April 28, 2022

END OF REQUEST

SDG&E – MGRA – Data Request Response 4

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-04
SDG&E RESPONSE

Date Received: May 08, 2023
Date Submitted: May 12, 2023

GENERAL OBJECTIONS

1. SDG&E objects generally to each request to the extent that it seeks information protected by the attorney-client privilege, the attorney work product doctrine, or any other applicable privilege or evidentiary doctrine. No information protected by such privileges will be knowingly disclosed.

2. SDG&E objects generally to each request that is overly broad and unduly burdensome. As part of this objection, SDG&E objects to discovery requests that seek "all documents" or "each and every document" and similarly worded requests on the grounds that such requests are unreasonably cumulative and duplicative, fail to identify with specificity the information or material sought, and create an unreasonable burden compared to the likelihood of such requests leading to the discovery of admissible evidence. Notwithstanding this objection, SDG&E will produce all relevant, non-privileged information not otherwise objected to that it is able to locate after reasonable inquiry.

3. SDG&E objects generally to each request to the extent that the request is vague, unintelligible, or fails to identify with sufficient particularity the information or documents requested and, thus, is not susceptible to response at this time.

4. SDG&E objects generally to each request that: (1) asks for a legal conclusion to be drawn or legal research to be conducted on the grounds that such requests are not designed to elicit facts and, thus, violate the principles underlying discovery; (2) requires SDG&E to do legal research or perform additional analyses to respond to the request; or (3) seeks access to counsel's legal research, analyses or theories.

5. SDG&E objects generally to each request to the extent it seeks information or documents that are not reasonably calculated to lead to the discovery of admissible evidence.

6. SDG&E objects generally to each request to the extent that it is unreasonably duplicative or cumulative of other requests.

7. SDG&E objects generally to each request to the extent that it would require SDG&E to search its files for matters of public record such as filings, testimony, transcripts, decisions, orders, reports or other information, whether available in the public domain or through FERC or CPUC sources.

8. SDG&E objects generally to each request to the extent that it seeks information or documents that are not in the possession, custody or control of SDG&E.

9. SDG&E objects generally to each request to the extent that the request would impose an

undue burden on SDG&E by requiring it to perform studies, analyses or calculations or to create documents that do not currently exist.

10. SDG&E objects generally to each request that calls for information that contains trade secrets, is privileged or otherwise entitled to confidential protection by reference to statutory protection. SDG&E objects to providing such information absent an appropriate protective order.

II. EXPRESS RESERVATIONS

1. No response, objection, limitation or lack thereof, set forth in these responses and objections shall be deemed an admission or representation by SDG&E as to the existence or nonexistence of the requested information or that any such information is relevant or admissible.

2. SDG&E reserves the right to modify or supplement its responses and objections to each request, and the provision of any information pursuant to any request is not a waiver of that right.

3. SDG&E reserves the right to rely, at any time, upon subsequently discovered information.

4. These responses are made solely for the purpose of this proceeding and for no other purpose.

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-04
SDG&E RESPONSE

Date Received: May 08, 2023
Date Submitted: May 12, 2023

Ignition Model

Please provide technical description of the following elements of the Ignition Rate Normalization process:

QUESTION 1

For the Wind Adjustment Rate:

a. What is the algorithm and formula used to apply the wind adjustment rate?

b. What data was used to determine the wind adjustment rate?

c. Show the analysis that determined the algorithm and formula from the available data.
d. Show how the wind adjustment rate was validated to prove that it accurately represents the ignition rate.

RESPONSE 1
SDG&E objects to the request on the grounds set forth in General Objections Nos. 2 and 3. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

a. The generalized factor adjustment process implementation is depicted below:

$$Adj.Ignition\ Rate = Initial\ Ignition\ Rate \times Ignition\ Adj.Factor_i \times Normalization\ Factor_i$$

Where, Initial Ignition Rate is the initial ignition rate prior to implementation of adjustment factor *i*, Ignition Adj. Factor$_i$ is the adjustment factor metric tied to the adjustment factor *i,* Normalization Factor$_i$ is the normalization factor tied to adjustment factor *i,* Adj. Ignition Rate is the adjusted ignition rate after implementation of adjustment factor *i and i* is the specific adjustment factor (e.g., wind speed, tree strikes, etc.).

For the wind speed ignition adj. factor, the historical max wind speeds are categorized into four severity ranges and each given an assigned adjustment factor rate:

1. < 40 mph = 0.025
2. 40 – 50 mph = 0.075
3. 50 – 60 mph = 0.225
4. > 60 mph = 0.675

b. Historical max wind speeds from associated weather stations tied to each circuit-segment.

c. The generalized factor adjustment formula is devised using principles of weighted-sum modeling and factor-adjustment parametrization. The severity range bucketing and associated adjustment factor variables tied to each were informed by subject matter expert guidance.

Note: The overall methodology for the WiNGS Planning ignition rate is currently undergoing evaluation for improvement. The current WiNGS Planning ignition rate methodology is based on the original methodology that was chosen by the development team during conception of the model. This methodology was retained during the WiNGS platform cut-over from Excel to Python/AWS to make sure output was as consistent as possible between architectural changes.

d. Unit test verification steps are performed within the model to ensure that the normalization for each ignition rate adjustment step is performed correctly. Ad-hoc analysis by modeling team has shown positive correlation between ignition rates and wind speeds, as intended. Furthermore, a thorough third-party review has been performed on the WiNGS-Planning model and completed in 2023, which reviewed and evaluated the validity of the modeling steps within the model, including the Ignition Rate Normalization Factor Sub-Model and found that the model is a robust model which meets user needs and performs the function for which it was designed. The third party review found no high-severity issues that could change the output of the model. The WiNGS model output is furthermore scrutinized for validity by scoping engineers via the Desktop Feasibility Study, which is implemented during the project scoping process.

Note: Section 6.7 of SDG&E's WMP details the roadmap for formalizing the WiNGS Planning model's validation process.

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-04
SDG&E RESPONSE

Date Received: May 08, 2023
Date Submitted: May 12, 2023

QUESTION 2

For the Vegetation Adjustment Rate:

a. What is the algorithm and formula used to apply the vegetation adjustment rate?

b. What data was used to determine the vegetation adjustment rate?

c. Show the analysis that determined the algorithm and formula from the available data.

d. Show how the vegetation adjustment rate was validated to prove that it accurately represents the ignition rate.

RESPONSE 2

SDG&E objects to the request on the grounds set forth in General Objections Nos. 2 and 3. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

a. The generalized factor adjustment process implementation is depicted below:

$$Adj.Ignition\ Rate = Initial\ Ignition\ Rate \times Ignition\ Adj.Factor_i \times Normalization\ Factor_i$$

Where, Initial Ignition Rate is the initial ignition rate prior to implementation of adjustment factor *i*, Ignition Adj. Factor$_i$ is the adjustment factor metric tied to the adjustment factor *i,* Normalization Factor$_i$ is the normalization factor tied to adjustment factor *i,* Adj. Ignition Rate is the adjusted ignition rate after implementation of adjustment factor *i and i* is the specific adjustment factor (e.g., wind speed, tree strikes, etc.).

The tree strike ignition adj. factor = $\frac{segment\ tree\ strike\ potential\ count}{segment\ OH\ miles}$

where a potential tree strike is a tree that is within contact-range proximity of the OH line.

b. The Veg Management tree inventory points as well as Circuit Segment line features were used to create the tree strike data.

c. The generalized factor adjustment formula is devised using principles of weighted-sum modeling and factor-adjustment parametrization. The associated adjustment factor variables tied to each were informed by subject matter expert guidance.

Note: The overall methodology for the WiNGS Planning ignition rate is currently undergoing evaluation for improvement. The current WiNGS Planning ignition rate methodology is based on the original methodology that was chosen by the development

team during conception of the model. This methodology was retained during the WiNGS platform cut-over from Excel to Python/AWS to make sure output was as consistent as possible between architectural changes.

d. Unit test verification steps are performed within the model to ensure that the normalization for each ignition rate adjustment step is performed correctly. Ad-hoc analysis by modeling team has shown positive correlation between ignition rates and potential tree strikes per OH miles, as intended. Furthermore, a thorough third-party review has been performed on the WiNGS-Planning model and completed in 2023, which reviewed and evaluated the validity of the modeling steps within the model, including the Ignition Rate Normalization Factor Sub-Model and found that the model is a robust model which meets user needs and performs the function for which it was designed. The third party found no high-severity issues that could change the output of the model. The WiNGS model output is furthermore scrutinized for validity by scoping engineers via the Desktop Feasibility Study, which is implemented during the project scoping process.

   Note: Section 6.7 of SDG&E's WMP details the roadmap for formalizing the WiNGS Planning model's validation process.

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-04
SDG&E RESPONSE

Date Received: May 08, 2023
Date Submitted: May 12, 2023

QUESTION 3

For the Asset Health Adjustment Rate:

a. What is the algorithm and formula used to apply the asset health adjustment rate?

b. What data was used to determine the asset health adjustment rate?

c. Show the analysis that determined the algorithm and formula from the available data.

d. Show how the asset health adjustment rate was validated to prove that it accurately represents the ignition rate.

RESPONSE 3

SDG&E objects to the request on the grounds set forth in General Objections Nos. 2 and 3. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

a. The generalized factor adjustment process implementation is depicted below:

$$Adj.Ignition\ Rate = Initial\ Ignition\ Rate \times Ignition\ Adj.Factor_i \times Normalization\ Factor_i$$

Where, Initial Ignition Rate is the initial ignition rate prior to implementation of adjustment factor *i*, Ignition Adj. Factor$_i$ is the adjustment factor metric tied to the adjustment factor *i,* Normalization Factor$_i$ is the normalization factor tied to adjustment factor *i,* Adj. Ignition Rate is the adjusted ignition rate after implementation of adjustment factor *i and i* is the specific adjustment factor (e.g., wind speed, tree strikes, etc.).

The Asset Health adj. factor =

$$\left(\frac{2*(Segment\ avg\ conductor\ age)}{avg\{Segment\ avg\ conductor\ age_1,\ Segment\ avg\ conductor\ age_2,\ldots,Segment\ avg\ conductor\ age_n\}}\right) + \left(\frac{Segment\ chi}{\{Segment\ chi_1,\ Segment\ chi_2,\ldots,Segment\ chi_n\}}\right)$$

Where CHI is the Circuit Health Index and *n* is the count of segments in the model scope.

b. Primary Overhead Conductor, Overhead Structure data from GIS Electric production database

c. The generalized factor adjustment formula is devised using principles of weighted-sum modeling and factor-adjustment parametrization. The associated adjustment factor variables tied to each were informed by subject matter expert guidance.

Note: The overall methodology for the WiNGS Planning ignition rate is currently undergoing evaluation for improvement. The current WiNGS Planning ignition rate methodology is based on the original methodology that was chosen by the development team during conception of the model. This methodology was retained during the WiNGS platform cut-over from Excel to Python/AWS to make sure output was as consistent as possible between architectural changes.

d. Unit test verification steps are performed within the model to ensure that the normalization for each ignition rate adjustment step is performed correctly. Ad-hoc analysis by modeling team has shown positive correlation between ignition rates and the asset health attributes, as intended. Furthermore, a thorough third-party review has been performed on the WiNGS-Planning model and completed in 2023, which reviewed and evaluated the validity of the modeling steps within the model, including the Ignition Rate Normalization Factor Sub-Model and found that the model is a robust model which meets user needs and performs the function for which it was designed. The third party found no high-severity issues that could change the output of the model. The WiNGS model output is furthermore scrutinized for validity by scoping engineers via the Desktop Feasibility Study, which is implemented during the project scoping process.

   Note: Section 6.7 of SDG&E's WMP details the roadmap for formalizing the WiNGS Planning model's validation process.

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-04
SDG&E RESPONSE

Date Received: May 08, 2023
Date Submitted: May 12, 2023

QUESTION 4

For the Significant Wildfire Adjustment Rate:

a. What is the algorithm and formula used to apply the significant wildfire adjustment rate?

b. What data was used to determine the significant wildfire adjustment rate?

c. Show the analysis that determined the algorithm and formula from the available data.

d. Show how the significant wildfire adjustment rate was validated to prove that it accurately represents the ignition rate.

RESPONSE 4

SDG&E objects to the request on the grounds set forth in General Objections Nos. 2 and 3. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

a. The factor adjustment process implementation is depicted below:

$$Wildfire\ Rate = Initial\ Ignition\ Rate \times SigWF\ Adj.Factor$$

Where, Initial Ignition Rate is the initial ignition rate prior to implementation of the adjustment factor, SigWF Adj. Factor is the adjustment factor metric, Wildfire Rate is the adjusted wildfire rate after implementation of the adjustment factor.

$$SigWF\ Adj.Factor = \frac{1}{(Wildfire\ Frequency \times Annual\ HFTD\ Ign\ Rate)}$$

Where wildfire frequency is represented in years, and Annual HFTD Ign Rate is the rate of ignition per year in the HFTD.

b. See RAMP 2019, section IV, B. "Sources of Input"
c. See RAMP 2019 ,section IV, B. "Sources of Input"
d. See RAMP 2019 , section IV, B. "Sources of Input"

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-04
SDG&E RESPONSE

Date Received: May 08, 2023
Date Submitted: May 12, 2023

QUESTION 5

For the Hardening Adjustment Rate:

a. What is the algorithm and formula used to apply the hardening adjustment rate?

b. What data was used to determine the hardening adjustment rate?

c. Show the analysis that determined the algorithm and formula from the available data.

d. Show how the hardening adjustment rate was validated to prove that it accurately represents the ignition rate.

RESPONSE 5

SDG&E objects to the request on the grounds set forth in General Objections Nos. 2 and 3. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

a. The factor adjustment process implementation is depicted below:

$$Adj.Wildfire\ Rate = \ Initial\ Wildfire\ Rate \times Pct\ Hardening_i \times (1 - Ign\ Effect\ Rate_i)$$

Where, Initial Wildfire Rate is the initial wildfire rate prior to implementation of the adjustment factor, $Pct\ Hardening_i$ is the percentage of segment hardening of hardening type *i,* $Ign\ Effect\ Rate_i$ is the effectiveness rate of hardening type *i,* and *i* is the hardening state type.

b. Primary Overhead Conductor, Overhead Structure data from GIS Electric production database

c. The generalized factor adjustment formula is devised using principles of weighted-sum modeling and factor-adjustment parametrization. The associated effectiveness rates tied to each hardening type were informed by subject matter expert guidance and/or efficacy studies.

   Note: The overall methodology for the WiNGS Planning ignition rate is currently undergoing evaluation for improvement. The current WiNGS Planning ignition rate methodology is based on the original methodology that was chosen by the development team during conception of the model. This methodology was retained during the WiNGS platform cut-over from Excel to Python/AWS to make sure output was as consistent as possible between architectural changes.

d. Efficacy studies and/or subject matter expert guidance has been utilized to assess the effectiveness rates that go into adjusting the ignition rate for the hardening state.

Additionally, a thorough third-party review was performed on the WiNGS-Planning model and completed in 2023, which reviewed and evaluated the validity of the modeling steps within the model, including the Ignition Rate Normalization Factor Sub-Model and found that the model is a robust model which meets user needs and performs the function for which it was designed. The third party found no high-severity issues that could change the output of the model. The WiNGS model output is furthermore scrutinized for validity by scoping engineers via the Desktop Feasibility Study, which is implemented during the project scoping process.

Note: Section 6.7 of SDG&E's WMP details the roadmap for formalizing the WiNGS Planning model's validation process.

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-04
SDG&E RESPONSE

Date Received: May 08, 2023
Date Submitted: May 12, 2023

END OF REQUEST

SDG&E – MGRA – Data Request Response 6

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-06
SDG&E RESPONSE

Date Received: May 19, 2023
Date Submitted: May 24, 2023

GENERAL OBJECTIONS

1. SDG&E objects generally to each request to the extent that it seeks information protected by the attorney-client privilege, the attorney work product doctrine, or any other applicable privilege or evidentiary doctrine. No information protected by such privileges will be knowingly disclosed.

2. SDG&E objects generally to each request that is overly broad and unduly burdensome. As part of this objection, SDG&E objects to discovery requests that seek "all documents" or "each and every document" and similarly worded requests on the grounds that such requests are unreasonably cumulative and duplicative, fail to identify with specificity the information or material sought, and create an unreasonable burden compared to the likelihood of such requests leading to the discovery of admissible evidence. Notwithstanding this objection, SDG&E will produce all relevant, non-privileged information not otherwise objected to that it is able to locate after reasonable inquiry.

3. SDG&E objects generally to each request to the extent that the request is vague, unintelligible, or fails to identify with sufficient particularity the information or documents requested and, thus, is not susceptible to response at this time.

4. SDG&E objects generally to each request that: (1) asks for a legal conclusion to be drawn or legal research to be conducted on the grounds that such requests are not designed to elicit facts and, thus, violate the principles underlying discovery; (2) requires SDG&E to do legal research or perform additional analyses to respond to the request; or (3) seeks access to counsel's legal research, analyses or theories.

5. SDG&E objects generally to each request to the extent it seeks information or documents that are not reasonably calculated to lead to the discovery of admissible evidence.

6. SDG&E objects generally to each request to the extent that it is unreasonably duplicative or cumulative of other requests.

7. SDG&E objects generally to each request to the extent that it would require SDG&E to search its files for matters of public record such as filings, testimony, transcripts, decisions, orders, reports or other information, whether available in the public domain or through FERC or CPUC sources.

8. SDG&E objects generally to each request to the extent that it seeks information or documents that are not in the possession, custody or control of SDG&E.

9. SDG&E objects generally to each request to the extent that the request would impose an undue burden on SDG&E by requiring it to perform studies, analyses or calculations or to create documents that do not currently exist.

10. SDG&E objects generally to each request that calls for information that contains trade secrets, is privileged or otherwise entitled to confidential protection by reference to statutory protection. SDG&E objects to providing such information absent an appropriate protective order.

II. EXPRESS RESERVATIONS

1. No response, objection, limitation or lack thereof, set forth in these responses and objections shall be deemed an admission or representation by SDG&E as to the existence or nonexistence of the requested information or that any such information is relevant or admissible.

2. SDG&E reserves the right to modify or supplement its responses and objections to each request, and the provision of any information pursuant to any request is not a waiver of that right.

3. SDG&E reserves the right to rely, at any time, upon subsequently discovered information.

4. These responses are made solely for the purpose of this proceeding and for no other purpose.

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-06
SDG&E RESPONSE

Date Received: May 19, 2023
Date Submitted: May 24, 2023

Ignition Model

SDG&E stated that: "Furthermore, a thorough third-party review has been performed on the WiNGS-Planning model and completed in 2023, which reviewed and evaluated the validity of the modeling steps within the model, including the Ignition Rate Normalization Factor Sub-Model."

QUESTION 1

Please provide a non-confidential version of the third-party review completed in 2023 which reviewed and evaluated the validity of the modeling steps within the model, including evaluation of all sub-models.

RESPONSE 1

SDG&E objects to the request on the grounds set forth in General Objections Nos. 1, 5, and 10. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

See attached file "WiNGS-Planning_Report_Final_2023_5_23.pdf."

MUSSEY GRADE OFFICE DATA REQUEST:
MGRA-SDGE-2023WMP-06
SDG&E RESPONSE

Date Received: May 19, 2023
Date Submitted: May 24, 2023

END OF REQUEST

PG&E – MGRA – Data Request Response 1

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_001-Q001-009		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_001-Q001-009		
Request Date:	March 29, 2023	Requester DR No.:	MGRA-PGE-WMP23_ DataRequest1
Date Sent:	April 7, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

QUESTION 001

Please provide for Asset Point data for Camera, Fuse, Support Structure, and Weather Station.

QUESTION 002

Provide Asset Line data for Transmission Line (as permitted as non-confidential), Primary Distribution Line, and Secondary Distribution Line.

QUESTION 003

Provide PSPS Event data. Include Event Log, Event Line, Event Polygon data. Please exclude customer meter data. Provide all PSPS Event Asset Damage data including photos.

QUESTION 004

Provide Risk Event Point data, including Wire Down, Ignition, Transmission unplanned outage (as classified non-confidential), Distribution Unplanned Outage data, Distribution Vegetation Caused Unplanned Outage, Risk Event Asset Log.

QUESTION 005

Provide photo data for Risk Events.

QUESTION 006

Under Initiatives, please provide Grid Hardening data, including Hardening Log, Hardening Point, and Hardening Line data. Inspection data is not requested at this time.

QUESTION 007

Under Initiatives, please provide Other Initiative data for point, line, polygon features and the Other Initiative Log.

QUESTION 008

Under Other Required Data, please provide Red Flag Warning Day polygon data.

QUESTION 009

Please provide a layer indicating calculated circuit-level risk using the methodology presented in the WMP.

a. If independent probability and consequence layers exist, please provide these independently as well.

GENERAL LIMITATIONS ON DATA PROVIDED IN RESPONSE TO THIS REQUEST

In response to requests 1 through 8 of this set of data requests, PG&E is providing non-confidential data from the Q4 2022 Office of Energy Infrastructure and Safety (Energy Safety) Geographic Information System (GIS) Data Standard submission. Due to the high volume of records in our Q4 2022 submission (approximately 11.8 million records), individual record review for confidential data is not feasible nor practical. The feature classes and related tables included in the submission are not static and change each quarter. Additionally, the interconnected aspect of feature class data and geospatial representation of the data creates complexities in identifying the confidentiality of individual records and introduces additional risk for error. PG&E is applying confidentiality designations at the feature class and field level, dependent on the subject data, to help mitigate against the risk of mislabeling individual records. Batch analysis was used to identify non-confidential records. Since this data request response includes over 3 million records, quality checks of each record individually for confidential data have not been performed. As such, PG&E respectfully requests that MGRA use this data for internal purposes only and restrict access to a need-to-know basis. Since ignition photos contain images of critical energy infrastructure, if combined with other feature classes and related tables, data keys enable the user to see the specific location of these assets and are therefore confidential. Please see attachment "WMP-Discovery2023_DR_MGRA_001-Q001-008Atch01.zip" for the data provided in response to this data request.

ANSWER 001

In response to this request, PG&E is providing Camera and Weather Station data, as delivered in the Q4 2022 OEIS GIS Data Standard Submission. PG&E is also providing non-confidential data from the Support Structure feature class. PG&E is not providing data for the Fuse feature class as this data is confidential critical energy infrastructure information (CEII).

ANSWER 002

In response to this request, PG&E is providing non-confidential data for the Primary and Secondary Distribution Line Feature Classes. PG&E is not providing the Transmission Line feature class because it is confidential CEII.

ANSWER 003

In response to this request, PG&E is unable to provide PSPS Event data, PSPS Event Damages data, and PSPS Damage photos since there were no PSPS Events that took place throughout 2022.

ANSWER 004

In response to this request, PG&E is providing non-confidential data for the Wire Down, Ignition, Transmission Unplanned Outage, Distribution Unplanned Outage, Distribution Vegetation Caused Unplanned Outage, and Risk Event Asset Log feature classes and related table.

ANSWER 005

PG&E does not have any non-confidential or non-privileged data to provide in response to this request. The photos provided in this feature class may be subject to attorney-client privilege or the work product doctrine and may be subject to an ongoing investigation. Additionally, PG&E risk event photos are confidential CEII because they reveal physical facility and critical infrastructure locations.

ANSWER 006

In response to this request, PG&E is providing non-confidential data for the System Hardening, Butte County Rebuild, and 10K Undergrounding WMP initiative programs that were included in the Grid Hardening Log, Grid Hardening Point, and Grid Hardening Line feature classes and related table. Additional initiative projects reported in these feature classes includes data on where PG&E's fuse replacements, switch replacements, surge arrester replacements, and SCADA enabled work has been performed, and where future work is planned to take place. These are confidential CEII because they reveal physical facility and critical infrastructure locations. As such, have been removed from the response.

ANSWER 007

In response to this request, PG&E is providing WMP initiative program data for the Weather Station Installation and Optimization and Camera Installation that were included in the Other Initiative Log and Other Initiative Point related table and feature class. Additional WMP initiative projects reported in this feature class and related table includes data on where PG&E's Line Sensor Installations, Distribution Fault Anticipation, EPSS Reliability Improvements and Early Fault Detection Sensors work

have been performed, and where future work is planned to take place. These items are confidential CEII because they reveal physical facility and critical infrastructure locations.

ANSWER 008

PG&E is providing the Red Flag Warning Day polygon data, as requested by MGRA.

ANSWER 009

The method described in the 2023 WMP to aggregate model results is conducted to produce a circuit segment level risk value but it is not used to produce a circuit level risk value. However, the geospatial representation of circuit segments that would be provided in response to this data request involves the identification of CEII, which we are required by law to maintain as confidential and cannot produce without the requesting party agreeing to protect the information through a non-disclosure agreement.

PG&E – MGRA – Data Request Response 2

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_002-Q001		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_002-Q001		
Request Date:	April 20, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.2
Date Sent:	April 25, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

REFCL

With regard to PG&E's response to CalPA_Set WMP-11_Q14: PG&E states that one of the significant changes to the grid required for REFCL is "The replacement of old, direct bury underground cable":

QUESTION 001

Please explain the incompatibility of "old, direct bury underground cable" with REFCL.

ANSWER 001

During the demonstration project, we reviewed primary distribution equipment insulation ratings. During REFCL operation, line-to-ground voltage increases by 1.7 times, so the equipment must be able to withstand this increased voltage. A long run of old (1970 build), direct bury underground cable was identified during the review. The cable was tested for concentric neutral resistance and tan delta. The cable sections did not pass the tests and would likely fail during REFCL operation, so the cable sections were replaced. Underground cable replacements like this may be needed before a REFCL can be put into service for a given distribution substation.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_002-Q002		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_002-Q002		
Request Date:	April 20, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.2
Date Sent:	April 25, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

REFCL

With regard to PG&E's response to CalPA_Set WMP-11_Q14: PG&E states that one of the significant changes to the grid required for REFCL is "The replacement of old, direct bury underground cable":

QUESTION 002

Does PG&E have any recently undergrounded segments that are also "direct bury"? If so would these be incompatible with REFCL?

ANSWER 002

Direct bury of underground cable, meaning laying the cable directly in a dirt trench and not inside a conduit, is not a standard, approved design for our underground electric distribution system at this point in time. As such, no, we have not recently undergrounded any electric distribution segments via direct bury. The direct bury underground cable design itself would not be incompatible with REFCL, however, many direct bury underground cable installations are old and the cable insulation may not withstand the 1.7 times normal line-to-ground voltages required during REFCL operation.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_002-Q003		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_002-Q003		
Request Date:	April 20, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.2
Date Sent:	April 25, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

REFCL

With regard to PG&E's response to CalPA_Set WMP-11_Q14: PG&E states that one of the significant changes to the grid required for REFCL is "The replacement of old, direct bury underground cable":

QUESTION 003

Does PG&E's future undergrounding plans include "direct bury" and if so would that make these segments incompatible with REFCL?

ANSWER 003

No, PG&E's undergrounding plans include cable in conduit with standard voltage ratings exceeding REFCL operating voltage.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_002-Q004		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_002-Q004		
Request Date:	April 20, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.2
Date Sent:	April 25, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

Risk Models

Please provide non-confidential versions of the following documents:

QUESTION 004

WMP-Discovery2023_DR_OEIS_001-Q007Atch02CONF.pdf

ANSWER 004

Please see *"WMP-Discovery2023_DR_OEIS_001-Q007Atch02_Redacted.pdf."*

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_002-Q005		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_002-Q005		
Request Date:	April 20, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.2
Date Sent:	April 25, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

Risk Models

Please provide non-confidential versions of the following documents:

QUESTION 005

WMP-Discovery2023_DR_OEIS_001-Q007Atch03CONF.pdf

ANSWER 005

Please see *"WMP-Discovery2023_DR_OEIS_001-Q007Atch03_Redacted.pdf."*

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_002-Q006		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_002-Q006		
Request Date:	April 20, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.2
Date Sent:	April 25, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

Risk Models

Please provide non-confidential versions of the following documents:

QUESTION 006

WMP-Discovery2023_DR_OEIS_001-Q007Atch04CONF.pdf

ANSWER 006

Please see *"WMP-Discovery2023_DR_OEIS_001-Q007Atch04_Redacted.pdf."*

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_002-Q007		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_002-Q007		
Request Date:	April 20, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.2
Date Sent:	April 25, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

EPSS

QUESTION 007

Please provide a GIS file of 2022 outages occurring on circuits where EPSS was enabled.

ANSWER 007

The method of providing a geospatial file with the location of 2022 outages on EPSS enabled circuits would require the disclosure of device location and therefore the geospatial representation of outage location that would be provided in this response to this data request involves the identification of Critical Energy Infrastructure Information (CEII), which we are required by law to maintain as confidential and cannot produce without the requesting party agreeing to protect the information through a non-disclosure agreement.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_002-Q008		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_002-Q008		
Request Date:	April 20, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.2
Date Sent:	April 25, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

EPSS

QUESTION 008

Please provide a GIS file of 2022 ignitions occurring on circuits where EPSS was enabled.

ANSWER 008

Please see *"WMP-Discovery2023_DR_MGRA_002-Q008Atch01.kmz."*

PG&E – MGRA – Data Request Response 4

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_004-Q001		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_004-Q001		
Request Date:	April 28, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.4
Date Sent:	May 3, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

SUBJECT: WDRM DATA:

Attachment 2023-03-27_PGE_2023_WMP _R1_Appendix C _Atch01\Section_6.gdb contains potentially useful risk information in an aggregated format. I believe that this is "6.4.1.1 Geospatial Maps of Top-Risk Areas within HFRA" However there are certain features that prevent its effective use:

- The risk data is not provided in numeric format, but in a percentile bin. This binning seems not to be accurate, since virtually all circuits fall under the "Lowest Risk" categories, making it impossible to differentiate circuit risk.
- There is considerably more visible distribution line in the "PrimaryDistributionLine" GIS data than is evident in the Section 6 file.
- "Hot pixels" appear in the data of higher risk, isolated from the rest of the distribution system.

Please the provide additional information and data to support the use of this file:

QUESTION 001

Please provide a description of how the data was created, and from which version of WDRM. Please provide a description of how risk data was assigned to the 100 meter square polygons that make up the layer, specifically if it is an average over the risk scores of the components within the area.

ANSWER 001

Section 6.4.1.1 is provided in response to Energy Safety's 2023-2025 WMP guidelines which requested a geospatial risk map with risk levels presented in three layers as the top 5%, 5% to 20%, and bottom 80% within the HFRA. PG&E provided a more detailed presentation of risk layers than requested. For this reason, the numeric risk value is not provided as it was not requested.

The data provided in Attachment 2023-03-27_PGE_2023_WMP_R1_Appendix C_Atch01\Section_6.gdb is from the Wildfire Distribution Risk Model v3. The risk values for each 100m x 100m pixel are the System Hardening composite value. As described in section 6.2.2.3, pages 171 and 172 in PG&E's 2023-2025 WMP, the pixel level risk value is the product of the cumulative probability of all risk drivers in that pixel and the wildfire consequence.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_004-Q002		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_004-Q002		
Request Date:	April 28, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.4
Date Sent:	May 3, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

SUBJECT: WDRM DATA:

Attachment 2023-03-27_PGE_2023_WMP _R1_Appendix C _Atch01\Section_6.gdb contains potentially useful risk information in an aggregated format. I believe that this is "6.4.1.1 Geospatial Maps of Top-Risk Areas within HFRA" However there are certain features that prevent its effective use:

- The risk data is not provided in numeric format, but in a percentile bin. This binning seems not to be accurate, since virtually all circuits fall under the "Lowest Risk" categories, making it impossible to differentiate circuit risk.
- There is considerably more visible distribution line in the "PrimaryDistributionLine" GIS data than is evident in the Section 6 file.
- "Hot pixels" appear in the data of higher risk, isolated from the rest of the distribution system.

Please the provide additional information and data to support the use of this file:

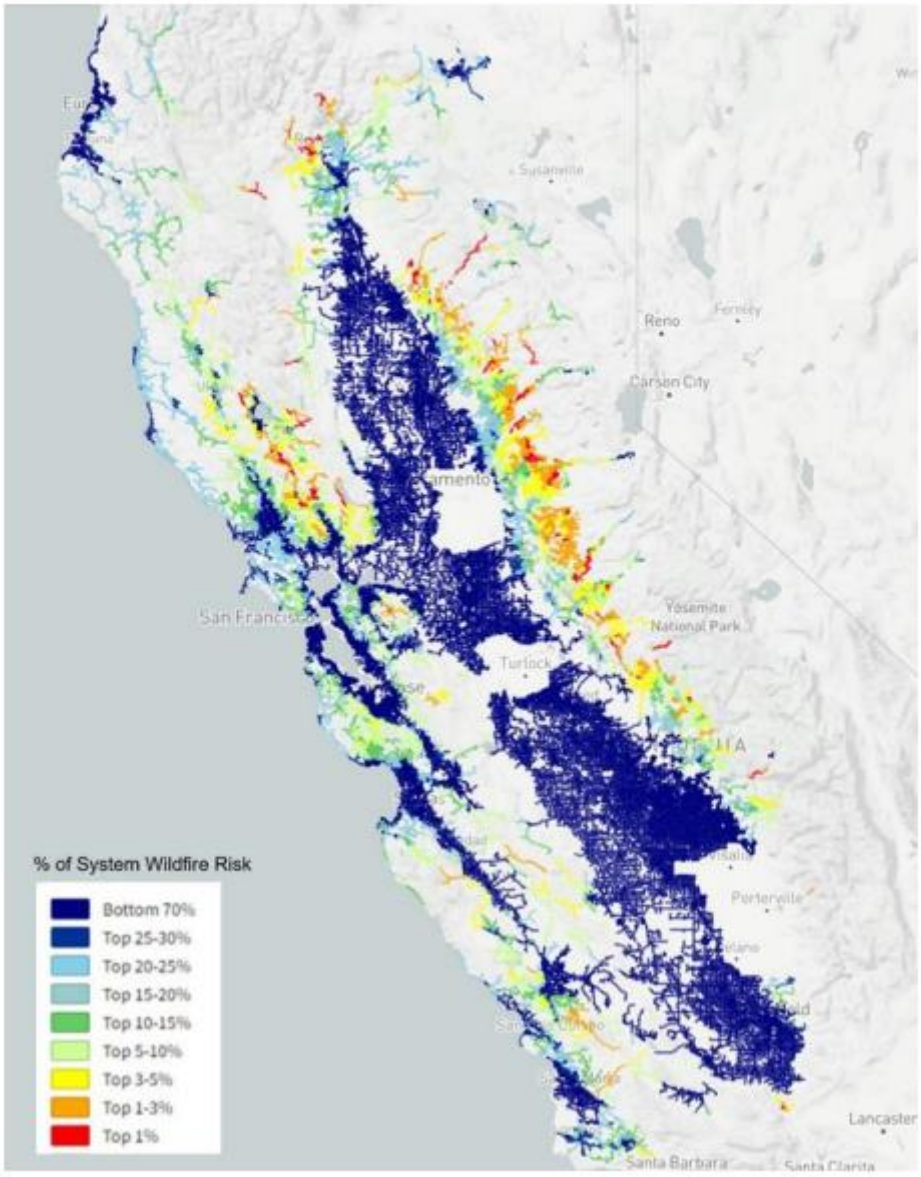
QUESTION 002

Explain why the vast majority of the polygons show low risk (<25%), and why high risk polygons (>70%) are very rare.

ANSWER 002

PG&E objects to this question as vague. Subject to and without waiving this objection, PG&E responds as follows: High risk polygons are rarer than low risk polygons as the highest wildfire risk is concentrated. This distribution of risk can be seen in Figure 6.2.2-11.

FIGURE PG&E-6.2.2-11:
SYSTEM HARDENING COMPOSITE RISK



PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_004-Q004		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_004-Q004		
Request Date:	April 28, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.4
Date Sent:	May 3, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

SUBJECT: WDRM DATA:

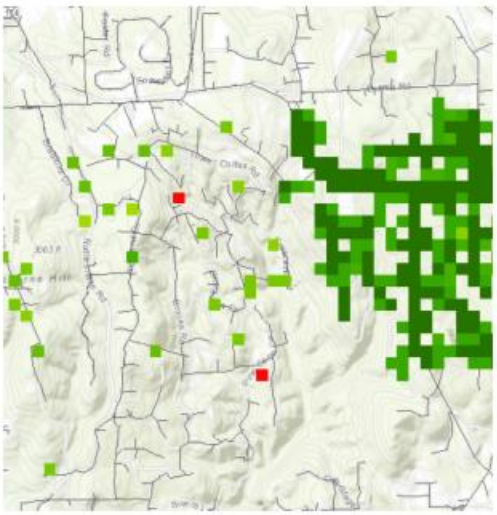
Attachment 2023-03-27_PGE_2023_WMP_R1_Appendix C_Atch01\Section_6.gdb contains potentially useful risk information in an aggregated format. I believe that this is "6.4.1.1 Geospatial Maps of Top-Risk Areas within HFRA" However there are certain features that prevent its effective use:

- The risk data is not provided in numeric format, but in a percentile bin. This binning seems not to be accurate, since virtually all circuits fall under the "Lowest Risk" categories, making it impossible to differentiate circuit risk.
- There is considerably more visible distribution line in the "PrimaryDistributionLine" GIS data than is evident in the Section 6 file.
- "Hot pixels" appear in the data of higher risk, isolated from the rest of the distribution system.

Please the provide additional information and data to support the use of this file:

QUESTION 004

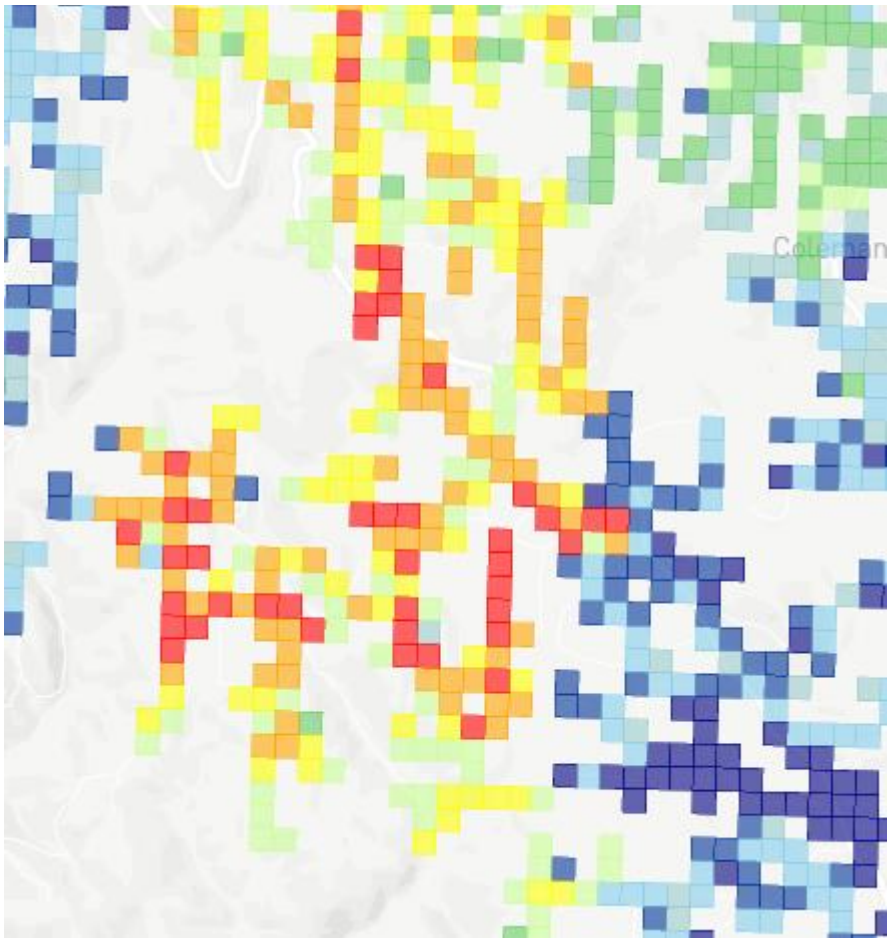
Please explain why isolated "hot polygons" appear in the data, as shown below, and whether these represent actual risk or an artifact.



The issues identified above make this data set of little use for analysis of PG&E' risk model However, minor modifications should make it more than satisfactory for this purpose.

ANSWER 004

It is difficult to determine the location of the provided example based on the information provided. Orphaned pixels, such as those shown in the example, may result from missing pixels due to incomplete data or processing of the data. At the pixel-by-pixel level, the model does exhibit some level of noise that can result in high-risk hot spots in an area of generally lower risk pixels . As seen in the example below, low risk and high-risk pixels can mix locally. For this reason, workplan development is generally guided by circuit segment level aggregations that provide an improved indication of risk level.



PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_004-Q006		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_004-Q006		
Request Date:	April 28, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.4
Date Sent:	May 3, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

SUBJECT: WDRM DATA:

Attachment 2023-03-27_PGE_2023_WMP_R1_Appendix C_Atch01\Section_6.gdb contains potentially useful risk information in an aggregated format. I believe that this is "6.4.1.1 Geospatial Maps of Top-Risk Areas within HFRA" However there are certain features that prevent its effective use:

- The risk data is not provided in numeric format, but in a percentile bin. This binning seems not to be accurate, since virtually all circuits fall under the "Lowest Risk" categories, making it impossible to differentiate circuit risk.
- There is considerably more visible distribution line in the "PrimaryDistributionLine" GIS data than is evident in the Section 6 file.
- "Hot pixels" appear in the data of higher risk, isolated from the rest of the distribution system.

Please the provide additional information and data to support the use of this file:

QUESTION 006

If the risk score for each polygon represents an average over the risk in the polygon, please provide an additional version in which the maximum numerical value in the polygon is provided instead.

ANSWER 006

As described in section 6.2.2.3, pages 171 and 172 in PG&E's 2023-2025 WMP, the pixel level risk value is the product of the cumulative probability of all risk drivers in that pixel and the wildfire consequence. As such, the value is not an average over the risk in a polygon.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_004-Q008		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_004-Q008		
Request Date:	April 28, 2023	Requester DR No.:	MGRA-PGE-WMP23_No.4
Date Sent:	May 3, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

SUBJECT: EPSS

QUESTION 008

Please provide an excel spreadsheet giving the Distribution Outage ID for each outage occurring while EPSS was enabled in 2022.

ANSWER 008

Please see *"WMP-Discovery2023_DR_MGRA_004-Q008Atch01.xlsx."*

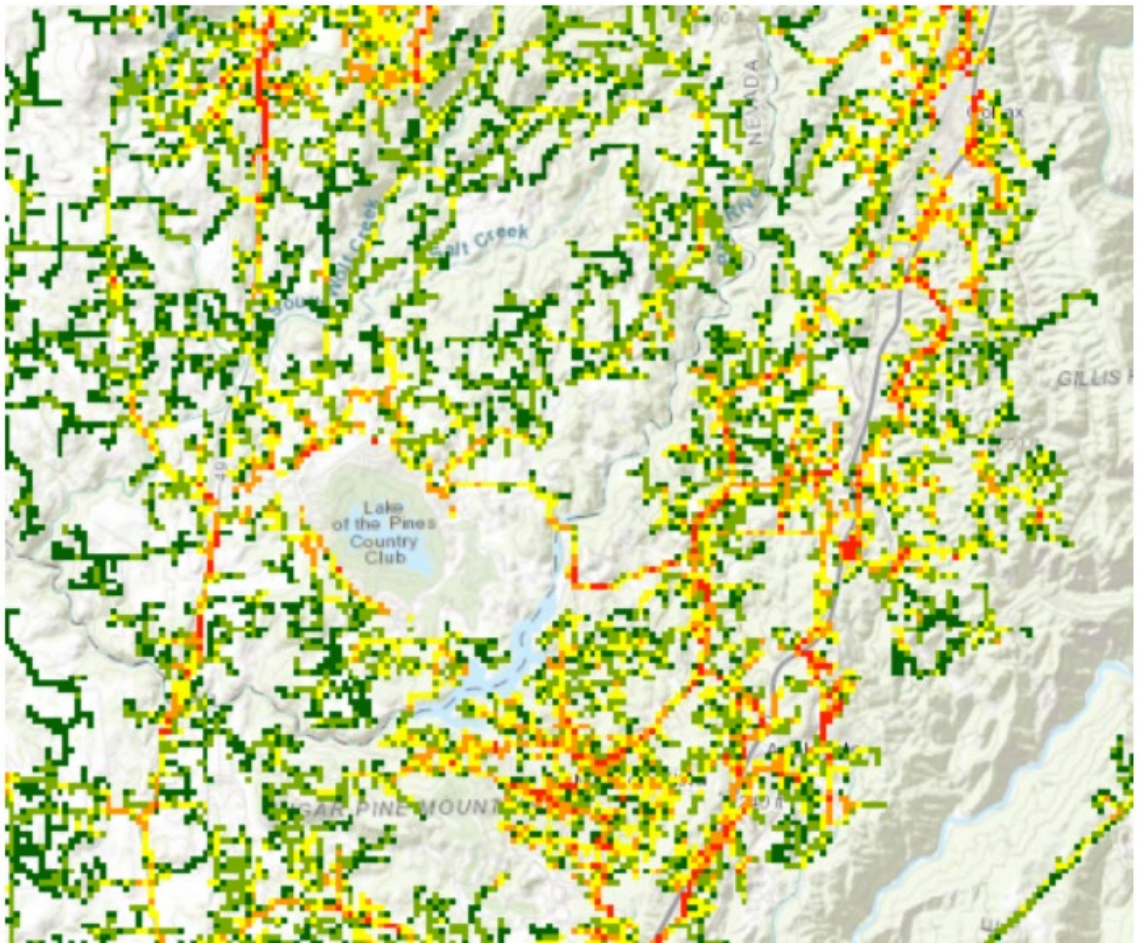
PG&E – MGRA – Data Request Response 5

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_005-Q001		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_005-Q001		
Request Date:	May 10, 2023	Requester DR No.:	MGRA Data Request No. 5
Date Sent:	May 15, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

Regarding WDRM Data provided in PG&E's response to Data Request 4:

The probability of ignition data shows significant local (fine-grained) variation, as exemplified below:



QUESTION 001

Is the sole source of this POI data the machine learning algorithm described in WDRM documentation? If not what other inputs go into the POI?

ANSWER 001

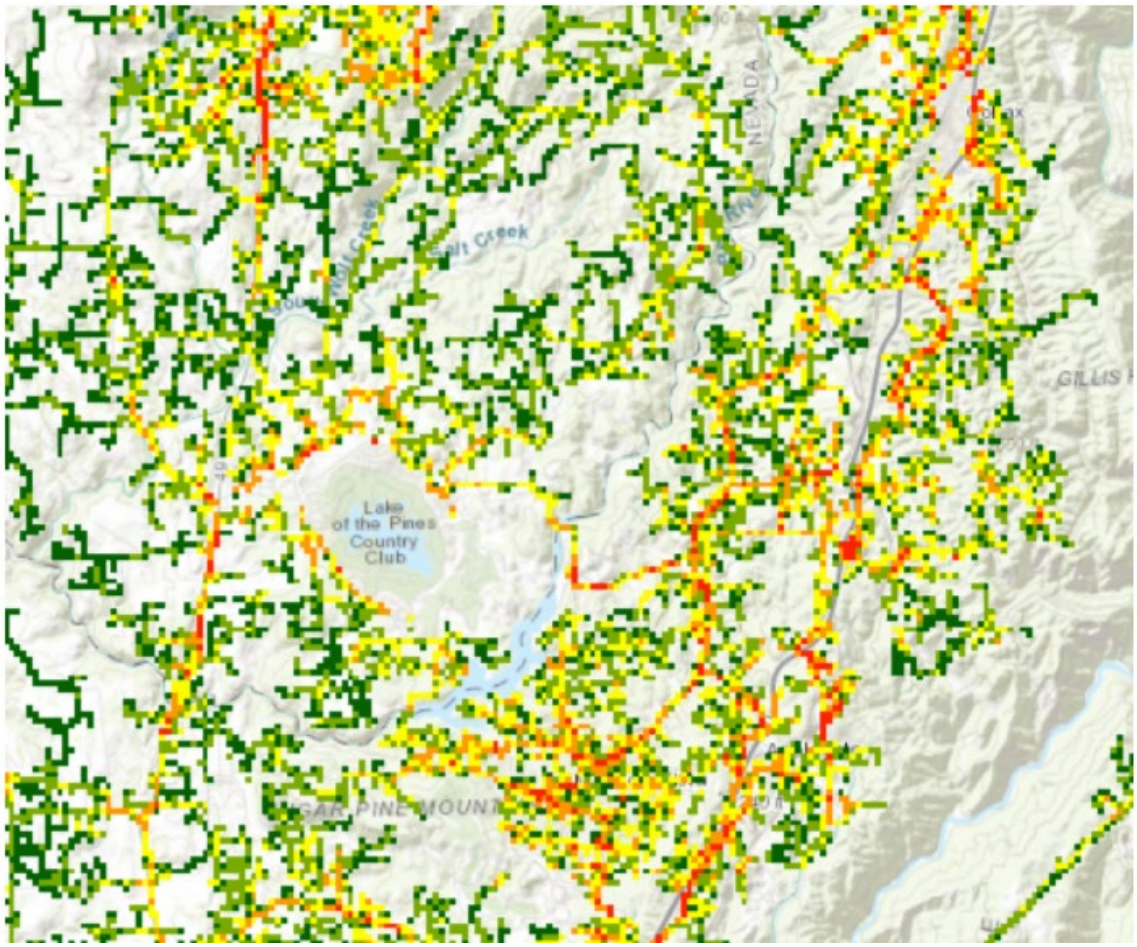
Yes, the POI data shown is the result of the process and data described in section 6.2.1 and shown in Table PG&E 6.2.1-1.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_005-Q002		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_005-Q002		
Request Date:	May 10, 2023	Requester DR No.:	MGRA Data Request No. 5
Date Sent:	May 15, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

Regarding WDRM Data provided in PG&E's response to Data Request 4:

The probability of ignition data shows significant local (fine-grained) variation, as exemplified below:



QUESTION 002

Is the fine-grained POI distribution a result of the localization of specific historical outages, characteristics of assets or environment, or both?

ANSWER 002

The fine-grained features (sharp contrasts in values between neighboring pixels) in PG&E's risk model outputs are a product of finely varying predictive covariates, including asset characteristics and environmental attributes. Please see PG&E's response to Question 4 of this Data Request for an explanation of how historical outages may influence fine-grained localization.

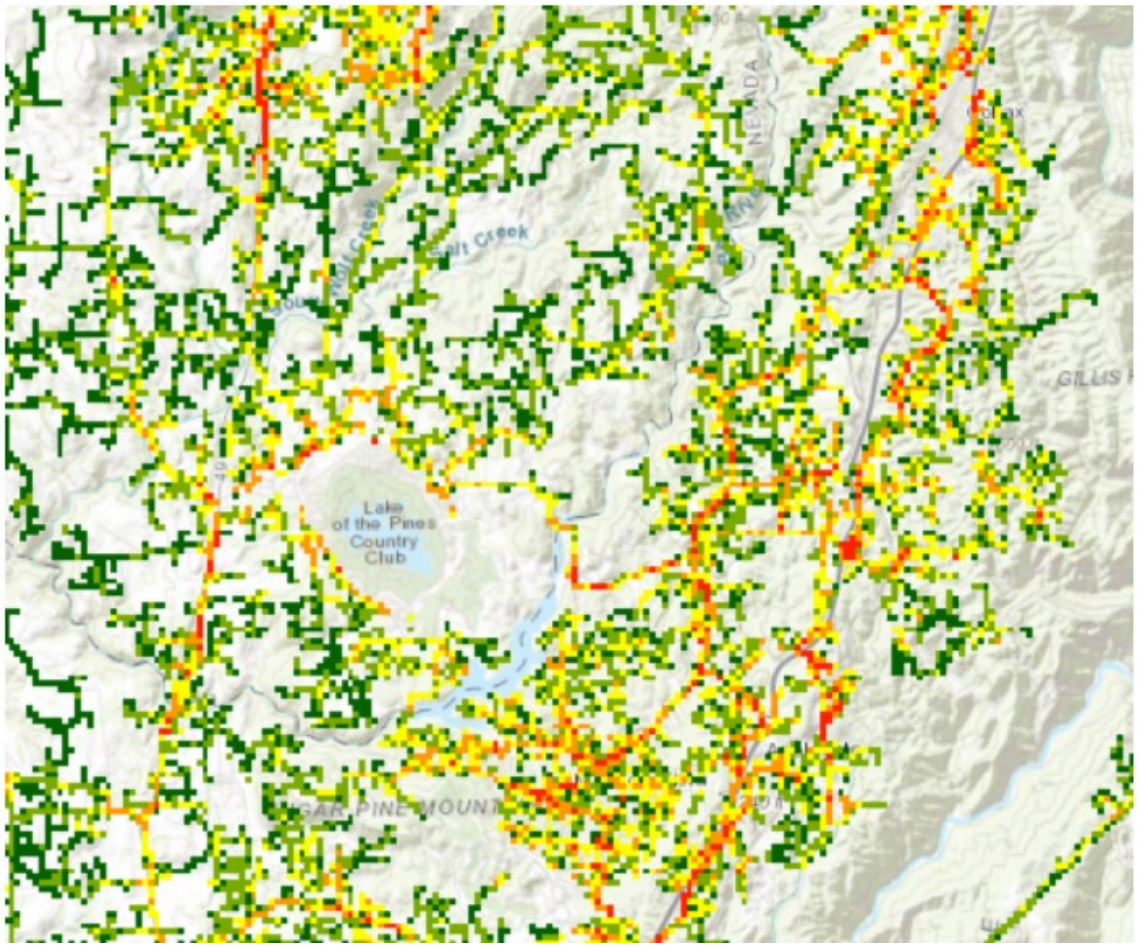
As mentioned in the response to MGRA 004 Q004, "At the pixel-by-pixel level, the model does exhibit some level of noise that can result in high-risk hot spots in an area of generally lower risk pixels. For this reason, workplan development is generally guided by circuit segment level aggregations that provide an improved indication of risk level."

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_005-Q003		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_005-Q003		
Request Date:	May 10, 2023	Requester DR No.:	MGRA Data Request No. 5
Date Sent:	May 15, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

Regarding WDRM Data provided in PG&E's response to Data Request 4:

The probability of ignition data shows significant local (fine-grained) variation, as exemplified below:



QUESTION 003

Which of the following characteristics is known or suspected to contribute to the fine-grained localization of POI shown above, and to what degree:

a. Vegetation

b. Tree density and height

c. Asset health

d. Asset age

e. Asset type

f. Hardening/Mitigation history

ANSWER 003

The data representing the items listed in parts a through e all contribute, in varying degrees depending on location and geography, to the fine-grained localization seen in PG&E's risk modeling outputs, including the spatial view provided by MGRA. Fine grained localization may result where locations of significant covariate variability exist in PG&E's service territory (e.g. a heavily forested area next to a non-forested area).

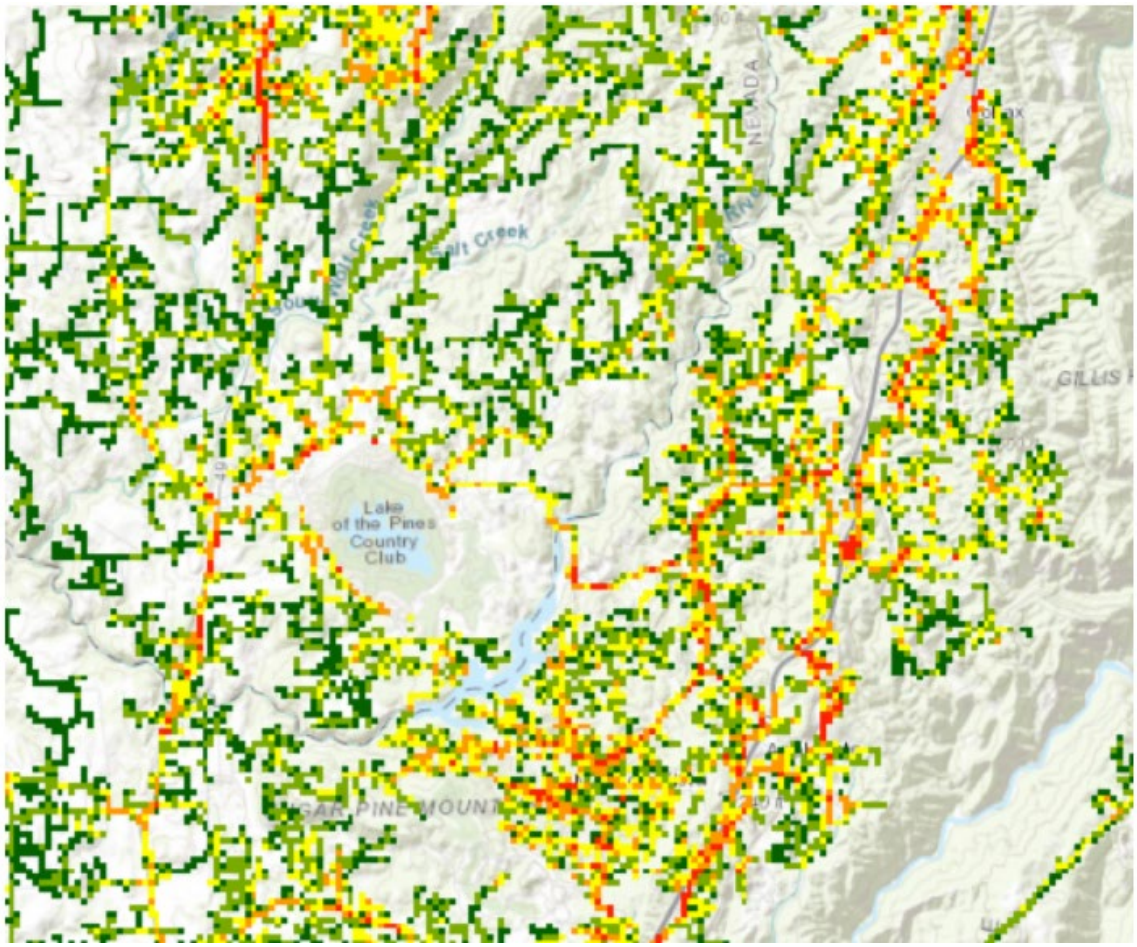
The causal effects of part f, hardening/mitigation history, were not directly estimated for the WDRM V3. To the extent an asset is replaced as part of a wildfire mitigation project, the asset health, age, and type would be reflected in WDRM v3 and may contribute to fine grained localization.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_005-Q004		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_005-Q004		
Request Date:	May 10, 2023	Requester DR No.:	MGRA Data Request No. 5
Date Sent:	May 15, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

Regarding WDRM Data provided in PG&E's response to Data Request 4:

The probability of ignition data shows significant local (fine-grained) variation, as exemplified below:



QUESTION 004

As an example of "localized outage" effects, if a vehicle were to collide with a utility pole and cause an outage in the boundary of the image above, and if the POI were to be recalculated, would the area where the outage occurred show an elevated POI? Or would conversely the incremental increase risk of vehicle collision outage be generally distributed over the entire landscape, or a portion of the landscape?

ANSWER 004

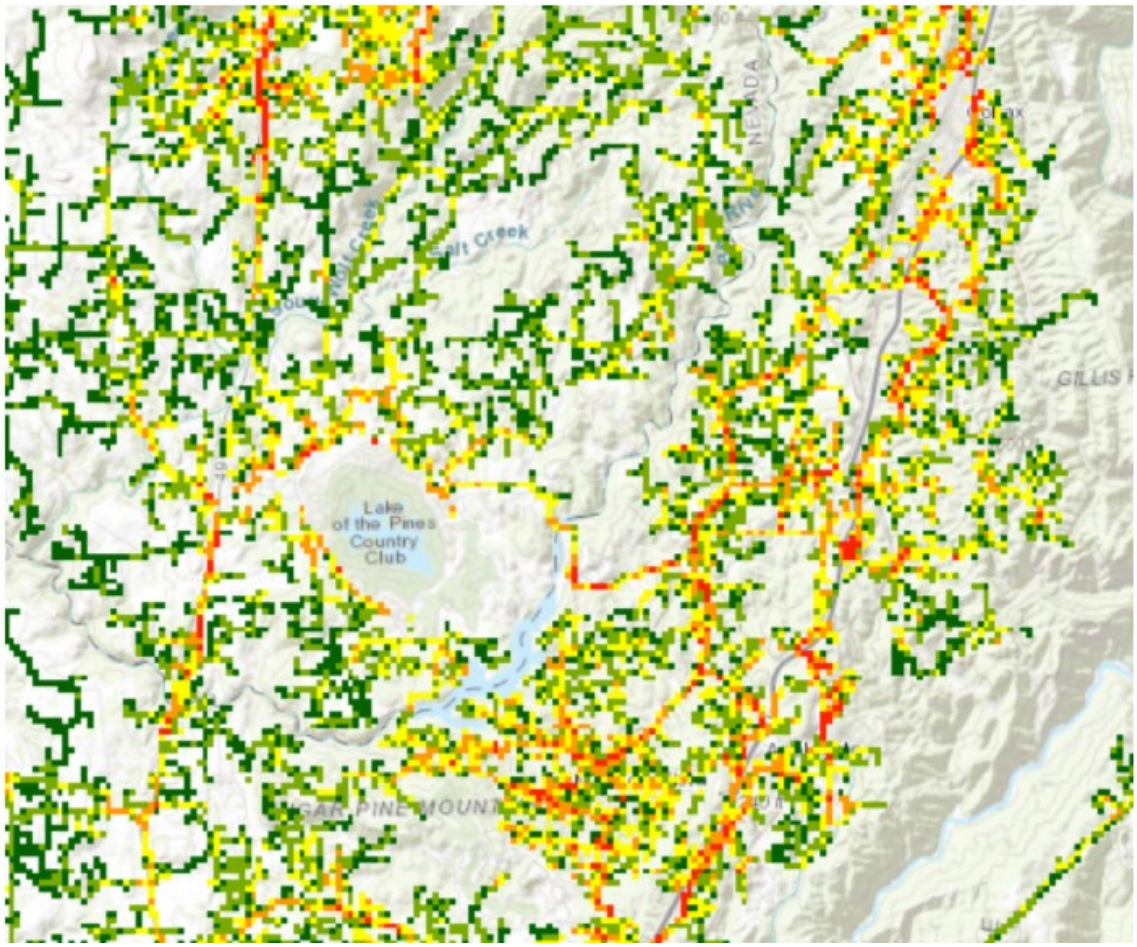
This type of outage would be classified into the Contact From Object “third party vehicle” subset as listed in Table PG&E-6.2.1-1. In reality, a single accident does not have very much sway over the third-party vehicle model one way or another because there are hundreds of historical events already contributing to the result. However, we can say that the additional data point would enhance the POI in locations that share the same covariate characteristics as the accident location. So, the resulting adjustments would not be localized to the accident location, but they would not be spread evenly across all locations either.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_005-Q005		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_005-Q005		
Request Date:	May 10, 2023	Requester DR No.:	MGRA Data Request No. 5
Date Sent:	May 15, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

Regarding WDRM Data provided in PG&E's response to Data Request 4:

The probability of ignition data shows significant local (fine-grained) variation, as exemplified below:



QUESTION 005

Are fire weather winds included in the WDRM v3 POI model in any other manner than that described in WDRM v2 discussion, in which aggregated yearly variables such as annual maximum or annual days over peak are used as explanatory variables?

ANSWER 005

Yes. In WDRM v3, day-of-event wind speed and fuel conditions are significant covariates in the probability of ignition given an outage model, which is trained on the conditions at the locations and on the day of each outage. Wind and other contributors to “fire weather” conditions are also prominent in the consequence calculations in WDRM v3.

PG&E – MGRA – Data Request Response 6

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_006-Q001		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_006-Q001		
Request Date:	May 15, 2023	Requester DR No.:	MGRA Data Request No. 6
Date Sent:	May 18, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

SUBJECT: FOLLOW UP TO MGRA DR-4-Q8, AND MGRA DR2-Q8

QUESTION 001

PG&E was requested to provide an Excel spreadsheet containing outage IDs. These were delivered with an OutageID totally unrelated to the DOutageID that it lists in its outage data provided as a result of DR1. Please provide the file sent in response to DR4-08 as soon as possible.

ANSWER 001

"*WMP-Discovery2023_DR_MGRA_006-Q001Atch01.xlsx*" contains a new column called "DOutageID" that will align with the same outage identifier (ID) from DR1.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_006-Q002		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_006-Q002		
Request Date:	May 15, 2023	Requester DR No.:	MGRA Data Request No. 6
Date Sent:	May 18, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

SUBJECT: FOLLOW UP TO MGRA DR-4-Q8, AND MGRA DR2-Q8

QUESTION 002

Please add (or re-add) a simple "cause" attribute to this outage file.

ANSWER 002

"*WMP-Discovery2023_DR_MGRA_006-Q001Atch01.xlsx*" contains a new column called "basic_cause" as requested.

PACIFIC GAS AND ELECTRIC COMPANY
Wildfire Mitigation Plans Discovery 2023
Data Response

PG&E Data Request No.:	MGRA_001-Q003		
PG&E File Name:	WMP-Discovery2023_DR_MGRA_001-Q003		
Request Date:	May 15, 2023	Requester DR No.:	MGRA Data Request No. 6
Date Sent:	May 18, 2023	Requesting Party:	Mussey Grade Road Alliance
DRU Index #:		Requester:	Joseph Mitchell

SUBJECT: FOLLOW UP TO MGRA DR-4-Q8, AND MGRA DR2-Q8

QUESTION 003

Likewise, please add a 'cause' attribute to the outage data in the GIS files issued in response to MGRA DR1. Alternatively, provide an Excel file in which cause is cross-referenced to DoutageID.

ANSWER 003

"*WMP-Discovery2023_DR_MGRA_006-Q001Atch01.xlsx*" includes both "basic_cause" and "DOutageID" for cross-referencing.

A-3 SCE Data Request Responses

SCE – MGRA – Data Request Response 1

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 1

To: MGRA
Prepared by: Jessica Clawson
Job Title: GIS Advisor
Received Date: 3/29/2023

Response Date: 4/3/2023

Questions 01-09:

1. Please provide for Asset Point data for Camera, Fuse, Support Structure, and Weather Station.
2. Provide Asset Line data for Transmission Line (as permitted as non-confidential), Primary Distribution Line, and Secondary Distribution Line.
3. Provide PSPS Event data. Include Event Log, Event Line, Event Polygon data.
Please exclude customer meter data. Provide all PSPS Event Asset Damage data including photos.
4. Provide Risk Event Point data, including Wire Down, Ignition, Transmission unplanned outage (as classified non-confidential), Distribution Unplanned Outage
data, Distribution Vegetation Caused Unplanned Outage, Risk Event Asset Log.
5. Provide photo data for Risk Events.
6. Under Initiatives, please provide Grid Hardening data, including Hardening Log, Hardening Point, and Hardening Line data. Inspection data is not requested at this time.
7. Under Initiatives, please provide Other Initiative data for point, line, polygon features and the Other Initiative Log.
8. Under Other Required Data, please provide Red Flag Warning Day polygon data.
9. Please provide a layer indicating calculated circuit-level risk using the methodology presented in the WMP.
a. If independent probability and consequence layers exist, please provide these independently as well.

Response to Questions 01-09:

SCE has provided the following requested data layers deemed non-confidential in the zipped geodatabase titled "SCE_2022_Q4_NonConfidential.gdb":

- SCE_Camera_2022_Q4
- SCE_WeatherStation_2022_Q4
- SCE_PrimaryDistributionLine_2022_Q4
- SCE_SecondaryDistribution Line_2022_Q4
- SCE_PspsEventLog_2022_Q4

- SCE_PspsEventLine_2022_Q4
- SCE_PspsEventPolygon_2022_Q4
- SCE_PspsEventDamagePoint_2022_Q4
- SCE_PspsEventDamagePhotoLog_2022_Q4
- SCE_WireDownEvent_2022_Q4
- SCE_Ignition_2022_Q4
- SCE_DistributionUnplannedOutage_2022_Q4
- SCE_DistributionVegetationCauseUnplanned Outage_2022_Q4
- SCE_RiskEventAssetLog_2022_Q4
- SCE_RiskEventPhotoLog_2022_Q4
- SCE_GridHardeningLog_2022_Q4
- SCE_GridHardeningPoint_2022_Q4
- SCE_GridHardeningLine_2022_Q4
- SCE_RedFlagWarningDayPolygon_2022_Q4

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 1

To: MGRA
Prepared by: Jessica Clawson
Job Title: GIS Advisor
Received Date: 3/29/2023

Response Date: 4/10/2023

Question 01-09 Supplemental:
1. Please provide for Asset Point data for Camera, Fuse, Support Structure, and Weather Station.
2. Provide Asset Line data for Transmission Line (as permitted as non-confidential), Primary Distribution Line, and Secondary Distribution Line.
3. Provide PSPS Event data. Include Event Log, Event Line, Event Polygon data.
Please exclude customer meter data. Provide all PSPS Event Asset Damage data including photos.
4. Provide Risk Event Point data, including Wire Down, Ignition, Transmission unplanned outage (as classified non-confidential), Distribution Unplanned Outage
data, Distribution Vegetation Caused Unplanned Outage, Risk Event Asset Log.
5. Provide photo data for Risk Events.
6. Under Initiatives, please provide Grid Hardening data, including Hardening Log, Hardening Point, and Hardening Line data. Inspection data is not requested at this time.
7. Under Initiatives, please provide Other Initiative data for point, line, polygon features and the Other Initiative Log.
8. Under Other Required Data, please provide Red Flag Warning Day polygon data.
9. Please provide a layer indicating calculated circuit-level risk using the methodology presented in the WMP.
a. If independent probability and consequence layers exist, please provide these independently as well.

Response to Question 01-09 Supplemental:

SCE has provided the following requested data layers deemed non-confidential in the zipped geodatabase, SCE_2022_Q1_NonConfidential.gdb:

(Note: there were no PSPS Events or Red Flag Warning Days in Q1 2022)

- SCE_Camera_2022_Q1
- SCE_WeatherStation_2022_Q1
- SCE_PrimaryDistributionLine_2022_Q1
- SCE_SecondaryDistribution Line_2022_Q1
- SCE_WireDownEvent_2022_Q1
- SCE_Ignition_2022_Q1
- SCE_DistributionUnplannedOutage_2022_Q1
- SCE_DistributionVegetationCauseUnplanned Outage_2022_Q1

- SCE_RiskEventAssetLog_2022_Q1
- SCE_RiskEventPhotoLog_2022_Q1
- SCE_GridHardeningLog_2022_Q1
- SCE_GridHardeningPoint_2022_Q1
- SCE_GridHardeningLine_2022_Q1

SCE has provided the following requested data layers deemed non-confidential in the zipped geodatabase, SCE_2022_Q2_NonConfidential.gdb:

(Note: there were no PSPS Events in Q2 2022)

- SCE_Camera_2022_Q2
- SCE_WeatherStation_2022_Q2
- SCE_PrimaryDistributionLine_2022_Q2
- SCE_SecondaryDistribution Line_2022_Q2
- SCE_WireDownEvent_2022_Q2
- SCE_Ignition_2022_Q2
- SCE_DistributionUnplannedOutage_2022_Q2
- SCE_DistributionVegetationCauseUnplanned Outage_2022_Q2
- SCE_RiskEventAssetLog_2022_Q2
- SCE_RiskEventPhotoLog_2022_Q2
- SCE_GridHardeningLog_2022_Q2
- SCE_GridHardeningPoint_2022_Q2
- SCE_GridHardeningLine_2022_Q2
- SCE_RedFlagWarningDayPolygon_2022_Q2

SCE has provided the following requested data layers deemed non-confidential in the zipped geodatabase, SCE_2022_Q3_NonConfidential.gdb:

(Note: there were no PSPS Event Damages in Q3 2022)

- SCE_Camera_2022_Q3
- SCE_WeatherStation_2022_Q3
- SCE_PrimaryDistributionLine_2022_Q3
- SCE_SecondaryDistribution Line_2022_Q3
- SCE_PspsEventLog_2022_Q3
- SCE_PspsEventLine_2022_Q3
- SCE_PspsEventPolygon_2022_Q3
- SCE_WireDownEvent_2022_Q3
- SCE_Ignition_2022_Q3

- SCE_DistributionUnplannedOutage_2022_Q3
- SCE_DistributionVegetationCauseUnplanned Outage_2022_Q3
- SCE_RiskEventAssetLog_2022_Q3
- SCE_RiskEventPhotoLog_2022_Q3
- SCE_GridHardeningLog_2022_Q3
- SCE_GridHardeningPoint_2022_Q3
- SCE_GridHardeningLine_2022_Q3
- SCE_RedFlagWarningDayPolygon_2022_Q3

SCE – MGRA – Data Request Response 2

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 2

To: MGRA
Prepared by: Berta Sandberg
Job Title: Senior Advisor
Received Date: 4/24/2023

Response Date: 4/27/2023

Question 01 :
Utility Risk Scores.
Cal Advocates in 02_CalAdvocates-SCE-2023WMP-05 Q.02 Answer requested an excel spreadsheet including a number of fields corresponding to circuit segments. SCE declared this document confidential.

Please provide a non-confidential version of 02_CalAdvocates-SCE-2023WMP-05 Q.02 Answer. If the non-confidential version lacks segment identifiers, the document must at the least contain 1) either the associated circuit or 2) general but not exact geographical location of segment.

Response to Question 01 :
Please see attached excel MGRA-SCE-002-01.xlsx for a non-confidential version of CalAdvocates-SCE-2023WMP-05 Q.02. SCE has aggregated the data at the circuit level.

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 2

To: MGRA
Prepared by: Jessica Clawson
Job Title: GIS Advisor
Received Date: 4/24/2023

Response Date: 4/27/2023

Question 02:
Utility Risk Scores.
Cal Advocates in 02_CalAdvocates-SCE-2023WMP-05 Q.02 Answer requested an excel spreadsheet including a number of fields corresponding to circuit segments. SCE declared this document confidential.

Please provide a non-confidential version of the GIS file provided in response to 03_CalAdvocates-SCE-2023WMP-05 Q.03 Answer

Response to Question 02:

Please see attached for the non-confidential version of the GIS file provided in response to 03_CalAdvocates-SCE-2023WMP-05 Q.03. Attachment: MGRA-SCE-002-02.gdb. SCE aggregated the data at the circuit level.

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 2

To: MGRA
Prepared by: Berta Sandberg
Job Title: Senior Advisor
Received Date: 4/24/2023

Response Date: 4/27/2023

Question 03:
For each of the drivers in WMP Appendix F / QDR Table 7.2, please provide an excel spreadsheet that indicates aggregated pre-mitigation risk scores, including columns for
a) Frequency / probability of driver risk event
b) Percentile fraction of total risk events from driver
c) Aggregated risk score for driver type
d) Percentile fraction of total risk score from driver

Response to Question 03:

The attached excel file, *MGRA-SCE-002-03.xlsx*, has the requested ignition and risk scores for the drivers in Appendix F. This ignition and risk data is for HFTD areas using SCE's Fire Investigation Preliminary Analysis (FIPA) data for 2019 through 2022 to calculate FOI (Frequency of Ignition) per structure for each driver, as described in the 2023 WMP Chapter 6, and then summed up. MARS risk is calculated in similar fashion, using FOI×consequence per structure and then summing up. Some drivers have zero ignitions, as there were no ignitions recorded for those drivers. Ignitions for connectors, splice and tie wire damage have been incorporated into the Equipment failure for conductor and show in the drivers associated with that.

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 2

To: MGRA
Prepared by: Arianne Luy
Job Title: Engineering Manager
Received Date: 4/24/2023

Response Date: 4/27/2023

Question 04:
Please provide an excel spreadsheet table that provides for 2019, 2020, 2021, 2022, and the first months of 2023:
a) Number of miles of fully covered conductor circuit segments in the HFRA.
b) Number of miles of fully "bare wire" conductor in the HFRA
c) Number of wires down for fully covered conductor segments in the HFRA.
d) Number of wires down for fully "bare wire" conductor in the HFRA,
e) Number reportable ignitions for fully covered conductor segments in the HFRA.
f) Number reportable ignitions for fully "bare wire" conductor in the HFRA

Response to Question 04:
See the attached spreadsheet MGRA-SCE-002 Q4.xlsx for the requested information. The spreadsheet includes two tabs: "HFRA Only Events" and "HFRA & Non-HFRA Events." The "HFRA Only Events" tab includes wire down and ignition information that occurred only in HFRA; however, note that the miles of fully covered and fully bare circuits will include miles in both HFRA and non-HFRA areas since some of the HFRA circuits may traverse through non-HFRA. The "HFRA & Non-HFRA Events" tab includes wire down and ignition information that occurred in HFRA and non-HFRA areas. The "HFRA Only Events" tab can be considered as a subset of the totals in the "HFRA & Non-HFRA Events" tab.

Please also note the following:

- SCE tracks this data at the HFRA circuit level. Therefore, the data provided will be provided at the HFRA circuit level.
- HFRA circuits are circuits that are completely in HFRA or have any portion of circuit miles in HFRA.
- A circuit is considered fully covered if covered conductor is installed on the entire circuit, including applicable non-HFRA portions. Therefore, the miles provided may include installations in non-HFRA areas.
- A circuit is considered fully bare if covered conductor is not installed on any portion of the circuit. Note that fully bare HFRA Circuit Miles will include miles outside of HFRA.
- Fully covered and fully bare circuit classifications are based on their status as of January 1st for each year.

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 2

To: MGRA
Prepared by: Arianne Luy
Job Title: Engineering Manager
Received Date: 4/24/2023

Response Date: 4/27/2023

Question 05:
Hardening
Please provide a non-confidential version of 04_CalAdvocates-SCE-2023WMP-06 Q.04 Answer

Response to Question 05:

Please see the attached excel spreadsheet, *MGRA-SCE-002_Q5*, for a non-confidential version of SCE's response to CalAdvocates-SCE-2023WMP-06-Q.04, which is the requested information (as of March 17, 2023) for WCCP and TUG work planned for 2023. SCE has aggregated the information to the circuit level.

Please note the following:

- Multiple work orders are associated with each circuit. Planned and actual construction/start dates may vary per work order within are circuit. Therefore, SCE provides the earliest and latest planned and actual construction/start dates per circuit to provide the range.
- Planned construction and start dates could change due to factors including construction priority, environmental constraints, and resource availability.
- This plan includes additional project scope that will allow SCE to complete other work in place of projects that may not meet planned construction start dates due to constraints. These additional projects may be completed at a later time.
- Due to the nature of the process of translating work scope into work orders, some WCCP and TUG work orders may not have structure IDs associated with them, may only contain new structures in the plan, or may only contain underground structures in the plan; thus wildfire risk values are not available for these work orders.
- SCE does not track length of overhead conductor permanently removed and not replaced with covered conductor or undergrounding as a result of WCCP and TUG.
- Other system hardening projects outside of WCCP and TUG are not organized by circuit mileage as part of work planning and scheduling.

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 2

To: MGRA
Prepared by: Arianne Luy
Job Title: Engineering Manager
Received Date: 4/24/2023

Response Date: 4/27/2023

Question 06:
Hardening
Please provide a non-confidential version of 04_CalAdvocates-SCE-2023WMP-06 Q.05 Answer

Response to Question 06:

Please see the attached excel spreadsheet, *MGRA-SCE-002 Q6*, for a non-confidential version of SCE's response to CalAdvocates-SCE-2023WMP-06-Q.05. SCE has aggregated the information to the circuit level. Note that each row in the spreadsheet is related to a Project Initiation Form (PIF).

Please note the following:

- SCE follows the Initiate, Plan, Schedule, Execute, Complete (IPSEC) process for WCCP and TUG projects. To initiate a project, SCE creates a Project Initiation Form (PIF) that provides the high-level scope of the project. The PIF scope is then broken into multiple work orders during the planning phase of the project to allow for operational flexibility.
- Planned construction and start dates are not available at this time.
- Scoping for 2024 WCCP is not yet complete. Project information for these remaining miles are currently unavailable and are not included in the attached spreadsheet.
- The 2024 TUG plan includes contingency projects to allow SCE to complete other work in place of projects that may not meet planned construction start dates.
- Wildfire risk scores are provided at the PIF level and are based on structure ID data. Note that some structures may appear in multiple PIFs as part of the planning process.
- SCE does not track length of overhead conductor permanently removed and not replaced with covered conductor or undergrounding as a result of WCCP and TUG.
- Other system hardening projects outside of WCCP and TUG are not organized by circuit mileage as part of work planning and scheduling.

SCE – MGRA – Data Request Response 3

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 3

To: MGRA
Prepared by: Angelica Guzman
Job Title: Engineer 3
Received Date: 5/3/2023

Response Date: 5/8/2023

Question 01 :
REFCL – Appendix F
Australian sources have found that REFCL is 90% effective in eliminating ignitions from phase-to-ground faults. Mitigation Effectiveness Values on p. 825 and following pages show much lower values for REFCL. Please justify how the values were obtained for:
a. Vegetation contact – 50%
b. Vehicle contact – 20%
c. Unknown contact – 50%
d. Conductor damage or failure – 50%
e. Crossarm damage or failure – 30%
f. Pole damage or failure – 40%
g. Splice damage or failure – 50%
h. Transformer damage or failure – 85%
i. Tie wire damage or failure – 50%
Provide data and calculation leading to these values.

Response to Question 01 :

SCE agrees with the results of the Australian testing program that identified the 90% effectiveness for REFCL related to single phase to ground faults, and SCE expects similar performance for SCE with regard to this specific type of fault.

However, drivers can result in different fault types, such as phase-to-phase, where REFCL has limited effectiveness. Fault events can also evolve as arcing occurs and related energy is expelled or alternately where facilities are damaged such as a conductor clash that causes downed wire. Accordingly, just because REFCL is 90% effective for single phase to ground faults, does not mean that it is 90% effective against all faults.

The mitigation effectiveness of REFCL for each driver is based on the expectation of the frequency of single line ground faults as the fault or ignition initiator, and an effectiveness of 90% relative to that fault, since that is the type of fault REFCL is effective at mitigating. Thus, for example, if 50% of all of the faults resulting from a specific driver were single line ground faults, REFCL would have a 45% mitigation effectiveness for that driver (.5*.9).

We expect to continue to refine our ME estimates over the coming years. Please see the table below for the detailed ME values for the drivers and the rationale for those values.

Sub-driver/ Consequence Type	**Mitigation Effectiveness**	**Rationale/Data source**
Veg. contact - Distribution	50%	Estimating 90% effectiveness for phase to ground vegetation contact. However, based on expert judgment, effectiveness for phase-to-phase contact will be much lower.
Vehicle contact - Distribution	20%	Estimating 90% effectiveness for phase to ground vehicle contact. However, based on expert judgment, it is common that vehicle strikes result in wire slap where effectiveness will be low. It can be effective in other scenarios such as when a down wire occurs.
Unknown contact - Distribution	50%	Aligned with vegetation and balloon contact values.
Conductor damage or failure - Distribution	50%	Estimating 90% effectiveness for single phase down wire incidents. However, based on expert judgment, there is potential for the initial failure to result in dropped incandescent particles.
Crossarm damage or failure - Distribution	30%	Estimating 90% effectiveness for single phase down wire incidents. However, based on expert judgment, phase to phase contact can be likely with a failed crossarm.
Pole damage or failure - Distribution	40%	Estimating 90% effectiveness for failures which involve a ground fault. However, based on expert judgment, pole damage can result in multi-phase faults.
Splice damage or failure - Distribution	50%	Estimating 90% effectiveness for failures which involve a ground fault. However, based on expert judgment, it is much less effective at other failure mechanisms, such as high resistance connections which drop incandescent particles.
Transformer damage or failure - Distribution	85%	Estimating 90% effectiveness for failures which involve a ground fault. However, based on expert judgment, it is much less effective at other failure mechanisms, such as high resistance connections which drop incandescent particles.
Tie wire damage or failure - Distribution	50%	Estimating 90% effectiveness for single phase down wire incidents. However, based on expert judgment, it is possible for incandescent particles to drop upon initial failure.

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 3

To: MGRA
Prepared by: Andrew Swisher
Job Title: Consulting Engineer
Received Date: 5/3/2023

Response Date: 5/8/2023

Question 02:
Please provide an additional column for the Mitigation Effectiveness Values table that represents a combination of Covered Conductor and REFCL.

Response to Question 02:
SCE continues to build its understanding of the combined effectiveness of covered conductor (CC) and Rapid Earth Fault Current Limiter (REFCL). As one approach to estimate the combined mitigation effectiveness, SCE considers the effectiveness of covered conductor to establish the remaining risk once CC is applied, then evaluates the effectiveness of REFCL to this remaining risk. The REFCL mitigation effectiveness is strongly correlated to the potential for single line to ground faults. SCE's approach for each driver considers the phase to ground fault ratio relationship to be the same between covered conductor and bare wire systems, and develops mitigation effectiveness values to the remaining risk following CC application. Based on this approach, the following mitigation effectiveness values are estimated and presently used by SCE as an input for evaluating the combination of CC and REFCL applications for distribution system ignition drivers. SCE notes these are estimates and subject to continued evaluation, including through field validation of REFCL installations and performance over the coming years. Please see Section 7.1.4.2 of SCE's WMP for additional discussion on the use of covered conductor alongside REFCL and other mitigations.

Driver Type	Subdriver Type	CC/REFCL ME
D-CFO	Veg. contact- Distribution	85%
D-CFO	Animal contact- Distribution	96%
D-CFO	Balloon contact- Distribution	99%
D-CFO	Vehicle contact- Distribution	85%
D-CFO	Unknown contact - Distribution	90%
D-UNK	Unknown - Distribution	82%
D-CFO	Other contact from object - Distribution	88%
D-WTW	Wire-to-wire contact / contamination- Distribution	99%
D-EFF	Anchor / guy damage or failure - Distribution	70%

D-EFF	Conductor damage or failure — Distribution	95%
D-EFF	Connection device damage or failure - Distribution	95%
D-EFF	Connector damage or failure- Distribution	95%
D-EFF	Crossarm damage or failure - Distribution	65%
D-EFF	Fuse damage or failure - Distribution	31%
D-EFF	Insulator and brushing damage or failure - Distribution	95%
D-EFF	Lightning arrestor damage or failure- Distribution	50%
D-EFF	Other - Distribution	57%
D-EFF	Pole damage or failure - Distribution	40%
D-EFF	Recloser damage or failure - Distribution	9%
D-EFF	Splice damage or failure — Distribution	95%
D-EFF	Tie wire damage or failure - Distribution	50%
D-EFF	Voltage regulator / booster damage or failure - Distribution	50%
D-CTM	Contamination - Distribution	30%
D-EFF	Capacitor bank damage or failure- Distribution	1%
D-EFF	Switch damage or failure- Distribution	2%
D-EFF	Transformer damage or failure - Distribution	88%
D-EFF	Tap damage or failure - Distribution	50%
D-EFF	Sectionalizer damage or failure - Distribution	70%
D-OTH	All Other- Distribution	50%
D-UTW	Utility work / Operation - Distribution	25%
D-VAN	Vandalism / Theft - Distribution	1%

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 3

To: MGRA
Prepared by: Andrew Swisher
Job Title: Consulting Engineer
Received Date: 5/3/2023

Response Date: 5/8/2023

Question 03:
On p. 845, The mitigations Distribution Open Phase Detection (DOPD) and High Impedance (Hi-Z) Relays are estimated to have no more that 2% recduction in ignition risk for all risk drivers.
a. Please explain the discrepancies with previous sections where these technologies are presented as mature and reliable mitigations for various types of risk driver.
b. Please explain why DOPD would have only a 2% effectiveness in reducing ignition risk for connector damage or failure or conductor damage or failure.
c. Please explain why Hi-Z would have a 2% effectiveness for vegetation contact, conductor damage or failure, or connection device damage or failure

Response to Question 03:

a. Please explain the discrepancies with previous sections where these technologies are presented as mature and reliable mitigations for various types of risk driver.

SCE does not agree with MGRA's statement that there are "discrepancies" regarding how these technologies are presented in the WMP, as SCE has discussed Distribution Open Phase Detection (DOPD) and High Impedance (Hi-Z) Relay technologies consistently in the WMP.

b. Please explain why DOPD would have only a 2% effectiveness in reducing ignition risk for connector damage or failure or conductor damage or failure.

SCE established the mitigation effectiveness (ME) for DOPD in the WMP based on the anticipated effectiveness of the technology across the various drivers that cause conductor separations, which can lead to ignitions from wire-down events. SCE reviewed historical ignition data to understand the overall frequency of the events for which DOPD could be effective and used this percentage (2%) as the measure of DOPD's effectiveness for each of the aforementioned drivers, including the connection device damage or failure and conductor damage or failure drivers. The ME value for DOPD is also influenced by SCE's application of DOPD to only mainline conductor, which is larger and less prone to separation (and subsequent wire-down events) than smaller tapline conductors. Additionally, DOPD does not reduce the risk of incandescent particle ignitions that may also be associated with conductor separations and connection failures. SCE is continuing to refine and improve this emerging technology along with the ME values.

c. Please explain why Hi-Z would have a 2% effectiveness for vegetation contact, conductor damage or failure, or connection device damage or failure

The Hi-Z Relay ME values for vegetation contact, conductor damage or failure, and connection device damage or failure drivers are primarily based on engineering judgment about the rate of occurrence of Hi-Z faults and the associated ignition events that might be avoided with Hi-Z Relay operations. For example, vegetation contact events may directly cause Hi-Z faults. On the other hand, connection device and conductor failures may indirectly cause Hi-Z faults, by resulting in downed conductors which in turn can cause Hi-Z faults. The engineering judgment that assigned 2% to these ignition drivers accounts for these factors for the Hi-Z Relay technology capabilities. SCE is continuing to refine and improve this emerging technology along with the ME values.

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 3

To: MGRA
Prepared by: Arianne Luy
Job Title: Engineering Manager
Received Date: 5/3/2023

Response Date: 5/8/2023

Question 04:
Referring to the data provided in Data Request Response 04_MGRA-SCE-002 Q4.xlsx:
After two years of no wires down in covered conductor, 5 wires down were reported in 2022. Additionally, there have been 11 covered conductors down in the first months of 2023.
a. What is the explanation for 1) the first years without covered conductors down, and 2) the sudden increase in covered conductor wires down in the past months.
b. If this is a weather related phenomenon, please specify how this phenomenon affected the conductors.

Response to Question 04:

a. What is the explanation for 1) the first years without covered conductors down, and 2) the sudden increase in covered conductor wires down in the past months.

The 16 wire downs experienced in 2022 through April 25, 2023 are due to the following drivers:

Driver	Number of Wire Downs
Tree Fall	11
Vehicle Contact	2
Weather (e.g., ice loading/lightning)	3

Note that wire downs due to these drivers may also cause wire downs on bare wire. SCE also notes that as covered conductor deployment continues each year, including in areas with exposure to vegetation, the population of covered conductor with exposure to these risk drivers increases.

Due to the increased amount of rain and snow fall during the past few months, SCE experienced a spike in wire downs. By the end of April 2023, SCE experienced approximately 50% more wire downs system wide compared to the average amount of wire downs experienced from January through April from 2019 to 2022.

b. If this is a weather related phenomenon, please specify how this phenomenon affected the conductors.

The majority of tree falls into the conductor or structure were due to wind, snow loading, or soil erosion driven by rainstorms or snow. The force or weight of the tree may surpass the strength of the pole or conductor, causing the pole to break or the conductor to part, respectively. Other weather-related events involved ice loading and lightning.

SCE accounts for ice on the conductor in areas with elevation exceeding 3,000 ft. above sea level by using conductor tensions designed to withstand a combination of wind at 6 pounds per square foot and ice at 0.5 inches of radial thickness at 0°F. However, ice forming on the conductor may surpass 0.5 inches of radial thickness. This increased radial thickness in combination with wind and temperature conditions may greatly increase the conductor tension, causing the conductor to exceed its rated strength and part.

Lightning strikes to overhead conductor can produce local damage to the conductor from the direct strike. The strike may also cause an electrical fault which may produce damage to conductors in addition to the energy from the lightning strike. Fault events may be at the strike location, but can also be remote from the strike location due to insulation flashovers created by over-voltages from the lightning. Damages include melting of conductor material at either the strike location or the fault location(s). Additionally, the fault on the electric system may produce high currents that can also cause annealing or melting of conductor at other areas beyond a fault or strike location, though this is generally associated with smaller conductor types.

SCE – MGRA – Data Request Response 4

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 4

To: MGRA
Prepared by: Cindy Jacobs
Job Title: Senior Manager
Received Date: 5/8/2023

Response Date: 5/11/2023

Question 01:
Please fill missing information in the attached file, which contains SCE 159 outages from 2022.
File: MGRA-SCE-WMP23_DataRequest4-Attach1.xlsx
Requested Fields:
Confirmation of Cause
Whether segment is 100% covered conductor at time of outage.
Detailed outage cause information when available.

Response to Question 01:
Please see the attached Excel file, "MGRA-SCE-WMP23_DataRequest4-Attch1 - 5.9.23"

The column titled, "Covered Conductor" provides whether or not the circuit was fully covered conductor at the time of the outage. The column titled, "Detailed Description" contains the outage cause, the category of equipment that failed and then the piece of equipment that failed. If the cause code in MGRA's spreadsheet indicated the piece of equipment that failed as opposed to the actual cause of the failure, SCE marked this as "No" under the column confirming the cause code. Please note that the list contained several duplicate outage IDs with a dash and a number following the outage ID indicating a different step in the restoration process for the outage. These will all have the same outage cause. Depending on the circuit involved in restoration process, there may be a different percentage of covered conductor. The list also contained several exact duplicate outage IDs. In this case, the same information was provided for both line items.

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 4

To: MGRA
Prepared by: Jesse Rorabaugh
Job Title: Senior Engineer
Received Date: 5/8/2023

Response Date: 5/11/2023

Question 02:
What has been the in-service up-time of installed GFNs in 2023?

Response to Question 02:
As of May 8, 2023, the Ground Fault Neutralizer at Neenach substation has been in service for 1,761 hours (73.3 days) since the start of the year. The Ground Fault Neutralizers at Acton and Phelan substations are on the foundations with ongoing construction but have not yet been placed into service.

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 4

To: MGRA
Prepared by: Angelica Guzman
Job Title: Engineer 3
Received Date: 5/8/2023

Response Date: 5/10/2023

Question 03:
Please provide an Excel spreadsheet of the tables in Appendix F, pp. 825-846.

Response to Question 03:

Please see the attachment labeled "MGRA-SCE-004 – 03 – Excel Attachment.xlsx".

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 4

To: MGRA
Prepared by: Bryan Landry
Job Title: Senior Advisor – Strategic Planning
Received Date: 5/8/2023

Response Date: 5/11/2023

Question 04:
p. 495 - "In 2022, Technosylva began estimating the number of buildings destroyed as one of its metrics. In addition, they created a metric that evaluates response complexity as a proxy to address wildfire suppression. In 2023, SCE will work with Technosylva to build upon these newly created metrics to more accurately reflect the number of buildings destroyed by wildfire and the ability to predict resource response."
a. Verify whether Technosylva's building loss model under development takes into account the building and neighborhood characteristics as far as age, materials, lot size, or building codes.

Response to Question 04:

Technosylva's building loss model is currently under development by Technosylva. As SCE understands the current state of the model, it is a Machine Learning (ML) algorithm which considers building conditions based on historical damage inspection data on buildings affected by fires over the past 13 years. These data include CAL FIRE Damage Inspection Specialist (DINS) post wildfire report information. DINS data contains information regarding damage to certain aspects of building structures and partial information regarding building material composition but does not contain information containing lot size or building codes.

SCE – MGRA – Data Request Response 5

Southern California Edison
2023-WMPs – 2023-WMPs

DATA REQUEST SET M G R A - S C E - 0 0 5

To: MGRA
Prepared by: Cindy Jacobs
Job Title: Senior Manager
Received Date: 5/12/2023

Response Date: 5/17/2023

Question 01:
Please provide an Excel spreadsheet summarizing outage causes for 2022:
a. The first column(s) should indicate the outage cause diagnosed by SCE.
Following columns should contain:
b. The fraction (in percentage) of all outages with the specific cause specified in the first column(s).
c. The fraction (in percentage) of outages on completely bare wire overhead segments with the specific cause specified in the first column(s).
d. The fraction (in percentage) of outages on completely covered conductor with the specific cause specified in the first column(s).
Each of columns b, c, and d should total to 100%.

Response to Question 01:

Please see the attached spreadsheet titled: "MGRA-SCE-005-01 FINAL OUTPUT v3"

The spreadsheet includes the counts and percentages requested. SCE interprets this data request to pertain to primary overhead fault outages. Column B includes all the outages in 2022 summarized by cause (i.e., outages occurring on bare wire, completely covered and partially covered). Column C is the subset of the outages in Column B that occurred on completely bare wire. Column D is the fraction in percentage of the outages in Column C for each cause. Column E is the subset of the outages in Column B that occurred on completely covered conductor. Column F is the fraction in percentage of the outages in Column E for each cause. Column G is the subset of the outages in Column B that occurred on partially covered conductor. Column H is the fraction in percentage of the outages in Column G for each cause. Each of the columns, B, D, F, and H total to 100%.

A-4 Other Data Requests

Data Request Number: MGRA-SDGE-002

Proceeding Name: A2205015_016 - SoCalGas and SDGE 2024 GRC

Publish To: Mussey Grade Road Alliance

Date Received: 2/17/2023

Date Responded: 3/6/2023

2-1 In Worksheet "1 Final GRC PTY RSE Workpaper - SDGE WildfireR_53731.xlsx", on the RSE_Summary page, the RSE for the combined Advanced Protection Program (APP) is given as 646, as compared to 223 for undergrounding, (HFTD Tier 3) and 31 for covered conductor (HFTD Tier 3).

a) What are the characteristics of the Advance Protection Program that give it such a high RSE?

SDG&E Response 2-1a:

The RSE for Advanced Protection Programs provides a quantification of reduction specific to wire-downs that are not impacted by other hardening programs specific to connection device failures. The primary components that are used to derive the RSE are the number of potential ignitions mitigated and the cost of installation. The cost of installing APP on a circuit basis is the driver for the higher RSE value. But it should be noted that the installation of APP on a given circuit will also typically require other costs from foundational projects such as WMP Private LTE which is described in budget code 198730 on page 112 of Ex. SDG&E-13-2R. The costs associated with these foundational projects is not included in the RSE calculation for the individual initiative.

SDG&E also notes that RSE scores are a useful input in selecting mitigations, but the overall risk reduction associated with the initiatives, and not just the risk per dollar, should be considered when creating a portfolio of initiatives aimed at reducing the overall wildfire and PSPS risk.

Question 2-1-Continued

b) Which component(s) of the APP are mostly responsible for the high RSE (Falling Conductor Protection, Sensitive Ground Fault Protection, Early Fault Detection, etc.)?

SDG&E Response 2-1b:

Falling Conductor Protection is the main contributor to the calculation of the APP RSE's.

Data Request Number: MGRA-SDGE-002

Proceeding Name: A2205015_016 - SoCalGas and SDGE 2024 GRC

Publish To: Mussey Grade Road Alliance

Date Received: 2/17/2023

Date Responded: 3/6/2023

MGRA-2-2 Can the APP including Falling Conductor Protection be implemented on a circuit containing covered conductor?

SDG&E Response 2-2:

Yes, APP including Falling Conductor Protection can be implemented on circuits containing covered conductor.

Data Request Number: MGRA-SDGE-002

Proceeding Name: A2205015_016 - SoCalGas and SDGE 2024 GRC

Publish To: Mussey Grade Road Alliance

Date Received: 2/17/2023

Date Responded: 3/6/2023

MGRA-2-3 Please provide any non-confidential internal or external documentation or technical papers on the Falling Conductor Program.

SDG&E Response 2-3

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. SDG&E further objects to the request to the extent it calls for information not in SDG&E's possession or calls upon SDG&E to perform studies and analysis that do not currently exist. Subject to and without waiving the foregoing objection, SDG&E responds as follows:

Please see the separately attached document titled "MGRA-SDGE-002_ATTACH_Q3.pdf."

MGRA-2-4 Has SDG&E applied for any patents for the Falling Conductor Programs? If so, what are the patent application numbers, and provide SDG&E's patent application filing.

SDG&E Response 2-4:

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. SDG&E further objects to the request to the extent it calls for information not in SDG&E's possession or calls upon SDG&E to perform studies and analysis that do not currently exist. Subject to and without waiving the foregoing objection, SDG&E responds as follows:

Please see the separately attached document titled "MGRA-SDGE-002_ATTACH_Q4.pdf."

Data Request Number: MGRA-SDGE-002

Proceeding Name: A2205015_016 - SoCalGas and SDGE 2024 GRC

Publish To: Mussey Grade Road Alliance

Date Received: 2/17/2023

Date Responded: 3/6/2023

MGRA-2-5 In SDG&E's response to PAO-SDGE-122-PWL Question 6, SDG&E provides the following chart containing its estimation of FCP risk reduction:

Metric	2023	2024-2027
Tier 3 wire downs (2015-2019 average)	14.4	
Tier 2 wire downs (2015-2019 average)	17.4	
Wire down with connection failures Tier 3	4	
Wire down with connection failures Tier 2	3.5	
Wire down Mitigated Tier 3	14.4 – 4 = 10.4	
Wire down Mitigated Tier 2	17.4 – 3.5 = 13.9	
Ignition rate Tier 3 (2015-2019 average)	2.69%	
Ignition rate Tier 2	3.29%	
Ignitions reduced Tier 3	10.4 x 2.69% = 0.280	
Ignitions reduced Tier 2	13.9 x 3.29% = 0.457	
Tier 3 circuits enabled (Years 2019-22 = 9)	5	14
Tier 2 circuits enabled (Years 2019-22 = 3)	0	20
Total Tier 3 circuits	28	
Total Tier 2 circuits	54	
Ignitions reduced Tier 3 (# circuits FCP enabled / 28) x 0.28	0.05	0.14
Ignitions reduced Tier 2 (# circuits FCP enabled / 54) x 0.457	0.00	0.169
Total Ignitions Reduced	0.05	0.309

a) In the above table, it appears that FCP is assumed to mitigate all wire downs without connection failures. Is this a correct interpretation and if not how are the first six rows to be understood?

SDG&E Response 2-5a:

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. SDG&E further objects to the request to the extent it calls for information not in SDG&E's possession or calls upon SDG&E to perform studies and analysis that do not currently exist. Subject to and without waiving the foregoing objection, SDG&E responds as follows:

Fallen Conductor Protection is intended to mitigate the consequences of wire-down events and does not prevent the risk event from occurring. While FCP can operate in the event of a connection device failure, connection device mitigations are captured in other programs as discussed in 2-5b to minimize double-counting the risk reduction associated with the overlaps of multiple initiatives.

Question 2-5-Continued

b) Please explain the difference between a wire down with and without a connection failure and its relevance to FCP effectiveness.

SDG&E Response 2-5b:

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. SDG&E further objects to the request to the extent it calls for information not in SDG&E's possession or calls upon SDG&E to perform studies and analysis that do not currently exist. Subject to and without waiving the foregoing objection, SDG&E responds as follows:

A wire down event can occur due to conductor failure or connection failure. The reason that connection device failures were excluded from the calculation of APP RSEs is that other initiatives, directly and indirectly, impact those specific types of risk events. The hotline clamp replacement program is one program that directly focuses on the replacement of high-risk connection devices. Covered conductor installations indirectly impact connection device failures because new hardware is installed when circuit segments are completed.

Data Request Number: MGRA-SDGE-002

Proceeding Name: A2205015_016 - SoCalGas and SDGE 2024 GRC

Publish To: Mussey Grade Road Alliance

Date Received: 2/17/2023

Date Responded: 3/6/2023

MGRA-2-6 Please provide non-confidential technical documentation regarding SDG&E's "Sensitive Ground Fault Protection" program.

SDG&E Response 2-6:

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. SDG&E further objects to the request to the extent it calls for information not in SDG&E's possession or calls upon SDG&E to perform studies and analysis that do not currently exist. Subject to and without waiving the foregoing objection, SDG&E responds as follows:

Sensitive Ground Fault (SGF) Protection

The electric utility industry has strived for years to utilize advancement in electronic relay technology for faster detection of low-level line-to-ground faults which can occur on distribution lines in high-risk fire areas. The combination of long overheard lines (high impedance) and unpredictably high contact surface resistance can result in low (<100 amp) line-to-ground fault currents. Sensitive Ground Faults (SGF) often display sub-cycle current spiking and other random electrical characteristics due to arcing, conductor bounce, and heating/drying of the contact surface. Detection may be further complicated by the presence of neutral load current due to line-to-neutral connected service transformers, which are frequently used in rural areas. Three versions of SGF protection are used in SDG&E networks:

- Conventional SGF (All reclosers: IntelliRupter, Eaton Cooper Form 6, SEL-651R2)
- Adaptive Conventional SGF (Eaton Cooper Form 6 Relays only)
- Spike Counting SGF
    - 60Hz Spike Counting (Eaton Cooper Form 6 Relay)
    - 50G High-Z (HIZ) Fault detection (SEL-651R2)
    - Sensitive Earth Current Spikes (IntelliRupter)

Conventional SGF: SDG&E began employing SGF protection starting in 2009. SGF protection is utilized to detect low level faults using a simple definite-time ground current element (set between 5 and 100 amps) with this definite-time delay, which is adjustable between 3.0 to 5.0 seconds to trip. The delay is set depending on how many devices are in service on a given circuit, a 0.5 second difference is given between each device to stagger the trip time coordination. This approach assumes a fallen line will maintain steady ground current above the relay pickup setting. Sensitivity for SGF relay settings

SDG&E Response 2-6 Continued:

will be limited in some cases by the need to accommodate historical peak neutral current (up to 90 amps on some circuits), due to circuit imbalances.

The setpoint for SGF is determined by reviewing a five-year historical neutral trend from PI Vision and ignoring anomalies and peaks during switch mode. SGF coordination with adjacent devices does not need to be considered since the time delay will provide optimal coordination.

Adaptive Conventional SGF: This method works based on the online monitoring of the residual current in the recloser location and adding a buffer on the measured standing current to adaptively adjust the SGF pickup. This way, the sensitivity of the SGF protection is maximized while likelihood of SGF overtripping under load condition is reduced. This scheme is only available in Eaton Form 6 controllers.

Spike Counting SGF: This method works based on the random characteristic of arcing faults. If number of spikes in the measured residual current exceeds a pre-defined setting within a specific time-frame, a sensitive ground fault is declared and recloser is tripped. Each recloser controller manufacturer offers its own unique Spike Counting SGF scheme.

Note that the abovementioned techniques can work in both three-wire and four-wire systems. However, the sensitivity of the conventional SGF can be significantly enhanced in three-wire system due to negligible standing residual current in those systems.

Data Request Number: MGRA-SDGE-002

Proceeding Name: A2205015_016 - SoCalGas and SDGE 2024 GRC

Publish To: Mussey Grade Road Alliance

Date Received: 2/17/2023

Date Responded: 3/6/2023

MGRA-2-7 Please provide an estimation of the number of reduced ignitions from SDG&E's "Sensitive Ground Fault Protection" program equivalent to the calculation done for the FCP program.

SDG&E Response 2-7:

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. SDG&E further objects to the request to the extent it calls for information not in SDG&E's possession or calls upon SDG&E to perform studies and analysis that do not currently exist. Subject to and without waiving the foregoing objection, SDG&E responds as follows:

SDG&E does not have an estimate for the number of ignitions reduced specific to Sensitive Ground Fault Protection (SGF). SGF has been in place since 2011 and the risk reduction of implementing SGF would be captured within the historical average of risk events. The provided RSE methodology is intended to derive the potential number of ignitions reduced for all the programs under the APP section.

MGRA-2-8 In its response to TURN-SEU-015, Question 9, SDG&E states that: "At wind speeds of 85 mph to 111 mph large airborne debris may be carried into the lines, and large trees could fall and strike the lines. Regardless of the type of conductor used, these incidents would cause a risk event and could result in potential ignition. Covered conductor can withstand certain vegetation/debris contacts; however, if a large piece of debris or tree contacts the line and causes a fracture, it could leave an exposed segment of bare conductor that protrudes from the covering." In its response to PAO-SDGE-082-MGN, Question 3, SDG&E states that: "Covered conductor is rated to withstand incidental contact, but is not rated for prolonged contact including wire-down scenarios which can occur at these higher wind speeds."

If the covered conductor in question has Falling Conductor Protection and Sensitive Ground Fault Protection enabled,

a) What ignition scenarios remain?

SDG&E Response 2-8a:

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. SDG&E further objects to the request to the extent it calls for information not in SDG&E's possession or calls upon SDG&E to perform studies and analysis that do not currently exist and not consistent with SDG&E's approved WMP initiatives. Finally, the request calls for speculation. Subject to and without waiving the foregoing objection, SDG&E responds as follows:

There are several ignition scenarios that can remain when FCP and SGF are enabled. These scenarios include but are not limited to:

- Any risk event that occurs where the insulating cover of the covered conductor is damaged. This can include object contact that damages the covering and causes arcing from the now bare conductor to the object.
- Equipment failure such as transformers, reclosers, or other overhead devices whose fault can cause arcing.
- A scenario where broken poles with unbroken electrical wire(s) are coupled with a high impedance fault having values below SGF setpoints and above load trending requirements. Further studies would be required to assess this scenario.

Question 2-8-Continued

b) Under these conditions, what is the relative reduction in ignition risk compared to bare conductor without APP in place?

SDG&E Response 2-8b:

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. SDG&E further objects to the request to the extent it calls for information not in SDG&E's possession or calls upon SDG&E to perform studies and analysis that do not currently exist. Finally, the request calls for speculation. Subject to and without waiving the foregoing objection, SDG&E responds as follows:

Covered Conductor is estimated to be 65% effective at reducing ignition risk while bare hardening is estimated to be 45% effective at reducing ignition risk. SDG&E has not completed the analysis to calculate the ignition risk reduction associated with the combination of initiatives. This analysis is ongoing and details of progress to date will be reported in SDG&E's 2023 Wildfire Mitigation Plan within the Joint IOU Covered Conductor Working Group Report.

Data Request Number: MGRA-SDGE-002

Proceeding Name: A2205015_016 - SoCalGas and SDGE 2024 GRC

Publish To: Mussey Grade Road Alliance

Date Received: 2/17/2023

Date Responded: 3/6/2023

MGRA-2-9 In its response to PAO-SDGE-112-MGN, Question 3, SDG&E states that: "SDG&E's strategic undergrounding initiative will not render APP obsolete. As areas of the system are undergrounded, SDG&E will still evaluate installation of APP equipment to support the various use cases defined in our WMP, including deploying FCP in the areas of the system with overhead facilities still in service."

a) Why has SDG&E not evaluated the combined use of APP with covered conductor as an alternative to undergrounding?

SDG&E Response 2-9a:

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. SDG&E further objects to the request to the extent it calls for information not in SDG&E's possession or calls upon SDG&E to perform studies and analysis that do not currently exist. Finally, the request calls for speculation and misstates or assumes facts that do not exist and not consistent with SDG&E's approved WMP initiatives. Subject to and without waiving the foregoing objection, SDG&E responds as follows:

This request is based on an inaccurate representation of SDG&E's answer to PAO-SDGE-112-MGN, Question 3, which addressed the efficacy of APP in the context of SDG&E's strategic undergrounding initiative. SDG&E has evaluated the combined use of APP with covered conductor in areas where overhead facilities will remain and in lower risk areas not planned for undergrounding in the short term or in areas where undergrounding is not feasible. SDG&E considers multiple approaches to grid hardening, including APP with covered conductor, however, in certain areas the combination of covered conductor and APP does not achieve the necessary wildfire and PSPS risk reduction. Specifically, undergrounding may be necessary to mitigate PSPS impacts.

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MGRA-2-10 In its response to PAO-SDGE-113-PWL, Question 1, "SDG&E notes that achieving this goal is contingent on potential resource constraints including but not limited to: Union and non-Union internal labor required for design, engineering, procurement and management, contract labor required for design, engineering, construction and project management, and equipment procurement supply chain challenges. These challenges were encountered during the Covid pandemic period, resulting in previous delays completing planned deployments."

a) Now that the Covid pandemic has abated along with supply chain issues, does SDG&E foresee the same kind of issue going forward?

SDG&E Response 2-10a:

SDG&E objects to this request on the grounds that it is compound, vague and ambiguous, particularly as it does not specify which initiative and "issue" MGRA is addressing. SDG&E further objects to the request that it misstates facts and or presumes facts not in evidence. Supply chain issues remain an issue in certain fields. SDG&E's response pertains to its APP program. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

Supply chain issues remain a challenge in 2023 but are expected to ease. SDG&E endeavors to countermeasure for long lead time equipment by purchasing earlier in the design cycle.

Question 2-10-Continued

b) How different are these challenges from those SDG&E has and continues to encounter in its undergrounding program and claims to be overcoming?

SDG&E Response 2-10b:

SDG&E objects to this request on the grounds that it is compound, vague and ambiguous, particularly as it does not specify which initiative and "challenges" MGRA is addressing. SDG&E further objects to the request that it misstates facts and or presumes facts not in evidence. Supply chain issues remain an issue in certain fields. SDG&E's response pertains to its APP program. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

Challenges between APP and undergrounding are different. APP utilizes specific electronic devices and protective relay components which are encountering specific manufacturing delays and shortages.

Question 2-10-Continued

c) Now that initial circuits have had APP implemented, does SDG&E have a deeper understanding of the engineering and procurement issues involved?

SDG&E Response 2-10c:

Yes.

Question 2-10-Continued

d) Could SDG&E re-allocate resources from its undergrounding program to its APP program if it wished to accelerate that program?

SDG&E Response 2-10d:

SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is likely reasonably calculated to lead to the discovery of admissible evidence. Additionally, the request calls for speculation and assumes facts not currently in existence and not consistent with SDG&E's approved WMP initiatives. Subject to and without waiving the foregoing objections, SDG&E responds as follows:

SDG&E's resources for its undergrounding program and APP program are not the same. The undergrounding program is managed by SDG&E's Electric System Hardening Program Management department and utilizes resources for civil construction, underground electric construction, and support services such as permitting and engineering. The APP program is managed by SDG&E's System Protection Automation and Control Engineering department and utilizes resources for overhead electric construction and support services such as permitting and engineering. These resources do not directly overlap and many of the undergrounding resources could not be utilized by the APP program.

Question 2-Continued

b) What fraction of circuits segments in HFTD 2 are three versus four wire?

SDG&E Response 2b:

Within HFTD Tier 2 SDG&E has 1,043.1 circuit miles of three-wire and 1,391.9 miles of four-wire. The ratio of three-wire to four-wire is 42.8% three-wire and 57.2% four-wire.

Question 2-Continued

c) What fraction of circuits segments in HFTD 3 are three versus four wire?

SDG&E Response 2c:

Within HFTD Tier 3 SDG&E has 742.2 circuit miles of three-wire and 966.5 miles of four-wire. The ratio of three-wire to four-wire is 43.4% three-wire and 56.6% four-wire.