Safety Policy Division
Staff Evaluation Report
on the
Southern California Edison Company's 2022 Risk Assessment and Mitigation Phase (RAMP) Application
(A.)22-05-013

November 10, 2022

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Executive Summary

Objective: The Safety Policy Division (SPD) of the CPUC is required by the Commission to review Risk Assessment and Mitigation Phase (RAMP) applications. This Staff report summarizes the results of SPD's evaluation of the Southern California Edison (SCE) Risk Assessment and Mitigation Phase (RAMP) application in Application (A.)22-05-013. The 2022 SCE RAMP is the first SCE RAMP in which SCE is bound by the terms of the Safety Model Assessment Phase (S-MAP) proceeding's Settlement Agreement.

Approach: As in previous SPD RAMP evaluations, the documents germane to the evaluation are the utility's RAMP application, the proceeding's Scoping Memo, the Safety Model Assessment Phase (S-MAP) Settlement Agreement adopted in Decision (D.)18-12-014, and D.14-12-025. Additional requirements relevant to RAMP applications became effective in 2021 with the adoption of D.21-11-009.

Consistent with the Scoping memo, SPD's evaluation endeavored to answer two questions:

1. Is the 2022 SCE RAMP compliant with all relevant requirements specified in the documents referenced above?
2. Are there any areas of deficiency concerning utility risk management practices in the 2022 SCE RAMP that can be improved?

   For the first question, when SPD staff encountered a deviation from these explicit requirements, we cited the specific requirements and identified the deviation from the requirements. Where appropriate, SPD staff would offer recommendations to address the deficiency.

   The second question is much broader in scope and was designed to examine whether the risk management practices SCE employed in preparing the 2022 RAMP have any identifiable deficiencies that can be improved on in relation to these steps based on the Cycla process[1]:

1. Identify threats and top safety risks.
2. Characterize sources of risk.
3. Identify candidate risk control measures (RCMs).
4. Evaluate the anticipated risk reduction for the identified RCMs.
5. Determine resource requirements for identified RCMs.
6. Select RCMs considering resource requirements and anticipated risk reduction.

[1] The Cycla process is a 10-step process developed by the Cycla Corporation to evaluate risk management practices and expenditure proposals in PG&E's gas distribution operation in the General Rate Case filed in 2013. SPD adapted the relevant steps to this RAMP evaluation.

7. Determine total resource requirement for selected RCMs.
8. Adjust the set of RCMs to be presented in the RAMP and GRC.
9. Consideration of alternative mitigations.

If SPD identified a deficiency in relation to Question 2, SPD staff highlighted the deficiency, explained our rationale for the observation, and, where appropriate, offered recommendations for improvement.

Summary of SPD's Critical Findings:

High-level critical observations that apply to the 2022 SCE RAMP:

1. Missing RSE calculations for compliance-related mitigation activities.
2. An unjustified 10% discount rate applied to incremental mitigation costs when calculating RSEs.
3. High implied Value of Statistical Life (VSL).
4. Lack of detail or explanation for the pace or extent of selected mitigations.
5. Lack of transparency related to models using machine learning techniques.
6. Oversimplified risk bowties.
7. Overly granular presentation of risk analysis.

Specific critical observations on individual risk chapters:

Wildfire Risk (Chapter 4)

1. Overly granular presentation of risk analyses.
2. Low cost-efficiency of wildfire covered conductor (WCCP) and targeted undergrounding (TUG) mitigation programs.
3. Lacking justification for the late addition of TUG circuit segments.
4. Routine vegetation management lacks risk modeling.
5. Not all risk factors, such as egress, included in RSE calculations.
6. Wind dependency is missing in SCE's ignition models.
7. Catastrophic losses are inadequately modeled.
8. Risk model does not include the health and safety consequences of wildfire smoke.
9. The risk reduction from the covered conductor mitigation program is likely under-valued in the risk modeling.

Public Safety Power Shutoff (PSPS) Risk (Chapter 4)

1. PSPS damage events not included in ignition risk model.
2. Granular tranches do not clearly explain the risk of PSPS to vulnerable customers.
3. Improper designation of activities as Foundational.
4. Lack of details regarding how Fast Curve de-energizations impact vulnerable customers.

Contact with Energized Equipment Risk (Chapter 5)

1. For the year 2025, staff assessed the SCE input data and identified that C1 and C2 RSEs differ from those presented in Chapter 5.
2. SCE should present updated information about the mitigations M2-M5, not in a pilot study phase, in the GRC filing.

Underground Equipment Risk (Chapter 6)

1. Oversimplified risk bowtie with insufficient details on risk drivers
2. Input data on RSEs not transparently explained.
3. Slow pace of BURD transformer replacement may be inadequate to sufficiently reduce risk from BURD transformer failures.

Cyber Attack Risk (Chapter 7)

1. SCE, as in past RAMP submittal iterations, errs on the side of too little disclosure of Cyber-security program specifics, citing the highly confidential nature of such sensitive information.
2. SCE's spending on Cyber-security programs is trending upward while program activities appear to largely consist of continuation of existing approaches and methods.

Seismic Risk (Chapter 8)

1. Tranche 4 is not included in the RAMP analysis even though it's part of SCE's Seismic Resiliency Program.

Physical Security Risk (Chapter 11)

1. As in other chapters, SCE omits detail on the subject of risk controls that address regulatory-compliance mandates and insufficiently speaks to costs and funding requests for such State- and federal-compliance activities.

Hydro Dam Failure Risk (Chapter 12)

1. Staff notes it is unclear why C2 – Dam Surface Protection and C5 – Seepage Mitigation are separate as they do not appear to have different homogenous risk profiles.

Climate Change Risk (Appendix B)

1. Concurrent filing dates for SCE's RAMP application and SCE's Climate Adaptation and Vulnerability Assessment (CAVA) prevented SCE from implementing CAVA results into the 2022 RAMP, resulting in no actual mitigation proposals to address climate risks in the RAMP.

Transmission and Substation Assets Risk (Appendix C)

1. Certain transmission asset risks have direct potential wildfire implications. It is not apparent why those related mitigations are not incorporated into the wildfire risk chapter.

Background and Introduction

Pursuant to the revised rate case plan schedule contained in D.20-01-002,[2] the Southern California Edison Company (SCE) filed its 2022 Risk Assessment and Mitigation Phase (RAMP) application on May 13, 2022. This RAMP application was filed in advance of SCE's Test Year 2025 GRC application. This RAMP application, covering years 2025 to 2028, has been given Commission proceeding number A.22-05-013.

Pursuant to the rate case plan in D.20-01-002 and as directed by the Scoping Ruling in A.22-05-013, the Safety Policy Division (SPD) has been tasked with evaluating SCE's RAMP application. This report summarizes the results of the evaluation.

The 2022 SCE RAMP is the first SCE RAMP in which SCE is bound by the terms of the Safety Model Assessment Phase (S-MAP) proceeding's Settlement Agreement.[3]

[2] Revised Rate Case Plan Decision, D.20-01-002, Appendix B.

[3] Phase 2 Decision Adopting S-MAP Settlement Agreement with Modifications, D.18-12-014, Appendix A.

Explanation of terms

RAMP Report – The individual chapters and appendices of the RAMP application are collectively referred to as the "RAMP Report." Supporting workpapers are also included as part of the RAMP Report.

2022 RAMP – Utilities refer to RAMP applications by the calendar year in which the application is filed. The 2022 SCE RAMP has a 2025 Test-Year and covers expenditures from 2025 to 2028.

TY 2025 GRC – The CPUC and IOUs refer to General Rate Case (GRC) applications by the test year (TY) on which the general rate case estimates and calculations were based. SCE refers to the upcoming GRC application that will be filed in the calendar year 2023 as the "TY 2025 GRC."

RSE – Risk Spend Efficiency. The ratio of the time-discounted value of risk reduction benefits to the time-discounted value of mitigation costs.

Scope and Methodology of Evaluation

The Scoping Memo in the SCE RAMP proceeding enumerates the following questions for consideration in the evaluation of SCE's RAMP Report:

1. Whether SCE's RAMP submission is complete and in compliance with D.14-12-025, D.21-11-009, the Safety Model Assessment Proceeding settlement agreement adopted in D.18-12-014, and other relevant decisions involving RAMP.
2. Whether there are gaps in the RAMP Report in identifying risks and considering mitigation options.
   a. Whether SCE evaluates the effect of inadequate inspections to existing risks;
   b. Whether SCE assesses harm to customers from de-energization events such as Public Safety Power Shutoff events;
   c. Whether SCE should explore the use of power law functions to model wildfire risks in this RAMP and/or in its future RAMPs;
   d. Whether wildfire smoke should be considered as a safety risk in this RAMP and/or in its future RAMPs; and
   e. Whether risk reduction and risk-spend efficiency should be established for Rapid Earth Fault Current Limiter prototyping and developments in this RAMP and/or in its future RAMPs.
3. Whether the utility's analysis is transparent and allows for independent validation of its results.
4. Whether RAMP feedback has been meaningfully evaluated, and when appropriate, incorporated into SCE's GRC filing.
5. Whether the Application aligns with or impacts the achievement of any of the nine goals of the Commission's Environmental and Social Justice Action Plan.

SPD staff employed the Cycla process[4] to examine risk management analysis used by SCE in preparing the 2022 RAMP to help areas of improvement. The Cycla steps include the following:

1. Identify threats and top safety risks
2. Characterize sources of risk
3. Identify candidate risk control measures (RCMs)
4. Evaluate the anticipated risk reduction for the identified RCMs
5. Determine resource requirements for identified RCMs
6. Select RCMs considering resource requirements and anticipated risk reduction
7. Determine total resource requirement for selected RCMs
8. Adjust the set of RCMs to be presented in the RAMP and GRC
9. Consideration of alternative mitigations

[4] The Cycla process is a 10-step process developed by the Cycla Corporation to evaluate risk management practices and expenditure proposals in PG&E's gas distribution operation in the General Rate Case filed in 2013. SPD adapted the relevant steps to this RAMP evaluation.

Where SPD staff observed notable flaws in SCE's RAMP Report and mitigation selection processes, this evaluation explicitly states the observations and highlights corresponding recommendations for improvement. Where SPD staff had no significant observations on a risk chapter, the SPD report largely remained silent. In some cases where SPD staff had no notable observations for an entire risk chapter, the report was silent on the entire risk chapter.

One aspect of the evaluation revolved around the analysis of Risk Spend Efficiency (RSE) scores. RSE of a mitigation program is defined as the amount of risk reduction divided by the cost of the mitigation program. The verification of mitigation cost estimates was beyond the scope of this evaluation. To the extent that there could be uncertainties and potential errors in SCE's mitigation cost estimates, those uncertainties and potential errors would carry through to the RSE calculations, leading to potential errors in the mitigation decisions. Therefore, the cost estimates should be substantiated in the TY 2025 GRC.

The staff endeavored to make the evaluation more concise than in the past to improve the accessibility and usefulness of this work product to stakeholders. The primary purpose of RAMP evaluations is to produce an analysis, make observations, and offer relevant recommendations to the utility for improvement rather than to summarize the publicly available contents of the utility's RAMP Report.

SCE's RAMP Report contains nine major risk chapters (Table 1), plus five appendices addressing other risk topics and assets (Table 2).

TABLE 1. Risk Chapters

RAMP Report Chapter	Risk
4	Wildfire and PSPS
5	Contact with Energized Equipment
6	Underground Equipment Failure
7	Cyber Attack
8	Seismic
9	Employee Safety
10	Contractor Safety
11	Major Physical Security
12	Hydro Dam Failure

SCE also included the following five risk topics in the 2022 RAMP Report, but these are not strictly RAMP risks selected using the process specified in the S-MAP Settlement Agreement. Since they are not technically RAMP risks and are not subject to the terms of the Settlement Agreement, SCE did not present any rigorous MAVF risk analyses on these risk topics.

TABLE 2. Appendices on Other Risk Topics and Assets

Appendix	Other Risk Topics and Assets
A	Battery Energy Storage Systems
B	Climate Change
C	Transmission and Substation Assets
D	Nuclear Decommissioning
E	Widespread Outage

Following the order of the RAMP Report, SPD staff reviewed each chapter in detail. For each risk chapter, the evaluation examined the soundness and adequacy of the overall risk assessment and analytical approach and whether the application complies with the MAVF process specified in the S-MAP Settlement Agreement and additional RAMP and GRC-related requirements specified in D.14-12-025, D.18-12-014, D.21-11-009, and the Scoping Memo for this RAMP proceeding.

Similar to the practice in the last two RAMPs, SPD invited parties to submit informal comments to SPD. These comments provided invaluable input into SPD's evaluation process. The Mussey Grade Road Alliance (MGRA), the Public Advocates Office (Cal Advocates), and The Utility Reform Network (TURN) submitted informal comments to SPD on Oct. 10, 2022. These are appended to the end of this report.

Key Differences between 2022 RAMP and 2018 RAMP

SCE's 2018 RAMP used a Multi-Attribute Risk Score (MARS) framework aligned with the S-MAP Settlement Agreement Multi-Attribute Value Function (MAVF) framework. Due to timing differences, the 2018 RAMP was not subject to the terms of the S-MAP Settlement Agreement as it had yet to be approved by the Commission when SCE filed its 2018 RAMP application. Although SCE framed its 2018 RAMP in terms of compliance with the Settlement Agreement, the 2022 RAMP is the first SCE RAMP in which the S-MAP Settlement Agreement officially applied.

There are notable differences between SCE's 2018 and 2022 RAMP filings. The following list is not an exhaustive comparison of the differences:

1. **Linear Scaling functions** - For the 2018 RAMP, SCE used a non-linear scaling function (a square root function) to convert the number of fatalities and serious injuries into their respective scaled, unitless risk scores. Other attributes in the 2018 RAMP used linear scaling functions. In contrast, all scaling functions in the SCE's 2022 RAMP are linear.

2. **Foundational costs** - D.21-11-009 added the new requirement to include foundational costs that exceed certain Commission-specified thresholds when calculating incremental costs and RSEs. The 2022 RAMP is subject to this new requirement. SCE included foundational costs, where applicable, and allocated these to mitigations based on their costs.

3. **Starting baseline for RSE calculations** - D.21-11-009 defined the relevant baseline (as a reference point in time) for estimating risk reductions. D.21-11-009 defined the baseline for calculating RSEs as the start of the new GRC cycle (or, equivalently, the end of the current GRC cycle). Accordingly, starting baseline for the 2022 SCE RAMP is the beginning of calendar year 2025 (or, equivalently, the end of calendar year 2024).

   For the 2018 RAMP, SCE treated the end of the last full calendar year before the RAMP was filed as the starting baseline. This meant that for the 2018 RAMP, the end of calendar year 2017 was used as the starting baseline to estimate risk reductions and incremental costs. Had SCE retained this outdated definition for the baseline, its 2022 RAMP would have used the end of 2021 as the starting baseline. Instead, for the 2022 RAMP, under the new definition for baseline as adopted in D.21-11-009, SCE used the end of 2024 as the starting baseline for the presentation of risk reductions, incremental costs, and RSEs of the 2025 Test Year. For the post-test years in the new GRC cycle, namely 2026 to 2028, SCE annually resets the baseline to the start of the new calendar year.

4. **Renaming of "compliance controls" as "compliance activities"** - In the 2018 RAMP, SCE referred to compliance-related mitigation activities as "compliance controls" and, in doing so, did not provide RSEs for these compliance-related mitigation activities.

   For the 2022 RAMP, after the Commission directed all investor-owned utilities to provide RSEs for all mitigations and all forms of controls[5], SCE renamed all such compliance-related mitigation activities that SCE previously called compliance controls (which are in essence compliance-related mitigation activities) by removing any reference to the words, mitigations or controls. In the 2022 RAMP, SCE began referring to these compliance-related mitigation activities by a new term, "compliance activities." By using this new term and not referring to them as either mitigations or controls, SCE seemed to have taken the position that the D.21-11-009 requirement to provide RSEs did not apply to these compliance-related mitigation activities.

5. **Machine learning** - For the 2022 RAMP, SCE began to apply machine learning techniques to develop an asset-based wildfire probability model.

6. **Technosylva fire simulation tool** - For the 2022 RAMP, SCE also incorporated a fire simulation tool developed by Technosylva to inform wildfire consequence modeling.

7. **Much more granular tranches** – For some risk chapters, such as wildfire risk, SCE began presenting substantially more granular tranches for risk analysis in the 2022 RAMP than in the 2018 RAMP.

[5] D.21-11-009, Ordering Paragraph, 1c, which states: "Each IOU shall calculate Risk Spend Efficiencies (RSEs) for all mitigations, including controls that are ongoing."

8. **Changes to MAVF attributes and weights with greater emphasis on reducing the likelihood of fatalities** - For the 2018 RAMP, there were four separate consequence attributes: serious injury, fatality, reliability, and financial, with each attribute receiving a 25% weight.

   For the 2022 RAMP, the serious injury consequence term is no longer a separate consequence. It is subsumed into a safety index, which is defined as the sum of the number of fatalities plus ¼ of the number of serious injuries. A serious injury is treated as having the same safety impact as ¼ of a fatality in the 2022 RAMP. The total safety index receives a 50% safety weight in the MAVF. These changes effectively place much heavier emphasis on preventing fatalities than serious injuries.

   The reliability and financial attributes are unchanged and receive the same 25% weight as in 2018.

9. **Tail-averages no longer presented** - The 2018 RAMP presented results in both the expected values and tail averages. The 2022 RAMP only presented results in terms of expected values.

10. **Different discount rates for risk reduction benefits and mitigation costs** - In the 2018 RAMP, SCE calculated RSEs by applying the same discount rate to calculate the present values of both risk reduction benefits and mitigation costs. In the 2022 RAMP, SCE began using a "societal discount rate" of 3% to discount risk reduction benefits while using an SCE-selected 10% "incremental cost of capital" rate to discount mitigation costs. Since the 3% discount rate for benefits is much less than the SCE-selected 10% "incremental cost of capital" rate for discounting costs, this change has the general effect of favoring mitigation options with a longer stream of benefits. Since mitigation activities involving costly asset replacement typically have much longer benefit streams than less expensive but short-lived maintenance activities, this change will effectively give capital-intensive asset replacement-type mitigations a boost in the RSE rankings compared to maintenance-type activities.

11. **Separate risk chapters for Employee and Contractor Safety** – The 2018 RAMP combined Employee and Contractor Safety in one RAMP chapter and combined the risk analysis. The 2022 RAMP provides separate risk chapters and risk analysis for Employee Safety and Contractor Safety.

12. **Seismic as a standalone risk** – The 2018 RAMP included seismic hazards as a sub-part of the Building Safety Risk. The 2022 RAMP treats Seismic as a standalone risk with a separate risk chapter and risk analysis.

13. **PSPS treated as a risk** – The 2018 RAMP treated PSPS as ignition mitigation of the Wildfire Risk. In the 2022 RAMP, PSPS is treated as both a mitigation and a risk factor.

SCE's RAMP Risk Selection Process

The Settlement Agreement in Step 1B, Row 8 specifies the process utilities must follow to select risks to be concluded in their RAMP applications. The process begins with the enterprise risk register. The Settlement Agreement in Step 2A, Row 9, then describes the process whereby the initial enterprise risks in the risk register are to be evaluated for safety impacts only. These risks are then given an initial safety-only score. The resulting safety-only scores are then sorted, with the top 40 percent of those risks included in the RAMP.

SCE's 2022 RAMP Report presents what SCE considers to be the top safety risks to its customers and the communities it services, to the SCE company, and its employees and contractors. At the December 6, 2021, Pre-RAMP workshop, SCE presented a preliminary list of RAMP risks. These RAMP risks were presumably selected using the Step 1B and Step 2A processes described above, but the information presented at the Pre-RAMP workshop was labeled "preliminary" and incomplete. At the Pre-RAMP workshop, SCE presented the safety risk scores for only 10 of the 27 risks in SCE's Enterprise Risk Register using the MAVF process.[6] SCE did not present safety risk scores for the remaining 17 enterprise-level risks and, instead, indicated in the Pre-RAMP presentation that the safety scores for enterprise risks 11 to 19 were to be determined (TBD). However, the safety risks scores for these remaining risks in SCE's enterprise risk register were not included in the 2022 RAMP application or the workpapers. In essence, the top 40% status of the included RAMP risks and full compliance with Step 1B, Row 8 and Step 2A, Row 9 were not conclusively demonstrated based on the submitted documents.

SPD recommends that SCE explicitly show how they complied with the RAMP risk selection process spelled out in the S-MAP Settlement Agreement when they file their GRC, even if such a showing may repeat information presented in the Pre-RAMP documents or previous RAMPs. It will also clarify in the GRC process how the top risks were identified and selected to assist the Energy Division and Commissioners in evaluating proposed expenditures.

[6] Slide 14 of SCE's Pre-RAMP presentation.

Findings of Overarching Deficiencies and Concerns

SPD staff are pleased to note that each successive iteration of RAMP applications has generally shown notable improvements in the depth, rigor, and overall maturity of the utilities' risk management approaches. This has been true across the large energy utilities and for SCE specifically. These improvements are attributable to several factors, including:

- Guidance provided by the Commission
- Utilities' improving adherence to the S-MAP Settlement Agreement
- Utilities learning from one another and from one another's RAMP evaluation results
- Increasing risk management experience gained by the utilities
- Utilities' own initiatives and increasing utility resources dedicated to implementing a risk-based approach to improve safety
- Intervenor and SPD staff input for improvement

Despite the foregoing comments, SCE still has room for improvement. Findings of concerns, deficiencies, and recommendations related to specific risk chapters of the SCE RAMP application are found in the individual risk chapter evaluations in this report. Overarching areas of concern and deficiencies that apply to the whole 2022 SCE RAMP application are listed below:

1. **Missing RSE calculations for compliance-related mitigation activities**. SCE failed to provide RSEs for mitigation activities performed to satisfy regulatory compliance requirements. For the 2022 RAMP, SCE began referring to compliance-related mitigations as "compliance activities." These are the mitigation activities that SCE previously referred to as "compliance controls" in the 2018 RAMP. SCE's failure to provide RSEs for compliance-related mitigation activities and controls in the 2022 RAMP occurred despite Decision (D.)21-11-009 in the Risk-Based Decision-Making Framework Rulemaking proceeding (R.20-07-013) explicitly directing the utilities to provide "RSEs for all mitigations, including controls that are ongoing."[7]

   At the time when D.21-11-009 was adopted, both the Commission and SPD staff understood Ordering Paragraph 1c to apply to all forms of existing controls, including those controls that SCE referred to as "compliance controls" in SCE's 2018 RAMP. It was never the intent of the Commission to exempt from Ordering Paragraph 1c in D.21-11-009 any compliance-related mitigations or controls (or any such compliance-related mitigation activities) that SCE up to that point in time had been referring to as "compliance controls." To the contrary, compliance controls were explicitly referenced and contemplated in the staff proposal[8] and in the December Decision. Renaming "compliance controls" to "compliance activities " does not negate the RSE requirement for compliance-related risk mitigation activities and controls.

[7] D.21-11-009, Ordering Paragraph 1c.

[8] Administrative Law Judge's Ruling Providing Staff Recommendations for Comment on June 4, 2021, at pages 4 -6. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M386/K581/386581684.PDF

RSEs for compliance-related mitigations, whether SCE refers to them as “compliance controls” or “compliance activities, are important reference points that SPD staff and other RAMP/GRC stakeholders could use to compare the cost-effectiveness of proposed mitigations and their alternatives. Having RSEs for “compliance controls”/”compliance activities” would also permit the evaluation of existing mitigation activities not related to regulatory compliance (those that the utilities refer to as controls) to determine whether there is justification for their continuation in the new GRC funding period. Furthermore, suppose legal and regulatory requirements have low RSE values. In that case, the Commission and parties could use this information to propose revisions to these requirements to avoid inefficient expenditures of ratepayer funds.

SPD recommends SCE correct this deficiency before filing SCE’s TY2025 GRC application.

2. **The 10% discount rate applied to incremental mitigation costs when calculating RSEs is excessive.** TURN submitted informal comments to SPD on October 10, 2022 arguing the 10% “incremental cost of capital” that SCE selected for discounting incremental mitigation costs in the RSE calculation is inappropriate. SPD agrees with TURN’s observation. Because SCE “finances its operations with a mix of debt and equity issuances,” the reasonable incremental cost of capital SCE should use to discount incremental costs should be SCE’s Weighted Average Cost of Capital (WACC), which is currently 7.68%.

   TURN also disputed in its informal comments the validity of the 3% rate (which SCE referred to as a “societal discount rate”) used by SCE to discount risk reduction benefits in the RSE calculations. TURN argued that SCE’s application of the 3% rate, adopted in another proceeding to discount solar generation benefits, is inappropriate for risk reduction benefits in the RAMP proceeding. Instead, TURN argued that SCE should use the same discount rate, i.e., the WACC of 7.68%, to discount both the mitigation costs and benefits in the RSEs.

   Setting aside the question of the validity of using the 3% discount rate for risk reduction benefits, the sizeable difference in discount rates applied to risk reduction benefits in the numerator and costs in the denominator (i.e., 3% vs. 10%) in the RSE formula has the effect of giving more weight to mitigation options that have a longer benefit stream. Since mitigation activities involving costly asset replacement will generally have a much longer benefit stream than less expensive but short-lived maintenance activities, the huge disparity in SCE’s selected discount rates will give capital-intensive asset replacement mitigation strategies a boost in RSE rankings compared to shorter duration and less costly maintenance-type mitigation alternatives. SPD recommends that SCE use the Weighted Average Cost of Capital applicable to SCE to discount RSE costs in the RSE calculations.

   The discount rate does not necessarily have to be the same for both the numerator and the denominator in the RSE calculation. Discounting is a method of expressing indifference between time-dependent outcomes at two different times by considering the applicable opportunity cost for delaying the realization of the outcomes. In the RSE calculations, the outcomes are the accumulation of risk reduction benefits in the numerator and the expenditure of mitigation costs in the denominator. A discount rate represents the opportunity cost to equate two different time-dependent outcomes. It does not necessarily make sense to force the same discount rate to be used to discount both the numerator and the denominator unless the two types of outcomes in the numerator and the denominator have the same characteristics and the same built-in assumptions. Furthermore, on its surface, it does not seem appropriate that fatalities averted (or other external benefits) one year from today should be worth less than fatalities averted today by an amount dependent on SCE's WACC.

Another nuance to ranking mitigation projects by RSEs is that capital projects involving asset replacements are always at a comparative disadvantage compared to short-duration maintenance activities when using RSEs as the comparative tool. This is because costs for asset replacements are incurred upfront (resulting in little or no discounting), but the benefit streams for asset replacements are much longer and are thus greatly reduced by discounting. Having a lower discount rate for benefits would be one way of placing capital projects and maintenance activities on a more equal footing when comparing RSEs between these two types of projects.

In summary, SPD supports TURN's argument that SCE should use SCE's current WACC to discount costs in the RSE, but SPD does not support TURN's argument that the same WACC is applicable to discount benefits in the RSE. Rather than a rigid direction to stick to a 3% discount rate, SCE should use the best available data combined with subject matter expert judgment, accompanied by a transparent justification to apply a reasonable discount rate for risk reduction benefits in the numerator of SCE's RSE calculations.

3. **High implied Value of Statistical Life (VSL).** For the 2022 RAMP, SCE uses a Safety Index to evaluate the safety impact in the MAVF. SCE defines the Safety Index by the formula:

   Safety Index = Number of Fatalities + ¼ x Number of Serious Injuries

   SCE's Safety Index formula implies that each serious injury has ¼ the equivalent safety impact as one fatality. Using the respective weights and ranges for the Safety Index and Financial attributes, it can be inferred that each unit of the Safety Index has an implied value of $100 Million. Combining this result with the observation that SCE treats one serious injury as having the same safety impact as ¼ of a fatality, it can be determined that the implied value of a statistical fatality (or, equivalently stated as the implied value of a statistical life, or VSL) in SCE's Safety Index formula is $94 Million and the implied value of each statistical serious injury is $23.5 Million.

   The implied VSL of $94 Million in SCE's MAVF can be interpreted as the implied average cost of incremental proposed mitigation activities necessary to reduce one statistical fatality in the new GRC period. This large implied average VSL compares very unfavorably against the latest available 2021 VSL guidance figure of $11.8 Million published by the U.S. Department of Transportation.[9,10]

To compare the SCE's implied value of serious injury against the US DOT guidance figure for VSL, we convert the US DOT guidance VSL into an implied value of statistical serious injury using the same ¼ conversion factor SCE used to convert between fatalities and serious injuries. This results in an equivalent US DOT guidance figure of $2.95 Million per serious injury compared to SCE's implied value of $23.5 Million.

These high implied average values of statistical life and serious injury reflect the great expense of SCE's proposed RAMP risk mitigation programs aimed at reducing the likelihood of fatalities and serious injuries. SPD recommends that SCE recalibrate the relative weights and ranges in the MAVF to produce an implied VSL that aligns much closer to the US DOT guidance figure.

4. **Little explanation for the pace or extent of selected mitigations is provided.** The justifications for the extent of desired risk reductions and associated mitigation expenditure levels were frequently not sufficiently explained and, in some cases, completely absent. SCE's risk analyses present the risk drivers and the corresponding mitigation options to reduce the consequences or frequencies of those risk drivers. However, in almost all cases, the analyses fall short of transparently describing how SCE decided on the implementation pace and scope of risk mitigations, and how SCE decided on the desired amount of total risk reduction to be achieved in the new GRC funding period and beyond. SPD recommends that SCE provide more thorough explanations for the selected scope and pace of proposed mitigations and how SCE decided on the amount of risk reduction to be achieved in the new GRC funding period.

5. **Lack of transparency related to models using machine learning techniques.** On the wildfire risk modeling, the machine learning techniques also contributed to this lack of transparency. Despite SCE's efforts to show the inner workings of the machine learning approach, it remains very much an opaque "black box" to SPD staff and probably also to the intervenors who attended SCE's presentation on this topic. This is not a criticism of SCE's initiative to apply machine learning techniques to model wildfire risk. Far from it, SPD supports its continued and broader use. It's simply an acknowledgment that there are challenges that SCE will have to overcome in the GRC and future RAMPs to provide greater transparency within the confines of the machine learning approach.

6. **Oversimplified risk bowties.** Bowtie analyses were sometimes oversimplified. For example, in the bowtie analysis for the Underground Equipment Failure risk (Chapter 6 of the RAMP Report),

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[9] https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis

[10] To be more precise, the US DOT's 2021 guidance figure for the VSL should be escalated to the middle of the new GRC period for proper comparison against SCE's implied VSL, but the effect of the escalation would be slight relative to the very large size of SCE's implied VSL and would not change SPD's observation.

the four risk drivers are, in fact, subcategories of the total exposure. A more thorough representation of the risk bowtie should show subcategories of risk drivers to more transparently present the true underlying threats or failure mechanisms of those asset tranches. Each exposure subcategory should have been given its modes of failure and its own set of risk drivers for failure. An oversimplified bowtie analysis could result in bias towards expensive asset replacement over other possibly less expensive maintenance-related mitigation strategies. SPD recommends that SCE explicitly include the main underlying threats, causes, or modes of failure contributing to the risk event from each tranche in the risk bowtie. In some cases, this could involve adding an extra column in the risk bowtie as necessary.

7. **Overly granular presentation of risk analysis**. In the prior RAMP filings of other utilities, both SPD staff and intervenors made the same observation that the utilities used insufficiently granular tranches for risk analysis. Perhaps as a result of proactively responding to these critiques, SCE presented risk analysis in the 2022 RAMP in a highly granular fashion. This was especially evident in the wildfire risk analysis, where SCE presented risk analysis at the highly granular pole-to-pole, structure-to-structure, or small circuit segment level. Such highly granular risk analyses are understandably needed by SCE internally for its risk simulations, prioritizations, and executions of mitigation activities, but exceed what is necessary for evaluation of program-level risk mitigation proposals in the RAMP.

   For risk analysis and model simulations, SPD encourages SCE to use as much granularity as SCE deems appropriate, provided the approach complies with the S-MAP Settlement Agreement. However, for presentation in the RAMP, SCE should transparently show how these highly granular risk tranches used in model simulations are rolled up into program-level tranches, program-level mitigation decisions, and program-level executions. Doing so would facilitate oversight by SPD staff and other stakeholders in the RAMP and GRC proceedings.

EVALUATION OF INDIVIDUAL RISK CHAPTERS

Wildfire Risk (Chapter 4, Excluding PSPS)

Summary of Overall Observations on the Wildfire Risk:

Granularity of Tranches: SCE defined circuit segment tranches so granularly that they cannot be chosen in isolation for proposed Targeted Undergrounding Program (TUG) or Wildfire Covered Conductor Program (WCCP) mitigations. If SCE still wants to use a granular risk modeling approach at the circuit segment scale, then the granular data should be transparently aggregated into project-sized isolatable segments to understand the risk reduction potential of a realistic tranche so that the mitigation plan can consider trade-offs between tranches based on the RSE of each tranche.

Low Cost Efficiency of WCCP and TUG mitigation programs: SCE's most expensive programs to address wildfire risk are its Wildfire Covered Conductor Program (WCCP) and Targeted Undergrounding Program (TUG programs). SPD's analysis of risk spending efficiency (RSE) for the WCCP and TUG proposals determined that 40% of spending in these programs will account for approximately 85% of the total expected risk reduction from these two programs (see Table 2). Meanwhile, the remaining 60% of proposed spending in the WCCP and TUG programs will collectively produce only 15% of the total risk reduction. Mitigations with low cost-effectiveness values should be carefully reviewed for reasonableness if they remain in the rate case.

Furthermore, SPD is skeptical that the $3 billion TUG would be a cost-effective use of ratepayer dollars, especially at the proposed scale, after the massive Covered Conductor (CC) program has been underway to mitigate the higher-risk areas for years. Other than TUG, the proposed pilot mitigation programs have high RSEs, and while data requests have clarified some issues, there are still many challenges as to whether they will be ready for wide-scale deployment starting in 2025.

Error in mileage scope: SPD found duplicate miles in multiple deployment years which caused SCE to discover an RSE coding error. SCE remedied the coding error and added in 173.4 circuit miles (30 percent) of new circuit segments as part of the proposed 580 TUG circuit miles. SPD finds adding these new circuit segments is questionable and recommends they be removed.

Compliance: SCE does not provide risk modeling for the routine vegetation management compliance control program. RSEs for controls are required by the D.21-11-009 and without risk modeling staff cannot tell how these routine activities would interact with other risk mitigation efforts.

Control RSEs: Branch Line Fuses (BLF) and Remote Automatic Reclosers (RAR) have high RSEs, but at present they have a limited scope.

<u>Alternative Wildfire Mitigation Plans:</u> The Proposed Plan focuses on TUG in the Severe Risk Areas and WCCP in the High Consequence Risk Areas. In contrast, the overall focus of WCCP in Alternative Plan #1 may be a more cost-effective alternative to the scale of targeted undergrounding that SCE is proposing in their Proposed Plan. Alternative Plan #2 assumes lower risk within the High Consequence Risk Areas and therefore removes all of the WCCP from this plan but retains the TUG mitigations in the Severe Risk Areas.

Additionally, SPD concurs with the following deficiencies identified by TURN and MGRA:

- SCE has not included all risk factors in its RSE calculations including egress. (TURN)
- Wind dependency is missing in SCE's ignition models. (MGRA)
- Catastrophic losses are not adequately modelled. (MGRA)
- SCE's heavy reliance on Technosylva's consequence modeling has limitations due to premature termination of fire growth. (MGRA)
- SCE's risk model does not capture correlations between risk drivers that increase outage rates and the "extreme weather" periods it uses for its consequence modeling. This has the effect of excessive weights on some drivers (non-weather related) and low weights on others (wind-driven). (MGRA)
- SCE's risk model does not include the health and safety consequences of wildfire smoke. (MGRA)
- Based on SCE's recent fault data, there is a high likelihood that SCE's covered conductor mitigation program is more effective than SCE gives it credit for in the risk modeling (MGRA).

Overall Recommendations:

1. SCE should revise its risk modeling to:
    a. Include all risk element factors, such as egress, into the risk reduction and RSE calculations.
    b. Include the missing wind dependency in SCE's ignition models.
    c. Improve modeling of catastrophic losses and the impacts of longer-lasting fires.
    d. Better reflect consequences of increased outage rates and "extreme weather" periods (i.e. adding a red flag warning day variable to better reflect the weighting of wind-driven drivers).
    e. Include estimates of health and safety consequences of wildfire smoke.
    f. Reflect the more accurate risk reduction from covered conductor based on SCE's fault and wire-down data.
2. SCE should utilize isolatable circuit segments for tranches to align more closely with how projects would be implemented on the ground.

3. Remove the additional 173.4 circuit miles (30 percent) in the most recent proposed TUG, as SCE included these to replace duplicated circuit miles without adequate justification.[11]
4. Additional tranche classifications should focus on using combinations of quintiles of LoRE and CoRE, so that the isolatable circuit segments with the highest 20 percent of LoRE and the highest 20 percent of CoRE would be grouped together. This would support a more logical calculation of RSEs.
5. Risk modeling should be conducted for Routine Vegetation Management even though it is a compliance-related risk mitigation activity.
6. SCE should consider expanding both BLF and RAR due to the high RSEs associated with these technologies.

SCE's wildfire risk chapter includes the most complex analysis found within this RAMP. While there are many noteworthy details, SPD considers the observations on SCE's tranches and RSE calculations to be the most concerning aspects of this chapter. These two primary observations, as well as others, are detailed below.

Tranches

The following section first clarifies the two distinct approaches SCE used to create tranches, namely HFRA-scale tranches and circuit segment-scale tranches. Next, we discuss the degree of granularity found within the circuit segment-scale tranches and their relationship to program-level executions of mitigations. Finally, SPD provides a recommendation that SCE consider using combinations of quintiles of LoRE and CoRE as an additional scale of tranches.

SCE established two distinct means of creating tranches: 1) Three broad tranches that correspond to the three HFRAs, and 2) granular tranches for each circuit segment on their network.

Regarding the HFRA-scale tranches, MGRA points out that by introducing the concept of "T1-Severe Risk Areas", "T2-High Consequence Areas" and "T3-Other HFRA" reporting tranches, SCE has decoupled its actual mitigation planning from its risk scores. [12] This is because SCE's risk score now constitutes only one component of its Severe Risk Area designation, and only as a threshold value at that. The additional risk factors that SCE lists (i.e. egress, burn history, extreme winds, and PSPS) are important and should be part of SCE's risk model as well. Adding these variables afterward in an ad-hoc, opaque process precludes effective evaluation of SCE's risk prioritization model by the Commission or intervenors.[13]

Regarding the granular approach of creating tranches, SCE uses the Wildfire Risk Reduction Model (WRRM) to classify every circuit segment as a tranche and performs fire simulations at this highly

[11] Data Request Response SPD-SCE-Verbal-002-Q.01
[12] MGRA Informal Comments to the SPD re: SCE's RAMP Filing, 10/10/2022, pages 14.
[13] MGRA Informal Comments to the SPD re: SCE's RAMP Filing, 10/10/2022, pages 14-15.

granular level. SCE uses these granular data (approximately 200,000 circuit segments for distribution and 40,000 segments for transmission) to calculate risk spend efficiencies (RSEs) at each circuit segment tranche to prioritize risk mitigation. SCE's granular risk analysis results in very small tranches that are, in some cases, measured in inches.[14] SPD found that the mean segment lengths within SCE's Wildfire Proposed Plan (see below) are less than 400 feet for TUG and WCCP (See Table 1). It's important to note that despite the highly granular circuit segmentation used to establish these tranches, SCE does not typically execute work at this level of granularity. While perhaps appropriate for SCE's WRRM framework to be built around highly granular circuit segmentation, SCE's RAMP presentation should show how these highly granular, segment-level, risk analyses would be applied to real-world program or project-level mitigations.

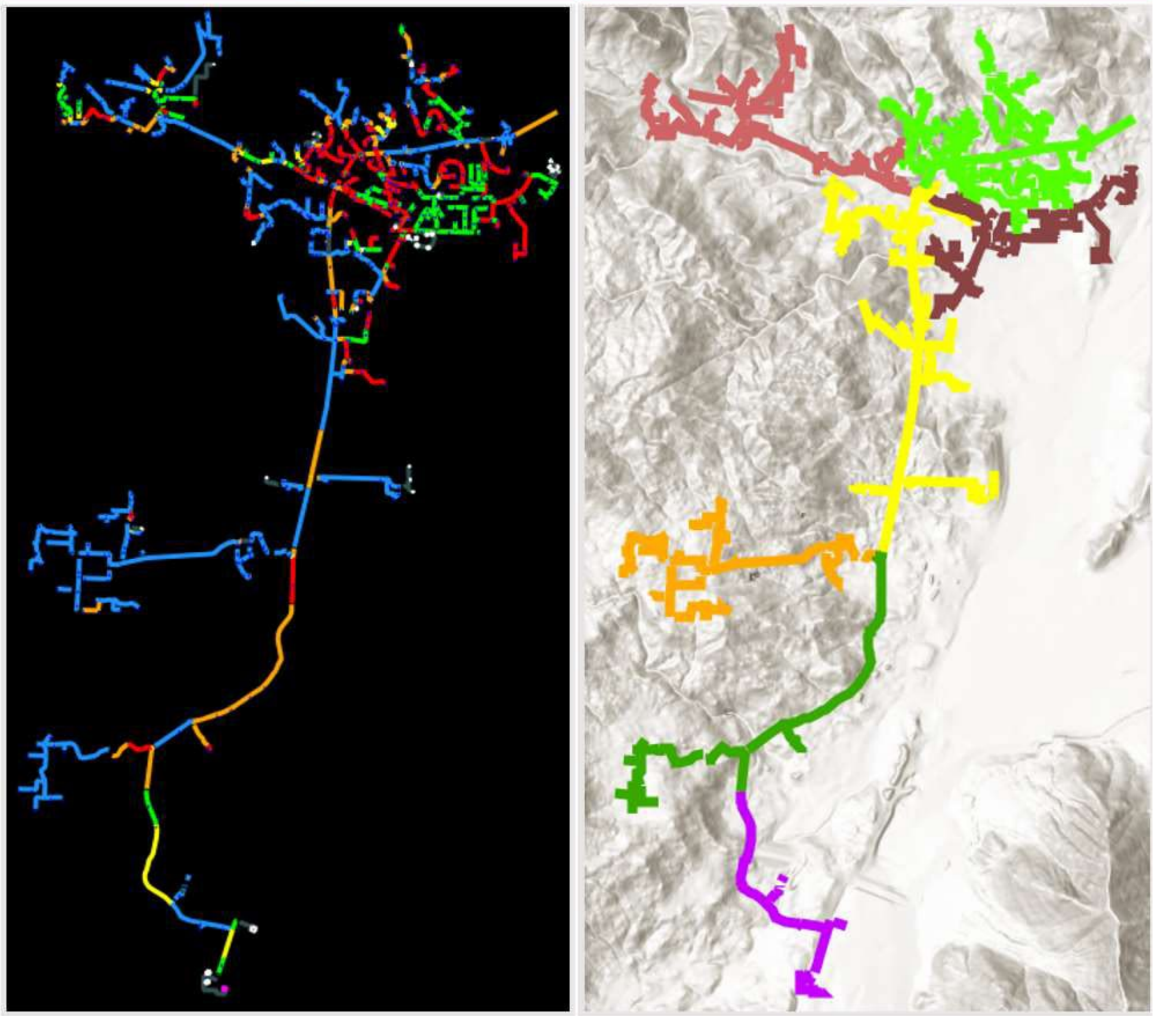
In contrast to this highly granular approach to creating tranches, SCE's Integrated Grid Hardening Strategy (IGHS) outputs are at the circuit segment level. However, after the risk modeling is finished, these outputs are aggregated to the isolatable segment.[15] Isolatable segments represent a scale closer to a typical work project (see Figure 1). SCE should aggregate their granular level of tranche analysis into isolatable circuit segments and present the corresponding risk reduction and RSEs. This isolatable circuit segment level of risk presentation would allow more meaningful review by Commission staff and other stakeholders in SCE's RAMP and GRC proceedings.

[14] SCE Data Request Response SPD-SCE-010-Q4.

[15] For SCE's visual representation of isolatable segments see SPD-SCE-Verbal-002: 04.a Response

Figure 1 Visual Model of Circuit Segments and Isolatable Segments[16]

"Circuit Segments"	"Isolatable Segments"



924 "Circuit Segments" (Visual Representation Only)	7 "Isolatable Segments" (Visual Representation Only)

As an additional scale of tranche analysis, SCE should consider using combinations of quintiles of LoRE and CoRE. This approach would mean that the isolatable circuit segments with the highest 20 percent of LoRE would be grouped within a tranche, and the highest 20 percent of CoRE would be grouped in another tranche. In combination with other tranches, this system of tranche analysis would create a total of 25 LoRE/CoRE tranches. This method would support a more practical presentation of risk reduction and RSEs to facilitate review and oversight by Commission staff and other stakeholders in the RAMP and GRC proceedings.

[16] Data Request Responses SPD-SCE-Verbal-002: 04.a Response

RSE Calculations

This section first describes the calculation of Risk Spending Efficiency (RSE) with a primary focus on SCE's largest mitigations, Targeted Undergrounding (TUG) and Wildfire Covered Conductor Program (WCCP). Next, SPD's analysis of the RSE calculations for TUG and WCCP is described in detail, which demonstrates the uneven distribution of Net Present Value (NPV) Benefit and NPV spend across the TUG and WCCP mitigations. Finally, SPD recommends that SCE focus their TUG and WCCP mitigations on a smaller sub-sample that would include the highest risk circuit segments that are also the most cost-effective.

SCE's RSE calculations indicate that the proposed mitigations will decrease total risk scores 21 percent for Severe Risk Areas, 16 percent for High Consequence Areas; and 7 percent for Other High Fire Risk Areas. The costs to achieve these results are detailed in Table 3 on page 38.

TUG has the highest cost because SCE proposes to underground 580 circuit miles of overhead distribution lines from 2025-2028.[17] RSEs for the WCCP are significantly higher than for the TUG program. SCE proposed TUG as the preferred mitigation in areas with the highest risk level that have not already been hardened. SCE claims that TUG provides a higher level of risk reduction than covered conductors as TUG almost eliminates the wildfire risk. It is therefore SCE's preferred mitigation strategy in areas where it can be feasibly deployed.[18]

SCE cautions against directly comparing RSEs between controls and mitigations, especially between different categories of work (i.e., system hardening vs. inspections). For example, the RSE for WCCP for Tranche 1 – Severe Risk, is 1,565 which corresponds to approximately one circuit mile of work. The RSE for Tranche 2 – High Consequence Segments, is 2,021 for approximately 680 circuit miles. Since the scope for T1 is significantly less than T2, SCE cautions against directly comparing these two numbers. The RSE for T2 is a combination of many circuit segment miles compared to the single circuit segment mile in T1.[19] As indicated in the settlement agreement, the calculation of RSEs in the MAVF framework should result in the use of "comparable measurements of benefits and costs."[20] Indeed, if RSEs cannot be used to compare one mitigation to another, it is not clear what value they would have.

Through data requests, SCE provided SPD with an updated dataset of RSE calculations for WCCP and TUG, and then later, on 10/19/2022, SCE provided another revision of its WCCP and TUG RSE

[17] Due to required rerouting, SCE estimates that 685 circuit miles will be undergrounded to replace the 580 circuit miles of overhead lines. See Data Request Response SPD-SCE-003-Q3.
[18] Data Request Response SPD-SCE-006-Q5
[19] Data Request Response SPD-SCE-005-Q1
[20] From line 25 of the SA, "RSE should be calculated by dividing the mitigation risk reduction benefit by the mitigation cost estimate. The values in the numerator and denominator should be present values <u>to ensure the use of comparable measurements</u> of benefits and costs."

calculations.[21] For WCCP and TUG, statistical analysis conducted by SPD staff found that the RSE standard deviations are extremely high (Table 1), which means there is a great deal of dispersion of the RSE results for the segments. The variation is likely due to great differences in segment LoRE and/or CoRE. Staff expects that the variation in LoRE/CoRE is too wide for the contributing segments to be grouped together into only three tranches for comparison of mitigation cost effectiveness by tranche.

A straightforward way to analyze risk spending efficiency is to evaluate the NPV Benefit and NPV Spend for SCE's proposed TUG and WCCP mitigations. Within their dataset, SCE's calculations of RSE's are NPV Benefit divided by NPV Spend. For SCE's proposed TUG, the total NPV Benefit is 81.26 benefit score points, while the total NPV Spend is $2.609 Billion. For SCE's proposed WCCP, the total NPV Benefit is 116.25 benefit score points, while the total NPV Spend is $722 Million. This comparison shows a larger risk reduction (about 43 percent) from the WCCP proposal compared to their TUG proposal, even though the cost of the TUG is 3.5 times the cost of the WCCP.

Table 1 Statistical Analysis on TUG & WCCP Circuit Segments[22]

TUG & WCCP Circuit Segments (Total Sample)		
Variable	**Undergrounding (TUG)**	**Covered Conductor (WCCP)**
# Segments	7989	16745
# Severe Segments	7310	10
# High Consequence Segments	41	11006
# Other HFRA	638	5729
RSE Mean	2279.58	8677.85
RSE Median	253.02	877.56
RSE Standard Deviation	13952.72	44064.58
Risk Reduction (RR) Mean	0.000416	0.000267
RR Median	0.000152	0.000083
RR 67th Percentile	0.000339	0.000195
RR Standard Deviation	0.000795	0.000618
Segment Length Sum (miles)	579.71	1249.11
Segment Length Mean (feet)	383.13	393.87
Max Segment Length (feet)	44309.5	75508.66
Min Segment Length (feet)	0.13	0.09

[21] Data Request Response SPD-SCE-Verbal-002_Q1_TUG-WCCP_RSEs_Revised.xlsx and RSE Summary Calcs – WCCP and TUG_Revised.xlsx
[22] Data Request Response RSE Summary Calcs – WCCP and TUG_Revised.xlsx

Additionally, by exploring a sub-sample of the 67th percentile of risk reduction, SPD discovered that more than 85 percent of the total planned risk reduction for both TUG and WCCP could be found within this smaller sub-sample (Table 2). This sub-sample comprised 85 percent of the total planned NPV Benefit from TUG and WCCP (Table 2). Yet this smaller sub-sample comprised less than 40 percent of the total NPV Spend for TUG and WCCP (Table 2).

Table 2 Statistical Analysis on TUG & WCCP within the 67th percentile of Risk Reduction[23]

Risk Reduction (RR) 67th Percentile Sample		
Variable	**Undergrounding (TUG)**	**Covered Conductor (WCCP)**
# Segments	2634	5533
% of Risk Reduction	85.06%	87.69%
% of NPV Benefit	83.77%	85.99%
% of NPV Spend	38.45%	37.97%
# of Segments Below Total Sample RSE Median	245 (9.27%)	371 (6.71%)
Segment Length Sum (miles)	224.46	468.77
Segment Length Mean (feet)	449.94	447.34

Based on this statistical analysis of SCE's TUG and WCCP risk reduction and RSE data, SPD recommends that SCE consider a third alternative to their wildfire plans discussed below. The third alternative would focus on TUG and WCCP proposals for the 67th percentile based on risk reduction. This sub-sample of circuit segments would be less than 40 percent of the proposed spending for both programs but would focus on about 85 percent of the risk reduction.

Additionally, SPD recommends SCE narrow this sub-sample further by selecting circuit segments that have RSEs below the total sample RSE median for each program (Table 2). Using the RSE median is a generous cutoff due to the wide range and high standard deviation of the RSEs. This would narrow the programs further and focus on the highest-risk segments and the most cost-effective segments based on Risk Spend Efficiencies.

SPD agrees with MGRA and TURN that SCE did not include all risks in its RSE calculations. Therefore, SPD recommends that SCE include all risks, such as egress, past historical fires, and wind, in its MAVF and RSE risk analysis.[24]

In addition to the important concerns related to tranches and RSE calculations described above, SPD provides observations and recommendations regarding the risk modeling, controls, mitigations, and the three wildfire plans found within this RAMP.

[23] Data Request Response RSE Summary Calcs – WCCP and TUG_Revised.xlsx

[24] TURN Informal Comments to SPD on SCE RAMP Report, 10/10/2022, page 14-16; MGRA Informal Comments to SPD on SCE RAMP Report, 10/10/2022, page 14-15.

Risk Modeling

Risk Description

SCE defines a wildfire risk event, or triggering event, as an "ignition associated with SCE's overhead electrical assets and operation in its High Fire Risk Area (HFRA)." SCE has nine regions with diverse topography, from heavily forested mountainous areas to large swaths of chaparral grassland and desert biomes. Despite providing geographic details of the nine regions in their service area, SCE does not overlay this geography with the HFRA in the RAMP. However, with SCE's Data Request responses, this overlay became clearer.[25] SCE's Severe Risk Areas, while wholly contained within SCE HFRA, generally intersect or are adjacent to Wildland-Urban Interface (WUI) and Wildland Urban Intermix (WUIx) locations (see Figure 2). Many of these WUI and WUIx locations are subject to population egress challenges, high historical fire frequency, and high wind locations.[26] SCE considers ignition in the HFRA relating to Distribution and Transmission systems to be in-scope. SCE explained it chose to focus on the distribution and transmission assets located in its HFRA for the RAMP analysis, as most of SCE's risk and corresponding mitigations are concentrated in these areas.

Exposure

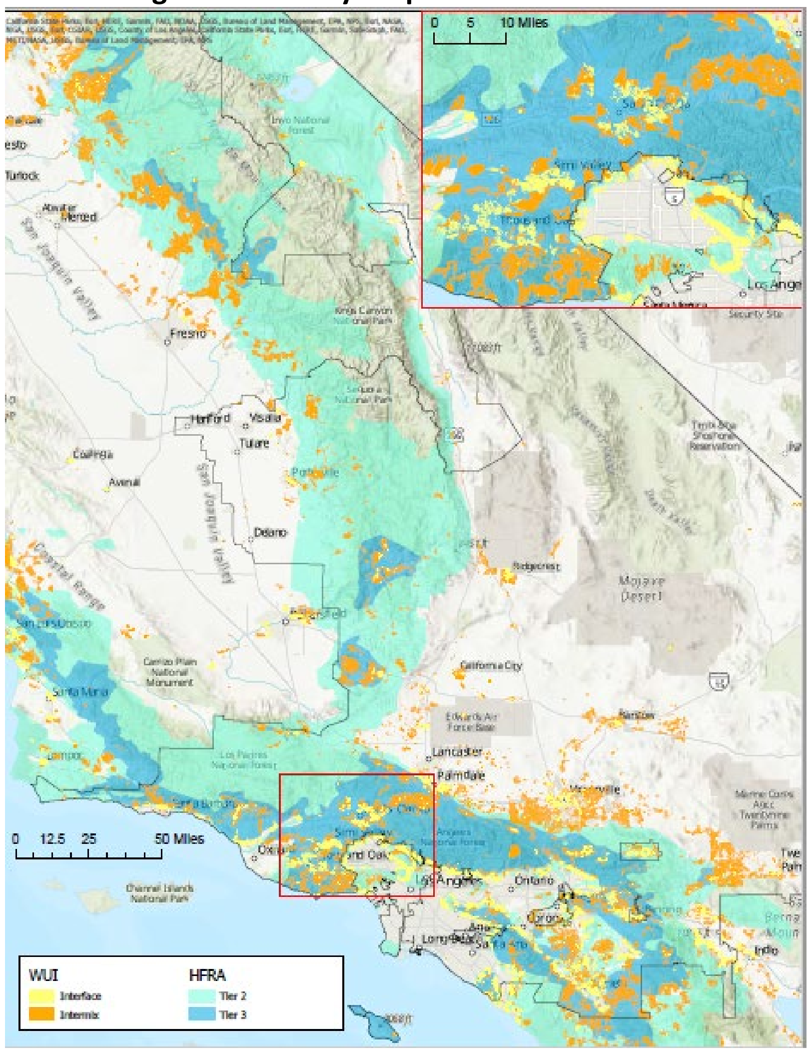
SCE focused its wildfire mitigation efforts on risk exposure from overhead distribution conductors. SCE discusses some existing controls related to overhead transmission conductors but provided no new mitigations except M7 C-Hooks Replacement, scheduled to be completed before 2025.

Risk Driver

SPD agrees with MGRA that SCE's risk model fails to account for wind as an external risk driver and how it can increase outage rates. SCE's risk model fails to include conditional probabilities that correctly account for the increased likelihood of outages during the "extreme weather days" in the wildfire modeling.[27] MGRA observed that for the sake of efficiency in running simulations, SCE's consequence model relies on a selected set of "worst-case" weather days. MGRA argues that this introduces bias in the simulation outcomes since some ignition drivers (specifically those related to wind) are more likely to occur on worst-case weather days and therefore be associated with catastrophic fire spreads. Ignition drivers unrelated to wind, such as balloons, animals, 3rd party contact, and vehicles, only occur on worst-case weather days by random chance. For the sake of risk modeling simplicity, SCE assumed that these other non-wind-related ignition drivers always occur on worst-case weather days. As a result, their comparative risk impacts are amplified dramatically (and incorrectly). Utility risk models that do not account for this bias will therefore assign exaggerated weights to the risk from these external agents (balloons, animals, 3rd party contact, and vehicles) compared to the risk from wind-related drivers (equipment damage and vegetation). Geographically, areas prone to high winds will have their predicted risk underestimated unless this bias is corrected.[28]

[25] See map within response to SPD Data Request SPD-SCE-011, Q.3.
[26] Response to SPD-SCE-011, Q1.
[27] MGRA Informal Comments to SPD re: SCE's RAMP Filing, 10/10/2022, page 15.
[28] MGRA Informal Comments to SPD re: SCE's RAMP Filing, 10/10/2022, pages 16-17.

Figure 2. Overlay Map of HFRA and WUI[29]



SPD agrees with MGRA that SCE's risk model is biased against ignitions most likely to lead to catastrophic fires. Therefore, SPD recommends SCE calculate enterprise risk model (ERM) risk values with a Red Flag Warning (RFW) filter in the same manner that PG&E had done for its ERM.[30]

Outcomes & Consequences

SPD agrees with MGRA's comments regarding the omission of health and safety consequences of wildfire smoke are missing in SCE's risk model. Therefore, SPD recommends that SCE use the same general method that SDG&E used in its RAMP, which applies a ratio of fatalities to acres burned in

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[29] Response to SPD-SCE-011, Q1.

[30] MGRA Informal Comments to SPD re: SCE's RAMP Filing, 10/10/2022, page 25.

the safety attribute of its MAVF function. Regarding the details of this ratio, SPD recommends that SCE follow MGRA's advice regarding proportionality.[31]

Risk Model

As part of SCE's Wildfire Risk Reduction Model, SCE developed asset-specific Probability of Ignition (POI) databases along with its fire consequence modeling tool. In addition, SCE developed a method to translate the risk scores produced by its POI and consequence models into unitless values using the Multi-Attribute Risk Score (MARS) approach at the structure (pole or tower) level.

SPD agrees with MGRA that SCE's risk prioritization, based on a combination of factors and internally determined weights, lacked the transparency necessary for parties or Commission staff to analyze SCE's decision-making thoroughly. Therefore, SPD recommends that SCE fully disclose the effective risk score that it is using to determine its prioritization by quantifying all factors being used in the effective risk score and showing how they are combined. This is the level of transparency required by Rows 26 and 29 of the S-MAP Settlement Agreement. SPD further recommends that SCE integrate its risk factors into the MAVF framework by clearly showing their impacts on the likelihood and consequence of risk events.[32]

SPD agrees with MGRA that SCE needs to develop an enterprise risk model (ERM) that accurately describes catastrophic wildfire risk. As MGRA referenced, the Commission required in D.21-11-009 that "Any best practice for wildfire modeling must produce a set of consequences for wildfires that sufficiently incorporate high-end losses.[33]

Hence, SPD recommends that SCE demonstrate the extent to which its risk model correctly characterizes extreme catastrophic fires by showing its predicted loss distribution fits a power law distribution and is consistent with the size distribution of historical catastrophic fires. SPD also recommends that if SCE's current risk model does not adequately represent catastrophic losses, then SCE should develop and implement an enterprise risk model (ERM) similar to that of PG&E and SDG&E, using a power law distribution to represent catastrophic losses, prior to the submission of its Test Year 2025 GRC filing.[34]

SPD also agrees with MGRA that SCE should correct the bias in its risk model due to PSPS by incorporating PSPS damage and hazard reports. This is a critical component of risk analysis because as PSPS becomes more pervasive as a mitigation strategy, "dead spots" are created in the outage and ignition records. Likelihood analysis of historical data, such as that done by SCE's machine learning model, will not incorporate ignitions or outages from where the power is turned off. This will bias the

[31] For details see MGRA Informal Comments to SPD re SCE's RAMP Filing, 10/10/22, pages 27-28.
[32] MGRA Informal Comments to the SPD re: SCE's RAMP Filing, 10/10/2022, pages 15.
[33] MGRA Informal Comments to SPD re SCE's RAMP Filing, 10/10/22, pages 4-11.
[34] MGRA Informal Comments to SPD re SCE's RAMP Filing, 10/10/22, pages 4-11.

likelihood model, underestimating the ignition risk in areas with frequent PSPS. Energy Safety has also tagged this issue in its 2022 WMP review (SCE-2022-26).[35]

Compliance, Controls, and Mitigations

SCE's principal programs to address wildfire risk are its Wildfire Covered Conductor Program (WCCP) and Targeted Undergrounding Program (TUG). SCE believes the Proposed Plan is the most effective combination of tools, including a mix of covered conductor, TUG, and Rapid Earth Fault Current Limiter (REFCL).

SCE will deploy a covered conductor, supplemented with other vegetation and asset management activities, in locations where undergrounding would not be practically feasible. Collectively, deploying covered conductors in combination with these other activities is known as CC++. For the approximately 1,200 miles categorized as High Consequence Segments, SCE proposed to deploy the full suite of CC++ measures as the preferred mitigation option.

<u>Wildfire Compliance Activities</u>

For the 2022 RAMP, SCE defines "compliance activities" as those required by law or regulation. This is a new term that SCE created in the 2022 RAMP to refer to those same types of compliance-related risk mitigation activities that SCE referred to as compliance controls in the 2018 RAMP. In the S-MAP rulemaking proceeding, R.20-07-013, the Commission provided clarifying directions to the utilities that they are required to provide RSE scores for all types of controls. This Commission directive clearly covers compliance controls. This directive was formalized in Ordering Paragraph 1c in the Phase 1, Track 1 decision, D.21-11-009.

By referring to these compliance-related mitigation activities by the newly-coined term "compliance activities" and no longer referring to them as compliance controls, SCE seems to have taken the position that it is not required to provide RSEs for these types of mitigation activities. However, to comply with the Commission's directive in R.20-07-013, SCE must provide RSE scores for these compliance-related mitigation activities, whether SCE refers to them as mitigations, compliance controls, "compliance activities," or some other similarly-phrased terms.

CM1 Routine Vegetation Management activities are performed to maintain clearances around poles and equipment on the distribution and transmission systems, to comply with current regulations and Commission recommendations. SPD recommends that risk modeling be conducted for Routine Vegetation Management precisely because it is a compliance activity that reduces risk. If they are determined to have low RSE values, the Commission should re-evaluate associated regulatory requirements.

[35] MGRA Informal Comments to SPD re SCE's RAMP Filing, 10/10/22, page 26.

Wildfire Mitigations

SCE's suite of complementary mitigations was initiated in 2021 to address the segments of its overhead distribution assets in HFRA where ignition has the most potential of growing into a significant wildfire. (Some of these activities incurred upfront design and planning costs in year(s) prior to 2021, but the actual installation occurred in 2021 or will occur in a later year.)

M1 Targeted Undergrounding

SCE's Undergrounding Implementation Reporting from its 2022 WMP Update provides additional information related to the implementation of TUG.[36] In the WMP, SCE also provides a cost-effectiveness analysis comparing alternatives such as covered conductors.

Undergrounding has an estimated timeframe of 25 – 48+ months from initial scoping to in-field project completion.[37] Many activities, such as planning, scheduling, and executing phases, are anticipated to take several months longer than for covered conductor work. This is because 1) SCE has already installed thousands of covered conductor miles and 2) undergrounding has more potential delays due to various factors, including agency requirements, land rights, rerouting, and cultural discoveries.

In SCE's 2022 WMP Update Appendix 9.4, SCE explained the process of defining the scope for undergrounding deployment before 2022. Under this process, SCE's engineering planners identify a certain number of miles that are operationally feasible to deploy at a given time. SCE then reviewed a list of all circuit segments in HFRA and eliminated the segments already in progress or scoped for covered conductors. From that reduced list, SCE prioritized the circuit segments based on risk using the WRRM. SCE then applied the mitigation effectiveness of covered conductors and undergrounding and generated "mitigated risk" values for both options for each circuit segment. Each circuit segment was then assessed to determine the highest delta of mitigated risk between both mitigation options of undergrounding versus covered conductors. Finally, local districts and SCE's ERM were consulted to identify and incorporate locations with known egress issues. This methodology and considerations of undergrounding constructability and potential risk of PSPS de-energization helped SCE engineers evaluate all HFRA circuits to determine specific circuits that would benefit most from undergrounding.

SCE's methodology for the TUG unit costs was discussed in detail in its GRC Track 4 Application testimony and workpapers.[38] The total TUG 2024 capital expenditure forecast was $45.996 million (nominal $) to underground approximately 21 miles or $2.2M per circuit mile. The 2024 scope was a blend of mainly low-difficulty miles with a few medium-difficult miles. SCE stated they expect to have more miles with higher unit costs in future years as the mix of work shifts to more medium- and high-difficulty miles. SCE's RAMP analysis used a weighted average unit cost of $4.02 million in 2022,

[36] Data Request Response SPD-SCE-003 Q2 2022 WMP Update Appendix 9_4 TUG.pdf
[37] Data Request Response SPD-SCE-003 Q2 2022 WMP Update Appendix 9_4 TUG.pdf
[38] Data Request Response SPD-SCE-003-Q4

including undergrounding primaries, secondaries, and services. SCE then escalated those costs to 2025-2028 dollars.[39]

The RAMP unit cost forecast for TUG is generally aligned with previous Rule 20A undergrounding projects from 2015-2020. SCE's analysis of 34 Rule 20A projects that covered 22 circuit miles showed an average cost of $3.75 million/circuit mile in 2020 dollars.[40]

M2 Rapid Earth Fault Current Limiter (GFN, Isobank, RGS)

As a pilot mitigation, SCE is confident it can deploy REFCL by 2025 at the proposed scale in its RAMP Report.[41] Additionally, before 2025, SCE will further refine operational efficiencies. However, REFCL is not always viewed as a feasible and cost-effective mitigation, and there are potential barriers to deployment.[42]

SCE believes REFCL can be scaled up to the level mentioned in SCE's Wildfire Proposed Plan. However, REFCL requires hardware updates to the electric system and therefore has increased costs compared to D-OPD and Hi-Z Relays in large-scale applications. General deployment-related issues may also arise with REFCL, including vendor supply, contracting, and technology integration issues.[43] In addition, SCE cautions it is not insulated from macro-economic uncertainties such as labor shortages and the need to pay premium time or the use of outside contractors, which can increase costs. Despite these potential barriers, SCE is reasonably confident in its ability to deploy REFCL.

SCE provided RSE data in its RAMP including the HFRA tranche RSEs listed in Table 3. SCE's currently estimated mitigation effectiveness values for REFCL are generally high (50+ percent) due to the reduction in energy released by ground faults (approximately 99.9 percent) and an increase in ground fault sensitivity (10-100 times as sensitive as traditional protection). The RSE scores for the initial application of REFCL technology pertain to top-risk candidates with limited complexities, which keeps the application costs low. [44]

M3 Distribution Open Phase Detection (D-OPD)

SCE is confident it can deploy D-OPD to sufficient scale by 2025.[45] Additionally, before 2025, SCE will further refine operational efficiencies of D-OPD. Many of the potential barriers mentioned above for REFCL also apply to D-OPD.

[39] Data Request Response SPD-SCE-003-Q4
[40] Data Request Response SPD-SCE-003-Q4
[41] Data Request Response SPD-SCE-004-Q1
[42] Data Request Response SPD-SCE-004-Q5
[43] Data Request Response SPD-SCE-004-Q1
[44] Data Request Response SPD-SCE-005-Q5
[45] Data Request Response SPD-SCE-004-Q1

M4 Early Fault Detection (EFD)

SCE is confident it can deploy EFD by 2025.[46] Additionally, before 2025, SCE will further refine operational efficiencies of EFD. SCE notes that EFD requires hardware updates to the electric system, and therefore has increased costs compared to D-OPD and Hi-Z Relays in large-scale applications. SCE cautions that general deployment-related issues may arise, including vendor supply and contracting, as well as technology integration. Despite these potential barriers, SCE is reasonably confident in its ability to deploy EFD.

M5 High Impedance Relays (Hi-Z)

SCE is confident it can scale Hi-Z Relays by 2025.[47] Additionally, before 2025, SCE will further refine operational efficiencies of Hi-Z Relays. SCE cautions that general issues may arise including vendor supply and contracting and technology integration. Despite these potential barriers, SCE is reasonably confident in its ability to deploy Hi-Z Relays.

SPD Observations on Controls & Mitigations

SCE considers any activity performed prior to 2021, such as WCCP, as a control. WCCP is part of the Integrated Grid Hardening Strategy and is the second largest proposed activity (i.e., $750M) after TUG ($3B). Although WCCP exhibits a higher RSE, SCE defends the use of TUG when it is feasible in areas of severe risk.[48] SCE provided risk analysis and RSEs for controls, except for a compliance control.

Given the lower RSE, SPD staff question the appropriateness of substantial investment of ratepayer funds for TUG after the large-scale implementation of the CC program has been underway for years. The WCCP was supposed to prioritize and install CC on the highest-risk circuit segments in the program's early years. Hence, there is no widespread need for TUG since the highest-risk circuit segments already have CC installed. Additionally, SCE cautioned that because of the uncertainties associated with accelerating climate change and changing risk profiles, SCE may need to underground specific circuit segments that were already hardened with covered conductor to reduce risk further and protect SCE's customers.[49] SCE expects such occurrences to be the exception and not the rule.

Additionally, SPD discovered many duplicate circuit segments for SCE's proposed TUG mitigations with differing RSEs and deployment years. SCE responded: "After reviewing the RSE coding, SCE noticed an error that allowed for selecting TUG scope in multiple years. We have remedied this issue in the code and have verified that it only impacted the TUG mitigation…SCE added in segments that were initially excluded…"[50]

[46] Data Request Response SPD-SCE-004-Q1
[47] Data Request Response SPD-SCE-004-Q1
[48] Data Request Response SPD-SCE-006-Q5
[49] Data Request Response SPD-SCE-007-Q4
[50] Data Request Response SPD-SCE-Verbal-002-Q.01

SPD found that 173.4 circuit miles (30 percent) of the proposed 580 TUG circuit miles were new segments to replace duplicate miles in multiple deployment years. Rather than reduce the proposed TUG mitigations by the amount of duplicated circuit segments, SCE replaced them with new segments. SPD recommends that SCE should remove the additional 173.4 circuit miles (30 percent) in the most recent proposed TUG as these were not identified by SCE to be part of their original Severe Risk Areas.[51]

A majority of proposed mitigations (i.e. REFCL, D-OPD, EFD and Hi-Z Relays) are in pilots, and there are many unknowns as to whether they will be ready for wide-scale deployment starting in 2025. Also, some of these pilot mitigations have very large RSEs. This means these pilot mitigations may soon become preferred over less cost-effective mitigations.

Wildfire Plans

The Proposed Plan has a focus on TUG in the Severe Risk Areas and WCCP in the High Consequence Risk Areas. In contrast, the overall focus of WCCP in Alternative Plan #1 may be a more cost-effective alternative to the scale of targeted undergrounding that SCE is proposing in their Proposed Plan. Alternative Plan #2 assumes lower risk within the High Consequence Risk Areas and therefore removes all the WCCP from this plan but retains the TUG mitigations in the Severe Risk Areas.

Wildfire Proposed Plan

Within the Proposed Plan, the RSE for WCCP in T1 Severe Risk Areas is more than five times the RSE for TUG. In workpapers, SCE presents that within the T1 Severe Risk Areas, only $719k of covered conductor installation is forecast in 2025, with zero in all other years. Most covered conductor costs ($600M) are proposed to be installed in T2 High Consequence Segments, with the rest ($150M) in T3 Other HFRA.

The C1a Fire Resistant Poles program appears reasonable, although the RSEs for this program are low compared to other controls and mitigations. RSEs for Fire Resistant Poles (FRP) may be relatively low in part because SCE estimated the benefits from mitigating the median “riskiest” pole as opposed to the next-highest “riskiest” poles on the risk buy-down curve.[52] SCE felt this was a prudent approach since it is unclear which wooden poles will be replaced with FRPs in 2025-2028. More importantly, the RSE calculation does not consider the resiliency benefits of installing FRPs, such as the ability of the structure to survive a wildfire.

The C2 Branch Line Fuses (BLF) program exhibits high RSEs, but the scope is limited (i.e., 45 miles/year). SCE installed a significant number of BLFs in HFRA and is continuing to determine the appropriate scope for its upcoming TY 2025 GRC application.[53] SCE included the currently proposed

[51] Data Request Response 01_SPD-SCE-Verbal-002-Q1_TUG-WCCP_RSEs.xlxs
[52] Data Request Response SPD-SCE-005-Q1
[53] Data Request Response SPD-SCE-005-Q1

scope in 2025-2028 to address customer electric service reliability improvements in addition to the ignition reduction benefits. SCE should consider expanding BLF due to high RSEs.

Table 3 RSEs According to HFRA Tranches by Ranked Cost Estimates (2025-2028)

				2025 Risk Spend Efficiencies		
#	**ID**	**2022 RAMP Control Name**	**Cost Estimate**	**T1 RSE**	**T2 RSE**	**T3 RSE**
#1	M1	Targeted Undergrounding	$3,098,420,000	323	88	39
#2	C1	Wildfire Covered Conductor Program	$751,437,000	1,565	2,021	628
#3	C10	Distribution Ground	$385,346,000	246	247	229
#4	M2	REFCL (Total)	$204,688,000	25,729	25,508	21,936
#5	C18	Dead & Dying Tree Removal Program	$200,033,000	23	22	22
#6	C16	Hazard Tree Mitigation Program	$193,007,000	19	19	19
#7	C19	Expanded Line Clearing	$187,317,000	474	306	148
#8	C11	Distribution Aerial	$159,171,000	70	69	66
#9	C12	Transmission Ground	$95,844,000	591	606	599
#10	C21	Aerial Suppression	$73,934,000	4,148	2,827	786
#11	C13	Transmission Aerial	$66,909,000	214	215	215
#12	M5	Early Fault Detection (EFD)	$51,081,000	1,992	3,147	715
#13	C1a	Fire Resistant Poles (FRP)	$49,059,000	68	55	34
#14	C17	Expanded Pole Brushing	$31,617,000	3,206	2,289	1,010
#15	C8	Long Span Initiative	$30,052,000	1,514	1,668	1,499
#16	C6	Tree Attachment Remediation	$27,479,000	6,581	6,498	4,957
#17	C3	Remote-Controlled Automatic Reclosers	$15,832,000	4,207	7,147	2,920
#18	M4	DOPD	$6,785,000	7,382	5,720	3,018
#19	C2	Branch Line (Fuses)	$6,074,000	4,265	3,304	3,575
#20	M6	Hi-Z Relays	$5,428,000	4,718	3,438	2,082
#22	C14	Distribution Infrared	$1,843,000	1	1	1
#21	M3	Vibration Dampers	$1,695,000	142	146	28
#23	C15	Transmission Infrared	$991,000	0	0	0

C3 Remote Automatic Recloser (RAR) installations could include more circuit miles annually since the RSEs are high. The total proposed cost of $15.8M for 1,128 miles. SCE's proposed scope of RAR deployments is based on factors including risk mitigation and location suitability for RARs. In the Proposed Plan, SCE is planning to install approximately 25 remote-controlled automatic reclosers (RARs) per year from 2025 to 2028. SCE should consider expanding RAR due to high RSEs.

Alternatives Analysis

Alternative Plan #1 differs from SCE's Proposed Plan in that it does not employ TUG as a mitigation option in the 2025-2028 period.

There were errors in Table VIII-19 for the units associated with C10, C11, and C12, but the information for these controls presented in the workpapers is correct.[54] After SCE issued an update to correct these errors, the RSEs for WCCP were found to be higher in T1 – Severe Risk Areas than T2 – High Consequence Segments. SCE's revision did not change the overall circuit miles from 2025-2028 for WCCP. However, the circuit miles per Tranche grouping was changed.[55] SCE's updated circuit miles by tranche for Alternative Plan #1 are provided below for reference:

Table 4 – Alternative Plan #1 Change in Tranche Mileage

Alt Plan #1 - RAMP Filing		
Mitigation Description	**Tranche ID**	**Total (2025-2028)**
WCCP	Severe	1
WCCP	High Consequence	1279
WCCP	Other	550
WCCP	**Total**	**1830**

Alt Plan #1 - Updated Values		
Mitigation Description	**Tranche ID**	**Total (2025-2028)**
WCCP	Severe	578
WCCP	High Consequence	886
WCCP	Other	366
WCCP	**Total**	**1830**

With the updated values for Alternative Plan #1, the risk score for T1 – Severe Risk Area decreases by 18 percent, compared to the less than one percent depicted in the RAMP filing in Table VIII-20 (should be Table VIII-21).[56] Furthermore, the T2 – High Consequence Segments and T3 – Other HFRA end of 2028 Risk Scores also changed, as depicted below:

Table 5 – Alternative Plan #1 – Updated Pre- and Post-LoRE, CoRE and Risk Scores

Alternative Plan #1 - Updated						
	Pre-Mitigation Risk Quantification Scores (End of 2024)	**Post-Mitigation Risk Quantification Scores (End of 2028)**				
	LoRE	**CoRE**	**Risk Score**	**LoRE**	**CoRE**	**Risk Score**
Wildfire - All HFRA	32.5	1.5	47.6	32.5	1.5	47.6
T1 - Risk Areas	4.3	3.6	15.4	4.3	3.6	15.4
T2 - High Consequence Segments	13.5	2.2	29.3	13.5	2.2	29.3
T3 - Other	14.8	0.2	2.9	14.8	0.2	2.9

The 2028 Risk Score in Alternative Plan #1 for T2 – High Consequence Segments of 25.1 is greater than the Proposed Plan 2028 Risk Score of 24.7. The T3 – Other HFRA 2028 Risk Score of 2.5 in

[54] Data Request Response SPD-SCE-006-Q2
[55] Data Request Response SPD-SCE-006-Q3
[56] Data Request Response SPD-SCE-006-Q3

Alternative Plan #1 is lower than the Proposed Plan Risk Score of 2.7.[57] SCE states this is because there are more circuit miles of WCCP compared to the Proposed Plan. SCE provided the below tables for circuit miles in WCCP by Tranche groupings.

Table 6 – Proposed Plan & Alt Plan #1 (Updated) Tranche Mileage Proposed Plan		
Mitigation Description	**Tranche ID**	**Total (2025-2028)**
WCCP	Severe	1
WCCP	High Consequence	999
WCCP	Other	250
WCCP	**Total**	**1250**

Alt Plan #1 - Updated Values		
Mitigation Description	**Tranche ID**	**Total (2025-2028)**
WCCP	Severe	578
WCCP	High Consequence	886
WCCP	Other	366
WCCP	**Total**	**1830**

Alternative Plan #2 represents a higher tolerance for simulated wildfire risk by raising the High Consequence Segments threshold from 300 acres to 1,000 acres in 8 hours. This plan would result in SCE not deploying any additional covered conductor work in High Consequence Segments (T2) during the 2025-2028 period. As a result, Alternative Plan #2 has most of the risk reduction in T1 – Severe Risk Areas and not in T2 – High Consequence Segments.

Observations on SCE's Alternatives Analysis

Alternative Plan #1 may be a more suitable alternative to continue the WCCP rather than initiate a new Targeted Undergrounding (TUG) program. There may be very small portions of lines that could be undergrounded, but the scale of the program should be limited given that SCE already targeted its highest-risk circuit segments for covered conductor in the previous GRC cycle. As mentioned above (See *RSE Calculations Observations*), SPD recommends an Alternative Plan #3 that would focus on TUG and WCCP mitigations in the highest risk segments.

[57] See Table VII-15 Pre- and Post-LoRE, CoRE and Risk Scores and Data Request Response SPD-SCE-006-Q3

PSPS Risk in the Wildfire Risk (Chapter 4)

Southern California Edison (SCE) considers Public Safety Power Shutoff (PSPS) to be an ignition mitigation measure of last resort to prevent the risk of wildfire during an extreme weather event. SCE also considers PSPS Risk Event, which may lead to serious injuries for Medical Baseline (MBL) and Access and Functional Needs (AFN) customers, loss of electrical reliability and financial losses for affected communities. According to SCE, four objectives guide their PSPS decision-making: (1) public safety; (2) keep the power on for as many customers as reasonably possible; (3) communicate clearly and accurately about de-energization and re-energization; and (4) minimize the impacts of de-energizations through customer support programs. SCE uses circuit-specific thresholds for fuel and wind conditions, calculated in the Fire Potential Index (FPI), as one of the primary ways to determine whether a circuit should be de-energized.

The bowtie analysis utilizes tranches based on the historical de-energization frequency of individual circuit segments.

Key Observations and Recommendations

1. SCE determined the likely number of circuit outages exceeding the annual average threshold of 314 circuit hours by applying the average time a circuit has exceeded this threshold historically. They used this figure to estimate the risk consequence of an outage. However, as MGRA points out in their informal comments because SCE does not include PSPS damage events in its ignition risk model, this will bias the likelihood model (which is dependent on historical data), and result in underestimating the ignition risk in areas with frequent PSPS.[58] SPD agrees with MGRA and recommends that SCE integrate PSPS damage and hazard reports into their likelihood calculations.

2. SCE does not directly quantify exposure to PSPS in terms of the number and type of customers in the RAMP chapter itself. SCE defined tranches at the circuit segment level, but it is not clear how this level of granularity helps explain the risk of a PSPS event to its most vulnerable customers. If AFN or MBL customers are de-energized but not notified (Outcome 3), this lack of notification could have severe health implications for that group of customers. Segment-level tranches do not help us understand the different risk scores that should exist for different types of customers, nor how different mitigations reduce the risk of PSPS Risk Events to these vulnerable groups. Additionally, SCE provides in-person local support to its customers through Community Resource Centers (CRC) and Community Crew Vehicles (CCV). SCE's Customer Resiliency Equipment Rebates are no longer limited to households dependent on pumps for well water and include higher rebates for income-qualified and MBL customers. SCE also provides the Critical Care Backup Battery (CCBB) program for customers residing in HFRAs who are enrolled in the MBL and the PSPS 2-1-1 Service for AFN customers experiencing a PSPS event. However, analytically

[58] MGRA Informal Comments to SPD on SCE RAMP Report, 10/10/2022, page 26

speaking, the benefit of these controls only make sense if SCE creates tranches associated with different types of customers affected by PSPS events. SPD recommends that SCE should consider analyzing PSPS impacts differently from Wildfire Risk by creating tranches to reflect impacts to different types of customers affected by PSPS Risk Events.

3. SCE designates community meetings, marketing, and PSPS Research and Education as Foundational Activities within Controls such as CRC/CCV, CCBB, and Customer Resiliency Equipment Rebates. This designation is problematic. By designating these activities as Foundational, SCE increases the costs of these activities but makes it appear that such foundational activities do not reduce risk. This designation will reduce the RSE of these Controls and potentially send the wrong signal to decision-makers that Controls supported by certain activities, such as community meetings, should not be prioritized. SCE could consider concrete ways to recognize the risk reduction that comes from ensuring vulnerable populations are aware of PSPS events and the consequences to their health that come from a PSPS event rather than designating these activities as Foundational.

4. SCE argues that the operating cost savings from using a higher FPI threshold found in Alternative Plan #1 would likely be more than offset by costs and impacts to the customers from the greater wildfire risk. However, SCE's RAMP lacks a comparative analysis to justify this explanation. SCE could utilize a Cost-Benefit Approach to compare the costs and impacts to customers from the increase or decrease of wildfire ignition risk caused by using the different FPI thresholds found in the Proposed Plan and the Alternative Plan #1.

5. SCE asserts that the RSEs in Alternative Plan #2 would be lower because of increasing costs. However, in Table VIII-27,[59] it appears that, except for C22 Weather Stations, all the RSEs are the same or higher than those found in Table VII-16[60] of the Proposed Plan. Additionally, there are inconsistencies within the RAMP and the work papers regarding which controls will be included in which plans (see Portfolio Inclusion in the workbook).[61] SCE could take steps to reconcile the way they present their Alternative Plans so that they are logical and consistent.

6. MGRA has noted that while Fast Curve settings are highly effective at preventing ignitions, they can lead to localized de-energization without advanced warning.[62] This leads to impacts on AFN customers who would benefit from certain PSPS Controls under a PSPS de-energization but would be left unprepared during a Fast Curve de-energization. SPD agrees with MGRA and recommends that SCE should provide details regarding how they address the impact of a Fast Curve de-energization on AFN and MBL customers.

[59] SCE RAMP Report, Ch. 4, at Page 128.
[60] SCE RAMP Report, Ch. 4, at Page 109.
[61] WP Ch. 4 - Wildfire and PSPS Baseline and RIsk Inputs.xlsx, Sheets C22-C28
[62] MGRA Informal Comments to SPD on SCE RAMP Report, 10/10/2022, page 34-35.

Contact with Energized Equipment Risk (Chapter 5)

Contact with Energized Equipment risk is defined as human contact with energized equipment potentially causing electrical shocks, including failure of overhead equipment resulting in a wire or other equipment down and contact with intact overhead and underground equipment by third parties (e.g., third-party tree trimmer). This risk excludes energized equipment contact by SCE employees or contractors and contact with energized equipment during the attempted theft of SCE equipment or property, which are covered in different chapters. In addition, SCE excluded reliability and financial consequences from their calculation of risk scores and instead focused on serious injury or fatality to members of the public.

Key Observations and Recommendations

1. Although SCE briefly discusses wire-down events and intact contact, SCE omitted discussion of tranche-level impacts in their submission. In the RAMP report, SCE did not identify risk scores for tranches associated with wire-down events and contact with intact equipment. For the purposes of modeling, these missing elements can impact the driver frequency and the likelihood of risk outcomes. According to the S-MAP Settlement agreement utilities are expected to select tranches to achieve "as deep a level of granularity as reasonably possible"[63] when conducting risk analysis. SCE's tranche analysis is not in compliance with the Settlement Agreement requirement.

2. Upon SPD staff request, SCE supplied LoRE and CoRE risk data for the Proposed Plan, Alternative Plan #1, and Alternative Plan #2. During this exercise, SCE identified errors in the risk scores in pre- and post-mitigation for 2024 and 2028 when SPD staff reached out with a data request for its verification. Staff recalculated the risk scores of the Proposed Plan and presents the corrected values here in Table 5-1. Staff identifies the LoRE and risk score for the year 2024 to be 1,111 instead of 1,122 and 1.05 instead of 1.04, respectively. Similarly, the LoRE and risk score for the year 2028 are 1,036 instead of 1,037 and 0.92 instead of 0.91 respectively as shown in the table below. The old values are stated in Tables I-1[64] and VIII-14[65] in Chapter 5 of the RAMP report. SCE also provided a redlined version of Chapter 5—*Contact with Energized Equipment_Redline.pdf*[66] with these corrected values. Staff finds that SCE clearly demonstrates a reduction of 12.38% in post-mitigation risk score at the end of 2028 in Table 5-1.

[63] S-MAP Settlement Agreement, Row 14.
[64] SCE RAMP Report, Ch. 5, at Page 5.
[65] SCE RAMP Report, Ch. 5, at Page 38.
[66] Errata: Contact with Energized Equipment Redline, Ch. 5, Pages at 5, 38.

Table 5-1. Corrected Proposed Plan Summary of Pre- and Post-LoRE and CoRE Risk Score[67]

	Pre-Mitigation Risk Quantification Scores (End of 2024)			Post-Mitigation Risk Quantification Scores (End of 2028)		
	LoRE	**CoRE**	**Risk Score**	**LoRE**	**CoRE**	**Risk Score**
Contact with Energized Equipment – Wires Down	1,111	0.001	1.05	1,036	0.001	0.92
Contact with Energized Equipment – Intact Contact	5.7	0.19	1.09	5.7	0.19	1.09

3. Staff further assessed the SCE input data and replicated the RSE values from the years 2025 through 2028 for the Proposed Plan of a single circuit. For the year 2025, staff has identified that C1 and C2 RSEs differ by 5.20 and 2.80, respectively in comparison to RSEs presented in Chapter 5.[68]

4. Staff recalculated and corrected the pre- and post-LoRE and risk scores in Tables 5-2 and 5-3 (Tables VIII-12 and VIII-14).

5. As mentioned under Alternative Plan #2, the CEE risk mitigations from M2 through M5 are still being evaluated as pilot studies not yet approved for a full-scale deployment. SCE should present updated information about these alternative mitigations in the GRC filing.

[67] SCE RAMP Report, Ch. 5, at Page 5.
[68] SCE RAMP Report, Ch. 5, at Page 33.

Table 5-2. Alternative Plan #1 Corrected Pre- and Post- LoRE, CoRE, and Risk Scores[69]

	Pre-Mitigation Risk Quantification Scores (End of 2024)			Post-Mitigation Risk Quantification Scores (End of 2028)		
	LoRE	**CoRE**	**Risk Score**	**LoRE**	**CoRE**	**Risk Score**
Contact with Energized Equipment – Wires Down	1,111	0.001	1.05	1,033	0.001	0.93
Contact with Energized Equipment – Intact Contact	5.7	0.19	1.09	5.7	0.19	1.09

Table 5-3. Alternative Plan #2 Corrected Pre- and Post- LoRE, CoRE, and Risk Scores[70]

	Pre-Mitigation Risk Quantification Scores (End of 2024)			Post-Mitigation Risk Quantification Scores (End of 2028)		
	LoRE	**CoRE**	**Risk Score**	**LoRE**	**CoRE**	**Risk Score**
Contact with Energized Equipment – Wires Down	1,111	0.001	1.05	1,036	0.001	0.92
Contact with Energized Equipment – Intact Contact	5.7	0.19	1.09	5.7	0.19	1.09

5. SPD staff also noted that the total cost for either Proposed Plan,[71] Alternative Plan #1,[72] or Alternative Plan #2[73] is the same. SCE did not offer reduced costs; therefore, ratepayers will pay the same regardless of which plan the Commission approves during the GRC evaluation process. Staff recommends SCE should lay out its rationale for not offering a lower cost to ratepayers during the GRC submission.

6. RSEs are numerical values representing the changes in risk scores per dollar spent associated with mitigation activities. Predominantly, it's an indicator of a program's risk reduction compared to

[69] SCE RAMP Report, Ch. 5, at Page 36.
[70] SCE RAMP Report, Ch. 5, at Page 38.
[71] SCE RAMP Report, Ch. 5, at Page 33.
[72] SCE RAMP Report, Ch. 5, at Page 35.
[73] SCE RAMP Report, Ch. 5, at Page 38.

the cost of that program. "The RSE is calculated based on those programs that have a direct impact on risk driver and/or consequence reduction."[74]

$$RSE = \frac{\text{NPV Benefits}}{\text{NPV Spend}} * 10{,}000{,}000 \text{ (Readability Factor)}$$

The staff made reasonable calculations for Proposed Plan and Alternative Plan #1 utilizing the RSE methodology and SCE input data. It appears that RSE values are slightly off for C1 and C2 controls. For example, for "Public Outreach – Wire Down" (C2) calculated value appears as 2.20 as opposed to 5.0.[75] This is because SCE calculated only for a single circuit. Staff understanding from the SCE's subject-matter expert is that if they must take all the circuit segments, it will take millions of rows to demonstrate the RSE value to 5.0. This value is provided by SCE's "machine learning tool." Similarly, the "Overhead Conductor Program" (OCP) calculation shows approximately 12.50 off from its actual RSE value of 80.0[76] for 2025. The same issues are observed for Alternative Plan #2. Staff believes that SCE should present these values in the RAMP report as such that these values are replicable to validate what is being reported.

[74] SCE RAMP Report, Ch. 2, at Page 14.
[75] SCE RAMP Report, Ch. 5, at Page 35.
[76] SCE RAMP Report, Ch. 5, at Page 35.

Underground Equipment Failure Risk (Chapter 6)

The Underground Equipment Failure risk concerns equipment failures on SCE's primary distribution system. The risk excludes failures in SCE's secondary distribution systems. The term "primary" refers to the high-voltage side of distribution transformers, typically 4 kV, 12 kV, 16 kV, and 33 kV. The term "secondary" refers to the low-voltage side of distribution transformers, typically 480 V or less. Events initiated by human performance are excluded from this risk. Failure of pad-mounted underground electrical equipment is also excluded from this risk.

The bowtie analysis starts with the four main tranches, with each tranche representing a different type of underground electric equipment.

Key Observations and Recommendations

1. In the risk bowtie, SCE equated subcategories of exposure with tranches, and the resulting tranches are also equated with risk drivers. This effectively obscures the true factors, threats, or mechanisms contributing to the failure of each of these subcategories of exposure. SPD suggests that in the risk bowtie analysis, adding an extra column of "sub-drivers" to characterize the true factors, threats, or mechanisms contributing to equipment failures in that tranche or that subcategory of exposure would make the bowtie analysis more meaningful.

2. In connection with providing data request answers to SPD staff on LoRE and CoRE, SCE identified errors in the risk scores in pre- and post-mitigation values for 2024 and 2028. Based on these corrections, SPD recalculated the risk scores and presented the corrected values in Table 6-3. These values are reflected in the Proposed Plan, Alternative Plan #1, and Alternative Plan #2. It appears that these values are the same for each plan. SPD staff recalculated the 2024 risk score, which produced a corrected value of 2.01 instead of 1.96 provided in the SCE RAMP. For 2028, SPD recalculated the risk score as 1.86 instead of the 1.71 presented in the RAMP. In addition, there is a minor correction in the CoRE value for 2028, which change from 0.0009 to 0.0010. The incorrect values are stated in Tables I-1[77], VII-8[78], VIII-10[79], and VIII-12[80] in Chapter 6 of the RAMP Report. Per data request, SCE provided a redline version of Chapter 6—*Underground Equipment Failure_Redline.pdf*[81] with these corrected values.

[77] SCE RAMP Report, Ch. 6, at Page 4.
[78] SCE RAMP Report, Ch. 6, at Page 26.
[79] SCE RAMP Report, Ch. 6, at Page 28.
[80] SCE RAMP Report, Ch. 6, at Page 31.
[81] Errata: Underground Equipment Failure Redline, Ch. 6, Pages at 4, 26, 28, 31.

Table 6-3. Corrected Summary of Pre- and Post- LoRE and CoRE Risk Scores

	Pre-Mitigation Risk Quantification Scores (End of 2024)			Post-Mitigation Risk Quantification Scores (End of 2028)		
	LoRE	**CoRE**	**Risk Score**	**LoRE**	**CoRE**	**Risk Score**
Underground Equipment Failure	1.955	0.0010	2.01	1.820	0.0010	1.86

3. SCE has about 328 BURD transformer failures per year out of a total of 82,000 BURD transformers. However, M1 is only proposing to replace 50 BURD transformers per year preemptively. Even if the replacement program is targeting the oldest and most failure-prone BURD transformers, the planned replacement rate will likely be insufficient to outpace the expected number of failures due to equipment deterioration. SPD recommends SCE re-examine the pace of the BURD transformer replacement program.

Cyber Attack Risk (Chapter 7)

SCE defines the Cyber-security risk as, "unauthorized access to SCE's bulk electric system and distribution system controls, including our Supervisory Control and Data Acquisition (SCADA) network, industrial control systems (ICS), and other systems that access and utilize Critical Energy/Electric Infrastructure Information (CEII),[82] in addition, SCE's administrative and customer data systems are also included." Cyber-security risk differs from natural disasters or equipment failure in that it involves rational actors whose means and methods continuously evolve and become more sophisticated. SCE explains that cyberattacks include "computer viruses, worms, phishing, spyware, ransomware, and advanced persistent threats.[83]"

For the Cyber-security risk chapter, SCE has segmented this risk category into three tranches covering the transmission system, the distribution system, and business operations. Three primary risk drivers underlie these tranches. These drivers include External Actors (cyber criminals, cyber terrorists, and state-sponsored cyber hackers), Insider Threats (employees and contractors who knowingly bypass SCE cyber security controls with malicious intent), and Supply Chain (malicious actors who penetrate SCE or SCE-vendor Cyber-security defenses to embed malware in code or compromise SCE access permissions to maliciously take control of SCE systems or tamper with sensitive corporate data).

Key Observations and Recommendations

1. For the Cyber-security risk chapter, SCE's risk bowtie could be improved to more clearly explain how the potential risk event could be brought to bear; such improvement would bring the cyber-security risk bowtie closer to meeting expectations and dynamic changes in means and methods. As submitted, the SCE risk bowtie equates subcategories of exposure (i.e., insider threat, supply chain procurement malware) with risk drivers. This has the effect of misidentifying a given trigger event that brings the risk event to be.

2. As in the 2018 RAMP filing, SCE's 2022 Analysis Scope of Work and Limitations for the cyber-security risk RAMP chapter provides a disclaimer noting that Edison's analysis does not speak to resulting significant secondary impacts involving a cyber-attack. As part of the risk and consequence analysis, SCE should attempt to quantify worst-case scenarios and secondary impacts developed via their risk assessments, work with government agencies (e.g., U.S. Department of Homeland Security's Assessment of Electricity Disruption Incident Response Capabilities), and apply the result of simulations and tabletop exercises such as those performed with Gridex.

[82]Operating systems for the electric system including, but not limited to, central-station power plants, transmission and distribution power systems, and interconnection of utility scale and localized, distributed energy resources.

[83] SCE RAMP Report, Ch. 7, at Page 7.

3. As with other risks, SCE omitted RSE values for Controls, omitting discussion of 2018 RAMP control descriptions, including one pertaining to Federal compliance obligations. As mentioned in earlier chapters, Decision 21-11-009 requires the calculation of RSEs for risk mitigation, including those previously categorized as controls associated with regulatory compliance obligations.

4. SCE does not adequately explain or justify why the utility proposes a four-year mitigation (risk containment) plan that totals $531.2 million, or about $132.8 million per year to continue five controls addressing three risk tranches. Edison's proposed spending amount represents a sizeable increase over prior spending levels for this risk category, with a total 2018 RAMP budget of just $477.4 million covering a six-year period, amounting to a past annual spend of only $79.6 million. One indicator of SCE's rising costs for its Cyber-security is the overhead cost, or what's referred to in the RAMP as O&M. SCE's 2018 RAMP had O&M costs of $21.5 million in annual spending compared to Edison's 2022 RAMP O&M costs of $34.8 million per year. O&M costs as a share of overall Cyber-security program costs increased slightly from 25 percent in the 2018 RAMP to 26 percent in the 2022 RAMP. It's worth noting that SCE's O&M for this risk is in the high range, with typical IOU O&M program costs tending to account for closer to 10 percent of overall program costs.[84]

   SCE indicates that its existing and planned approach to Cyber-security appears to be adequate for the cyber threats that exist today. However, SCE anticipates a steady growth in cybercrime and increased capability and sophistication of malicious cyber actors. As a result, SCE proposes increased spending to evolve and expand its cybersecurity defenses. SCE should better substantiate the need for increased spending.

[84] It's worth noting that unlike as was done for its 2018 RAMP, which had O&M provided for both annual and full-RAMP-term bases, SCE's 2022 RAMP provides O&M for year 2025 only, requiring some extrapolation to gauge the program-length cost, and masking somewhat the overall proportion of program cost.

Seismic Risk (Chapter 8)

According to SCE, "Southern California is earthquake country. It encompasses high seismic hazards that have been well-characterized, and that constitute half of the nation's earthquake risk, according to both the United States Geological Survey (USGS) and the Federal Emergency Management Agency (FEMA)." Four counties in SCE's service area ranked "Very High" for seismic risk. Los Angeles County was ranked highest in the United States. Neighboring counties served by SCE also received "Very High" and "Relatively High" scores.

SCE's seismic risk Tranches are based on safety and reliability which is then combined to obtain a Criticality of Asset (CoA) index. SCE has employed the CoA index to categorize buildings into the following four tranches:

- Tranche 1: CoA index 1.0-1.3, 19 assets and facilities. This tranche includes SCE's most critical assets, such as data centers, regional operational centers, primary blackstart generation assets, and communication hubs.
- Tranche 2: CoA index 1.4-2.9, 88 assets and facilities. This tranche is comprised of other critical assets, including switching centers, service centers, bulk substations, and secondary blackstart assets.
- Tranche 3: CoA index 3.0-5.0, 1,073 assets and facilities. This tranche is comprised of highly important assets, namely redundant communications facilities, distribution substations, and other generation assets.
- Tranche 4 is composed of other critical facilities including but not limited to transmission corridors, lattice towers, and other major facilities.

<u>Key Observations and Recommendations:</u>

1. Staff notes it is not clear if there are distinct differences between Tranche 1 and 2 other than different Criticality of Asset indexes; both tranches have critical assets. Therefore, Tranches 1 and 2 do not appear to have different homogenous profiles. Lastly, it is unclear why Tranche 4 is not included in the RAMP analysis but is a part of SCE's Seismic Resiliency Program. Tranche 4 is composed of other critical facilities including but not limited to transmission corridors, lattice towers, and other major facilities.

2. SCE maps the following three outcomes to the seismic triggering event: O1 – Moderate Earthquake, O2 – Severe Earthquake, and O3 – Catastrophic Earthquake. Probabilities for the three outcomes are determined using tranche 3 as discussed in the risk bowtie section and data request SPD-SCE-008 Q.01. SCE has explained that tranche 3 was utilized because a large majority of the assts within the RAMP scope are in this tranche. In addition, tranche 3 provides the best geographic representation of assets. Seismic risk outcomes are unique from other risk outcomes in that the outcome probabilities among tranches cannot be summed; an earthquake that affects

one tranche will likely also affect the other tranches and therefore summing could result in double-counting earthquakes.

3. SCE has identified two alternatives which both will reduce risk at a slower pace by decreasing the amount of money spent on mitigation activities. Alternative 1 is to reduce the current scope from $44M/yr to $25M/yr and Alternative 2 is to reduce the current scope from $44M/yr to $15M/yr. Staff recommends proposing programmatic alternatives in future RAMP filings such as different mitigation programs.

Employee Safety Risk (Chapter 9)

SPD has no critical observations on this risk chapter.

Contractor Safety Risk (Chapter 10)

SPD has no critical observations on this risk chapter.

Major Physical Security Incident (Chapter 11)

Physical Security risk concerns threats to SCE facilities and the risks posed to the people and assets in those facilities. For SCE RAMP purposes, Physical Security consists of tactics[85] and implements[86] directly supporting the physical safeguarding of SCE facilities that are critical to the integrity of SCE's grid operations and its reliable delivery of electricity.

For the Physical Security risk chapter,[87] SCE has divided this risk category into three tranches, which are not explicitly called out within its risk bowtie diagram, but which cover operational categories.[88] These include Protection of Grid Operations Transmission System, the Protection of Major Business Functions, and Protection of Generation Capabilities.

For the Physical Security risk chapter, SCE identified seven risk drivers,[89] which contribute to this risk and serve as the starting point for SCE's 2022 risk bowtie diagram. SCE's risk bowtie indicates that all resulting Safety impacts reside within all five identified Outcomes.

Key Observations and Recommendations

1. Edison's identified Tranche categories for this RAMP risk chapter are generally interchangeable with the utility's identified Controls. SCE's 2022 assignment of risk Tranches aligns with the utility's operational hierarchy (power generation, power delivery, and support services). In this framework, a single[90] risk Tranche contains 85 percent of the overall risk. The analysis could be improved by assigning risk Tranches into more categories that account for discrete portions of the identified risks.

2. For the Physical Security risk chapter, RSEs could be better presented so as to be more useful. Notably, SCE provides no RSE calculations for its risk chapter and provides little insight into how its limited treatment of RSE was derived. The only hard numbers SCE provides on the subject is a single column within the spending table for each mitigation plan showing the RSE assigned to individual control measures. For its proposed plan,[91] SCE provides information for seven risk

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[85] Examples of Physical Security tactics include appropriate procedures and training to deter, detect, assess, and respond to physical threats.

[86] Examples of Physical Security Implements include perimeter walls and fencing, lighting, cameras, video analytics, and other security tools.

[87] Available online at https://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=476640383

[88] For comparison purposes, the cyber security risk chapter establishes its risk tranches as T1. Transmission System, T2. Distribution System, and T3. Business Operations.

[89] These include Security System Breach or Failure, Human/Process Failure, Insider Threat, Gunfire, Drones, and Trespassing.

[90] Grid Operations.

[91] P. 11-32

controls and five mitigation measures having 2023 RSE values ranging from 0.1 to 189.7. SCE provides no overall RSE value for any of the three risk mitigation plans it describes.

3. SCE's CM category of controls consists of regulatorily-required controls.[92] As in other chapters, SCE did not provide an analysis or RSE calculations for its CM controls.[93]

[92] P. 21-32. Two controls to address federal compliance mandates, and one control to comply with Commission requirements: Physical Security Reliability Standard NERC CIP-2, NERC CIP-003-v6, and R.15-06-009 Physical Security of Electrical Infrastructure per D.19-01-018.

[93] SCE, within in its 2018 RAMP application's explanatory preamble provides some insight into this RAMP item; such description is missing from its 2022 RAMP. SCE's 2018 language states, "Compliance Controls (commonly referred to in the report with the prefix "CM") are defined as currently established activities that modify or reduce risk, and that are required by law or regulation. To take some examples, activities that support Federal or State OSHA requirements, FERC Orders and requirements for hydro facilities, and Commission General Orders, are all considered Compliance Controls. In most cases, SCE will include compliance activities in its baseline risk. Because SCE is required to perform these activities by law or regulation, they are foundational to operating the utility. In addition, it is often very difficult to evaluate the inherent risk that is present in the absence of these compliance activities. In each risk chapter, SCE will describe these Compliance Controls and show their recorded expenditures, but will not evaluate the risk reduction or Risk Spend Efficiently (RSE) of the compliance activities. Stated differently, the benefits of these compliance activities are included in the baseline risk level for each risk." P. 1-5.

Hydro Dam Failure Risk (Chapter 12)

SCE operates a portfolio of 81 hydro dams supporting 33 hydroelectric plants. Twenty-seven dams, classified as high hazard, are in the scope of this RAMP analysis. Relying on its existing Dam Safety Risk Assessment Program, SCE systematically identified potential ways specific dams could fail using Potential Failure Modes (PFMs). SCE then evaluated the likelihood of an incident and the potential consequence of each PFM. SCE's Dam Safety Risk Assessment Program was initiated in 2008 and is based on hydro dam risk management best practices established by the U.S. Bureau of Reclamation (USBR). In addition, SCE's Dam Safety Program adheres to federal and state regulations overseen by USBR, the United States Army Corps of Engineers, The Federal Emergency Management Agency's Risk Informed Decision Making (RIDM) and Benefit Cost Analysis (BCA) for Dam and Levee Projects process, and the California Department of Water Resources' Division of Safety of Dams (DSOD) regulations.

<u>Key Observations and Recommendations:</u>
Staff notes it is unclear why C2 – Dam Surface Protection and C5 – Seepage Mitigation are separate as they do not appear to have different homogenous risk profiles. Therefore, staff suggests SCE consider consolidating C2 and C5.

Battery Energy Storage Systems (SCE RAMP Application, Appendix A)

SCE addresses two safety-related risks related to Battery Energy Storage Systems (BESS): (a) thermal propagation risk and (b) decommissioning.

Key Observations and Recommendations

1. Senate Bill 1383 (Hueso, 2022)[94] was signed into law on September 28, 2022, and will take effect on January 1, 2023. This bill extends the CPUC's current authority to inspect wholesale electric generators to battery storage resources by requiring the CPUC to implement and enforce standards for the maintenance and operation of electric storage facilities owned or contracted for by electrical corporations. As battery energy storage systems proliferate and become a more critical component of the electric grid, increased regulatory oversight will become more important. The CPUC anticipates initiating and Order Instituting a Rulemaking in 2023 to develop rules, establish the program, and initiate increased oversight over this rapidly growing component of the State's electrical system.

2. The risk analysis presented for this risk is qualitative rather than quantitative. SCE voluntarily included this risk topic in the RAMP Report even though it does not rise to the level of a RAMP risk. The Settlement Agreement requirements do not apply to this risk topic or to the other four risk topics included in the Appendices of the 2022 SCE RAMP Report.

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[94] Senate Bill 1383 (Hueso, Chapter 725, Statutes of 2022). Text of the bill is available here: https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220SB1383

Climate Change Risk (SCE RAMP Application, Appendix B)

The risk related to climate change has both shorter-term and long-term components. Since the RAMP is primarily concerned with shorter-term safety-related risks, the longer-term safety impacts from climate change do not rise to the level of RAMP risks. Thus, most of the climate change-related safety impacts fall outside of the scope of the 2022 RAMP.

Observations and Recommendations

It appears that due to the concurrent due date for both the 2022 RAMP application and the Climate Adaptation and Vulnerability Assessments (CAVAs), SCE was unable to incorporate results from its CAVAs into the 2022 RAMP. SCE also addresses compliance with the Commission's goals on environmental and social justice issues in its CAVA. The 2022 RAMP has no proposed mitigation programs aimed at reducing safety risks related to climate change. Instead, the climate change risk analysis in this RAMP lists potential (rather than proposed) mitigation options for the 2025 to 2028 GRC period.[95] SCE should rectify this situation by making concrete mitigation proposals related to climate change adaptations and showing compliance with the Commission's environmental justice and social justice goals in the TY2025 GRC.

[95] SCE RAMP Report, Appendix B, Page 10, Table III-1.

Transmission and Substation Assets Risk (SCE RAMP Application, Appendix C)

This risk explores certain potential but direct safety risks associated with transmission lines, sub-transmission lines, and substation assets that are not addressed within the RAMP chapters. SCE identified two types of direct safety risks associated with these assets: (1) Contact with energized equipment; and (2) Equipment and/or structure failure where a person is injured as a result of asset failure.

SCE provides seven examples of this risk:

- Transmission Line Clearances;
- Transmission Conductor and/or Conductor Attachment Failure;
- Transmission Line Structure Failure;
- Substation Transformer Failure;
- Substation Circuit Breaker Failure;
- Relays, Protection, and Control Replacements; and
- Substation Switch Racks Failure

Observations and Recommendations

Some of the examples above have direct potential wildfire implications, even though the risk in Appendix C is not classified as a RAMP-level risk. It is not readily apparent why some of the risk remediation activities SCE listed in the table below[96] are not included as part of the analysis in the wildfire risk chapter. By treating this as a non-RAMP risk, SCE did not provide MAVF-level risk analyses and RSE information on the risk and the associated mitigations. By placing some of these mitigations outside of the scope of a RAMP risk, SCE has effectively shielded them from Commission oversight in the RAMP process. SPD recommends that analyses of these risk mitigation activities should be incorporated into the appropriate RAMP risk chapters where appropriate.

[96] SCE RAMP Application, Appendix C, Page 8.

Table II-2
SCE 2022 RAMP Transmission and Substation Asset Failure Risks and SCE's Risk Remediation Activities[9]

#	Transmission and Substation Asset Failure Risk	SCE Risk Remediation Activities			
1	**Transmission Line Clearances - Example of contact with energized equipment**	Transmission Line Rating Remediation (TLRR)	Transmission Line Patrols	Transmission Routine Vegetation Management	
2	**Transmission Conductor and/or Conductor Attachment Failure - Example of equipment and/or structure failure**	Transmission Capital Maintenance	Transmission O&M Maintenance	Insulator Washing	
3	**Transmission Line Structure Failure - Example of equipment and/ or structure failure**	Transmission Capital Maintenance	Tower Corrosion Program	Transmission O&M Maintenance	Transmission Underground Structure Inspection
4	**Substation Transformer Failure - Example of equipment and/or structure failure**	Substation Equipment Replacement Program	Substation Transformer Bank Replacement Program	Transformer Inspections and Maintenance	
5	**Substation Circuit Breaker Failure - Example of equipment and/or structure failure**	Circuit Breaker Replacement	Substation Equipment Replacement Program	Circuit Breaker Inspections and Maintenance	
6	**Relays, Protection, and Control Replacements - Example of equipment and/or structure failure**	Relays, Protection and Control Replacements	Relay Inspections and Maintenance		
7	**Substation Switch Racks Failure - Example of equipment and/or structure failure**	Substation Switch Rack Rebuild			

Nuclear Decommissioning (SCE RAMP Application, Appendix D)

SPD has no critical observations on this risk chapter.

Widespread Outage (SCE RAMP Application, Appendix E)

SPD has no critical observations on this risk chapter.

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Acknowledgements

The SPD evaluation team would like to acknowledge the contributions during public workshops and from written comments made by the various intervenor parties as well as SCE in this RAMP proceeding, including California Public Advocates (Cal Advocates), the Mussey Grade Road Alliance (MGRA), Small Business Utility Advocates (SBUA), and The Utility Reform Network (TURN).

INFORMAL COMMENTS from Intervenor Parties on the RAMP and Email from SCE

The following documents are appended as attachments to this report:

Cal Advocates Informal Comments, October 10, 2022
MGRA Informal Comments, October 10, 2022
TURN Informal Comments, October 10, 2022
Email from SCE to correct a factual error in Cal Advocates' informal comments, October 18, 2022

Attachments – Informal Comments from Intervenors and SCE

Attachment 1- Cal Advocates

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of Southern California Edison Company (U338E) Regarding 2022 Risk Assessment Mitigation Phase.	Application 22-05-013

INFORMAL COMMENTS OF THE PUBLIC ADVOCATES OFFICE ON SOUTHERN CALIFORNIA EDISON COMPANY 2022 RISK ASSESSMENT MITIGATION PHASE

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October 10, 2022

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INFORMAL COMMENTS OF THE PUBLIC ADVOCATES OFFICE ON SOUTHERN CALIFORNIA EDISON COMPANY 2022 RISK ASSESSMENT MITIGATION PHASE

I. INTRODUCTION

Pursuant to the Safety Policy Division's (SPD) directive in its September 27, 2022 email to the service list in this proceeding,[1] the Public Advocates Office at the California Public Utilities Commission (Cal Advocates) submits these informal comments on Southern California Edison Company's (SCE's) 2022 Risk Assessment and Mitigation Phase (RAMP) proceeding, Application (A.) 22-05-013. These preliminary comments discuss the most significant issues Cal Advocates has identified to date. Cal Advocates recommends that SPD include in its evaluation report an assessment of SCE's overdue and unresolved maintenance in High Fire Threat District (HFTD) areas. Cal Advocates may raise additional issues as its analysis continues.

II. COMMENTS

A. SPD Should Assess the Risk of SCE's Overdue and Unresolved Maintenance in HFTD Areas.

Cal Advocates' protest preliminarily identifies several issues the Commission should include within the scope of SCE's RAMP proceeding.[2] The identified issues include whether SCE adequately evaluates risks that may arise from inadequate

[1] Email from Steven Haine, Safety Policy Division, titled "A.22-05-013," September 27, 2022.

[2] Protest of the Public Advocates Office to the Application of SCE Regarding Its 2022 Risk Assessment and Mitigation Phase (June 20, 2022).

inspections or asset management, and whether SCE's RAMP Report adequately identifies and analyzes major safety risks and develops effective mitigation programs to address those risks. An evaluation of the risks posed by inadequate inspections or asset management is necessary to improve safety and to adequately maintain SCE's electrical system.

Cal Advocates initially raised concerns regarding SCE's significant amount of overdue and unresolved maintenance in HFTD areas in its 2022 Wildfire Mitigation Plan (WMP) Update Comments.[3, 4] SCE has a total of 35,431 open distribution maintenance tags and 4,776 open transmission maintenance tags within HFTD areas.[5] While relatively few of SCE's open maintenance tags are classified as high priority,[6] the backlog is nevertheless substantial as shown in Tables A and B below.

Table A[7]
Priority 2 Distribution Maintenance Tags

	Overdue	Total	Percent of Total Overdue
HFTD Tier 2	1,623	19,547	8%
HFTD Tier 3	3,550	15,741	23%
HFTD Total	5,173	35,288	15%

Table B[8]
Priority 2 Transmission Maintenance Tags

	Overdue	Total	Percent of Total Overdue
HFTD Tier 2	1,406	2,453	57%
HFTD Tier 3	1,881	2,323	81%
HFTD Total	3,287	4,776	69%

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[3] *See* Comments of the Public Advocate's Office on the 2022 Wildfire Mitigation Plan Updates of the Large Investor-Owned Utilities Docket 2022-WMPs, (April 11, 2022) (Cal Advocates' WMP Comments) at 31-35.

[4] All data on the number of open maintenance notifications is as of February 1, 2022.

[5] SCE's supplemental response to DR CalAdvocates-SCE-2022WMP-05, questions 1 and 2, March 3, 2022.

[6] 143 of 35,431 open distribution maintenance tags and none of the transmission maintenance tags are classified as high priority.

[7] Cal Advocates WMP Comments at 33.

[8] Cal Advocates WMP Comments at 34.

Cal Advocates has recommended tracking utilities' backlog metrics in the Safety Performance Metrics Reports in Rulemaking (R.) 20-07-13[9] because backlog metrics are critical to ensuring that critical safety and reliability work is carried out.[10] Backlogs can lead to serious safety hazards. As detailed in Cal Advocates' WMP Comments,[11] SCE identified 103 Commission-reportable ignitions in 2021 linked to assets that had pending maintenance tags.[12] Of these 103 ignitions, nine are particularly troubling because SCE identified the cause as "equipment/facility failure." The equipment involved in each of these nine ignitions had an open Priority 1 or 2 tag at the time.[13] The tags mean that these ignitions were potentially preventable with timely maintenance.[14]

Given the size of SCE's backlog and the potential consequences of a preventable ignition, the Commission should require SCE to address its backlogs in a timely manner to reduce the threat to public safety from overdue maintenance.

B. SPD Should Evaluate Backlogs for All Safety Work, Not Just Electric Safety Work.

SPD should conduct a deeper analysis on SCE's overdue maintenance and backlogs in deferred replacement or upgrades of aging infrastructure across the enterprise. As explained in section A above, backlog metrics can provide key insights into risks associated with such backlogs. An analysis of backlog metrics can also uncover significant risks in other business units. One example would include SCE's hydro and dam assets. Deferred safety work has been identified as the root cause of

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[9] R.20-07-013, Order Instituting Rulemaking to Further Develop a Risk-Based Decision-Making Framework for Electric and Gas Utilities (July 24, 2020).

[10] *See* Opening Comments of the Public Advocates Office on Track 2 Proposed Safety and Operational Metrics, Safety Performance Metrics, and Track 1 Staff Recommendations (June 29, 2021), and *See* Reply Comments of the Public Advocates Office on Track 2 Proposed Safety and Operational Metrics, Safety Performance Metrics, and Track 1 Staff Recommendations (July 9, 2021).

[11] Cal Advocates WMP Comments at 34-35.

[12] SCE's response to DR CalAdvocates-SCE-2022WMP-07, question 9, March 15, 2022.

[13] Priority 1 tags must be remediated or made safe within 72 hours, while Priority 2 tags are considered lower risk and, therefore, must be resolved within six months in HFTD Tier 3, or 12 months within HFTD Tier 2.

[14] SCE's response to DR CalAdvocates-SCE-2022WMP-07, question 9, March 15, 2022.

safety incidents in the past. For example, SCE identified two wildfires linked to assets with pending maintenance tags.[15] One fire was between 10 and 99 acres, and the other was between 300 and 999 acres.

SPD should also evaluate safety risks not only to the public, but also to workers. In September 2022, the press reported a fire at an SCE hydroelectric plant in which a reported eight workers were injured.[16] SPD should evaluate the causes for this incident and should consider risk assessment improvements to prevent it.

III. CONCLUSION

For the reasons stated herein, Cal Advocates requests that SPD conduct further analysis of SCE's backlog and maintenance issues across all enterprise, and that SPD direct SCE to address and mitigate the potential risks of its growing backlog.

Respectfully submitted,

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October 10, 2022

[15] SCE's response to DR CalAdvocates-SCE-2022WMP-07, question 9, March 15, 2022.

[16] September 15, 2022 Fox News Article: *Explosion reported at SoCal Edison hydroelectric plant at Shaver Lake*. "At least eight Southern California Edison employees are being evaluated by medical personnel after an incident at the Eastwood Power Station Tunnel at Shaver Lake." Please see: https://kmph.com/news/local/injuries-reported-at-socal-edison-hydroelectric-plant-accident-southern-california-edison-fresno-county-health-calfire-fresno-fire

Attachment 2 – MGRA

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**

Application of Southern California Edison Company (U 338-E) Regarding 2022 Risk Assessment Mitigation Phase.	Application 22-05-013 (Filed May 13, 2021)

MUSSEY GRADE ROAD ALLIANCE INFORMAL COMMENTS TO THE

SAFETY POLICY DIVISION REGARDING

SOUTHERN CALIFORINA EDISON COMPANY'S RAMP FILING

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Dated: October 10, 2022

1. INTRODUCTION

The Mussey Grade Road Alliance (MGRA or Alliance) submits these informal comments on the SCE 2022 RAMP filing[1] to the CPUC's Safety Policy Division (SPD) as per email instructions.[2] These informal comments are prepared by Mussey Grade Road Alliance expert Joseph Mitchell.

In its Response[3] to SCE's application MGRA raised a number of issues that needed deeper examination in the RAMP proceeding, including:

- Missing wind dependency in SCE ignition models.
- Use of power laws to model catastrophic losses.
- Limitations on Technosylva consequence modeling due to premature termination of fire growth.
- SCE's risk model does not capture correlations between risk drivers that increase outage rates and the "extreme weather" periods it uses for its consequence modeling, thus overweighting some drivers (non-weather related) and underweighting others (wind-driven).
- Health and Safety Consequences of Wildfire smoke.
- Abnormally low wire down rates may imply higher than advertised covered conductor efficiency.
- Substantial increase in the rate of undergrounding.
- The need to evaluate PSPS as a mitigation as well as a hazard when determining optimal mitigation strategies, particularly for high-cost mitigations.

Additionally, OEIS's review of SCE's Wildfire Mitigation Plan has raised a number of issues with SCE's approach to risk modeling and mitigation, a number of which MGRA has

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[1] A.20-06-013; APPLICATION OF SOUTHERN CALIFORNIA EDISON COMPANY (U 338-E) REGARDING 2022 RISK ASSESSMENT MITIGATION PHASE (RAMP); May 13, 2022. (RAMP)
[2] Email: Subject: A.22-05-013; From: steven.haine@cpuc.ca.gov; September 27, 2021.
[3] A.22-05-013; MUSSEY GRADE ROAD ALLIANCE RESPONSE TO SOUTHERN CALIFORNIA EDISON COMPANY 2022 RISK ASSESSMENT AND MITIGATION PHASE REPORT; June 13, 2022. (MGRA Response)

identified in its review of the 2021 and 2022 WMPs. Some specific issues that MGRA has provided comment on include:

- MGRA suggested that SCE provide additional justification of its aggressive covered conductor program that supports the high risk-spend efficiency that it finds,[4] and that it participate in a covered conductor working group.[5]
- MGRA analyzed SCE ignition data and showed that ignitions are more likely under extreme fire weather conditions.[6]
- MGRA showed that SCE wildfire risk overweighted third-party ignition sources such as balloons, animals, and vehicles.[7]
- MGRA proposed that Southern California Edison "test drive" the Pacific Gas and Electric Company Transparency Proposal in order to provide timely feedback on its efficacy.[8]

2. ENERGY SAFETY FINDINGS FROM SPD-2 AND WSD-020

The Commission approved Resolution SPD-2 which ratifies Energy Safety's review of SCE's 2022 Wildfire Mitigation Plan (WMP). Many of these findings are directly applicable to SCE's RAMP finding. MGRA contributed to a number of these findings, including:

SCE-22-01. Prioritized List of Wildfire Risks and Drivers: "*SCE must further refine its prioritized list of wildfire risks and drivers. It must do so by weighting each risk driver by likelihood of causing a catastrophic wildfire (e.g., does this ignition tend to happen in high wildfire risk areas identified by SCE's risk models, including the HFTD)*"[9]

This finding is related to MGRA's discussion in Section 3.3.

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[4] WSD-020; Action Statement; p. 23.
[5] Id.; pp. 10-11.
[6] Id; p. 23; Issue-SCE-21-11.
[7] Id; p. 23, 40.
[8] D.21-11-009; p. 143.
[9] SPD-2; p. 115.

SCE-22-12. Residual Risk Reduction Associated with Covered Conductor:

“ *Provide SCE’s plan and timeline for moving forward with REFCL, including mileage and risk addressed.*

 Provide SCE’s plan and timeline for moving forward with additional pilot technologies, such as DFA and EFD.

 Include effectiveness evaluations of added mitigation measures for CC++ in comparison to undergrounding when determining initiative selection.”[10]

SCE-22-23. RSE Estimates of Emerging Initiatives:

“o *Description: SCE does not calculate RSE estimates for emerging initiatives.*

o Required Progress: In its 2023 WMP, SCE must detail an action plan for calculating RSE estimates for emerging initiatives.”[11]

SCE-22-26. PSPS System Damage in Consequence Modeling.

“o *Description: In 2021 field personnel inspecting lines prior to restoring power after PSPS events found 46 incidents of wind-related damage. This damage was on lines de-energized during PSPS events that potentially could have caused ignitions. SCE has not performed consequence modeling based on these damage points to better understand potential incidents that the shutoffs may have prevented*.”[12]

This is discussed further in Section 3.4.

In the previous year, SPD had found other issues with SCE’s WMP, and evaluated SCE’s progress in 2022. Certain issues were seen to require more effort:

SCE-21-11. *Unclear how SCE’s ignition models account for correlations in wind speeds, ignitions, and consequence,*

Utility sufficiently addressed the required remedy thus far; Energy Safety will continue to monitor progress. For discussion of progress, see Section 4.6.3 of this Decision.

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[10] SPD-2; p. 120.
[11] SPD-2; p. 125.
[12] SPD-2; p. 126.

3. TECHNICAL ANALYSIS OF THE SCE RAMP

In addition to SCE's current RAMP filing, intervenors and staff have access to SCE's wildfire mitigation plans and the reviews conducted by OEIS and stakeholders. Additionally, intervenors and staff have worked together with SCE and other IOUs during the R.20-07-020 Risk-based Decision-making Framework (RDF) proceeding and have had the opportunity to see how SCE approaches risk, particularly wildfire risk, compared to other IOUs and what intervenors maintain should be best practices.

In summary, based on SCE's presentation and those in its WMP, MGRA concludes that SCE's wildfire modeling has a number of significant shortcomings, both compared to other California utilities and to ideal best practices. These errors will lead to significant underestimation of catastrophic fire risks, geographic misallocation of resources, and potential choice of non-optimal mitigations.

Briefly summarized:

- SCE does not have any mechanism to account for increased probability of outage due to external drivers during the extreme weather days they use in their consequence model. This leads their wildfire risk model to over-assign risk to drivers such as animals, balloons, 3rd party contact, and vehicles.
- SCE is the only major IOU with an enterprise risk model that does not model consequences in the extreme loss region where data is sparse with an analytical function. Both SDG&E and PG&E currently use a power-law model for this purpose. Instead, SCE uses only Technosylva fire spread modeling to predict consequences for its enterprise risk model, despite the fact that the 8 hour fire spread limitation of that model limits fire sizes to approximately 10,000 acres. This will lead to a gross underestimation of catastrophic fire risk, and geographically will overweight areas near population centers and underweight remote high-wind areas where catastrophic fires often gestate before moving into the wildland urban interface.
- SCE does not incorporate wildfire smoke risk. In its 2022 WMP comments and in comments on SDG&E's 2021 RAMP, MGRA demonstrated that wildfire smoke is likely to be the source of the greatest health and safety risk from wildfires. MGRA

has issued a data request to SCE asking it to incorporate to smoke scenarios into its model using the approximate method pioneered by SDG&E.

- SCE and other utilities are still analyzing the benefit of covered conductor. Initial data from SCE indicates that the wires down rate may be lower than estimate, meaning that the effectiveness of covered conductor may be higher than anticipated.

3.1. Catastrophic Wildfire Losses and Power Laws

MGRA has been advocating for the use of power law distributions to describe extreme losses from wildfires based on numerous academic references.[13] MGRA has been advocating for the use of power law distributions to model extreme wildfire losses in a number of proceedings, in particular the RDF proceeding R.20-07-020. In that proceeding, SCE has had exposure to the concept and has been a vociferous opponent of the suggestion that utilities should use power laws to model extreme consequences.[14] While SPD withdrew its original suggestion that utilities be required to evaluate the power law distribution in their MAVF analysis, the final decision in that proceeding determined that "*Any best practice for wildfire modeling must produce a set of consequences for wildfires that sufficiently incorporate high-end losses.*"[15] MGRA will demonstrate SCE's model fails in this regard.

SCE has remained opposed to use of a power law distribution in this proceeding, expressing this opposition in both its reply comments[16] to MGRA's Response and its reply[17] to MGRA's

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[13] MGRA White Paper, Wildfire Statistics and the Use of Power Laws for Power Line Fire Prevention, (MGRA White Paper) February 11, 2021 was attached as Appendix A to MGRA's Comments Regarding Development of Safety and Operational Metrics filed March 1, 2021, available as of August 23, 2021 at: https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M368/K055/368055506.PDF.

[14] R.20-07-013; ADMINISTRATIVE LAW JUDGE'S RULING PROVIDING STAFF RECOMMENDATIONS FOR COMMENT; pp. 20-21.

[15] D.21-11-009; p. 122.

[16] A.22-05-013; SOUTHERN CALIFORNIA EDISON COMPANY'S (U 338-E) REPLY TO PROTESTS TO RAMP REPORT; June 30, 2022 (SCE Reply Comments).

[17] A.22-05-013; SOUTHERN CALIFORNIA EDISON COMPANY'S (U 338-E) REPLY BRIEF ON ADDITIONAL SCOPING MEMO ITEMS FOR SCE'S 2022 RAMP; September 1, 2022; pp. 4-6. (SCE Scoping Reply Brief)

Scoping Brief.[18] SCE summarizes its opposition to use of the power law and argues for its own approach in its Scoping Reply Brief:

"*While power law analyses may be beneficial in understanding system-wide tail-end risk in instances where more granular circuit or circuit segment level analysis is unavailable, the generalized power-law types of analyses should not supplant more detailed and granular analyses, which SCE has already included. In SCE's RAMP Report, tail-end wildfire risk is characterized by using the maximum simulated consequence over an eight-hour simulated burn period for each individual circuit segment. The benefit of this approach is that it allows SCE to expand the analysis beyond historical catastrophic wildfire information, which, as power law implies, are relatively rare events and for which data may not be available at a granular level*."[19]

SCE's understanding of catastrophic loss distributions and the appropriate use of Technosylva's fire spread model is erroneous.

3.1.1. Wildfire losses are well described by power law distributions

Power law functions can be used to fit wildfire size distributions over several orders of magnitude, as shown in the MGRA Whitepaper submitted to the RDF proceeding. According to analysis by J. Mitchell in the MGRA White Paper and cited references, the cumulative statistical distribution of wildfire losses in California can be described by a power law with an exponent of -0.4 to -0.5.[20] One characteristic of power law distributions (and the catastrophic wildfires they represent) is that the majority of cumulative damage over time is done by a few very large events. In its comments on SDG&E's RAMP proceeding, MGRA showed that for a P50 of $2.1 billion (determined by SDG&E's subject matter expert), half of the risk above the P50 point will come from wildfires doing more than $7 billion in damage using a truncated power law distribution.[21]

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[18] A.22-05-013; MUSSEY GRADE ROAD ALLIANCE BRIEF REGARDING SOUTHERN CALIFORNIA EDISON COMPANY 2022 RISK ASSESSMENT AND MITIGATION PHASE REPORT SCOPING; August 22, 2022. (MGRA Scoping Brief)
[19] Op. Cite; p. 5.
[20] MGRA White Paper; pp. 5-8.
[21] Safety Policy Division Staff Evaluation Report on SDG&E's and SoCalGas' Risk Assessment and Mitigation Phase (RAMP) Application Reports; November 5, 2022; p. 212/295; Appendix: MUSSEY GRADE ROAD ALLIANCE INFORMAL COMMENTS TO THE SAFETY POLICY DIVISION REGARDING SAN DIEGO GAS AND ELECTRIC COMPANY'S RAMP FILING; p. 4. (SPD SDG&E RAMP Report)

Being able to accurately calculate consequences for very large and destructive fires is therefore essential to correct risk estimation.

3.1.2. PG&E and SDG&E have adopted a power law fit for catastrophic wildfire losses in their ERM

For several years, both PG&E and SDG&E have recognized that extreme losses need to be modeled in their enterprise risk models, and developed functions to fit catastrophic loss values where historical data is lacking. Originally, PG&E used a lognormal function for this purpose, and SDG&E used a gamma function, but thanks to input and analysis by MGRA and SPD,[22] both companies have opted to adopt a power law function (Pareto Type 2), and have verified that it adequately fits historical data.[23]

SCE, however, continues to take issue with the application of power laws. Quoting from PG&E's analysis, SCE claims:

"*Indeed, in PG&E's analysis of the power law distribution analysis of wildfire risk, PG&E appeared to suggest that other distributions, notably a truncated lognormal distribution, might potentially better characterize tail-end risk, and that PG&E could not conclude that power law was the right pathway*."[24]

However, PG&E does not claim that truncated lognormal "might potentially better characterize tail-end risk", but rather that it cannot confirm or reject the hypothesis that power laws provide a better fit than lognormal. In fact "*PG&E ultimately decided to use the power law distribution to describe some of its data based on a combination goodness-of-fit test results and because it assigns, consistent with historical frequencies, more weight to extremely high consequence events*,"[25] though PG&E declined to recommend its use to other utilities at this point.

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[22] Id; p. 11, MGRA appendix pp. 2-5 (p. 210/295). Also,
A.20-06-012; Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012; p. 17.
[23] A.20-06-021; DIRECT TESTIMONY OF THE MUSSEY GRADE ROAD ALLIANCE PACIFIC GAS AND ELECTRIC COMPANY 2023 GENERAL RATE CASE; June 13, 2022; pp. 20-21, 25-31. https://docs.cpuc.ca.gov/PublishedDocs/SupDoc/A2106021/5111/484091126.pdf . Also,
A.22-05-016; SDG&E (RISK MANAGEMENT TESTIMONY VOLUME); p. RSP/GSF-9.
[24] SCE Scoping Reply Brief; p. 5.
[25] R.20-07-013, PG&E Power Law Distribution Whitepaper_09_03_021, pp. 9-10

SCE, however, is not arguing that it should be allowed to use a lognormal distribution. Instead, it uses fire spread simulation data only. It argues that "*While power law analyses may be beneficial in understanding system-wide tail-end risk in instances where more granular circuit or circuit segment level analysis is unavailable, the generalized power-law types of analyses should not supplant more detailed and granular analyses, which SCE has already included*."[26]

SCE concludes: "*SCE's wildfire analysis has meaningfully advanced beyond the need to resort to what might fairly be characterized as 'blunt instrument' techniques. We also believe that using simulated wildfire information to characterize granular tail-end risk aligns with the Commission's goals of more granularity in risk analysis and is more appropriate than regressing back to using system-wide probability distributions*."

For the sake of clarification, SDG&E and PG&E's use of extreme value functions such as power laws for fitting to catastrophic losses is applied only to their system-wide ERM, or ERM with tranches. At the granular circuit level, PG&E and SDG&E face the same challenges as SCE, as will be discussed subsequently. SCE would be correct if the granular circuit model accurately calculated the tail the risk for individual circuits. If this were the case then the system risk could be determined by aggregating the individual circuit risk. However, this assumes that the "simulated wildfire information" correctly characterizes catastrophic fires – and it does not. Technosylva wildfire simulations used by utilities have serious limitations due to their limited duration and therefore size, and therefore cannot be used to calculate "tail-risk".

3.1.3. Technosylva's fire spread model fails to adequately capture catastrophic losses

As has been known and discussed widely since the adoption of the Technosylva fire spread model for consequence modeling by the major California IOUs, effective fire spread modeling time is limited to eight hours. As SCE explains in its RAMP:

"*As wildfire simulations increase in time duration, so does the uncertainty associated with those simulations. It is not uncommon for both natural (e.g., changing wind direction) and human activity (e.g., fire suppression) to change the intensity and direction of wildfires as they progress.*

[26] Op. Cite.

Additionally, as seen during the 2020 wildfire season, the availability of suppression resources over a large geographic area can influence how much attention individual fires receive, as well as how they are contained and suppressed. Stated simply, while it is theoretically possible to model wildfire spread beyond 8 hours, the longer-duration those simulations become the less certainty there can be about their accuracy."[27]

While SCE adequately justifies its choice of fire spread modeling duration, terminating fire growth at 8 hours has the effect of putting a size limit on the wildfires. MGRA explored this issue in its analysis of the 2021 WMPs. MGRA used Technosylva fire size data provided by PG&E to examine whether the fire size distribution matched the distribution of natural wildfires, and found it did not.[28] MGRA's findings are shown below:

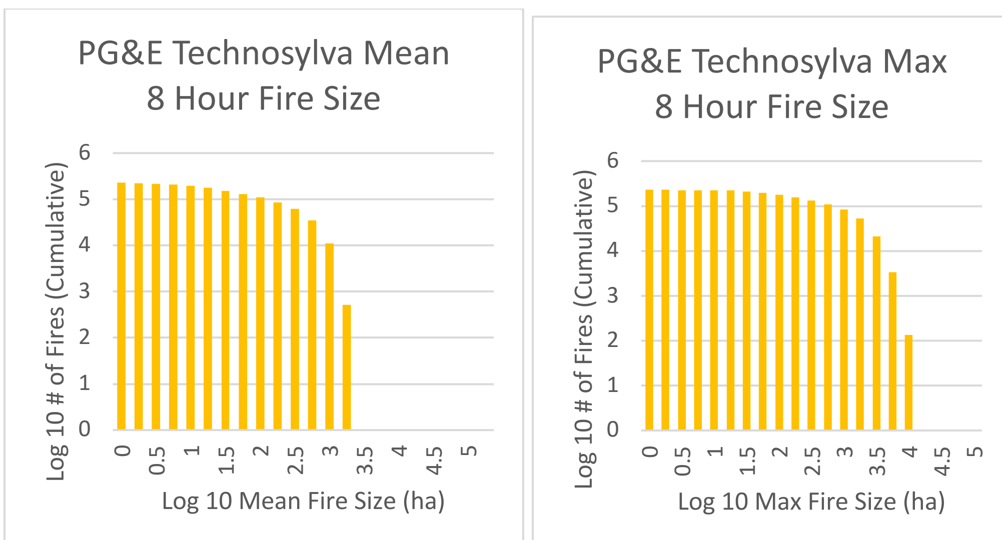

Figure 1 - Cumulative number of simulated wildfires greater than a given fire size threshold. This log-log plot is meant for comparison to **Error! Reference source not found.** showing the power law dependency of wildfire areas in California. As can be seen, the set of simulated fires amplifies the number of fires in intermediate ranges (with respect to small fires) and then cuts off abruptly. The left chart indicates mean fire sizes of simulations for specific geographic data points and the right indicates the maximum size of simulations for specific geographic data points. Overall, fires over 10,000 acres are very rare (< 1% of even the maxima) for 8 hour simulations. Fire sizes are in hectares (ha, 2.7 acres) to be directly comparable to the California fire sizes.

"*Rather than dropping off with a power law dependency, which would be seen as a constant slope, the log of the number of maximum fire sizes and means remains roughly constant as a*

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[27] SCE RAMP; p. 12, fn. 24.

[28] OEIS 2021-WMPs; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON 2021 WILDFIRE MITIGATION PLANS OF PG&E, SCE, AND SDG&E; March 29, 2021; pp. 50-51. (MGRA 2021 WMP Comments)

function of size up to several hundred acres, then drops precipitously. The PG&E 8 hour simulation data also shows that the Technosylva calculations will rarely produce fires over 10,000 acres (3,700 ha) within 8 hours, even when "worst case" spread conditions are selected. The largest wildfire simulated by any PG&E Technosylva run in a set of 9 million simulations was 31,015 acres."

MGRA currently has a data request pending to SCE requesting fire size data from Technosylva runs.[29]

The limitations of the 8 hour fire spread have been widely discussed in workshops, in CPUC proceedings, and during Energy Safety OEIS reviews. SCE acknowledges these limitations for the purposes of circuit tranche prioritization,[30] as will be discussed in a subsequent section. However, SCE's consequence "fixes" do not apply to risk estimation through their MAVF function.

Another limitation in the Technosylva model has to do with the accuracy of the model as the fire increases in size. The weather input to the Technosylva model comes from a WRF simulation, and these have a limit of 1-2 km in their resolution. Weather conditions are therefore modeled as a fairly coarse grained input. In fact, weather at the ground is a highly granular and non-linear phenomenon, and accurately forecasting fire spreads at finer scales requires more granular physics models.[31] Unfortunately these finer-grained models require significantly more computing power and cannot operationally perform the massive number of simulations run by Technosylva for the California IOUs.

Finally, the maximum size that a catastrophic fire will achieve is due to a combination of weather changes and fire suppression, and so far no one has successfully developed a model that can accurately describe fire suppression, and Technosylva does not incorporate suppression into its models at this time. This is another reason that Technosylva's fire modeling cannot be used to characterize "tail risk".

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[29] Appendix A.
[30] Resolution SPD-2; pp. 37-38.
[31] Coen, J.L., Schroeder, W., Conway, S., Tarnay, L., 2020. Computational modeling of extreme wildland fire events: A synthesis of scientific understanding with applications to forecasting, land management, and firefighter safety. Journal of Computational Science 45, 101152. https://doi.org/10.1016/j.jocs.2020.101152 (Coen, et. al., 2020)

3.1.4. SCE needs to develop an ERM that accurately describes catastrophic wildfire risk

SCE's enterprise wildfire risk model is misconceived. As D.21-11-009 states: "*Any best practice for wildfire modeling must produce a set of consequences for wildfires that sufficiently incorporate high-end losses.*"[32] SCE's approach is not best practice.

The story of catastrophic utility fire in California, the story of the individual lives lost, the homes burned, and the monies paid out by utilities, is for the by far greatest part the story of megafires. Catastrophic fires are not an outlier from the consequence standpoint – they represent by far most of the risk. Modeling wildfire risk means modeling megafires. That is hard to do accurately, and this is why all IOUs terminate their Technosylva runs after eight hours.

Unlike PG&E and SDG&E, SCE has made no effort at all to account for this shortcoming in its ERM modeling. Its capabilities are lacking, and it will likely take a significant revision of their risk model in order to incorporate the ability to use an analytical Monte Carlo model to predict catastrophic losses. MGRA has asked for a "sensitivity analysis" in which SCE uses a power law to predict catastrophic losses for its enterprise risk model,[33] But given that this is new ground for them MGRA is not optimistic that this process will be complete within the scope of this RAMP proceeding.

MGRA therefore suggests that SPD make the following findings in its Report:

Recommendations:

- SPD should request that SCE demonstrate the extent to which its risk model correctly characterizes extreme catastrophic fires by showing its predicted loss distribution fits a power law distribution and is consistent with the size distribution of historical catastrophic fires.[34]

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[32] D.21-11-009; p. 122.
[33] Appendix A.
[34] Appendix A; Questions MGRA-1 and MGRA-2.

- If SCE's current risk model does not adequately represent catastrophic losses, SPD should recommend that SCE develop and implement an ERM risk model similar to that of PG&E and SDG&E, using a power law distribution to represent catastrophic losses, prior to the submission of its GRC.[35]

3.2. SCE Needs to Quantify its Remedial Measures to Address Consequence Model Issues

As noted in the previous section, the limitations of the consequence model introduced by the eight-hour Technosylva simulation run duration are being addressed by SCE by a number of ad-hoc measures. The previous section how the duration limitation leads to a cap on fire sizes. This cap affects not only the ERM, as discussed in the previous section, but also circuit-level risk modeling.

A systematically smaller fire size for a simulated fire versus a real fire means that the point of ignition will tend to be nearer the point of damage. Since consequences are greater in developed areas, predicted risk will be greater when the ignition point is near a populated area. In its 2022 WMP analysis, MGRA showed an example of this from the PG&E service area. An excerpt follows:

[35] Appendix A; Questions MGRA-3 to MGRA-8.

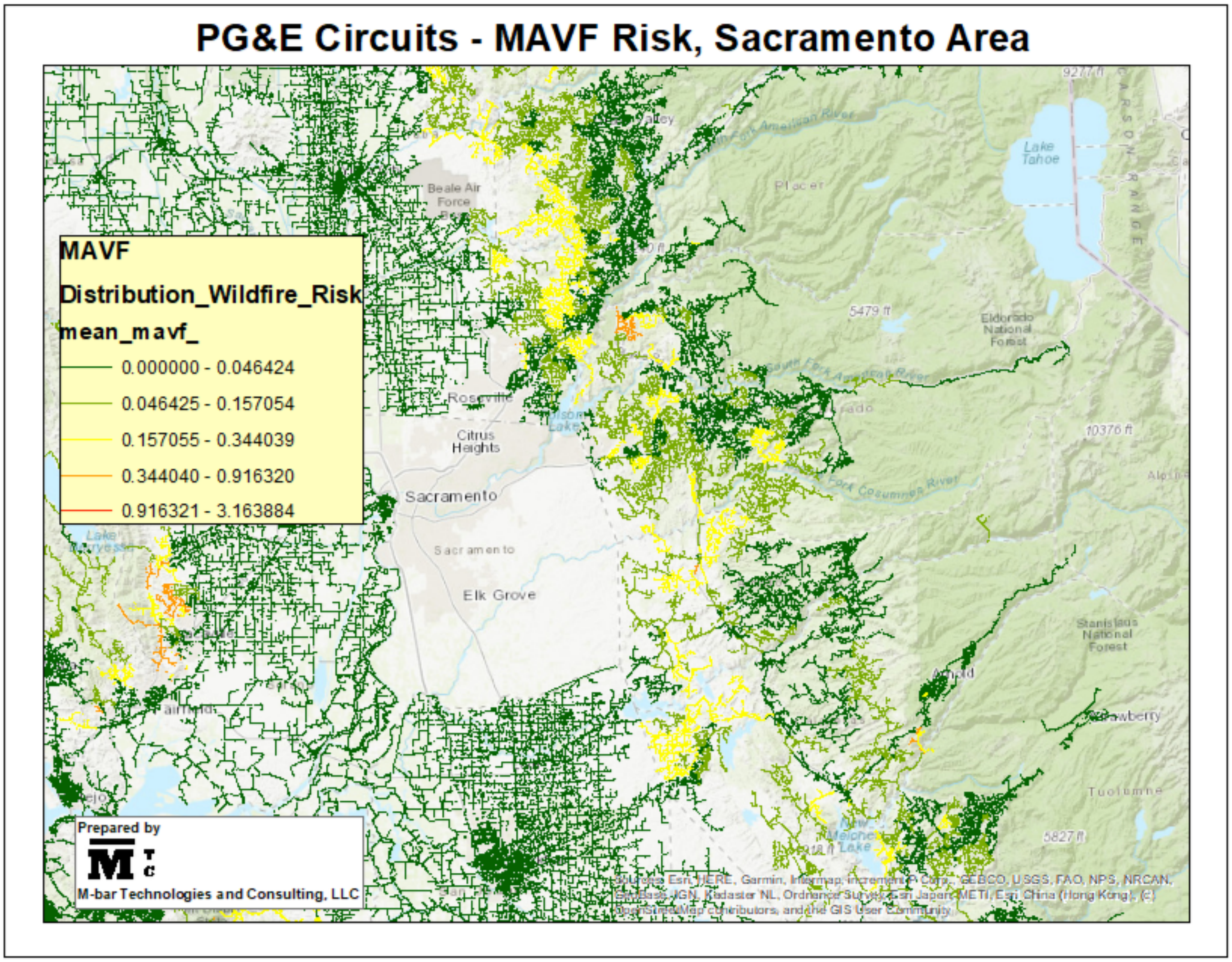

Figure 2 - PG&E's calculated risk scores using its WDRM v2 in the Sacramento / Lake Tahoe area.

"*As can be seen in the figure, there is a general trend that more remote circuits are ranked as having lower risk than those closer to more developed areas. This is expected from the bias introduced by smaller fire sizes due to the 8 hour limitation of the Technosylva fire spread modeling.*"[36]

The results in shown in Figure 2 use PG&E's WDRM v2 model, which uses Technosylva as its circuit consequence model, and therefore is biased by the fire size limitations. PG&E has recognized this issue, and has modified its wildfire risk model (WDRM v3) to incorporate VIIRS satellite data as well as historical catastrophic risk size in order to assign its CoRE:

[36] OEIS; 2022-WMPs; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON 2022 WILDFIRE MITIGATION PLANS OF PG&E, SCE, AND SDG&E; April 11, 2022; p. 46.

"*For the 2022 WDRM v3, fire severity for a given day is assessed for 'destructive potential' vs. not, where destructive potential is assessed using Technosylva outputs of flame length and rate of spread (with threshold values that provide full recall of historically destructive fires) for historically worst weather and Rscores (4 and above) for all days in the June through November fire season. If either approach evaluates to destructive potential, the day/location is considered to have consequences consistent with the expectation value of MAVF CoRE assigned to fires from the VIIRS data set that also are flagged with destructive potential*."[37]

SCE has likewise recognized that Technosylva fire spread alone does not adequately characterize risk, at least for the sake of developing prioritization tranches. For its prioritization, SCE has developed the concept of "Severe Risk Areas":

"*SCE divided its HFRA into equally-sized hexagons, each approximately 214 acres in size. SCE used hexagons given that the distance from the center of a hexagon to all adjacent hexagons is the same distance without any gaps between hexagons. This enabled SCE to compare variables across similar-sized hexagons. From these hexagons, SCE identified Severe Risk Areas as locations with egress challenges, areas that fires have historically propagated towards (burn-in buffer), areas with extreme high winds, and segments with extreme Technosylva consequence (i.e., greater than 10,000 acres in 8 hours with simulated wildfire ignition consequence*)."[38]

Additionally, SCE identified what it designated as High Consequence Segments for prioritization:

"*These are segments in which simulated wildfire ignitions resulted in a wildfire consequence of 300-acres or greater in 8 hours, as well as those circuits which have the potential to be frequently impacted by PSPS events*."[39]

It is important to note that by doing this, SCE has decoupled its actual mitigation planning from its risk score, which now constitutes only one component of its Severe Risk Area designation, and only as a threshold value at that. 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

[37] MGRA 2022 WMP Comments; Appendix A; MGRA-PGEWMP22_DataRequest3-Q01.
[38] SCE RAMP; pp. 39-40.
[39] SCE RAMP; p. 45.

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.

The principal of the Risk-based Decision-making Framework is that utilities should make every effort to quantify risk so that it can be used in their decision-making processes and so that their choices are transparent to the Commission and stakeholders. SCE's prioritization process moves away from the Framework by basing SCE's decision on a combination of factors that they alone determine and that are given arbitrary weight in their decision-making. SPD should request that SCE develop a risk score based on transparent and quantifiable factors and that these be included into its MAVF function.

Recommendations:

- SCE should require SCE to fully disclose the effective risk score that it is using to determine its prioritization by quantifying all factors being used in the effective risk score and showing how they are being combined. Risk factors should be combined into an MAVF risk score, clearly showing the likelihood and consequence of risk events.

3.3. SCE's Risk Model Fails to Account for External Driver (Wind) Related Increases in Outage Rates

SCE's risk model, like those of other utilities, fails to include conditional probabilities that correctly account for the increased likelihood of outages during the "extreme weather days" that are used for consequence modeling.

MGRA performed extensive analysis of the utility risk models and their relationship to wind drivers during its review of the 2021 WMPs[40] and 2022 WMPs.[41] In these reviews MGRA demonstrated that utility outage rates increase exponentially with wind speed. This is acknowledged by all three major utilities, and they have all successfully incorporated this dependency into their operational risk models. For planning purposes and for ERM, however, utilities use machine-learning models to analyze historical ignition or outage data in order to determine risk event

[40] MGRA 2021 WMP Comments; pp. 14-38.
[41] MGRA 2022 WMP Comments; pp. 17-52.

likelihood. All utilities, including SCE, use aggregated (time-averaged) risk data for this purpose, mostly because there is no clear-cut way to incorporate time-dependent variables into machine learning models. The machine learning models from all three major utilities found that wind (or weather-related covariate) had little predictive value in determining likelihood of ignition.

MGRA's 2021 analysis centered on showing that this paradox occurred because the weather variables used were averaged over time or were otherwise unable to appropriately identify and weight the extreme weather events. The analysis pointed out that while the significant majority of ignitions do not occur under unusual weather conditions, the vast majority of catastrophic wildfire ignitions do.

MGRA's 2021 analysis drew upon its analysis of the PG&E 2020 RAMP filing. In this analysis, MGRA asked for a sensitivity analysis in which PG&E used Red Flag Warnings as a tranche designation. Both PG&E and MGRA in parallel analyses determined that:[42]

- The probability of ignition from both vegetation-related and equipment-related root causes increases under moderate to high wind conditions.
- Catastrophic fires are more likely to ignite during high wind events.
- The relative fraction of ignitions caused by external agents (animals, balloons, third-parties, vehicles) decreases with wind speed.

MGRA's 2022 WMP analysis relied on a new observation: specifically that the consequence model for all utilities relies on a selected set of "worst-case" weather days to run simulations, for the sake of efficiency. However, the utility likelihood models are from data collected over *all* weather days. This introduces a bias, since some ignition drivers (specifically those related to wind) are more likely to occur on worst-case weather days, and therefore be associated with catastrophic fire spreads. Ignition drivers unrelated to wind, such as balloons, animals, 3rd party contact, and vehicles only occur on worst-case weather days by random chance. But for the sake of risk modeling, it is assumed they always occur on worst-case weather days, and so their comparative risk is dramatically (and incorrectly) amplified. Utility risk models that do not account for this bias

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42 A.20-06-012; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON THE PACIFIC GAS AND ELECTRIC COMPANY 2020 RISK ASSESSMENT AND MITIGATION PHASE REPORT AND THE SAFETY POLICY DIVISION STAFF EVALUATION REPORT; January 15, 2021; pp. 22-25.

will therefore overweight the risk from external agents (balloons, animals, 3rd party contact, and vehicles) compared to risk from wind-related drivers (equipment damage and vegetation). Geographically, areas that are prone to high winds will have their predicted risk underestimated unless this bias is corrected.

SCE's present RAMP filing makes no attempt to correct this bias, and therefore its risk analysis shows large contribution from external agents, as their table of "Contact from Object" risk drivers shows:

Table II-6
D1 (CFO) Sub-driver Statistics (Distribution and Transmission)

Contact From Object (CFO) Sub Driver	Total (2017 - 2021)	Annualized Frequency	% of CFO Driver Frequency
D1a - Vegetation	26	5.2	24%
D1b - Animal	27	5.4	25%
D1c - Balloons	30	6	28%
D1d - Vehicle	17	3.4	16%
D1d - Other / Unknown	9	1.8	8%
Total	**109**	**21.8**	**100%**

Table 1- SCE sub-driver statistics, showing that SCE's risk model estimates that third-party risk sources (animal, balloon, vehicle) constitute nearly 70% of its ignition risk.[43]

Some key excerpts from MGRA's 2021 and 2022 WMP Comments relating to SCE's wildfire history and ERM risk calculations are shown in the following subsections.

3.3.1. SCE ignition drivers as a function of wind speed

The following is from MGRA's 2021 WMP Comments:[44]

- "*Weather station data was scanned from publicly available sources to determine the maximum wind gust speed measured within 8 miles of the ignition point within 1 hour of the ignition.*

[43] RAMP; Chapter 4; p. 27.
[44] MGRA 2021 WMP Comments; pp. 30-31.

- *A Monte Carlo simulation was run for 1,500 data points at randomly selected ignition locations and using a randomly selected time between January 1, 2015 and December 31, 2020. This selected the maximum wind gust speed at any weather station within 8 miles of the random ignition point within 1 hour of the randomly selected time.*

The ignition data was also classified as to general cause: Agent (animal, vehicle, balloon, 3rd party, vandalism), vegetation, equipment, unknown, or under investigation (ignition not confirmed by SCE and subject to litigation/investigation).

SCE Ignitions 2015-20 Wind Gust	Agent	Equipment	Investigation	Unknown	Vegetation	Total
< 25mph	46	33	6	10	7	102
25-40mph	11	11	6	2	1	31
40-55mph			3	1	1	5
55mph+		2	5	1		8
Total	**57**	**46**	**20**	**14**	**9**	**146**

Table 2 - SCE ignitions, 2015-2020, by wind speed and cause. "Agents" are animal, vehicle, balloon, 3rd party, and vandalism. "Investigation" ignitions are not confirmed by SCE but being investigated or litigated. Wind speed was highest wind gust measured at any publicly available weather station within 8 miles of the ignition point within a 1 hour window of the ignition.

It is notable that no ignitions attributed to "agents" occurred at wind speeds over 40 mph, which would be expected because there should be no causal relationship between external agents and wind speed. The category with the largest contribution at high wind speeds is "Investigation", which is also not surprising since wildfires ignitions under high wind speeds are more likely to spread and become damaging fires.

The Monte Carlo data shows "ambient" wind conditions at the ignition points, and allows a comparison with the wind conditions for actual ignitions.

Wind Gust	Random Sample	Fraction
< 25mph	1253	0.8353
25-40mph	197	0.1128
40-55mph	32	0.0206
55mph+	6	0.0040

Wind Gust	Expected	Observed
< 25mph	121.9587	102
>25 mph	20.05492	44

No data	12
Grand Total	**1500**

Table 3 - SCE ignition data 2015-2020 compared with a Monte Carlo simulation using randomly selected ignition points and times. The Monte Carlo data is used to predict an expected number of ignitions above and below 25 mph wind gust speed. This is compared with the observed number of ignitions in the SCE data.

As can be seen, there is a significant excess of ignitions occurring at wind speeds above 25 mph, with 20 ignitions expected from the Monte Carlo simulation and 44 being observed in the actual data. The probability that this value is due to a statistical fluctuation is 1.7 X 10^{-8}.[45]

The excess at wind speeds greater than 55 mph is dramatic, as shown in the figure below.

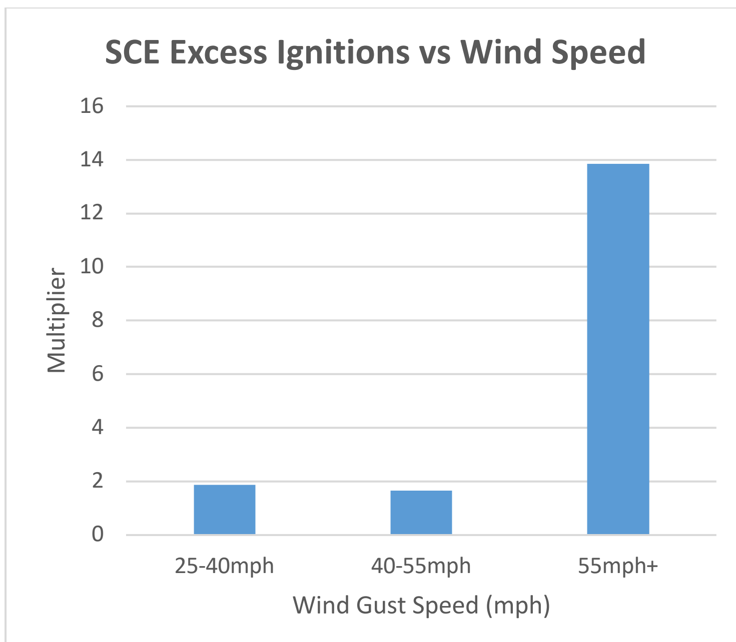

Figure 3 - Excess ignitions above ambient wind speed for SCE 2015-2020 ignition data as compared against Monte Carlo data using the same ignition locations. The "multiplier" is determined by dividing measured ignitions by expected ignitions in each bin.

The point of this discussion is to demonstrate that utility-ignited wildfires are to a great extent a problem of wind, at the fault and ignition level and not merely a fire consequence problem."

[45] Using Microsoft Excel CHISQ.TEST function.

3.3.2. SCE and SDG&E's risk rankings overweight ignitions from external agents

In their 2022 WMPs, both SDG&E and SCE provide a list of ERM wildfire risk drivers and their rankings. These overweight ignition drivers by external agents. PG&E filters its ERM risk drivers based on Red Flag Warnings, and gets a very different result. Here is an excerpt for MGRA's 2022 WMP Comments:[46]

"*Utilities calculate "ignition risk" as the outage rate times the probability that the outage proceeds to ignition.*

Table SCE 4-6

List of SCE Wildfire Risk Drivers and Rankings

Cause Category	Sub-cause category	Average Outage 2019-2021	Ignition Rate 2019-2021	Adjusted Risk	Ignition Rank
D-EFF	Conductor damage or failure — Distribution	922	2.02%	18.67	1
D-CFO	Animal contact- Distribution	612	2.72%	16.67	2
D-CFO	Balloon contact- Distribution	953	1.75%	16.67	3
D-CFO	Veg. contact- Distribution	386	3.63%	14.00	4
D-CFO	Vehicle contact- Distribution	530	1.82%	9.67	5
D-EFF	Connection device damage or failure - Distribution	467	1.86%	8.67	6
D-CFO	Other contact from object - Distribution[25]	328	2.24%	7.33	7
D-EFF	Transformer damage or failure - Distribution	2688	0.27%	7.33	8
D-EFF	All Other- Distribution[26]	2563	0.26%	6.67	9
D-EFF	Wire-to-wire contact / contamination-Distribution	25	23.68%	6.00	10
D-EFF	Vandalism / Theft - Distribution	82	7.32%	6.00	11
D-EFF	Other - Distribution[27]	254	2.23%	5.67	12

SDG&E's table 4-6 shows similar results:

[46] MGRA 2022 WMP Comments; pp. 32-34.

Table 4-6: Prioritized List of Wildfire Risks and Drivers

Cause category (final)	Sub-cause category (final)	Average Outage (2015-2019)	Average Ignition rate (Sum of Ignitions ÷ Sum of Outages)	Adjusted Risk (Avg. Outage x Ignition Rate)	Risk Ranking
Contact from object	Vehicle contact	96.4	3.73%	3.60	1
Contact from object	Balloon contact	95.8	3.76%	3.60	1
Contact from object	Veg. contact	43.8	7.31%	3.20	2
Contact from object	Other contact from object	46.0	3.48%	1.60	3
Equipment / facility failure	Other	14.2	11.27%	1.60	3
Equipment / facility failure	Conductor damage or failure	59.6	2.01%	1.20	4
Contact from object	Animal Contact	78.0	1.28%	1.00	5
Equipment / facility failure	Transformer damage or failure	54.2	1.48%	0.80	6
Equipment / facility failure	Lightning arrestor damage or failure	24.8	2.42%	0.60	7
Equipment / facility failure	Switch damage or failure	13.4	4.48%	0.60	7
Equipment / facility failure	Wire-to-wire contact / contamination	4.6	13.04%	0.60	7
Equipment / facility failure	Unknown	0.1.8	0.20%	0.60	7
Equipment / facility failure	Fuse damage or failure	70.8	0.56%	0.40	8
Equipment / facility failure	Anchor / guy damage or failure	1.8	22.22%	0.40	8
Equipment / facility failure	Vandalism / Theft	2.4	16.67%	0.40	8
Vandalism / Theft	Capacitor bank damage or failure	8.8	2.27%	0.20	9
Equipment / facility failure	Crossarm damage or failure	20.2	0.99%	0.20	9
Equipment / facility failure	Pole damage or failure	40.8	0.00%	0.00	10
Equipment / facility failure	Insulator and brushing damage or failure	7	0.00%	0.00	10
Equipment / facility failure	Recloser damage or failure	1.4	0.00%	0.00	10
Equipment / facility failure	Voltage regulator / booster damage or failure	0.4	0.00%	0.00	10
Contamination	Contamination	0.6	0.00%	0.00	10

PG&E's results for their enterprise risk are different, for reasons that will be discussed shortly.

As can be seen, contact from vehicles, balloons, and animals constitute a considerable portion of the ignition risk for both SCE and SDG&E.

To simplify the comparison between the SDG&E and SCE results, all distribution equipment failures have been summed into one category, and then the overall fraction of ignition risk represented by each driver is shown:

Driver	Percentage	
	SDG&E	SCE
Vehicle	17	7
Balloon	17	13
Veg Contact	15	11
Other Contact	8	6
Animal	5	13
Wire Contact	3	5
Vandalism	2	5
Equipment	33	42

Table 4 - Percentage of ignition risk represented by different risk drivers as per SCE's and SDG&E's Table 4-6.

Here are PG&E's results:[47]

"*As to PG&E's results, it explains that*:

'*In the process of providing feedback to PG&E's 2020 RAMP Report, the Mussey Grade Road Alliance, a party to the proceeding, requested an analysis of ignitions by different drivers by local wind speed. From the analysis, it was concluded that ignitions resulting from both vegetation-related and equipment-related root causes are more likely to occur under higher wind speed conditions, and there is a strong correlation between high winds and RFW, during which destructive or catastrophic fires are more likely to occur.*

In the 2022 ERM, PG&E incorporated lessons learned from analyzing ignition data that indicated the likelihood of an ignition occurring during an RFW varies by ignition driver. Based on PG&E's 2015–2020 CPUC reportable ignitions report, the percentage of ignitions occurring when an RFW is in effect is the highest for vegetation contact, followed by equipment / facility failure, and then all other drivers.

Also, since there is a higher likelihood for an ignition to develop into a large, destructive, or catastrophic fire when an RFW is in effect than when an RFW is not in effect, this results in a higher CoRE value for the vegetation-contact driver than the CoRE value for other drivers.'[48]

As a result, PG&E's list of wildfire risk drivers is differently ordered than those of SCE and SDG&E:

TABLE PG&E-4.2-2:
WILDFIRE RISK DRIVERS

% Risk	HFTD				Non-HFTD				
Drivers	Distribution	Transmission	Substation	HFTD Total	Distribution	Transmission	Substation	Non-HFTD Total	Grand Total
Vegetation Contact	58.7%	0.5%	0.0%	59.3%	0.4%	0.0%	0.0%	0.4%	59.7%
Equipment / facility failure	31.2%	1.2%	0.1%	32.5%	0.5%	0.0%	0.0%	0.5%	33.0%
Contact from object	2.8%	1.3%	0.0%	4.1%	0.2%	0.0%	0.0%	0.2%	4.2%
Wire-to-wire contact	1.3%	0.0%	0.0%	1.3%	0.0%	0.0%	0.0%	0.0%	1.4%
Unknown	0.8%	0.1%	0.0%	0.9%	0.0%	0.0%	0.0%	0.0%	0.9%
Other	0.5%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.6%
Utility work / Operation	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%
Vandalism / Theft	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%
Contamination	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%
CC - Seismic Scenario	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Grand Total	**95.6%**	**3.2%**	**0.1%**	**98.9%**	**1.1%**	**0.0%**	**0.0%**	**1.1%**	**100.0%**

[47] MGRA 2022 WMP Comments; p. 37.
[48] PG&E WMP; p. 87.

Table 5 - PG&E Wildfire Risk Driver tables, assuming a RFW day filter. Note that Vegetation contact and Equipment Failure predominate and that "Contact from Object" (animals, balloons, vehicles) represents only 4% of the predicted risk.

In summary, PG&E's risk of "contact from object" other than vegetation during RFW periods is only 4.1%. As shown in Table 4, SCE's contact from objects other than vegetation represents 39% of its calculated ignition risk. This amplified risk for drivers uncorrelated with severe fire conditions is erroneous and will lead SCE to concentrate resources in places not having the highest wildfire risk.

3.3.3. Catastrophic fires are less likely to occur from external agents than would be expected from SCE's calculated risk

If SCE's amplification of ignitions from external agents and relative suppression of vegetation contact and equipment failure are as MGRA claims they are, then then the distribution of fire causes for SDG&E's catastrophic fire should provide evidence for one or the other of these claims. MGRA analyzed cause data for SCE catastrophic fires between 2015 and 2020 and presented them int its 2022 WMP Comment

s. These are presented below:[49]

"*Looking at SCE-related fires between 2015 and 2020 that are larger than 100 acres and with known (alleged) causes,*[50] *we see the following*:

Fire	Year	Cause[51]

[49] MGRA 2022 WMP Comments; pp. 34-36.
[50] Disclaimer: Some of these fires are still under active litigation, and SCE may contest any of these assignments. These "cause" designations are for illustrative purposes only and not intended for use in litigation or regulatory investigations.
[51] Id. Additionally, investigations may not be complete or public, and sometimes press reports were used, of varying quality. Sources for fire cause attribution include:
SCE Ignitions 2015-2020; Amended_2015-2020 Reportable Ignitions
Erskine: https://www.bakersfield.com/news/erskine-fire-caused-by-power-line-fire-officials-say/article_bd1f7a02-bbc6-59e2-a47f-30fc7a99b744.html
Marina: https://thesheetnews.com/wp-content/uploads/2016/10/The-Sheet_10.22.16.pdf
Rye: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-and-enforcement-division/investigations-wildfires/sed-investigation-report---rye-fire---redacted.pdf
Liberty: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-and-enforcement-division/investigations-wildfires/sed-investigation-report---liberty-fire---redacted.pdf
Holiday: https://www.independent.com/2020/03/21/power-lines-started-holiday-fire-in-goleta/
Woolsey: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-and-enforcement-division/investigations-wildfires/sed-investigation-report---woolsey-fire---redacted.pdf
Tenaja: https://www.firelawblog.com/2021/09/06/cal-fire-sues-utility-to-recoup-tenaja-fire-costs/

Birchim	2015	Veg Contact
Cachuma	2016	Veg Contact
Erskine	2016	Veg Contact
Marina	2016	Equipment
Rye	2017	Equipment
Liberty	2017	Equipment
Holiday	2018	Veg Contact
Woolsey	2018	Wire Contact
Star	2019	Animal
Tenaja	2019	Wire Contact
Easy	2019	Equipment
Maria	2019	Equipment

Table 6 - Wildfires from 2015 to 2019 greater than 100 acres with allegedly "known" cause and allegedly related to SCE equipment**.**

None of these fires was caused by vehicle collision, 3rd party contact, or balloons, and only one was stated by SCE to have been caused by an animal. It is unlikely that the statistical distribution that SCE claims for ignition probability represents the statistical distribution for catastrophic fires. This is shown in the following simple Pearson Chi-squared analysis.

Predicted and observed major fires for SCE, 2015-2020

Driver	Ign Risk %	Observed	Expected	Chi2	Yates
Vehicle	7	0	0.88	0.88	2.17
Balloon	13	0	1.52	1.52	2.69
Veg Contact	11	4	1.28	5.79	3.86
Other Contact	6	0	0.67	0.67	2.04
Animal	13	1	1.52	0.18	0.69
Wire Contact	5	2	0.55	3.85	1.65
Vandalism	5	0	0.55	0.55	2.00

Easy, Maria: https://www.vcstar.com/story/news/local/2020/10/22/ventura-county-fires-easy-maria-caused-power-lines-simi-valley/3729055001/

Equipment	42	5	5.03	0.00	0.05
Total	100	12	12	13	15

P - Chi2	0.06213238
P - Yates	0.03409584

Table 7 - Pearson Chi-squared goodness of fit[52] comparing observed major fire causes against ignition probabilities. It can be seen that the probability that the observed pattern arises from the predicted distribution is low. Using the "Yates" correction used for sparse bins the hypothesis that the ignition probability distribution predicts catastrophic fire probability can be excluded with statistical significance (P < 0.05).

The SCE results suggest that the ignition probabilities for different drivers are not consistent with the observed causes of large fires. While the statistical significance is only marginal (P < 0.05 only when using a Yates correction), this same trend holds for SDG&E and PG&E as well. None of the major fires from SDG&E or PG&E equipment has been caused by vehicle collisions, animals, or balloons."

3.3.4. SCE's risk model is biased against ignitions most likely to lead to catastrophic fires

From analysis of data from SCE and other utilities, MGRA has concluded that their risk models incorporate a significant bias due to the failure to correctly incorporate the increased likelihood of outages on "worst case" weather days. Because the geographic distribution of high-wind areas is likely to be different than that for ignitions unrelated to wind, SCE's risk model is likely to incorrectly prioritize circuits for remediation. SCE's incorporation of high wind areas in its Severe Risk Area designation will help to correct this bias, but because this designation is non-transparent it is impossible to determine whether it is optimal or effective.

Recommendation:

- SPD should request that SCE calculate ERM risk values with a RFW filter, in the same manner that PG&E has done for its ERM.

[52] $\chi^2_{Pearson} = \sum(O - E)^2/E$ where E is the expected number and O is the observed. $\chi^2_{Yates} = \sum(O - E - 0.5)^2/E$. Probabilities were calculated with the Excel function CHISQ.DIST.RT, using 8 degrees of freedom.

- SPD should request that as SCE develops a risk model that can represent its circuit prioritization, that it include the conditional probability that a risk driver will occur on the day used for Technosylva consequence modeling.

3.4. SCE fails to Include PSPS Damage Events in its Ignition Risk Model

MGRA has urged utilities to incorporate PSPS Damage events into their risk models in many proceedings, workshops, and in WMP reviews.[53] The reason that this is a critical component of risk analysis is that as PSPS becomes more pervasive as a mitigation strategy (and SCE now uses it extensively), "dead spots" are created in the outage and ignition records. Likelihood analysis of historical data, such as that done by SCE's machine learning model, will not incorporate ignitions or outages from where the power is turned off. This will bias the likelihood model, underestimating the ignition risk in areas with frequent PSPS (which in fact would be expected to be more dangerous, since PSPS is being applied). This has been tagged as an issue by Energy Safety in its 2022 WMP review (SCE-2022-26)

PG&E has begun to successfully incorporate PSPS damage into its ignition likelihood calculation, and has done so for its GRC.[54] PG&E's consequence model "*allows PG&E to forecast ~100 million virtual fires daily across the PG&E territory in forecast mode, simulate fires on demand as they start, simulate hypothetical fires based on PSPS damage and hazard reports, as well as simulate fires in past weather scenarios*."[55]

There is no reason that SCE could not correct its PSPS bias using a similar approach.

Recommendation:

- SCE should correct the bias in its risk model due to PSPS by incorporating PSPS damage and hazard reports.

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[53] Example; MGRA 2020 WMP Comments; p. 37.

[54] A.21-06-021; MGRA Testimony MGRA-1; DIRECT TESTIMONY OF THE MUSSEY GRADE ROAD ALLIANCE PACIFIC GAS AND ELECTRIC COMPANY 2023 GENERAL RATE CASE; June 13, 2021; p. 55.

[55] A.21-06-021; PG&E Testimony Workpapers; p. WP4-53.

3.5. Risks from Wildfire Smoke

As SPD saw in last year's SDG&E RAMP proceeding, SDG&E was the first to pioneer the inclusion of wildfire smoke as a safety risk. MGRA found flaws with their approach and suggested a number of improvements.[56] Regarding wildfire smoke risks, SPD recommended that "*We encourage SDG&E (and other utilities) to continue developing more comprehensive and complete measures of consequences.*."[57]

In the meantime, MGRA has brought up the wildfire smoke issue in many venues. SCE has had more than sufficient time to develop its approach to this risk, however it continues to ignore it. SCE's explanation is that "*there is currently no approved methodology for including these consequences in a utility RAMP model. This issue will be the subject of discussion at an upcoming OEIS workshop, and that is the more appropriate venue for considering this complex and potentially far-reaching topic*," even though SCE concedes that: "*Attempting to quantify the health effects for modeling purposes will likely lead to modeling results that significantly increase the perceived health risks associated with wildfires, and therefore (perhaps dramatically) increase the assumed RSEs for wildfire mitigations programs*."[58]

MGRA concurs with SCE that the issue is wide-ranging and complex, and should be discussed in multi-utility proceedings and fora. However, SCE's General Rate Case, with billions of dollars of spending is pending, and SCE should be making the attempt to estimate risks to the best of its abilities to estimate its risk so that its spending request can be put into proper context. SDG&E has made an attempt at wildfire smoke risk calculation, and however flawed, are at least an attempt to quantify wildfire smoke impacts, and these do appear to be large.

MGRA refers the reader to its 2021 analysis, contained in SPD's Report on SDG&E's RAMP, for its full analysis of the smoke issue. For SCE's RAMP, MGRA proposes that SCE use the same general method that SDG&E used in its RAMP, which applies a ratio of fatalities to acres burned in the safety attribute of its MAVF function. Instead of SDG&E's proportionality, which MGRA showed to be in error, MGRA proposes that two different proportions be analyzed,

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[56] SPD SDG&E RAMP Report; MGRA Appendix pp. 2-18.
[57] SPD SDG&E RAMP Report; p. 12.
[58] SCE Reply; pp. 3-4.

proposed in its SDG&E RAMP comments:[59] 1150 acres per fatality based on MGRA's analysis of O'Dell et. al.[60] and 10900 acres per fatality based on MGRA's analysis of Liu et. al.[61]

MGRA has requested that SCE perform scenario analyses in a pending data request.[62]

Recommendation:

- SPD should request that SCE include a smoke calculation using SDG&E's approximate method and values recommended by MGRA so that this major contributor to safety risk is not ignored in SCE's risk analysis.

3.6. SCE's Covered Conductor Program

Edison currently estimates that it has 5,277 miles in the WUI in SCE's service area. It also estimates that it has 14,100 circuit miles of overhead conductor in its High Fire Risk Areas (HFRAs).[63] SCE's covered conductor hardening program has been underway since 2018 through its Wildfire Covered Conductor Program (WCCP), and has used this as its primary hardening tool. At the beginning of its 2025 GRC period, SCE estimates that 3,250 circuit miles will remain unhardened in its HFRA. Of these, SCE has designated 600 miles as "Severe Risk Areas" and 1,200 miles as "High Consequence Segments". SCE states that it intends to mitigate Severe Risk areas through targeted undergrounding (TUG) because it considers covered conductor insufficient mitigation.[64]

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[59] SPD RAMP Report; MGRA Appendix; p. 17; p. 225/295.
[60] O'Dell, K., Bilsback, K., Ford, B., Martenies, S.E., Magzamen, S., Fischer, E.V., Pierce, J.R., 2021. Estimated Mortality and Morbidity Attributable to Smoke Plumes in the United States: Not Just a Western US Problem. GeoHealth 5, e2021GH000457. (O'Dell et.al.) https://doi.org/10.1029/2021GH000457
[61] Liu, Y., Austin, E., Xiang, J., Gould, T., Larson, T., Seto, E., 2021. Health Impact Assessment of the 2020 Washington State Wildfire Smoke Episode: Excess Health Burden Attributable to Increased PM2.5 Exposures and Potential Exposure Reductions. GeoHealth 5, e2020GH000359. https://doi.org/10.1029/2020GH00035
[62] Appendix A; MGRA-10.
[63] RAMP; p. 5.
[64] RAMP; p. 8.

Even though Edison's proposed undergrounding program covers considerably less of its infrastructure, its cost is approximately four times higher than its covered conductor program. This is due to the fact that its Risk Spend Efficiency is less than 1/3 that of covered conductor. [65] Rather than "targeted", SCE proposes that its undergrounding program be applied to all segments that it designates as Severe Risk Areas. As noted in Section 3.1.3, the Severe Risk Area designation is based on a number of factors that are somewhat arbitrarily determined by SCE and non-transparent.

As SCE notes, SCE, PG&E and SDG&E jointly analyzed covered conductor effectiveness, including jointly retaining an independent third-party expert, which is still ongoing. [66] MGRA reviewed the initial report of utilities and the independent contractor as part of its 2022 WMP evaluation. MGRA's conclusion was that covered conductor effectiveness may in fact be higher than that used by utilities. An excerpt from MGRA's analysis is shown below:

"*Part of the hesitation appears to be what is claimed to be the limited effectiveness of covered conductor in preventing ignitions. Even SCE claims that it is effective in preventing only 60% effective in preventing vegetation ignitions.*[67] *In fact, even with SCE's extensive experience many of the estimates regarding covered conductor effectiveness for various scenarios involve guess work. For example: 'SCE analyzed the composition of historical wire downs from vehicle collisions and found that nearly all ignitions from a vehicle collision are caused by conductor contact. SCE testing established the covered conductor is effective against conductor-to-conductor contact. However, there is uncertainty regarding the effectiveness of covered conductor during a wire down due to exposed conductor at the dead-end or breakpoint. To account for this uncertainty, a mitigation effectiveness of 50% was assumed.'*[68] *The other utilities make similar conjectures, with PG&E estimating overall effectiveness at 63%*[69] *and SDG&E estimating effectiveness at 65%.*[70] *Pacificorp, which actually has experience with spacer cable systems reports effectiveness closer to 90% for drivers such as vegetation, vehicle contact, and equipment failure.*[71]

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[65] RAMP; p. 102.
[66] RAMP; p. 7.
[67] SDG&E WMP; Att. H; p. 9.
[68] Id.; p. 10.
[69] Id; p. 14.
[70] Id; p. 15.
[71] Id; p. 19.

SCE has the most experience so far, and with the 2,500 miles of line that it has currently deployed. As can be seen below, this reduces the fault rate:

Figure 8: SCE Faults on HFRA Circuits in 2021

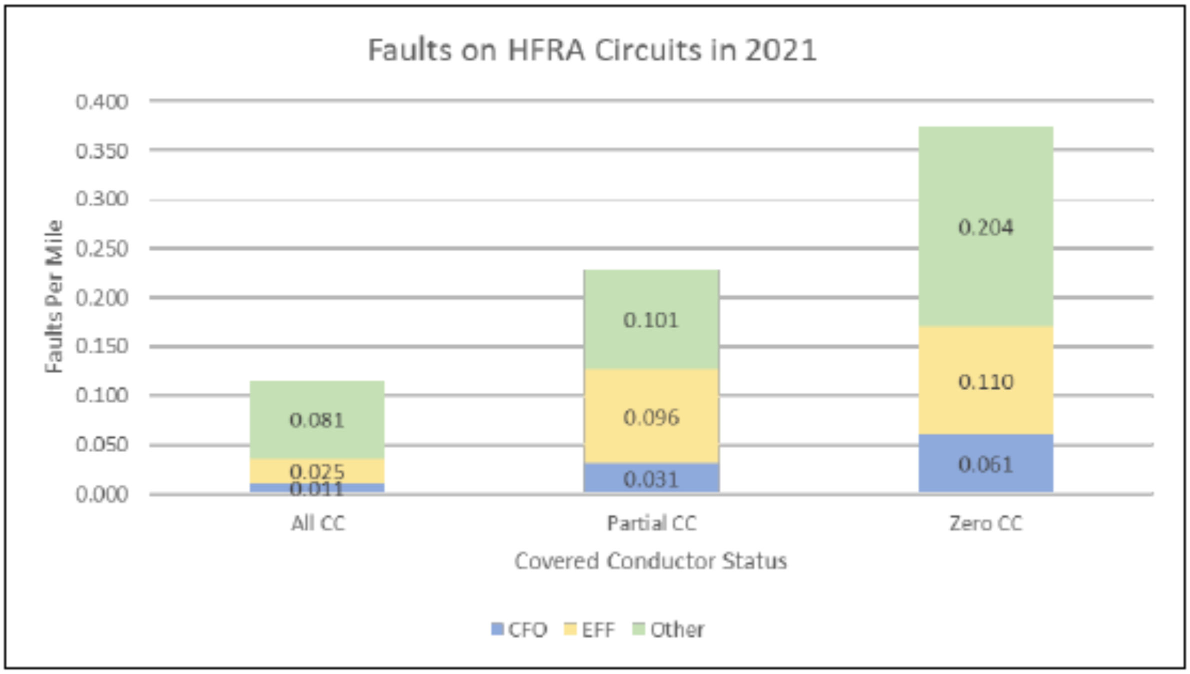

Figure 4 - SCE faults on HFRA circuits for circuits with, without, and partially with covered conductor. CFO is "contact from object" and EFF is "electrical facility failure"

Far more noteworthy is the following statement by SCE: '*SCE is measuring the overall effectiveness of covered conductor by comparing events (primary wire downs, primary conductor caused ignitions and faults) on fully covered circuits to bare circuits in its HFRA on a per-mile basis in current years. As of November 2021,* ***SCE's wire down and fire data does not show any events occurring on fully covered circuits***.' (emphasis added).

Examination of SCE's Table data shows exactly how remarkable this observation is. Table 8 shows that in 2021 SCE had 13,887 miles of conductor in the HFTD2 and HFTD3 districts. During 2021, 48 ignitions and 398 wires down occurred in SCE's HFTD2 and HFTD3 districts. If we assume that 2500 miles of covered conductor were deployed during that period, the 11,387 miles of non-covered conductor was responsible for the 48 ignitions and 398 wires down, while the 2,500 miles of covered conductor were responsible for zero ignitions and zero wires down.

Ordinarily, I would drive the point home with a statistical significance calculation but in this case it isn't really necessary. Even if the full 2,500 miles were not deployed until the end of the year, the conclusion must be the same. While outages still seem to happen at some reduced level on covered conductor circuits, there appear to be additional barriers from those outages progressing to ignitions.

The utilities are therefore, intentionally or not, "low-balling" the effectiveness of covered conductor and therefore artificially repressing its RSE. This requires immediate attention by OEIS, especially since programs currently under consideration by PG&E and SDG&E are plan to use underground hardening, partially justified on the basis that the RSE for covered conductor is not substantially higher than for undergrounding."

MGRA in its Response provided additional analysis based on SCE response to its data requests.[72] It noted that SCE's wire down data showed a lower than expected rate for covered conductors, and conducted a statistical analysis of significance:

SCE Comparison of Bare Wire to Fully Covered Conductor

									Predicted Ignitions			Predicted Wires Down		
Year	CC Full miles	Ign CC	WD CC	Bare miles	Ign BW	WD BW	Ig/mi BW	WD/mi BW	Pred CC 0%	Pred CC 60%	Pred CC 85%	Pred CC 0%	Pred CC 69%	Pred CC 85%
2019	0	0	0	14546	36	198	0.004	0.023	0	0	0	0	0	0
2020	366	0	0	8973	31	96	0.0049	0.022	1.7934	0.71736	0.107604	8.052	2.49612	1.2078
2021	429	0	0	6092	10	65	0.0041	0.024	1.7589	0.70356	0.105534	10.296	3.19176	1.5444
2022	508	0	1	4135	2	19	0.001	0.008	0.508	0.2032	0.03048	4.064	1.25984	0.6096
(to May)														
Total		0	1						4.0603	1.62412	0.243618	22.412	6.94772	3.3618
							Events	95% CL (1 tail)						
							0	2.99573227						
							1	4.74386452		WD 95% CL	78.8%			

Table 8 - SCE data on the effectiveness of its covered conductor program from 2019 to May 2022. Mileage indicates circuits that are either fully covered conductor (CC) or fully bare (BW). Partially covered circuits are not included. The number of ignitions (Ign) and wires down (WD) are given for each year. An annual ignition and wires down rate per mile is shown for bare wire. Based on these rates predicted numbers of ignitions and wires down are shown for 0%, 60%, and 85% covered conductor effectiveness. No ignitions and only one wire down were reported on fully covered conductor circuits in the reported period. Based on predicted wire down rates for bare wire, a 95% confidence level lower limit of 78.8% can be set on covered conductor effectiveness in preventing wires down.[73]

MGRA's Response concludes that "*While there are insufficient statistics to make a conclusion regarding the ignition rate, it is possible to set a 95% confidence level on the lower limit of covered conductor correlation with wire-down prevention of 78.8%.*

[72] MGRA Response; pp. 9-10.
[73] Id; Questions 01 through 08. One-tailed 95% confidence limit was calculated using the Excel CHISQ.INV.RT function. Supplemental data available in file SCE_2022_WMP_CC.xlxs.

While generally utilities claimed 60-70% effectiveness in their Joint Covered Conductor Report, SCE claims that for object contact the effectiveness of covered conductor is 85%. While still within the range of statistical variation, much higher effectiveness values would be allowed by the current data. Therefore, one issue that should be investigated as part of this RAMP is whether covered conductor efficiency at reducing risk is being underestimated by the IOUs."

MGRA currently has a data request pending with SCE requesting additional data on ignitions and wires down since May 2022.[74]

Recommendation:

- SCE should provide any additional results from the continued joint of covered conductor working group as soon as they are available, making a supplemental filing.
- SPD should closely watch future data on outages and ignitions to validate utility estimates of effectiveness.

3.7. REFCL

SCE has also taken leadership of the development of Rapid Earth Fault Current Limiter (REFCL) technologies, and has successfully deployed them on its circuits. Deployed in combination with covered conductor, it provides protection against fault scenarios that covered conductor would not (usually related to serious damage to conductors), approaching protection levels that would otherwise only be achieved by undergrounding. SCE proposes that its covered conductor be deployed in conjunction with REFCL, vegetation management, and other hardening, a configuration it calls REFCL++.[75] While more expensive than covered conductor alone, it is less expensive than undergrounding

Undergrounding and REFCL are mutually exclusive. Circuits that are undergrounded do not benefit from REFCL, and the prospect of putting a circuit underground removes any motivation or justification for deployment of REFCL. REFCL would be highly beneficial if it were deployed with covered conductors in Severe Risk Areas, and justifications for it are marginal if risk is otherwise

[74] Appendix A; Questions MGRA-11 to MGRA-16.
[75] SCE 2022 WMP; p. 217.

low. However, SCE plans undergrounding for its Severe Risk Areas, which effectively sidelines REFCL as a potential solution.

It is important to note that SCE's plan to underground its Severe Risk Areas originated in its RAMP, and was not part of its 2022 WMP. Energy Safety, nevertheless, has requested that SCE provide further analysis for REFCL and other advanced technologies that could be applied to reduce residual risk for circuits hardened with covered conductor (SPD-2, Issue SCE-2022-12).

Recommendation:

- SCE should provide an alternative that includes advanced technologies such as REFCL in combination with covered conductor, including projected cost and mitigation effectiveness.

3.8. Undergrounding

SCE's "Targeted Under Grounding" (TUG) proposal is not particularly "targeted": any circuit determined to be in what SCE designates as "Severe Risk Area" is to be undergrounded in their preferred alternative. SCE's planned expenditure for undergrounding program is significantly larger than for its planned spending on covered conductor. While SCE provides an alternative using covered conductor, it does not provide an alternative where covered conductor is enhanced with REFCL and other advanced technologies.

As mentioned in the previous section, SCE's TUG alternative was not part of its 2022 Wildfire Mitigation Plan, so Energy Safety did not issue guidance regarding undergrounding in its review of SCE's WMP. The section describing TUG from a technical standpoint in SCE's WMP contained no mileage targets.[76] However, both PG&E and SDG&E had significant undergrounding components with mileage targets described in their wildfire mitigation plans, and Energy Safety provided specific guidance regarding undergrounding:

SPD-1, Issue SDGE-22-15 – "*Undergrounding Risk-Spend Efficiency Demonstration.*

[76] SCE Data Request Response; 02_SPD-SCE-003 Q2 2022 WMP Update Appendix 9_4 TUG.

o Description: SDG&E plans on ramping up future undergrounding efforts without adequately demonstrating cost-effectiveness based on specific ignition risks.

o Required Progress: In its 2023 WMP, SDG&E must provide a description of its decision-making process demonstrating risk/cost benefit analysis as it pertains to future undergrounding installations."[77]

SCE has likewise failed to provide a risk-spend efficiency justification for its undergrounding program, and should be required to do so before all or part of its undergrounding proposal should be accepted. In order for a risk-spend efficiency calculation to be accurate, SCE will also need to remedy the multiple issues with its wildfire risk model mentioned in previous sections.

Recommendation:

- SCE should provide a risk/spend efficiency analysis justifying its TUG program using corrected wildfire risk models.

3.9. Risk Versus Benefit Power Shutoff as Mitigation

As detailed in MGRA's RAMP Response,[78] MGRA has been supporting a proper risk benefit analysis for power shutoff since SDG&E's first advice letter regarding shutoff in 2008. This analysis should include both the harm and the benefit in avoided ignitions from power shutoff. Especially now that utility undergrounding programs are being proposed that will have dramatic impacts on electricity rates, alternatives need to be considered that take into account all forms of risk. MGRA intends to request that the Commission revisit its decision to exclude PSPS as a mitigation from utility wildfire analyses.

MGRA also observed in its RAMP Response that PG&E stated that it was able to reduce ignition risk by 75% by adjusting its "fast trip" values, a program that it calls EPSS (Enhanced Powerline Safety Settings).[79] While having greater negative impacts because it leads to power

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[77] SPD-1; pp. 114-115.
[78] pp. 11-13.
[79] 2022-WMPs; PG&E 2022 WMP; p. 731, 738.

shutoff without advanced warning, it is highly effective in preventing many ignitions. This RAMP should consider whether SCE's own fast trip settings have been optimized during periods of extreme wildfire danger.

Recommendations:

- SCE should include PSPS as a mitigation in some of its alternatives, with an appropriately constructed set of harms and benefits.
- SCE should provide supporting information to indicate that its own "fast trip" settings have been optimized.

4. CONCLUSION

The subject of risk analysis, particularly wildfire risk analysis is a highly complex and difficult subject, with many inputs. While SCE should be given due credit for improvements over the past years as it has added experts on wildfire, risk, and data analysis to its staff, its progress has been compromised by an unwillingness to examine some of its presumptions and practices. Commission Staff, MGRA and other intervenors have been providing input regarding some of the shortcomings in SCE's analysis for years now: the limitations of an eight-hour fire spread model, the importance of wind as an ignition driver, the importance of weighing risks and benefits of PSPS, and adjusting for the effect of PSPS on collected data.

The product of this long process is a wildfire risk model with many fundamental flaws. The question that Staff need to address is how much remediation is required in order for this RAMP filing to adequately support a General Rate Case. We urge staff to select remediations that will SCE's GRC filing more into line with those of PG&E and SDG&E, which whatever their shortcomings have made major improvements based on Staff and intervenor input.

Submitted this 10th day of October, 2021,

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APPENDIX A – DATA REQUESTS

Application No. A.22-05-013
SCE RAMP
MGRA Data Request No. 1
September 28, 2022

MGRA-1 Please provide a distribution of all wildfire sizes in acres produced by the Technosylva fire consequence model used for the Excel spreadsheet WCCP_UG_RSE_Calculations and also for calculating the overall CoRE for SCE's wildfire risk. Wildfire size distributions are to be those used to calculate the Pre and Post mitigated consequences on the WCCP Proposed and TUG Proposed tabs. Size distributions are to be for all weather conditions used for consequence modeling.
To summarize, wildfire size distributions are to be provided for: 1) Overall wildfire risk calculation CoRE 2) WCCP Proposed spreadsheet and 3) TUG Proposed tab.

MGRA-2 Alternative to MGRA-3: If wildfire size distributions are not directly available for all values because they have not been permanently stored, SCE may select a sample of 400 of the WCCP Proposed segments and 150 of the TUG Proposed segments from the Excel file WCCP_UG_RSE_Calculations to obtain Technosylva fire spread acres burned for 8 hour simulations. Selected segments should be from the Excel spreadsheet row starting at 11 and thence every 40th Excel row (11,51,91,131,171, etc) until 400 and 150 samples, respectively, are provided. Each segment should be simulated against the full set of standard weather conditions SCE uses for its CoRE risk calculations.

MGRA-3 SCE states that "SCE used a ratio of 256 structures impacted to one fatality, and a ratio of 107 structures impacted to one serious injury, to estimate the safety consequences associated with each wildfire ignition simulation. These data are based on historical information." SCE's citation states: "Data based on 2016-2019 fires." Please provide the data and calculation leading to these ratios.

MGRA-4 For a wildfire burning exactly 256 homes, applying SCE's ratios listed above:
256 * $940337 = $240,726,272 (financial)
(1 + 256/107* 0.25) * $100,000,000 = $ 158,813,084 (safety equivalent)
The ratio between these values is 1.52 (financial/safety).
In the WCCP_UG_RSE_Calculations spreadsheet, the ratio between Safety and Financial Attributes in MARS units (ratio of columns BT/BA) shows considerable variation, between approximately 1.3-1.5 on the TUG Proposed sheet and 1.0-1.5 on the WCCP Proposed sheet.
If SCE has set a fixed ratio between fatalities, injuries, and properties lost, what is the source of this variation?

MGRA-5 If SCE were to use a Value of Statistical Life of $10 million instead of $100 million, would this substantially affect the ordering of circuit priorities or scope of its WCCP Proposal or TUG proposal? If so how?

MGRA-6 In its 2022 WMP, SCE has stated that: "Fires that burn over 10,000 acres in the first 8 hours on average burn over 100,000 acres." (2022 SCE WMP, p. 214). Are the consequences shown in file WCCP_UG_RSE_Calculations in any way adjusted for the 8 hour limit, or are the financial and safety consequences limited to 8 hour spread? If SCE adjusts consequence values for the fact that damage from large fires exceed 10,000 acres or burn for more than 8 hours, how does it apply this adjustment?

MGRA-7 SCE restricts its Technosylva fire simulations to 8 hours due to limitation in accuracy for fire simulations propagating longer than that period. (p. 12, fn 24). Does SCE use any extrapolated fit for larger fires, such as power law, lognormal distribution, or other, to predict loss distributions used in either its program CoRE calculations or circuit-level calculations? Or does it strictly use Technosylva outputs for its CoRE calculation in both cases? If method other than use of Technosylva fire spread simulation is used in calculating CoRE at the program level or for prioritization, provide technical details of how other methods are incorporated.

MGRA-8 If any extrapolation method is used to calculate the impact of extreme fires, such as lognormal or gamma function, please run a sensitivity analysis adopting a truncated power law distribution similar to that used by Pacific Gas and Electric Company.[1]

MGRA-9 SCE in its Scoping Memo Reply Brief states that "tail-end wildfire risk is characterized by using the maximum simulated consequence over an eight-hour simulated burn period for each individual circuit segment."(p. 5) If Technosylva calculations are the only contributor to CoRE, does SCE use any other considerations than CoRE to select mitigations or priorities, such as wind corridors, egress, or other? If SCE uses other weighting mechanisms to determine mitigation or priority for circuit segements, show how these quantitatively are analyzed along with CoRE to decide appropriate mitigation and priority.

MGRA-10 SCE's RAMP states that "Financial impacts represent those costs associated with damage to physical structures, as well as firefighting suppression costs and land restoration costs. For purpose of this analysis, SCE used a system-wide average estimated structure cost of $940,337 per structure. SCE also used a peracre fire-fighting suppression cost figure of $876, and a land restoration cost of $1,460 per acre." (p. 38).
This demonstrates that it is possible for SCE to conduct wildfire smoke safety risk calculations in the same manner that SDG&E does.
Please conduct a sensitivity analysis for overall wildfire risk CoRE values and for

[1] See R.20-07-013, PG&E Power Law Distribution Whitepaper_09_03_021.

the WCCP and TUG proposals under the following assumptions:
a) There is one fatality from wildfire smoke for every 1,150 acres burned.
b) There is one fataility from wildfire smoke for every 10,900 acres burned.

MGRA-11 How many miles of "fully covered circuits" (covered conductor) does SCE currently have installed?

MGRA-12 Have any wire down or ignition events occurred on fully covered circuits since May 31, 2022? If so, how many of each?

MGRA-13 How many ignitions did SCE record on bare circuits in its HFRA from May 31, 2022 to present?

MGRA-14 How many wires down did SCE record on bare circuits in its HFRA from May 31, 2022 to present?

MGRA-15 What is the calculated ignition rate for bare circuits in SCE's HFRA 2022 to present?

MGRA-16 What is the calculated wire down rate for bare circuits in SCE's HFRA for 2022 to present?

MGRA-17 What mechanism, if any, does SCE use to correct its outage and/or ignition rates used in its LoRE calculation for PSPS, which creates "dead spots" in the data record?

MGRA-18 What mechanism, if any, does SCE use to incorporate into its risk scoring the conditional probability that outages from specific drivers (vegetation, equipment failure) are comparatively more likely than other drivers (animals, vehicles, 3rd party, balloons) during the "worst weather days" used for Technosylva fire spread modeling?

Attachment 3 – TURN

INFORMAL COMMENTS OF THE UTILITY REFORM NETWORK (TURN)

TO THE SAFETY POLICY DIVISION

ON THE SOUTHERN CALIFORNIA EDISON RAMP REPORT

A.22-05-013

October 10, 2022

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Informal Comments of The Utility Reform Network (TURN)
To the Safety Policy Division on the Southern California Edison RAMP Report
A.22-05-013

The Utility Reform Network (TURN) appreciates this opportunity to provide the Safety Policy Division (SPD) with our comments on Southern California Edison's RAMP Report, which we hope will aid SPD with its evaluation report on SCE's submission.

1. SCE Uses Improper Discount Rates to Calculate RSEs

Row 25 of the S-MAP Settlement requires that RSE values be calculated using present values for both risk reductions (the numerator) and costs (the denominator). The Settlement states that these values should be present values "to ensure the use of comparable measurements of benefits and costs." Although the Settlement does not specify a discount rate value that must be used for all RSE calculations, the discount rate chosen should be consistent with basic economic and financial principles that reflect the time value of money.

In Chapter 2 of its RAMP report on page 15, SCE states it uses what it describes as a "societal discount rate" of 3% to discount the risk reduction, the numerator of the RSE. With respect to costs, the denominator of the RSE, SCE states that it uses a different discount rate of 10%, which it describes on page 16 as its "incremental cost of capital."

As will be shown below, neither discount rate is justified and SCE's use of different discount rates for the numerator and denominator is contrary to the S-MAP settlement and sound economic and financial practice. SCE's approach causes a significant upward bias in its RSE values, which distorts RSE comparisons and generally makes SCE's risk reduction efforts seem more cost-effective than they actually are. Instead, SCE, like PG&E, should use its weighted average cost of capital (WACC) as the discount rate for both the numerator and denominator of its RSE calculations.

1.1. SCE Wrongly Applies Different Discount Rates to Calculate the Present Value of Risk Reduction Benefits and Present Value Costs

TURN raised concerns about SCE's chosen discount rates in its Protest.[1] In its June 30, 2022, Reply to Protests, SCE contended that the rates it used were appropriate and argued that the S-MAP settlement does not require the use of the same discount rate for calculating present value risk reduction benefits and present value costs.[2] TURN disagrees. As noted, the

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[1] TURN Protest, June 20, 2022, p. 3.

[2] Southern California Edison, Reply to Protests to RAMP Report, June 30, 2022 ("SCE Reply"), at 6.

Settlement requires the use of "comparable" measurements of benefits and costs. Using different discount rates prevents the required comparability.

Applying the same discount rate to future cost and benefit streams is a fundamental requirement of cost-benefit analysis. SCE's approach of having different discount rates for the numerator and denominator is not consistent with accepted economic and financial theory. Hence, based on both the S-MAP Settlement and basic economic and financial principles, to determine the present value costs and benefits of a utility project, whether a capital investment or an expense, the discount rate used to convert the streams of future benefits and costs must be the same.[3] The appropriate discount rate to use for both benefits and costs is SCE's WACC, which represents SCE's time value of money.

1.2. SCE's Use of a Claimed Social Discount Rate to Calculate the Present Value of Risk Reduction Benefits is Inappropriate

SCE states that its use of a three percent discount rate for risk reduction benefits is based on D.19-05-019, which, according to SCE, "prescribed a societal discount rate as part of a cost-benefit framework for evaluating distributed energy resources."[4] SCE contends that such a societal discount rate is warranted for safety benefits and says that it used the same 3% discount rate for reliability and financial benefits "for consistency and ease of understanding."[5] SCE's position is not well-founded.

SCE misleadingly states that D.19-05-019 "prescribed" a 3% social discount rate for cost-effectiveness analysis of distributed resources. In fact, the 3% social discount rate discussed in that decision was included as part of a Societal Cost Test that the Commission *declined* to adopt for decision-making purposes as a primary cost-effectiveness test.[6] Instead, the Commission directed that the Societal Cost Test, with its 3% discount rate, be tested "for informational purposes" before deciding whether it would be appropriate to adopt for decision-making purposes.[7] That decision makes clear that the 3% discount used in the Societal Cost

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[3] The only exception to this is that, in some cases, one can argue that a risk-adjusted discount rate can be applied to risky future cash flows, typically volatile streams of future benefits. However, risk-adjusted discount rates mean that future and uncertain benefits are discounted at higher rates than future, known costs. SCE has done the opposite.

[4] SCE RAMP Report, Chapter 2, p. 15.

[5] *Id*., pp. 15-16. Thus, even SCE does not try to make the case that reliability and financial benefits from its risk reduction activities should be discounted at a 3% social discount rate.

[6] D.19-05-019, pp. 21-22.

[7] D.19-05-019, pp. 32-33. In addition, even the Societal Cost Test would not use different discount rates for benefits and costs, as SCE proposes here.

Test was lower than the current, market-based discount rate being used in the Total Resource Cost test, which is the primary test of cost-effectiveness for all distributed energy resources applicable filings or advice letters.[8] Notably, in its pending Building Electrification application (A.21-12-009), SCE states that a societal discount rate of 3% should *not* be used "because the Commission has rejected its use in prior decisions."[9]

In fact, in comments quoted in D.20-05-019, SCE joined the other large utilities in arguing <u>against</u> use of a 3% discount rate for decision-making purposes:

> The Utilities argue that use of a three percent real discount rate for approving program funding will result in projects being approved that are not cost-effective and misallocate resources within the utility. Surmising that the appropriate discount rate is one that reflects the risks and uncertainties of the cash flows, and the opportunity costs of those cash flows as reflected in market rates of return, the Utilities assert the best source of that information is the Utilities respective weighted average cost of capital.[10]

This reasoning applies with equal force to decisions regarding the cost-effectiveness of proposed utility programs to mitigate operating risks.

Given that SCE's cost of obtaining additional capital needed for mitigation investments is measured by the company's WACC, that is the appropriate discount rate to use for costs. As such, it must also be the discount rate used to determine present value benefits and thus enable the Commission to meaningfully compare the benefits and costs of SCE's proposed risk mitigations. Applying SCE's logic, the cost-effectiveness of <u>all</u> company investments – new substations, new transmission lines, storage facilities, etc. – would require discounting at a social rate because those investments also have safety benefits to the public. As noted, even though the environmental benefits of building electrification have a societal benefit, SCE argues against using the 3% social discount rate in its pending Building Electrification application.[11]

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[8] D.20-05-019, pp. 2, 17,

[9] SCE Rebuttal Testimony, A.21-12-009, Sept. 19, 2022, p. 56. SCE's testimony responds to TURN's use of the 3% social discount rate as an alternative scenario for comparative purposes. TURN's primary net present value analysis in that case used SCE's weighted average cost of capital (WACC).

[10] D.20-05-019, p. 47 (footnotes omitted).

[11] SCE Rebuttal Testimony, A.21-12-009, Sept. 19, 2022, p. 56.

1.3. SCE's Use of a 10% "Incremental" Cost of Capital to Discount Costs Is Inappropriate

SCE states that it discounts nominal costs at a 10% rate because that represents SCE's "incremental cost of capital."[12] SCE's RAMP Report does not define what "incremental cost of capital" means, nor how SCE determined that its incremental cost of capital is 10.0%, as opposed to its current approved return on equity of 10.30%.[13]

According to Investopedia, the incremental (or marginal) cost of capital" refers to the average cost a company incurs to issue one additional unit of debt or equity."[14] If SCE financed its operations solely through issuances of equity, then its incremental cost of capital would be 10.30%. But SCE finances its operations with a mix of debt and equity issuances. Therefore, its appropriate incremental cost of capital is simply its WACC, which is currently 7.68%.[15]

1.4. SCE's Discount Rates Introduce an Upward Bias to All of its RSE Calculations

SCE's use of an artificially low discount rate for risk reduction benefits and an artificially high rate for costs biases all of the RSE calculations upward. The magnitude of this bias is greatest for mitigation programs with the longest expected lifetimes and can reduce SCE's reported RSE values by more than 60%.

Correcting the numerator and denominator of the RSE values required two different adjustments. To correct the bias in the present value of risk reduction benefits (i.e., the numerator), the RSE values should be multiplied by the following factor:[16]

$$\frac{\left\{\left(\frac{1+WACC}{WACC}\right)\times\left[1-\frac{1}{(1+WACC)^{LIFE+1}}\right]-1\right\}}{\left\{\left(\frac{1.03}{0.03}\right)\times\left[1-\frac{1}{(1.03)^{LIFE+1}}\right]-1\right\}}\times\left(\frac{1}{(1+WACC)^{YEAR\text{-}2024}}\right),$$

where WACC is SCE's current WACC of 7.68%, LIFE is the lifetime of the mitigation measure, and YEAR is the deployment year of the mitigation measure. (This correction assumes the

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[12] SCE RAMP Report, Chapter 2, p. 16.

[13] D.19-12-056, p. 2.

[14] https://www.investopedia.com/terms/i/incremental-cost-of-capital.asp

[15] D.19-12-056, p. 2.

[16] TURN can provide the derivation of this correction factor at SPD's request and has included a table of adjustment factors at the end of this discussion for convenience.

benefits of a mitigation are first realized at the end of the deployment year.)[17] For example, SCE assumes a 45-year lifetime for targeted undergrounding (TUG) of 45 years. Hence, for targeted undergrounding undertaken in 2028, the resulting correction factor is 0.3622, in other words, the reported RSE numerator is reduced by almost 64%.

Because SCE reports costs for programs on an annual basis, the correction factor for RSE program costs (i.e., the denominator) is simpler, and equals:

$$\left(\frac{1.10}{1+WACC}\right)^{YEAR-2025}$$

where YEAR is the year during which the risk mitigation cost is incurred. (SCE treats 2025 as its baseline investment year. The correction factor assumes the program costs are incurred at the beginning of the year.)

The overall correction to the RSE is found by multiplying SCE's reported RSE by the present value benefit adjustment factor and then dividing by the present value cost adjustment factor. For example, using SCE's filed WACC of 7.68%, for targeted undergrounding undertaken in 2028, the present value cost adjustment factor is $(1.10/1.0768)^3 = 1.0660$. The present value benefit adjustment factor, based on SCE's assumed 45-year program life for undergrounding, is 0.3809. Thus, the overall RSE adjustment factor is 0.3809 / 1.0660 = 0.3573. This means that a reported RSE of, say, 100, would be corrected to an actual RSE of 35.73, a decrease of over 64%. Because SCE assumes a 45-year life for Covered Conductor (WCCP), the same adjustment factors apply to that activity.

Table 1 provides examples of the RSE corrections for three major programs: Targeted Undergrounding (TUG), which addresses the Wildfire risk, and Worst Circuit Rehabilitation (WCR) and Cable-in-Conduit (CIC), which address the Underground Equipment Failure risk. The table illustrates the specific RSE benefit and cost correction factors, the combined RSE adjustment factors, and the corrected RSE values. As Table 1 shows, correcting for SCE's improper discounting of costs and benefits reduces the reported RSE values for these programs by between 48% and 64%. The longer the assumed mitigation benefits, the greater the percentage reduction in SCE's reported RSE values.

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[17] Note that this correction factor holds if benefits are assumed either to be constant each year or change at a constant rate each year.

Table 1: Examples of Corrected RSE Calculations for SCE Mitigation Programs

Targeted Underground Program (TUG)

	YEAR			
	2025	2026	2027	2028
SCE Reported RSEs, Severe Tranche	454	152	427	319
Program Assumed Lifetime (Years)	45	45	45	45
Benefit Adjustment Factor	0.4755	0.4416	0.4101	0.3809
Cost-Adjustment Factor	1.0000	1.0215	1.0436	1.0660
Combined RSE Adjustment Factor	0.4755	0.4323	0.3930	0.3573
Corrected RSE Values	**216.05**	**65.85**	**167.89**	**114.01**
Percent Reduction from Reported RSE	**52.4%**	**56.8%**	**60.7%**	**64.3%**

Worst Circuit Rehabilitation Program (WCR)

	YEAR			
	2025	2026	2027	2028
SCE Reported RSEs,Other HFRA Tranche	92.37	54.11	44.51	42.79
Program Assumed Lifetime (Years)	40	40	40	40
Benefit Adjustment Factor	0.4960	0.4606	0.4278	0.3973
Cost-Adjustment Factor	1.0000	1.0215	1.0436	1.0660
Combined RSE Adjustment Factor	0.4960	0.4509	0.4099	0.3727
Corrected RSE Values	**45.82**	**24.40**	**18.25**	**15.95**
Percent Reduction from Reported RSE	**50.4%**	**54.9%**	**59.0%**	**62.7%**

Cable-in-Conduit Program (CIC)

	YEAR			
	2025	2026	2027	2028
SCE Reported RSEs,Other HFRA Tranche	31.47	28.42	30.07	27.17
Program Assumed Lifetime (Years)	35	35	35	35
Benefit Adjustment Factor	0.5205	0.4834	0.4489	0.4169
Cost-Adjustment Factor	1.0000	1.0215	1.0436	1.0660
Combined RSE Adjustment Factor	0.5205	0.4732	0.4302	0.3911
Corrected RSE Values	**16.38**	**13.45**	**12.94**	**10.62**
Percent Reduction from Reported RSE	**47.9%**	**52.7%**	**57.0%**	**60.9%**

RSE Benefits Adjustment Factors

SCE WACC:	Benefit Correction Factor (Multiply SCE numerator by this factor)			
7.68%	YEAR			
Life of Mitigation (Years)	2025	2026	2027	2028
1	0.8883	0.8250	0.7661	0.7115
2	0.8693	0.8073	0.7497	0.6962
3	0.8510	0.7903	0.7339	0.6816
4	0.8334	0.7740	0.7188	0.6675
5	0.8165	0.7583	0.7042	0.6540
6	0.8003	0.7432	0.6902	0.6410
7	0.7846	0.7287	0.6767	0.6284
8	0.7696	0.7147	0.6637	0.6164
9	0.7551	0.7013	0.6512	0.6048
10	0.7412	0.6883	0.6392	0.5936
11	0.7278	0.6759	0.6277	0.5829
12	0.7149	0.6639	0.6166	0.5726
13	0.7025	0.6524	0.6059	0.5627
14	0.6906	0.6413	0.5956	0.5531
15	0.6791	0.6306	0.5857	0.5439
16	0.6680	0.6204	0.5761	0.5350
17	0.6574	0.6105	0.5669	0.5265
18	0.6471	0.6010	0.5581	0.5183
19	0.6372	0.5918	0.5496	0.5104
20	0.6277	0.5830	0.5414	0.5028
21	0.6186	0.5745	0.5335	0.4954
22	0.6098	0.5663	0.5259	0.4884
23	0.6013	0.5584	0.5186	0.4816
24	0.5931	0.5508	0.5115	0.4750
25	0.5852	0.5435	0.5047	0.4687
26	0.5776	0.5364	0.4982	0.4626
27	0.5703	0.5296	0.4919	0.4568
28	0.5633	0.5231	0.4858	0.4511
29	0.5565	0.5168	0.4799	0.4457
30	0.5499	0.5107	0.4743	0.4404
31	0.5436	0.5048	0.4688	0.4354
32	0.5375	0.4992	0.4636	0.4305
33	0.5316	0.4937	0.4585	0.4258
34	0.5260	0.4885	0.4536	0.4213
35	0.5205	0.4834	0.4489	0.4169
36	0.5153	0.4785	0.4444	0.4127
37	0.5102	0.4738	0.4400	0.4086
38	0.5053	0.4693	0.4358	0.4047
39	0.5006	0.4649	0.4317	0.4009
40	0.4960	0.4606	0.4278	0.3973
41	0.4916	0.4566	0.4240	0.3938
42	0.4874	0.4526	0.4203	0.3904
43	0.4833	0.4488	0.4168	0.3871
44	0.4793	0.4451	0.4134	0.3839
45	0.4755	0.4416	0.4101	0.3809
46	0.4718	0.4382	0.4069	0.3779
47	0.4683	0.4349	0.4039	0.3751
48	0.4649	0.4317	0.4009	0.3723
49	0.4615	0.4286	0.3981	0.3697
50	0.4583	0.4257	0.3953	0.3671
51	0.4553	0.4228	0.3926	0.3646
52	0.4523	0.4200	0.3901	0.3622
53	0.4494	0.4173	0.3876	0.3599
54	0.4466	0.4148	0.3852	0.3577
55	0.4439	0.4123	0.3829	0.3555
56	0.4413	0.4098	0.3806	0.3535
57	0.4388	0.4075	0.3784	0.3515
58	0.4364	0.4053	0.3764	0.3495
59	0.4340	0.4031	0.3743	0.3476
60	0.4318	0.4010	0.3724	0.3458

1.5 Conclusion

The changes in RSEs show that correcting SCE's discount rates can have a dramatic impact on program cost-effectiveness, particularly for programs with long benefit periods. In all cases, the RSE values will decrease, often by 50% or more. Using SCE's WACC for both benefits and costs would thus materially affect both the ranking of programs and tranches by RSE and the Benefit-Cost Ratios derived from SCE's RSEs.[18]

To produce more accurate RSEs and to comply with the S-MAP Settlement, SCE should use its WACC as the discount rate for both the numerator and denominator of the RSE calculation.

2. Modifying SCE's MAVF Parameters to Reflect a More Reasonable Statistical Value of Life Has a Significant Effect on the RSEs

As TURN explained in its Protest,[19] SCE's MAVF implies a statistical value of life (SVL) of $100 million. That value is approximately 8-10 times larger than the current values used by U.S. government agencies, including the EPA and the Dept. of Transportation, to evaluate the cost-effectiveness of health and safety issues.

An unreasonably high SVL introduces bias into SCE's RSE calculations by overvaluing safety improvements and undervaluing improvements that reduce reliability and financial consequences. TURN provided SCE with an alternative MAVF and weights, as follows:

SCE MAVF			**TURN REVISED MAVF**		
Safety	**Reliability**	**Financial**	**Safety**	**Reliability**	**Financial**
Attribute Weights			Attribute Weights		
50%	25%	25%	40%	30%	30%
Ranges:			Ranges:		
0 – 100	0 – 2 billion CMI	$0 - $5 Billion	0 – 500	0 – 2 billion CMI	$0 - $5 Billion

[18] Under SCE's MAVF, RSEs can be expressed as Benefit-Cost Ratios by dividing by 50.

[19] TURN Protest, p. 6.

TURN's revised MAVF results in an SVL of $13.3 million.[20] This value is close to current U.S. government values. TURN's MAVF does not change the value of reliability, which remains at $2.50/CMI.[21]

In its response to TURN-SCE-01(a), SCE provided revised RSE values for its mitigation programs using TURN's recommended MAVF. The summary results are shown in Table 1 for the covered conductor (WCCP) and undergrounding (TUG) programs. As this table shows, using an MAVF that provides a more accurate SVL reduces SCE's RSE for these two programs between about 15% and 25%.[22]

[20] Calculated as: [($5 x 10^9) / 30] / (500 / 40)] = $13,333,333.

[21] TURN has not evaluated the reasonableness of this reliability value in this proceeding.

[22] As shown in Table 1, for the TUG program, the "Other HFRA" tranche RSE values increase by 0.2%, unlike the years 2025 – 2027 when the RSE values decrease between about 15% and 21%. As TURN received the response from SCE on October 6, TURN has not had an opportunity to determine why this is the case.

Table 1: Change in RSE Values for TUG and WCCP Programs, by Year and Tranche[23]

SCE MAVF				
WCCP	**RSEs**			
	2025	2026	2027	2028
Severe	1565	NA	NA	NA
High Consequence	2021	1315	2815	1148
Other HFRA	628	594	642	631
TUG	**RSEs**			
	2025	2026	2027	2028
Severe	323	109	406	421
High Consequence	88	NA	642	119
Other HFRA	39	288	231	319
TURN REVISED MAVF				
WCCP	**RSEs**			
	2025	2026	2027	2028
Severe	1,167	NA	NA	NA
High Consequence	1,528	1,012	2,111	904
Other HFRA	525	471	542	632
TUG	**RSEs**			
	2025	2026	2027	2028
Severe	249	85	309	322
High Consequence	70	NA	485	96
Other HFRA	32	308	178	243
PERCENTAGE CHANGE IN RSE VALUES				
WCCP	2025	2026	2027	2028
Severe	-25.4%	NA	NA	NA
High Consequence	-24.4%	-23.0%	-25.0%	-21.2%
Other HFRA	-16.3%	-20.7%	-15.7%	0.2%
TUG	2025	2026	2027	2028
Severe	-22.9%	-22.0%	-23.9%	-23.3%
High Consequence	NA	NA	-24.6%	-19.4%
Other HFRA	NA	NA	NA	NA

TURN also evaluated the changes in SCE's proposed Underground Equipment Failure (UEF) programs – Worst Circuit Rehabilitation (WCR), Cable-In-Conduit Replacement Program (CIC), Underground Switch Replacement Program, and Cover Pressure Relief and Restraint Program (CPRR). As shown in Table 2, the reduction in RSEs for the WCR and CPRR programs were larger than for Covered Conductor and Undergrounding. The reduction in the RSEs of the WCRR program average over 47% and the reductions in the CPRR program were

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[23] Source: SCE TURN-SCE-01_RSE_LoRE_CoRE_Revised.xlsx, worksheet "Q1A."

84% in each year. The CIC program showed a slight increase in RSEs for the years 2026 – 2028, presumably because the Safety impacts of the CIC program are relatively small in comparison to the reliability benefits.[24]

Table 2: Change in RSE Values for UEF Programs, by Year[25]

SCE MAVF				
RSEs				
	2025	2026	2027	2028
WCR	92.37	54.11	44.51	42.70
CIC	52.87	39.19	28.49	25.54
UG Switch	31.45	28.85	30.45	27.03
CPRR	113.93	97.06	83.00	74.53
TURN REVISED MAVF				
	2025	2026	2027	2028
WCR	32.89	27.27	26.35	28.07
CIC	51.79	40.83	31.12	28.67
UG Switch	23.34	21.40	24.56	21.79
CPRR	18.23	15.53	13.28	11.92
PERCENTAGE CHANGE IN RSE VALUES				
	2025	2026	2027	2028
WCR	-64.4%	-49.6%	-40.8%	-34.3%
CIC	-2.0%	4.2%	9.2%	12.2%
UG Switch	-25.8%	-25.8%	-19.4%	-19.4%
CPRR	-84.0%	-84.0%	-84.0%	-84.0%

In sum, the changes in RSEs for both the Wildfire and UEF programs show that SCE's overvaluation of safety impacts has a significant impact on program cost-effectiveness. In most cases, using a more reasonable SVL decreases the cost-effectiveness of SCE's programs, the amount of the decrease varying by the extent to which the risk reduction benefits of the mitigation are focused on the Safety attribute. TURN's modifications to SCE's MAVF would

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[24] As TURN received the revised response from SCE on October 6, 2022, TURN has not determined why the TURN CIC RSE decreases slightly in 2025 but then increases in 2026-2028 relative to the SCE RSEs. A similar pattern of relative increases in the TURN RSEs relative to the SCE RSEs can be seen for the WCR and UG Switch programs.

[25] Source: SCE TURN-SCE-01_RSE_LoRE_CoRE_Revised.xlsx, worksheet "Q1A."

thus materially affect both the ranking of programs and tranches by RSE and the Benefit-Cost Ratios derived from SCE's RSEs.

To produce more accurate RSEs, SCE should revise its MAVF along the lines of the TURN Revised MAVF, which will result in an SVL that is more in line with SVLs used by federal agencies for risk analysis.

3. SCE's Failure to Provide Complete RSE Calculations Violates the S-MAP Settlement

Based on SCE data request responses, TURN is concerned that SCE is not calculating fully inclusive RSEs and mis-attributing its failure to do so to the methodology that SCE agreed to in the S-MAP Settlement and that the CPUC adopted in D.18-12-014.

The most consequential example of this issue is SCE's failure to include benefits related to egress in its RSE calculations for Wildfire mitigations, as acknowledged in SCE's response to SPD's data request 5-5.[26] TURN followed up on this response in TURN data request 2-6, in which TURN asked SCE why its RSE for wildfire mitigations does not include egress benefits, even though D.21-08-036 (p. 37) had made clear that including egress in the consequence calculation would be a welcome improvement.[27]

SCE responded that, while it considered consideration of egress risk to be important, "[t]he current Multi-attribute Value Function does not account for egress . . .." TURN disagrees with SCE's suggestion that the MAVF methodology does not accommodate the calculation of benefits from egress. To the contrary, the point of the MAVF is to capture *all* benefits from a risk reduction activity. The S-MAP Settlement's definition of "Attribute" states: "Changes in the levels of attributes are used to determine the consequences of a Risk Event. The attributes in an MAVF should cover the reasons that a utility would undertake risk mitigation activities."[28] Thus, the intent of the MAVF's consequence Attributes is to enable the calculation of all changes in consequence levels from a risk mitigation activity. SCE is wrong in blaming the MAVF approach adopted in D.18-12-014 for its failure to account for all benefits from Wildfire mitigations.

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[26] A similar issue is presented by SCE's response to SPD DR 5-1 and TURN's follow up DR 2-5, in which SCE erroneously, in TURN's view, claims that the MAVF "does not account for" resiliency benefits from installing Fire Resistant Poles.

[27] TURN Data Requests 2-5 and 2-6 can be found in Appendix B to these informal comments.

[28] S-MAP Settlement, p. A-2.

Under the S-MAP Settlement, utilities are required to estimate consequence benefits using data "whenever practical and appropriate." However, the Settlement expressly states that "the available data should not restrict the application of the risk assessment methodologies." When data are unavailable, "SME judgment should be used if the methodologies require use of data that is not available." The Settlement further notes that, [o]ver time, SME judgment should be increasingly supplemented by data analysis as the methodologies mature."[29] Thus, contrary to SCE's statement, there is nothing in the S-MAP Settlement methodology that prevents SCE from calculating egress and other consequence benefits from a mitigation program.

In light of these requirements of the S-MAP Settlement, in data request 2-6(b)(i), TURN asked whether SCE has data related to egress benefits. SCE's answer does not provide any information about whether or not it has such data. (In other words, SCE's answer is non-responsive.) TURN further asked, in data request 2-6(c)(i), whether its experts are incapable of estimating the egress benefits from wildfire mitigations. SCE's answer again dodges the question, cross-referencing the non-responsive answer to subpart (b). These answers show that SCE has not made the effort required under the S-MAP Settlement to calculate egress benefits, based on either data or subject matter expertise, or a combination of both. Egress benefits would seem to be geographic-specific and thus could be an appropriate factor in defining appropriate tranches.

Finally, TURN asked in data request 2-6(d) whether SCE expected inclusion of egress benefits to have a material effect on its RSE calculations. SCE responded that, because it has not quantified egress benefits, it could not provide a definitive statement regarding the impact on RSEs. However, it volunteered that it expected that RSEs would be higher. TURN expects that any increase to RSEs would be quite localized.

SCE's responses highlight the importance of utilities upholding their obligation under the S-MAP Settlement to include all material impacts in their RSE calculations. The Commission has stated that "RSE calculations are critical for determining whether utilities are effectively allocating resources to initiatives that provide the greatest risk reduction benefits per dollar spent, thus ensuring responsible use of ratepayer funds."[30] Incomplete utility RSE calculations open the door to utility claims that RSEs are of limited use because they don't capture all relevant considerations. However, as has been shown, the S-MAP Settlement *does* require all significant considerations to be estimated and accounted for in the RSE calculations. SCE should not be allowed to undermine the usefulness of RSEs in CPUC decision-making by failing to comply with the clear requirements of the S-MAP Settlement.

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[29] S-MAP Settlement, Row 31, p. A-18.

[30] D.21-08-036, p. 38, quoting Resolution WSD-002, p. 20.

Accordingly, in its GRC re-calculation of RSEs, SCE should include egress benefits and all other considerations that materially affect its RSE calculations for any risk, in accordance with the requirements of the S-MAP Settlement.

4. SCE Should Supplement Its Year-by-Year RSE Figures with Combined Four-Year Numbers

SCE's RAMP report and workpapers provide separate RSEs for each of the four years of the rate case period. TURN supports providing a year-by-year breakdown of RSEs. However, TURN requests that SCE's GRC submission also include a combined *four-year RSE* for all of its risk reduction activities, both at the program and tranche levels. Particularly where there is little variation among the yearly RSE figures, the four-year numbers can be useful for enabling more concise presentation of RSE results, as has been the case in the PG&E GRC.

Dated: October 10, 2022

Prepared by:

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Appendix A – Summary of Recommendations

1. SCE, like PG&E, should use its weighted average cost of capital (WACC) as the discount rate for both the numerator and denominator of its RSE calculations. Correcting SCE's erroneous discount rates in this way will reduce all of SCE's RSEs, often by 50% or more, depending on the length of the benefit period for the mitigation in question.

2. SCE's MAVF reflects an unreasonably high statistical value of life (SVL). To produce more accurate RSEs, SCE should revise its MAVF along the lines of the TURN Revised MAVF, which will result in an SVL more in line with SVLs used by federal agencies for risk analysis. Making this change will reduce SCE's RSEs for many mitigations by roughly 25% or more, depending on the extent to which the risk reduction benefits are focused on the Safety attribute.

3. In its GRC re-calculation of RSEs, SCE should include egress benefits and all other considerations that materially affect its RSE calculations for any risk, in accordance with the requirements of the S-MAP Settlement.

4. SCE's GRC submission should supplement the yearly RSE figures with combined four-year RSE calculations for all of its risk reduction activities, both at the program and tranche levels.

Appendix B

SCE Responses to TURN Data Requests 2-5 and 2-6

Southern California Edison
A.22-05-013 – Application of Southern California Edison Company Regarding 2022 Risk Assessment Mitigation Phase

DATA REQUEST SET T U R N - S C E - 0 0 2

To: TURN
Prepared by: Bryan Landry
Job Title: Senior Advisor – Strategic Planning
Received Date: 9/15/2022

Response Date: 9/29/2022

Question 05:
SCE's response to SPD Data Request 5-1 includes the following statement: "More importantly, however, the RSE [for Fire Resistant Poles (FRP)] does not take into account the resiliency benefits realized from installing FRPs. For example, one of the primary reasons for installing FRPs is to enhance the ability of the structure to survive a wildfire, irrespective of source. This is especially the case for the subset of FRPs that are fire-wrapped as opposed to composite poles. The MAVF does not directly incorporate these enhanced resiliency benefits and therefore simply viewing the RSE in isolation understates the importance of this work."

a. Please explain why SCE's calculation of the RSE for FRP does not take into account the resiliency benefits from installing FRPs.
b. Does SCE have no data regarding the resiliency benefits of installing FRPs? If so, how has SCE concluded that there are such resiliency benefits?
c. Are SCE's subject matter experts (SMEs) incapable of estimating the resiliency benefits from FRPs in reducing either the frequency or consequences of ignitions? If so, please explain why.
d. Is SCE contending that there is something inherent in the MAVF framework adopted in D.18-12-014 that makes it impossible to include "enhanced resiliency benefits" from FRPs? Please explain your answer.
e. Would inclusion of "enhanced resiliency benefits" have a material effect on SCE's RSEs for FRPs? Please provide SCE's best assessment of the impact that inclusion of these benefits would have on SCE's RSE for this risk reduction activity.

Response to Question 05:

a. Please explain why SCE's calculation of the RSE for FRP does not take into account the resiliency benefits from installing FRPs.

The SMAP settlement agreement approved the Multi-attribute Value Function, which does not account for qualitative benefits, such as resiliency. Although it is theoretically possible to estimate the avoided CMI benefits and financial (potential avoided pole replacements) costs, SCE has not performed that calculation for this RAMP.

b. Does SCE have no data regarding the resiliency benefits of installing FRPs? If so, how has SCE concluded that there are such resiliency benefits?

SCE has not developed a model specifically designed to estimate the qualitative resiliency benefits associated with Fire Resistant Poles (FRP). However, it is beyond reasonable dispute that poles that survive wildfires provide resiliency benefits. For example, below are pictures of FRPs that survived a wildfire.

c. Are SCE's subject matter experts (SMEs) incapable of estimating the resiliency benefits from FRPs in reducing either the frequency or consequences of ignitions? If so, please explain why.

While SCE's SMEs are capable of estimating the resiliency benefits, FRPs are installed primarily to increase the resiliency of the system, not to reduce the frequency or consequences of a wildfire. There is an ancillary wildfire mitigation-related ignition reduction benefit to the composite pole subset of FRPs and all FRPs that survive a wildfire will lead to faster system restoration, which will reduce the CMI per outage. SCE has not currently quantified the resiliency benefits associated with this technology. SCE believes that utilization of this technology is warranted regardless of inclusion of these benefits. In D.21-08-036, the CPUC approved funding for FRPs associated with WCCP. In that proceeding, no party challenged SCEs proposal to install FRPs associated with WCCP. Instead, the discussion was in regard to the appropriate ratio to fire wrapped FRPs to composite material FRPs. SCE has prudently chosen to install a significant percentage of fire wrapped FRPs in appropriate circumstances, which will still provide resiliency benefits at a lower cost than would have been incurred by moving forward with installing 100% composite FRPs.

d. Is SCE contending that there is something inherent in the MAVF framework adopted in D.18-12-014 that makes it impossible to include "enhanced resiliency benefits" from FRPs? Please explain your answer.

   Please see response to a – c.

e. Would inclusion of "enhanced resiliency benefits" have a material effect on SCE's RSEs for FRPs? Please provide SCE's best assessment of the impact that inclusion of these benefits would have on SCE's RSE for this risk reduction activity.

   As noted above, SCE has not quantified the resiliency benefits and therefore cannot provide a definitive statement on what the impact would be on the RSEs for this activity.

Southern California Edison
A.22-05-013 – Application of Southern California Edison Company Regarding 2022 Risk Assessment Mitigation Phase

DATA REQUEST SET T U R N - S C E - 0 0 2

To: TURN
Prepared by: Bryan Landry
Job Title: Senior Advisor – Strategic Planning
Received Date: 9/15/2022

Response Date: 9/29/2022

Question 06:
SCE's response to SPD Data Request 5-5 (p. 2) states that the RSEs for undergrounding do not account for the benefits in relation to "factors like egress and PSPS impacts."

a. Please explain why SCE's calculation of the RSE for undergrounding does not take into account benefits in relation to: (i) egress and (ii) PSPS.
b. Does SCE have no data regarding the benefits of undergrounding with respect to: (i) egress and (ii) PSPS? If so, how has SCE concluded that there are such benefits?
c. Are SCE's subject matter experts (SMEs) incapable of estimating the benefits from undergrounding regarding: (i) egress and (ii) PSPS? If so, please explain why.
d. Would inclusion of benefits related to egress have a material effect on SCE's RSEs for undergrounding? Please provide SCE's best assessment of the impact that inclusion of these benefits would have on SCE's RSE for this risk reduction activity.
e. Would inclusion of benefits related to PSPS have a material effect on SCE's RSEs for undergrounding? Please provide SCE's best assessment of the impact that inclusion of these benefits would have on SCE's RSE for this risk reduction activity.

Response to Question 06:

a. Please explain why SCE's calculation of the RSE for undergrounding does not take into account benefits in relation to: (i) egress and (ii) PSPS.
   (i) The current Multi-attribute Value Function does not account for egress and should be discussed as part of a broader stakeholder forum such as the Risk OIR R.20-07-013 or other appropriate forums facilitated by OEIS. SCE believes that consideration of egress risk is important, however, consistent with TURN's recommendation in the TY 2021 GRC.[1]

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[1] *See* D.21-08-036 at p. 37: "Similarly, TURN's recommendation to include egress in the calculation of wildfire risk consequence would improve SCE's risk management approach, and is generally uncontested.

(ii) SCE would like to clarify our response to SPD-SCE-05 Q5 that TURN is referencing. The sentence should have stated: "However, the RSEs for TUG currently do not account for egress benefits and REFCL does not provide equivalent PSPS-reducing and egress-risk-mitigation benefits compared to TUG." Therefore, SCE's RSE calculation for undergrounding does account for the benefits associated with PSPS reduction.

b. Does SCE have no data regarding the benefits of undergrounding with respect to: (i) egress and (ii) PSPS? If so, how has SCE concluded that there are such benefits?

(i) As discussed in SCEs Track 4 testimony when we refer to egress risk, we are referring to the inability of a specific community to safely and effectively evacuate in time during a propagating wildfire associated with our infrastructure. SCE Integrated Grid Hardening Strategy (IGHS) specifically prioritizes locations that have historically experienced high fire frequency and are likely to experience egress challenges in the event of an encroaching wildfire. In those extraordinarily high-risk communities, SCE must do everything within its reasonable control to prevent ignitions. Undergrounding prevents almost all potential ignitions.

(ii) SCE's RSE calculation for undergrounding does account for the benefits associated with PSPS reduction, as discussed above.

c. Are SCE's subject matter experts (SMEs) incapable of estimating the benefits from undergrounding regarding: (i) egress and (ii) PSPS? If so, please explain why.

See response to part b (i) and (ii).

d. Would inclusion of benefits related to egress have a material effect on SCE's RSEs for undergrounding? Please provide SCE's best assessment of the impact that inclusion of these benefits would have on SCE's RSE for this risk reduction activity.

As noted above, SCE has not quantified the egress benefits and therefore cannot provide a definitive statement on what the impact would be on the RSEs for this activity; however, it would mathematically have a positive impact on the risk reduction for this activity. In the past four years, there have been multiple tragic fatalities associated with egress constraints during wildfire events.

e. Would inclusion of benefits related to PSPS have a material effect on SCE's RSEs for undergrounding? Please provide SCE's best assessment of the impact that inclusion of

(cont.) To the extent this issue is not addressed in R.20-07-013, we direct SCE to incorporate egress, and other conditional risks as appropriate, in future RAMP and GRC risk modeling."

these benefits would have on SCE's RSE for this risk reduction activity.

As discussed above, SCE's RSE calculation for undergrounding accounts for the benefits associated with PSPS reduction.

Attachment 4 – Email from SCE to correct a factual error in Cal Advocates' informal comments

Subject: [EXTERNAL] A.22-05-013_RAMP: SCE Request to Identify and Correct Factual Error
Date: Tuesday, October 18, 2022 at 2:43:00 PM Pacific Daylight Time
From: Legal Admin
To: Lirag, Rafael L.
CC: Dugowson, Andrew, Andrew J. Graf, Yip-Kikugawa, Amy C., Yang, Anna, C7MO@pge.com, CentralFiles@SempraUtilities.com, Parkes, Christopher, Claire Torchia, constantine.lednev@guggenheimpartners.com, Patel, Chirag "CJ", Camille Stough, Daniel Komula, DJ0Conklin@Earthlink.net, Van Dyken, David, Hanes, Fred, Chowdhury, Hafizur, James Birkelund, Battis, Jeremy, joe mccawley, Lam, Joseph, Joseph Mitchell, Kris G Vyas, Luke@UtilityAdvocates.org, mcade@buchalter.com, Gordon, Miles, Valencia, Manuel, regrelcpuccases (pge.com), Russell Archer, SCEGRC, Foley, Shanna, Haine, Steven K., tlong (turn.org), Vanessa Ruiz, W.Steele1@iCloud.com, Al-Mukdad, Wendy
Priority: High

Sent on behalf of Kris G. Vyas, Senior Attorney for Southern California Edison Company

Dear ALJ Lirag,

Good afternoon, Your Honor. Southern California Edison Company ("SCE") is writing to you to identify and correct a factual error on the part of the Public Advocates Office ("Cal Advocates") in connection with the informal comments that Cal Advocates submitted on October 10, 2022 regarding SCE's Risk Assessment Mitigation Phase ("RAMP") Report. A copy of SCE's email to you is being sent to the service list for this proceeding.

While SCE respectfully disagrees with a number of the policy and factual positions taken by the three parties who submitted informal comments on October 10th in this docket, SCE will rely on the normal regulatory process to respond to those issues in writing after SPD issues its Regulatory Review Report. SCE does feel compelled at this point, however, to promptly correct the inaccurate statement of fact in Cal Advocates' comments regarding the September 15, 2022 safety incident at SCE's Big Creek utility-owned generation facility, especially given the fact that SCE had already provided a summary of the incident to Cal Advocates to correct this erroneous news story.

Cal Advocates' comments assert that the incident resulted in "eight workers being injured from a fire at an SCE hydroelectric plant." That statement is apparently based on inaccurate news media reporting, and does not take into consideration that SCE already clarified to Cal Advocates earlier this month that <u>no</u> workers were injured and there were <u>no</u> signs of a fire.

However, SCE takes this near-miss safety incident seriously. SCE already informed Cal Advocates that we are conducting a root cause evaluation to determine the factors contributing to the equipment failure. We also informed Cal Advocates that in accordance with SCE internal policies, SCE has initiated a safety evaluation of organizational and programmatic causes, use of controls and barriers, and human performance.

SCE is correcting the RAMP proceeding's record to make clear that, in connection with the referenced incident, there were no resulting injuries and there were no signs of a fire found. Thank you for your attention to this item.

Kris G. Vyas
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Southern California Edison Company
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