SDG&E RAMP REPORT



2025 Risk Assessment Mitigation Phase

(Chapter RAMP-1)

Overview

May 15, 2025

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CHAPTER RAMP-1: OVERVIEW

I. INTRODUCTION

Southern California Gas Company (SoCalGas) and San Diego Gas & Electric Company's (SDG&E) (individually, Company, and collectively, Companies) Chapter RAMP-1 provides an overview of their 2025 Risk Assessment Mitigation Phase (RAMP) Reports (or Report), submitted pursuant to the California Public Utilities Commission's (CPUC or Commission) Risk-Based Decision-Making Framework (RDF).[1] The instant RAMP proceedings are the first phase of each Company's next General Rate Case (GRC), Test Year (TY) 2028. "The purpose of the RAMP is 'to examine the utility's assessment of its key risks and its proposed programs for mitigating those risks.'"[2] Consistent with this purpose, the 2025 RAMP Reports focus on each of SoCalGas's and SDG&E's key safety risks and the current and proposed activities to help mitigate those risks.

SoCalGas and SDG&E are the first utilities to implement the Commission's Phase 3 Decision into their RAMP filings, and the Reports reflect the Companies' initial implementation of the methodologies adopted in the Phase 2 and Phase 3 Decisions. The RAMP Reports also reflect lessons learned from the Companies' 2021 RAMP Reports and further improvement of the RAMP process. In addition, the Companies considered the comments and suggestions by intervenors[3] and reviewed the recent RAMP filings of Pacific Gas and Electric Company (PG&E) and Southern California Edison Company (SCE).[4]

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1 The RDF Framework refers to modifications to the Commission's Rate Case Plan, as set forth in decisions adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceedings (S-MAP), and R.20-07-013 (the Risk OIR), including decisions (D.) 14-12-025, D.16-08-018, D.18-12-014, D.20-01-002, D.21-11-009, D.22-10-002, D.22-12-027 (Phase 2 Decision), and D.24-05-064 (Phase 3 Decision).

2 D.14-12-025 at 31 (citation omitted).

3 Comments considered include those made by intervenors in the Companies' prior RAMP and GRC cycle, as well as comments received during the Companies' December 17, 2024 pre-filing workshop for the 2025 RAMP.

4 The RDF requirements have continued to evolve since the filing of SCE's and PG&E's respective RAMP Reports, meaning that SCE and PG&E were not subject to some of the requirements that apply to SoCalGas's and SDG&E's 2025 RAMP Reports.

Chapter RAMP-1 provides the following:

- An executive summary of the organization of SoCalGas's and SDG&E's RAMP Reports, by chapter;
- A summary of modifications to the RDF since the Companies' 2021 RAMP filing and how the Companies have met these requirements;
- A description of improvements and lessons learned since the Companies' 2021 RAMP filing; and
- An overview of SoCalGas's and SDG&E's Environmental and Social Justice (ESJ) Pilot Studies, attached as Appendix 4 to each Report.

II. EXECUTIVE SUMMARY

The RAMP Reports comprise two volumes and five appendices, beginning with the following volume of joint and individual introductory chapters that lay the foundation of this filing and explain the methodologies used throughout:[5]

Table 1: SoCalGas/SDG&E Introductory Chapters (Volume 1)

Chapter RAMP-1: Overview (Joint SoCalGas/SDG&E)
Chapter RAMP-2: Enterprise Risk Management Framework (Joint SoCalGas/SDG&E)
Chapter RAMP-3: Risk Quantification Framework (Joint SoCalGas/SDG&E)
Chapter RAMP-4: Safety Culture (Joint SoCalGas/SDG&E)
Chapter RAMP-5: Climate Change Adaptation (Individual, SoCalGas or SDG&E)

The Volume 1 Chapters are organized as follows:

- **Chapter RAMP-1 (Joint)** provides an overview of the requirements for SoCalGas's and SDG&E's RAMP Reports, how the Companies have met the requirements, and changes and updates since the Companies' 2021 RAMP Reports. Chapter RAMP-1 also provides an overview of the organization of each Volume 1 Introductory Chapter and each Volume 2 Risk Chapter, and lessons learned by SoCalGas and SDG&E in developing the RAMP Reports.
- **Chapter RAMP-2 (Joint)** presents SoCalGas's and SDG&E's risk philosophy and objectives, their Enterprise Risk Management (ERM) Framework, explains

[5] Volume 1, Chapters RAMP-1, RAMP-2, RAMP-3, and RAMP-4 are jointly sponsored by SoCalGas and SDG&E; Chapter RAMP-5 is company specific.

the selection of RAMP risks, and discusses continuous improvement and changes to the Enterprise Risk Registry since 2022.

- **Chapter RAMP-3 (Joint)** explains the quantitative methodology used for establishing SoCalGas's and SDG&E's Cost-Benefit Ratio (CBR) calculations and tranching methodology.
- **Chapter RAMP-4 (Joint)** discusses SoCalGas's and SDG&E's safety cultures, executive and board involvement in safety, and compensation policies to incentivize a strong commitment to safety.
- **Chapter RAMP-5** discusses SoCalGas's and SDG&E's approaches to managing risk associated with Climate Change.

SoCalGas's RAMP Report presents seven risk chapters (six of which are specific to SoCalGas), SDG&E's RAMP Report presents eight risk chapters (seven of which are specific to SDG&E), and each Company's RAMP Report contains one joint risk chapter (Cybersecurity).[6] Each Company's risk chapters are presented in the respective RAMP Report as identified below. Each identified RAMP risk is discussed in detail in the respective individual risk chapters in Volume 2 and is presented in compliance with the directives in the RDF, as discussed below and in Volume 1, Chapters RAMP-2 and RAMP-3.

Table 2: RAMP Risk Chapters (Volume 2)

SoCalGas RAMP Risk Chapters	
Chapter	**Subject**
SCG-Risk-1	Excavation Damage
SCG-Risk-2	High Pressure Gas System
SCG-Risk-3	Medium Pressure Gas System
SCG-Risk-4	Underground Gas Storage
SCG-Risk-5	Employee Safety
SCG-Risk-6	Contractor Safety
SCG-Risk-8/SDG&E-Risk-8	Cybersecurity

[6] Chapter RAMP-2: Enterprise Risk Management Framework describes the process for selecting these risks for inclusion in the RAMP Report.

SDG&E RAMP Risk Chapters	
Chapter	**Subject**
SDG&E-Risk-1	Excavation Damage
SDG&E-Risk-2	High Pressure Gas System
SDG&E-Risk-3	Medium Pressure Gas System
SDG&E-Risk-4	Wildfire and PSPS
SDG&E-Risk-5	Electric Infrastructure Integrity
SDG&E-Risk-6	Employee Safety
SDG&E-Risk-7	Contractor Safety
SCG-Risk-8/SDG&E-Risk-8	Cybersecurity

The following appendices to the 2025 RAMP Reports provide supplemental information to aid in understanding the Reports.

- **Appendix 1: Glossary of Terms**
- **Appendix 2: 2025 RAMP Roadmap** provides a listing of RAMP requirements and where they have been addressed in the Reports.
- **Appendix 3: SoCalGas and SDG&E's Alternative Tranching White Paper** describing their Homogeneous Tranching Method (HTM), served November 1, 2024.[7]
- **Appendix 4: Environmental and Social Justice (ESJ) Pilot Study Results** provided in accordance with D.22-12-027 (Phase 2 Decision).
- **Appendix 5: Ranking of Mitigations by Cost Benefit Ratios (CBR)** provided in accordance with D.24-05-064 (Phase 3 Decision), RDF Row 26.

III. PROCEDURAL HISTORY AND REQUIREMENTS

On November 14, 2013, the Commission opened Rulemaking (R.) 13-11-006, *Order Instituting Rulemaking to Develop a Risk-Based Decision-Making Framework to Evaluate Safety and Reliability Improvements and Revise the Rate Case Plan for Energy Utilities*. The purpose of that Rulemaking was to incorporate a risk-based decision-making framework into the Rate

[7] SoCalGas and SDG&E's development of a tranching methodology and service of the White Paper was done in accordance with the guidance provided in the Phase 3 Decision. *See, e.g.,* D.24-05-064 at 26-28.

Case Plan (RCP) for the energy utilities' GRCs, in which utilities request funding to operate and maintain their systems, including for safety-related activities. Further, the California Legislature enacted Public Utilities Code (Pub. Util. Code) Section 963, which states that "[i]t is the policy of the state that the commission and each gas corporation place [the] safety of the public and gas corporation employees as the top priority."[8] In 2014, the California Legislature amended the Pub. Util. Code, adding Section 750, which directed the Commission to "develop formal procedures to consider safety in a rate case application by an electrical corporation or gas corporation."[9]

As a result of these directives, in D.14-12-025, the Commission adopted a risk-based decision-making framework into the Rate Case Plan for the energy utilities' GRCs. Further, it established two new proceedings to address risk assessment procedures, the S-MAP and RAMP. These proceedings inform the subsequent GRC applications.

On May 1, 2015, as ordered in D.14-12-025, SDG&E, SoCalGas, PG&E, and SCE filed S-MAP Applications (A.) 15-05-002, A.15-05-003, A.15-05-004, and A.15-05-005, which were consolidated on June 19, 2015, as A.15-05-002 and Related Matters. Phase One of that proceeding explored the models the utilities proposed in these applications to identify and manage risks.

On August 18, 2016, the Commission issued D.16-08-018 (the Phase 1 Interim S-MAP decision), which adjudicated the consolidated S-MAP applications, determined the format of future RAMP submissions, and directed the utilities to develop a more uniform approach to risk management in Phase 2 of that proceeding. On May 2, 2018, SoCalGas, SDG&E, PG&E, SCE, and other settling parties filed a Joint Motion for Approval of a Settlement Agreement in A.15-05-002 (cons.). The Commission adopted the S-MAP Settlement Agreement with modifications in D.18-12-014 (the Settlement Decision).

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[8] Pub. Util. Code § 963(b)(3).

[9] Pub. Util. Code § 750.

The 2025 RAMP Reports are the Companies' fourth RAMP submissions, following the 2016, 2019, and 2021 RAMP Reports.[10] SoCalGas's and SDG&E's last RAMP Reports were submitted on May 15, 2021, and were the first to present safety risks in the manner required by the Settlement Decision. Since the Companies filed their 2021 RAMP Applications and Reports, the Commission has issued four separate decisions in Rulemaking (R.) 20-07-013 (the Risk OIR) – D.21-11-009, D.22-10-002, D.22-12-027 (Phase 2 Decision), and D.24-05-064 (Phase 3 Decision) – which substantially modify the CPUC's Risk-Based Decision-Making Framework (RDF), including the adoption of new regulations governing RAMP submissions. PG&E was the first utility to submit a RAMP Report under D.21-11-009, D.22-10-002, and the Phase 2 Decision, and PG&E's 2024 RAMP Report and the feedback it has received have informed SoCalGas and SDG&E in preparing their 2025 RAMP Reports. SoCalGas and SDG&E are the first utilities to submit a RAMP Report under the new requirements adopted in the Phase 3 Decision.

IV. RECENT MODIFICATIONS TO RDF

This section enumerates and highlights several recent modifications to the RDF that the Commission has adopted since the Companies' 2021 RAMP filings and indicates how and where they are addressed.

A. Modifications Adopted in D.21-11-009

D.21-11-009 approved changes to the RDF that created new RAMP filing requirements, such as: requiring RAMP analysis for all mitigations, including controls,[11] requiring utilities to treat PSPS as risk events within the RDF framework (not just as a mitigation),[12] changing RAMP

[10] After the filing of the Companies' 2019 RAMP reports, which were intended to inform their respective TY 2022 GRCs, the Commission issued D.20-01-002, which modified the GRC cycles of the large energy utilities, eliminating the Companies' TY 2022 GRCs. The Commission issued D.20-09-004, which closed the 2019 RAMP proceeding and clarified that the Companies' respective 2019 RAMP Reports would not be integrated into each Company's next GRC application.

[11] D.21-11-009 at 17. In D.21-11-009, the Commission required utilities to perform a risk-spend efficiency (RSE) calculation for each mitigation. This was superseded by D.22-12-017, which replaced the RDF's previous RSE requirement with a requirement to perform a specified cost-benefit analysis, as more fully discussed in Chapter RAMP-3. *See* D.22-12-017 at 24-30.

[12] D.21-11-009 at 28-30.

baselines to begin at the start of the new GRC cycle,[13] and adopting a revised S-MAP Lexicon.[14] D.21-11-009 also established a requirement to include foundational program costs in a utility's RAMP, defined as "initiatives that support or enable two or more mitigation programs or two or more risks but do not directly reduce the consequences or the likelihood of risk events."[15] Information on where these requirements are addressed is provided in Appendix 2.

B. Modifications Adopted in D.22-10-002

D.22-10-002 approved new RAMP filing requirements, including calling for utilities to provide graphics of historical progress in their RAMP reports that illustrate what safety work has been accomplished and what work remains to be done (including information over the two preceding RAMP cycles), as well as various cost mapping and reporting requirements.[16] SoCalGas and SDG&E have included these graphics in each risk chapter.

C. Modifications Adopted in the Phase 2 Decision

On December 15, 2022, the Commission superseded the Settlement Decision by approving the Phase 2 Decision. The Phase 2 Decision adopted a Cost-Benefit Approach (CBA) that requires utilities to report on risk in monetized terms (*i.e.*, dollars) for purposes of creating "utility risk and Mitigation Benefit calculations that are more useful during review and consideration of RAMP and GRC filings,"[17] along with numerous other modifications, as summarized below.

1. Cost-Benefit Approach (CBA)

The focus of the Phase 2 Decision is the "replace[ment of] the 'Multi-Attribute Value Function' adopted in D.18-12-014 with a Cost-Benefit Approach that includes standardized dollar valuations of Safety, Electric Reliability and Gas Reliability Consequences from Risk Events."[18]

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[13] *Id.* at 136 (Conclusion of Law (COL) 7).

[14] *Id.* at 145 (OP 10).

[15] *Id.* at 19 (Examples of foundational programs or activities may include "software and computer hardware resources, situational awareness initiatives such as weather modeling, and vehicles used by employees.").

[16] D.22-10-002 at 28.

[17] D.22-12-027 at 26.

[18] *Id.* at 2.

Risk consequences in the 2021 RAMP reports were calculated via the Multi-Attribute Value Function (MAVF) methodology, which governed risk estimation through application of weights and ranges for the Safety, Reliability, and Financial consequence attributes in accordance with the Settlement Decision.[19] As noted above, the Phase 2 Decision supersedes the MAVF, along with its components of attribute ranges and weights, with a Cost-Benefit Approach that requires consequence attributes to be expressed in dollars (referred to as "monetization"). The Phase 2 Decision further provided guidance as to the dollar equivalencies to be applied for non-financial consequence attributes, as discussed below.

SoCalGas and SDG&E are implementing the CBA for the first time in this 2025 RAMP Report. Chapter RAMP-3 describes the quantitative mechanics the Companies applied to do so.

a. Monetization of Consequences – Attribute Dollar Equivalencies (RDF Row 6)

In monetizing all consequence attributes, the Phase 2 Decision provides the following guidance for valuing those attributes in dollars:

- **Safety Consequence Attribute**. Fatalities are to be valued on the basis of the Department of Transportation's (DOT) Value of Statistical Life (VSL); further, injuries of varying degrees are to be valued by attribution of the VSL according to the DOT's Maximum Abbreviated Injury Scale (MAIS).[20] As described in Chapter RAMP-3, and in accordance with D. 22-12-027 and D. 24-05-064, RDF Row 6, SoCalGas and SDG&E used the DOT VSL, adjusted as appropriate to reflect current dollars and their respective service territories. The Companies have also used an MAIS structure for injuries, based on data availability.[21]
- **Electric Reliability Consequence Attribute**. Electric outages are to be valued on the basis of the Lawrence Berkeley National Laboratory (LBNL) Interruption Cost Estimate (ICE) Calculator, which calculates a dollar value per Customer Minute of Interruption (CMI) based on inputs that include the duration and customer mix affected by the outage. SDG&E has used the CMI metric for

[19] D.18-12-014.

[20] D.22-12-027 at 63 (OP 2) (with a provision for justifying the use of an alternative VSL if applicable).

[21] D.22-12-027 at 35 ("We adopt Staff's recommendation to require a dollar valuation of the Safety Attribute in the Cost-Benefit Approach in the RDF using the DOT VSL as the standard value.").

Electric Reliability consequences and adopted the ICE calculator as the means of estimating those consequences, adapted to reflect its respective service territories, as described in Chapter RAMP-3.

- **Gas Reliability Consequence Attribute**. Gas outages are to be valued on the basis of the "implied" gas reliability dollar equivalency derived from the IOUs' previous RAMP filings' MAVF weights and ranges. SoCalGas and SDG&E have used this approach, applied to gas meters curtailed, as described in Chapter RAMP-3.

b. Risk Spend Efficiencies (RSE) replaced by Cost-Benefit Ratios (CBRs) (RDF Row 25)

SoCalGas's and SDG&E's 2021 RAMP Reports reported RSEs for mitigations. The Phase 2 Decision eliminated RSEs and required IOUs to report CBRs for mitigations.[22] SoCalGas and SDG&E have presented CBRs for all mitigations and, as discussed in Chapter RAMP-3, have included in this RAMP filing the numerous required permutations of CBRs.

The Commission also stated in the Phase 2 Decision that "we do not intend that the Cost-Benefit Ratios produced using this method must serve as the sole determinants of IOU proposals or Commission decisions on risk Mitigations,"[23] and further that "mitigation Cost-Benefit Ratio rankings need not be the only consideration in the utility's selection of Mitigations." [24] Accordingly, and consistent with SoCalGas's and SDG&E's multi-factor decision-making framework as referenced further in Chapter RAMP-2, SoCalGas and SDG&E have included, for certain risks and mitigations, a supplemental analysis of the pre- and post-mitigation estimated tail risk, described more fully in Chapter RAMP-3.

c. Use of Expected Value for Consequences in Calculating CBRs (RDF Row 24)

The Phase 2 Decision requires the expected value of consequences to be applied in the calculation of CBRs.[25] The CBRs presented by SoCalGas and SDG&E in their respective RAMP Reports reflect expected value, scaled as appropriate in accordance with Row 7 of the

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22 D.22-12-027, RDF Row 25.

23 D.22-12-027 at 26.

24 *Id.* at 59 (Finding of Fact (FOF) 7); *id.*, RDF Row 26.

25 *Id.*, RDF Row 24.

RDF (as discussed in Section D.2, *infra*). For information on how SDG&E addresses tail risk in its wildfire risk modeling, refer to Chapter SDG&E-Risk-4 Wildfire and PSPS.

2. Environmental and Social Justice (ESJ) Pilot Study

The Phase 2 Decision also directs the IOUs to develop and submit an ESJ Pilot Study along with their RAMP Reports, as described and summarized in Section VII. SoCalGas's and SDG&E's ESJ Pilot Studies are attached as Appendix 4 to their respective RAMP Reports.

D. Modifications Adopted in the Phase 3 Decision

On May 30, 2024, the Commission adopted significant additional changes to the RDF RAMP requirements by adopting the Phase 3 Decision. New provisions in the Phase 3 Decision include: requiring that utilities present CBRs for each general rate case post-test year and continue to use and test Transparency Pilot Guidelines in conjunction with RAMP; identifying as a "best practice" a methodology for determining tranches and a process for using an alternative methodology for determining tranches; identifying as a "best practice" the use of truncated power law distribution for modeling wildfire tail risk and a process for using other tail risk modeling approaches; in addition to numerous other technical requirements that will be described more fully within these Reports. The Phase 3 Decision modifications to the RDF are briefly summarized below.

1. Tranching (RDF Row 14)

The Phase 3 Decision modified Row 14 of the RDF to provide more specific guidance regarding the determination of "tranches" or subsegments of RAMP Risks, with the objective of "ensur[ing] the IOUs strategically reduce the most destructive and catastrophic risks that face Californians today and each successive year, so that the IOUs are always addressing the highest relative risks first."[26] This RAMP Report reflects a marked increase in the number, granularity, and specificity of tranches compared to the Companies' 2021 RAMP filings, in compliance with the guidance provided by the Commission in the Phase 3 Decision and RDF Row 14. SoCalGas's and SDG&E's HTM methodology for determining tranches is described in their

[26] D.24-05-064 at 28.

Alternative Tranching White Paper, served November 1, 2024[27] and attached hereto as Appendix 3.

A comparison of the number of tranches included in this RAMP Report relative to the 2021 RAMP filings is shown in the table below:

Table 3: RAMP Tranches Comparison

Company	RAMP Risk[28]	2021 Tranches	2025 Tranches
SoCalGas	Excavation Damage	1	49
SoCalGas	High Pressure Gas System	2	32
SoCalGas	Medium Pressure Gas System	1	67
SoCalGas	Underground Gas Storage	1	12
SoCalGas	Employee Safety	1	6
SoCalGas	Contractor Safety	1	5
SDG&E	Excavation Damage	1	32
SDG&E	High Pressure Gas System	2	23
SDG&E	Medium Pressure Gas System	1	47
SDG&E	Wildfire & PSPS	3	64
SDG&E	Electric Infrastructure Integrity	5	69
SDG&E	Employee Safety	1	7
SDG&E	Contractor Safety	1	5
SoCalGas/SDG&E	Cybersecurity	1	4

2. Risk Scaling (RDF Row 7)

The Phase 3 Decision modified RDF Row 7 to provide more guidance on the application of risk scaling (or "risk attitude"), clarifying the appropriateness of convexly non-linear risk scaling (*i.e.*, "risk averse"), while concavely non-linear risk scaling (*i.e.*, "risk seeking") is not appropriate. The Phase 3 Decision also clarified that, in the event an IOU uses tail risk in the determination of CBRs, it is required to also present the tail-risk derived CBRs unscaled.[29] SoCalGas's and SDG&E's CBRs are presented on the basis of expected value CoRE, adjusted

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[27] SoCalGas's and SDG&E's development of a tranching methodology and service of the White Paper was done in accordance with the guidance provided in the Phase 3 Decision. *See, e.g.,* D.22-12-027 at 27, 31, 32-33 at Row 14.

[28] Changes made between the 2021 RAMP and this RAMP to the name and/or scope of risks is discussed in Chapter RAMP-2.

[29] D.24-05-064 at 98.

by application of a convexly non-linear scaling function. A detailed description of the methodology SoCalGas and SDG&E applied to risk scaling is contained in Chapter RAMP-3. Risk scaling is applied consistently across all RAMP risks and the scaling factors are based on multiple, independent, and peer-reviewed studies of societal risk aversion.

A summary of the unscaled ("risk neutral") and scaled ("risk averse") pre-mitigated risk for each of the RAMP Risks in this filing is shown below:

Table 4: Scaled and Unscaled RAMP Risks
(Direct, in 2024 $millions)

Company	RAMP Risk	Unscaled Risk Value	Scaled Risk Value
SoCalGas	Excavation Damage	35.31	69.29
SoCalGas	High Pressure Gas System	44.85	183.98
SoCalGas	Medium Pressure Gas System	113.34	115.90
SoCalGas	Underground Gas Storage	13.33	56.08
SoCalGas	Employee Safety	23.61	26.01
SoCalGas	Contractor Safety	12.73	13.86
SDG&E	Excavation Damage	3.85	6.83
SDG&E	High Pressure Gas System	3.58	15.11
SDG&E	Medium Pressure Gas System	8.67	8.97
SDG&E	Wildfire and PSPS	476.41	3,020.61
SDG&E	Electric Infrastructure Integrity	398.05	398.05
SDG&E	Employee Safety	10.90	11.16
SDG&E	Contractor Safety	14.56	14.56
SoCalGas/SDG&E	Cybersecurity	163.36	1,904.22

3. Forecasting Period Extended to 2031

Pursuant to the Phase 3 Decision, all control and mitigation programs must include CBRs in each of the GRC post-test years (PTY), as well as an aggregate CBR for the entire PTY period and the entire GRC cycle, by tranche. SoCalGas and SDG&E's next GRC cycle will have a test year of 2028 and post-test years of 2029, 2030, and 2031. Consistent with the Phase 3 Decision, the Companies have provided CBRs for the PTY period for all control and mitigation programs, as well as aggregate CBRs. Because CBRs depend on reporting risks in monetized terms (*i.e.*, dollars), SoCalGas and SDG&E estimated costs for the activities presented in RAMP over a seven-year forward-looking period (2025-2031).

The Commission has recognized that there is an "attendant widening of 'forecast error'"[30] as forecasts are required further into the future. While SoCalGas and SDG&E provide forecasts through 2031 in these RAMP Reports, updated costs and forecasts will be presented in SoCalGas's and SDG&E's respective GRC applications.

4. Discount Rates (RDF Row 25)

The Phase 3 Decision modified RDF Row 25 to require that CBRs be calculated three ways, each using a different discount factor scenario. These scenarios include the Weighted Average Cost of Capital (WACC) discount rate for all CoRE attributes and costs, the Societal discount rate for all CoRE attributes and costs, and a hybrid scenario, where the Safety and Reliability CoRE attributes are discounted using a Hybrid rate, while the Financial CoRE attribute and the costs are discounted using the WACC rate.[31]

Table 5 shows the three discount rates for SoCalGas and SDG&E, respectively:

Table 5: Discount Factors Applied to the 2025 RAMP

	SoCalGas	SDG&E
Weighted Average Cost of Capital (WACC)[32]	7.49%	7.45%
Social Discount Rate	2%	2%
Hybrid rate calculated as defined in Phase 3[33]	6.1%	6.1%

SoCalGas and SDG&E have provided the requisite three CBRs in accordance with the modified RDF Row 25 requirement for each mitigation in this Report. The applicability of the discounted CBRs in the Companies' decision-making is discussed for each risk in the risk chapters. In those chapters, the Companies also discuss alternative discount rate scenarios presented, as appropriate, if better reflective of the Companies' risk-informed decision-making.

V. CONTINUOUS IMPROVEMENT AND LESSONS LEARNED

In addition to implementing the changes required in recent Risk OIR decisions (D.21-11-009, D.22-10-002, the Phase 2 Decision, and the Phase 3 Decision), the 2025 RAMP Reports

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30 D.20-01-002 at 36.

31 D.24-05-064 at 102-105.

32 Sempra, *2024 Annual Report – Powering Potential* (March 2025) at F-59, *available at:* https://investor.sempra.com/static-files/42894eb7-9d54-409c-982d-c8fd4465538d.

33 D.24-05-064 at 103.

also reflect improvements and lessons learned from SoCalGas's and SDG&E's 2021 RAMP Reports. SoCalGas and SDG&E have considered comments and suggestions received by intervenors[34] to further improve upon and enhance their RAMP Reports. Examples of such improvements are provided below.

A. Removal of Stakeholder Satisfaction Attribute

The consequences considered in the former MAVF included stakeholder satisfaction to capture the consequential impacts of a risk event on five key stakeholders: customers, employees, public, government, and regulators. In accordance with feedback received from SPD and intervenors on the 2021 RAMP filings, the quantification of such consequences has been removed.[35]

B. Cross-Functional Factors

In the 2021 RAMP Reports, SoCalGas and SDG&E presented cross-functional factor (CFF) volumes, which provided additional information regarding safety-related initiatives that impacted the enterprise or were associated with more than one RAMP risk. In this RAMP, SoCalGas and SDG&E opted not to present a CFF volume (in part due to SPD criticism of the approach),[36] but instead focus on key safety risks pursuant to Commission decisions.

C. Climate Change Adaptation

SoCalGas and SDG&E recognize that climate change is driving an increased need for energy resilience in California. SoCalGas's and SDG&E's respective adaptation, assessment, and commitment to meet the challenges posed by climate change is discussed in Chapter RAMP-5.[37] That chapter describes: Climate Hazards as required by the Phase 3 Decision;[38] key results

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[34] Comments considered include those made by intervenors in the Companies prior RAMP and GRC cycle, as well as comments received during the Companies' pre-filing workshop for the 2025 RAMP.

[35] *See* A.21-05-011/-014 (cons.), SPD Staff Evaluation Report on SDG&E's and SoCalGas's RAMP Application Reports (SPD Report on the 2021 RAMP) at 205 (November 5, 2021) ("The new Stakeholder Satisfaction attribute should be removed from the MAVF until the identified shortcomings have been addressed.").

[36] *See, e.g.,* A.21-05-011/-014 (cons.), SPD Report on the 2021 RAMP at 205 ("Cross-Functional Factor chapters do not quantify the expected benefits of mitigation programs.").

[37] SoCalGas's and SDG&E's 2021 RAMP Reports presented CFF volumes addressing energy system resilience and climate change adaptation.

[38] D.24-05-064 at 124 (OP 3(b)).

from SoCalGas's and SDG&E's respective Climate Adaptation Vulnerability Assessments (CAVA); how the effects of climate change can potentially be addressed through adaptive actions; and how these actions may impact certain RAMP risks.

D. Cost Information and Striving for Consistency

To develop their 2025 RAMP presentation, SoCalGas and SDG&E built a module within their General Rate Case Integrated Database (GRID) that is similar to the system used for producing GRC workpapers and tables. SoCalGas and SDG&E designed the GRID database for the specific purpose of meeting the data requirements of the Rate Case Plan and to help efficiently manage the data and data outputs. The development and consistent presentation of the GRC forecasts and workpapers is heavily dependent on the use of this GRID application.[39]

For the TY 2028 GRC cycle, the Commission requires that the Companies must "explicitly map costs and comments between the RAMP and GRC filings. The cost mapping must identify expenses as either capital or operating expenses."[40] Thus, for the first time in the 2025 RAMP Reports, SoCalGas and SDG&E are using GRID to systematically map historical costs to the appropriate control or mitigation. The use of GRID to develop SoCalGas's and SDG&E's RAMP Reports is intended to support consistent mapping of costs between the 2025 RAMP and the 2028 GRC, whenever feasible. Using GRID for RAMP reporting also reduces the manual input of data, so that costs can be accurately mapped and integrated to build a reliable and consistent framework for the GRC.

E. Summary of Workshop Input

While developing their RAMP Reports, SoCalGas and SDG&E met with stakeholders and held a virtual public workshop on December 17, 2024, to provide interested parties an overview of the anticipated RAMP Reports, including the list of risks under consideration for inclusion in the RAMP, and to gather feedback from stakeholders. The list of RAMP risks was subject to discussion and party feedback and helped SoCalGas and SDG&E finalize the list of risks included in their Reports. Most notable of the feedback was the suggestion that although it was not in the top 40% of SoCalGas's Enterprise Risk Registry (ERR) risks,[41] the Underground

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[39] SoCalGas and SDG&E first used GRID for the TY 2012 GRC and subsequently used GRID in the TY 2016, TY 2019, and TY 2024 GRCs.

[40] D.22-10-002 at Appendix A, A-1.

[41] As determined by D.24-05-064, RDF Row 9.

Storage risk is of interest to stakeholders and is therefore included in the final list. The workshop also included discussion of SoCalGas and SDG&E's HTM tranching methodology, which was described in a whitepaper served on November 1, 2024.[42] SoCalGas and SDG&E provided a comparison of the Phase 3 Decision's tranching methodology with HTM, which generated a very robust discussion; however, no party expressed a preference for one methodology over the other.

VI. RISK CHAPTER ORGANIZATION

In each individual risk chapter, the Companies describe the existing controls and new and/or incremental planned mitigations for each risk, presenting at least two alternative mitigation plans for each risk. SoCalGas and SDG&E present the following sections in each risk chapter:

1. Introduction – This section includes an overview of the risk definition and scope.
2. Risk Assessment – In accordance with the RDF, this section describes the risk score, risk bow tie (*i.e.*, possible drivers/triggers, and potential consequences of each identified risk), as well as the process for tranching assets into similar groups of assets. This section also includes tables summarizing the costs, units, and CBRs for mitigations included in the risk and control mitigation plan.
3. 2024 – 2031 Control and Mitigation Plan – This section identifies and describes the controls and mitigations comprising the portfolio of mitigations for each risk and reflects any changes to the portfolio expected to occur from the last year of recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031).
4. Alternative Mitigations – This section presents at least two alternative mitigation plans considered as part of the risk assessment process.
5. Historical Graphics[43] – This section illustrates safety work accomplishments and safety risk mitigation progress over the two immediately preceding RAMP cycles.

VII. ENVIRONMENTAL AND SOCIAL JUSTICE PILOT STUDY OVERVIEW

As directed in the Phase 2 Decision, SoCalGas and SDG&E have each developed an ESJ Pilot Study. In Appendix 4 of each RAMP Report, SoCalGas and SDG&E present their

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[42] The White Paper was served at least 45 days prior to the workshop, as directed by the Commission in D.24-05-064. SoCalGas and SDG&E's alternative tranching methodology is further discussed in Chapter RAMP-3.

[43] D.22-10-002, Appendix C at C3.

respective ESJ Pilot Study addressing the following seven action items from the Phase 2 Decision.[44]

- Action Item 1: Consider equity in the evaluation of consequences and risk mitigation within the Risk-Based Decision-Making Framework, using the most current version of CalEnviroScreen to better understand how risks may disproportionately impact some communities more than others;
- Action Item 2: Consider investments in clean energy resources in the RDF, as possible means to improve safety and reliability and mitigate risks in Disadvantaged and Vulnerable Communities (DVC);
- Action Item 3: Consider mitigations that improve local air quality and public health in the RDF, including supporting data collection efforts associated with Assembly Bill 617 regarding community air protection program;
- Action Item 4: Evaluate how the selection of proposed mitigations in the RDF may impact climate resiliency in DVCs;
- Action Item 5: Evaluate if estimated impacts of wildfire smoke included in the RDF disproportionately impact DVCs;[45]
- Action Item 6: Estimate the extent to which risk mitigation investments included in the RDF impact and benefit DVCs independently and in relation to non-DVCs in the IOU service territory; and
- Action Item #7: Enhance outreach and public participation opportunities for DVCs to meaningfully participate in risk mitigation and climate adaptation activities consistent with D.20-08-046.

The goal of the ESJ Pilot Study was to evaluate the impact of selected risks and mitigation activities on DVCs and how that compares to non-DVC areas. This study examined disparities in safety, reliability, and climate resilience between DVCs and non-DVCs, including the effects of the evaluated mitigation efforts. For Action Items 1, 4 and 6, SoCalGas elected to utilize the data available for its Medium Pressure Gas System and Excavation Damage risks, overlaying it on the CalEnviroScreen 4.0 at the census tract level to better understand these

[44] D.22-12-027 at 65-67 (OP 5).

[45] This action item does not apply to SoCalGas, as a natural gas utility.

impacts. Similarly, SDG&E focused on the Wildfire and PSPS risk and Electric Infrastructure Integrity risk.

VIII. CONCLUSION

In summary, the RAMP Reports provide information regarding how SoCalGas and SDG&E think about, plan for, and mitigate identified key safety risks, and present these key safety risks in compliance with the directives in the RDF. The RAMP Reports will inform the safety-related funding requests that the Companies will include in their respective TY 2028 GRC applications, currently anticipated to be filed in May 2026.



2025 Risk Assessment Mitigation Phase

(Chapter RAMP-2)

Enterprise Risk Management Framework

(Joint SoCalGas/SDG&E)

May 15, 2025

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CHAPTER RAMP-2: ENTERPRISE RISK MANAGEMENT FRAMEWORK

I. INTRODUCTION

SoCalGas and SDG&E's risk-based decision-making is guided foremost by an unwavering commitment to delivering safe and reliable energy to customers at a reasonable cost.[1] This includes the prevention of catastrophic, loss-of-life events, protracted service interruptions, and the associated financial losses to customers and the public that may stem from such events. SoCalGas and SDG&E's ERM frameworks, including ERM governance, processes, data, and tools, are designed to advance those objectives. These objectives and practices are also consistent with the CPUC's requirements in the Risk-Based Decision-Making Framework (RDF) to prioritize safety, consistent with California Public Utility Code section 451 requirements. SoCalGas and SDG&E further recognize that the risk landscape is increasingly dynamic and evolving. This demands that risk assessments and mitigation strategies remain nimble and adaptable.

This chapter provides an overview of SoCalGas and SDG&E's approach to risk management, ERM frameworks, and ongoing advancements to align risk, asset, and investment management over this and future GRC cycles. Consistent with the requirements of the RDF,[2] this chapter also identifies changes to the Enterprise Risk Registry (ERR) from the previous 2021 RAMP Report and the Test Year (TY) 2024 GRC filing.

II. SOCALGAS AND SDG&E'S RISK MANAGEMENT PHILOSOPHY AND OBJECTIVES

SoCalGas and SDG&E's risk management decision-making incorporates the selection of cost-effective means of reducing: (i) the occurrence and/or consequences of risk events (including catastrophic events), (ii) prioritizing investments that address the highest relative risks,[3] (iii) maintaining compliance with applicable laws and regulations (such as PHMSA's gas pipeline Integrity Management Program requirements, as well as from the Occupational Safety and Health Administration (OSHA), the North American Electric Reliability Corporation's Critical Infrastructure Protection (NERC CIP), the Federal Energy Regulatory Commission

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1 *See* ISO 31000 at 2.

2 D.24-05-064, RDF Row 8.

3 D.24-05-064 at 29.

(FERC), the California Independent System Operator (CA-ISO), the Environmental Protection Agency (EPA), and the Department of Transportation (DOT)), and (iv) other factors.

The Commission's RDF has evolved significantly since the 2021 RAMP, as discussed in Chapter RAMP-1. This includes voluminous data analyses required to comply with new RDF guidelines, including numerous required permutations of Cost-Benefit Ratios (CBRs).[4] As described more fully in Chapter RAMP-3: Risk Quantification Framework, the Companies have included, for certain risks and mitigations, a supplemental analysis of the pre- and post-mitigation estimated tail risk to align with SoCalGas and SDG&E's continued pursuit to reduce the likelihood of catastrophic events. SoCalGas and SDG&E recognize the importance of using increasingly quantitative models to inform risk and mitigation analysis, but also believe it is important to place these analyses in the broader context of prudent utility management, which reviews and weighs a number of factors beyond the three quantified under the RDF—safety, reliability, and financial— when making determinations.[5]

III. ENTERPRISE RISK MANAGEMENT FRAMEWORK

SoCalGas's and SDG&E's ERM frameworks are modeled after ISO 31000 and designed to identify, assess, respond to, and report on key enterprise risks. These frameworks consist of an ERM governance structure to define the ERM-related roles and responsibilities of employees at various levels up to SoCalGas's and SDG&E's respective Boards of Directors, in addition to risk processes and tools. SoCalGas's and SDG&E's respective risk management teams work closely with senior leadership, management, and employees to proactively identify threats and opportunities, align risk exposure to organizational priorities, drive risk-informed business decisions and resource allocation, and monitor identified risks and mitigation plans to foster continuous improvement. This comprehensive approach to enterprise risk management supports and informs the Commission's RDF.

SoCalGas and SDG&E each follow a process, by which SoCalGas and SDG&E identify, manage, and mitigate enterprise risks while aiming to provide consistent, transparent, and

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[4] CBRs state the relative cost-effectiveness of mitigations on the basis of the Expected Value of risk reduction, however CBRs alone do not provide insight as to the reduction of catastrophic risk events, nor do they provide insight as to whether mitigations are substitutes of other mitigations addressing the same risk allowing them to be compared directly.

[5] Examples of additional factors taken into consideration include, but are not limited to, environmental, community, and operational impacts.

repeatable results.[6] This process aligns with the evaluation method adopted by the Commission in 2016 "as a common yardstick for evaluating maturity, robustness, and thoroughness of utility Risk Assessment and Mitigation models and risk management frameworks."[7] Given that risks are dynamic, SoCalGas and SDG&E perform their ERM processes annually, resulting in a refreshed ERR each year that evaluates the identified enterprise-level risks and considers evolving risk conditions and emerging risks.

IV. CONTINUOUS IMPROVEMENT OF RISK MANAGEMENT PRACTICES

As discussed in Chapter RAMP-4: Safety Culture, SoCalGas and SDG&E both implement comprehensive Safety Management Systems (SMS) to continually enhance the safety of their operations, strengthen safety culture, and improve overall safety performance. Continuous improvement is a foundational value of both the SMS and ERM frameworks. To continuously identify improvement opportunities, SoCalGas and SDG&E leadership, risk owners, risk managers, and the risk management teams monitor dynamic risk conditions and risk management developments in the industry, consider feedback and input from internal and external subject matter experts and stakeholders, and evaluate the effectiveness of the Companies' overall risk management frameworks and the effectiveness of risk management plans and activities.

SoCalGas and SDG&E both continue to expand the use of metrics to inform risk-based decision-making, including asset performance and other risk metrics that inform and demonstrate progress related to planned investments. The Commission in D.19-04-020 and D.21-11-009 approved and mandated annual reporting of safety performance metrics, which began in March 2020 and is ongoing.

Further, both SoCalGas and SDG&E utilize Copperleaf Portfolio, an enterprise-wide risk-informed investment decision-support system that integrates safety, risk, and asset management data to support strategic and risk-informed capital investment decisions. SoCalGas and SDG&E aim to enhance the Copperleaf system and expand it to include multi-year scenario analyses. This will support long-term sustainability and safety by aligning risks with asset and

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[6] The six-step process was discussed in SoCalGas's and SDG&E's Risk Policy testimonies served in the Companies' last GRC. *See* 2024 GRC, Direct Testimony of SoCalGas witness Deana M. Ng (Exhibit (Ex.) SCG-03: Chapter 1) and 2024 GRC, Direct Testimony of SDG&E witness Michael M. Schneider (Ex. SDG&E-03: Chapter 1).

[7] D.16-08-018 at 195 (Ordering Paragraph (OP) 4).

capital investment management, and integrating SMS activities, wildfire risk (SDG&E), and emergency management mitigation actions.

For the 2025 RAMP, SoCalGas and SDG&E have also made significant advancements in their data science capabilities through the adoption of Python, MathWorks MATLAB, and Microsoft Structured Query Language (MS SQL) databases to perform detailed risk assessments. These tools enhance their modeling, simulation, and Quantitative Risk Assessment (QRA) capabilities enabling potentially greater accuracy. Python and MATLAB provide robust computational power and flexibility for complex analyses, while MS SQL databases promote efficient data management and retrieval. This integrated approach improves the reliability of risk models, streamlines workflows, and enhances scalability.

SoCalGas and SDG&E also communicate regularly with risk management representatives at Pacific Gas and Electric Company, Southern California Edison Company, and industry consortia groups such as the Edison Electric Institute and the American Gas Association to discuss and share best practices, address trends and emerging issues, and to improve risk management practices.

V. SELECTION OF RAMP RISKS

As discussed above, SoCalGas's and SDG&E's ERM processes result in an updated ERR each year. For this Report, using the updated Risk Quantification Framework described in Chapter RAMP-3: Risk Quantification Framework, SoCalGas and SDG&E scored each of the 2024 ERR risks utilizing the safety attribute only and sorted the risks in descending order by the monetized safety risk score. For the top 40% of ERR risks with a monetized safety risk score greater than zero, SoCalGas and SDG&E then calculated a risk score using all attributes in the RDF (*i.e.*, in addition to the safety attribute). The Companies reviewed the outputs of this process and developed a preliminary list of RAMP risks, based on the initial monetized safety risk scores and other discretionary enterprise risks that are determined to be top priorities. This list was presented at a pre-filing workshop[8] held on December 17, 2024, as discussed in Chapter RAMP-1: Overview. After careful consideration and based on the input received from the

[8] D.24-05-064, RDF Row 12.

Commission's Safety Policy Division (SPD) and other interested parties, the RAMP risk list was finalized as presented with the addition of Underground Gas Storage Risk (SoCalGas only).[9]

A. Evolution of Risks between the ERR and RAMP

The RDF OIR Phase 3 Decision requires that RAMP Reports highlight changes to the ERR from previous RAMP or GRC filings.[10] Pursuant to this requirement, Tables 1 and 2 provide comparisons of the risks in this 2025 RAMP Report with those that were presented in SoCalGas's and SDG&E's respective 2021 RAMP Reports and their 2024 ERRs and include changes made to the scope and naming conventions.

Table 1: Comparison of SoCalGas's 2025 RAMP Risks and 2024 ERR to the 2021 RAMP Risks

2025 RAMP Risks	2024 ERR	2021 RAMP Risks
Excavation Damage	Excavation Damage	Excavation Damage (Dig-In) on the Gas System
High Pressure Gas System	High Pressure Gas System	Incident Related to the High-Pressure System (Excluding Dig-In)
Medium Pressure Gas System	Medium Pressure Gas System	Incident Related to the Medium Pressure System (Excluding Dig-In)
Underground Gas Storage	Underground Gas Storage	Incident Related to the Storage System (Excluding Dig-in)
Employee Safety	Employee Safety	Incident Involving an Employee
Contractor Safety	Contractor Safety	Incident Involving a Contractor
Cybersecurity	Cybersecurity	Cybersecurity
	Asset Records Management	
	Beyond the Meter	
	Energy Resiliency – Climate Change	
	Energy Resiliency – Energy Transition	
	Energy Supply	
	Physical Security	
	Seismic Activity	
	Technology Recovery & Resiliency	

[9] SDG&E does not have any underground gas storage facilities within its service territory.

[10] D.24-05-064, RDF Row 8.

The following describes the changes, if any, in scope related to SoCalGas's 2025 RAMP risks as listed in Table 1 above. If not identified below, the risk definition has either remained unchanged, such as the Cybersecurity risk, or the risk has not had a material scope change, even where the name of the risk may have changed, such as the Contractor Safety risk.

- **High Pressure Gas System:** The name of this risk was changed in the 2024 ERR and 2025 RAMP. The risk scope was also refined in the 2025 RAMP to reflect the inclusion of aboveground storage assets and their respective controls.
- **Medium Pressure Gas System***:* The name and scope of this risk have changed from the 2021 RAMP to the 2024 ERR and 2025 RAMP. In the 2021 RAMP this risk included risks associated with medium pressure infrastructure both before the meter and after the meter. For the 2024 ERR and the 2025 RAMP, SoCalGas assessed these risks separately as Medium Pressure Gas System (defined as up to the meter) and Beyond the Meter (defined as after the meter), respectively. Beyond the Meter as a standalone risk, did not meet the 40% safety assessment threshold to merit being included in the 2025 RAMP.
- **Underground Gas Storage***:* The name of this risk has changed from the 2021 RAMP to the 2024 ERR and 2025 RAMP. The scope was also refined to reflect that this risk solely addresses underground storage assets and their respective controls.

Table 2: Comparison of SDG&E's 2021 RAMP Risks and 2024 ERR to the 2025 RAMP Risks

2025 RAMP Risks	2024 ERR	2021 RAMP Risks
Excavation Damage	Excavation Damage	Excavation Damage (Dig-In) on the Gas System
High-Pressure Gas System	Incident Related to the High-Pressure Gas System (Excluding Dig-In)	Incident Related to the High-Pressure System (Excluding Dig-In)
Medium-Pressure Gas System	Incident Related to the Medium-Pressure Gas System (Excluding Dig-In)	Incident Related to the Medium Pressure System (Excluding Dig-In)
Wildfires and Public Safety Power Shutoff (PSPS)	Wildfires involving SDG&E Equipment (including Third Party Pole Attachments)	Wildfires Involving SDG&E Equipment (including Third Party Pole Attachments)
Electric Infrastructure Integrity	Electric Infrastructure Integrity	Electric Infrastructure Integrity

2025 RAMP Risks	2024 ERR	2021 RAMP Risks
	Customer & Public Safety – Contact with Electric Equipment	Customer & Public Safety – Contact with Electric Equipment
Employee Safety	Employee Safety	Incident Involving an Employee
	Motor Vehicle Incident	
	Workplace Violence	
Contractor Safety	Contractor Safety	Incident Involving a Contractor
Cybersecurity	Cybersecurity	Cybersecurity
	Aviation Incident	
	Capacity Restrictions or Disruptions to the Natural Gas Transmission System	
	Consumer Privacy	
	Contracted Supplier Risk	
	Customer & Public Safety – After Meter Gas Incident	
	Electric Grid Failure and Restoration Blackout/Failure to Black Start)	
	Environmental Compliance	
	Inability to Recover Technology and Applications	
	Insufficient Supply to the Natural Gas Transmission System	
	Lack of IT Resiliency	
	Massive Smart Meter Outage	
	Physical Security of Critical Electric Infrastructure	

The following details the changes, if any, in scope related to SDG&E's 2025 RAMP risks as listed in Table 1 above. If not identified below, the risk has either remained unchanged, such as the Cybersecurity risk, or the risk has not had a scope change, even where the name of the risk may have changed, such as the Contractor Safety risk.

- **Medium-Pressure Gas System:** The name of this risk has changed in the 2025 RAMP. In the 2021 RAMP this risk was a consolidation of two ERR risks:

(a) Incident Related to the Gas Distribution System (Excluding Dig-In), and (b) Customer & Public Safety – After Meter Gas Incident. For the 2025 RAMP, SDG&E chose not to consolidate these risks. The Customer & Public Safety – After Meter Gas Incident is a standalone ERR risk, as noted in the above table, and it did not meet the 40% safety assessment threshold to merit being included in the 2025 RAMP.

- **Wildfire and Public Safety Power Shutoff (PSPS):** The name and scope of this risk have changed from the 2021 RAMP. The term "Public Safety Power Shutoff (PSPS)" has been added to reflect the identification and assessment of PSPS as a risk[11] in addition to being a wildfire mitigation implemented by SDG&E during fire weather conditions. The specific details regarding the scope of PSPS are included in the Wildfire and PSPS chapter.
- **Electric Infrastructure Integrity**: The scope of this risk has changed from the 2021 RAMP to the 2025 RAMP to include the Customer & Public Safety – Contact with Electric Equipment risk. In the 2021 RAMP, Customer & Public Safety – Contact with Electric Equipment was presented as a separate risk chapter.
- **Employee Safety:** The name of this risk has changed from the 2021 RAMP to the 2025 RAMP. In addition, the scope of this risk has been expanded to include the Motor Vehicle Incident ERR risk as well as the Workplace Violence ERR risk. The Motor Vehicle Incident risk is a new addition to the ERR since the 2021 ERR. It was considered a Driver/Trigger in the 2021 RAMP.

[11] D.21-11-009 at 142 (OP 1(h)).



2025 Risk Assessment Mitigation Phase

(Chapter RAMP-3)

Risk Quantification Framework

May 15, 2025

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CHAPTER RAMP-3: RISK QUANTIFICATION FRAMEWORK

I. INTRODUCTION

SoCalGas and SDG&E's risk quantification framework described in this chapter is designed to comply with the Commission's Risk-Based Decision-Making Framework (RDF). Chapter RAMP-1: Overview describes the procedural history of the RDF, including four decisions issued since the Companies filed their 2021 RAMP Applications and Reports – D.21-11-009, D.22-10-002, D.22-12-027 (Phase 2 Decision), and D.24-05-064 (Phase 3 Decision) – which substantially modified the RDF and adopted new regulations governing RAMP submissions.[1] The Companies' 2021 RAMP Reports implemented a Multi-Attribute Value Function (MAVF) methodology set forth in D.18-12-014. The Phase 2 Decision superseded D.18-12-014 and replaced the MAVF methodology with a Cost-Benefit Approach (CBA), which was further modified in the Phase 3 Decision and is implemented in the Companies' 2025 RAMP Reports.

SoCalGas and SDG&E's risk quantification framework accounts for applicable laws related to public safety and reliability, while building upon such requirements consistent with SoCalGas's and SDG&E's dedication to continuous improvement. The RDF has substantially increased in complexity since the Companies filed their 2021 RAMP Reports, and SoCalGas and SDG&E have evolved their data management and analytical capabilities to meet these expanded requirements.

Chapter RAMP-3 describes the components, methods, and sequencing of the quantitative framework adopted by SoCalGas and SDG&E in accordance with the following steps of the RDF:

- Step 1A: Building a Cost-Benefit Approach;
- Step 1B: Identifying Risks for the Enterprise Risk Register;
- Step 2A: Risk Assessment and Risk Ranking in Preparation for RAMP;
- Step 2B: Selecting Enterprise Risks for RAMP; and
- Step 3: Mitigation Analysis for Risks in RAMP.

[1] Chapter RAMP-1: Overview more fully describes the procedural history of the RDF Framework, as established in Decision (D.) 14-12-025, D.16-08-018, D.18-12-014, D.20-01-002, D.21-11-009, D.22-10-002, D.22-12-027, and D.24-05-064.

The above process was used for each risk in the 2025 RAMP Reports and serves as the outline for this chapter.

The RDF incorporates various prescriptive approaches to risk and mitigation quantification, including multiple permutations of Cost-Benefit Ratios (CBRs).[2] In adopting a CBA, the Commission acknowledged that CBRs are not intended to "serve as the sole determinants of [utility] proposals or Commission decisions on risk Mitigations."[3] Instead, the Commission retained language from prior decisions explaining that a utility is not bound to select a mitigation strategy based solely on the CBRs produced under the CBA:

> In the RAMP and GRC, the utility will clearly and transparently explain its rationale for selecting Mitigations for each risk and for its selection of its overall portfolio of Mitigations. […] Mitigation selection can be influenced by other factors including, but not limited to, funding, labor resources, technology, planning and construction lead time, compliance requirements, Risk Tolerance thresholds, operational and execution considerations, and modeling limitations and/or uncertainties affecting the analysis. In the GRC, the utility will explain whether and how any such factors affected the utility's Mitigation selections.[4]

Addressing each risk thus requires a thoughtful, proactive approach that extends beyond standard quantification methods that merely consider the expected outcome of a risk event.

During preparation of the 2025 RAMP Reports, certain issues have been under consideration in Phase 4 of the Commission's Risk OIR.[5] For example, risk tolerance, which is the level of residual risk one is willing to accept, is currently under consideration in Phase 4. Accordingly, the Companies have not incorporated risk tolerance in their 2025 RAMP Reports but reserve the right to incorporate risk tolerance in future proceedings.

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2 *See, e.g.,* D.24-05-064 at Appendix A. For example, Row 25 of the RDF provides a highly specified process for calculating CBRs, including the requirement to provide three specified discount rate scenarios. *Id.* at A-15. Rows 14 and 16 of the RDF extend the CBR requirement to provide such calculations at the tranche level. *Id.* at A-13, A-14. Row 26 of the RDF requires a presentation of CBR calculations for each GRC post-test year. *Id.* at A-17.

3 D.22-12-027 at 26.

4 *Id.* at 26-27; *see also, id.* at 56 (Finding of Fact (FOF) 11) (*citing* RDF Row 26).

5 *See* R.20-07-013 (the Risk OIR), Assigned Commissioner's Phase 4 Scoping Memo and Ruling (September 13, 2024) at 2-3.

II. STEP 1A: BUILDING A COST BENEFIT APPROACH

A. CoRE Attributes

Rows 2 through 6 of the RDF's "Step 1A – Building a Cost-Benefit Approach," shown in Table 1 below, describe the determination of attributes for the quantitative framework.[6]

Table 1: Rows 2-7 of the RDF

#	RDF Element Name	Element Description & Requirements
2	Cost-Benefit Approach Principle 1 – Attribute Hierarchy	Attributes are evaluated together as a hierarchy, such that the primary Attributes are typically labels or categories and the sub-Attributes are observable and measurable.
3	Cost-Benefit Approach Principle 2 – Measured Observations	Each sub-Attribute has Levels expressed in Natural Units that are observable during ordinary operations and as a Consequence of the occurrence of a Risk Event.
4	Cost-Benefit Approach Principle 3 – Comparison	Use a measurable proxy for an Attribute that is logically necessary but not directly measurable. This principle only applies when a necessary Attribute is not directly measurable. For example, a measure of the number of complaints about service received can be used as a proxy for customer satisfaction.
5	Cost-Benefit Approach Principle 4 – Risk Assessment	When Attribute Levels that result from the occurrence of a Risk Event are uncertain, assess the uncertainty in the Attribute Levels by using expected value or percentiles, or by specifying well-defined probability distributions, from which expected values and tail values can be determined. Monte Carlo simulations or other similar simulations (including calibrated subject expertise modeling), among other tools, may be used to satisfy this principle.
6	Cost-Benefit Approach Principle 5 – Risk Assessment	Apply a monetized value to the Levels of each of the Attributes using a standard set of parameters or formulas, from other government agencies or industry sources, as determined by the Phase II Decision Adopting Modifications to the Risk-Based Decision-Making Framework Adopted in D.18-12-014 and Directing Environmental and Social Justice Pilots in Rulemaking (R.) 20-07-013. A utility may deviate from the agreed upon standard set

[6] While *Step 1A – Building a Cost Benefit Approach* of Appendix A has further elements, only the most pertinent elements are shown here.

#	RDF Element Name	Element Description & Requirements
		of parameters or formulas by submitting a detailed explanation as to why the use of a different value would be more appropriate. The use of a different set of parameters or formulas to determine the Monetized Levels of Attributes requires an analysis comparing the results of its "equivalent or better" set of parameters or formulas against the results of the agreed upon standard set of parameters or formulas.

SoCalGas and SDG&E comply with these elements by assessing the Consequence of Risk Event (CoRE) attributes shown in Table 2.

Table 2: CoRE Attributes by Company

Attribute	SDG&E	SCG
Safety	✓	✓
Electric Reliability	✓	
Gas Reliability	✓	✓
Financial	✓	✓

The attributes and their respective sub-attributes and monetized values are summarized in Table 3, and their determination is explained in the subsequent sections. While these attributes and sub-attributes serve as the general approach to consequence valuation, consequence modeling for particular risks is augmented to include risk-specific modeling consequences. This augmentation is further described below in Section VI.C.2: Consequence Modeling for Certain Risks.

Table 3: CoRE Attributes and Monetized Values (Direct, in 2024 $)

Attributes	Sub-Attributes	Monetized Value[7]
Safety	Fatality	$16.2 million per fatality
Electric Reliability (SDG&E Only)	Customer Minute Interrupted[8]	$3.76 per CMI
Gas Reliability	Gas Meter Outage	$3,868.79 per gas meter experiencing outage
Financial	US Dollar	$1

B. Valuing the CoRE Safety Attribute

The CoRE Safety Attribute estimates human injuries and fatalities resulting from a risk event. In determining the CoRE values – both Pre-Mitigation CoRE in accordance with RDF Row 18 (which, in turn, feeds into Pre-Mitigation Risk Value per RDF Row 19), and Post-Mitigation CoRE in accordance with RDF Row 21 (which, in turn, feeds into Post-Mitigation Monetized Risk Value per RDF Row 22) – are determined for each risk in this RAMP filing for which Safety is relevant. The Safety CoRE estimates the potential for a risk event to result in human injuries or fatalities. In turn, a mitigation's benefits for the Safety CoRE reflect the degree to which the mitigation is estimated to reduce the magnitude of those injuries or fatalities.

In accordance with D.24-05-064, RDF Row 6 guidance for monetized levels of attributes, SoCalGas and SDG&E use a California-adjusted VSL (VSL-CA) of $16.2 million for calculating the Safety Attribute CoRE. This value is derived by replicating the Department of Transportation's (DOT) methodology[9] as applied beginning from the 2012 DOT VSL of $9.1 million and extrapolating that methodology to 2024, with adjustments for California.

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7 Monetized values were developed using the latest available data; through year-end 2024.

8 Customer Minute of Interruption, a standard measure for electric outages.

9 DOT, *Departmental Guidance – Treatment of the Value of Preventing Fatalities and Injuries in Preparing Economic Analyses* (March 2021), *available at:* https://www.transportation.gov/sites/dot.gov/files/2021-03/DOT%20VSL%20Guidance%20-%202021%20Update.pdf.

Methodology

The DOT VSL of $9.1 million from 2012 is scaled to the current period, consistent with the DOT's methodology, using the following formula:

$$VSL_t = VSL_0 * \left(\frac{P_t}{P_0}\right) * \left(\frac{I_t}{I_o}\right)^{\varepsilon}$$

where:

- 0 = Original Base Year
- t = Current Base Year
- P0 = Price Index in original base year
- P_t = Price Index in Year t
- I_0 = Real Incomes in original base year
- I_t = Real Incomes in Year t
- Ɛ = Income Elasticity of VSL

The National VSL is then adjusted for California using:

$$VSL_{CA} = VSL_{USA} * \left(\frac{P_{t,CA}}{P_t}\right) * \left(\frac{I_{t,CA}}{I_t}\right)^{\varepsilon}$$

where:

- $P_{t,CA}$ = Price Index for California in Year t
- $I_{t,CA}$ = Real Incomes in California in Year t

Data Sources

- National VSL: Department of Transportation[10]
- Inflation: Bureau of Labor Statistics (CPI-U)[11]
- California CPI: Department of Industrial Relations[12]
- Earnings: Bureau of Labor Statistics[13]

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10 DOT, *Departmental Guidance on Valuation of a Statistical Life in Economic Analysis*, *available at* https://www.transportation.gov/office-policy/transportation-policy/revised-departmental-guidance-on-valuation-of-a-statistical-life-in-economic-analysis.

11 U.S. Bureau of Labor Statistics, *Table 1. Consumer Price Index for all Urban Consumers (CPI-U) U. S. city average, by expenditure category* (March 2025), *available at:* https://www.bls.gov/news.release/cpi.t01.htm.

12 State of California – Department of Industrial Relations, *California Consumer Price Index (1955-2025)*, *available at:* https://www.dir.ca.gov/oprl/CPI/EntireCCPI.PDF.

13 U.S. Bureau of Labor Statistics, *Labor Force Statistics from the Current Population Survey - Earnings - Current Population Survey (CPS)*, *available at:* https://www.bls.gov/cps/earnings.htm.

Assumptions

Elasticity is assumed to be 1. The base VSL of $9.1 million is used for all calculations after 2012.

Table 4: VSL Values Over Time

Year	National VSL (million $)	CA VSL (million $)
2024	*13.7*[14]	16.2
2023	13.2	15.2
2022	12.5	15.0
2021	11.8	14.4
2020	11.6	13.9
2019	10.9	12.6
2018	10.5	12.0
2017	10.2	11.6
2016	9.9	11.1
2015	9.6	10.6
2014	9.4	10.2
2013	9.2	10.1
2012	9.1	10.1

The Phase 2 Decision requires, "depending on the availability of data," for the IOUs to apply "(1) a serious injury as 0.25 of a fatality, or (2) the injury severity level using DOT estimates for the value of injury prevention as indicated [in the following table]:"[15] Safety incidents resulting in non-fatal injuries are quantified using a fraction of the VSL.

Table 5: DOT Fractional VSLs – Corresponding with Injury Severity

Injury Severity	Fraction of VSL
Minor	0.003
Moderate	0.047
Serious	0.105
Severe	0.266
Critical	0.593
Unsurvivable	1.000

[14] Preliminary estimate.

[15] D.22-12-027 at 63-64 (Ordering Paragraph (OP) 2.).

SoCalGas and SDG&E model a serious injury as 0.25 of a fatality for asset-based risks and the workplace violence components of Employee Safety and Contractor Safety Risks. For Employee Safety and Contractor Safety Risks, where more data is available, a more granular approach is used. Prior to the issuance of the Phase 2 Decision, SoCalGas and SDG&E did not track "injury severity" data in a manner consistent with all DOT categories shown in Table 5. Therefore, SoCalGas and SDG&E cannot currently accommodate all six levels of the DOT MAIS injury severity shown in Table 5. Instead, SoCalGas and SDG&E have applied the Federal Aviation Administration's (FAA) Abbreviated Injury Scale (AIS).[16] Although the FAA AIS also includes six categories, the middle four are grouped into a "serious injury" category as a composite of the categorizations, which better aligns with SoCalGas's and SDG&E's available safety incident data. Accordingly, and as derived from the VSL-CA value of $16.2 million per fatality, serious injuries are valued at $4.10 million ($16.2 million × 0.253) and minor injuries are valued at $0.049 million ($16.2 million × 0.003).

The resulting SoCalGas and SDG&E safety sub-attribute values and monetized values are shown in Table 6 and are applied in calculating the annualized pre-mitigated risk and mitigation benefits relating to Safety Attribute CoRE.

Table 6: Safety Sub-Attributes, Values and Monetized Value (Direct, in 2024 $millions)

Safety Sub-Attributes		Relative Value	Monetized Value[17]
Fatality		1.000	16.2
Serious Injury		0.253	4.10
Minor Injury		0.003	0.049

[16] The FAA's AIS categorizations of injuries are: minor, moderate, serious, severe, critical and fatal. *See* FAA, *Economic Values for FAA Investment and Regulatory Decisions, A Guide: 2024 Update – Section 2: Treatment of the Values of Life and Injury in Economic Analysis* (2024), *available at:* https://www.faa.gov/regulations_policies/policy_guidance/benefit_cost/econ-value-section-2-tx-values.pdf.

[17] Monetized values were developed using the latest available data; through year-end 2024.

In the 2021 RAMP, SDG&E included Acres Burned as a sub-attribute to account for the detrimental environmental impacts of wildfire smoke.[18] During the transition to the Cost Benefit Approach, this sub-attribute was eliminated from the Safety Attribute due to several challenges, including the difficulty of accurately identifying and quantifying the potential number of SDG&E customers impacted by smoke related to utility-caused wildfires and assessing the extent of the effects on both customers and the environment. The complexity arises from several factors, including but not limited to the variability in wildfire behavior, identifying and quantifying the type of material burned, the duration of the fire, the diverse locations and existing characteristics of the customers impacted, and the difficulty in predicting long-term environmental impacts. While the removal of the Acres Burned sub-attribute may lead to an underestimation of wildfire risk in SDG&E's service territory, this change is intended to streamline the wildfire risk quantification process and improve the accuracy of SDG&E's assessments to provide a more transparent wildfire risk evaluation.

As a utility, SDG&E lacks the information necessary to adequately quantify and measure the health or overall environmental impacts of utility-related wildfire smoke. SDG&E is open to collaborating with Safety Policy Division, Energy Safety, and academia, to assess whether the potential risks of utility-related wildfire smoke on air quality and the environment can be isolated and whether this should be incorporated into future cost-benefit calculations. SDG&E's core wildfire mitigation efforts remain aimed at reducing the risk of ignition, or the incidence of ignition evolving into a catastrophic wildfire; thus, SDG&E's wildfire mitigation efforts have the simultaneous effect of reducing the impacts of wildfire smoke.

C. Valuing the CoRE Electric Reliability Attribute

The CoRE Electric Reliability Attribute estimates electric outages resulting from a risk event. In determining the CoRE values – both Pre Mitigation CoRE in accordance with RDF Row 18 (which, in turn, feeds into Pre Mitigation Risk Value per RDF Row 19), and Post Mitigation CoRE in accordance with RDF Row 21 (which, in turn feeds into Post Mitigation Monetized Risk Value per RDF Row 22) – are identified for each SDG&E Risk in this RAMP filing for which Electric Reliability is relevant. The CoRE Electric Reliability estimates the potential for a risk event to result in outages. In turn, a mitigation's benefits with respect to the

[18] *See* SoCalGas and SDG&E 2021 RAMP Report, Chapter RAMP-C at RAMP-C-5 (Table 2: Risk Quantification Framework and Safety Index).

Electric Reliability CoRE reflects the degree to which the mitigation is estimated to reduce the magnitude of those outages.

In accordance with the RDF's requirements on valuing the Electric Reliability attribute,[19] SDG&E captures electric reliability in terms of customers experiencing electric outages. In the 2021 RAMP, SDG&E quantified electric reliability value in terms of two sub-attributes: outage duration (*i.e.*, SAIDI) and outage frequency (*i.e.*, SAIFI).[20] Consistent with changes to the RDF, SDG&E has modified its Electric Reliability Attribute CoRE in the 2025 RAMP to be valued by Customer Minutes of Interruption (CMI), in alignment with PG&E, SCE, and the LBNL's ICE version 1.0.

CMI is monetized using the LBNL ICE Version 1.0,[21] calibrated with SDG&E-specific customer demographics, historical billing and load information, regional economic measures, and utility historical reliability metrics as of year-end 2023, based on data availability. The table below outlines CMI and cost per event values per sector,[22] using system-wide averages.

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[19] Decision D.22-12-027 at 64, OP 2(b) requires the following:

(b) Each IOU shall use the most current version of the Lawrence Berkeley National Laboratory (LBNL) Interruption Cost Estimate (ICE) Calculator to determine a standard dollar valuation of electric reliability risk for the Reliability Attribute included in Appendix A.

i. If applicable, each IOU shall justify its choice of an alternative model by providing an analysis comparing the results of its preferred alternative model to the results using the ICE Calculator.

ii. Each IOU shall participate in the customer survey process needed to incorporate California data into the ICE 2.0 model.

iii. Each IOU is authorized to submit a Tier 1 advice letter establishing a memorandum account to track the costs of participating in ICE 2.0 Calculator development for costs up to $600,000, plus an additional 15 percent for potential incremental costs, and to seek recovery of these costs at a later date.

[20] SAIDI = System Average Interruption Duration Index; SAIFI = System Average Interruption Frequency Index.

[21] At the time of SDG&E's 2025 RAMP filing, ICE 1.0 was the latest known and available LBNL model. Within a reasonable timeframe and as needed, SDG&E will update its approach accordingly after the slated successor tool, ICE 2.0, becomes available.

[22] C&I: Commercial and Industrial customers.

Table 7: SDG&E Monetized CMI
(Direct, in 2024 $ millions)

Sector	No. of Customers	Cost Per Event	Total CMI in 2023 (000s)	Cost Per Average kW (2024 $s)	Cost Per Unserved kWh	Total Cost of Sustained Interruptions (2024 $millions)	$/CMI
Medium and Large C&I	26,421	20,560.5	1,649	464.9	227.7	310.7	188.38
Small C&I	135,253	909.3	9,003	808.7	396.1	70.3	7.81
Residential	1,355,077	5.6	94,283	12.4	6.1	4.3	0.05
All Customers	1,516,751	444.2	104,935	349.5	171.2	385.4	$3.67

The standardized $ per CMI value is determined by dividing the Total Cost of Sustained Interruptions by the Total CMI in 2023 and then applying a 2.5% inflation rate for 2024. The resulting SDG&E Electric Reliability Attribute value produced by the LBNL ICE Version 1.0 is $3.76 per CMI, which is applied uniformly to all customer types in CoRE modeling.

D. Valuing the CoRE Gas Reliability Attribute

The CoRE Gas Reliability Attribute estimates gas outages resulting from a risk event. In determining the CoRE values – both Pre-Mitigation CoRE in accordance with RDF Row 18 (which, in turn, feeds into Pre-Mitigation Risk Value per RDF Row 19), and Post-Mitigation CoRE in accordance with RDF Row 21 (which, in turn feeds into Post-Mitigation Monetized Risk Value per RDF Row 22) – are used for each risk in this RAMP filing for which Gas Reliability is relevant. The Gas Reliability CoRE estimates the potential for a risk event to result in gas meter outages. In turn, a mitigation's benefits with respect to the Gas Reliability Attribute CoRE reflect the degree to which the mitigation is estimated to reduce the magnitude of those gas meter outages.

In accordance with the RDF's Row 6 guidance on valuing the Gas Reliability Attribute,[23] SoCalGas and SDG&E have adopted the implied monetary value of a gas meter experiencing an outage based on their respective 2021 MAVF figures. In calculating MAVF for the 2021 RAMP filings, the Meters Out sub-attribute of Gas Reliability had a scale of 0 to 100,000 or 0 to 50,000 gas meters experiencing outage, for SoCalGas and SDG&E, respectively. The number of meter outages was one of two Gas Reliability sub-attributes and was given a weight of 50% within the Reliability attribute of the MAVF for SoCalGas and 25% for SDG&E. This sub-attribute was equivalent to the Financial attribute MAVF in SoCalGas and SDG&E's 2021 RAMP filings, which had a scale of 0 to $500 million and represented 17%[24] of the overall MAVF value.[25] Using that equivalency, one gas meter experiencing an outage equates to $3,868.79 in 2024 dollars, accounting for inflation from 2021, for both Companies.[26] In the transition to the CBA, the Companies determined it was not feasible to develop a methodology for calculating a Gas Curtailment sub-attribute in the time available and only utilize meter outages as a single attribute to measure gas reliability CoRE. This decision was due to lack of data to quantify curtailment volumes as distinct impacts from meter outages during a risk event. Because gas curtailment is an important component in measuring how customers are impacted during a risk event, SoCalGas and SDG&E continue to evaluate how this sub-attribute can be accurately incorporated into the CBA in the future.

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[23] D.22-12-027 at 64-65, OP 2(c) requires the following:

(c) Each IOU shall apply a dollar value for gas reliability based on the implied value from their most recent Multi-Attribute Value Function Risk Score calculation presented in their most recent RAMP or shall justify its choice of an alternative model by providing an analysis comparing the results of its preferred alternative model to the results using the implied values. If using the implied value from its most recent RAMP: […].

ii. For SDG&E and SoCalGas, use the 2021 RAMP filings.

[24] SoCalGas and SDG&E revised the 2021 RAMP MAVF to remove the Stakeholder Satisfaction attribute in the GRC filing, per SPD's guidance in their evaluation report. As a result of removing this attribute, the weight to the financial attribute increased from 15% shown in the 2021 RAMP report to 17% in the GRC filing.

[25] *See* SoCalGas and SDG&E 2021 RAMP Report, Chapter RAMP-C at RAMP-C-6 (Table 3: Risk Quantification Framework Reliability Index for SDG&E).

[26] 1 meter experiencing outage = ($500 million / 50,000 meters out) * (23% Reliability Weighting / 17% Financial Weighting) * (1 reliability attribute / 4 reliability attributes).

As part of gas reliability quantification, SoCalGas and SDG&E's CBA currently does not quantify the value of the gas system as an integral component of California's interconnected energy system and the many functions it provides as the reliability backstop for the electric grid and broader energy system for the State as well as the region. For instance, a considerable share of the CAISO generation fleet consists of gas-fired power plants which are expected to be called upon in the foreseeable future.[27] Therefore, electric sector reliability is dependent on gas infrastructure and electric sector reliability risks can be mitigated through leveraging gas infrastructure. As the recent North American Electric Reliability Corporation (NERC) 2024 Reliability Report (NERC 2024 Reliability Report) highlights, the important role of gas pipelines to meet electric demand during peak hours complements the intermittent nature of renewable energy resources.[28] According to the Department of Energy, the grid's need for reliable dispatchable power will continue to grow as the percentage of renewables eclipses traditional fossil-fuel energy sources and projected electricity demand requires greater reliability to serve significant new demand from non-traditional users, such as increased mobility sector electrification, data centers, and generative artificial intelligence energy demands potentially reaching up to 9% of total US electricity generation by 2030.[29]

SoCalGas and SDG&E continue to explore refining the quantification of gas reliability and will consider revisions in future filings given the significant spectrum of value the gas system provides to support the State's interconnected energy system. These include as a just-in-time and seasonal reliability resource with the ability to meet increased peak daily and hourly

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[27] *See* CAISO Summer Market Performance Report (September 2024) at 22, *available at* summer-market-performance-report-september-2024.pdf; *see also* California Energy Commission (CEC), *2023 Integrated Energy Policy Report* (February 2024) at 11 (Table ES-1), 27 (Table 3), *available at: https://efiling.energy.ca.gov/GetDocument.aspx?tn=254463*.

[28] NERC, *2024 Long-Term Reliability Assessment,* (December 2024), *available at:* https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_Long%20Term%20Reliability%20Assessment_2024.pdf. ("Natural-gas-fired generators are a vital [bulk power system] BPS resource. They provide [essential reliability services] ERSs by ramping up and down to balance a more variable resource mix and are a dispatchable electricity supply for winter and times when wind and solar resources are less capable of serving demand. Natural gas pipeline capacity additions over the past seven years are trending downward, and some areas could experience insufficient pipeline capacity for electric generation during peak periods.").

[29] Department of Energy, *Artificial Intelligence – Powering AI*, *available at:* https://www.energy.gov/topics/artificial-intelligence.

peak ramping electric sector needs which supports renewable integration and changing demand patterns.

E. Valuing the CoRE Financial Attribute

The CoRE Financial Attribute estimates both Pre-Mitigation CoRE in accordance with RDF Row 18 (which, in turn, feeds into Pre-Mitigation Risk Value per RDF Row 19), and Post-Mitigation CoRE in accordance with RDF Row 21 (which, in turn feeds into a Post-Mitigation Monetized Risk Value per RDF Row 22) to estimate the financial impacts resulting from a risk event. The Financial CoRE estimates the magnitude of financial impact that could result from a risk event. In turn, any mitigation that has a benefit with respect to the Financial CoRE reflects the degree to which the mitigation is estimated to reduce the magnitude of those financial consequences. Unlike the other CoRE valuations, the Financial CoRE attribute is inherently dollar-denominated and no conversion is necessary.[30]

In accordance with the RDF's guidance on valuing the Financial Attribute, financial risk is captured in a similar fashion to the 2021 RAMP filings. The Financial Attribute has no sub-attributes or index and is measured in dollars. Like the other attributes, the Financial Attribute is used to estimate aspects of the impact from risk events. Unlike the other attributes, however, different types of costs are measured in the attribute. The two general types of costs measured include: societal damage (including physical damage, lost wages, relocation costs, etc.) and utility service restoration and repair costs (labor, materials). The Financial Attribute focuses on impact to the public and does not include any impacts related to shareholder financial interests.

The quantitative approach used by SoCalGas and SDG&E primarily utilizes historical events as a guide for possible future impacts. Precision for the Financial Attribute is difficult to achieve, however, as risk events are rarely reported with a single summation of all financial impacts. Depending on the risk event, differing approaches were therefore used to estimate the financial impacts. For example, for pipeline risks, Pipeline and Hazardous Materials Safety Administration (PHMSA) data was used in combination with internal data; however, the financial values provided by PHMSA do not necessarily include all societal financial impacts. For electrical outages, subject-matter expert estimates were used for the cost of repairs. Additional information can be found in the individual risk chapters and Attachment B.

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[30] Except for time value of money considerations that apply to all aspects of monetized benefits, as discussed *infra* Section VI.E (which addresses discounting).

III. STEP 1B: IDENTIFYING RISKS FOR THE ENTERPRISE RISK REGISTER

Row 8 of the RDF's "Step 1B – Identifying Risks for the Enterprise Risk Register" describes the method for identifying risks to be assessed by the quantitative framework.

Table 8: Row 8 of the RDF

#	RDF Element Name	Element Description & Requirements
8	Risk Identification and Definition	Utilities' risks are defined in their respective Enterprise Risk Registers. The Enterprise Risk Register is the starting point for identifying the risks that will be included in the RAMP. The process for determining these risks will be described in the RAMP. The RAMP will consider risks using the same risk definitions as in the ERR. Each RAMP filing will highlight any changes to the ERR from the previous RAMP or GRC filings.

The starting point for determining if a risk is to be included in the RAMP filing is to review the risks contained in SoCalGas's and SDG&E's respective 2024 enterprise risk registers (ERRs). Each applicable enterprise risk is then assessed in accordance with RDF Step 2A, as described in the next section, to determine if it is to be included in the RAMP filing.

IV. STEP 2A: RISK ASSESSMENT AND RISK RANKING IN PREPARATION FOR RAMP

Rows 9-11 of the RDF's "Step 2A – Risk Assessment and Risk Ranking in Preparation for RAMP" describe the method for initial assessment and risk ranking of risks via the quantitative framework.

Table 9: Rows 9-11 of the RDF

#	RDF Element Name	Element Description & Requirements
9	Risk Assessment	Using the Cost-Benefit Approach developed in accordance with Step 1A, for each Risk included in the Enterprise Risk Register, the utility will compute a monetized Safety Risk Value using only the Safety Attribute. The utility will sort its ERR Risks in descending order by the monetized Safety Risk Value. For the top 40% of ERR risks with a Safety Risk Value greater than zero dollars, the utility will compute a monetized Risk Value using at least the Safety, Reliability and Financial Attributes to determine the output for Step 2A. The output of Step 2A, along with the input from stakeholders described in Row 12 below, will be used to decide which risks will be addressed in the RAMP.

#	RDF Element Name	Element Description & Requirements
		The Risk Assessment in preparation for RAMP will follow the steps in Rows 10 and 11.
10	Identification of Potential Consequences of Risk Event	The identified potential Consequences of a Risk Event should reflect the unique characteristics of the utility. For each enterprise risk, the utility will use actual results, available and appropriate data (*e.g.*, Pipeline and Hazardous Materials Safety Administration data), and/or Subject Matter Experts (SMEs) to identify potential Consequences of the Risk Event, consistent with the Cost-Benefit Approach developed in Step 1A. The utility should use utility specific data, if available. If data that is specific to the utility is not available, the utility must supplement its analysis with subject matter expertise. Similarly, if data reflecting past results are used, that data must be supplemented by SME judgment that takes into account the Benefits of any Mitigations that are expected to be implemented prior to the GRC period under review in the RAMP submission.
11	Identification of the Frequency of the Risk Event	The identified Frequency of a Risk Event should reflect the unique characteristics of the utility. For each enterprise risk, the utility will use actual results and/or SME input to determine the annual Frequency of the Risk Event. The utility should use utility specific data, if available. If data that is specific to the utility is not available, the utility must supplement its analysis with subject matter expertise. In addition, if data reflecting past results are used, that data must be supplemented by SME judgment that takes into account the Benefits of any Mitigations that are expected to be implemented prior to the GRC period under review in the RAMP submission. The utility will take into account all known relevant Drivers when specifying the Frequency of a Risk Event. Drivers should reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to the asset. For example, where applicable, Drivers may include: the presence of corrosion, vegetation, dig-ins, earthquakes, windstorms or the location of a pipe in an area with a higher likelihood of dig-ins.

Starting with their respective 2024 ERR risks, pursuant to RDF Row 9, SoCalGas and SDG&E computed a monetized Safety Risk Value using only the Safety Attribute. The pre-mitigated Safety Risk Value (SRV) for each risk is estimated as the product of the Risk's Likelihood of a Risk Event (LoRE) and Expected Value[31] of the risk's (unscaled) Safety Consequence of a Risk Event (CoRE). The Companies then sorted these ERR risks in descending order by the monetized SRVs. Applying a 2023 VSL[32] of $15.2 million, the Companies used estimated LoREs and unscaled safety CoRE estimates for the safety calculation. For the top 40% of risks that had SRV's greater than $0, SoCalGas and SDG&E computed the risk values for Reliability and Financial Attributes to determine the total monetized risk values for the preliminary RAMP Risks.

At their discretion, the Companies elected to present an additional risk, Cybersecurity, which did not meet the RDF's 40% threshold. For SDG&E, Employee Safety-related risks, including Motor Vehicle Incident and Workplace Violence, were consolidated in a single RAMP risk. Similarly, Electric Infrastructure Integrity was consolidated with Customer & Public Safety – Contact with Electric Equipment, and SDG&E selected Medium Pressure Gas as an additional RAMP Risk.

In accordance with the RDF, and as described in detail in the sections that follow, the analysis performed produces CBRs for all selected RAMP risks for the GRC cycle (2028 through 2031) on the basis of the residual risk as of the "baseline" year (2028, the start of the GRC period), after taking into account all risk reduction benefits from all mitigation activities projected to have been performed by the start of 2028.[33] Please refer to Chapter 2 for additional information regarding the Companies' selection of RAMP risks.

V. STEP 2B: SELECTING ENTERPRISE RISKS FOR RAMP

Row 12 of the RDF's "Step 2B – Selecting Enterprise Risks for RAMP" describes the method for selecting risks for RAMP.

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31 "Expected Value" is the probability-weighted sum of all possible risk outcomes.

32 At the time the Safety Risk Assessment was performed and presented during the December 17, 2024 pre-filing risk selection workshop, the 2023 VSL value was the best available information.

33 *See* "Baseline Risk" in RDF Lexicon.

Table 10: Row 12 of the RDF

#	RDF Element Name	Element Description & Requirements
12	Risk Selection Process for RAMP	Using the analysis performed in Step 2A, the utility will preliminarily select risks to be included in the RAMP. The utility will host a publicly noticed workshop, to be appropriately communicated to interested parties and at a minimum, should include the CPUC's Safety Policy Division (SPD), to gather input from SPD, other interested CPUC staff, and interested parties to inform the determination of the final list of risks to be included in the RAMP. At least 14 days in advance of the workshop, the utility will provide to SPD and interested parties at least the following information: (1) its preliminary list of RAMP risks; and (2) the monetized Safety Risk Value for each risk in the ERR and the monetized Risk Value for the top ERR risks identified through the process in Row 9. The utility will make its best effort to timely respond to reasonable requests for additional information prior to the workshop. Based on input received from SPD, other interested CPUC staff, and interested parties, the utility will make its determination of the final list of risks to be addressed in its RAMP. The rationale for taking or disregarding input during the workshop will be addressed in the utility's RAMP.

SoCalGas and SDG&E's selected RAMP risks were presented informally to the CPUC's Safety Policy Division (SPD) for review on October 14, 2024, and formally to SPD and interested parties during the December 17, 2024 RAMP pre-filing risk selection public workshop. Following the workshop, based on feedback provided by stakeholders, SoCalGas elected to present Underground Storage as an additional RAMP risk.

VI. STEP 3: MITIGATION ANALYSIS FOR RAMP RISKS

Rows 13-25 of the RDF's "Step 3 – Mitigation Analysis for Risks in RAMP" describes the method for analyzing risks per the quantitative framework.

Table 11: Rows 13-25 of the RDF

#	RDF Element Name	Element Description & Requirements
13	Calculation of Risk	For purposes of the Step 3 analysis, pre- and post-mitigation risk will be calculated by multiplying the Likelihood of a Risk Event (LoRE) by the Consequences of a Risk Event (CoRE). The CoRE is the sum of each of the Risk-Adjusted Attribute Values using the utility's full Cost-Benefit Approach.
14	Definition of Risk Events and Tranches	Detailed pre- and post-mitigation analysis of Mitigations will be performed for each risk selected for inclusion in the RAMP. The utility will endeavor to identify all asset groups or systems subject to the risk and each Risk Event associated with the risk. For example, if Steps 2A and 2B identify wildfires associated with utility facilities as a RAMP Risk Event, the utility will identify all Drivers that could cause a wildfire and each group of assets or systems that could be associated with the wildfire risk, such as overhead wires and transformers. For each Risk Event, the utility will subdivide the group of assets, or the system associated with the risk into Tranches. Risk reductions from Mitigations and Risk Spend Efficiencies will be determined at the Tranche level, which gives a more granular view of how Mitigations will reduce Risk. The determination of Tranches will be based on how the risks and assets are managed by each utility, data availability and model maturity, and strive to achieve as deep a level of granularity as reasonably possible. The rationale for the determination of Tranches, or for a utility's judgment that no Tranches are appropriate for a given Risk Event, will be presented in the utility's RAMP submission. For the purposes of the risk analysis, each element (*i.e.*, asset or system) contained in the identified Tranche would be considered to have homogeneous risk profiles (*i.e.*, considered to have the same LoRE and CoRE).
15	Bow Tie	For each risk included in the RAMP, the utility will include a Bow Tie illustration. For each Mitigation presented in the RAMP, the utility will identify which element(s) of its associated Bow Tie the Mitigation addresses.
16	Expressing Effects of a Mitigation	The effects of a Mitigation on a Tranche will be expressed as a change to the Tranche-specific pre-mitigation values for LoRE and/or CoRE. The utility will provide the pre- and post-mitigation values for LoRE and CoRE determined in

#	RDF Element Name	Element Description & Requirements
		accordance with this Step 3 for all Mitigations subject to this Step 3 analysis.
17	Determination of PreMitigation LoRE by Tranche	The pre-mitigation LoRE is the probability that a given Risk Event will occur with respect to a single element of a specified Tranche over a specified period of time (typically a year) in the planning period, before a future Mitigation is in place.
18	Determination of PreMitigation CoRE	The pre-mitigation CoRE is the sum of each of the pre-mitigation Risk Adjusted Attribute Values using the utility's full Cost-Benefit Approach. The CoRE is calculated using the full Cost-Benefit Approach tool constructed consistent with Step 1A above.
19	Measurement of PreMitigation Risk Value	The monetized pre-mitigation risk value will be calculated as the product of the pre-mitigation LoRE and the pre-mitigation CoRE for each Tranche subject to the identified Risk Event.
20	Determination of PostMitigation LoRE	The post-mitigation LoRE calculation will be conducted at the same level of granularity as the pre-mitigation risk analysis within Step 3. The calculated value is the probability of occurrence of a Risk Event after the future Mitigation is in place.
21	Determination of PostMitigation CoRE	The post-mitigation CoRE calculation will be conducted at the same level of granularity as the pre-mitigation risk analysis. The post-mitigation CoRE is the sum of each of the post-mitigation Risk-Adjusted Attribute Values using the utility's full Cost-Benefit Approach.
22	Measurement of PostMitigation Monetized Risk Value	The monetized post-mitigation risk value will be calculated as the product of the post-mitigation LoRE and post-mitigation CoRE for each Tranche subject to the identified Risk Event.
23	Measurement of Risk Reduction Provided by a Mitigation	The risk reduction provided by a risk mitigation will be measured as the difference between the values of the monetized pre-mitigation risk value and the monetized post-mitigation risk value.
24	Use of Expected Value for CoRE; Supplemental Calculations	The utility will use expected value for the Cost-Benefit Approach-based measurements and calculations of CoRE in Rows 13, 18, 19, 21, 22, and 23. If a utility chooses to present Alternative Analysis of monetized pre- and post-

#	RDF Element Name	Element Description & Requirements
		mitigation CoRE using a computation in addition to the expected value of the Cost-Benefit Approach, such as tail value, it does so without prejudice to the right of parties to the RAMP or GRC to challenge such Alternative Analysis.
25	Cost-Benefit Ratios Calculation	The Cost-Benefit Ratio calculation should be calculated by dividing the dollar value of Mitigation Benefit by the Mitigation cost estimate. The values in the numerator and denominator should be present values to ensure the use of comparable measurements of Benefits and costs. The Benefits should reflect the full set of Benefits that are the results of the incurred costs. For capital programs, the costs in the denominator should include incremental expenses made necessary by the capital investment.

F. Estimating LoRE and CoRE

For each RAMP risk, the RDF directs utilities to assess each mitigation's prospective benefits (monetized, over the mitigation's life, and discounted to present value in accordance with RDF requirements) in relation to the mitigation's cost (likewise discounted to present value). In this section, SoCalGas and SDG&E present their methodology for estimating mitigation benefits in accordance with RDF guidance.

The RDF defines mitigation benefits as the difference between the Pre-Mitigation Risk Value (per RDF Row 19) and the Post-Mitigation Monetized Risk Value (per Row 22). SoCalGas and SDG&E note, however, that Pre-Mitigation Risk Values are time specific. That is, the underlying Pre-Mitigation LoRE and/or Pre-Mitigation CoRE can change over time, owing to the presence or removal of existing mitigations, as well as ongoing system deterioration and inflation. For example, in meeting the requirement to provide CBRs for each GRC Post-Test Year (per RDF Row 26), the Pre-Mitigation Risk Value for a RAMP risk for 2029 may be different than for 2030. As such, in SoCalGas and SDG&E's modeling, the Pre-Mitigation Risk Value is not a singular, unchanging value.

Further to this point, there are certain mitigations that have the effect of "preserving" the risk profile (*i.e.*, maintaining the Pre-Mitigation Risk Value over time). That is, absent the presence of such mitigations (which are typically ongoing mitigations or controls), the Pre-

Mitigation Risk Value would be greater, all other things being held constant. The modeling of such effect, referred to as "preservation," is discussed in detail in Section VI.D.3 below.

To distinguish between the computed Pre-Mitigation Risk Value for a RAMP risk for which "preservation" mitigations remain in place (and new mitigations have yet to be considered), and the Pre-Mitigation Risk Value absent ongoing "preservation" mitigations, in the methodology presented in this chapter, SoCalGas and SDG&E refer to the former value as the "Risk Value" while reserving the term Pre-Mitigation Risk Value for the final calculations of CBRs. For the final calculations of CBRs for the Test Year 2028 and each of the Post-Test Years 2029, 2030, and 2031, the benefit is the difference between the Pre-Mitigation Risk Value and the Post-Mitigation Risk Value specific to the year for which the CBRs are calculated.

Calculating a Risk Value for each RAMP risk involves estimating the LoRE and the three attributes comprising the CoRE before applying any mitigations and continuing current risk-treatment activities. The LoRE is calculated by multiplying the annual probability of a risk event per unit of exposure (*e.g.*, per mile of pipe) by the total number of units. This method allows for the calculation of LoRE at both the tranche and system levels.

When the probability of a risk event is multiplied by the number of units, the resulting value is a rate or frequency and hence can exceed 1, especially at the system level. Thus, the LoRE is a frequency or rate, indicating the number of times the risk event is expected to occur per year. This behavior is expected, as risk is additive, but probabilities are not.

The CoRE is estimated by modeling the range of possible outcomes resulting from a risk event. For each CoRE attribute (Safety, Reliability, and Financial), possible outcomes[34] are modeled independently. Each CoRE attribute is then scaled in accordance with Row 7 of the RDF; and, as described in the next section, the expected value (EV) of the scaled distribution of outcomes for that attribute represents the attribute's CoRE value. As shown in Equation 3.1, the expected values of the three CoRE attributes—Safety, Reliability, and Financial—are summed to comprise the total CoRE expected value.

$$\mathrm{EV}\left(\mathrm{CoRE}^{\mathrm{Total}}\right) = \mathrm{EV}\left(\mathrm{CoRE}^{\mathrm{safety}}\right) + \mathrm{EV}\left(\mathrm{CoRE}^{\mathrm{reliability}}\right) + \mathrm{EV}\left(\mathrm{CoRE}^{\mathrm{financial}}\right) \qquad 3.1$$

[34] Outcomes are derived from: (i) direct observations, (ii) random sampling from known or constructed distributions fit to observations, or (iii) Monte Carlo simulations on failure consequence models (*e.g.*, safety CoRE modeling of high-pressure gas).

Table 12: Row 7 of the RDF

7	Cost-Benefit Approach Principle 6 – Risk-Adjusted Attribute Levels	Apply a Risk Scaling Function to the Monetized Levels of an Attribute or Attributes (from Row 6) to obtain Risk-Adjusted Attribute Levels. The Risk Scaling Function is an adjustment made in the risk model due to different magnitudes of Outcomes, which can capture aversion or indifference towards those Outcomes. The Risk Scaling Function can be linear or convexly non-linear. For example, the Risk Scaling Function is linear to express indifference if avoiding a given change in the Monetized Attribute Level does not depend on the Attribute Level. Alternatively, the Risk Scaling Function is convexly non-linear to express aversion if a change in the Attribute level results in an increasing rate of change in the Risk-Adjusted Monetized Attribute Level as the Level of the Attribute increases. When completing Rows 5 and 24 in the RDF, if a utility chooses to address tail risk using the power law or other statistical approach and chooses to present Risk-Adjusted Attribute Levels by relying on a convex scaling function, then it must supplement its analysis by also presenting Risk-Adjusted Attribute Levels by relying on a linear scaling function.

G. Risk-Averse Scaling of CoRE

An additional consideration in developing the CoRE expected value is the application of societal risk-averse scaling to the CoRE outcomes. Row 7 of the RDF provides for convex non-linear (risk-averse) risk scaling, which SoCalGas and SDG&E applied to risk-scale CoRE estimates for all RAMP Risks. This approach recognizes that an increasing aversion to progressively larger CoRE outcomes aligns with societal preferences.[35]

For certain asset-based risks such as High Pressure Gas and Wildfire & PSPS, Monte Carlo simulation is used to produce a scaled CoRE distribution for each attribute by applying a convex risk-averse scaling function, described in the following section, at the trial (event) level. The scaled expected value of the CoRE is equivalent to the expected value of the scaled distribution, estimated by computing the average outcome from all the scaled trials. The scaled

[35] *See*, *e.g.*, UCLA School of Engineering and Applied Sciences, *The Use of Risk Aversion in Risk Acceptance Criteria?* (June 1980), *available at:* https://www.osti.gov/servlets/purl/5230500.

expected value is calculated at the attribute level, and then all the attributes are summed (as shown in Equation 3.1) to determine the total scaled expected value CoRE.

1. Risk-Averse Scaling Function

One commonly-used convex risk-averse scaling function is the Power Law function,[36] as shown in Equation 3.6, where the risk aversion factor, $\alpha > 1$, is determined from the relationship between the number of fatalities (N) and the frequency (f) of those events across a wide range of occurrences (such relationship is termed an "$f-N$ *c*urve").

The Power Law function can be derived from the regression line of an $f - N$ curve with a negative slope of $-\alpha$, as shown in the Gas Research Institute (GRI)[37] study. In the GRI study's Figure 3.8, the log-fatalities (N) of events are plotted against the log-likelihoods (p) of those events. The Power Law equation, Equation 3.6, is derived from the regression line in Equations 3.2-3.5.

$$\log_{10} p = -\alpha \cdot \log_{10} N + C \quad 3.2$$

$$\Longrightarrow 10^{\log_{10} p} = 10^{\log_{10} N^{-\alpha}} 10^{C} \quad 3.3$$

$$\Longrightarrow p = k\, N^{-\alpha} \quad 3.4$$

$$\Longrightarrow pN^{\alpha} = k \quad 3.5$$

$$f(N) = N^{\alpha} \quad 3.6$$

Equation 3.5 shows the concept of risk neutral versus risk-averse well. Note that when $\alpha = 1$, the product of the likelihood and its corresponding fatalities are always constant (*i.e.*, "risk neutral"). This implies that rare catastrophic events are treated the same as more frequent, less catastrophic events, which is the concept of risk neutrality. Hence, in the case of societal risk-aversion, α is greater than 1, leading to increased scaling of consequences as the severity of catastrophic events rises.

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[36] The power law function describes a relationship where a relative change in one variable results in a proportional relative change in another variable, raised to a constant exponent. For risk-averse scaling, the constant exponent term is $\alpha > 1$. Note that this should not be confused with the power law or other statistical methods used to address tail risk, which specifically refers to the Probability Density Function of the Pareto distribution with a negative exponent.

[37] Journal of Pressure Vessel Technology, Transactions of the ASME, *Target Reliability Levels for Design and Assessment of Onshore Natural Gas Pipelines* (December 2009), *available at*: https://www.researchgate.net/publication/245365044_Target_Reliability_Levels_for_Design_and_Assessment_of_Onshore_Natural_Gas_Pipelines.

To determine an appropriate value for α, SoCalGas and SDG&E conducted an analysis based on independent and peer-reviewed empirical studies that quantify risk aversion in similar industries. These studies provide a suitable proxy for societal risk aversion with respect to SoCalGas's and SDG&E's operations. Specifically, two studies of $f - N$ and $F - N$ curves, commonly used to estimate risk aversion in infrastructure-intensive industries with potential for catastrophic injury or fatality events, were utilized. SoCalGas and SDG&E leveraged studies from the Department of Energy (DOE)[38] and the GRI to identify the risk scaling factor. The DOE and GRI studies determined implied risk aversion coefficients of 1.34 for natural catastrophic events and 1.6 for North American pipeline standards, respectively. SoCalGas and SDG&E adopted the average of these two implied factors, resulting in a risk scaling factor α of 1.47. [39] A PHMSA study[40] on risk tolerance across various industries globally focused on $F - N$ curves and lines with slopes of $-\alpha$ for risk tolerance. As demonstrated in the GRI study, this can be translated to a risk-averse function (Equation 3.6). The PHMSA study found slopes of -1, -1.5, and -2, corresponding to α values of 1, 1.5, and 2, respectively. This indicates that the value of 1.47 is consistent with other risk-aversion practices across industries and around the world.

2. Implied Thresholds and the Application of the Scaling Function

Since fatalities in the $f - N$ and $F - N$ curves start at 1, the scaling function in Equation 3.6 is defined for $N \geq 1$. In SoCalGas and SDG&E's Fractional VSL framework (described in Section II B. above), equivalence of fatalities are represented as fractions (*e.g.*, 0.25 for serious injuries). Therefore, for purpose of the RAMP Reports, SoCalGas and SDG&E define the risk-averse scaling function in Equation 3.7, to be applicable for all values of equivalent fatalities:

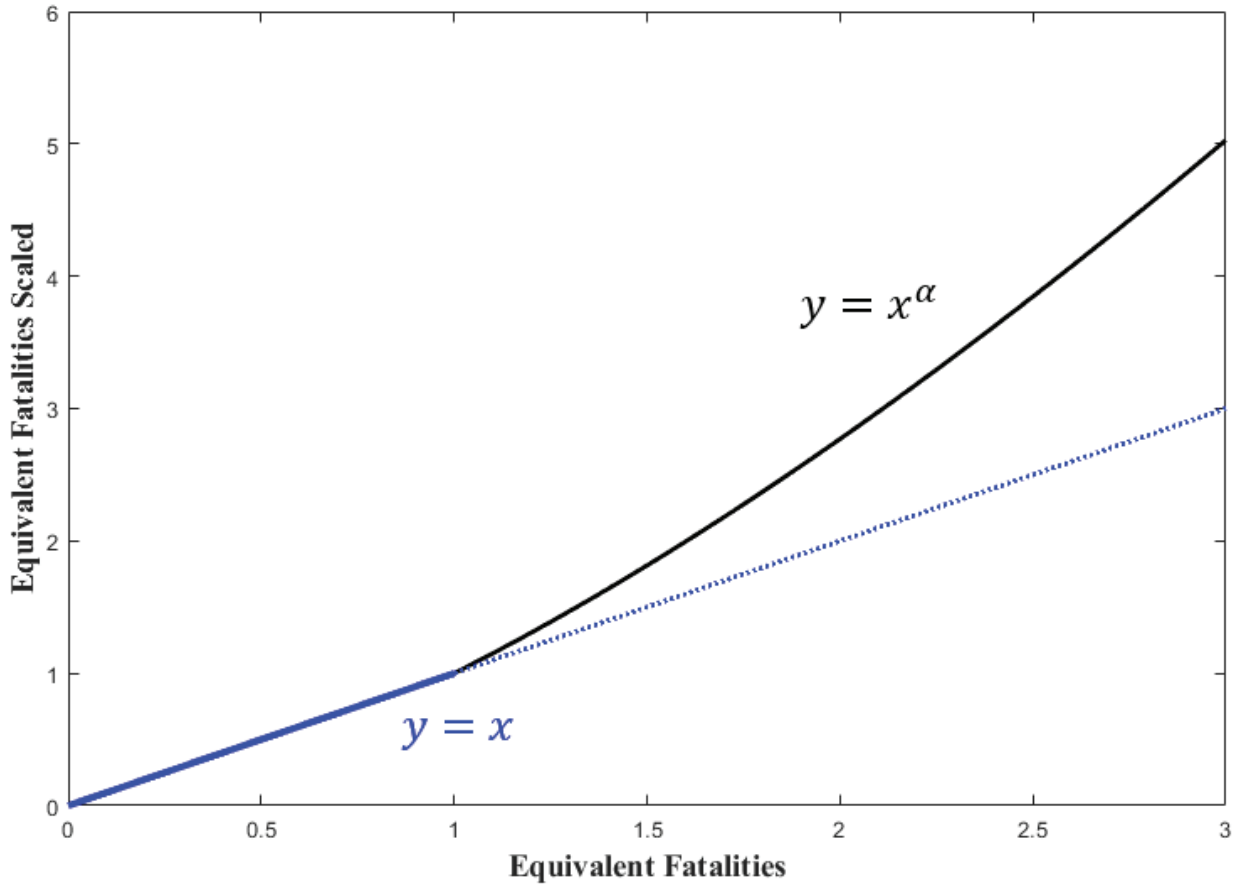
$$f(x) = \begin{cases} x & 0 \leq x < 1 \\ x^{\alpha} & x \geq 1 \end{cases} \qquad 3.7$$

[38] UCLA School of Engineering and Applied Sciences, *The Use of Risk Aversion in Risk Acceptance Criteria?* (June 1980), *available at:* https://www.osti.gov/servlets/purl/5230500.

[39] This is consistent with PHMSA and other global and local risk aversion practices (*i.e.*, 1.0-2.0 range).

[40] PHMSA, *Final Report on Paper Study on Risk Tolerance* (June 30, 2016), *available at:* https://primis.phmsa.dot.gov/matrix/FilGet.rdm?fil=10733.

Figure 1: Risk-Averse Scaling Function Equation 3.7



This produces an implied transition from linear scaling to convex scaling at one equivalent fatality. This transition threshold is applied consistently for all CoRE attributes.[41] The monetized scaling function for any attribute will be the composition of Equations 3.7, 3.8 and its inverse 3.9, as seen in Equation 3.10:

$$g(x) = \frac{x}{VSL} \qquad 3.8$$

$$g^{-1}(x) = VSL \cdot x \qquad 3.9$$

$$s(x) = g^{-1} \circ f \circ g(x) = g^{-1}\Big(f\big(g(x)\big)\Big) \qquad 3.10$$

Note that any monetized CoRE will first transform into equivalent fatalities using Equation 3.8, then be scaled by Equation 3.7, and finally be transformed back to monetized scaled CoRE.

[41] Note that the implied transition point of one equivalent fatality is not indicative of a risk tolerance threshold for either company and is presented here solely for purposes of risk-averse scaling for SoCalGas's and SDG&E's 2025 RAMP presentations, which are submitted in compliance with the Commission's RDF.

Consistent with the Commission's shift to monetization in the Phase 2 Decision, SoCalGas and SDG&E's adoption of Equation 3.10 produces a consistent implied threshold for Safety, Reliability, and Financial attributes. Specifically, the Companies apply the risk scaling factor on a trial-by-trial basis to each CoRE attribute, starting at the monetized equivalent of the VSL dollar value for one fatality. This process is applied to each attribute using Monte Carlo sampling from the CoRE distribution. The expected value of the resulting scaled CoRE distribution represents the scaled CoRE for each attribute, and using Equation 3.1, SoCalGas and SDG&E derive the total scaled CoRE. Table 13 below illustrates the application of both the implied threshold and the step-by-step application of Equations 3.8, 3.7, and 3.9, culminating in Equation 3.10.

Table 13: Illustrative Risk Aversion Function Applied to CoRE Distribution for each Attribute through the VSL

Simulation	Unscaled CoRE ($) x	Unscaled CoRE (Fatality-equivalent) $y = g(x) = \frac{x}{VSL}$	Scaled CoRE (Fatality-equivalent) $z = f(y) = \begin{cases} y & y < 1 \\ y^{1.47} & y \geq 1 \end{cases}$	Scaled CoRE ($) $w = g^{-1}(z) = z \cdot VSL$
Trial 1	$200,000	0.012	0.012	$200,000
Trial 2	$12,000,000	0.741	0.741	$12,000,000
Trial 3	$50,000	0.003	0.003	$50,000
Trial 4	$27,000,000	1.667	2.119	$34,326,749
Trial 5	$100,000	0.006	0.006	$100,000
Trial 6	$55,000,000	3.395	6.030	$97,692,471
Trial 7	$250,000	0.015	0.015	$250,000
Trial 8	$1,200,000	0.074	0.074	$1,200,000
Trial 9	$8,000,000	0.494	0.494	$8,000,000
Trial 10	$25,000	0.002	0.002	$25,000
Expected Value ($) =	$10,382,500			$15,384,422
If LoRE = 0.1, then Risk ($) =	$103,825			$153,844

VSL: $16.2M ($2024)

H. Deriving Risk Values

Consistent with the RDF, the Risk Value is the product of LoRE and the scaled expected value of CoRE (denoted hereinafter as CoRE):

$$\text{Risk Value} = \text{LoRE} \times \text{CoRE} \qquad 3.11$$

1. Data Sources Used in Estimating Risk Values

SoCalGas and SDG&E applied the RDF's analytical requirements by leveraging internal and external historical data, external research, simulations, and subject matter expertise (SME) to assess the range of potential risk event impacts to inform the CoRE attributes. Probabilistic distributions of consequence outcomes are developed where sufficient data exists. The data for such analyses are derived from internal historical records, external sources, or SME estimates, as needed.

The distribution for each consequence outcome is determined based on the properties of the consequence and the available data. The expected values of consequences, as well as other relevant values (*i.e.*, tail outcome values), are derived from the probabilistic range of outcomes presented in the distributions. A non-exhaustive list of potential distributions used, sometimes in combination, for 2025 RAMP calculations includes:

- Lognormal
- Poisson
- Bernoulli
- Generalized Pareto Distribution
- Truncated Pareto
- Capped discrete Pareto
- Truncated Normal
- Uniform
- Kernal Density Estimation
- Beta
- PERT

Data to assess risk and mitigation value comes from various sources, such as internal data at SoCalGas and SDG&E, publicly available data, external research, and historical utility datasets. A non-exhaustive list of examples includes the following:

A. Electric outage data – SAIDIDAT [2014-23]
B. Circuit customer count [2014-23]
C. PHMSA Reportable Incident and Annual Data
D. Damage Information Reporting Tool (DIRT) data
E. Other SoCalGas and SDG&E Internal Data
F. Other Industry Reports, Studies, Papers
G. Field-Based Safety Management System (SMS) data [2016-24]

H. CPUC-reportable fire incident data[42]

Table 14: Sample Data Sources Used in Estimating Risk Value

RAMP Risk	Data Source(s)
HP Gas	C, E, F
MP Gas	C, E, F
Excavation Damage	C, D, E, F
Gas Storage	C, E, F
Employee Safety	F, G
Contractor Safety	F, G
EII	A, B, E, F
Cybersecurity	F, G
Wildfire	A, B, E, F, H (*see* section 2.i)

2. Consequence Modeling for Certain Risks

Special consequence modeling is administered for certain risks, as described below, which supersedes the analyses described above.

i. Consequence Modeling for Wildfire Risk

The unique nature of Wildfire Risk has garnered specialized methodologies, as described in the section below. The prevalence and complexity of wildfire risk has garnered heightened attention and analyses from SDG&E, as exemplified in the Wildfire Mitigation Plan (WMP) filings and prior RAMP reports. Consequence modeling for wildfire risk include modeling for the risk itself as well as Public Safety Power Shutoff (PSPS) and Protective Equipment and Device Settings (PEDS) considerations. Each are described below, and additional details can be found in SDG&E's 2026-2028 WMP.[43]

Wildfire consequence estimations are derived from Technosylva's FireSight™ simulations (also known as WFA-E WRRM). These simulations assess fire behavior at each asset location under historical worst-case fire weather conditions. Currently, SDG&E evaluates fire behavior scenarios for 125 days, spanning from 2013 to 2021, which represent the worst fire

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[42] CPUC, *Wildfire and Wildfire Safety*, *available at:* https://www.cpuc.ca.gov/industries-and-topics/wildfires.

[43] State of California – Office of Energy Infrastructure and Safety, *2026-28 Base Wildfire Mitigation Plans (WMP)*, *available at:* https://energysafety.ca.gov/what-we-do/electrical-infrastructure-safety/wildfire-mitigation-and-safety/wildfire-mitigation-plans/2026-28-base-wildfire-mitigation-plans/.

weather days in its service area. These days are selected and reviewed by experts from the Meteorology, Fire Science, Engineering, and Risk Analytics groups to properly account for the most critical fire weather conditions in SDG&E's service territory and promote accurate risk assessments. SDG&E subject matter experts are collaborating with the Technosylva team to reevaluate and expand the selection of these critical fire weather days to include the latest fire weather events that occurred in California from November 2024 to January 2025, including the Palisades and Eaton fires.

Technosylva's advanced and proprietary wildfire modeling incorporates weather variables, detailed fuel layers, and a 24-hour unsuppressed fire spread model to estimate potential ignition size (acres burned) and impact (buildings destroyed), both at and around asset locations within SDG&E's service territory.

Table 15: Attributes for Wildfire Consequence

Risk Attribute	Wildfire Consequence
Safety	Equivalent Safety Serious Injuries and Fatalities are calculated based on Technosylva estimates of structures destroyed. Assumption: To estimate the total number of equivalent fatalities per structure destroyed a 0.00617 factor is assumed. This factor is estimated based on an internal analysis conducted on the CALFIRE dataset.
Reliability	Subject matter expert assumption to estimate Customer Minutes Interrupted (CMI) values based on estimates of outage duration and assumed restoration duration. These CMI estimates are subsequently monetized using the $/CMI value provided in this chapter. Assumption: Restoration time is 24h
Financial	Subject matter expert conservative assumption to translate buildings destroyed and acres impacted estimated by Technosylva simulations to financial dollars. Assumptions: - Suppression and restoration cost: $2,350/acres burned[44] - Structure Destroyed cost: $1,000,000/structure destroyed[45]

[44] SME assumption based on a review of CALFIRE suppression costs incurred from 2000 to 2023. Data for 2024 and 2025, which should include the devastating fires in Los Angeles, is not included as suppression costs for these incidents are not available as of February 2025.

[45] SME assumption based on a review of publicly available data on the median listing home price in San Diego County as of February 2025.

To calculate the potential impacts of PSPS de-energizations, the duration of de-energization by feeder segment and the number of downstream customers affected by de-energization on each feeder segment are considered. These values are used to determine natural unit values for the three consequence components.

Table 16: Attributes for PSPS Consequence

Risk Attribute	PSPS Consequence
Safety	Subject matter expert conservative assumption to estimate the potential number of Serious Injuries and Fatalities created by a PSPS de-energization event. Assumption: 1 fatality per 10 billion customer minutes de-energized. This assumption is estimated based on a review of historical PSPS events in California (2018-2021).[46,47,48]
Reliability	Customer Minutes Interrupted (CMI) estimates are calculated directly from the number of customers impacted at each feeder segment with varying event durations based on historical and projected PSPS event durations. Assumption: These CMI estimates are subsequently monetized using the $/CMI value provided in this chapter.
Financial	Subject matter expert conservative assumption to estimate the potential financial loss experienced by customers affected by a PSPS de-energization event. Assumption: For Residential customers a $482 cost per event is calculated using the per diem rates applicable to San Diego, CA, as of September 2024 with the assumption of accommodating four family members per customer meter. For C&I customers, a $1,446 cost per event is estimated.[49]

[46] CPUC, *Utility PSPS Reports: Post-Event, Pre-Season and Post-Season*, *available at*: https://www.cpuc.ca.gov/consumer-support/psps/utility-company-psps-reports-post-event-and-post-season.

[47] SCE, *PSPS Reports to the CPUC*, *available at:* https://www.sce.com/outage-center/outage-information/psps.

[48] PG&E, *Public Safety Power Shutoffs*, *available at:* https://www.pge.com/en/outages-and-safety/safety/community-wildfire-safety-program/public-safety-power-shutoffs.html.

[49] For FY 2025 per diem rates for San Diego, California refer to: U.S. General Services Administration (GSA), *FY 2025 per diem rates for ZIP Code. Financial values as of February 2025. A factor of three is assumed for C, available at:* https://www.gsa.gov/travel/plan-book/per-diem-rates/per-diem-rates-results?action=perdiems_report&city=San%20Diego&fiscal_year=2025&state=CA&zip=.Financial%20values%20as%20of%20February%202025.%20A%20factor%20of%20three%20is%20assumed%20for%20C&I%20customers.

To align the risk quantification requirements between this RAMP filing and WMP filings,[50] SDG&E includes risks associated with Protective Equipment Device Settings (PEDS). This PEDS model follows a similar approach to PSPS as it is modeled as a reliability outage. The following assumptions are considered to establish PEDS consequences.

Table 17: Attributes for PSPS Consequence

Risk Attribute	PEDS Consequence
Safety	The same assumption as in the PSPS consequence model is used for PEDS. Subject matter expert conservative assumption to estimate the potential number of Serious Injuries and Fatalities created by a PEDS reliability outage event. Assumption: 1 fatality per 10 billion customer minutes de-energized. This assumption is estimated based on a review of historical PSPS events in California (2018-2021).[51,52,53]
Reliability	Customer Minutes Interrupted (CMI) estimates are calculated directly from the number of customers impacted at each feeder segment, with varying event durations based on historical and projected PEDS event durations. These CMI estimates are subsequently monetized using the $/CMI value provided in of this chapter.
Financial	Subject matter expert conservative assumption to estimate the potential financial loss by a PEDS de-energization event. Assumption: Based on historical overhead line patrol costs during elevated or extreme fire weather conditions, whether conducted on foot or by helicopter, a 10% ratio of the expected reliability cost is assumed to model this impact.

[50] State of California – Office of Energy Infrastructure Safety, *Wildfire Mitigation Plans Guidelines* (February 24, 2025), *available at:* https://efiling.energysafety.ca.gov/eFiling/Getfile.aspx?fileid=58026&shareable=true.

[51] CPUC, *Utility PSPS Reports: Post-Event, Pre-Season and Post-Season*, *available at*: https://www.cpuc.ca.gov/consumer-support/psps/utility-company-psps-reports-post-event-and-post-season.

[52] SCE, *PSPS Reports to the CPUC*, *available at:* https://www.sce.com/outage-center/outage-information/psps.

[53] PG&E, *Public Safety Power Shutoffs*, *available at:* https://www.pge.com/en/outages-and-safety/safety/community-wildfire-safety-program/public-safety-power-shutoffs.html.

ii. Modeling Safety Consequences for High-Pressure, Above-Ground Gas Facilities and Storage

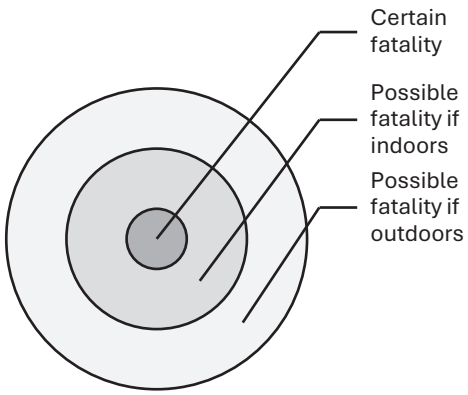
Due to the lack of historical high-pressure gas risk events resulting in fatalities or serious injuries, SoCalGas and SDG&E have relied on national natural gas pipeline incident data provided by PHMSA to quantify the potential safety impacts of such events. This approach takes into account pipeline specifications, such as operating pressure and pipe diameter, as well as service territory characteristics like population density, which may differ from national data. This is done using mathematics and physical principles, based on an equation provided in the Gas Research Institute (GRI),[54] which is based on the same physical model as the Potential Impact Radius (PIR) model used for natural gas pipelines in the U.S. Code of Federal Regulations (49 CFR § 192). The general form of the equation is the following:

$$N = p_i \cdot a_h \cdot \rho \cdot \tau \qquad 3.12$$

where p_i is the probability of ignition, a_h is the size of the hazard area, ρ is the population density, and τ is the probability of an occupant being present at the time of the incident. The probability of ignition p_i is calculated as a function of pipe diameter and a_h is assumed to be a circle with radius r_i, within which the heat intensity exceeds a certain threshold that results in certain fatality or possible fatality depending on the threshold. The study depicts the hazard area and potential safety consequences in Figure 2 below:

[54] Journal of Pressure Vessel Technology, Transactions of the ASME, *Target Reliability Levels for Design and Assessment of Onshore Natural Gas Pipelines* (December 2009), *available at*: https://www.researchgate.net/publication/245365044_Target_Reliability_Levels_for_Design_and_Assessment_of_Onshore_Natural_Gas_Pipelines.

Figure 2: **Hazard Areas**



For the outcome rupture, Nessim et al. (2009) shows Equation 3.12 can be expanded to:

$$N = p_i \cdot \rho \cdot \tau \cdot \pi \cdot [P_{in} \cdot (0.25 \cdot (r_{i-0}^2 - r_{i-100}^2) + r_{i-100}^2) + P_{out} \cdot (0.5 \cdot (r_{o-0}^2 - r_{o-100}^2) + r_{o-100}^2)] 3.13$$

where r_{i-0} and r_{i-100} are the radii of the hazard area when indoors, and similarly r_{o-0} and r_{o-100} describe the hazard radii for outdoor exposure. The study also makes assumptions that τ is 40%, the probability of being indoor P_{in} is 90%, and the probability of being outdoors P_{out} is 10%. Large leaks are also modeled using Equation 3.13 with different radii and a probability of ignition accounting for the differences between a rupture and a large leak.

Using these assumptions SoCalGas and SDG&E adopted the approach presented in the GRI study in Monte Carlo simulation to estimate the average number of fatalities per rupture and large leak. Since the equation only predicts fatalities, PHMSA data was used to estimate how many serious injuries would occur given a rupture or large leak. This approach using heat thresholds and hazard radii was also applied to High-Pressure facilities and Underground Storage, with different assumptions based on the type of asset.

Additionally, the Monte Carlo simulations for the Safety CoRE distributions included distributions for Class locations for transmission and Zone locations for High-Pressure distribution infrastructure. These Class/Zone distributions were constructed using internal sliding miles data and the latest available California and US census data.

This comprehensive approach enhances the modeling of the safety consequences of high-pressure risk events, taking into account specific pipeline and service territory characteristics.

iii. Safety Consequence Modeling for Medium-Pressure Gas Risk including Excavation

Consequence modeling for Medium Pressure risk involves assessing the probability that a leak results in a serious incident (a serious injury or fatality or SIF), the expected number of SIFs, and the proportion of those SIFs that are fatalities versus serious injuries. Equation 3.13 discussed above applies only to high-pressure assets and cannot be used to estimate safety consequences for the medium pressure system, as safety incidents associated with the Medium Pressure Gas Risk typically occur due to gas migration and accumulation into a structure.

Where possible, internal data was leveraged, such as the probability of a serious incident, which is an output of the Companies' Integrity Management Quantitative Risk Analytics (QRA) model. Where internal data was unavailable, national PHMSA incident data was used. The total number of SIFs expected per incident and the proportion of those SIFs expected to be fatalities were determined using PHMSA data. For risk-averse scaling, probability distributions calibrated to PHMSA data were used to perform Monte Carlo simulations.

SoCalGas and SDG&E recognize potential drawbacks to using national data, such as varying levels of population density nationwide that may not reflect the service territory population density and thus may not entirely reflect potential safety outcomes. To address this, SoCalGas and SDG&E categorized the locations of the national incident data into one of four types: Business District High Population, Business District Low Population, Non-Business District High Population, and Non-Business District Low Population.

Considering business districts and population density as two different dimensions allows for different location types to be considered, which may have varying amounts of traffic. For example, an area may have low population density because it is commercial and lacks many homes. It would not be accurate, however, to assume that safety consequences are relatively low just because there are few homes, as this area may be highly populated during business hours. Using Google Maps and 2020 census data, SoCalGas and SDG&E were able to categorize the national incident data into one of these four categories, allowing the modeled safety outcomes to align more closely with the Companies' respective service territories.

This approach is intended to accurately model the safety consequences of medium pressure risk events and account for specific characteristics of the service territories.

I. Estimate Mitigation Costs and Benefits

1. Estimating Mitigation Costs

Control and mitigation costs are derived from business unit forecasts of expected unit installations and related capital and O&M costs from 2028-2031. Costs are further broken down by labor and units (*e.g.*, number of poles) required to implement the associated mitigation. Forecasts are informed by historical units and costs of controls, where relevant data is available.

2. Estimating Mitigation and Control Benefits

Mitigations and controls either reduce or maintain risk. When risk is reduced, the LoRE or CoRE may be decreased, resulting in a potential baseline shift in the Risk Value for future years. For activities that maintain risk that otherwise would increase owing to ongoing infrastructure deterioration or exogenous factors such as climate effects, SoCalGas and SDG&E consider an alternative scenario where the activity does not exist, allowing the Companies to quantify the benefit of the activity. In this scenario, the Risk Value would be higher without the activity, and thus the LoRE or CoRE would be higher. This concept of "prevention" versus "preservation" will be discussed in the following section.

Estimating mitigation benefits depends on the availability and quality of data. In an effort to use the most reliable information, SoCalGas and SDG&E developed a data prioritization framework. This framework prioritizes: 1) internal data sources to assess mitigation effectiveness, including pre- and post-implementation reports, integrity management analysis, failure rates (*e.g.*, leak rates), incident rates, and maintenance data. When internal data is insufficient, SoCalGas and SDG&E incorporate 2) external industry sources, such as reports from the DOE, PHMSA incident data, vendor documentation, and academic research. For emerging technologies with limited empirical data, the Companies adopt a 3) qualitative approach, leveraging SME (Subject Matter Expert) insights to estimate potential benefits.

3. Calculating Benefits Through Prevention, Preservation, and Containment

The risk reduction or risk maintenance attributable to a mitigation or control – which constitutes the "benefits" for CBR purposes – is the estimated difference between the Pre-Mitigated and Post-Mitigated Risk Value resulting from application of the mitigation or the scenario of the absence of an ongoing activity. Calculating the risk reduction or risk maintenance entails modeling whether and how the mitigation or control impacts LoRE, one or more CoRE attributes, or some combination.

For this RAMP filing, SoCalGas and SDG&E modeled risk reduction or risk maintenance according to three categories of how mitigations or controls interact with risk, as described below. For simplicity, scope[55] is not considered in Equations 3.14−3.17; scope calculations are introduced in the next section.

Prevention: This involves reducing the LoRE without affecting the CoRE. Examples include replacing pipelines and undergrounding powerlines. Equation 3.14 shows the risk reduction as the difference between the Pre-Mitigated Risk and the Post-Mitigated Risk:

$$\text{Risk Reduction} = (\text{LoRE} \times \text{CoRE}) - (\alpha \times \text{LoRE} \times \text{CoRE}) \qquad 3.14$$

where $0 \leq \alpha \leq 1$.[56] Here the effectiveness of the mitigation is represented by α, where $(1 - \alpha)$ is the effectiveness of the mitigation. For example, for a mitigation that is 95% effective, we use $\alpha = 0.05$.

Preservation: This involves maintaining the current level of risk. Examples include routine maintenance, corrosion control, vegetation management, inspections, and safety training mitigations. Equation 3.15 shows the risk reduction as the difference between the Pre-Mitigated Risk and the Post-Mitigated Risk:

$$\text{Risk Reduction} = (\rho \times \text{LoRE} \times \text{CoRE}) - (\text{LoRE} \times \text{CoRE}) \qquad 3.15$$

where $\rho \geq 1$. Here the effectiveness of an ongoing mitigation or control is represented by ρ, where $\frac{\rho-1}{\rho}$ is the effectiveness of the mitigation or control. For example, if an ongoing mitigation or control is 50% effective, we use $\rho = 2$. Another way to estimate ρ is to determine how many more failures would be expected in absence of the ongoing activity.

Containment: This involves reducing the severity of outcomes (CoRE) without affecting the LoRE. Examples include emergency response plans, fire suppression systems, automated valves, and personal protective equipment (PPE) mitigations. Equations 3.16 and 3.17 represent this for new mitigations or controls, and ongoing mitigations or controls, respectively:

$$\text{Risk Reduction} = (\text{LoRE} \times \text{CoRE}) - (\text{LoRE} \times \gamma \times \text{CoRE}) \qquad 3.16$$

[55] Scope is the proportion of risk that could be addressed by mitigation.

[56] Here, alpha is used as the parameter of LoRE reduction; in the section describing the approach to risk scaling, alpha is used to denote the scaling coefficient.

$$\text{Risk Reduction} = (\text{LoRE} \times \kappa \times \text{CoRE}) - (\text{LoRE} \times \text{CoRE}) \quad 3.17$$

where $0 < \gamma \leq 1$ and $\kappa \geq 1$. Similar to α and ρ, γ and κ represent the effectiveness of a new mitigation or control, or an ongoing activity, through $(\gamma - 1)$ and $\frac{\kappa-1}{\kappa}$, respectively.

4. Mitigation Scope, Future Values, and Shifting the Baseline

When applying one of the parameters α, ρ, γ or κ, from prevention, preservation, or containment, to a LoRE or CoRE, it should only be applied to the portion that the mitigation or control covers. For example, if focusing on 100 miles of medium pressure mains, one must first consider the LoRE or CoRE specific to medium pressure mains and then apply the parameter to the proportion that corresponds to the 100 miles.

Certain models with high granularity allow for precise targeting of the portion addressed by the control or mitigation, while others require estimating the percentage, and some require both approaches. Step 1 involves narrowing down the slices of risk that the mitigation or control addresses as much as possible. Step 2 involves using exposure data to determine the percentage being addressed.

To demonstrate the math, SoCalGas and SDG&E assume that the LoRE/CoRE pairs in the equations represent Step 1, and the scope parameter s (or S) is the percentage of that LoRE or CoRE being addressed by the parameters α, ρ, γ or κ.

To discuss the equations for scope calculation, one must first express all LoREs and CoREs in terms of future values. In subsection E below, an explanation for how everything is discounted back to a single point in time (base year 2024 for these RAMP Reports), using three discount scenarios, is provided. This discussion focuses on applying inflation to the CoRE attributes and Costs, and degradation to the LoRE.

SoCalGas and SDG&E start with the general equations to convert CoRE and Cost into future values from the base year t_0 (for this RAMP, 2024) to a future year $T > t_0$:

$$\text{CoRE}_T = \text{CoRE}_{t_0} \cdot (1 + r_{\text{inf}})^{(T-t_0)} \quad 3.18$$

$$\text{Cost}_T = \text{Cost}_{t_0} \cdot (1 + r_{\text{inf}})^{(T-t_0)} \quad 3.19$$

Here, r_{inf} represents the inflation rate.

For any degradation rate, such as corrosion, that increases LoRE, the following equation is used:

$$\text{LoRE}_T = \text{LoRE}_{t_0} \cdot \left(1 + r_{\text{deg}}\right)^{(T-t_0)} \quad 3.20$$

where r_{deg} represents the degradation rate.

Next, for a mitigation m_0 with scope s_0 and prevention parameter α_0 in year $T-1$:

$$\text{LoRE}_T = \text{LoRE}_{T-1} \cdot (1 - s_0) + LoRE_{T-1} \cdot s_0 \cdot \alpha_0 \quad 3.21$$

This equation can be rewritten as:

$$\text{LoRE}_T = \text{LoRE}_{T-1} \cdot (1 - s_0 \cdot (1 - \alpha_0)) \quad 3.22$$

Similarly, for mitigation M_0 with scope S_0 and containment parameter γ_0 in year $T-1$:

$$\text{CoRE}_T = \text{CoRE}_{T-1} \cdot (1 - S_0 \cdot (1 - \gamma_0)) \quad 3.23$$

For multiple mitigations $m_0, m_1, \ldots, m_n$ with scopes $s_0, s_1, \ldots, s_n$ and prevention parameters $\alpha_0, \alpha_1, \ldots, \alpha_n$ in year $T-1$, respectively:

$$\text{LoRE}_T = \text{LoRE}_{T-1} \cdot \prod_{i=0}^{n} \left(1 - s_i \cdot (1 - \alpha_i)\right) \quad 3.24$$

Similarly, for multiple mitigations $M_0, M_1, \ldots, M_N$ with scopes $S_0, S_1, \ldots, S_N$ and containment parameters $\gamma_0, \gamma_1, \ldots, \gamma_N$ in year $T-1$, respectively:

$$\text{CoRE}_T = \text{CoRE}_{T-1} \cdot \prod_{i=0}^{N} \left(1 - S_i \cdot (1 - \gamma_i)\right) \quad 3.25$$

Equations 3.18−3.20 and 3.23−3.25 define LoRE and CoRE in future values.

Equations 3.21−3.25 correspond to mitigations that are preventions or new containments. These equations shift the baseline, as the left-hand sides define the start of the next year as a function of the previous year. For year T, the right-hand sides also represent the post Mitigation LoREs and post Mitigation CoREs. Specifically:

$$\text{postMitigation LoRE}_T = \text{LoRE}_T \cdot (1 - s \cdot (1 - \alpha)) \quad 3.26$$

$$\text{postMitigation CoRE}_T = \text{CoRE}_T \cdot (1 - s \cdot (1 - \gamma)) \quad 3.27$$

for year T.

Prevention and containment mitigations and controls do not shift baselines, and the math is the same for determining the pre-Mitigation LoREs and pre-Mitigation CoREs, as follows:

$$\text{preMitigation LoRE}_T = \text{LoRE}_T \cdot (1 - s \cdot (1 - \rho)) \quad 3.28$$

$$\text{preMitigation CoRE}_T = \text{CoRE}_T \cdot (1 - s \cdot (1 - \kappa)) \quad 3.29$$

for year T.

These equations help determine how the effectiveness of mitigations and controls, represented by parameters α, ρ, γ and κ, impact the LoRE and CoRE over time.

J. Discounting Costs and Benefits, and Calculating the Cost-Benefit Ratio

The previous subsection describes how to convert all LoREs, CoREs, and costs into future values. The next step is to discount everything back to a single point in time (the net present value), which, for purposes of the 2025 RAMP is 2024, the last recorded year of data available at the time of this RAMP filing. Consistent with the direction provided in the RDF, this is done using three discount scenarios: Societal, Weighted Average Cost of Capital (WACC), and a Hybrid approach. The Hybrid approach discounts the Safety and Reliability CoREs using a Hybrid rate, as prescribed by the Phase 3 Decision, while the Financial CoRE and costs are discounted using the WACC.

SoCalGas and SDG&E perform this discounting either before or after calculating the risk. For any CoRE attribute in future value, the following equation is used:

$$\mathrm{PV}_{r_{\mathrm{dis}}}[\mathrm{CoRE}_T] = \frac{\mathrm{CoRE}_T}{(1 + r_{\mathrm{dis}})^{(T - t_0)}} \tag{3.30}$$

Alternatively, this can be expressed as:

$$\mathrm{PV}_{r_{\mathrm{dis}}}[\mathrm{CoRE}_T] = \mathrm{CoRE}_{t_0} \cdot \left(\frac{1 + r_{\mathrm{inf}}}{1 + r_{\mathrm{dis}}}\right)^{(T - t_0)} \tag{3.31}$$

where r_{dis} is the discount rate.

Similarly, for costs:

$$\mathrm{PV}_{r_{\mathrm{dis}}}[\mathrm{Cost}_T] = \mathrm{Cost}_{t_0} \cdot \left(\frac{1 + r_{\mathrm{inf}}}{1 + r_{\mathrm{dis}}}\right)^{(T - t_0)} \tag{3.32}$$

Note that:

$$\mathrm{PV}_{r_{\mathrm{dis}}}[\mathrm{LoRE}_T \cdot \mathrm{CoRE}_T] = \mathrm{LoRE}_T \cdot \mathrm{PV}_{r_{\mathrm{dis}}}[\mathrm{CoRE}_T] \tag{3.33}$$

for any of the CoRE attributes (Safety, Financial, or Reliability), since LoRE is not monetary. Hence, one can now define the net present value of Risk:

$$\mathrm{PV}[\ \mathrm{Risk}_T] = \mathrm{LoRE}_T \cdot \left(\mathrm{PV}_{r_{\mathrm{dis}_s}}\left[\mathrm{CoRE}_T^{\mathrm{safety}}\right] + \mathrm{PV}_{r_{\mathrm{dis}_r}}\left[\mathrm{CoRE}_T^{\mathrm{reliability}}\right] + \mathrm{PV}_{r_{\mathrm{dis}_f}}\left[\mathrm{CoRE}_T^{\mathrm{financial}}\right]\right) \tag{3.34}$$

where r_{dis_s}, r_{dis_r}, and r_{dis_f} are discount rates for the Safety CoRE, Reliability CoRE, and Financial CoRE, respectively. As mentioned, in the two discount scenarios, WACC and Societal, all discount rates apply uniformly to all attributes. In the Hybrid scenario, while the

cost and Financial CoRE use WACC as the discount rate, the safety and reliability CoRE use a Hybrid discount rate, as described in the Phase 3 Decision.[57]

What follows is the net present value of the benefit of a mitigation:

$$\text{Benefit}_T = \text{PV}[\text{ PreMitigation Risk}_T] - \text{PV}[\text{ PostMitigation Risk}_T] \quad 3.35$$

And the total benefit:

$$\text{Benefit} = \sum_{t \in \text{BY}} \text{Benefit}_t \quad 3.36$$

where BY is all the benefit years of the mitigation.

The ratio of Equation 3.36 and Equation 3.32 define the Cost-Benefit Ratio for a mitigation or control:

$$\text{CBR} = \frac{\text{Benefit}}{\text{PV}[\text{Cost}_T]} \quad 3.37$$

When comparing the effects of the three discount rate scenarios on the CBRs, several observations can be made. For mitigations with a one-year benefit, the WACC and Societal discount rates yield identical CBRs. This occurs because both the numerator and denominator are inflated and discounted over the same period, causing the rates to cancel each other out. In contrast, under the Hybrid scenario, the numerator and denominator are discounted differently, leading to different CBRs.

For mitigations with benefits lasting longer than one year, if the discount rate (*e.g.*, WACC) exceeds the inflation rate, the benefits are reduced more than the costs. For instance, consider a mitigation with a 68-year benefit where a pipe is replaced in 2028. The cost is discounted over 4 years, while the benefit is discounted over a period ranging from 4 to 72 years. This creates a significant difference in CBR values between the discount rate scenarios, especially between the WACC and Societal rates.

[57] D.24-05-064 at 103.

Table 18 shows the three discount rates for SoCalGas and SDG&E, respectively:

Table 18: Discount Factors Applied to the 2025 RAMP

	SoCalGas	SDG&E
Weighted Average Cost of Capital (WACC)[32]	7.49%	7.45%
Social Discount Rate	2%	2%
Hybrid rate calculated as defined in Phase 3[33]	6.1%	6.1%

K. Mitigation Strategy – Other Considerations

As stated in Chapter RAMP-2, SoCalGas and SDG&E's risk management philosophy prioritizes the prevention of catastrophic, loss-of-life events, protracted service interruptions, and the associated financial losses of such events. Row 26 of the RDF provides that a utility "is not bound to select its Mitigation strategy based solely on the Cost-Benefit Ratios produced by the Cost-Benefit Approach" and that "[m]itigation selection can be influenced by other factors." One such consideration that factors into the Companies' decision-making is the effectiveness of risk mitigations in reducing the potential for the type of catastrophic ("tail risk") outcomes described above. Providing insight into the specific question of tail risk reduction entails an analysis of pre- and post-mitigation tail risk. This section illustrates such tail risk analysis[58] as applied to certain of SDG&E's Wildfire mitigations.

For tail risk analysis, SDG&E uses the same probability distribution modeling underlying the development of the CBRs as described in the preceding sections within Step 3: Mitigation Analysis for RAMP Risks of this Chapter. In accordance with the RDF, SDG&E calculated CBRs for Strategic Undergrounding (SUG) and Combined Covered Conductor (CCC), which provide a comparison of those two mitigations on an expected value basis. In addition, SDG&E compares pre- and post-mitigation outcomes at various tail percentile values, including the 98th percentile (1 in 50 years) and the 99th percentile (1 in 100 years) to understand the potential residual tail risk remaining in the system after deploying these mitigations.

For illustrative purposes, the table below presents an evaluation of the residual risk (unmitigated) for the 98th percentile (1 in 50-year return period) for both SUG and CCC, Notwithstanding the CBRs, the post-mitigation (residual) tail risk (98th percentile outcome)

[58] The analysis presented in this section is not an application of tail risk-based CBRs in accordance Row 24 of the RDF, but a separate consideration in accordance with Row 26 of the RDF.

resulting from CCC is very large and, arguably, "intolerable."[59] Accordingly, and given SDG&E's aim of effectively and cost-efficiently reducing the risk of catastrophic outcomes, SDG&E's decision process would consider whether supplemental mitigation would be required with CCC to further reduce the P98 residual risk over the lifetime of the assets.

Table 19: Residual Tail Risk Comparison

Feeder Segment	Mitigation	Pre-Mitigation Risk at P98 [k$]	Post-Mitigation Risk at P98 [k$]	Risk Reduction at P98 [%]
235-899R	SUG	$ 4,667.33	$ 175.48	96.24%
235-899R	CCC	$ 4,667.33	$ 3,111.56	33.33%
222-1990R	SUG	$ 1,102.51	$ 445.56	59.59%
222-1990R	CCC	$ 1,102.51	$ 891.12	19.17%

L. Tranching

1. SoCalGas and SDG&E's 2025 RAMP Tranching Methodology

RAMP Risks are characterized by variation in the level of risk within the Risk, meaning that certain segments are riskier than others, particularly with asset-based risks. Within the RDF, "tranching" is the method by which a risk is partitioned in accordance with the variation in the risk profiles – that is, variation in the risk scores across the Risk – and "tranches" are the partitions resulting from tranching. One of the CPUC's stated goals of the RDF tranching requirement is to provide more granular tranches to inform the Commission of the riskiest portions of the Companies' infrastructure.[60] Calculating CBRs at the tranche level generally follows the process described above in Step 3 of this Chapter (Mitigation Analysis for RAMP Risks). To produce the requisite tranche-level view of a risk, the process first entails application of a method for partitioning the risk into tranches. Further, the tranches should adhere to the guidance of RDF Row 14 in terms of being sufficiently granular and exhibiting homogeneous risk profiles within each tranche. The Phase 3 Decision adopts a Row 14 tranche granularity approach (referred to as the Phase 3 Tranching Approach (PTTA)) and requires utilities "to use this approach to determine tranches in most cases,"[61] while allowing for flexibility, as follows:

[59] "Intolerable" is used indicatively here; SDG&E is not asserting a risk tolerance.

[60] D 24-05-064 at 28.

[61] *Id.* at 26.

> The best practice for determining the homogeneity of risk profiles in reporting Tranches is the use of quintiles of LoRE and quintiles of CoRE, resulting in 25 reporting tranches. The utility can and should submit more granular data in workbooks included with RAMP and GRC filings if it is available, but that more granular data shall be aggregated into at least 25 reporting tranches with homogeneous risk profiles. If the assets or system associated with a given risk are less than 25 in number, the utility may use an alternative means of determining homogeneity of risk profiles, including quartiles or other smaller divisions of LoRE and CoRE, but this alternative means must be described in detail in the RAMP filing.
>
> If a utility desires to use an alternative determination of Tranches not reflecting 25 homogenous risk profiles based on LoRE and CoRE, or they wish to use a percentile ranking approach that would result in more than 25 reporting Tranches, the utility must submit a White Paper describing their preferred method for determining Tranches and relevant workpapers to SPD no later than 45 days before their first pre-RAMP workshop and must serve the White Paper to the service list of R.20-07-013 or a successor proceeding as well as the service list of the utility's most recent RAMP application proceeding no later than 45 days before their first pre-RAMP workshop. Staff and Parties may provide input on the IOU's White Paper within the 21 days from the submittal. The utility must also include the White Paper in its RAMP filing, clearly indicating any changes to the previously served version. An IOU may submit this White Paper without prejudice to the right of parties to the RAMP or GRC to challenge such alternative determination of tranches.[62]

The PTTA tranching methodology has not yet been applied or implemented in a RAMP application. Indeed, SoCalGas and SDG&E are the first utilities to test the PTTA approach in their RAMP Reports, which is especially important within the context of assessing and presenting infrastructure risk. This testing process identified inconsistencies between the stated objectives of the PTTA and the methodology itself, as SoCalGas and SDG&E explain in their Alternative Tranching White Paper (White Paper), which was served November 1, 2024, in accordance with the process set forth in Row 14, and is attached to this RAMP Report as Appendix 3.

The White Paper explains that testing of the PTTA revealed the following issues:

- Inconsistencies between the Phase 3 Decision's objective to develop tranches with "homogeneity of risk profiles" and the PTTA's guidance to produce twenty-five tranches reflective of each possible pairing of LoRE and CoRE quintiles. Specifically, many of the resultant tranches from application of the PTTA included a heterogeneous – not homogeneous – mix of risk events, in contrast

[62] D.24-05-064 at 33 (describing changes to the RDF Row 14).

with CPUC objectives.[63]

- Inconsistencies between the Phase 3 Decision's objective to identify "the riskiest portions of [a utility's] infrastructure and/or management system …" and the PTTA's potential to mix unlike risk profiles in a way that does not best represent the differences in risk profiles of the assets within the risk.[64]
- Inconsistencies between the Phase 3 Decision's goal of informing the Commission on the riskiest portions of the Companies' infrastructure and the PTTA's potential to minimize the presence of risk with respect to specific assets, due to the blending of different risk profiles within a tranche.[65]

Given these results, the White Paper explains that SoCalGas and SDG&E developed and applied a methodology referred to as the Homogeneous Tranche Method (HTM). The HTM is designed to achieve the stated objectives of the PTTA process (*i.e.*, by introducing an algorithm that addresses unwanted PTTA results observed in the testing), while adhering closely to the Row 14 PTTA process. Specifically, the algorithm produces homogeneity within each tranche, meaning the elements within the tranche are of substantially the same risk profile, within the same risk quantile, and arranged into similar LoRE/CoRE regions. In turn, each tranche provides a delineation as to the tranche's asset class within the Risk (*e.g.*, medium pressure underground assets), the relative level of risk (*e.g.*, the top 20%), and the LoRE/CoRE profile (*e.g.*, lower LoRE/upper CoRE). The HTM aligns with and advances the Commission's objective to identify the "riskiest portions of [a utility's] infrastructure and/or management system," consistent with the Phase 3 Decision's stated objectives.

A full explanation of the HTM is provided in the White Paper. The schematic in Figure 3 below provides a step-by-step illustration of the HTM. A similar schematic, specific to each risk, is also provided as an attachment to each Volume II risk chapter. In the graphic, the starting point is the set of risk incidents with their associated likelihood (LoRE) and consequence (CoRE) pairings. In the example below, the numerous causes of faults on SDG&E's electrical system (EII Risk) is the set of "LoRE/CoRE pairs" from which the tranches are derived. Next, the LoRE/CoRE pairs are aligned to Classes (Step 1). Classes for asset-based risks such as EII are generally asset subcategories (in the case of EII, substations, overhead infrastructure and

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63 White Paper at 8.

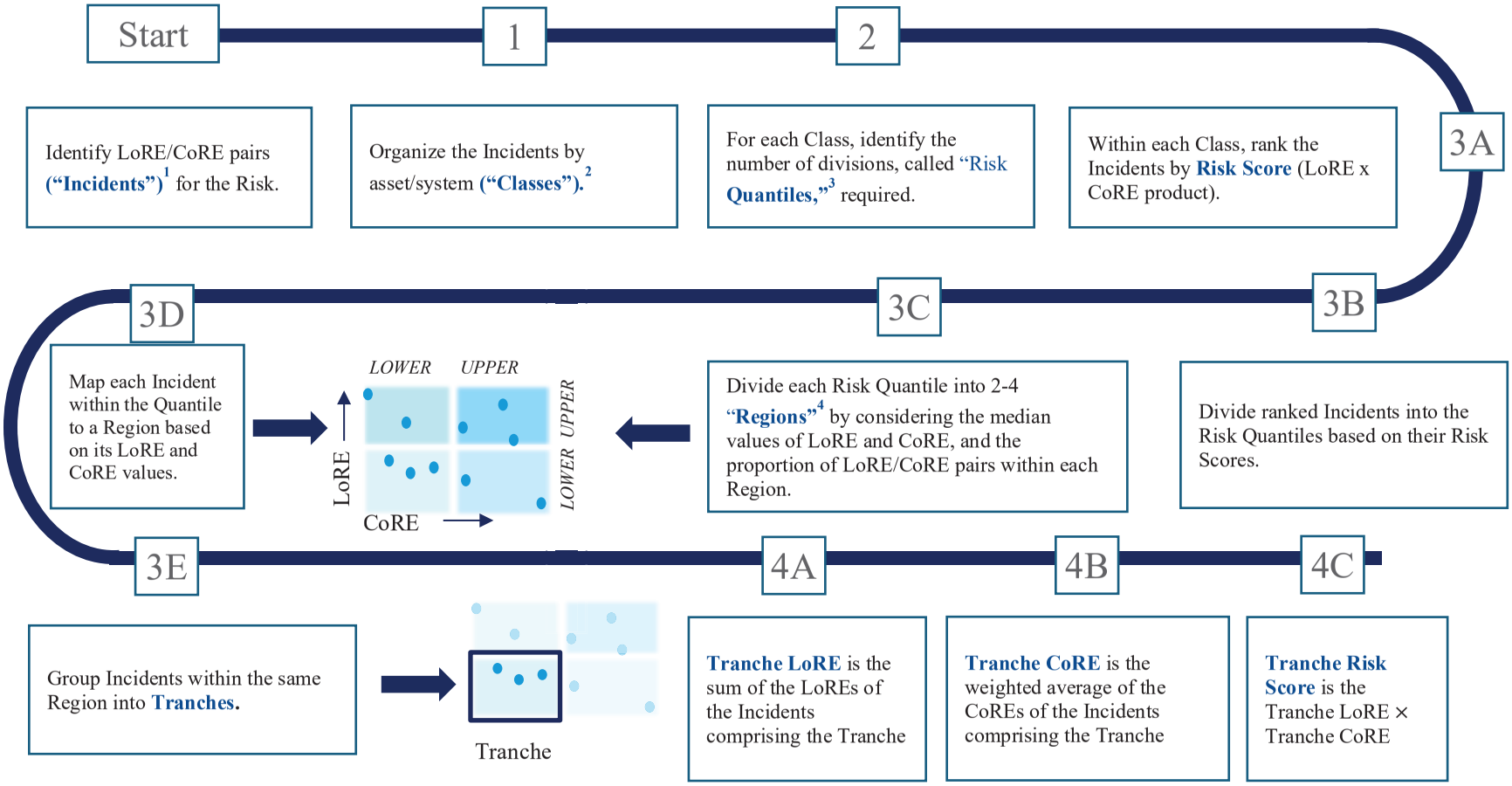
64 *Id.*

65 *Id.*

underground infrastructure). The classes provide the first "cut" of increased granularity. The next step (Step 2) is to determine how many divisions of incidents within each Class are needed to yield tranches that are homogeneous. Without this step, tranches for Classes with many incidents would be too broad (*i.e.*, too wide a range of LoRE/CoRE pairs within a tranche) and not achieve the RDF's goal of homogeneity within tranches. Accordingly, the number of "risk quantiles" is determined to facilitate homogeneity. In this way, Step 2 provides a second "cut" of increased granularity by dividing class LoRE/CoRE pairs into meaningful divisions *(e.g.*, "risk quartiles" if four divisions are determined, "risk quintiles" if five, and so forth).

As shown in Steps 3A through 3E of the graphic, the LoRE/CoRE pairs within each Class are organized highest to lowest (3A), the quantile lines "drawn" (3B), and the LoRE/CoRE pairs within each Class-quantile are mapped to the two to four LoRE x CoRE regions (3C). In this way, the resulting tranches (3E, in which LoRE/CoRE pairs within a region are group) are class-specific, within the same quantile of risk, and exhibit common LoRE/CoRE profiles. An example of a resulting tranche might therefore be "all of the low likelihood, high-consequence incidents in the first quartile of substation faults." As the original LoRE and CoRE attributes for each incident remain intact, the re-scoring of the tranche-level Risk Values is then determined (steps 4A through 4C).

Figure 3: Step-by-Step of the Homogeneous Tranching Method



NOTES

[1] *For example, **Incidents (or "Risk Incidents")** for Electric Infrastructure Integrity (EII) are generally fault types.*

[2] *For example, **Classes (or "Asset Classes")** for EII include Overhead Lines/Components, Underground Lines/Components, and Substations.*

[3] ***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*

[4] *The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*

2. Response to Initial SPD Feedback

As contemplated in the Phase 3 Decision, SPD Staff provided input on the Companies' White Paper following its submittal, in a letter sent on November 22, 2024 (the SPD Letter).[66] While SoCalGas and SDG&E developed the HTM in good faith to align with and improve upon the PTTA and enhance transparency, consistent with the Phase 3 Decision's goal, SPD raised concerns regarding the transparency and understandability of the HTM in its letter. SoCalGas and SDG&E appreciate SPD's feedback and have endeavored to address SPD's concerns regarding the transparency and understandability of the HTM in this RAMP presentation,[67] and provide the following context in considering the SPD Letter:

SoCalGas and SDG&E are Aligned with SPD on the Policy Objectives of Tranching.
The central stated policy objective of the RDF's tranching requirement is to promote targeted and efficient use of risk mitigation dollars by "prioritizing mitigations in the highest-risk tranches."[68] Pursuit of that objective was the overarching driver of the Companies' extensive, good faith effort to develop the HTM, which was designed to produce "tranches" for which the risk between tranches is measurably different, and for which the risk within each tranche is similar ("homogeneous"). The HTM also aims to achieve data-driven results, increase the transparency and granularity of information contained in the Companies' RAMP filing, and align with and inform risk mitigation efforts compatible with the Companies' existing and prospective operating procedures.[69]

SoCalGas and SDG&E Exercised Transparency in Developing the HTM.
SoCalGas and SDG&E conducted a testing analysis of the Phase 3 Decision's PTTA to understand how to model it and undertook a good faith effort to develop an empirical model with

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66 Letter from Danjel Bout, Director, Safety Policy Division, CPUC, to Kathe Hunter Córdova, GRC Program Manager, GRC Case Management – SoCalGas/SDG&E (November 22, 2024) Re: Safety Policy Division Response to the Sempra Alternative Tranching Method Whitepaper.

67 SPD Letter at 4.

68 *See* D.24-05-064 at 13; *see also id.* at 28 ("[U]sing LoRE/CoRE quintile tranches will aid the Commission and parties understand if a utility is requesting funding for mitigations in the riskiest portions of their infrastructure and/or management system.").

69 White Paper at 2.

the goal of producing tranches that adhere to the guidance contained in the PTTA.[70] The PTTA was not tested in S-MAP Phase 3, and there was no known pilot analysis the Companies could reference to understand how to model the Phase 3 Decision's PTTA guidance empirically. The Companies met with SPD staff on August 16, 2024 to discuss their intent to test the Phase 3 Decision's tranching methodology, then subsequently on September 10, 2024 and October 14, 2024, to provide status updates and share preliminary observations from that testing. SoCalGas and SDG&E's PTTA testing provided a critical foundational context for the HTM, as it was developed specifically to address the fact that the resulting PTTA tranches were not homogenous. The Companies have attempted in good faith to convey these steps in the meetings with SPD on tranching, as well as in the detailed White Paper, and remain committed to sharing information and analysis that serves the goal of achieving transparency and understandability.

Use of the HTM Aligns with the Phase 3 Decision's Desired Tranching Results.
SoCalGas and SDG&E include in their 2025 RAMP filings a significantly greater number of tranches compared with their 2021 RAMP filings. The Companies' tranching results are consistent with the Phase 3 Decision's intent and represent significant progress in advancing stated policy goals related to tranching. The Companies understand from the SPD Letter and subsequent meetings with SPD staff a concern that the HTM approach's mathematical complexity may hinder its ability to support risk-based decisions. While this feedback is appreciated, to provide additional context, the HTM's complexity is a function of the intent to improve upon the PTTA results while deviating as little as possible from the Phase 3 Decision's RDF Row 14 guidance. During the December 17 Pre-RAMP Workshop, certain participants posited alternative methodologies – including TURN's recommended asset-centric approach and OEIS's suggested "clustering" – that were suggested could produce even more homogeneous and useful tranches. While constructive, those suggestions depart even further from the Phase 3 Decision's Row 14 guidance than using the HTM.[71] While SoCalGas and SDG&E are receptive to consideration of alternative, more simplified approaches proposed by Stakeholders, the

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[70] White Paper at 5-7.

[71] Additionally, tranching alternatives suggested at the Pre-RAMP Workshop could not have been considered for use in this 2025 RAMP Report, given RDF Row 14's White Paper requirement and timing constraints.

Commission would need to express support for such approaches. In sum, SoCalGas and SDG&E are in alignment with SPD and intervenors on the important policy goals that tranches are intended to advance and submit that the development and application of the HTM has resulted in significant progress in the development and use of tranching in the Companies' 2025 RAMP filings. Constructive feedback on the mechanics of tranching is appreciated in considering future enhancements to the RDF. For purposes of their 2025 RAMP presentations, SoCalGas and SDG&E have utilized their HTM[72] and appreciate consideration of their good faith tranching presentation and results, which were designed to adhere to the RDF's Row 14 both in letter and in spirit, and to comply with the Phase 3 Decision while advancing the CPUC's stated policy goals.

VII. QUANTITATIVE WORKPAPERS

SoCalGas and SDG&E are providing workpapers to support the quantitative analysis in their RAMP Reports. The RDF Row 29 states the following:

> The methodologies used by the utility should be mathematically correct and logically sound. The mathematical structure should be transparent. All algorithms should be identified. All calculations should be repeatable by third parties using utility data and assumptions recognizing that, dependent on the models used, some variation of result may occur. This requirement is subject to practicality and feasibility constraints of sharing data and models (such as confidentiality, critical energy infrastructure data, volume of information and proprietary models). If these constraints arise, the utility will walk through the calculations in detail when requested by intervenors or the CPUC staff.

The Companies are providing quantitative workpapers that include (1) Excel-based workbooks and calculations and (2) tranche visuals in HTML format. For the workbooks and calculations, the Companies are producing these quantitative workpapers in the format for which the calculations were executed. For some RAMP risks, the quantitative modeling was performed either partially or entirely in Excel, and in these instances, Excel modeling workbooks with formulas intact are being provided. For other RAMP risks, Python and MATLAB programming languages were used to perform the quantitative risk modeling and calculations. When analytical programs are used, Excel-based workpapers are generated to present the output data. These workpapers may not include all underlying formulas. When this is the case, detailed calculation

[72] In workpapers, SoCalGas and SDG&E have also provided as points of comparison examples of tranching using the PTTA method for two risks: Underground Storage System and Wildfire and PSPS.

steps are provided for each mitigation that explain how the benefit-cost ratio is derived.

Risk quantification is further supported by additional resources and workpapers that include calculations, pseudocode, formulas, and detailed explanations, as applicable. In accordance with the RDF and Commission Rules, the Companies will walk through the calculations when requested by intervenors or the CPUC staff.



2025 Risk Assessment Mitigation Phase

(Chapter RAMP-4)

Safety Culture

May 15, 2025

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CHAPTER IV: SAFETY CULTURE

I. INTRODUCTION

This Chapter provides information regarding Southern California Gas Company's (SoCalGas) and San Diego Gas & Electric Company's (SDG&E) (collectively, the Companies) organizational structures, programs, cultures, and compensation as they relate to safety, as required by Decision (D.) 18-12-014.

Safety is foundational to both SoCalGas's and SDG&E's operations, requiring commitment from each Company's respective leaders, employees, and contractors to deliver safe and reliable energy to customers. SoCalGas and SDG&E define safety as the presence of controls for known hazards, actions to anticipate and guard against unknown hazards, and the commitment to continuously improve SoCalGas's and SDG&E's ability to recognize and mitigate hazards. Safety requires strong ongoing leadership commitment and active engagement and ownership from all employees. SoCalGas and SDG&E focus on safety through the lenses of employee safety,[1] public safety,[2] infrastructure safety,[3] and contractor safety.[4] Safety is a fundamental core value at the Companies and underpins all their actions. This commitment to safety is ingrained in the culture and exemplified by a dedicated workforce – from senior leadership to the front-line workers who safely manage and operate the systems and serve customers each day.

The Companies each describe the elements of their safety organizations, cultures, and practices in various proceedings and regulatory submissions, including the California Public Utility Commission's (Commission or CPUC) Order Instituting Investigation into SoCalGas's

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1 Safety systems and processes focused on the health and safety of employees. This includes safety policies, programs, and training.

2 Safety systems and processes focused on protection of customers and the public (*i.e.*, emergency management, environmental safety, customer data privacy, accessibility, protection of the public from harm caused by operations or assets, and the safety of vulnerable populations).

3 Safety systems and processes associated with the design, construction, operation, inspection, and maintenance of SoCalGas's and SDG&E's infrastructure.

4 Safety systems and processes focused on the safety and protection of contractors and subcontractors who provide services to support SoCalGas's and SDG&E's assets and operations.

Organizational Culture (I.19-06-014) (Safety Culture OII),[5] the Safety Culture Assessment Rulemaking proceeding (R.21-10-001),[6] SDG&E's annual Wildfire Safety Culture Assessments pursuant to Assembly Bill (AB) 1054, and annual Safety Performance Metrics Report (SPMR) submissions as required by the Commission's Safety Model Assessment Proceeding (S-MAP) Phase Two Decision, D.19-04-020. Additionally, SoCalGas and SDG&E participated in the joint Commission and Office of Energy Infrastructure Safety (OEIS) annual Public Safety Briefing in August 2024, outlining their respective safety organizations, cultures, and practices.[7] This chapter is intended to provide an overview and references the above-mentioned proceedings and regulatory submissions for additional information.

A. Safety Culture Goals & Objectives

SoCalGas and SDG&E recognize the importance of fostering and sustaining a strong culture of safety and share common objectives. Their commitment to a "safety first" mindset is demonstrated through the actions, allocation of resources, and organizational governance of the Companies. SoCalGas's and SDG&E's leadership teams actively build trust through non-punitive measures, a commitment to reducing high-risk conditions, leveraging data to identify risks, and continuously advancing as learning organizations. SoCalGas and SDG&E employees and contractors – at all levels, across all work locations and departments – are empowered and encouraged to offer safety suggestions, report near misses, identify hazards, raise safety concerns, and "stop the job" if they ever perceive unsafe actions or situations. The Companies work continuously to advance their respective safety cultures and measure the effectiveness of these initiatives.

SoCalGas and SDG&E have previously engaged in assessments to learn about and improve upon their company cultures and are collaboratively engaged in R.21-10-001 to help the Commission develop a Normative Safety Culture Framework for California's Investor-Owned Utilities. This recently adopted framework defines safety culture as "the collective set of values,

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[5] I.19-06-014, Order Instituting Investigation on the Commission's Own Motion to Determine Whether Southern California Gas Company's and Sempra Energy's Organizational Culture and Governance Prioritize Safety (issued December 24, 2024).

[6] R.21-10-001, Order Instituting Rulemaking to Develop Safety Culture Assessments for Electric and Natural Gas Utilities (issued October 13, 2021).

[7] SoCalGas and SDG&E presentations can be accessed at: https://www.cpuc.ca.gov/about-cpuc/divisions/safety-policy-division/safety-culture-and-governance.

principles, beliefs, norms, attitudes, behaviors, and practices that an organization's leadership, employees, and contractor personnel share with respect to risk and safety."[8]

The Normative Safety Culture Framework for California's Investor-Owned Utilities, as adopted by the Commission in D.25-01-031, includes the following traits:

- Leadership Safety Values and Actions: Leaders demonstrate a commitment to safety in their decisions and behaviors.
- Problem Identification and Resolution: Issues potentially impacting safety are systematically identified, fully evaluated, and promptly addressed and corrected commensurate with their significance.
- Personal Accountability: All individuals take personal responsibility for safety.
- Work Processes: The process of planning and controlling work activities is implemented so that safety is maintained.
- Continuous Learning: Opportunities to learn about ways to ensure safety are sought out and implemented.
- Environment for Raising Concerns: A safety-conscious work environment is maintained where personnel feel free to raise safety concerns without fear of retaliation, intimidation, harassment, or discrimination.
- Effective Safety Communication: Communications maintain a focus on safety.
- Respectful Work Environment: Trust and respect permeate the organization.
- Questioning Attitude: Individuals avoid complacency and continuously challenge existing conditions and activities to identify discrepancies that might result in error or inappropriate action.
- Decision making: Decisions that support or affect utility safety are systematic, rigorous, and thorough.

SoCalGas and SDG&E are dedicated to delivering safe, reliable, and affordable energy; and committed to continuously improving upon and enhancing the maturity of their respective cultures and approaches to safety, including maturing and evolving as learning organizations. As part of this commitment and as further described in Sections II and III, below, SoCalGas and SDG&E are continuously reviewing, measuring and improving their respective Safety

[8] D.25-01-031 at 53 (Finding of Fact (FOF) 10).

Management Systems (SMS), consistent with American Petroleum Institute Recommended Practice 1173 (API RP 1173), and are engaged in continuous learning and improvement to enhance their organizational safety cultures.

B. Current Safety Culture Improvement Efforts

1. SoCalGas Safety Culture Improvement Plan

As part of the CPUC's Safety Culture OII, SoCalGas underwent a safety culture assessment based on the International Atomic Energy Agency's (IAEA) approach to assess leadership and culture for safety.[9] As described by Safety Policy Division, this new assessment approach for California is based upon the following methodology:[10]

- Focus on understanding the invisible aspects of culture or what's "below the surface" (Schein's Iceberg Model).
- Data by itself says little about culture (tip of iceberg).
- Based on an exploratory approach.
- Captures information to foster dialogue, reflection, and insight within the organization regarding its behavior, rather than data for a corrective action process.

This approach to safety culture learning and improvement has fostered significant reflection and growth at SoCalGas. To improve SoCalGas's understanding of the assessment results, the Company's understanding of the existing safety culture and its drivers, and of the need and opportunity to improve, SoCalGas enlisted the support of renowned external experts to engage in over 90 employee and contractor dialogue and facilitated co-creation sessions. This work resulted in a deeper and richer understanding of SoCalGas's culture, enabled the identification of the basic assumptions influencing culture, and informed how to effect positive change.

As part of this change and improvement effort, SoCalGas engaged in efforts to align its safety culture through "**Safer Together.** Advancing a culture that empowers communication, curiosity, commitment, and collaboration." Safer Together is SoCalGas's "North Star"—the

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[9] This assessment methodology and framework aligns with the framework developed by the Commission in R.21-10-001.

[10] *See* California Public Utilities Commission (CPUC), *Workshop: Evaluation of SoCalGas revised Safety Culture Improvement Plan* (February 3, 2025), *available at:* https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/meeting-documents/i1906014-workshop-slides-for-spd020325.pdf.

fixed point on the horizon that will keep the Company reliably oriented and on course to navigate to its safety culture aspirations. The words Safer Together express the concepts of shared interests, broad and inclusive perspectives, stakeholder collaboration, and continuous improvement.

With Safer Together representing SoCalGas's safety culture goals and objectives, on September 20, 2024, SoCalGas filed its Revised Safety Culture Improvement Plan as a portfolio of actions to move toward the goals. Figure 1 below illustrates actions SoCalGas proposed to influence positive culture change. Following the submission of the Revised Plan, SoCalGas began implementing the change and improvement efforts and has been communicating progress, challenges, and learnings through ongoing quarterly reports to the Commission.

Figure 1



2. SDG&E Safety Culture Improvement Efforts

SDG&E recognizes the importance of fostering and sustaining a strong culture of safety. The Company's commitment to a "safety first" mindset is demonstrated through its actions, allocation of resources, and organizational governance. SDG&E leadership actively builds trust through non-punitive measures, a commitment to reducing high-risk conditions, leveraging data to identify risks, and advancing as a learning organization. The Company continuously works to advance the safety culture and measure the effectiveness of initiatives. SDG&E's efforts to assess, understand, sustain, and continuously improve the culture of safety include monthly Electric and Gas Safety Subcommittee meetings to solicit safety input directly from employees closest to the risks with identified action items tracked through completion, quarterly Contractor Safety Summits to advance the safety partnership with SDG&E's contracted workforce, an annual Start Strong Safety Event, and an annual Safety Congress and award ceremony to recognize and reinforce the importance of safe behavior and a safety-first mindset. SDG&E promotes two-way communication and conducts regular surveys of the workforce to identify strengths and opportunities for improvement.

Since January 2023, SDG&E hosts an annual "Start Strong" safety event for its operational (field) employees. This event, which is a partnership between SDG&E leadership and IBEW Local 465, emphasizes the joint commitment to safety and sets clear expectations for the year. It allows the majority of SDG&E's represented workforce to hear directly from leaders on key safety messaging and resources. The event aims to foster psychological safety where all employees are empowered and feel comfortable speaking up, raising safety concerns, submitting near misses, and stopping the job whenever they are unsure how to safely perform a task. Another key objective of the event is for all attendees to understand their role with respect to safety and how their actions and decisions contribute to the safety of their colleagues, contractors and communities served by SDG&E.

SDG&E also hosts an annual Safety Congress and Safety Leadership Award Ceremony to promote a culture of safety engagement and recognition. SDG&E currently has approximately 60 Safety Committees (34 office-based, 27 field-based committees) that represent their respective work location or department. Safety Committees meet regularly to discuss safety topics and identify actionable items to promote safety across their teams. Since 2002, SDG&E has held an annual Safety Congress, which provides a platform for the Safety Committee

members and other safety leaders to collaborate and share insights through networking and workshops. Each year at the Safety Congress, SDG&E recognizes outstanding safety leaders, honoring individuals and teams who exemplify the Company's safety vision. Such employee recognition helps SDG&E employees feel valued and appreciated for their contributions to safety, builds trust, and boosts morale.

SDG&E has processes, programs, and committees in place that encourage two-way communication with internal stakeholders. To foster a culture of continuous safety improvement, SDG&E promotes a psychologically safe work environment where employees at all levels can raise safety concerns and offer suggestions for improvement. SDG&E has a formalized Stop Work Authority Process outlining that all employees – regardless of title or tenure - are empowered to stop work whenever unsafe conditions are perceived. All employees are encouraged to report near misses for follow-up, assessment and hazard awareness.

Communication with external stakeholders (*e.g.*, the public, first responders, public officials) is coordinated through SDG&E's Public Awareness Plan[11] and public liaison program.[12] For significant projects and programs, a dedicated outreach and communication plan is established to gather input, including safety-related feedback, from the community and other stakeholders.

SDG&E's Contractor Safety Management program incorporates feedback from contractors on safety risks at SDG&E. Contractors receive training on the reporting policy and procedures. Contractor feedback is highly valued and essential for continuous improvement. SDG&E promotes two-way communication with its contractors to exchange safety information such as near misses, incident reporting, incident debriefs, safety best practices, and monthly newsletters. Moreover, SDG&E leadership conducts safety connection touchpoints with contractor leadership to identify proactive and preventive solutions, lessons learned, and opportunities for safety enhancement.

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[11] SDG&E's Public Awareness Plan includes SDG&E's natural gas safety marketing campaign that provides outreach to various stakeholders regarding general safety and specific infrastructure projects that impact a particular area or group.

[12] Additional detail on SDG&E's public liaison program is available at: www.sdge.com/safety/sdge-first-responder-liaison-activities.

C. Future Safety Culture Learning and Improvement Efforts

1. Office of Energy Infrastructure Safety AB 1504 Assessment

Since 2021, SDG&E has undergone an annual safety culture assessment, as directed by the OEIS. The OEIS assesses electrical corporations' Wildfire Mitigation Plans, safety culture, safety certifications, and executive compensation structures. Pursuant to Public Utilities (Pub. Util.) Code Section 8389(d)(4), OEIS issued its 2023 Safety Culture Assessment Report for SDG&E on March 22, 2024. The 2023 report details the assessment carried out by the National Safety Council (NSC), which assessed the safety culture of SDG&E through management self-assessment as well as workplace surveys and interviews. In both the 2022 and 2023 reports, the NSC generally concludes that SDG&E "has exhibited continued commitment to advancing its safety culture maturity."[13] SDG&E uses its annual OEIS assessment to gain cultural insights and identify opportunities for continuous improvement. Issuance of SDG&E's 2024 Safety Culture Assessment Report is currently pending.

2. Safety Culture Assessment Framework Rulemaking

In October 2021, the CPUC issued Order Instituting Rulemaking (OIR) R.21-10-001 to develop and adopt a safety culture assessment framework and identify the structure, elements, and process necessary to drive regulated investor-owned electric and natural gas utilities and gas storage operators to establish and continuously improve their organization-wide safety culture. In January 2025, the CPUC approved the *Decision Adopting a Safety Culture Framework for the Large Investor-Owned Utilities*.[14] This Decision adopts a normative framework adapted from the United States Nuclear Regulatory Commission's Safety Culture Common Language and the Institute of Nuclear Power Operations' Ten Traits of a Healthy Nuclear Safety Culture to serve as the basis of the CPUC's Safety Culture Assessment framework.[15] Per the schedule adopted in the Decision, SDG&E will undergo a comprehensive safety culture assessment in 2026 and SoCalGas will undergo a comprehensive safety culture assessment in 2029. These assessments will be used to drive deeper cultural understanding and identify opportunities for continuous improvement.

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[13] *See*, OEIS, *2023 Safety Culture Assessment San Diego Gas & Electric Company Prepared by the National Safety Council Published March 2024* (March 22, 2024), Executive Summary at 3, *available at:* https://efiling.energysafety.ca.gov/eFiling/Getfile.aspx?fileid=56373&shareable=true .

[14] D.25-01-031.

[15] *Id.* at 22-23, and Findings of Fact 12 at 54.

II. SAFETY ORGANIZATION STRUCTURE

A. SoCalGas

SoCalGas is committed to safety as foundational to every aspect of its enterprise and central to its vision, mission, and values. Safety is a shared responsibility across the company, with several notable systems in place to align safety strategy, objectives, and goals.

First, to align actions, SoCalGas is advancing a comprehensive SMS framework that integrates safety systems and processes. This system supports continuous learning and improvement, enhancing the safe and reliable delivery of service to customers. A core part of SoCalGas's SMS and safety culture improvement efforts includes a governance structure for managing key components of SMS, with cross-functional teams for each functional area of SoCalGas's SMS. These teams will consist of leaders from departments leading and supporting the SMS. In this way, safety efforts will have cross-functional and company-wide alignment, governance, and accountability.

Second, SoCalGas embeds safety practices into its operating groups. This is done in the form of safety processes and procedures, initiatives, and policies that are driven by various employees across the Company. SoCalGas utilizes a variety of engagement initiatives to bring employees and contractors together in forums to discuss safety concerns from the perspective of those closest to the risks. These include the Executive Safety Council engagement, Employee Safety & Health Congresses, Safety Standdowns, local safety committees, safety culture surveys, the Safety (Management/Union) Leadership Team, the Contractor Safety Congress, and Stop the Job/Near Miss reporting tools. The reporting and sharing of questions, events, suggestions, and observations provides learning opportunities that help prevent incidents and foster organizational awareness and learning. SoCalGas recognizes that learning is key to improvement and incident prevention, and endeavors to identify systemic improvements with attention to culture, management systems, process conditions, and human factors. Feedback, suggestions, and recommendations with respect to safety are sought through multiple platforms and processes to gather and analyze employee safety feedback. These include:

- The Injury & Illness Prevention Program (IIPP) encourages employees to identify risks and elevate them to management.

- Employees are encouraged to report near misses,[16] stop the jobs,[17] and good catches.[18] These employee reports, as well as safety incidents incurred during the week, are posted on SoCalGas's intranet site and distributed by e-mail to be shared with employees at regularly scheduled meetings.
- Employee dialogues and executive base visits offer opportunities for in-person dialogue between frontline employees and SoCalGas executives.
- Engagement surveys and other localized and company-wide survey efforts to gather employee feedback and perceptions.
- Town Halls to share and engage on safety topics and seek input, feedback, and suggestions from employees.
- Meetings and dialogue sessions where employees and local safety committees meet with Executive Safety Council (ESC)[19] members provide important opportunities for senior leadership to hear directly from frontline employees on safety issues.
- Meeting and dialogue sessions where employees meet directly with Advisory Safety Council (ASC)[20] to ask questions and raise concerns in a confidential manner.
- Learning Teams as well as Event Learnings include frontline employees to foster broader understanding, improve work processes, and gain insights directly from those performing work to enhance safety and continuously improve.
- Annual Employee and Contractor Safety Congresses and District Safety Standdowns across the service territory.
- Meetings between the Chief Safety Officer (CSO), Union Leadership, and other safety leaders.
- SoCalGas engages with contractor stakeholders to identify continuous improvement opportunities through safety-related engagements and dialogues.

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[16] A Near Miss report is when an individual identifies an incident(s) where no injury, illness or damage occurred but there was the potential for injury, illness, or damage.

[17] A Stop the Job report is when someone encounters an unsafe condition or action or is uncertain on how to perform a job and stops work before endangering themselves or others.

[18] A Good Catch is the report of an observation, event, or situation that has the potential to cause injury, illness, or damage, but did not occur thanks to timely intervention by an engaged employee or the presence of an effective control.

[19] SoCalGas's ESC provides safety oversight and executive interactions with employees over safety matters. The ESC meets at various operating locations to engage with represented employees, supervisors, and managers associated with an operating district or a region. Employee dialogue sessions are held to provide a forum for employees to share feedback and executives to listen and learn. Issues brought up are discussed and resolved during the dialogue session or carried forward as action items for later resolution, with follow up to the employees who made the suggestion.

[20] In 2020, SoCalGas established an independent Advisory Safety Council to engage the perspectives of external experts as part of SoCalGas's safety journey.

In addition to this cross-functional approach to advancing safety across the organization in an integrated and aligned way, several SoCalGas departments also advance foundational safety efforts in a more centralized fashion, including the Safety Organization, Asset Management Team, and Enterprise Risk Management Team.

1. Safety Organization

SoCalGas's safety organization is led by a dedicated Chief Safety Officer who, along with a team of directors, managers, supervisors, and subject matter experts, with centralized accountability and responsibility to advance and influence the following:

- Providing strategic guidance and establishing appropriate policies, standards, procedures, and key performance indicators, as well as technology and data analytics tools, platforms, and reporting capabilities;
- Leading incident investigations and sharing lessons learned with stakeholders to demonstrate risk reduction and improvement; and
- Collaborating with employees to provide safety and compliance support, emergency preparedness, and response support capabilities.

The Safety Organization advances safety programs (including implementation of SoCalGas's various safety policies, trainings, and programs, including: the Environmental & Safety Compliance Management Program, Industrial Hygiene programs, Incident Investigations, Contractor Safety programs, as well as Near Miss, "Stop the Job," and Jobsite Safety programs).

2. Emergency Management

Emergency Management at SoCalGas is integrated into the broader SoCalGas safety organization. The Emergency Management function coordinates safe, effective and risk-based emergency preparedness and response to safely and efficiently prepare for, respond to, and recover from an emergency or disaster. As part of the Emergency Management department, personnel focus on the following activities: 1) business resumption, 2) emergency preparedness and response operations, 3) information and technical services, and 4) operational field emergency readiness. Emergency Management also sustains quality assurance and improvement processes through strategic planning, training, simulation exercises, and a comprehensive After-Action Review and Improvement program.

3. Enterprise Risk Management

The Enterprise Risk Management department works in close collaboration with senior leadership, management, and employees to proactively identify potential threats and opportunities, assess and prioritize risks, document mitigation efforts, and monitor risk mitigation effectiveness. This collaborative approach enables the results of the risk management process to inform decision-making and resource planning across the organization.

SoCalGas's Enterprise Risk Management (ERM) Framework, modeled after the International Organization for Standardization (ISO) Standard 31000, is designed to create and protect long-term value for customers, employees, shareholders, and the communities served. The ERM Framework incorporates a formalized governance structure to integrate and align risk management practices across the enterprise and foster appropriate communication and collaboration throughout the Company. Both leadership and subject matter expert input is incorporated into the ERM Framework to drive risk-informed business decisions and resource allocations, and monitor identified and emerging risks and mitigation plans to foster continuous improvement and achieve Company objectives.

Effective risk management practices reinforce a strong and positive safety culture and are integral to SoCalGas's approach to adopting risk management structures and processes at all levels. This commitment continually advances the development of a risk-aware culture, as the ERM practices and processes are actively utilized by various operational and functional departments to identify safety risks, thereby serving as a critical component of SoCalGas's SMS. Further details regarding the Enterprise Risk Management process are provided in Volume 1, Chapter 2, Enterprise Risk Management Framework (Joint SoCalGas/SDG&E).

4. Enterprise Asset Management

SoCalGas has implemented an Enterprise Asset Management (EAM) program that consolidates, cleanses, and geospatially aligns asset data to build capabilities around asset analytics and decision making through advanced technologies, business process changes, and improved definition around roles and responsibilities. This program increases the knowledge and accountability of asset owners through a more robust and comprehensive operating model that aligns with SoCalGas's strategic objectives. EAM is intended to improve safety, integrity, transparency, and availability of asset records by integrating asset data for advanced analytics and leveraging reliable asset data for data-driven asset investment management.

B. SDG&E

Safety is a shared responsibility for everyone at SDG&E, however, SDG&E's Chief Safety Officer bears ultimate accountability for the safety of the workforce and communities it serves. SDG&E conveys a comprehensive, proactive and preventative approach to safety where all employees have a role to play and are empowered and encouraged to speak up and stop work whenever unsafe conditions are perceived. SDG&E has dedicated teams embedded in the organization whose roles revolve around management of safety and other risks. Such centralized organizational structures include:

- Safety;
- Asset Management;
- Enterprise Risk Management; and
- Emergency Management.

Dedicated safety roles also exist at the operational level, partnering with the above-listed teams to advance safety within their respective organization. Such decentralized safety roles include SDG&E's:

- Gas Safety Center;
- Electric Safety Center;
- Kearny Maintenance and Operations;
- Customer Field Operations; and
- Behavior Based Safety Observers.

1. Safety Department

SDG&E's safety department is organized under SDG&E's Chief Safety Officer.[21] SDG&E has a centralized, dedicated safety department comprising a director and managers who oversee the implementation of the Company's various safety policies, trainings, and programs, including the Environmental & Safety Compliance Management Program (ESCMP), the Behavior Based Safety Programs, Stop the Job, Close Call/Near-Miss program, Incident Investigations, Safety Culture Assessments, and Contractor Safety Programs. These programs are described within the Employee Safety Risk Chapter (SDG&E-Risk-06) and Contractor Safety Risk Chapter (SDG&E-Risk-04) of this RAMP Report.

[21] Kevin Geraghty, Chief Operating Officer and Chief Safety Officer.

SDG&E's Executive Safety Council, led by SDG&E's Chief Safety Officer and the Director of Safety and comprising cross-functional Company officers, advances the Company's safety culture, addresses enterprise-wide safety strategy, and is the centralized governing body for all safety committees. Executive Safety Council meetings integrate employee and supervisor dialogue sessions so that employees have an opportunity to share safety experiences directly with Company leadership. Resulting follow-up action items are documented and tracked through resolution. Quarterly Executive Safety Council meetings are held at various Company locations (*e.g.*, district Construction and Operation facilities) to allow top Company leadership to engage directly with a cross-functional representation of SDG&E's frontline workers and operational support staff.

Additionally, SDG&E has numerous field and office site safety committees. These site-specific committees actively engage in safety awareness by educating, promoting a healthy lifestyle, encouraging work-life balance, and always maintaining a safe work environment. Quarterly meetings are held with committee chairpersons and co-chairpersons, where safety updates are shared, training is provided, and action planning steps are identified.

The Director of Safety also serves as the Chairperson for SDG&E's SMS governance team. The SMS governance team represents centralized authority, accountability, and responsibility to support the execution of an SMS throughout the organization, including designing, developing, implementing, and continuously improving the SMS. The SMS governance team is a cross-functional team composed of business leaders representing SDG&E's employee and contractor safety, customer and public safety, risk management, gas operations, electric operations, emergency management, and asset management organizations. The primary role of the SMS governance team is to represent their respective organizations and work together to create and maintain a comprehensive SMS that informs consistent, effective, and appropriately adapted practices across the enterprise.

2. Asset Management

In 2017, SDG&E began asset management initiatives focused on developing a strategic asset management capability for the Company that aligns with the international standard of ISO 55000. The initiatives focus on implementing the tenets of ISO 55000 across the organization to more optimally balance asset cost, asset risk (including safety), and asset performance. In collaboration with SDG&E's operating units, the teams develop, implement, and enable

strategies and solutions in the areas of regulatory compliance, business technology, data management, and integrated asset management in support of the safe, clean, and reliable delivery of energy to customers.

3. Enterprise Risk Management

SDG&E's Enterprise Risk Management organization comprises a Vice President and Chief Risk Officer, Director of Risk and Compliance, two managers, and support staff. Their collective roles are dedicated to implementing the risk management process and the integration of risk-based decision-making across the Company. This includes the development of transparent, repeatable, and consistent processes that are quantitative and data-driven, facilitating an annual identification and evaluation of risk, and supporting operational areas across the Company in the assessment of their risks and development of associated risk controls and mitigations. SDG&E's Enterprise Risk Management organization oversees the development of the annual Enterprise Risk Registry process. Further details regarding the ERM process are provided in Volume 1, Chapter RAMP-2, Enterprise Risk Management Framework.

4. Emergency Management

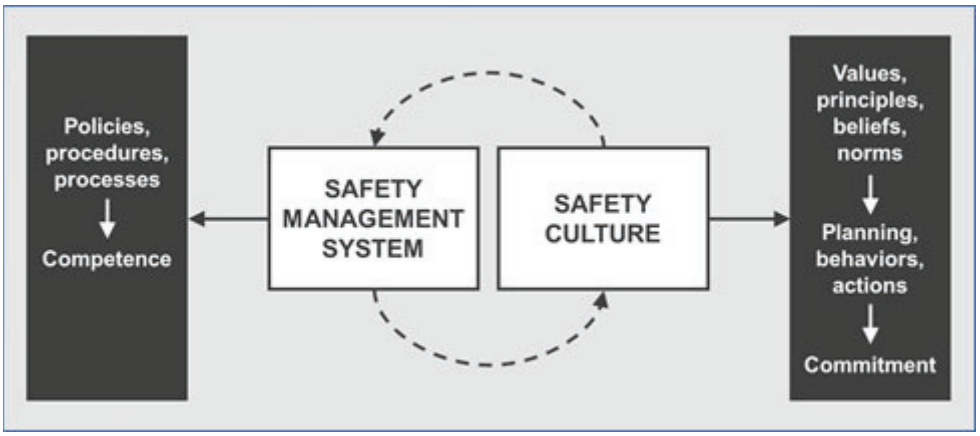
SDG&E's Emergency Management department coordinates safe, effective, and risk-based emergency preparedness to safely and efficiently prepare for, respond to, and recover from all threats and hazards. The Emergency Management Department sustains quality assurance and improvement processes through strategic planning, training, simulation exercises, and a comprehensive After-Action Review and Improvement program. SDG&E's Emergency Management department is comprised of: (1) aviation services, (2) business resumption, (3) emergency preparedness, training and response operations, (4) information and technical services, and (5) operational field emergency readiness.

SDG&E responds to gas and electric emergencies and/or short-term crises as an important part of its normal business practices and has implemented and adapted a Utility Incident Command System (UICS) into those practices based on the National Incident Management System.

Each of the above-described departments are aligned and integrated within SDG&E's Safety Management System, as further detailed below.

III. SAFETY MANAGEMENT SYSTEM

A Safety Management System (SMS) and organizational safety culture are interconnected, and their integration is key to fostering a safe and effective work environment, as depicted in the graphic below.



SoCalGas's and SDG&E's respective safety management systems connect and consolidate each Company's respective processes, to provide a risk-based approach to operations through established accountabilities, responsibilities, and continuous improvement. The intent of an SMS is to comprehensively define elements that identify and add rigor, accountabilities, and assurance to the ways risks are managed and to help prevent or mitigate the likelihood and consequences of an incident or injury. SoCalGas's and SDG&E's respective safety management systems provide the structure, processes, and tools, while their safety cultures provide the values, attitudes, and behaviors that breathe life into those tools. When integrated well, they form a synergistic relationship that drives safety excellence across the organization, providing formality and structure for integrating safety culture and management into organizational activity in a sustainable way. For example:

1. **Leadership Commitment:** SoCalGas's and SDG&E's respective safety management systems promote a structured approach to safety, and success relies on leadership commitment to safety and culture. Leaders should embody safety values and prioritize safety over competing goals, such as productivity or costs.
2. **Policies and Procedures:** SoCalGas's and SDG&E's respective safety management systems establish well-defined policies and procedures, which are designed to align with each organization's safety culture and approach to safety. These guidelines help formalize and demonstrate commitment to safety.

3. **Training and Awareness:** SoCalGas's and SDG&E's respective safety management systems include ongoing safety training programs that instill safety awareness and reinforce the values of their safety cultures among employees. This helps create shared attitudes and practices around risk reduction.
4. **Employee Participation:** Safety culture thrives when employees are engaged. SoCalGas's and SDG&E's respective safety management systems integrate tools for reporting incidents and hazards, encouraging open communication without fear of blame. This mutual trust strengthens safety culture.
5. **Continuous Improvement:** SoCalGas and SDG&E's respective safety management systems emphasize evaluations, audits, and feedback loops to refine safety practices. This aligns with their mutual commitment to always strive for improvement in safety outcomes.
6. **Shared Responsibility:** Through the SMS framework, safety is framed as a shared responsibility across all levels of the organization. This shared accountability reinforces a culture where everyone feels invested in and accountable for maintaining a safe environment.

SoCalGas and SDG&E have each established comprehensive safety management systems, consistent with American Petroleum Institute (API) Recommended Practice 1173.[22] Their common objective is to enhance the safety and integrity of operations, establish compliance with regulatory requirements, and promote a culture of continuous improvement and safety excellence. A successfully implemented SMS will highlight safety risks and provide a framework for addressing them, with the goal of improving safety performance. An SMS comprehensively defines elements that identify and add rigor, establish accountability, and provide assurance to the ways risks are managed, thereby helping to prevent or mitigate the likelihood and consequences of an unintended incident or event. Measuring and reporting safety performance and demonstrating continuous improvement, increases employee and stakeholder confidence in safe operations. This policy and centralized SMS standard with subsequent element standards sets the framework for the way the Companies manage safety.

[22] SoCalGas' and SDG&E's respective Safety Management Systems each apply the ten elements and principles of API 1173. Absent an electric-industry equivalent, SDG&E adapted the ten elements of API 1173 to apply to both its electric and gas operations.

IV. COMPENSATION POLICIES RELATED TO SAFETY

Safety culture at SoCalGas and SDG&E is supported and demonstrated by using compensation metrics and key performance indicators to drive improved safety performance. As the Commission stated in D.16-06-054, "[o]ne of the leading indicators of a safety culture is whether the governance of a company utilizes any compensation, benefits or incentive to promote safety and hold employees accountable for the company's safety record."[23] Benefits programs that promote employee health and welfare also contribute to SoCalGas's and SDG&E's safety performance and cultures.

The compensation and benefits programs at SoCalGas and SDG&E are designed to focus employees on safety and continue to emphasize employee and operational safety measures in their variable pay plans, commonly referred to as the Incentive Compensation Plans (ICP).[24] ICP is a longstanding component of SoCalGas and SDG&E's total compensation strategies for their entire non-represented workforce. The ICP targets for goals within the Employee & Public Safety Operations category are the same for every non-represented employee, regardless of their role in the company. ICPs place a portion of employee compensation at risk, subject to achievement of identified performance measures, motivating employees to meet or exceed important company goals, including those related to safety.

Safety is a core value for SoCalGas and SDG&E, and this is reflected in the weighting of the safety measures in the Companies' ICP metrics. Safety measures represent the largest category of performance measures in the Companies' ICPs. The Companies have a longstanding practice of prioritizing safety measures in the design of their ICPs to drive improved safety performance, with safety measure weightings making up 80% of the non-executive ICP's company performance component for SoCalGas and 68% for SDG&E since 2020.[25] These safety-related measures broadly include factors related to contractor, public, employee, as well as

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[23] D.16-06-054 at 153.

[24] 2024 GRC, Revised Direct Testimony of SoCalGas/SDG&E witness Deborah Robinson, (Ex. SCG-25-R/SDG&E-29-R) at 11. SoCalGas's and SDG&E's compensation packages include base pay, short-term incentive compensation (ICP), long-term incentive compensation (for key management employees only), and special recognition awards. *Id.* at 8. Executive officer compensation is excluded from rates under Public Utilities (Pub. Util.) Code 706. *See, e.g., id.* at 1, n.3.

[25] 2024 GRC, Ex. SCG-25-R/SDG&E-29-R (Robinson) at 5, 11-12, reflecting safety measure weightings in 2022. In 2019, the weighting was 68% at SDG&E and 70% at SoCalGas; and in 2018, it was 68% at SDG&E and 60% at SoCalGas.

electric and gas system safety, as applicable. Safety-related measures comprise a majority of their respective 2024 Executive ICPs.[26]

This strong emphasis on employee and operational safety measures in SoCalGas's and SDG&E's ICPs, in turn, bolsters their safety culture and safety performance. Providing continued alignment between the Companies' safety programs and their ICPs helps to strengthen the Companies' safety cultures and signal to employees that safety is a core value.

V. BOARD ENGAGEMENT AND OVERSIGHT OVER SAFETY PERFORMANCE

A. SoCalGas

1. Board Safety Committee

SoCalGas's Board Safety Committee advises and assists the Company's Board of Directors in the oversight of employee, contractor, public, and infrastructure safety matters. These quarterly meetings include the following oversight functions:

- Review and monitor safety culture, goals, and risks;
- Monitor safety performance metrics;
- Monitor and review significant utility safety incidents;
- Provide strategic guidance and recommendations to management on safety issues; and
- Continuous review of governance practices.

The Board Safety Committee has evolved its oversight, and promotes greater discipline, structure, and a broader view of safety. This includes an enhanced governance structure and enhanced engagement with stakeholders and experts. These continuous improvements include:

- Improve the Committee's charter and oversight function;
- Focus on leading safety indicators;

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[26] As noted in Section I.C, *supra,* OEIS assesses and approves SDG&E's executive compensation structures annually, pursuant to Pub. Util. Code Section 8389(e)(4) and (e)(6), and OEIS guidelines. Submissions and approvals are available at: https://energysafety.ca.gov/what-we-do/electrical-infrastructure-safety/wildfire-mitigation-and-safety/executive-compensation/. SoCalGas and SDG&E each also submit to the CPUC an annual Safety Performance Metrics Report (SPMR), which "[i]dentif[ies] all metrics linked to or used in any way to determine executive compensation levels and/or incentives" and "[d]escribe[s] the bias controls that the utility has in place to ensure that reporting of the metric(s) has not been gamed or skewed to support a financial incentive goal." D.19-04-020 at 63, Ordering Paragraph 6A and 6C. SPMR reports are available at:https://www.cpuc.ca.gov/about-cpuc/divisions/safety-policy-division/wildfire-and-safety-performance/safety-performance-metrics-reports.

- Review and align safety-related goals for incentive compensation; and
- Expand opportunities to allow committee members to interact directly with non-executive employees and outside experts.

2. Advisory Safety Committee

SoCalGas established an independent Advisory Safety Council in 2020 to engage external experts and improve safety culture, complementing the SoCalGas Board Safety Committee which advises the Company's Board. SoCalGas created the Advisory Safety Council to invite new ideas and perspectives and has intentionally engaged individuals with varied experience and expertise, with a focus on public safety, potential significant events, and safety culture. SoCalGas leverages the Advisory Safety Council to learn from other industries, companies, and academia, and to create new tools and processes to engage employees in learning and improvement. Advisors engage directly with SoCalGas employees to listen, learn, and provide SoCalGas leadership insights and input.

B. SDG&E

1. Board of Directors Safety Committee

SDG&E's Board of Directors Safety Committee (Board Safety Committee) performs the following governance and oversight with respect to safety culture.

- Reviews safety culture, goals, and risks;
- Reviews incidents, measures and management strategies to prevent, mitigate or respond to safety-related incidents involving employees, contractors, customers or community members;
- Monitors current and emerging safety matters and issues raised by safety audits;
- Provides strategic guidance and recommendations to management on safety issues; and
- Continuous review of governance practices through annual review of Committee Charter.

The Board Safety Committee meets quarterly with SDG&E management and operational leaders on various safety topics. Meetings begin with a safety briefing and include a regular review of year-to-date safety performance as well as current safety and risk-related topics. The Board Safety Committee monitors safety performance using a robust set of metrics across key

safety areas. The Board Safety Committee also advises and reviews Company Incentive Compensation metrics related to safety.

The Board Safety Committee chairperson engages with external partners through the SDG&E Wildfire Safety Community Advisory Council, described below. The Board Safety Committee Chair reports to the full Board of Directors on safety matters addressed by the Committee and presents to the Commission and Office of Energy Infrastructure Safety as part of SDG&E's annual public safety briefing.[27]

2. Community Wildfire Safety Advisory Council

In 2019, SDG&E established a Community Wildfire Safety Advisory Council (CWSAC) comprised of independent community members who possess extensive public safety and wildfire experience. The CWSAC meets on a quarterly basis and provides input and guidance to the SDG&E Board Safety Committee and the Company on safety matters. The CWSAC's primary function is to provide SDG&E with recommendations and insights on wildfire safety strategies, including vegetation management, infrastructure hardening, and public outreach. The CWSAC plays a crucial role in ensuring that SDG&E's wildfire safety measures are effective and aligned with the needs and concerns of the communities they serve.

VI. CONCLUSION

SoCalGas and SDG&E are committed to fostering, continuously improving upon, and maintaining robust cultures of safety. SoCalGas's and SDG&E's respective SMS programs provide the framework, processes, and tools necessary to support a safety culture that embodies the values, attitudes, and behaviors essential for these tools' effectiveness. SoCalGas and SDG&E will continue to mature as learning organizations, strive to consistently evaluate, review, and enhance their respective organizational cultures to safeguard employees, contractors, and the communities the Companies are privileged to serve.

[27] On August 29, 2024, the Commission hosted a Public Meeting on Utility Safety Practices, during which representatives from SDG&E, SoCalGas, and Southern California Edison presented on safety matters and answered questions from Commissioners and the Director of Energy Safety.



2025 Risk Assessment Mitigation Phase

(Chapter SDG&E RAMP-5)

Climate Change Adaptation

May 15, 2025

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CHAPTER V: CLIMATE CHANGE ADAPTATION

I. INTRODUCTION

In 2024, the United States of America experienced 27 weather and climate disasters exceeding $1 billion in losses each, following the record-breaking 28 weather and climate disasters experienced in 2023.[1] Total losses due to extreme weather and climate events have grown since 1980. According to the U.S. Department of Commerce's National Oceanic and Atmospheric Administration, major U.S. loss events now happen every 2.7 weeks versus every 2.7 months a few decades ago.[2] Increased awareness of the importance of planning for these events amongst utilities has been growing, as these climate-driven events can have severe impacts on energy infrastructure. San Diego Gas & Electric Company (SDG&E or Company) accordingly is evaluating adaptive measures to visualize vulnerabilities, minimize impact and build resilience to future extreme events.

Projected climate hazards that will have short- and long-term ramifications in the San Diego region include extreme temperatures, extreme winds and precipitation (such as Santa Ana winds and atmospheric rivers), and sea level rise. SDG&E recognizes the need to adapt to these climate hazards to provide safe and reliable services to its customers and to mitigate the increasing risk through innovative, community-centric approaches.

Climate vulnerability refers to the susceptibility of SDG&E's infrastructure and operations to the change in climate hazards over their multiple dimensions, such as intensity, duration, and frequency. This includes factors such as the sensitivity of power lines to extreme heat, gusty winds, and heavy precipitation events, the exposure of gas pipelines to flooding and landslides, and the capacity of the utility to adapt to changing conditions, all of which are explored in the Climate Adaptation Vulnerability Assessment (CAVA). In contrast, climate risk refers to the consequences to human or ecological systems that results from the vulnerability of infrastructure and operations, as follows:

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1 NOAA, National Centers for Environmental Information, *U.S. Billion-Dollar Weather and Climate Disasters* (2025), *available at:* https://www.ncei.noaa.gov/access/billions/time-series.

2 *Id.* Measured by a change in the number of billion-dollar disasters happening annually. In the past 10 years, there were 19 billion-dollar disasters annually. From 1980-99, there was an average of 4.5 per year.

> In the context of climate change impacts, risks result from dynamic interactions between climate-related hazards with the exposure and vulnerability of the affected human or ecological system to the hazards.[3]

Climate risk integrates both the probability of climate hazard events and the potential consequences of energy delivery disruptions on the utility and the communities served. Understanding both concepts is crucial for developing and prioritizing effective strategies to plan for reliable and resilient energy services in the face of climate change.

The California Public Utilities Commission (CPUC or Commission) has two open proceedings that consider how utilities should incorporate potential climate change impacts in their risk assessment processes: the Risk-Based Decision-Making Framework (RDF) proceeding (Rulemaking (R.) 20-07-013) and the Order Instituting Rulemaking (OIR) to Consider Strategies and Guidance for Climate Change Adaptation (Climate Change Adaptation OIR) (R.18-04-019). In the Climate Change Adaptation OIR, SDG&E is directed to file the Company's first Climate Adaptation Vulnerability Assessment (CAVA) on the same day it files its 2025 Risk Assessment and Mitigation Phase (RAMP) Report.[4] Findings from the CAVA have been used to assist in identifying the types of impacts that future climate events may have across SDG&E's infrastructure, operations, and services. The development of the CAVA has also supported SDG&E's ongoing foundational work that seeks to improve SDG&E's internal capabilities to understand and analyze climate data in decision-making.

This chapter describes how activities related to Climate Adaptation impact the risks described in SDG&E's 2025 RAMP. The purpose of this chapter is to identify how climate change affects SDG&E's system and how the effects can potentially be addressed through adaptive actions. Climate change is recognized as a factor that can drive, trigger, or exacerbate multiple RAMP risks. Implementing climate change adaptation measures and integrating climate vulnerability considerations into RAMP controls and mitigations can enhance system longevity and reduce the severity of long-term negative climate impacts. In this chapter, SDG&E provides an overview of its climate change adaptation culture that examines, anticipates

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[3] *Id.*

[4] Decision (D.) 20-08-046 at 4 and Conclusions of Law (COL) 57 at 117.

and mitigates effects on its assets and operations, details key results from the CAVA, and identifies RAMP controls and mitigations that may address climate impacts.

II. CLIMATE CHANGE ADAPTATION CULTURE AT SDG&E

SDG&E's Fire Science and Climate Adaptation (FSCA) department was established in 2018 to respond to and strategize for increasing wildfire and climate-related risks. The department consists of meteorologists, fire coordinators, climate advisors, and project management personnel. SDG&E's FSCA group leads the CAVA efforts and climate adaptation-related activities within the company. SDG&E also established an inter-disciplinary and cross-departmental climate advisory group in 2019 that meets quarterly to act as a forum in which company leaders and decision-makers can discuss the expected impacts of climate change hazards on operations and develop innovative solutions to address them. SDG&E uses these meetings to promote climate change expertise in SDG&E leadership and better incorporate climate change information to maintain safe and resilient operations. In addition, the FSCA regularly engages with internal subject matter experts to determine if there are gaps in existing data for vulnerability assessment and adaptation planning. SDG&E also actively engages in partnerships with academic and research institutions to leverage cutting-edge expertise and further advance climate resilience initiatives.

III. CLIMATE ADAPTATION VULNERABILITY ASSESSMENT

SDG&E has a long history as a leader in understanding extreme weather and its impact on energy utilities. The Commission has taken targeted action in recent years to adequately respond to the threat of climate hazards and support energy utilities in their effort to become more resilient to those events. On May 7, 2018, the CPUC issued the Climate Change Adaptation OIR, which defined climate change adaptation for energy utilities and promoted efforts "to address climate change adaptation issues in Commission proceedings and activities to ensure safety and reliability of utility operations."[5] Building on this effort, the Commission issued D.20-08-046 on Energy Utility Climate Change Vulnerability Assessments and Climate Adaptation in Disadvantaged Communities in September 2020, to promote the use of the "best available climate science" to make informed decisions towards building resilient infrastructure

[5] R.18-04-019, Order Instituting Rulemaking to Consider Strategies and Guidance For Climate Change Adaptation (May 7, 2018) at 2.

and services to tackle climate change.[6] Furthermore, acknowledging the profound and unequal burden climate change places on Disadvantaged and Vulnerable Communities (DVCs) across the state, the CPUC defines DVCs within the decision and mandates robust utility engagement to empower and support these communities in building resilience. California investor-owned utilities (IOUs) are required to conduct a CAVA every four years, at a minimum, and their analyses must reflect the best available science. Additionally, IOUs are required to submit a Community Engagement Plan (CEP) and a Disadvantaged Survey Report.

On August 12, 2024, the CPUC issued D.24-08-005 to update climate change adaptation modeling requirements and refine the climate adaptation and vulnerability assessments.[7] This decision established the Shared Socioeconomic Pathway (SSP) 3-7.0 emissions scenario as the reference for energy utility use in the CAVA, adopted the Global Warming Level approach as the basis of CAVA planning in lieu of the targeted years approach, and updated the timing of CAVA submittal, requiring the assessment be filed a year prior to each utility's RAMP application, starting with PG&E's next CAVA in 2027.[8] SDG&E submitted its CEP in 2024 and is submitting its first CAVA concurrently with this RAMP filing, on May 15, 2025. The SDG&E CAVA addresses the requirements of the CPUC Climate Change Adaptation OIR and industry best practices for assessing physical climate risks.

This chapter provides an overview of the concurrently filed SDG&E CAVA, highlighting the methodology and key findings as they relate to the risks detailed in the following chapters. The results of CAVA serve primarily to identify assets at moderate- to high-vulnerability to climate hazards that could impact safe and reliable service and identify adaptation options for consideration.

Methodology

The CAVA aims to identify asset and operational vulnerabilities across the SDG&E system. The analysis focused on three key future years—2030, 2050, and 2070—and explored different possible climate futures, known as SSP scenarios. These scenarios, labeled SSP2-4.5, SSP3-7.0, and SSP5-8.5, represent varying levels of greenhouse gas emissions and their potential

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6 D.20-08-046 at 2.

7 D.24-08-005.

8 *Id*., COL 12 at 81.

impacts on the climate. The climate hazards of extreme heat, flooding (coastal and inland), and wildfire are considered for each electrical asset class. SDG&E electrical assets were grouped into five asset families: distribution, transmission, substations, communication, and facilities. [9] For gas asset classes, flooding (coastal and inland), wildfire, coastal erosion, and landslides are considered. Land subsidence has been determined to be of low consequence within the SDG&E service territory. SDG&E's analysis also examines cascading impacts. These are multifaceted compound weather and climate events that occur in succession and can lead to more significant impacts. Climate hazards listed as part of the CAVA analysis were determined by the CPUC in its Climate Change Adaptation OIR.

SDG&E conducted an analysis using data retrieved from Cal-Adapt, a tool provided by the state of California to visualize climate data and access a central repository of information. The primary dataset employed for this analysis was Localized Constructed Analogs, Version 2 (LOCA2), developed by the University of California San Diego Scripps Institution of Oceanography. LOCA2 is a high-resolution climate dataset specifically tailored to California. It enables detailed climate projections by downscaling global climate models to a finer resolution—approximately 3 kilometers (or 1/16th of a degree). This high level of detail is particularly valuable for understanding climate impacts in areas with complex terrain, such as mountains or valleys in the SDG&E service territory, and makes LOCA2 an indispensable resource for developing local-level strategies for climate adaptation and resilience.

As part of its exposure analysis, SDG&E examined the 90th, 95th, and 99th percentiles of climate variables relative to the observed baseline period (1995-2014). These percentiles were analyzed to identify events with conditions far more severe than typical historical patterns. In the context of climate adaptation planning and the vulnerability assessment, SDG&E is analyzing events with outsized impacts and magnitudes relative to historical values rather than to pre-defined thresholds.

The methodology used in this analysis is aligned with the CPUC's guidance to consider asset exposure, sensitivity, and adaptive capacity to determine vulnerability. Forward-looking climate science information and subject matter expert input is applied to determine each of these components for individual assets. Exposure and sensitivity scores between 0-5 are determined

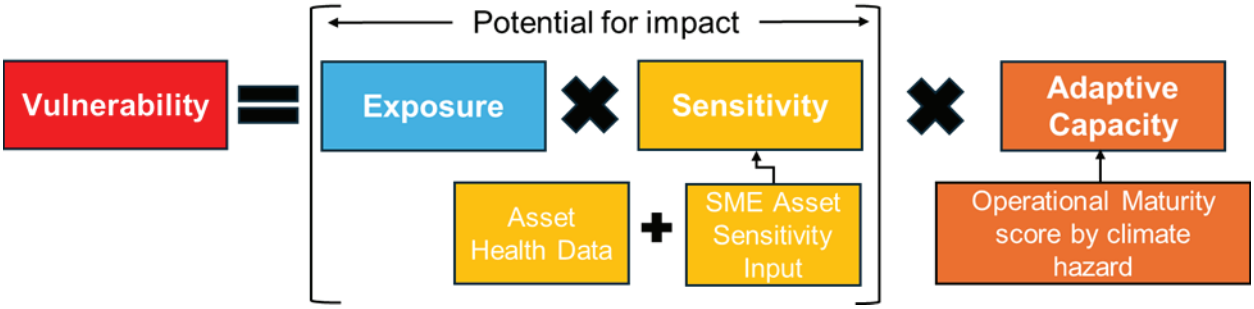
[9] SDG&E's electric transmission assets are under the jurisdiction of the Federal Energy Regulatory Commission (FERC) and thus will not be addressed in SDG&E's Test Year 2028 General Rate Case.

for each asset based on the raw data. In turn, these scores serve to derive vulnerability scores from 0-25 that help identify the asset-hazard combinations that are considered priority vulnerabilities across SDG&E's system. This approach is shown below in Figure 1.

The key components of Figure 1 are defined as follows:

- Vulnerability: the susceptibility of SDG&E's infrastructure and operations to the change in frequency and/or magnitude of climate hazards.
- Exposure: the degree to which assets or regions may experience climate hazards based on their physical locations.
- Sensitivity: the degree to which an asset's integrity or operation could be adversely impacted in the event of hazard exposure.
- Adaptive Capacity: the degree to which the vulnerability of an asset is reduced due to the ability to mitigate climate hazards' negative outcomes based on the organization's operational maturity.

Figure 1: Vulnerability Assessment Approach



Extreme events linked with climate change also have a disproportionate impact on vulnerable communities, requiring utilities to understand and identify community vulnerability alongside asset vulnerability. Constructing a representative community vulnerability and adaptive capacity measurement that considers the nuances of DVCs requires a multi-layered approach. SDG&E built upon the DVC definition to address this challenge and created the Community Vulnerability Index (CVI). The CVI process starts with improving the default DVC indicators by increasing their granularity, enhancing data recency, and expanding coverage to include socioeconomic and tribal land metrics tailored to the SDG&E service area. Next, additional SDG&E-specific indicators, including Access and Functional Needs (AFN) customers and critical facilities, are added to reflect service area specific population needs and infrastructure readiness. The indicator set is also designed with future scalability in mind,

anticipating the inclusion of San Diego region-specific factors. By focusing on temporal advancements, geospatial precision, expanded dimensions of vulnerability, and improved environmental metrics, the CVI can continue to evolve as a pioneering tool in resilience planning. These enhancements, coupled with meaningful community collaboration, will position the CVI and allow SDG&E to prioritize resilience measures and actions while aligning with industry best practices.

The Climate Change Adaptation OIR requires SDG&E and the other California energy utilities to conduct robust community outreach throughout the CAVA process. This stakeholder engagement includes interactions with local governments, community-based organizations, local tribal governments, and customers, among others, to corroborate the findings of the CAVA and facilitate a regional approach to climate adaptation. SDG&E's outreach efforts include holding workshops, conducting interviews, convening information sessions, and deploying surveys to provide ample opportunity for engagement and collaboration throughout the CAVA process, as appropriate.

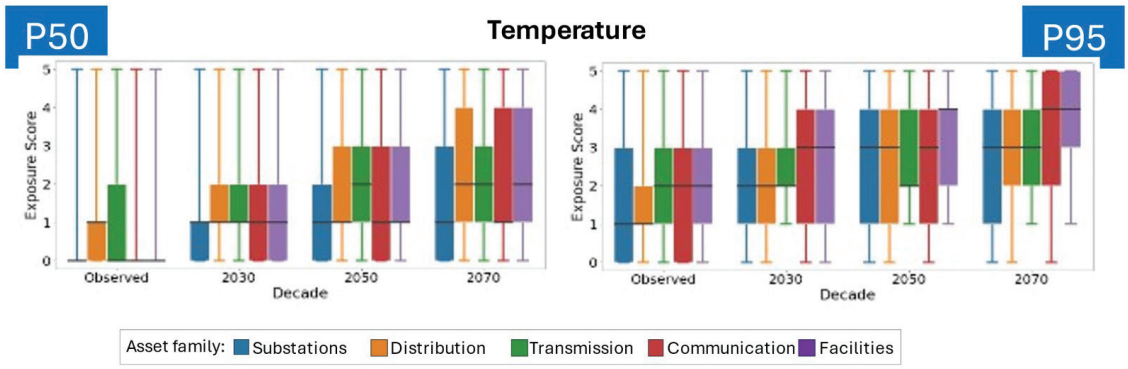
Key Findings

Climate model projections across the service territory reveal how climate hazards may impact the SDG&E system. The following findings present an overview of exposure score distributions and vulnerability metrics to illustrate how different asset families may be affected over time. The following exposure plots in Figures 2-4 show the hazard-specific exposure scores for electrical assets for the observed baseline (1995-2014), 2030, 2050, and 2070 using the median model within the SSP3-7.0 scenario. Exposure score distributions are shown for the 50th percentile median-year case (P50) and 95th percentile extreme-year case (P95) for each time horizon.

As temperatures warm, exposure to extreme heat is projected to increase steadily through the 21st century across the SDG&E service territory, with the greatest increase in the Inland and Mountain regions. The cooler Coastal region is projected to have the lowest exposure scores with the smallest increase, while the hotter Desert region is also projected to experience a small increase in exposure due to historically high exposure scores. Across all electrical asset families, temperature exposure scores are projected to increase over time. Using median-year (P50) temperature exposure scores, the communications and facilities asset families are projected to experience the greatest change in exposure magnitudes, while distribution and facilities are

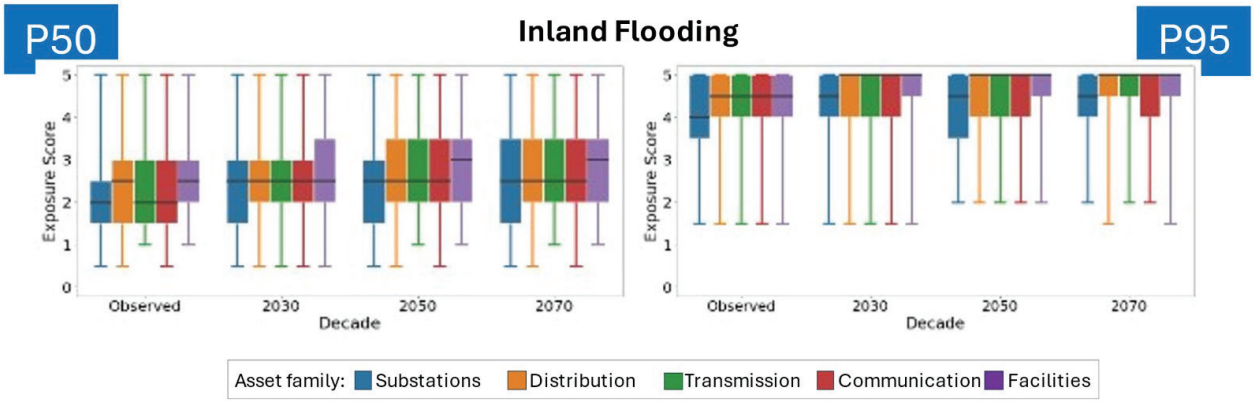
projected to experience the greatest change in extreme-year (P95) exposure magnitudes, as shown in Figure 2.

Figure 2: Temperature Exposure Score Distributions for Electrical Asset Families



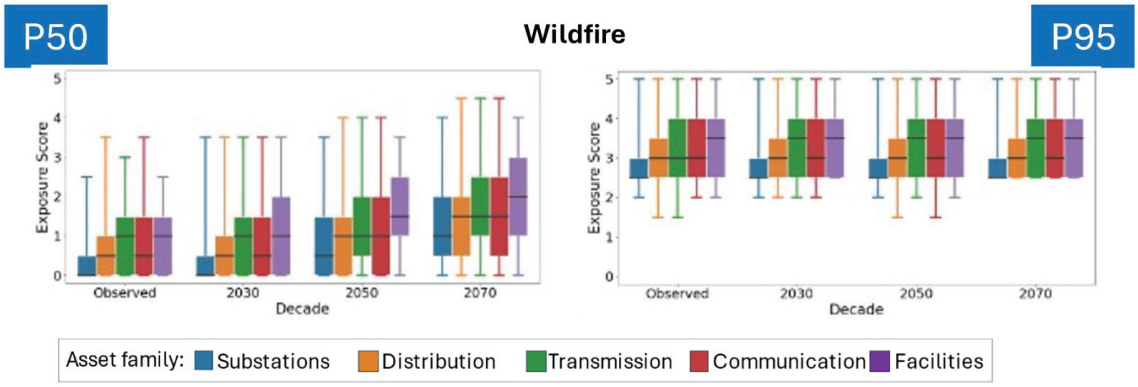
Exposure to inland flooding is projected to increase across SDG&E's service territory in the Coastal, Inland, and Mountain regions throughout the 21st century, with the highest exposure scores in the Mountain and Inland regions. Increases in exposure are projected to be lower-magnitude relative to increases in exposure to temperature and wildfire, with consistent increases across all regions except the Desert region. The Desert region is projected to experience minimal change in exposure to inland flooding. The projected inland flooding exposure scores for each electrical asset family are shown in Figure 3. Using median-year (P50) inland flood exposure scores, the communications and facilities asset families are projected to experience the greatest change in exposure magnitudes, with transmission and substations experiencing the greatest change in extreme-year (P95) exposure magnitudes.

Figure 3: Inland Flooding Exposure Score Distributions for Electrical Asset Families



Conditions that are conducive to large wildfires (sometimes referred to as elevated fire danger days) – which are closely related to temperature and precipitation, as well as humidity – are expected to worsen over the years, with a greater rate of change to be more likely during the latter half of the 21st century. Exposure to wildfire is projected to increase across the service territory through the 21st century, particularly in the Mountain and Inland regions where exposure scores are projected to be highest. The wildfire exposure scores for each electrical asset family are shown in Figure 4. Using the annual number of days above the historical 95th percentile Canadian Forest Fire Weather Index (FWI) and historical wildfire probability, the CAVA analysis aims to identify assets in SDG&E's service territory that are most exposed to wildfire. The analysis is intended to evaluate how the exposure of individual assets and asset classes to wildfire will change over time, examining median changes as well as extreme changes in exposure magnitude. Using median-year (P50) wildfire exposure scores, the communications asset class and the facilities asset class are projected to experience the greatest change in exposure magnitudes, with the transmission asset class and facilities asset class experiencing the greatest change in extreme-year (P95) exposure magnitudes.

Figure 4: Wildfire Exposure Score Distributions for Electrical Asset Families

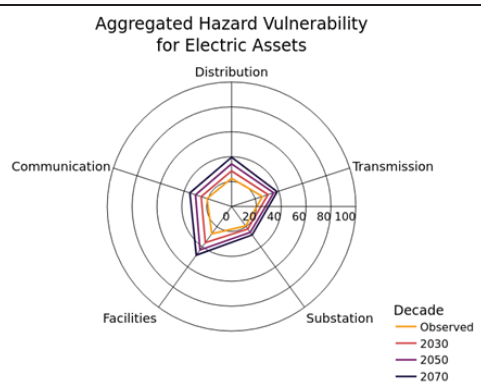
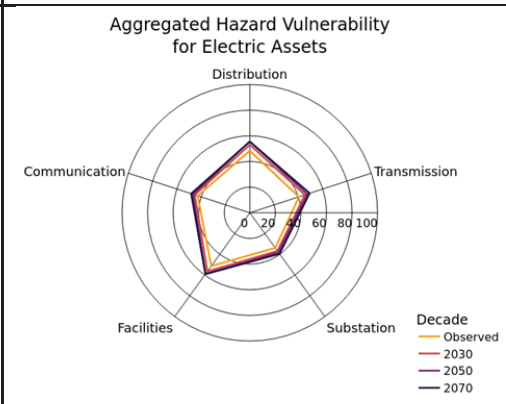
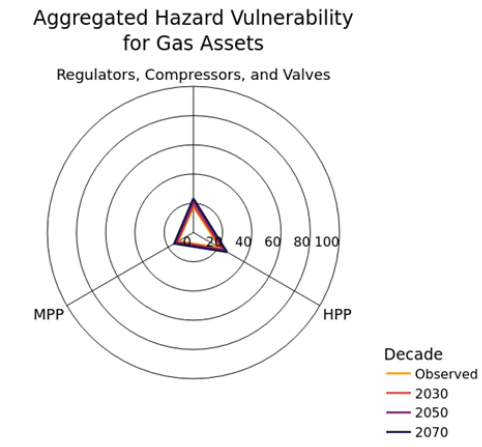
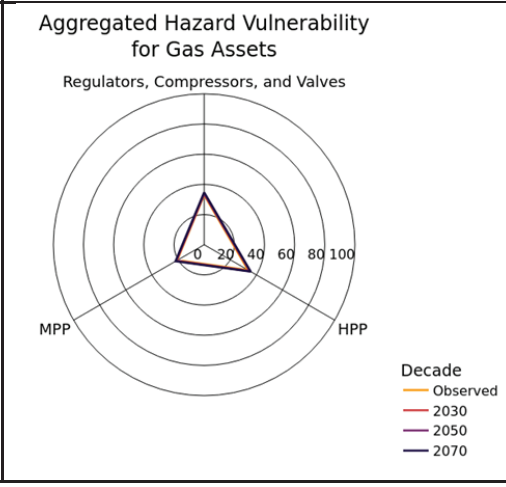


Beyond extreme heat, inland flooding, and wildfire impacts, the sea level is expected to rise gradually over the upcoming decades, with faster rates projected in the latter half of the 21st century, which could lead to potential flooding in isolated coastal locations around Mission Bay, San Diego Bay, and San Luis Rey River estuary. Changes to landslide exposure of gas assets is not projected to be significant, with modest impact to isolated areas expected.

An all-hazards view, shown through the radar plots in Table 1, illustrates how overall vulnerability across climate hazards shifts over time, highlighting the changes in both the median (P50) and extreme case (P95) for each major asset class through the end of the century. These

values are calculated using the median of available climate models using the SSP3-7.0 scenario. To assess the vulnerability of the entirety of SDG&E's asset portfolio across all climate hazards, an aggregated vulnerability score was calculated for each asset class (or family) and asset type (or component). To calculate these aggregated scores, the 95th percentile vulnerability score for each asset-hazard combination was selected and summed, resulting in one vulnerability score for each asset type to all hazards. This score was normalized to a scale of 100.

Table 1: 95th Percentile of Aggregate Vulnerability for Electrical and Gas Assets

	Median (P50)	Extreme (P95)
Electrical		
Gas		

These aggregated scores for each asset type and hazard were plotted together in spider charts in Table 1 with separate lines for each time horizon, visualizing the rise in vulnerability over all time frames for all hazards and asset types. For electrical assets, facilities exhibit the highest aggregated vulnerability, followed by distribution and transmission assets. The plots in Table 1 illustrate the vulnerability based on the median (50th percentile) and extreme (95th percentile) climate exposure values. Using median values, the increase in aggregate

vulnerability happens in relatively even intervals throughout all timeframes. Using the extreme values, high vulnerability for assets is reached in the observed baseline (1995-2014) period and persists through 2070. This highlights the importance of preparing for extreme climate events, as they are likely to have a disproportionately large impact on the most vulnerable assets in the near-term.

For gas assets, high pressure pipes have the highest observed baseline (1995-2014) aggregated vulnerability and are projected to have the most significant rise in vulnerability, followed closely by regulator, compressor, and valve assets. Under P50, the vulnerability scores are very close throughout time horizons. Under P95, there is an increase in aggregated vulnerability in all asset classes by 2030, before remaining relatively stable through 2050 and 2070.

While the CAVA is designed to inform medium- to long-term planning, the focus in RAMP is on identifying asset classes with high vulnerability in the near-term (*i.e.*, within the Test Year 2028 General Rate Case (GRC) cycle). Vulnerability, however, does not equate to risk. Some of the assets identified as vulnerable in CAVA may not appear in risk chapters due to RAMP asset prioritization criteria set forth in the RDF, but their identification remains critical to informing adaptation planning. For a detailed methodology of the framework used to determine risks included in RAMP through the cost-benefit approach, please refer to Chapter RAMP-3: ERM Risk Quantification Framework. To explore further information on asset types more prone to specific climate hazards and examine how their vulnerability evolves through 2030, 2050, and 2070, please refer to Section 4 of the CAVA, titled "Vulnerability Analysis." As described below, SDG&E is actively exploring ways to incorporate climate exposure data and vulnerability analysis into future RAMP reporting.

IV. CLIMATE CHANGE ADAPTATION IN THE RISK-BASED DECISION-MAKING FRAMEWORK

Effective climate adaptation requires the identification and evaluation of actions that can be taken to address vulnerabilities associated with climate change impacts. SDG&E will continue to explore ways to integrate climate exposure data and vulnerability analysis into its quantitative risk models. Translating climate vulnerability into risk presents several challenges, as the translation of one concept into the other involves nonlinear relationships, interdependencies, and uncertainties. Climate hazards do not necessarily impact every risk directly, and additional analyses are required to understand the specific pathways and

interactions involved. Addressing these challenges will require ongoing research and collaboration across the industry to establish best practices for integrating climate data into risk considerations. SDG&E is actively working to refine methodologies and conduct the critical analyses needed to create a robust approach to climate risk that captures the intricate dynamics linking hazards, system responses, and potential outcomes.

The table below summarizes the controls and mitigations listed in individual RAMP chapters that pertain to climate adaptation options listed in CAVA or which increase climate resiliency. This list includes options to harden assets to climate hazards and modify SDG&E's operational practices.

Table 2: Controls and Mitigations that Align with Increasing Resilience to Climate Hazards

Risk Chapter	Relevant ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
Wildfire and PSPS	C501	Wireless Fault Indicators	Wildfires
	C502	Capacitor Maintenance and Replacement Program (SCADA)	Wildfires
	C504	Standby Power Program (Fixed Backup Commercial)	Wildfires
	C506	Microgrids	Wildfires
	C507	CMP Repairs	Wildfires
	C508	Advanced Protection	Wildfires
	C510	Hotline Clamps	Wildfires
	C512	Customized Resiliency Assessments	Wildfires
	C516	Generator Assistance Program	Wildfires
	C518	Strategic Undergrounding	Wildfires
	C520	Distribution Overhead System Hardening	Wildfires
	C522	Transmission Overhead Hardening (Distribution Underbuild)	Wildfires
	C524	Lightning Arrestor Removal/Replacement Program	Wildfires
	C526	Distribution Overhead Detailed Inspections	Wildfires
	C528	Distribution Infrared Inspections	Wildfires
	C530	Distribution Wood Pole Intrusive Inspections	Wildfires
	C534	Risk-Informed Drone Inspections	Wildfires
	C536	Distribution Overhead Pole Inspections	Wildfires
	C550	Combined Covered Conductor	Wildfires
	C552	PSPS Sectionalizing Enhancements	Wildfires
	C559	LiDAR Flights	Wildfires

Risk Chapter	Relevant ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
	C564	Distribution Communications Reliability Improvements (DCRI)	Wildfires
	C565	Transmission Overhead Detailed Inspections	Wildfires
	C568	Strategic Pole Replacement	Wildfires
	C569	Cleveland National Forest Fire Hardening	Wildfires
	C570	Expulsion Fuse Replacements	Wildfires
	C573	Early Fault Detection	Wildfires
	C576	Avian Protection	Wildfires
	C537	Off-Cycle Patrol	Wildfires
	C540	Fuels Management	Wildfires
	C544	Pole Clearing	Wildfires
	C551	Prune and Removal (Clearance)	Wildfires
	C554	Detailed Inspections	Wildfires
	C578	QA/QC of Veg Management	Wildfires
	C562	Weather Station Maintenance and Calibration	Wildfires
	C572	Situational Awareness and Forecasting	Wildfires
	C546	Aviation Firefighting Program	Wildfires
	C548	Wildfire Infrastructure Protection Teams	Wildfires
	C556	Engagement with AFN Populations	Wildfires
	C557	Public Outreach and Education Awareness	Wildfires
	C567	Public Emergency Communication Strategy	Wildfires
	C571	Emergency Preparedness and Recovery Plan	Wildfires
	C566	Enterprise Data Foundation	Wildfires
	C575	Vegetation Management Enterprise System	Wildfires
	C563	Wildfire Mitigation Strategy Development	Wildfires
	C558	Risk Methodology and Assessment	Wildfires
	M503	Grounding Banks	Wildfires
Electric Infrastructure Integrity	C202	Underground Cable Replacement Program - (Proactive)	Wildfires
	C250	Substation Reliability for Distribution Components	Extreme Temperatures, Inland Flooding, and Coastal Flooding
	C253	Restoration of Service	Extreme Temperatures, Wildfires, Inland Flooding, and Coastal Flooding
	C254	Underground Cable Replacement Program – Reactive	Wildfires

Risk Chapter	Relevant ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
	C262	Distribution Substation SCADA Expansion	Wildfires
	C263	Wireless Fault Indicator	Extreme Temperatures
	C269	Distribution Circuit Reliability	Extreme Temperatures
	C270	SCADA Capacitors	Wildfires
	C551	Prune & Removal (Clearance)	Wildfires
	C554	Detailed Inspections	Wildfires
	C578	QA/QC of Veg Management	Wildfires
	M1	Transformer Load Monitoring Driven Transformer Replacement	Extreme Temperatures
Employee Safety	C317	Employee Safety Training & Field Oversight Programs	Extreme Temperatures
	C328	Safety Compliance & Industrial Hygiene Program	Extreme Temperatures, Wildfires
	M303	Enhanced, Risk Informed, Employee Safety Training & Field Safety Oversight Programs	Extreme Temperatures
Contractor Safety	M307	Risk Informed Class 1 Contractor Safety Program Management	Extreme Temperatures
High-Pressure Gas System	C010	Pipeline Monitoring Technologies	Inland Flooding and Landslides
	C013	Gas Transmission Safety Rule – Maximum Allowable Operating Pressure (MAOP) Reconfirmation	Inland Flooding and Landslides
	C104	Cathodic Protection - Capital	Inland Flooding and Landslides
	C113	Leak Repair	Inland Flooding and Landslides
	C125	Pipeline Relocation/Replacement	Inland Flooding and Landslides
	C126	Shallow/Exposed Pipe Remediations	Inland Flooding and Landslides
	C171	Integrity Assessments & Remediation	Inland Flooding and Landslides
Medium-Pressure Gas System	C134	Pipeline Monitoring	Inland Flooding and Landslides
	C139	Gas Distribution Safety Relocations	Inland Flooding and Landslides

SDG&E will continue efforts to align regulatory proceedings, such as RAMP and the GRC, with efforts to address climate risk mitigation activities. SDG&E supports the

Commission's decision in D.24-08-005 to move the timing of the CAVA filing to one year prior to the RAMP report.[10] This change will promote further integration of results and climate adaptation options into mitigation and control programs.

[10] *See* D.24-08-005, Ordering Paragraph 1 at 83.



2025 Risk Assessment Mitigation Phase

(Chapter SDG&E-Risk-1)

Excavation Damage

May 15, 2025

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I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or Company) risk control and mitigation plan for Excavation Damage. This chapter contains the information and analysis for this risk that meet the requirements of the California Public Utilities Commission's (Commission or CPUC) Risk-Based Decision-Making Framework (RDF),[1] including the requirements adopted in Decision (D.) 22-12-027 (Phase 2 Decision)[2] and D.24-05-064 (Phase 3 Decision).[3] Excavation Damage is included in the 2025 RAMP Report based on a safety risk assessment, further informed by its reliability and financial consequence attributes, consistent with RDF guidance. This risk chapter describes the basis for selection of Excavation Damage, the controls and/or mitigations put forth to reduce the likelihood or consequence of this risk, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter presents cost and unit forecasts for the risk mitigating activities, but it does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk-reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation consistent with the method and process prescribed in the RDF.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SDG&E's Excavation Damage is defined as the risk of a dig-in on the natural gas system that is either classified as high or medium pressure, including appurtenance piping, caused by excavation activities, which result in serious injuries, fatalities and/or damages to the infrastructure.

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1 As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A.15-05-002 et al. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

2 D.22-12-027 is the "Phase II Decision Adopting Modifications to the Risk-Based Decision-Making Framework Adopted in Decision 18-12-014 and Directing Environmental and Social Justice Pilots" (December 21, 2022).

3 D.24-05-064 is the "Phase III Decision" (June 6, 2024).

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF reporting requirements, such as those from the CPUC's General Order (GO) 112-F and PHMSA including but not limited to subparts of Rule 49 Code of Federal Regulations (CFR). A list of compliance requirements applicable to Excavation Damage is provided in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction calculated under the RDF, such as enhancing operations, alignment with sustainability goals and improving customer service.

2. Risk Overview

SDG&E operates and manages a natural gas system of over 15,400 miles of Distribution pipe and 219 miles of Transmission pipe within its 4,100 square mile service territory. Pipe mileage can be further segregated into general operating pressure categories of Medium Pressure (MP), which operates at or less than 60 psig, and High Pressure (HP), which operates above 60 psig. SDG&E's large piping network and large service territory have exposure to potential dig-in related incidents. This risk highlights the consequence and likelihood of dig-in damage that cause a release of natural gas, damage property, or personal injury.

SDG&E has been mitigating dig-in risk to its underground gas infrastructure for decades. Dig-ins are a ubiquitous problem for all industries and utilities with buried infrastructure and are not unique to SDG&E. Excavation activities can vary widely based on project scope and size. Examples include: a homeowner doing landscaping work, a plumber repairing a sewer line, contractor performing excavation work on streets or sidewalks, or a city upgrading its aging municipal water or sewer systems. Excavation damage can range from minor scratches and/or dents on gas piping, to ruptures with an uncontrolled release of natural gas. The release of natural gas may not just occur at the time of the damage. A leak or rupture may also occur after the infrastructure has sustained damage that has accumulated over time. Damage that does not result in a release of gas is less often reported by the responsible party. Unfortunately, SDG&E cannot always assess the pipe for damage and make the appropriate repairs to preserve the integrity of the pipe.

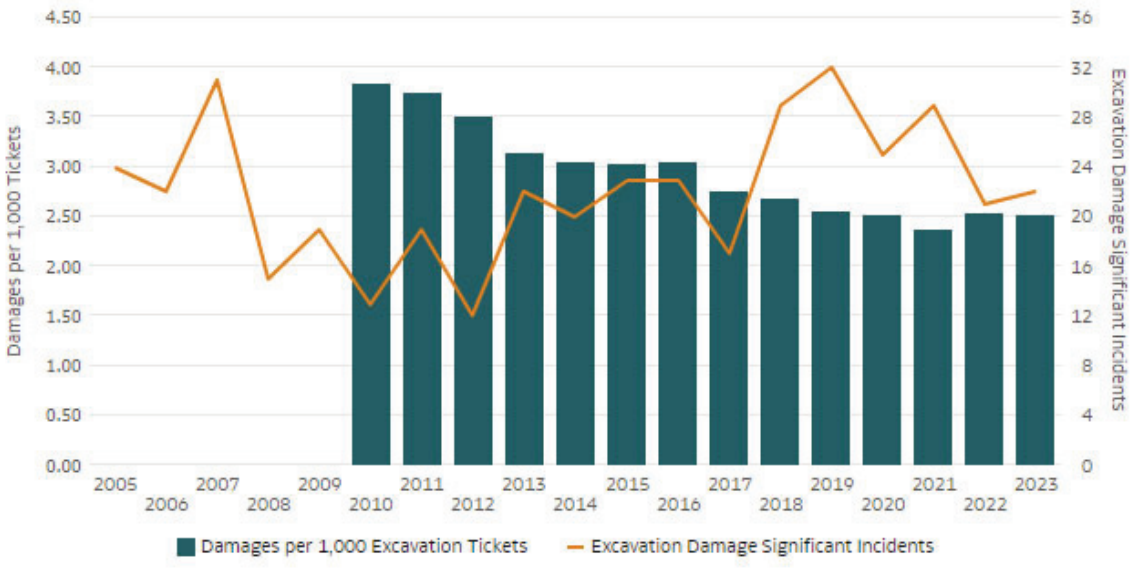
Serious consequences may result if an event occurs because of this risk. For example, if a leak or rupture occurs, ignition of the released gas could lead to an explosion, fire, or both. The nearby public could be seriously injured, and property damage could be extensive. Federal and state agencies acknowledge the threat of dig-in risk and have responded by adopting several

regulations and industry standards and supporting awareness efforts to help prevent dig-ins. For example, the Department of Transportation (DOT) sponsored the "Common Ground Study," completed in 1999. Subsequently, the "Common Ground Study" led to the creation of the Common Ground Alliance (CGA), a member-driven association of 3,200 individuals, organizations, and sponsors in every facet of the underground utility industry. With industry-wide support, CGA created a comprehensive consensus document that details the best practices addressing every stakeholder groups' activity in promoting safe excavation and dig-in prevention.

While these efforts are important and commendable, and the number of dig-ins per 1,000 excavation tickets within the industry has been trending down (Figure 1), excavation damage incidents continue. Excavation tickets are a common metric used throughout the industry to gauge the status of a damage prevention program. Figure 1 represents industry trends for dig-ins on distribution lines. Excavation data for transmission incidents are less frequent and harder to trend. Thus, the DOT's Pipeline and Hazardous Materials Safety Administration (PHMSA) collects ticket totals in annual reports for distribution facilities but did not collect ticket information for transmission facilities before 2024.

Figure 1

Excavation Damage: Excavation Tickets & Incidents



Under California State Law, an excavator planning excavation work is required to contact the Regional Notification Center for their area, also known as Eight-One-One (811) or

Underground Service Alert (USA), at least two (2) full working days prior to commencing construction excavation activities, not including the day of the notification.[4] 811 is the national phone number designated by the Federal Communications Commission (FCC), that connects homeowners or contractors who plan to dig with professionals through a local call center. California has two Regional Notification Centers, DigAlert and USA North, that split California at the Los Angeles/Kern county, and Santa Barbara/San Luis Obispo County lines; USA North serves all counties north of the county lines and DigAlert serves all counties south of the county lines. SDG&E is served exclusively by DigAlert which will be referenced as 811 USA for the remainder of this chapter. Once an excavator makes contact, the Regional Notification Center will issue a USA Ticket notifying local utilities and other operators of the location and areas to be inspected for potential conflicts of underground infrastructure with the pending planned excavation work. Operators are then required to provide an Electronic positive response to indicate that there are no facilities in conflict or to mark their underground facilities via aboveground identifiers (*e.g.*, paint, chalk, flags, whiskers) to designate where underground utilities are approximately positioned, thus enabling excavators, like contractors and homeowners, to recognize the existence of underground utility facilities within the respective digging area. The law also requires excavators to use careful, manual (hand digging) methods to expose subsurface installations prior to using mechanical excavation tools.[5]

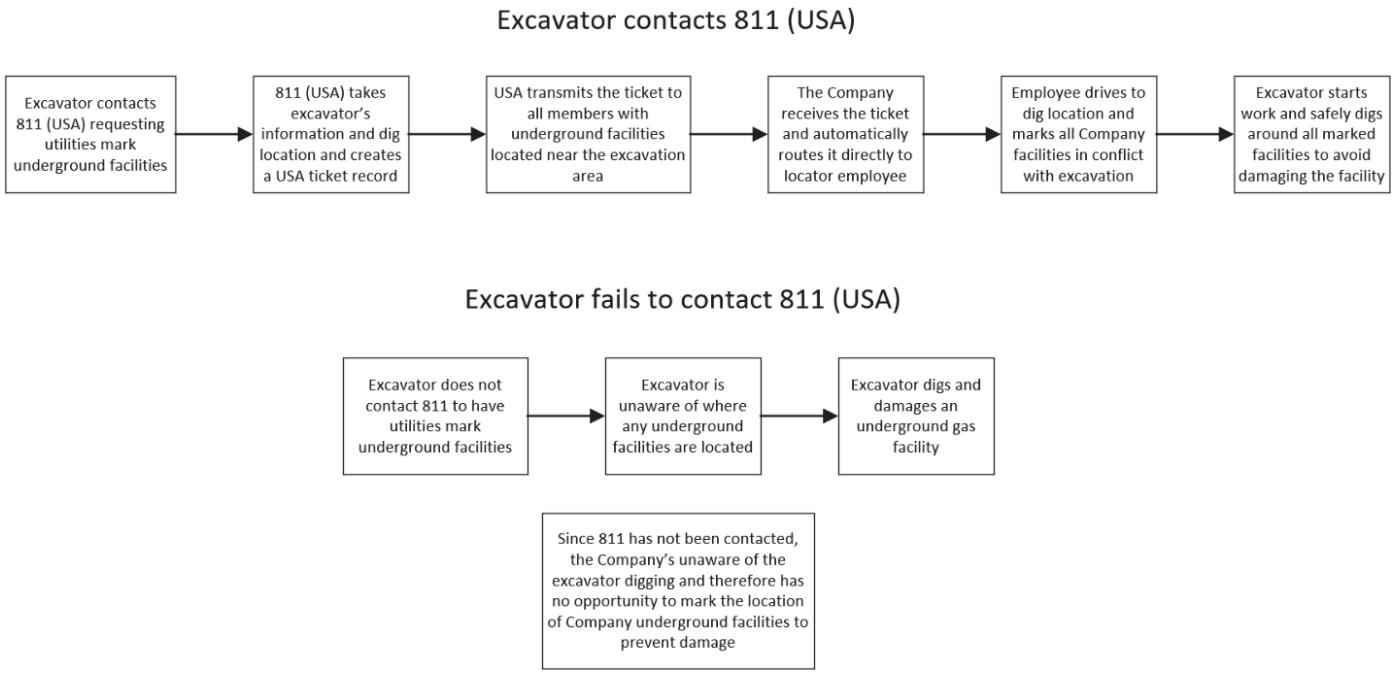
Figure 2 below illustrates the sequence of events that may occur when an excavator contacts 811 USA prior to conducting excavation work and, in contrast, the sequence that may occur when they do not.

[4] Cal. Gov. Code § 4216.2(b).

[5] Cal. Gov. Code § 4216.4(a)(1).

Figure 2

Excavation Damage: Excavation Contact Process Flow



While there may be more steps when an excavator calls 811 USA prior to commencing excavation work, it can protect from a negative outcome that might result were a call not made. When excavators call 811 USA before excavating, the risk of a dig-in is reduced. SDG&E managed over 210,000 natural gas 811 USA tickets and reported over 250 natural gas dig-in excavation damage incidents in 2024. Analysis of the data collected during routine damage investigations indicate that further analysis of the reported damage incidents shows that the majority of damages were caused by a lack of notification to 811 USA for a locate and mark ticket and the next greatest cause was inadequate excavation practices even after the excavator called 811 USA and underground facilities were marked.

In addition to direct involvement with excavators and 811 USA, SDG&E engages in promoting safe digging practices through its Public Awareness Program and corporate safety messaging through stakeholder outreach. This educational messaging comes in multiple formats, including mail, email, social media, television, radio, events, and association sponsorships.

B. Risk Scope

SDG&E analysis considers the risk of a dig-in on the natural gas system that is either classified as high or medium pressure, including appurtenance piping, caused by excavation activities, which results in serious injuries, fatalities and/or damage to the infrastructure.

C. Data Sources Used in Quantifying Risk Estimates[6]

SDG&E utilized internal data sources to determine Excavation Damage Pre-Mitigation Risk Value and calculate risk reduction estimates for migration activities (which enables estimation of Post Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used as appropriate and adjusted to account for the risk characteristics associated with the Company's specific operating locations and service territory. For example, certain types of incident events have not occurred within the SoCalGas and SDG&E service territories. Expanding the quantitative data sources to include to encompass industry data where such incidents have been recorded is appropriate to establish a baseline of risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of Excavation Damage, including a risk Bow Tie which delineates potential Drivers/Triggers and Potential Consequences, followed by a description of the Tranches determined for this risk and the risk's Pre-Mitigated Risk Value.

A. Risk Selection

Excavation Damage was included as a risk in SDG&E's 2021 RAMP and was included in the 2022, 2023 and 2024 Enterprise Risk Registries (ERR).[7] SDG&E's ERR evaluation and selection process is summarized in Chapter RAMP-2: Enterprise Risk Management Framework.

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[6] Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

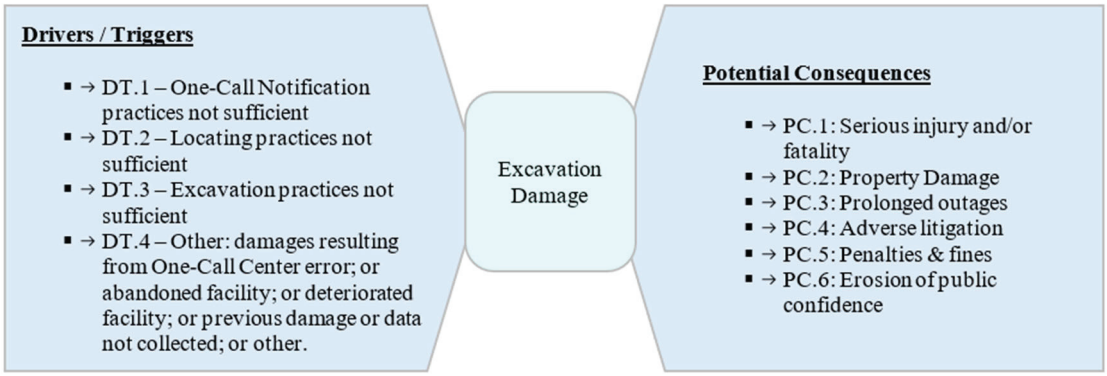
[7] In the 2021 RAMP Report this risk was called Excavation Damage (Dig-In) on the Gas System. The risk definition is unchanged.

SDG&E selected this risk in accordance with RDF Row 9.[8] Specifically, SDG&E assessed top risks from the Company's 2024 ERR based on the Consequence of a Risk Event (CoRE) Safety attribute. The Excavation Damage Risk was among the risks presented in SDG&E's list of Preliminary 2025 RAMP Risks on December 17, 2024 at a Pre-Filing Workshop. Excavation Damage was selected electively, as it did not qualify based on the Safety attribute alone. At the pre-filing workshop, no party expressed opposition to inclusion of this risk in SDG&E's 2025 RAMP Report.

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the risk Bow Tie, possible Drivers, potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that addresses it.[9] As illustrated in the risk Bow Tie shown below in Figure 3, the Risk Event (center of the Bow Tie) is Excavation Damage that leads to asset failure, serious injury or death, the left side of the Bow Tie illustrates Drivers/Triggers that could lead to the Excavation Damage that could cause asset failure, serious injury or death, and the right side shows the Potential Consequences of the Excavation Damage. SDG&E applies this framework to identify and summarize the information provided in Figure 3. A mapping of each mitigation to the elements of the risk Bow Tie is provided in Attachment C.

Figure 3
Excavation Damage: Risk Bow Tie



[8] RDF Row 9 states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars."

[9] D.24-05-064, RDF Row 15.

C. Potential Risk Event Drivers/Triggers[10]

When performing a risk assessment for the Excavation Damage Risk, SDG&E identifies potential leading indicators, referred to as Drivers or Triggers, that reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to the asset.[11] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1 –** One-Call Notification practices not sufficient: damages resulting from no notification made to the One-Call Center; or notification made to One-Call Center, but not sufficient; or wrong information provided to One-Call Center, which could lead to one or many of the potential consequences listed below occurring.
- **DT.2** – Locating practices not sufficient: damages resulting from facility could not be found or located; or the facility marking or location is not sufficient pursuant to requirements; or the facility was not located or marked; or incorrect facility records/maps, which may lead to one of the potential consequences listed below occurring if not mitigated through other practices.
- **DT.3** – Excavation practices not sufficient by excavator: damages resulting from failure to maintain marks; or failure to support exposed facilities; or failure to use hand tools where required; or failure to test-hole (pothole); or improper backfilling practices; or failure to maintain clearance; or other insufficient excavation practice, which could lead to one or many of the potential consequences listed below occurring.
- **DT.4** – Other: damages resulting from One-Call Center error; or abandoned facility; or deteriorated facility; or previous damage or data not collected; or other, which could lead to one or many of the potential consequences listed below occurring.

[10] An indication that a risk could occur. It does not reflect actual or threatened conditions.

[11] D.24-05-064, RDF Row 10-11.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed to the right side of the risk Bow Tie. SDG&E identifies the Potential Consequences of this Risk by analyzing internal data sources where available, industry data, and subject matter expertise (SME).[12] These Bow Tie Consequences inform the CoRE component of the risk value. If one or more of the Drivers listed above were to result in an incident, the Potential Consequences, in a plausible worst-case scenario, could include:

- **PC.1:** Serious injury and/or fatality
- **PC.2:** Property Damage
- **PC.3:** Prolonged outages
- **PC.4:** litigation
- **PC.5:** Penalties & fines
- **PC.6:** Erosion of public confidence

These Potential Consequences were used by SDG&E in the scoring of Excavation Damage during the development of its SDG&E's 2024 ERR.

E. Evolution of Its Drivers and Consequences

As specified in the Phase 3 Decision,[13] the following changes to the previous ERR and/or the 2021 RAMP include the following.

1. Changes to Drivers/Triggers of the Risk Bow Tie

While evaluating this risk to consolidate HP and MP into one risk, it was also recognized that many of the 2021 drivers had the same root driver and as such were consolidated into four (4) drivers seen in the 2025 RAMP bowtie. To clarify, the following drivers were present in 2021 RAMP but removed in 2025 RAMP:

- DT.1 – Excavators such as contractors or property homeowners/tenants do not follow 811 One-Call Dig-Safe law requirements (USA) for locate and mark prior to excavation
- DT.2 – Excavator fails to contact company "standby" personnel

[12] D.24-05-064, RDF Row 10.

[13] *Id.*, RDF Row 8.

- DT.3 – Hand excavation and other required excavation practices are not performed in the vicinity of located underground facilities
- DT. 4 – Company does not respond to 811 requests in required timeframe
- DT.5 – Company does not "standby" when requested near required facilities
- DT.6 – Locator error contributing to the incorrect marking of underground facilities
- DT. 7 – Delayed updates to asset records of underground facilities leading to incorrect locate and mark
- DT. 8 – Incorrect/inadequate information in existing asset records leading to incorrect locate and mark
- DT.9 – Execution Constraints

As discussed above, the following drivers were established for the 2025 RAMP:

- DT.1 – One-Call Notification practices not sufficient
- DT.2 – Locating practices not sufficient
- DT.3 – Excavation practices not sufficient
- DT.4 – Other: damages resulting from One-Call Center error; or abandoned facility; or deteriorated facility; or previous damage or data not collected; or other.

2. Changes to Potential Consequences of the Risk Bow Tie

- No changes to potential consequences

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and in accordance with Row 14 of the RDF, SDG&E applied the Homogeneous Tranching Methodology (HTM) as outlined in Chapter RAMP - 3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:

Table 1: Excavation Damage Risk
Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches
HP	48	12
MP	91	20
TOTAL	**139**	**32**

Attachment D illustrates the derivation of the Tranches, as shown in Table 1 above, in accordance with the HTM. The classes were identified by SDG&E subject matter experts as logical groups of assets and systems based on the Company's operations. These classes also align risk treatments with asset risk profiles reflective of SDG&E's operations. More detailed Tranche information, including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches, is provided in workpapers.

III. PRE MITIGATION RISK VALUE

In accordance with the RDF Row 19, the table below provides the pre-mitigation risk values for the Excavation Damage Risk. Further details, including pre-mitigation risk values by tranche, are provided in workpapers. Explanations of risk quantification methodology and other higher-level assumptions are provided in Chapter RAMP-3: Risk Quantification Framework.

Table 2: Excavation Damage Risk
Monetized Risk Values
(Direct, in 2024 $ millions)

LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]
	Safety	Reliability	Financial		
323.18	$0.005	$0.013	$0.002	$0.021	$6.83

A. Risk Value Methodology

SDG&E's risk modeling for the Excavation Damage risk follows RDF guidance[14] for implementing a Cost Benefit Approach, as described below:

1. Cost Benefit Approach Principle 1 – Attribute Hierarchy (RDF Row 2): Excavation Damage risk is quantified in a combined attribute hierarchy as

[14] D.24-05-064, RDF Rows 2-7.

shown in the table above, such that Safety, Reliability, and Financial are presented based on available, observable and measurable data.

2. **Cost Benefit Approach Principle 2 – Measured Observations (RDF Row 3):** Excavation Damage risk features observable and measurable CoRE values. SDG&E utilized its database of reportable excavation damage incidents data (mentioned in the introduction of this Chapter) to represent natural units for excavation damage events.

3. **Cost Benefit Approach Principle 3-Comparison (RDF Row 4):** Excavation Damage quantification did not include any attributes that are not directly measurable, so proxy data, as described in the RDF, was not necessary.

4. **Cost Benefit Approach Principle 4-Risk Assessment (RDF Row 5):** The data sources used for Excavation Damage – as described in the preceding paragraphs – were sufficient to model probability distributions for use in estimating risk values.

5. **Cost Benefit Approach Principle 5-Monetized Levels of Attributes (RDF Row 6):** As described more fully in Volume 1, Chapter RAMP-3, the Safety CoRE attribute is valued at a monetized equivalent of $16.2 million per fatality, $49 thousand for minor injuries, and $4.1 million per serious injury; the Gas Reliability CoRE attribute is valued at a monetized equivalent of $3,868 per gas meter outage; and the Financial CoRE attribute is valued at $1 per dollar.[15] The Electric Reliability CoRE attribute is not considered for SDG&E's Excavation Damage Risk.

Further information regarding SDG&E's quantitative risk analyses, including raw data, calculations, and technical references, are provided in workpapers.

[15] *See* Chapter RAMP-3: Risk Quantification Framework, Section II.

6. Cost Benefit Approach Principle 6-Adjusted Attribute Level (RDF Row 7):

Table 3: Excavation Damage Risk
Risk Scaled vs Unscaled Value by CoRE Attribute
(Direct, in 2024 $ millions)

	Safety	Reliability	Financial	Total
Unscaled Risk Value	$0.50	$2.60	$0.75	$3.85
Scaled Risk Value	$1.75	$4.30	$0.78	$6.83

The values in the table above are the result of SDG&E applying the risk scaling methodology described in Chapter RAMP-3 to the CoRE attributes for the Excavation Damage Risk. Excavation Damage Risk features significant risk aversion scaling due to the potential for high impact consequence outcomes resulting from excavation damage leading to an asset failure/uncontrolled release of gas.

For further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply, is provided in Chapter-RAMP-3.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section identifies and describes the controls and mitigations comprising the portfolio of mitigations for Excavation Damage and reflects any changes to the portfolio expected to occur from the last year of recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). For clarity, a current activity that is included in the plan may be referred to as either a control and/or a mitigation. Table 4 below shows which control activities are in place in 2024 and which are expected to be on-going, completed, or new during the 2025-2031 time periods. Because the TY 2024 GRC proceeding established rates through 2027,[16] information through 2027 is calculated as part of the baseline risk, in accordance with D.21-11-009.[17] For the TY 2028 GRC, SDG&E calculated CBRs beginning with TY 2028 and for each Post-Test Year 2029, 2030, and 2031.[18]

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[16] *See* D.24-12-074.

[17] D.21-11-009 at 136 (Conclusion of Law (COL) 7) (providing a definition for "baselines" and "baseline risk").

[18] In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

Table 4: Excavation Damage Risk
2024-2031 Control and Mitigation Plan Summary

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C001	Damage Prevention Strategies	X	Ongoing
C002	Damage Prevention Activities – Gas	X	Ongoing
C003	Damage Prevention – Public Awareness	X	Ongoing
C004	Damage Prevention Mapping	X	Ongoing

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place"[19] (*i.e.*, activities in this section were in place as of December 31, 2024). Controls that will continue as part of the risk mitigation plan are identified in Table 4 above.

- **C001: Damage Prevention Strategies:**

  The Damage Prevention Strategies control is spearheaded on two fronts, the Damage Prevention Analyst Program and Ticket Risk Analysis (TRA).

  The Damage Prevention Analyst (DPA) Program aims to mitigate third-party damages to gas facilities by identifying high-risk excavating contractors through data analysis and informing them that their practices may be in violation of digging laws and standards such as, but not limited to, proper one-call procedures and safe digging techniques. The benefits of the DPA are numerous. First, it enables SDG&E to check if underground markings are present where they happen to notice construction occurring. Second, it provides an opportunity to educate contractors on the requirements before digging or when digging around gas facilities before damage is done. This education has far-reaching benefits as the contractor will perform future projects in other districts not currently part of the program, and the education can be applied to those future projects. Third, it creates a list of contractors who might be repeat offenders and/or prevalent site characteristics to improve prioritization of future construction site inspections.

[19] D.18-12-014 at 33.

The DPAs focus on districts with the greatest number of reported incidents by driving to and physically inspecting excavation projects with 811 USA ticket requests. The analysts stop at some other construction projects to investigate if the excavator notified USA 811 and if safe excavating techniques are followed. SDG&E expects to expand this program with additional analysts and broader system-wide coverage. SDG&E's DPAs have stopped many jobs since the program's inception in 2024 and have conducted over 2,500 contractor outreach and educational opportunities. The final activity of the DPAs is to validate that locators are following processes and procedures when performing locating tasks on all SDG&E substructures to include natural gas, electric, and fiber optic substructures. This Quality Assurance by DPA evaluators document each ticket assessment and identify opportunities for improvement. SDG&E's Gas Quality Assurance department administers the DPA program and visits every operating district at least once per year. During these visits, they select a prescribed number of 811 USA tickets for each Locator, check the employee's Operator Qualification status, and evaluate the documentation on the ticket. Additionally, they will perform field visits, when possible, to evaluate in-field activities such as equipment setup and use, Company Gas Standard compliance, accuracy of locate and mark placement (on natural gas, electric, and fiber optic substructures), proper documentation, and proper use of the Korterra ticket management system, among other activities. Feedback on a quality assurance audit is provided to each local supervisor who is responsible for following up with employees and providing coaching or refresher training.

The TRA portal is a proprietary in-house software tool designed to assist DPA and field supervisors by providing a GIS map interface that highlights high-risk tickets. Key features include color-coded ticket locations, advanced filtering capabilities, and the ability to display pipeline locations. The portal also offers automated email notifications to ticket requesters based on custom criteria, such as boring, and categorizes tickets using a model that considers work type. A typical use case involves a DPA using the TRA portal to identify clusters of high-

risk tickets, enabling them to prioritize their efforts on areas with the highest potential for damage.

- **C002: Damage Prevention Activities-Gas:**

  The purpose of the Damage Prevention Activities – Gas is to prevent damage to gas infrastructure caused by third-party excavators. Three primary locate and mark activities are listed below:
  (1) locating and marking underground gas facilities before excavation occurs;
  (2) observing (stand-by) pipeline excavation activities; and
  (3) providing staff support for compliance and improvement.

  The first of these activities refers to the physical act of locating and marking underground facilities. SDG&E has been moving towards in-sourcing work related to locate and mark activities. In 2024, SDG&E responded to over 210,000 natural gas locate-and-mark ticket requests. By providing a visual indication of the location of underground facilities, the excavator has the necessary information to excavate safely.
  The second activity is pipeline observation, or "stand-by," which is a critical activity that requires a qualified Company representative to be present anytime excavation activities take place near high-priority pipelines. The purpose of this activity is to decrease the likelihood of damage occurring by having a dedicated employee present to maintain the integrity of the pipeline.
  The third activity is providing daily damage prevention staff support to operations by interpreting policies, tracking compliance, evaluating tools, equipment, and new technologies, providing refresher training, and tracking and trending locate-and-mark data to proactively identify areas for improvement. This is a critical risk reduction activity that directly supports the field locator personnel in their daily activities and leads to more accurate and timely responses to locate-and-mark tickets and reductions in damages. This collection of Damage Prevention Activities – Gas ultimately provides the excavator with additional information to avoid hitting or damaging gas facilities.

- **C003: Damage Prevention - Public Awareness:**[20]
  SDG&E is dedicated to raising public awareness about damage prevention through a series of strategic controls and enhancements. These efforts are designed to educate the public, promote safe practices, and reduce the risk of damage to subsurface facilities. Key components include:
- **Compliance Monitoring**: The Company endeavors to comply with public awareness regulations and standards. This includes adhering legal requirements for public education and outreach. Regular audits and reviews are conducted to monitor compliance and identify areas for improvement.
- **Public Education Campaigns**: The Company conducts ongoing public education campaigns to inform the community about the importance of safe excavation practices. These campaigns utilize various media channels, including social media, print, and broadcast, to reach a wide audience.
- **Educational Materials**: The Company develops and distributes educational materials, such as brochures, flyers, and instructional videos, to provide clear and accessible information on safe excavation practices. These materials are made available at public events, community centers, and online.
- **Collaborative Partnerships**: The Company collaborates with local governments, industry associations, and other stakeholders to enhance public awareness efforts. These partnerships help amplify the message and promote a coordinated approach to damage prevention.
- **Community Outreach Programs**: Through community outreach programs, the Company engages directly with local communities. These programs include workshops, seminars, and informational sessions that provide valuable insights into damage prevention and the proper use of 811 services.
- **Feedback and Improvement**: The Company actively seeks feedback from the public and stakeholders to continuously improve its public awareness initiatives.

[20] In 2028 SB1371 costs associated with Public Awareness media and marketing campaigns (which began in 2020) will transfer to the TY2028 GRC Base O&M request.

This feedback is used to refine messaging, identify new outreach opportunities, and enhance the overall effectiveness of the program.

By implementing these controls and enhancements, the Company aims to promote safety and awareness among the public, ultimately reducing the risk of damage to subsurface facilities and promoting safer excavation practices.

- **C004: Damage Prevention Mapping:**

  The entirety of the accurate and complete GIS mapping records of the Gas Distribution and Transmission system is a critical risk mitigation measure in identifying hazards to public and employee safety, infrastructure sustainability, and also supports the reliable delivery of natural gas to SDG&E's customers. As gas system construction, maintenance, and repair projects are completed throughout SDG&E's service territory, accurate pipeline data is captured and records kept for the life of the pipeline, consistent with GO 112-F and 58-A. Projects requiring mapping and database records work include all new business activity, pipeline relocations, main extensions, pressure betterment projects, pipeline replacements, and various other operational activities that change the gas system configuration. The GIS-based mapping system includes the capability to capture pipeline attribute data, and this data is added to the facilities when mapped in GIS. GIS mapping personnel are responsible for updating all distribution infrastructure maps whenever facilities in the field are constructed, modified, or replaced. The timely maintenance of these Gas Distribution system records is a critical risk mitigation measure in preventing hazards to public and employee safety, infrastructure integrity, and to the reliable delivery of natural gas to SDG&E's customers.

B. Changes from 2024 Controls

SDG&E plans to continue each of the existing controls discussed above, and reflected in Table 1, through the 2025-2031 period without any significant changes.

C. Mitigation Programs

SDG&E does not currently foresee implementing new mitigations not described above during the 2025-2031 period.

D. Climate Change Adaptation

In assessing Excavation Damage, controls and/or mitigations that address climate adaptation planning were determined to be inapplicable (from the perspective of climate exposure, asset sensitivity, and asset adaptive capacity). A list of climate-relevant controls and mitigations is provided in Volume 1, Chapter RAMP-5: Climate Change Adaptation.

E. Foundational Programs

Foundational Programs are "[i]nitiatives that support or enable two or more Mitigation programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[21] There are no activities that meet this definition of a foundational activity.

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for Excavation Damage, including the associated costs, units, and CBRs. Additional information by Tranche is provided in workpapers. The costs shown are estimated using assumptions provided by SMEs and available data. In compliance with the Phase 3 Decision,[22] for each enterprise risk, SDG&E uses actual results and industry data and when that is not available, supplements the data with SME input. Additional details regarding the data and expertise relied upon in developing these estimates are provided in Attachment B.

Table 5: Excavation Damage Risk
Risk Control and Mitigation Plan – Recorded and Forecast Costs Summary
(Direct, in 2024 $thousands)

ID	Control/Mitigation Name	Recorded Costs		Forecast Costs			
		2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C001	Damage Prevention Strategies	0	598	800	0	0	2,400
C002	Damage Prevention Activities – Gas	0	6,547	7,811	0	0	25,615
C003	Damage Prevention – Public Awareness	0	1,142	1,029	0	0	3,087
C004	Damage Prevention Mapping	0	686	686	0	0	2,058

[21] D.24-05-064, Appendix A at A-4.

[22] D.24-05-064, RDF Row 10.

Table 6: Excavation Damage Risk
Risk Control & Mitigation Plan – Units Summary

Control/Mitigation Name		Recorded Units			Forecast Units			
ID	**Name**	**Unit of Measure**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C001	Damage Prevention Strategies	Employees	0	6	8	0	0	24
C002	Damage Prevention Activities – Gas	Tickets	0	212,553	253,614	0	0	831,629
C003	Damage Prevention – Public Awareness	Customers reached	0	56,078	56,539	0	0	169,617
C004	Damage Prevention Mapping	Reconciled work orders	0	3,366	3,366	0	0	10,098

In the table below, CBRs are presented in summary at the mitigation or control level for the aggregate 2028-2031 period, reflective of the Test Year 2028 GRC cycle. CBRs are calculated based on scaled, expected values, unless otherwise noted and are calculated for each of the three required discount rates[23] in each year of the GRC cycle and for the Post-Test Years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in workpapers.

Table 7: Excavation Damage Risk
Cost Benefit Ratio Results Summary (2028-2031)
(Direct, in 2024 $ millions)

ID	Control/Mitigation Name	Capital (2028-2031)	O&M (2028-2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C001	**Damage Prevention Strategies**	0	3.2	0.68	0.72	0.68
C002	**Damage Prevention Activities – Gas**	0	33.426	6.17	6.60	6.21
C003	**Damage Prevention – Public Awareness**	0	4.116	0.28	0.30	0.28
C004	**Damage Prevention Mapping**	0	2.744	4.31	1.47	1.14

Bold *indicates a mandated program.*

[23] *See* Chapter RAMP-3: for definitions of discount rates, as ordered in the Phase 3 Decision.

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025 and D.16-08-018,[24] SDG&E considered two alternatives to the risk mitigation plan for the Excavation Damage risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this plan considers changes in risk reduction, cost, reasonableness, current conditions, modifications to plan and constraints, such as budget and resources.

Table 8: Excavation Damage Risk
Alternative Mitigation Plan Forecasted Costs Summary (2028-2031)
(Direct, in 2024 $millions)

ID	Alternative Mitigation Name	Forecast Costs			
		2025-2028 Capital	PTY Capital	2025-2028 O&M	PTY O&M
A001	MP Standby for Repeat Offenders	0	0	24	18
A002	Installation of non-required EFV's	0	0	3.2	2.4

Table 9: Excavation Damage Risk
Cost Benefit Ratio Results Summary
(Direct, in 2024 $millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A001	MP Standby for Repeat Offenders	0	6	0.03	0.03	0.03
A002	Installation of non-required EFVs	0	0.8	~0.00	~0.00	~0.00

A. Alternative 1: MP Standby for Repeat Offenders

1. This alternative mitigation will require additional oversight on excavation damage repeat offenders (RO)[25] when excavating within 10 feet of Company medium pressure substructures. This assumes that the excavator has complied with the applicable law related to notifications. This would require Company personnel to meet onsite with an RO to agree upon excavation activities prior to legal excavation start date and verify the RO

[24] *See, e.g.,* D.18-12-014 at 33-35.

[25] Repeat Offender is defined as an excavator who has more than two damages on company substructures in a running 12-month period.

is using appropriate excavation activities to reduce the risk of Company substructure being damaged by the RO. This mitigation would mirror current California code 4216.2c requirements for high priority subsurface installations.

By implementing this mitigation plan, the Company would aim to encourage responsible behavior among contractors, enhance safety standards, and reduce the need for stand-by activities. This approach not only promotes compliance but also fosters a collaborative relationship between the Company and excavators within the company's service territory. The company has not included this mitigation as part of the control plan because it would not mitigate risks beyond a narrow group of excavators and yet the costs would be significant.

B. Alternative 2: Installation of non-required EFV's

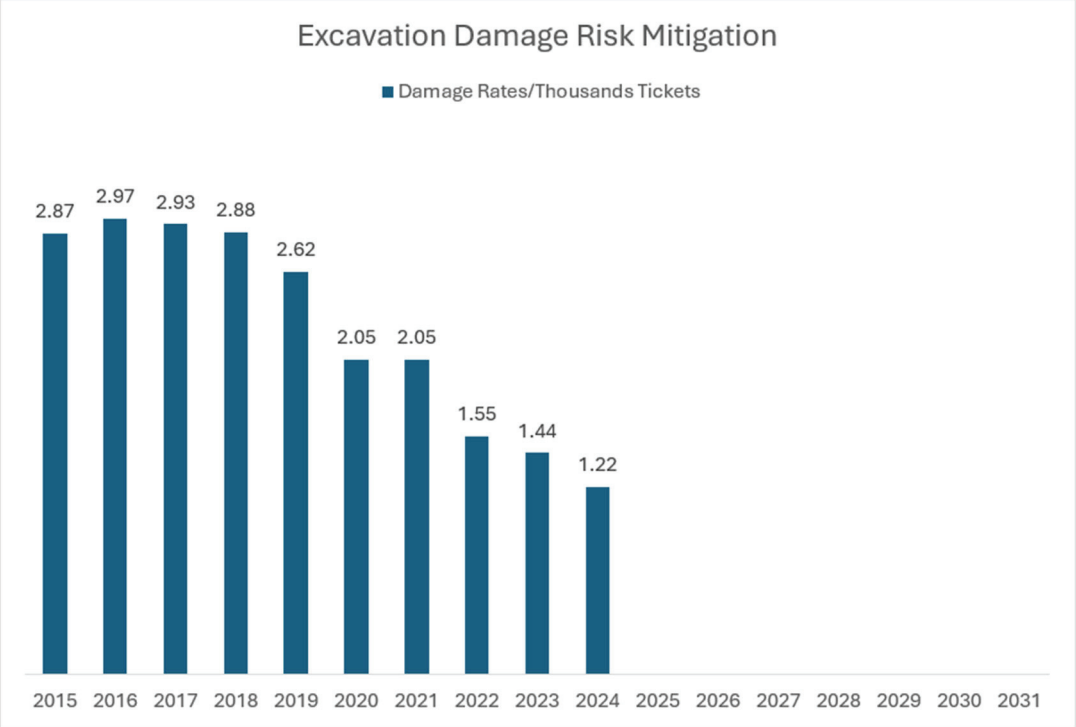
Per CFR 192.385 installation of manual service line shut-off valve (a "curb" valve or other manually operated valve) or an excess flow valve (EFV) are required on new or replaced service lines with meter capacity exceeding 1,000 Standard Cubic Foot Hours. This alternative mitigation would install EFV's on all existing services that fall under the capacity requirements of CFR 192.385. By implementing this alternative mitigation plan, the Company could enhance the safety of its gas distribution system. The installation of EFVs on all service lines would help prevent uncontrolled gas flow, reduce the risk of gas leaks, and protect customers and infrastructure. The Company has not included this mitigation as part of the control plan because the Company is currently compliant with CFR 192.385 and additional in-depth analysis would be required to determine feasibility dependent on service line customer consumption and industry EFV technology.

VI. HISTORICAL GRAPHICS

As directed by the Commission in D.22-10-002, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. A bar chart graphic is employed to depict historical progress. This graphic uses a key metric that aligns with Company safety goals to illustrate trends in historical progress and identify the remaining tasks necessary to continue mitigating risks.

Figure 4

Excavation Damage: Safety Progress 2016-2024



The historical safety work activities completed using the above metric from 2016-2024 include:

- 2019: Damage Prevention Strategies Program created to reduce excavation damages, educate excavation community on 811 requirements, and improve safe excavation. Create and maintain relationships with municipalities and excavators.
- 2019/2020: Shared service with SoCalGas. Focus on Engagement, Education, Enforcement, and Enhancements. In-House Ticket Risk Assessment tool created to identify potential high risk excavation sites.
- 2019/2020: Ticket Risk Assessment (TRA) tool developed with continuance updates and retraining of model.
- 2020/2021: Collaborate with Public Awareness and Marketing/Communication teams to meet compliance requirements and enhance the communication and awareness to the local communities of 811 and the importance of calling before digging.

- 2020/2021: 100% Internal Locate & Mark Workforce: Address pride in addressing all tickets with internal resources.
- 2021: Repeat Offender Program initiated to identify and educate excavators who have more than 2 damages in a 12-month period.
- 2023: Partnership with PHMSA, CPUC and USB to develop a reporting platform for excavations caused by no notification made to 811.
- 2024: Launched 811 Dig Champions Ambassador Program to internal employees to report unsafe excavation activities.

The safety work that remains to be done is addressed the controls/mitigations detailed above in Section III. 2024-2031 Control & Mitigation Plan.

ATTACHMENTS

ATTACHMENT A

EXCAVATION DAMAGE - CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates the compliance drivers which underpin identified controls and mitigations.

ID	Control/Mitigation Name	Compliance Driver
C001	Damage Prevention Strategies	PHMSA, CPUC GO-112F, California Gov Code 4216
C002	Damage Prevention Activities – Gas	49 CFR § 192, CPUC GO-112F, California Gov Code 4216
C003	Damage Prevention – Public Awareness	49 CFR § 192, CPUC GO-112F
C004	Damage Prevention Mapping	49 CFR § 192, California Gov Code 4216

ATTACHMENT B

EXCAVATION DAMAGE - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision at RDF Row 10 and Row 29 directs each utility to identify Potential Consequences of a Risk Event using available and appropriate data.[26] Appropriate data may include Company specific data or industry data supplemented by the judgment of subject matter experts. Provided below is a listing of the inputs utilized as part of this assessment and the description of the data.

Excavation damage was modelled as a driver in both the medium pressure and high pressure risk models. For data sources used to model risk see Attachment B in the High Pressure Gas System and Medium Pressure Gas System risk chapters. Risk data unique to quantification of excavation damage risk is provided below.

Risk Data	**Source Type**	**Source Information**
Excavation damages by cause	Internal Data	Source: Internal data managed by the Gas System Integrity Department. Description: Data was used to quantify benefits to controls and mitigation that address specific causes of excavation damage, such as locate and mark or mapping issues.
Excavation damages from repeat offenders	Internal Data	Source: Internal data managed by the Gas System Integrity Department. Description: Data was used to quantify damages caused by repeat offenders for benefits calculation.

[26] D.24-05-064, RDF Rows 9-11, Risk Assessment and Risk Ranking in Preparation for RAMP.

ATTACHMENT C

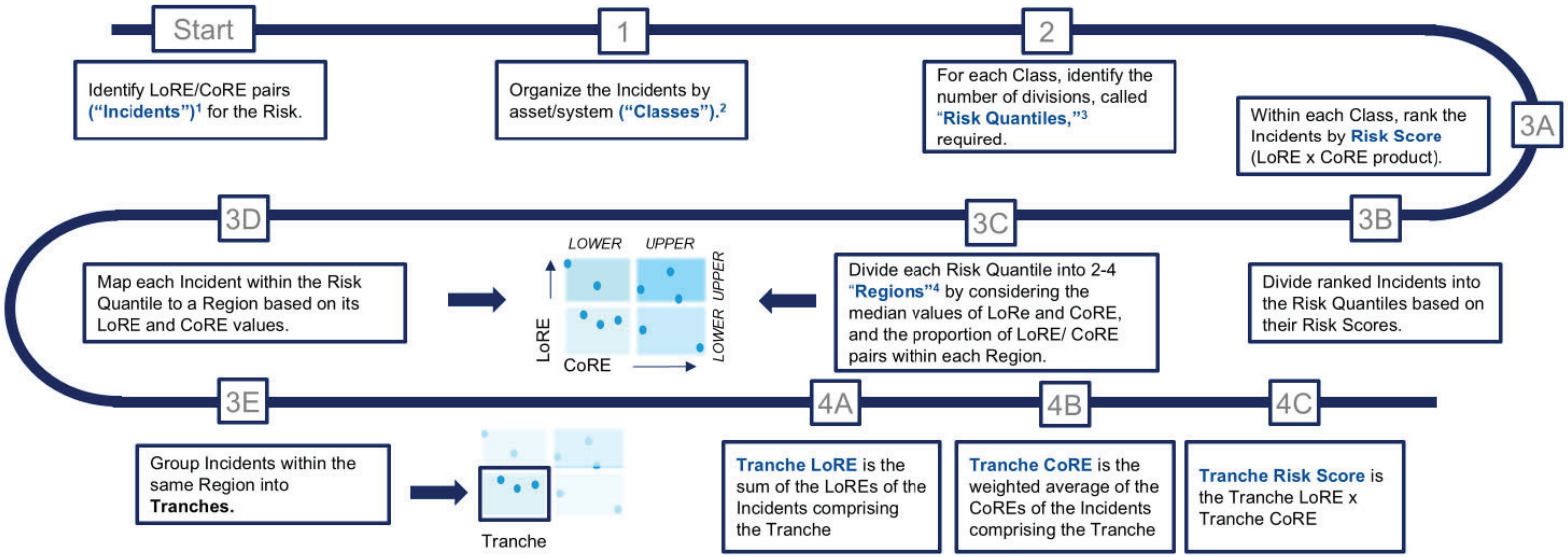
EXCAVATION DAMAGE - SUMMARY OF ELEMENTS OF BOW TIE

SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
C001	Damage Prevention Strategies	1, 3, 4	1,2,3,4,5,6
C002	Damage Prevention Activities – Gas	2	1,2,3,4,5,6
C003	Damage Prevention – Public Awareness	1, 3, 4	1,2,3,4,5,6
C004	Damage Prevention Mapping	2	1,2,3,4,5,6

ATTACHMENT D

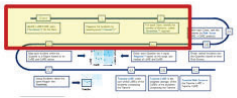
EXCAVATION DAMAGE - APPLICATION OF TRANCHING METHODOLOGY

A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP-3: Risk Quantification Framework is provided.



NOTES

[1] *For example, **Incidents (or "Risk Incidents")** for Excavation Damage these include leaks or damages cause by dig ins.*
[2] *For example, **Classes (or "Asset Classes")** for Excavation Damage these include High or Medium pressure pipe.*
[3] ***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*
[4] *The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*



Start → 1 → 2

Identify LoRE/CoRE pairs ("**Incidents**")[1] for the Risk.

Organize the Incidents by asset/system ("**Classes**").[2]

For each Class, identify the number of divisions, called "**Risk Quantiles**,"[3] required.

Class	LORE / CORE PAIRS	TOTAL # PAIRS
High Pressure	Transmission Rupture - Class 1	48
	HCA Transmission Rupture - Class 3	
	High_Pressure_Distribution Large_Leak - Zone 3	
	…and 45 more pairs	
Medium Pressure	Service: PLASTIC Non-State-of-the-Art N Business District L Population Density	91
	Main: STEEL State-of-the-Art N Business District H Population Density	
	…and 89 more pairs	

$$\min\left(\frac{N}{8}-1,9\right) < K \leq \min\left(\frac{N}{8},10\right)$$ → **6**

10

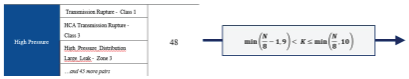
Step 3 for *High Pressure*



Within each Class, rank the Incidents by **Risk Score** (LoRE x CoRE product). 3A

3B

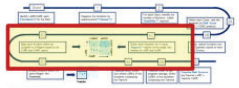
Divide ranked Incidents into the Risk Quantiles based on their Risk Scores.



From Step 2 for *High Pressure*

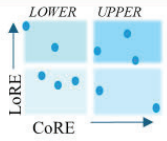
3A 3B

Incident (LoRE/CoRE) Pair	Risk Score	Rank	Quantile
HCA Transmission Rupture - Class 3	1,439,367.14	1	#1
HCA Transmission Large_Leak - Class 3	383,149.72	2	
HCA Transmission Rupture - Class 4	374,565.09	3	
Transmission Rupture - Class 2	292,214.96	4	
Transmission Large_Leak - Class 2	228,971.45	5	
Transmission Rupture - Class 1	188,418.18	6	
Transmission Large_Leak - Class 1	147,716.67	7	
High_Pressure_Distribution Rupture - Zone 3	64,774.66	8	
High_Pressure_Distribution Rupture - Zone 4	43,046.06	9	
MCA Transmission Large_Leak - Class 1	27,422.18	10	
MCA Transmission Rupture - Class 1	34,504.56	11	#2
MCA Transmission Large_Leak - Class 2	22,287.86	12	
MCA Transmission Rupture - Class 2	28,540.07	13	
HCA Transmission Large_Leak - Class 4	32,432.86	14	
High_Pressure_Distribution Large_Leak - Zone 3	27,533.98	15	
High_Pressure_Distribution Small_Leak - Zone 3	31,832.58	16	
...	...	17-48	...



3C

Divide each Risk Quantile into 2-4 "**Regions**"[4] by considering the median values of LoRe and CoRE, and the proportion of LoRE/ CoRE pairs within each Region.

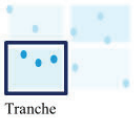


3D

Map each Incident within the Quantile to a Region based on its LoRE and CoRE values.

3E

Group Incidents within the same Region into **Tranches**.



		3A	3B	3C	3D
Incident (LoRE/CoRE) Pair	Risk Score	Rank	Quantile	Region	Tranche
HCA Transmission Rupture - Class 3	1,439,367.14	1	#1	LL/UC	HP-1-1
HCA Transmission Large_Leak - Class 3	383,149.72	2		UL/LC	HP-1-2
HCA Transmission Rupture - Class 4	374,565.09	3		LL/UC	HP-1-1
Transmission Rupture - Class 2	292,214.96	4		LL/UC	HP-1-1
Transmission Large_Leak - Class 2	228,971.45	5		UL/LC	HP-1-2
Transmission Rupture - Class 1	188,418.18	6		LL/UC	HP-1-1
Transmission Large_Leak - Class 1	147,716.67	7		UL/LC	HP-1-2
High_Pressure_Distribution Rupture - Zone 3	64,774.66	8		UL/LC	HP-1-2
High_Pressure_Distribution Rupture - Zone 4	43,046.06	9		LL/UC	HP-2-3
MCA Transmission Large_Leak - Class 1	27,422.18	10		LL/UC	HP-2-3
MCA Transmission Rupture - Class 1	34,504.56	11	#2	LL/UC	HP-2-3
MCA Transmission Large_Leak - Class 2	22,287.86	12		LL/UC	HP-2-3
MCA Transmission Rupture - Class 2	28,540.07	13		LL/UC	HP-2-3
HCA Transmission Large_Leak - Class 4	32,432.86	14		LL/UC	HP-2-3
High_Pressure_Distribution Large_Leak - Zone 3	27,533.98	15		UL/LC	HP-2-4
High_Pressure_Distribution Small_Leak - Zone 3	31,832.58	16		UL/LC	HP-2-4
…	…	17-48		…	



4A

Tranche LoRE is the sum of the LoREs of the Incidents comprising the Tranche

4B

Tranche CoRE is the weighted average of the CoREs of the Incidents comprising the Tranche

4C

Tranche Risk Score is the Tranche LoRE x Tranche CoRE

Incident (LoRE/CoRE) Pair	Tranche	4A Tranche LoRE	4B Tranche CoRE	4C Tranche Risk Score
HCA Transmission Rupture - Class 3	HP-1-1	0.005	509,413,537	$2,294,565
HCA Transmission Rupture - Class 4	HP-1-1			
Transmission Rupture - Class 2	HP-1-1			
Transmission Rupture - Class 1	HP-1-1			
HCA Transmission Large_Leak - Class 3	HP-1-2	0.007	126,185,292	$824,612
Transmission Large_Leak - Class 2	HP-1-2			
Transmission Large_Leak - Class 1	HP-1-2			
High_Pressure_Distribution Rupture - Zone 3	HP-1-2			
High_Pressure_Distribution Rupture - Zone 4	HP-2-3	0.001	228,296,464	188,233
MCA Transmission Large_Leak - Class 1	HP-2-3			
MCA Transmission Rupture - Class 1	HP-2-3			
MCA Transmission Large_Leak - Class 2	HP-2-3			
MCA Transmission Rupture - Class 2	HP-2-3			
HCA Transmission Large_Leak - Class 4	HP-2-3			
High_Pressure_Distribution Large_Leak - Zone 3	HP-2-4	0.170	349,290	$59,367
High_Pressure_Distribution Small_Leak - Zone 3	HP-2-4			



2025 Risk Assessment Mitigation Phase

(Chapter SDG&E-Risk-2)

High Pressure Gas System

May 15, 2025

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I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or Company) risk control and mitigation plan for the High Pressure Gas System risk (HP System Risk). This chapter contains information and analysis for this risk that meet the requirements of the California Public Utilities Commission's (Commission or CPUC) Risk-Based Decision-Making Framework (RDF),[1] including the requirements adopted in Decision (D.) 22-12-027 (Phase 2 Decision) and D.24-05-064 (Phase 3 Decision). HP System Risk is included in the 2025 RAMP Report based on a safety risk assessment, further informed by its reliability and financial consequence attributes, consistent with RDF guidance. This risk chapter describes the basis for selection of HP System Risk, the controls and/or mitigations put forth to reduce the likelihood or consequence of this risk, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter presents cost and unit forecasts for the risk-mitigating activities, but it does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk-reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation consistent with the method and process prescribed in the RDF.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SDG&E's HP System Risk is defined as the risk of failure of a high-pressure pipeline[2] (including non-line pipe, appurtenances, and facilities) that results in serious injuries, fatalities, and/or damages to the infrastructure. As discussed further below, the failure event would be a result of one or more of the risk's eleven Drivers/Triggers depicted in its Bow Tie analysis, which include eight threat categories identified by the United

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[1] As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A.15-05-002 et al. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

[2] Maximum Allowable Operating Pressure (MAOP) at higher than 60 psig. Hereinafter references in this chapter to "pipelines," "transmission," and "distribution" refer to high-pressure unless otherwise noted.

States Department of Transportation (DOT) Pipeline and Hazardous Materials and Safety Administration (PHMSA). Medium pressure assets operating at a pressure of 60 psig or less are included in the Medium Pressure Gas System Risk chapter (SDG&E-Risk-3). Events caused by third-party dig-in damage are included in the Excavation Damage Risk chapter (SDG&E-Risk-1).

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF requirements, such as those from the CPUC's General Order (GO) 112-F and PHMSA, including but not limited to, subparts of Rule 49 Code of Federal Regulation (CFR). A list of compliance requirements applicable to high pressure gas system is provided in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction calculated under the RDF, such as addressing catastrophic (*i.e.*, tail) risk, targeting high risk assets, enhancement of operations, and/or preparing for future capacity needs (such as driven by electrification or climate impacts).

2. Risk Overview

The SDG&E natural gas transmission[3] and distribution[4] system spans from the California-Mexico border to the Pacific Ocean and to the Southern California Gas Company (SoCalGas) territory border. In total, SDG&E operates nearly 550 miles of high-pressure pipelines in its service territory, which includes 219 miles of transmission-defined pipelines.

Title 49 Part 192 of PHMSA's CFR and American Society of Mechanical Engineers (ASME) pipeline integrity standard B31.8S, "Managing System Integrity of Gas Pipelines," categorizes types of threats that could lead to a high-pressure pipeline incident. Eight of those threat types are discussed in this Chapter:

1) External Corrosion
2) Internal Corrosion
3) Stress Corrosion Cracking
4) Manufacturing Defect
5) Construction & Fabrication
6) Outside Forces

[3] As defined in 49 C.F.R. § 192.3 (2024).

[4] *Id.*

7) Incorrect Operation

8) Equipment Threat

These threat types, as well as three additional threats categories identified by SDG&E, together comprise the eleven Drivers/Triggers in the Risk Bow Tie presented in Section II.B. These threat types can work independently and/or interactively together and can lead to leaks or ruptures on the pipeline system.

Leaks, which are defined by PHMSA as unintentional releases of gas and can range from non-hazardous leaks – which can usually be resolved by lubrication, adjustment, or tightening – to more severe instances where more extensive and long-term modifications (*e.g.*, welded repair bands, segment removal/replacement) to the pipe or equipment are required.

The presence of a leak alone may not necessarily represent a risk of serious injury or fatality. The risk to the public and employees can increase; however, when leaks are in close proximity to an ignition source and/or where there is a potential for gas to migrate to and accumulate in a confined space. SDG&E addresses the safety concerns of leaks through its leak indication and repair prioritization and scheduling procedures as discussed in Section III of this chapter.

Instances of a pipeline rupturing, however, are considered an elevated risk since this type of failure[5] has the potential to rapidly release a high volume of combustible energy, which could ignite, resulting in damage to the surrounding area, injury, and/or loss of life.

Whether a pipeline fails by leak versus rupture is dependent on several factors, including the stress on the pipe, the pipe material properties, and the geometry of the pipeline flaw/defect. Pipelines operating at stress levels above 20% Specified Minimum Yield Strength (SMYS), and especially above 30% SMYS, are at greater risk of rupture (sometimes referred to as a propagating fracture), as compared to pipelines operated at stress levels below 20% SMYS.[6]

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[5] As defined in ASME B31.8S.

[6] *See* B.N. Leis et al., Leak Versus Rupture Considerations for Steel Low-Stress Pipelines, Battelle Final Report GRI-00/0232 at 32 (January 2001): Given the results generated, the leak to rupture transition for corrosion defects in the low-wall-stress pipeline system can be taken as 30 percent of SMYS, a value that is conservative in comparison with in-service incidents. Thresholds for the transition from leak to rupture also were evaluated for immediate as well as delayed mechanical damage incidents with reference to full-scale test data, incident data, and mechanics and fracture analysis. Full-scale test data indicated this threshold was in excess of 30 percent of SMYS, the lowest threshold identified for rupture due to corrosion, whereas the steels represented in reportable incidents

B. Risk Scope

SDG&E's HP System Risk analysis considers risk events associated with failure of a high-pressure pipeline (*i.e.*, pipeline with a maximum allowable operating pressure (MAOP) greater than 60 psig), including non-line pipe, appurtenances, and facilities, which result in consequences such as injuries, fatalities, and/or damages to infrastructure.

The SDG&E HP System Risk is substantially similar to the SoCalGas HP System Risk because the threats are the same, and the SoCalGas/SDG&E high pressure transmission system is managed in an integrated manner.

C. Data Sources Used to Quantify Risk Estimates[7]

SDG&E utilized internal data sources to determine an HP System Risk Pre-Mitigation Risk Value and calculate risk reduction estimates for mitigation activities (which enables estimation of Post Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used, as appropriate, and adjusted to account for the risk characteristics associated with the Company's specific operating locations and service territory. For example, certain types of incident events have not occurred within the SoCalGas and SDG&E service territories (*i.e.*, a transmission pipeline rupture in an HCA). Expanding the quantitative data sources to include industry data where such incidents have been recorded is appropriate to establish a baseline of risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

The probability of failure component of the quantitative risk models for high pressure gas assets is primarily derived from failure rates sourced from SoCalGas, SDG&E, and broader industry data. Time-dependent phenomena such as material degradation (*e.g.*, corrosion), are accounted for using an exponential model to characterize changes in failure likelihood over time. This approach has not yet been implemented across all threat categories. Where time-dependent modeling is not yet available, the absence of explicit time-dependent modeling should not be interpreted as indicating these assets are unaffected by time-dependent trends.

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possess toughness [sic] indicated a threshold on order of 25 percent of SMYS.

[7] Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of the HP System Risk, including a risk Bow Tie, which delineates potential Drivers/Triggers and potential Consequences, followed by a description of the Tranches determined for this risk.

A. Risk Selection

HP System Risk was included as a risk in SDG&E's 2021 RAMP and was included in the 2022, 2023, and 2024 Enterprise Risk Registries (ERR).[8] SDG&E's ERR evaluation and selection process is summarized in Chapter RAMP-2, Enterprise Risk Management Framework and in Chapter RAMP-3 Risk Quantification Framework.

SDG&E selected this risk in accordance with the RDF Row 9.[9] Specifically, SDG&E assessed the top risks from the Company's 2024 ERR based on the Consequence of a Risk Event (CoRE) Safety attribute. The HP System Risk was among the risks presented in SDG&E's list of Preliminary 2025 RAMP Risks on December 17, 2024 at a Pre-Filing Workshop. HP System Risk was selected based on the qualification of its Safety risk attribute, as required under the RDF. At the pre-filing workshop, no party expressed opposition to the inclusion of this risk in SDG&E's 2025 RAMP Report.

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the risk Bow Tie, possible Drivers, potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that address them.[10] As illustrated in the risk Bow Tie shown below in Figure 1, the risk event (center of the Bow Tie) is an HP System Risk that leads to failure of an high pressure asset, the left side of the Bow Tie illustrates Drivers/Triggers that could lead to the HP System Risk that may cause a HP System Risk event asset failure, and the right side shows the Potential Consequences of the HP System Risk event. SDG&E applies this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to

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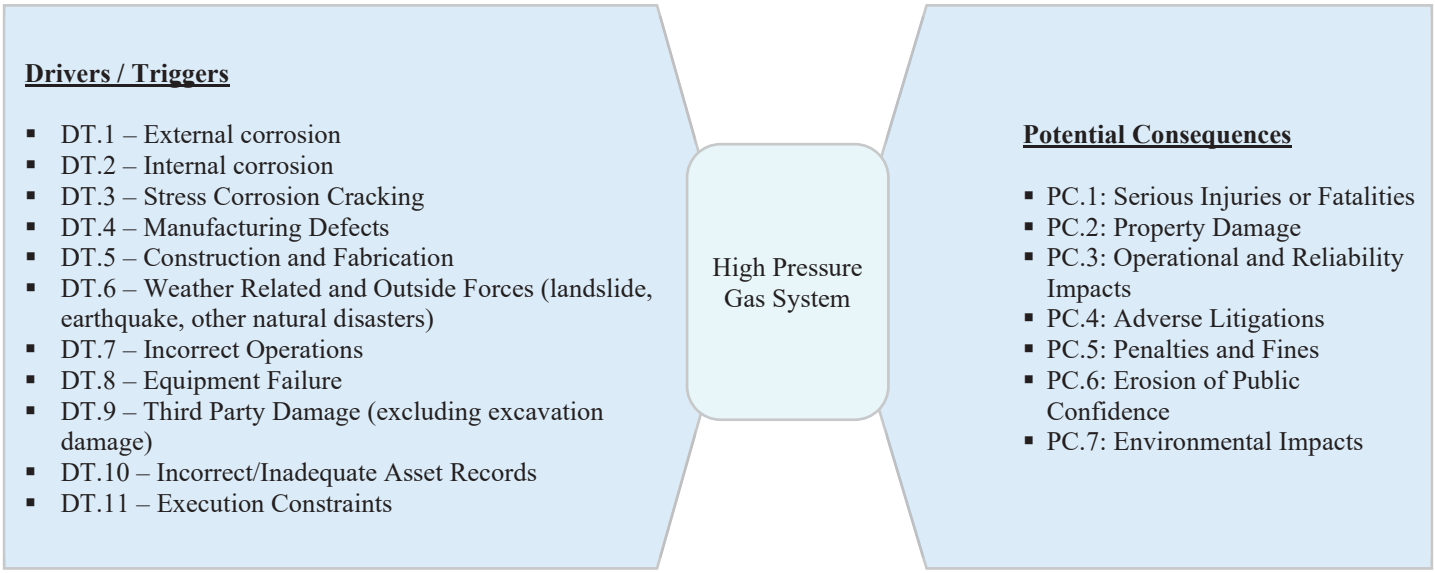
8 In the 2021 RAMP Report this risk was called Incident Related to the High Pressure System. For 2025, the following was added to the risk definition, to further define high-pressure pipeline: "(including non-line pipe, appurtenances, and facilities) that…"

9 D.24-05-064, RDF Row 9 states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars".

10 D.24-05-064, RDF Row 15.

the addressed elements of the risk Bow Tie is provided in Attachment C.

Figure 1
High Pressure Gas System: Risk Bow Tie



C. Potential Risk Event Drivers/Triggers[11]

When performing a risk assessment for the HP System Risk, SDG&E identifies potential leading causes, referred to as Drivers or Triggers, that reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to the asset.[12] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1 – External corrosion:** A naturally occurring phenomenon commonly defined as the deterioration of a material (usually a metal) that results from a chemical or electrochemical reaction with its environment.[13] This risk driver is based on the potential for corrosion on the external surface of assets, such as steel tubing, casing, and pipelines exposed to corrosive environments.
- **DT.2 – Internal corrosion:** Deterioration of the interior of a pipeline attributable

[11] An indication that a risk could occur. It does not reflect actual or threatened conditions.

[12] D.24-05-064, RDF Rows 10-11.

[13] *See* ASME B31.8S.

to environmental conditions inside the asset.[14]

- **DT.3 – Stress Corrosion Cracking:** A type of environmentally assisted cracking usually resulting from the formation of cracks due to various factors in combination with the environment surrounding the pipe that together reduce the pressure-carrying capability of the pipe.[15]
- **DT.4 – Manufacturing Defects:** This risk driver is based on the potential for failure due to defects introduced during the manufacturing process. It is attributable to material defects within the pipe, component, or joint due to faulty manufacturing procedures, design defects, or in-service stresses such as vibration, fatigue, and environmental cracking.
- **DT.5 – Construction and Fabrication:** This risk driver is attributable to the construction methodology applied during the installation of pipeline components typically based on the vintage of the construction standards, fabrication techniques (welding, bending, etc.), and overall guiding regulations.
- **DT.6 – Weather Related and Outside Forces (landslide, earthquake, other natural disasters):** This risk driver is attributable to causes not involving humans, and includes the effects of climate change. This driver includes events such as earth movement, earthquakes, landslides, subsidence, heavy rains/floods, lightning, temperature, thermal stress, frozen components, and high winds.
- **DT.7 – Incorrect Operations:** This risk driver may include a pipeline incident attributed to insufficient or incorrect operating procedures or the failure to follow a procedure.
- **DT.8 – Equipment Failure:** This risk driver is attributable to malfunction of a component, including but not limited to, regulators, valves, meters, flanges, gaskets, collars, and couples.
- **DT.9 – Third-Party Damage (excluding excavation damage):**[16] This risk driver is attributable to outside force damage other than excavation damage or natural

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[14] *Id.*

[15] *Id.*

[16] Excavation damage is addressed in a separate risk chapter.

forces, such as damage by car, truck, or motorized equipment not engaged in excavation.

- **DT.10 – Incorrect/Inadequate Asset Records:** This risk driver is attributable to the use of inaccurate or incomplete information that could result in the failure to: (1) construct, operate, or maintain SDG&E's pipeline system safely and prudently; or (2) to satisfy regulatory compliance requirements.
- **DT.11 – Execution Constraints:** This risk driver refers to events (excluding those covered by outside force damages) that impact the Company's ability to perform as planned. Examples include, but are not limited to, reduced availability of materials or operational oversight, delays in response and awareness, resource constraints, and/or inefficiencies and reallocation of (human and material) resources, unexpected maintenance, or regulatory requirements.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed on the right side of the risk Bow Tie. SDG&E identifies the Potential Consequences of this Risk by analyzing internal data sources where available, industry data, and subject matter expertise (SME).[17] These Bow Tie Consequences inform the CoRE component of the risk value. If one or more of the Drivers listed above were to result in an incident, the Potential Consequences, in a plausible worst-case scenario, could include:

- **PC.1: Serious Injuries or Fatalities**
- **PC.2: Property Damage**
- **PC.3: Operational and Reliability Impacts**
- **PC.4: Adverse Litigation**
- **PC.5: Penalties and Fines**
- **PC.6: Erosion of Public Confidence**
- **PC.7: Environmental Impacts**

These potential consequences were used by SDG&E to assess HP System Risk during the development of its 2024 ERR.

[17] D.24-05-064, Row 10.

E. Evolution Of Risk Drivers and Consequences

As specified in the Phase 3 Decision,[18] the following changes to the previous ERR and/or the 2021 RAMP include:

- The title of *High Pressure Gas System* was changed from *Incident Related to the High Pressure System (Excluding Dig-In)* to align with the updated terminology for 2025.

1. Changes to Drivers/Triggers of the Risk Bow Tie

- DT.6 – "Outside Forces (natural disasters, fire, earthquake)" in the 2021 RAMP was changed to "Natural Forces (natural disasters, fire, earthquake)" in the 2024 ERR, and "Weather Related and Outside Forces (landslide, earthquake, other natural disasters)" for the 2025 RAMP.
- DT.9 – "Third Party Damage (except underground damages)" in the 2021 RAMP was changed to "Third Party Damage (excluding excavation damage)."

2. Changes to Potential Consequences of the Risk Bow Tie

- PC.7 – Added "Environmental Impacts."

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and in accordance with Row 14 of the RDF, SDG&E applied the Homogeneous Tranching Methodology (HTM) as outlined in Chapter RAMP - 3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:

Table 1: High Pressure Gas System Risk Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches
HP Pipe	313	23
Facilities	3	1
TOTAL	**316**	**24**

[18] D.24-05-064, RDF Row 8.

Attachment D illustrates the derivation of the Tranches, as shown in Table 1 above, in accordance with the HTM. The classes were identified by SDG&E subject matter experts as logical groups of assets and systems based on the Company's operations. These classes also align risk treatments with asset risk profiles reflective of SDG&E's operations. More detailed Tranche information, including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches is provided in workpapers.

III. PRE-MITIGATION RISK VALUE

In accordance with RDF Row 19, the table below provides the pre-mitigation risk values for the HP System Risk. Further details, including pre-mitigation risk values by Tranche are provided in workpapers. Explanations of the risk quantification methodology and other higher-level assumptions are provided in Chapter RAMP-3 Risk Quantification Framework.

Table 2: High Pressure Gas System Risk
Monetized Risk Values
(Direct, in 2024 $ millions)

LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]
	Safety	Reliability	Financial		
7.15	$1.25	$0.58	$0.29	$2.11	$15.11

A. Risk Value Methodology

SDG&E's risk modeling for the HP System Risk follows RDF guidance[19] for implementing a Cost Benefit Approach, as described below:

1. **Cost Benefit Approach Principle 1 – Attribute Hierarchy (RDF Row 2):** HP System Risk is quantified in a combined attribute hierarchy as shown in the table above, such that Safety, Reliability, and Financial are presented based on available, observable, and measurable data.
2. **Cost Benefit Approach Principle 2 – Measured Observations (RDF Row 3):** SDG&E uses observable and measurable data to estimate CoRE values for HP System Risk. SDG&E utilized a combination of internal data and external data to estimate consequences in terms of natural units, (*e.g.*, fatalities, serious injuries,

[19] D.24-05-064, Rows 2-7.

and meters out) that occur as the result of a risk event that could occur on the HP System.

3. **Cost Benefit Approach Principle 3-Comparison (RDF Row 4):** HP System Risk quantification does not include any attributes that are not directly measurable, so proxy data, as described in this RDF, is not necessary.
4. **Cost Benefit Approach Principle 4-Risk Assessment (RDF Row 5):** The data sources used for the HP System Risk, as described in the preceding paragraphs, are sufficient to model probability distributions for use in estimating risk values.
5. **Cost Benefit Approach Principle 5-Monetized Levels of Attributes (RDF Row 6:** In accordance with D.22-12-027 and D.24-05-064, RDF Row 6, SoCalGas and SDG&E used a California-adjusted Department of Transportation monetized equivalent to calculate the Safety CoRE attribute at a monetized equivalent of $16.2 million per fatality, and $4.1 million per serious injury;[20] the Gas Reliability CoRE attribute is valued at a monetized equivalent of $3,868 per gas meter outage; and the Financial CoRE attribute is valued at $1 per dollar.[21]

Further information regarding SDG&E's quantitative risk analyses, including raw data, calculations, and technical references is provided in workpapers.

6. **Cost Benefit Approach Principle 6-Adjusted Attribute Level (Row 7):**

Table 3: High Pressure Gas System Risk
Risk Scaled vs Unscaled Value by CoRE Attribute (Direct, in 2024 $ millions)

	Safety	Reliability	Financial	Total
Unscaled Risk Value	$1.2	$0.46	$1.92	$3.58
Scaled Risk Value	$8.94	$4.12	$2.05	$15.11

The values in the table above are the result of SDG&E applying the risk scaling methodology described in Chapter RAMP-3 to the CoRE attributes for HP System Risk. Like all SDG&E RAMP risks, a convex risk-averse scaling function is applied to the monetized levels of each CoRE attribute for high potential events, resulting in risk-adjusted attribute levels. The

[20] *See* D.22-12-027 at 35 ("We adopt Staff's recommendation to require a dollar valuation of the Safety Attribute in the Cost Benefit Approach in the RDF using the DOT VSL as the standard value.").

[21] *See* Chapter RAMP-3: Risk Quantification Framework, Section II.

societal risk-averse scaled values reflect a wide range of possible outcomes, including multiple fatalities and serious injuries from a single event, such as a rupture with ignition in HCAs, such as Class 3 or 4 locations. Consequently, the risk adjustment is more significant than compared to medium pressure pipes, where the range of possible outcomes from one event is narrower.

Further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply, is provided in Chapter-RAMP-3.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section identifies and describes the controls and mitigations comprising the portfolio of mitigations for HP System Risk and reflects any changes to the portfolio expected to occur from the last year of recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). For clarity, a current activity that is included in the plan may be referred to as either a control and/or a mitigation. Table 4 below shows which control activities are in place in 2024, which are expected to be ongoing, completed, or new during the 2025-2031 time periods. Because the TY 2024 GRC proceeding established rates through 2027,[22] information through 2027 is calculated as part of the baseline risk, in accordance with D.21-11-009.[23] For the TY 2028 GRC, SDG&E calculated CBRs beginning with TY 2028 and for each Post-Test Year (2029, 2030, and 2031).[24]

Since the high-pressure pipeline system is managed by two operating departments (Gas Transmission and Gas Distribution), it is difficult to identify costs solely dedicated to high-pressure pipelines managed by Gas Distribution Operations. Therefore, the costs in this risk Chapter are primarily related to the Gas Transmission Operations department, and activities and costs for high pressure pipelines managed by the Gas Distribution Operations department are included in the Medium Pressure Gas System Risk chapter.

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22 *See* D.24-12-074.

23 *See,* D.21-11-009 at 136 (Conclusion of Law (COL) 7) (providing a definition for "baselines" and "baseline risk").

24 In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

Table 4: High Pressure Gas System Risk
2024-2031 Control and Mitigation Plan Summary

ID[25]	Control/Mitigation Description	2024 Control	2025-2031 Plan
C010	Pipeline Monitoring Technologies	X	Ongoing
C013	Gas Transmission Safety Rule – MAOP Reconfirmation	X	Ongoing
C104	Cathodic Protection – Capital	X	Ongoing
C108	Cathodic Protection – Maintenance	X	Ongoing
C113	Leak Repair	X	Ongoing
C118	Rupture Mitigation Valve Installation – Valve Rule	X	Ongoing
C125	Pipeline Relocation/Replacement	X	Ongoing
C126	Shallow/Exposed Pipe Remediations	X	Ongoing
C132	Pipeline Maintenance	X	Ongoing
C136	Compressor Stations – Capital	X	Ongoing
C142	Compressor Station – Maintenance	X	Ongoing
C151	Measurement & Regulation Station – Capital	X	Ongoing
C155	Measurement & Instrumentation – Maintenance	X	Ongoing
C171	Integrity Assessments & Remediations: Transmission Integrity Management Program (TIMP)	X	Ongoing

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place"[26] (*i.e.*, the activities in this section were in place as of December 31, 2024). Controls that will continue as part of the risk mitigation plan are identified in Table 4 above.

- **C010 – Pipeline Monitoring Technologies:** The Control Center Modernization (CCM) organization has begun deploying new field pipeline monitoring technologies along existing high-consequence and evacuation-challenged areas and new and replaced transmission pipelines. These field monitoring assets (*i.e.*,

[25] The order of Control Programs is based on logical groupings of similar controls rather than numerical.

[26] D.18-12-014 at 33.

fiber optics, methane sensors) allow Gas Control to better monitor pipelines to more quickly identify and respond to abnormal operating or emergency conditions resulting from risk drivers. These new field pipeline technologies provide multiple safety and reliability benefits, including, but not limited to:

- Faster response times to incidents and the reduction of severity of incidents due to the ability to monitor and respond to unfolding incidents in real-time.
- Centralized and modernized technology, increasing operational efficiency and improving the speed and ability to manage incidents, enhancing public, infrastructure, and employee safety.

- **C013 – Gas Transmission Safety Rule – MAOP Reconfirmation:** Pursuant to 49 CFR section 192.624(a), which was initially published in October 2019 as part of PHMSA's Pipeline Safety: Safety of Gas Transmission Pipelines: MAOP Reconfirmation, Expansion of Assessment Requirements, and Other Related Amendments Final Rule (GTSR Part 1), SDG&E is required to reconfirm, by July 2035, the Maximum Allowable Operating Pressure (MAOP) of transmission lines that meet the applicability requirements of 49 CFR section 192.624(a). Separate from the State-mandated Pipeline Safety Enhancement Plan (PSEP), which has also been leveraged to comply with 49 CFR § 192.624, SDG&E has identified approximately 22 miles out of 219 miles of SDG&E's transmission pipelines that currently fall within the scope of MAOP Reconfirmation. For these pipelines, reconfirmation must be performed using one of six prescribed methods: pressure testing, replacement, pressure reduction, engineering critical assessment (ECA), pressure reduction for lines with a small Potential Impact Radius (PIR), and/or an alternative technology approved by PHMSA.

  The MAOP reconfirmation program, which is incorporated in SDG&E's Integrated Safety Enhancement Plan,[27] reduces the risk of failure on the high

[27] As presented by SDG&E in its TY 2024 GRC application, the Integrated Safety Enhancement Plan combines federal requirements (49 C.F.R. § 192.624 (2020)) and state requirements (D.19.09-051 at 779-780 (Ordering Paragraph (OP) 15)) for the development of traceable, verifiable, and complete pressure test records where applicable.

pressure gas system through the re-evaluation of a pipeline's MAOP and, when necessary, repair/remediation of each pipeline that is within the scope of the program. SDG&E has begun this work and plans to continue it beyond 2031 until pipelines subject to this requirement have been reconfirmed in accordance with the deadlines established by PHMSA in 49 CFR section 192.624(b). With ongoing work on pipelines that may result in changes to records, SDG&E continues to review and refine the total miles of pipe that require MAOP reconfirmation.

This control also includes a variety of activities related to supporting the MAOP reconfirmation program and other emergent activities resulting from new federal safety regulations (*e.g.*, data analysis and management, reporting, planning, process development, and quality assurance). Because this program includes a variety of activities to comply with GTSR Part 1, a single unit of measure was not identified to reflect the breadth of work. SDG&E monitors and evaluates federal regulatory and industry activity to identify and, where applicable, adopt best practices and compliance measures to enhance the safety of its pipeline system.

- **C104 – Cathodic Protection – Capital:** Cathodic protection (CP) activities consist of the planning, installation, construction, and closeout of rectifiers/deep well anode beds, remote power, and pipeline coating replacements on transmission pipelines. Corrosion on pipelines increases the risk of leaks and may reduce the useful life of the pipelines. In addition to applying coating and electrical isolation, CP is a method for mitigating external corrosion on steel pipelines. CP combats corrosion by imposing an electric current flow toward the surface of the pipeline, which means keeping the pipeline negatively charged (cathodic) with respect to the surrounding soil. This results in reduced corrosion on the pipeline system. Rectifiers/deep well anode beds drive the electrochemical reaction required for cathodic protection via an impressed current system along SDG&E pipelines. The utilization of remote power allows SDG&E the flexibility to install impressed current systems without having to find a power supply and instead focus on the most effective placement for an impressed current system.

Pipeline coating replacements allow SDG&E to replace the pipeline's first line of defense against corrosion-related defects and reduce the amount of CP current needed to protect the newly recoated portion of the pipeline. These activities are necessary to maintain or improve the pipeline CP system, extend the life of pipeline assets, and maintain compliance with 49 CFR section 192.463. The variety of work activities in this category makes it infeasible to identify a single unit of measurement.

- **C108 – Cathodic Protection – Maintenance:** Cathodic protection maintenance activities consist of annual electrical test station (ETS) reads, bi-monthly current source inspections, and annual rectifier maintenance on transmission pipelines. These activities involve the following: read/record voltage and verify compliance, inspect ETS for signs of damage, verifying ID tags and test leads for correct information and good condition, verify rectifier proper operation, read/record voltage and amperage across rectifier, clean and tighten current carrying connections on rectifier, clean ventilating screens on rectifier units, calibrate voltage and amperage meters on rectifier, repair damaged wires, check fuses/circuit breakers, clean off rectifier unit, replace rectifier ID tags, diagnose and troubleshoot substandard conditions or out of tolerance reads. These activities are necessary to maintain or improve the pipeline CP system, extend the life of the pipeline, and maintain CP compliance prescribed by 49 CFR Part 192 Subpart I – Requirements for Corrosion Control. The variety of work activities in this category makes it infeasible to identify a single unit of measurement.
- **C113 – Leak Repair:** Leak repair activities consist of the planning, installation, construction, and closeout of projects initiated due to leaks on transmission pipelines or appurtenances. Classification of leaks is based on the relative degree of hazard and must be remediated in accordance with the timelines set out by General Order 112 F. Leak repair activities are necessary to support public safety system reliability, as well as meet regulatory requirements prescribed by 49 CFR section 192.717. The variety of work activities in this category makes it infeasible to identify a single unit of measurement, as the scope of work is project-specific and varies significantly from project to project.

- **C118 – Rupture Mitigation Valve Installation – Valve Rule:** On April 8, 2022, PHMSA amended 49 CFR Parts 192 and 195 through the publication of the Pipeline Safety: Requirement of Valve Installation and Minimum Rupture Detection Standards Final Rule (Valve Rule), which became effective on October 5, 2022. The rule requires operators to install rupture mitigation valves (RMVs) on newly constructed or "entirely replaced"[28] transmission pipeline segments with six inches or greater diameters and perform risk analyses annually to identify RMV installation opportunities.

  This control captures valve installations planned in compliance with the Valve Rule. The activities of this control mitigate the risk of pipeline ruptures and enable a faster response time should a failure occur due to natural forces (*e.g.*, natural disasters, fires, earthquakes, landslides), third-party damage, vandalism, or other causes. SDG&E completed its first annual risk analysis in 2023 to identify areas where RMV installations are appropriate, and the forecast of activities is an initial estimate based on this analysis.
- **C125 – Pipeline Relocation/Replacement:** Pipeline relocation and replacement activities consist of planning, installation, construction, and closeout of pipeline reroutes triggered by weather-related external forces, municipality requests, right-of-way agreements, or class location changes. Pipeline replacements due to changes in operating class are time-sensitive and must be completed within 24 months of the class location change.[29] These relocation and replacement activities are necessary to reduce the potential for pipeline damage, support public safety, and maintain pipeline access. The variety of work activities in this category makes it infeasible to identify a single unit of measurement, as project costs and scopes in this category vary significantly from project to project.
- **C126 – Shallow/Exposed Pipe Remediations:** Shallow or exposed pipe

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[28] 49 CFR § 192.3 provides that "Entirely replaced onshore transmission pipeline segments means, for the purposes of §§ 192.179 and 192.634, where 2 or more miles, in the aggregate, of onshore transmission pipeline have been replaced within any 5 contiguous miles of pipeline within any 24-month period. This definition does not apply to any gathering line."

[29] 49 CFR § 192.611(d).

activities consist of the planning, installation, construction, and closeout of projects to add additional cover or protection to Transmission pipelines. Exposed pipelines are inspected for signs of corrosion, metallurgical flaws, construction flaws, and mechanical damage. Concrete revetment mats (technology designed to help prevent shoreline erosion), installation of a drop section, and/or additional earth coverage are installed to prevent damage to exposed/shallow pipes caused by corrosion, third-party damages, erosion, or other external forces. These activities are necessary to support public safety, reduce the potential for pipeline damage, and extend the life of pipeline assets. The variety of work activities in this category makes it infeasible to identify a single unit of measurement.

- **C132 – Pipeline Maintenance:** Pipeline Maintenance activities consist of class location surveys, valve inspections, vault inspections, and bridge and span inspections on transmission pipelines. The mentioned activities involve the following: surveying lines to identify and report changes in population density, verifying ID tags for correct information and good condition, partially operating valves (*i.e.*, open/close) to confirm good working condition, inspecting and servicing actuators, lubricating valves, checking for atmospheric corrosion, testing for combustible gas, inspecting covers, ventilation systems, the structural condition of vaults, vault ladders, steps, and handrails. These activities are necessary to maintain or improve the pipeline system, extend the life of pipeline assets, and maintain compliance with 49 CFR 192 sections 192.745 and 192.749. The variety of work activities in this category makes it infeasible to identify a single unit of measurement.
- **C136 – Compressor Stations – Capital:** Compressor station activities consist of the planning, installation, construction, and closeout of compressor upgrades, pipe replacements, valve replacements, and equipment upgrades, including water, oil, and air systems at the compressor station. These upgrades are required over time due to the normal wear and tear of compressor station equipment. These activities are necessary to maintain or improve system reliability, extend equipment and system life, and support public safety. The variety of work activities in this category makes it infeasible to identify a single unit of measurement.

- **C142 – Compressor Station – Maintenance:** Compressor Station Maintenance activities consist of compressor unit inspections, primary and backup power generator inspections, fire water system and emergency system inspections, programable logic controllers (PLC) and instrumentation inspections, valve inspections, vessel inspections, tank inspections, scrubber inspections, relief valve inspections, actuator/controller and regulator inspections, and leak surveys on compressor station equipment and pipeline systems. The above-mentioned activities involve the following: complete periodic performance analysis and time-based overhauls on main compressor units and generators; function test fire water systems and emergency systems (including Station ESD and gas detection systems); maintenance and calibration of PLC systems, pressure and temperature transmitters, flow meters, pressure regulators, uninterruptible power supply systems, odorant sensing equipment and gas moisture monitoring systems; verify ID tag information and good condition; examine operating valves, inspect and service actuators, and lubricate valves; check for atmospheric corrosion; test for combustible gas; test/record set points and/or verify rupture disc rating; check supply regulators for proper operation; check for leakage; blow/inspect supply filters; check hydraulic fluid levels; check controller for proper operation; and test/record set points. These activities are necessary to maintain or improve the pipeline system, extend the life of pipeline and compressor assets, and maintain compliance with 49 CFR sections 192.731. The variety of work activities in this category makes it infeasible to identify a single unit of measurement.
- **C151 – Measurement & Regulation Station – Capital:** Measurement & Regulation Station – Capital activities consist of the planning, installation, construction, and closeout of redesigns/upgrades for producer vessels, meters, stations, Company-owned facilities at customer meter set assemblies, and control valve stations on transmission pipeline systems. These upgrades are required to replace aging equipment with new equipment to enhance functionality. The safety and reliability of SDG&E's transmission system depends on the meter and regulator equipment used to control the flow of natural gas in transmission pipelines using valves and regulator stations. These activities are necessary to

maintain or improve system reliability, extend equipment and system life, and support public safety. The variety of work activities in this category makes it infeasible to identify a single unit of measurement, as project costs and scopes vary significantly from project to project in this category.

- **C155 – Measurement & Instrumentation – Maintenance:** Measurement & Instrumentation Station activities consist of valve inspections, vault inspections, producer station inspections, pressure limiting station inspections, relief valve inspections, and actuator/controller and regulator inspections on transmission pipelines. These activities involve the following: verifying ID tags for correct information and good condition; partially operating valves to confirm good working condition; inspecting and servicing actuators; lubricating valves; checking for atmospheric corrosion; testing for combustible gas; inspecting covers, ventilation systems, structural condition of vaults, vault ladders, and test/record set points; verifying rupture disc rating; checking supply regulators for proper operation; checking for leakage; blowing/inspecting supply filters; checking hydraulic fluid levels; checking controller for proper operation; and testing/recording set points. These activities are necessary to identify or remediate any developing system deficiencies during the performed activities, to maintain or improve the pipeline system, extend the life of the pipeline, and maintain compliance with 49 CFR 192 section 192.739. The variety of work activities in this category makes it infeasible to identify a single unit of measurement.
- **C165 – Security & Auxiliary Equipment:** Security & auxiliary equipment activities include planning, installing, constructing, and closing security cameras, lighting, gates, locks, and equipment upgrades such as pipe supports, analyzers, and Supervisory Control and Data Acquisitions (SCADA) on transmission pipeline facilities. These activities harden the security at pressure limiting stations, valve stations, and compressor stations, increase personnel safety, and reduce the potential of system damage. The variety of work activities in this category makes it infeasible to identify a single unit of measurement.

- **C171 – Integrity Assessments & Remediations: Transmission Integrity Management Program (TIMP):** Through the TIMP, SDG&E continuously manages the integrity and safety of its transmission pipeline system, conducting a robust set of federally mandated activities.[30] SDG&E identifies threats to transmission pipelines in high consequence areas (HCAs), Class 3 and Class 4 locations not in HCAs, and moderate consequence areas (MCAs); determines the risk posed by these threats; schedules prescribed assessments to evaluate these threats; collects information about the condition of pipelines; and takes actions to minimize applicable threat and integrity concerns to reduce the risk of a pipeline failure.

  The TIMP Threat and Risk Assessment process includes an evaluation of the Likelihood of Failure (LOF), using threat categories such as those discussed in Section I.A. (External Corrosion, Internal Corrosion, Stress Corrosion Cracking, Manufacturing, Construction, Equipment, Third Party Damage, Incorrect Operations, and Weather Related and Outside Force), and the Consequence of Failure (COF), using pipeline operational parameters and information about the area near the pipeline. The LOF multiplied by the COF produces the pipeline's Relative Risk Score, which is then used to inform assessment scope and methods. Information about the physical condition of transmission pipelines is collected regularly through integrity assessments.

  At a minimum of every seven years for pipeline segments in HCAs and every ten years for other pipeline segments, transmission pipelines within the scope of TIMP are assessed using methods such as In-Line-Inspection (ILI), Direct Assessment, or Pressure Test, and remediated as needed. Generally, ILI is the preferred assessment method to identify potential pipeline integrity threats due to the amount of data that can be collected on the pipeline during this process. During an ILI, intelligent pipeline inspection devices are inserted into pipelines to collect pipeline condition data via sensors; such data includes but is not limited to wall thickness measurements, geographical positioning of features, as well as

[30] 49 C.F.R. Part 192, Subpart O and 49 C.F.R. § 192.710 (2023).

measurements and locations of anomalies such as dents and cracks. Assessment method selection depends on factors such as the threats that require assessment,[31] pipeline characteristics, and operational considerations.

Upon detection during pipeline assessments, anomalies are classified and addressed based on severity, with the most severe requiring immediate action. Actions are then taken to address applicable threats and integrity concerns to increase safety and prevent pipeline failures. SDG&E may remediate pipe to reduce risk where corrosion, welding joint failure, or other forces are occurring or have occurred. When appropriate, post-assessment pipeline repairs or replacements are intended to increase public and employee safety by reducing or eliminating conditions that might lead to an incident.

The number and types of TIMP activities vary year to year and are based on the timing of previous assessments performed in the same locations. The TIMP consists of both O&M and capital activities, which are primarily driven by the number of assessments completed and the results of those assessments. Capital activities consist of data application improvements and a variety of remedial actions, dependent upon the O&M assessment activities, which cannot be unitized.

The TIMP reduces the risk of failure to the transmission system, and, on a continual basis, the Integrity Management department evaluates the effectiveness of the program and scheduled assessments.

B. Changes from 2024 Controls

SDG&E plans to continue each of the existing controls discussed above, and reflected in Table 2, through the 2025-2031 period without significant changes.

C. Mitigation Programs

SDG&E does not currently foresee implementing new mitigations not described above during the 2025-2031 period beyond the mitigations described in this Chapter.

[31] 49 CFR §§ 192.921(a) & 192.937(c).

D. Climate Change Adaptation

Pursuant to Commission decisions in the Climate Adaptation OIR (R.18-04-019),[32] SDG&E performed a Climate Adaptation Vulnerability Assessment (CAVA) focused on years 2030, 2050, and 2070, with the aim of identifying asset and operational vulnerabilities to climate hazards across the SDG&E system. SDG&E recognizes the need to address climate vulnerabilities to promote the safety and reliability of its services and mitigate the increasing climate-related hazards through innovative and community-centric approaches. Some of the climate hazards that will have short- and long-term ramifications in the San Diego region include extreme temperatures, wildfire, inland flooding, coastal flooding and erosion, and landslides. Climate change is recognized as a factor that can drive, trigger, or exacerbate multiple RAMP risks. Implementing climate change adaptation measures and integrating climate vulnerability considerations into RAMP controls and mitigations can enhance system infrastructure longevity and reduce the severity of long-term negative climate impacts. The controls and mitigations described in further detail in this chapter, as shown below, align with the goal of increasing SDG&E's physical and operational resilience to the increasing frequency and intensity of climate hazards. Additional information on the CAVA and a list of climate-relevant controls and mitigations included in RAMP, are provided in Chapter RAMP-5: Climate Change Adaptation.

Table 5: High Pressure Gas System Risk
Controls and Mitigations that Align with Increasing Resilience to Climate Hazards

ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
C010	Pipeline Monitoring Technologies	Inland Flooding and Landslides
C013	Gas Transmission Safety Rule – Maximum Allowable Operating Pressure (MAOP) Reconfirmation	Inland Flooding and Landslides
C104	Cathodic Protection - Capital	Inland Flooding and Landslides
C113	Leak Repair	Inland Flooding and Landslides
C125	Pipeline Relocation/Replacement	Inland Flooding and Landslides
C126	Shallow/Exposed Pipe Remediations	Inland Flooding and Landslides
C171	Integrity Assessments & Remediation	Inland Flooding and Landslides

E. Foundational Programs

Foundational Programs are "[i]nitiatives that support or enable two or more Mitigation

[32] D.19-10-054; D.20-08-046.

programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[33]

This risk chapter does not have any foundational programs.

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for the High Pressure Gas System, including the associated costs, units, and CBRs. Additional information by Tranche is provided in workpapers. The costs shown are estimated using assumptions provided by SMEs and available data. In compliance with the Phase 3 Decision,[34] for each enterprise risk, SDG&E uses actual results and industry data and when that is not available, supplements the data with SME input. Additional details regarding the data and expertise relied upon in developing these estimates are provided in Attachment B.

Table 6: High Pressure Gas System Risk Control and Mitigation Plan –Recorded and Forecast Costs Summary (Direct, in 2024 $ thousands)

Control/Mitigation		Recorded Costs			Forecast Costs		
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C010	Pipeline Monitoring Technologies	324	0	336	4,116	1,605	1,249
C013	Gas Transmission Safety Rule - MAOP Reconfirmation	11,423	0	18	45,937	64,862	54
C104	Cathodic Protection - Capital	58	0	0	232	174	0
C108	Cathodic Protection - Maintenance	0	135	134	0	0	402
C113	Leak Repair	0	0	0	4,032	3,024	0
C118	Rupture Mitigation Valve Installation - Valve Rule	0	0	0	4,051	20,255	0
C125	Pipeline Relocation/Replacement	200	0	0	800	600	0
C126	Shallow/Exposed Pipe Remediations	2,230	0	0	8,916	6,687	0
C132	Pipeline Maintenance	0	933	933	0	0	2,799

[33] D.24-05-064, Appendix A at A-4.

[34] D.24-05-064, RDF Row 10.

Control/Mitigation		Recorded Costs			Forecast Costs		
ID	**Name**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C136	Compressor Stations - Capital	4,761	0	0	19,044	14,283	0
C142	Compressor Station - Maintenance	0	5,598	5,072	0	0	15,215
C151	Measurement & Regulation Station Capital	2,686	0	0	10,744	8,058	0
C155	Measurement & Instrumentation Maintenance	0	364	364	0	0	1,092
C171	Integrity Assessments & Remediation	31,938	31,072	29,031	73,391	57,108	118,748
Total		**53,620**	**38,102**	**35,888**	**171,263**	**176,656**	**139,559**

Table 7: High Pressure Gas System Risk
Control & Mitigation Plan – Units Summary

Control/Mitigation			Recorded Units		Estimated Units			
ID	**Name**	**Units**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C010	Pipeline Monitoring Technologies	HCA Methane Sensors	0	0	1	87	60	3
C013	Gas Transmission Safety Rule - MAOP Reconfirmation	Miles	0	0	0	5	17	0
C104	Cathodic Protection - Capital	N/A	0	0	0	0	0	0
C108	Cathodic Protection - Maintenance	N/A	0	0	0	0	0	0
C113	Leak Repair	N/A	0	0	0	0	0	0
C118	Rupture Mitigation Valve Installation - Valve Rule	Valves	0	0	0	1	5	0
C125	Pipeline Relocation/Replacement	N/A	0	0	0	0	0	0
C126	Shallow/Exposed Pipe Remediations	N/A	0	0	0	0	0	0
C132	Pipeline Maintenance	N/A	0	0	0	0	0	0
C136	Compressor Stations - Capital	N/A	0	0	0	0	0	0
C142	Compressor Station – Maintenance	N/A	0	0	0	0	0	0

Control/Mitigation			Recorded Units		Estimated Units			
ID	**Name**	**Units**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C151	Measurement & Regulation Station Capital	N/A	0	0	0	0	0	0
C155	Measurement & Instrumentation Maintenance	N/A	0	0	0	0	0	0
C171	Integrity Assessments & Remediation	Miles	0	11	8	0	0	112

In the table below, CBRs are presented in summary at the mitigation or control level for the Test Year 2028 GRC cycle. CBRs are calculated based on scaled, expected values unless otherwise noted, and are calculated for each of the three required discount rates[35] in each year of the GRC cycle and for the post-test years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in workpapers.

Table 8: High Pressure Gas System Risk
Cost Benefit Ratio Results Summary
(Direct, in 2024 $ millions)

ID	Control/Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C010	Pipeline Monitoring Technologies	2,536	1,585	1.09	0.80	0.67
C013	**Gas Transmission Safety Rule - MAOP Reconfirmation**	66,810	72	0.77	0.26	0.19

[35] *See* Chapter RAMP-3: for definitions of discount rates, as ordered in the Phase 3 Decision.

ID	Control/Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C104	**Cathodic Protection – Capital**	233	0	141.55	151.67	141.75
C108	**Cathodic Protection - Maintenance**	0	540	21.47	23.01	21.50
C113	**Leak Repair**	4,032	0	2.21	2.36	2.21
C118	**Rupture Mitigation Valve Installation - Valve Rule**	24,306	0	0.10	0.04	0.04
C125	**Pipeline Relocation/Replacement**	802	0	1.41	0.53	0.39
C126	**Shallow/Exposed Pipe Remediations**	8,920	0	0.35	0.08	0.05
C132	**Pipeline Maintenance**	0	3,733	24.34	25.93	24.35
C136	**Compressor Stations – Capital**	19,045	0	12.24	5.48	4.26
C142	**Compressor Station – Maintenance**	20,286	0	0.30	0.32	0.30
C151	**Measurement & Regulation Station Capital**	10,744	0	0.35	0.16	0.12
C155	**Measurement & Instrumentation Maintenance**	0	1,457	1.11	1.19	1.11
C171	**Integrity Assessments & Remediation**	71,018	147,782	1.33	1.25	1.12

Bold *indicates this control/mitigation includes mandated programs/activities.*

Tranche-level CBRs by year and in aggregate for each mitigation are provided in workpapers.

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025, D.16-08-018, and D.18-12-014,[36] SDG&E considered two alternatives to the risk mitigation plan for HP System Risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this plan considers changes in risk reduction, cost, reasonableness, current conditions, modifications to the plan and constraints, such as budget and resources.

Table 9: High Pressure Gas System Risk
Alternative Mitigation Plan –Forecast Costs Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Forecast Costs			
		2025-2028 Capital	PTY Capital	2025-2028 O&M	PTY O&M
A125	Pipeline Rerouting to Mitigate Landslide Impacts	14,380	10,785	0	0
A171	DIMP - High Pressure Pipeline In-Line Inspections	8,064	6,048	16,410	12,307
Total		**22,444**	**16,833**	**26,664**	**19,998**

Table 10: High Pressure Gas System Risk
Alternative Mitigation Cost Benefit Ratio Results Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A125	Pipeline Rerouting to Mitigating Landslide Impacts	3,595	0	~0.00	~0.00	~0.00
A171	DIMP – High Pressure Pipeline In-Line Inspections	2,016	6,666	0.07	0.06	0.06

A. Alternative 1: Pipeline Rerouting to Mitigate Landslide Impacts

The Pipeline Rerouting – Landslide Exposure alternative consists of identifying

[36] D.18-12-014 at 33-35.

transmission pipelines currently in areas susceptible to landslides and rerouting them to more desirable locations. In recent years, SDG&E has experienced an increase in extreme weather events throughout its service territory that have resulted in landslides that have impacted high-pressure pipelines. This alternative would mitigate the likelihood of failure associated with landslide-driven pipeline damages and support public safety and operational reliability.

Proposed work for this mitigation includes surveying, planning, construction, and closeouts of identified pipeline reroutes. At this time, SDG&E estimates approximately 41 miles of transmission pipelines are in high landslide risk areas. This proposal estimates that one mile of pipeline would be identified and replaced each year. SDG&E currently replaces pipeline segments on an as-needed basis following extreme weather events. While replacements under this rerouting program would subsume such replacements, the cost to execute this alternative is estimated to be higher, and there is uncertainty about whether all identified pipeline segments would benefit from rerouting.

Before pursuing the mitigation, a more in-depth analysis of the benefits and costs associated with this alternative is required. This work would require additional resources or redirection of existing resources.

B. Alternative 2: DIMP – High Pressure Pipeline In-Line Inspections

Through the DIMP, SDG&E is federally mandated to demonstrate an understanding of its gas distribution system; identify threats to its gas distribution system; determine the risk posed by these threats; and take actions to minimize applicable threat and integrity concerns to reduce the risk of a pipeline failure. These actions include identifying and implementing risk reduction measures, monitoring the results of these measures, and evaluating their effectiveness.

The alternative mitigation of conducting ILI assessments on high pressure distribution pipeline segments installed in more populated areas would enhance SDG&E's evaluation and management of the integrity of high-pressure pipe, which is associated with a higher consequence of failure. This activity would enable SDG&E to collect additional information about the physical condition of high-pressure pipelines that are not within the scope of TIMP regulations. SDG&E would evaluate collected data and detect conditions that are validated and addressed based on severity. Risk reduction measures would be taken to address applicable threats and integrity concerns to reduce the likelihood of failure and increase the safety of the pipeline.

SDG&E does not propose at this time to adopt this alternative as a programmatic risk reduction measure for two primary reasons. As discussed in PHMSA's 2024 report on *Integrity Assessment of Distribution Pipelines*, which was mandated by Section 122 of the "Protecting Our Infrastructure of Pipelines and Enhancing Safety Act of 2020" (PIPES Act of 2020), ILI technology is not readily available for all distribution pipe configurations.[37] A more in-depth evaluation of SDG&E's distribution pipelines and available technology is necessary to determine the actual scope of a high pressure distribution in-line inspection program. This would then require an updated evaluation of costs, risk reduction, and overall benefits. Additionally, there is not currently a set of ILI assessment policies within the industry that apply to this category of assets.

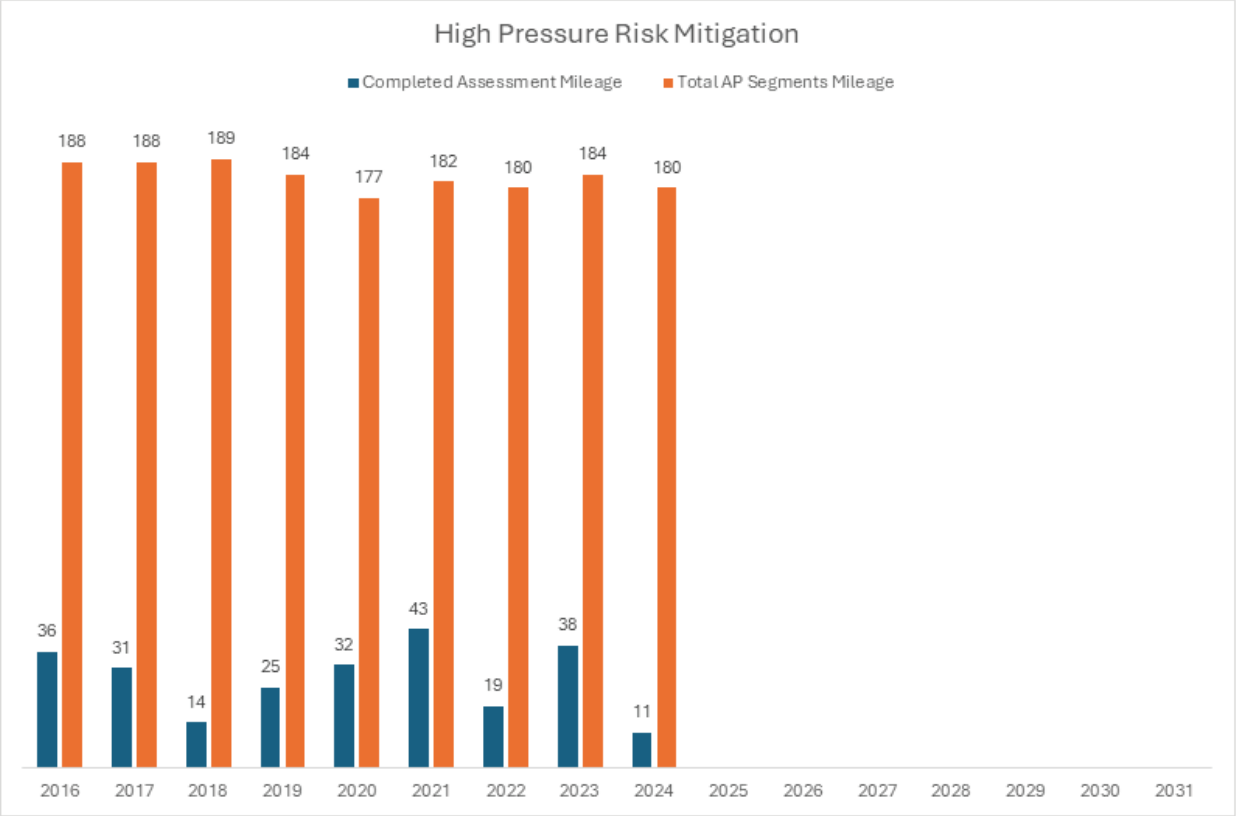
Currently, SDG&E continuously assesses risks on its distribution pipeline system through the DIMP and manages those associated with high pressure distribution pipe through activities such as pipeline repair and replacement, which are included in forecasts for C007 (Underperforming Mains and Services) in the Medium Pressure Risk chapter (SDGE-Risk-3). SoCalGas is currently conducting a pilot project to evaluate technology and inform a set of policies and practices that can be applied to a high pressure distribution ILI assessment program, which may also inform a possible program for SDG&E. Until then, SDG&E will continue to execute its current work plan to address high pressure risk.

VI. HISTORICAL GRAPHICS

As directed by the Commission in the Phase 2 Decision, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. A bar chart graphic is employed to depict historical progress. This graphic uses a TIMP metric that aligns with Company safety goals to illustrate trends in historical progress and identify remaining tasks necessary to continue mitigating risks. It presents completed assessment mileage and total assessment plan (AP) mileage.

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[37] PHMSA, *Integrity Assessments of Distribution Pipelines* (January 2024) at Section 6, *available at:* https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2024-09/Report%20to%20Congress%20-%20Integrity%20Assessments%20of%20Distribution%20Pipelines.pdf.



As described in Section III.A., the TIMP (C171 – Integrity Assessments & Remediations: Transmission Integrity Management Program) is a prescriptive program that includes continuous cycles of assessments and remediations to manage pipeline integrity. Regular evaluations are conducted at intervals no less than every seven years for HCAs and every ten years for other segments, using methods such as ILI, Direct Assessment, or Pressure Testing.

From 2016 to 2024, SDG&E successfully conducted regular pipeline assessments, improved data integration, and completed necessary remediations to enhance pipeline safety through the TIMP. In the forecast years, continuous improvements in threat and risk analyses, the expansion of assessments with advanced technologies, and evaluations and applications of preventive measures will continue to enhance the integrity and safety of the high-pressure gas pipeline system.

Due primarily to the reassessment requirements established in 49 CFR section 192.939, TIMP activity levels vary year to year based on assessment findings and pipeline safety considerations. The planning and execution of assessment projects primarily depend on the timing and intervals of prior assessments and compliance dates, as well as external factors such as applicable risks and threats. The cyclical nature of TIMP results in a somewhat stable scope

of work (*i.e.*, pipeline miles) that is not expected to decrease over time. In 2020, there was an increase to the overall miles scoped under the TIMP due to the issuance of the *Pipeline Safety: Safety of Gas Transmission Pipeline: MAOP Reconfirmation, Expansion of Assessment Requirements, and Other Related Amendments* Final Rule, which mandated integrity assessments on pipeline segments in non-HCA Class 3 and Class 4 locations, as well as the newly defined MCAs.

The safety work that remains to be done is addressed in the controls/mitigations detailed above in Section III. 2024-2031 Control and Mitigation Plan.

ATTACHMENTS

ATTACHMENT A

CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates the compliance Drivers that underpin identified controls and mitigations.

ID	Control/Mitigation Description	Compliance Driver
C013	Gas Transmission Safety Rule – MAOP Reconfirmation	49 CFR § 192.624
C104	Cathodic Protection – Capital	49 CFR 192 Subpart I
C108	Cathodic Protection – Maintenance	49 CFR 192 Subpart I
C113	Leak Repair	49 CFR 192 Subpart M
C118	Rupture Mitigation Valve Installation – Valve Rule	PHMSA "Pipeline Safety: Requirement of Valve Installation and Minimum Rupture Detection Standards" final rule (49 CFR Parts 192 and 195)
C125	Pipeline Relocation/Replacement	49 CFR 192 Subpart M
C126	Shallow/Exposed Pipe Remediations	49 CFR 192 Subpart M
C132	Pipeline Maintenance	49 CFR 192 Subpart M
C136	Compressor Stations – Capital	49 CFR 192 Subpart M
C142	Compressor Station – Maintenance	49 CFR 192 Subpart M
C151	Measurement & Regulation Station Capital	49 CFR 192 Subpart M
C155	Measurement & Instrumentation - Maintenance	49 CFR 192 Subpart M
C171	Integrity Assessments & Remediation: Transmission Integrity Management Program (TIMP)	49 CFR Part 192, Subpart O 49 CFR § 192.710

ATTACHMENT B

HIGH PRESSURE GAS SYSTEM RISK - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision RDF at Row 10 and Row 29 directs each utility to identify Potential Consequences of a Risk Event using available and appropriate data.[38] Appropriate data may include Company specific data or industry data supplemented by the judgment of subject matter experts. Provided below is a listing of the inputs utilized as part of this assessment and the description of the data.

Risk Data	Source Type	Source Information
Likelihood of failure	Internal Model results	Source: Internal TIMP, HP Distribution and FIMP models Description: A combination of internal and external PHMSA data to model likelihood of failure by outcome and cause for SoCalGas and SDG&E's high pressure pipelines and facilities
Population Density	Internal Data	Source: Results from sliding mile data along SoCalGas and SDG&E's pipelines, and census data. Links: https://data.census.gov/profile/California?g=040XX00US06 https://data.census.gov/table/ACSDT1Y2022.B11016?q=B11016:%20Household%20Type%20by%20Household%20Size Description: SoCalGas and SDG&E population density data used to determine average value and distributions for potential safety consequences per class or zone locations.
National Pipeline Incidents (2010-2024)	External Data	Agency: PHMSA Link: https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data Description: National data was used to estimate the proportion of high pressure pipeline incidents that resulted in customer outages

[38] D.24-05-064, RDF Row 10 and Row 29.

Risk Data	Source Type	Source Information
		because internal data was not available. This source was also used to model serious injuries.
Meter Outages	Internal Data	Source: SME judgment and GIS data Description SME expertise was used to determine scenarios that could result in a significant reliability impact ang GIS data was used to determine the number of meters downstream that would be impacted
National High Pressure Incident Cost data	External Data	Agency: PHMSA Link: https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-flagged-files Description: National data was used to estimate costs such as property damage in current year (2024) dollars because internal data was not available
Average cost of a fatality	External Data	Agency: National Safety Council (NSC) Link: https://injuryfacts.nsc.org/work/costs/work-injury-costs/ Description: Costs include wage losses, medical expenses, administrative expenses and employer costs, which are not included in the PHMSA costs.
Average Cost of a serious injury	External Data	Agency: CDC Link: https://wisqars.cdc.gov/cost/?y=2022&o=TAR&i=0&m=3000&g=00&s=0&u=TOTAL&u=AVG&t=COMBO&t=MED&t=LIFE&t=WORK&a=5Yr&g1=0&g2=199&a1=0&a2=199&r1=MECH&r2=INTENT&r3=NONE&r4=NONE&c1=NONE&c2=NONE Description: Wage loss and medical costs associated with non-fatal injuries that require hospitalization that are not included in PHMSA costs.

ATTACHMENT C

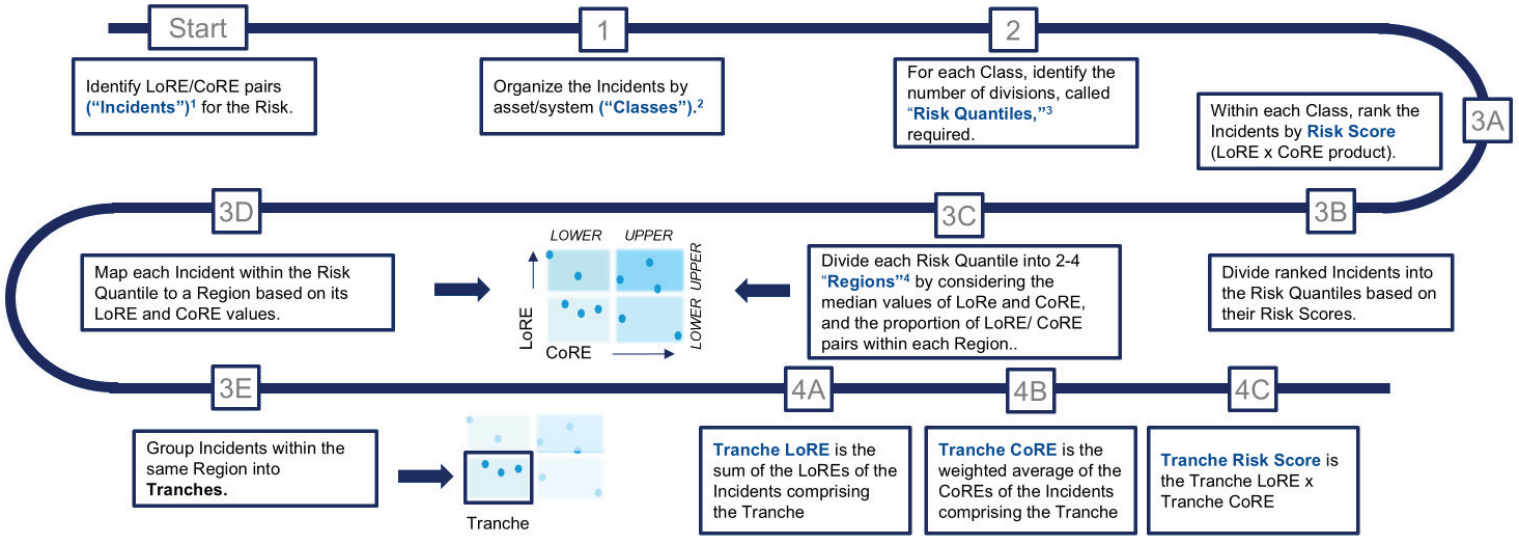
HIGH PRESSURE GAS SYSTEM RISK – SUMMARY OF ELEMENTS OF BOW TIE

SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
C010	Pipeline Monitoring Technologies	DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C013	Gas Transmission Safety Rule – MAOP Reconfirmation	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.9, D.10	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C104	Cathodic Protection - Capital	DT.1, DT.2, DT.4, DT.6, DT.8	PC.1, PC.3, PC.7
C108	Cathodic Protection – Maintenance	DT.1, DT.2, DT.4, DT.8	PC.1, PC.3, PC.7
C113	Leak Repair	DT.6, DT.9	PC.3, PC.7
C118	Rupture Mitigation Valve Installation – Valve Rule	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.9, DT.10	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C125	Pipeline Relocation/Replacement	DT.4, DT.5, DT.6, DT.9, DT.10	PC.3, PC.4, PC.5, PC.7
C126	Shallow/Exposed Pipe Remediations	DT.5, DT.6	PC.3, PC.4, PC.5, PC.7
C132	Pipeline Maintenance	DT.7, DT.8	PC.3, PC.7
C136	Compressor Stations – Capital	DT.3, DT.4, DT.5, DT.8	PC.1, PC.3, PC.5, PC.7
C142	Compressor Station – Maintenance	DT.3, DT.4, DT.5, DT.10	PC.1, PC.3, PC.5, PC.7
C151	Measurement & Regulation Station Capital	DT.4, DT.7, DT.8	PC.1, PC.3, PC.5, PC.7
C155	Measurement & Instrumentation Maintenance	DT.4, DT.7, DT.8, DT.10	PC.1, PC.3, PC.5, PC.7
C171	Integrity Assessments & Remediation	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.9, DT.10	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7

ATTACHMENT D

APPLICATION OF TRANCHING METHODOLOGY

A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP - 3: Risk Quantification Framework is provided.



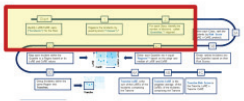
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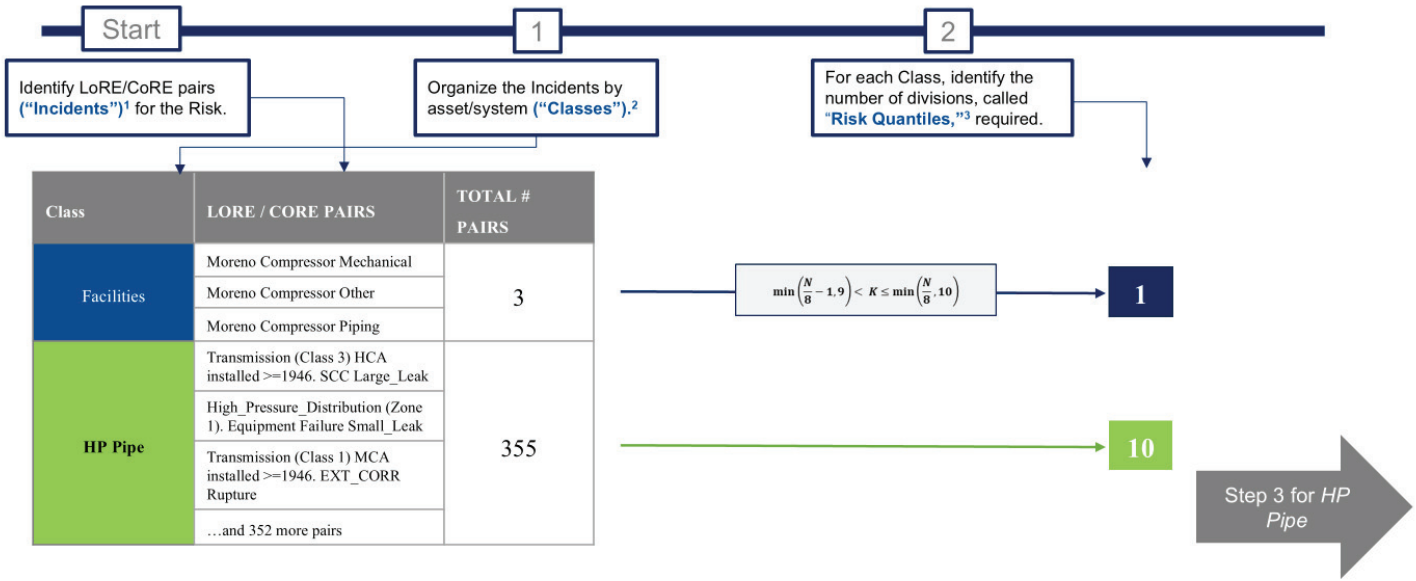
[1] *For example, **Incidents (or "Risk Incidents")** for High Pressure are generally modes of failure of High Pressure assets in various environments such as low or high population densities.*

[2] *For example, **Classes (or "Asset Classes")** for High Pressure include Facilities and High Pressure Pipe.*

[3] ***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*

[4] *The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*



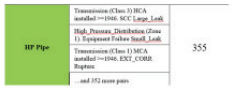

Start
1
2
Identify LoRE/CoRE pairs ("Incidents")[1] for the Risk.
Organize the Incidents by asset/system ("Classes").[2]
For each Class, identify the number of divisions, called "Risk Quantiles,"[3] required.
Class
LORE / CORE PAIRS
TOTAL # PAIRS
Facilities
Moreno Compressor Mechanical
Moreno Compressor Other
Moreno Compressor Piping
3
HP Pipe
Transmission (Class 3) HCA installed >=1946. SCC Large_Leak
High_Pressure_Distribution (Zone 1). Equipment Failure Small_Leak
Transmission (Class 1) MCA installed >=1946. EXT_CORR Rupture
…and 352 more pairs
355
$\min\left(\frac{N}{8}-1,9\right) < K \leq \min\left(\frac{N}{8},10\right)$
1
10
Step 3 for HP Pipe



Within each Class, rank the Incidents by **Risk Score** (LoRE x CoRE product). 3A

3B

Divide ranked Incidents into the Risk Quantiles based on their Risk Scores.

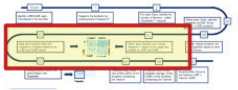


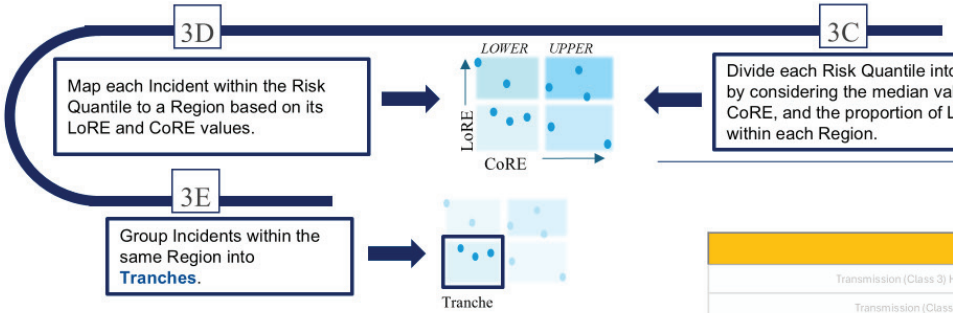
10

From Step 2 for *HP Pipe*

3A 3B

Incident (LoRE/CoRE) Pair	Risk Score	Rank	Quantile
Transmission (Class 3) HCA installed >=1946. CONS Rupture	2,229,358	1	#1
Transmission (Class 3) HCA installed >=1946. IO Rupture	1,953,059	2	
Transmission (Class 3) HCA installed >=1946. MFG Rupture	1,915,890	3	
Transmission (Class 3). Equipment Failure Small_Leak	1,461,113	4	
High_Pressure_Distribution (Zone 3) HCA installed >=1946. IO Large_Leak	778,759	5	
Transmission (Class 3) HCA installed >=1946. CONS Large_Leak	627,707	6	
Transmission (Class 3) HCA installed >=1946. EQUIP Large_Leak	532,258	7	
Transmission (Class 3) HCA installed >=1946. EQUIP Rupture	500,613	8	
Transmission (Class 3) HCA installed >=1946. WROF Rupture	450,184	9	
Transmission (Class 3) HCA installed >=1946. EXT_CORR Rupture	358,554	10	
Transmission (Class 3). Corrosion Small_Leak	317,858	11	
High_Pressure_Distribution (Zone 3). Pipe, Weld, or Joint Failure Small_Leak	255,260	12	
High_Pressure_Distribution (Zone 3) HCA installed >=1946. INT_CORR Rupture	192,526	13	
Transmission (Class 3) HCA installed >=1946. CONS Rupture	134,429	14	
Transmission (Class 4) HCA installed >=1946. SCC Rupture	116,831	15	
Transmission (Class 4). Incorrect Operations Small_Leak	110,219	16	
High_Pressure_Distribution (Zone 3) HCA installed >=1946. IO Rupture	97,345	17	
...	...	18-355	





		3A	3B	3C	3D
Incident (LoRE/CoRE) Pair	Risk Score	Rank	Quantile	Region	Tranche
Transmission (Class 3) HCA installed >=1946. CONS Rupture	2,229,358	1		UL/UC	HP Pipe-1-1
Transmission (Class 3) HCA installed >=1946. IO Rupture	1,953,059	2		UL/UC	HP Pipe-1-1
Transmission (Class 3) HCA installed >=1946. MFG Rupture	1,915,890	3		UL/UC	HP Pipe-1-1
Transmission (Class 3). Equipment Failure Small_Leak	1,461,113	4		UL/UC	HP Pipe-1-1
High_Pressure_Distribution (Zone 3) HCA installed >=1946. IO Large_Leak	778,759	5		UL/LC	HP Pipe-1-2
Transmission (Class 3) HCA installed >=1946. CONS Large_Leak	627,707	6		UL/LC	HP Pipe-1-2
Transmission (Class 3) HCA installed >=1946. EQUIP Large_Leak	532,258	7		UL/LC	HP Pipe-1-2
Transmission (Class 3) HCA installed >=1946. EQUIP Rupture	500,613	8		UL/UC	HP Pipe-1-1
Transmission (Class 3) HCA installed >=1946. WROF Rupture	450,184	9		LL/UC	HP Pipe-1-3
Transmission (Class 3) HCA installed >=1946. EXT_CORR Rupture	358,554	10	#1	LL/UC	HP Pipe-1-3
Transmission (Class 3). Corrosion Small_Leak	317,858	11		LL/UC	HP Pipe-1-3
High_Pressure_Distribution (Zone 3). Pipe, Weld, or Joint Failure Small_Leak	255,260	12		UL/LC	HP Pipe-1-2
High_Pressure_Distribution (Zone 3) HCA installed >=1946. INT_CORR Rupture	192,526	13		UL/LC	HP Pipe-1-2
Transmission (Class 3) HCA installed >=1946. CONS Rupture	134,429	14		LL/UC	HP Pipe-1-3
Transmission (Class 4) HCA installed >=1946. SCC Rupture	116,831	15		LL/UC	HP Pipe-1-3
Transmission (Class 4). Incorrect Operations Small_Leak	110,219	16		LL/UC	HP Pipe-1-3
High_Pressure_Distribution (Zone 3) HCA installed >=1946. IO Rupture	97,345	17		UL/LC	HP Pipe-1-2
...	...	18-355		...	...



4A

Tranche LoRE is the sum of the LoREs of the Incidents comprising the Tranche

4B

Tranche CoRE is the weighted average of the CoREs of the Incidents comprising the Tranche

4C

Tranche Risk Score is the Tranche LoRE x Tranche CoRE

		4A	4B	4C
Incident (LoRE/CoRE) Pair	**Tranche**	**Tranche LoRE**	**Tranche CoRE**	**Tranche Risk Score**
Transmission (Class 3) HCA installed >=1946. CONS Rupture	HP Pipe-1-1	.0054	1,496,178,140	8,110,092
Transmission (Class 3) HCA installed >=1946. IO Rupture	HP Pipe-1-1			
Transmission (Class 3) HCA installed >=1946. MFG Rupture	HP Pipe-1-1			
Transmission (Class 3) HCA installed >=1946. EQUIP Large_Leak	HP Pipe-1-1			
Transmission (Class 3) None installed None. Equipment Failure Small_Leak	HP Pipe-1-1			
High_Pressure_Distribution (Zone 3) HCA installed >=1946. IO Large_Leak	HP Pipe-1-2	6.322	448,515	2,835,702
Transmission (Class 3) HCA installed >=1946. CONS Large_Leak	HP Pipe-1-2			
Transmission (Class 3) None installed None. Corrosion Small_Leak	HP Pipe-1-2			
High_Pressure_Distribution (Zone 3) None installed None. Pipe, Weld, or Joint Failure Small_Leak	HP Pipe-1-2			
High_Pressure_Distribution (Zone 3) None installed None. Incorrect Operations Small_Leak	HP Pipe-1-2			
High_Pressure_Distribution (Zone 3) HCA installed >=1946. EQUIP Rupture	HP Pipe-1-2			
Transmission (Class 3) HCA installed >=1946. WROF Rupture	HP Pipe-1-3	.0008	2,054,397,679	1,765,645
Transmission (Class 3) HCA installed >=1946. EXT_CORR Rupture	HP Pipe-1-3			
Transmission (Class 3) HCA installed >=1946. INT_CORR Rupture	HP Pipe-1-3			
Transmission (Class 3) HCA installed >=1946. CONS Rupture	HP Pipe-1-3			
Transmission (Class 4) HCA installed >=1946. SCC Rupture	HP Pipe-1-3			
Transmission (Class 4) HCA installed >=1946. IO Rupture	HP Pipe-1-3			



2025 Risk Assessment Mitigation Phase

(Chapter SDG&E-Risk-3)

Medium Pressure Gas System

May 15, 2025

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Attachment C: Medium Pressure Gas System - Summary of Elements of Bow Tie
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I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or Company) risk control and mitigation plan for the Medium Pressure Gas System (MP System Risk). This chapter contains information and analysis for this risk that meet the requirements of the California Public Utilities Commission's (Commission or CPUC) Risk-Based Decision-Making Framework (RDF),[1] including the requirements adopted in Decision (D.) 22-12-027 (the Phase 2 Decision)[2] and D.24-05-064 (Phase 3 Decision).[3] MP System Risk is included in the 2025 RAMP Report based on a safety risk assessment, further informed by its reliability and financial consequence attributes, consistent with RDF guidance. This risk chapter describes the basis for selection of MP System Risk, the controls and/or mitigations put forth to reduce the likelihood or consequence of this risk, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter presents cost and unit forecasts for the risk mitigating activities, but it does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk-reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation consistent with the method and process prescribed in the RDF.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SDG&E's MP System Risk is defined as "the risk of failure of a medium pressure pipeline (including appurtenances to and at the meter) which results in serious injuries, fatalities, and/or damages to the infrastructure."

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1 As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A.15-05-002 et al. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

2 D.22-12-027 is the "Phase II Decision Adopting Modifications to the Risk-Based Decision-Making Framework Adopted in Decision 18-12-014 and Directing Environmental and Social Justice Pilots" (December 21, 2022).

3 D.24-05-064 is the "Phase III Decision" (June 6, 2024).

Medium pressure gas systems consist of an interconnected network of mains that feed service lines. The system includes regulator stations, meters, and other appurtenances (such as couplings, joints, risers that connect service lines to meters, and meter set assemblies). Main lines are defined by PHMSA as distribution lines that serve as a common source of supply for more than one service line.[4] Service lines are typically smaller diameter pipes which feed customer homes, businesses, some industrial, and commercial applications and end at the customer meter or at the connection to a customer's piping, whichever is further downstream, or at the connection to customer piping if there is no meter.[5] Medium pressure pipelines are made of steel or plastic material.

SDG&E currently operates approximately 15,100 miles of medium pressure mains and services with approximately 5,900 miles being steel and 9,200 miles being plastic. The medium-pressure pipelines serve over 920,000 SDG&E consumers. For safety and compliance, Title 49 of the Code of Federal Regulations (CFR) Part 192, General Order (GO) 58, and GO 112-F are the leading sources of requirements for SDG&E's gas distribution system pipelines (among other legal and regulatory provisions). Title 49 CFR Part 192 prescribes safety requirements for pipeline facilities and the transportation of gas at the federal level and is enforced by both the U.S. Department of Transportation's (DOT) Pipeline and Hazardous Material Safety Administration (PHMSA) and the CPUC. GO 112-F and GO 58 complement and enhance the requirements of 49 CFR 192 at the state level and are enforced by the CPUC.

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF reporting requirements, such as those from the CPUC's GO 112-F and PHMSA including but not limited to subparts of Rule 49 CFR. A list of compliance requirements applicable to MP System Risk in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction calculated under the RDF, such as enhancing operations and/or preparing for future capacity needs (such as driven by electrification or climate impacts).

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4 9 C.F.R. § 192.3.

5 *Id.*

B. Risk Scope

SDG&E's MP System Risk analysis considers the risk of failure of a medium pressure pipeline (including appurtenances to and at the meter) which results in serious injuries, fatalities, and/or damages to the infrastructure.

SDG&E notes that when the loss of gas cannot be resolved by lubing, tightening, or adjusting, it is defined as a "leak." A leak in and of itself may cause little-to-no risk of serious injury or fatality. Risk to the public and employees can increase when leaks are in close proximity to an ignition source and/or where there is a potential for gas to migrate and accumulate in a confined space. The safety concern of the leak is addressed by SDG&E's leak indication prioritization and repair schedule procedures. In most cases, where leaks are non-hazardous, a pipe with a leak will continue to transport natural gas and therefore is not considered a pipeline "failure" using the definition in American Society of Mechanical Engineering B31.8S.[6] However, SDG&E actively monitors and prioritizes such leaks in accordance with 49 CFR 192.723, which requires leakage surveys to be conducted at least once annually in business districts and at least once every five years outside of business districts.

C. Data Sources Used to Quantify Risk Estimates[7]

SDG&E utilized internal data sources to determine MP System Pre-Mitigation Risk Value and calculate risk reduction estimates for mitigation activities (which enables estimation of Post Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used, as appropriate and adjusted to account for the risk characteristics associated with the Company's specific operating locations and service territory. For example, certain types of incident events have not occurred within the SoCalGas and SDG&E service territories. Expanding the quantitative data sources include industry data where such incidents have been recorded is appropriate to establish a baseline of

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[6] American Society of Mechanical Engineering standard B31.8S: Managing System Integrity of Gas Pipelines. AMSE B31.8S is specifically designed to provide the operator with the information necessary to develop and implement an effective integrity management program utilizing proven industry practices and processes. Recorded costs and forecast ranges are rounded. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding.

[7] Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of MP System Risk, including a risk Bow Tie, which delineates potential Drivers/Triggers and potential Consequences, followed by a description of the Tranches determined for this risk and the risk's Pre-Mitigated Risk Value.

A. Risk Selection

The MP System Risk was included as a risk in SDG&E's 2021 RAMP and was included in the 2022, 2023 and 2024 Enterprise Risk Registries SDG&E's (ERR)[8]. SDG&E's ERR evaluation and selection process is summarized in Chapter RAMP-2: Enterprise Risk Management Framework.

SDG&E selected this risk in accordance with RDF Row 9.[9] Specifically, SDG&E assessed top risks from the Company's 2024 Enterprise Risk Registry based on the Consequence of a Risk Event (CoRE) Safety attribute. The MP System Risk was among the risks presented in SDG&E's list of Preliminary 2025 RAMP Risks at the December 17, 2024 Pre-Filing Workshop. MP System Risk was selected based on the qualification of its Safety risk attribute, as required under the RDF. At the pre-filing workshop, no party expressed opposition to inclusion of this risk in SDG&E's 2025 RAMP Report.

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the risk Bow Tie, possible Drivers, potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that addresses it.[10] As illustrated in the risk Bow Tie shown below in Figure 1, the Risk Event (center of the Bow Tie) is a MP System failure that could leads to gas release that may cause fatalities and injuries to employees and/or the public, the left side of the Bow Tie illustrates Drivers/Triggers that could lead to the MP System failure, and the right side shows the

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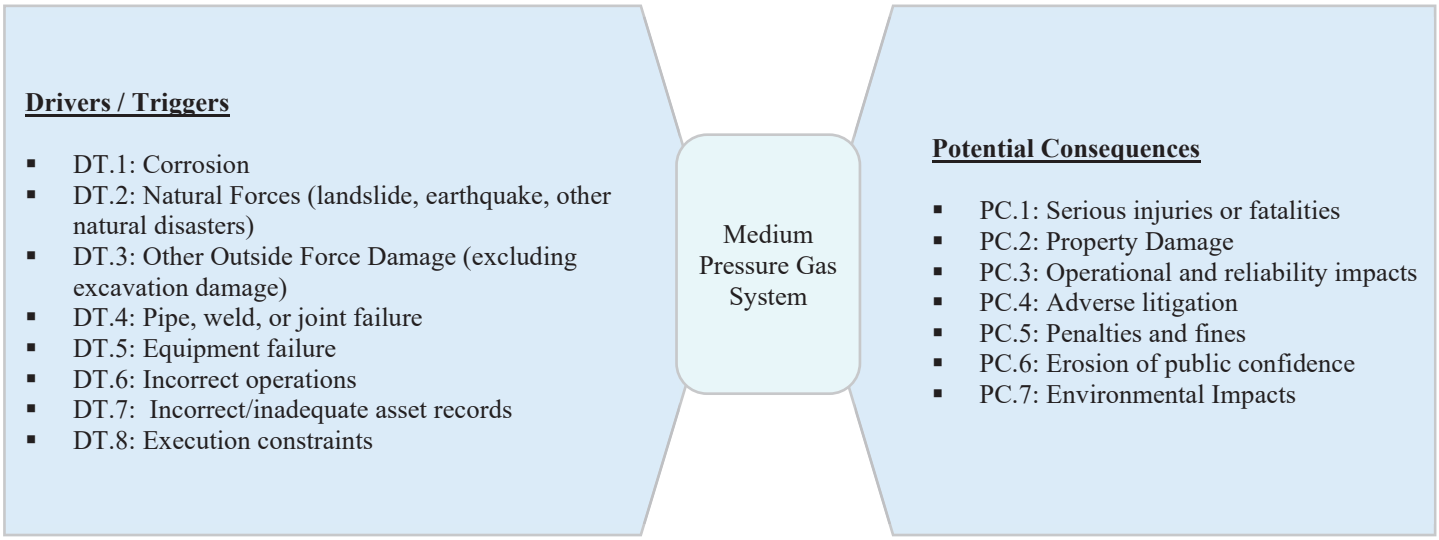
8 In the 2021 RAMP Report this risk was called Incident Related to the Medium Pressure System (Excluding Dig-In). The risk definition and elements are unchanged.

9 RDF Row 9 states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars."

10 D.24-05-064, RDF Row 15.

potential consequences of the MP System failure. SDG&E applies this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to the element(s) of the risk Bow Tie is provided in Attachment C.

Figure 1
Medium Pressure Gas System: Risk Bow Tie



C. Potential Risk Event Drivers/Triggers[11]

When performing a risk assessment for the MP System Risk, SDG&E identifies potential leading indicators, referred to as Drivers or Triggers, that reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to the asset.[12] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1 – Corrosion**: This Driver includes external corrosion, which is a naturally occurring phenomenon commonly defined as the deterioration of a material (usually a metal) that results from a chemical or electrochemical reaction with its environment. This Driver also includes internal corrosion which is the deterioration of the interior of an asset as a result of the environmental conditions

[11] An indication that a risk could occur. It does not reflect actual or threatened conditions.

[12] D.24-05-064, RDF Row 10-11.

on the inside of the pipeline.[13] In pipelines, corrosion can occur internally and/or externally, both potentially resulting in a pipeline incident; therefore, both internal and external corrosion will be referred to as "corrosion" in the remainder of this chapter, unless otherwise indicated.

- **DT.2 – Natural Forces (landslide, earthquake, other natural disasters)**: This Driver includes forces attributable to causes not involving humans, but includes effects of climate change such as earth movement, earthquakes, landslides, subsidence, heavy rains/floods, lightning, temperature, thermal stress, frozen components, wildfires, and high winds.
- **DT.3 – Other Outside Force Damage (excluding excavation damage)**: This Driver includes forces attributable to outside damage other than excavation damage or natural forces, such as damage by car, truck, or motorized equipment not engaged in excavation.
- **DT.4 – Pipe, weld, or joint failure**: This Driver includes materials defect within the pipe, component or joint due to faulty manufacturing procedures, design defects, improper construction or fabrication, or in-service stresses such as vibration, fatigue, and environmental cracking.
- **DT.5 – Equipment failure**: This Driver is similar to DT.4, but unrelated to pipe (main and services). These failures are attributable to the malfunction of a component including, but not limited to, regulators, filters, valves, meters, flanges, gaskets, collars, and couplings. This Driver is specific to the material properties related to the manufacturing process or post installation of the equipment.
- **DT.6 – Incorrect operations**: This Driver includes a pipeline incident attributed to insufficient or incorrect operating procedures or the failure to follow a procedure.
- **DT.7 – Incorrect/inadequate asset records**: This Driver includes forces attributable the use of inaccurate or incomplete information that could result in the

[13] ASME B31.8S, "Managing System Integrity of Gas Pipelines."

failure to: (1) construct, operate, and maintain SDG&E's pipeline system safely and prudently; or (2) to satisfy regulatory compliance requirements.

- **DT.8 – Execution constraints**: This Driver includes constraints including third-party vendor issues, Quality Assurance/Quality Control issues related to materials and operational oversight, resource constraints (e.g., workforce, material), re-allocation or unexpected maintenance or regulatory requirements, or the inability to complete projects initiatives or meet operational compliance.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed to the right side of the risk Bow Tie. SDG&E identifies the Potential Consequences of this Risk by analyzing internal data sources where available, industry data, and subject matter expertise (SME).[14] These Bow Tie Consequences inform the CoRE component of the risk value. If one or more of the drivers listed above were to result in an incident, the Potential Consequences, in a plausible reasonable worst-case scenario, could include:

- **PC.1: Serious injuries or fatalities**
- **PC.2: Property Damage**
- **PC.3: Operational and reliability impacts**
- **PC.4: Adverse litigation**
- **PC.5: Penalties and fines**
- **PC.6: Erosion of public confidence**
- **PC.7: Environmental Impacts**

These potential consequences were used by SDG&E in the scoring of the MP System Risk during the development of SDG&E's 2024 ERR.

E. Evolution of Its Drivers and Consequences

As specified in the Phase 3 Decision,[15] the following changes to the previous ERR and/or the 2021 RAMP include:

[14] D.24-05-064, RDF Row 10.

[15] D.24-05-064, RDF Row 8.

- The title of *Medium Pressure Gas System* was changed from *Incident Related to the Medium Pressure System (Excluding Dig-In)* to align SoCalGas's Medium Pressure Gas RAMP risk title.
- The scope of *Medium Pressure Gas System* has been narrowed. In the 2021 RAMP, *Incident Related to the Gas Distribution System (Excluding Dig-In)* and was a combination of two separate risks: (a) Incident Related to the Gas Distribution System (Excluding Dig-In), and (b) Customer and Public Safety – After Meter Gas Incident. *Customer and Public Safety – After Meter Gas Incident* is a standalone risk in the 2024 ERR, which is not included in the 2025 RAMP.

1. Changes to Drivers/ Triggers of the Risk Bow Tie

- None

2. Changes to Potential Consequences of the Risk Bow Tie

The following change from the 2021 RAMP was made:

- PC.7 – Added "Environmental Impacts"

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and in accordance with Row 14 of the RDF, SDG&E applied the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP - 3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:

Table 1: Medium Pressure Gas System Risk Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches
Above Ground	60	14
Below Ground	570	33
TOTAL	**630**	**47**

Attachment D illustrates the derivation of the Tranches, as shown in Table 1 above, in accordance with the HTM. The classes were identified by SDG&E as logical groups of assets and systems based on the Company's operations. These classes also align risk treatments with asset risk profiles reflective of SDG&E's operations. More detailed Tranche information,

including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches, are provided in workpapers.

III. PRE-MITIGATION RISK VALUE

In accordance with the RDF Row 19, the table below provides the pre-mitigation risk values for the MP System Risk. Further details, including pre-mitigation risk values by tranche, are provided workpapers. Explanations of the risk quantification methodology and other higher-level assumptions are provided in Chapter RAMP-3: Risk Quantification Framework.

Table 2: Medium Pressure Gas System Risk
Monetized Risk Values
(Direct, in 2024 $ millions)

LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]
	Safety	Reliability	Financial		
4,932.73	<0.000	<0.000	0.001	0.002	$8.97

A. Risk Value Methodology

SDG&E's risk modeling for the MP System Risk follows RDF guidance[16] for implementing a Cost Benefit Approach, as described below:

1. **Cost Benefit Approach Principle 1 – Attribute Hierarchy (RDF Row 2):** MP System Risk is quantified in a combined attribute hierarchy as shown in the table above, such that Safety, Reliability, and Financial are presented based one available, observable and measurable data.
2. **Cost Benefit Approach Principle 2 – Measured Observations (RDF Row 3):** MP System Risk used observable and measurable data in the estimation of CoRE values. SDG&E utilized a combination of internal and external data to estimate consequences in terms of natural units, (e.g. fatalities, serious injuries, and meters out) that occur as the result of a risk event on the MP System.
3. **Cost Benefit Approach Principle 3-Comparison (Row 4):** The MP System Risk quantification did not include any attributes that are not directly measurable, so proxy data, as described in the RDF, was not necessary.

[16] D.24-05-064, RDF Rows 2-7.

4. **Cost Benefit Approach Principle 4-Risk Assessment (RDF Row 5):** The data sources used for MP System Risk – as described in the preceding paragraphs – were sufficient to model probability distributions for use in estimating risk values.
5. **Cost Benefit Approach Principle 5-Monetized Levels of Attributes (RDF Row 6):** In accordance with D.22-12-027 and D.24-05-064, RDF Row 6, SoCalGas and SDG&E used a California-adjusted Department of Transportation monetized equivalent to calculate the Safety CoRE attribute at a monetized equivalent of $16.2 million per fatality, and $4.1 million per serious injury; the Gas Reliability CoRE attribute is valued at a monetized equivalent of $3,868 per gas meter outage; and the Financial CoRE attribute is valued at $1 per dollar.[17] Further information regarding SDG&E's quantitative risk analyses, including raw data, calculations, and technical references, are provided in workpapers.
6. **Cost Benefit Approach Principle 6-Adjusted Attribute Level (RDF Row 7):**

Table 3: Medium Pressure Gas System
Risk Scaled vs Unscaled Value by CoRE Attribute
(Direct, in 2024 $ millions)

	Safety	Reliability	Financial	Total
Unscaled Risk Value	$0.79	$0.56	$7.32	$8.67
Scaled Risk Value	$1.01	$0.56	$7.40	$8.97

The values in the table above are the result of SDG&E applying the risk scaling methodology described in Chapter RAMP-3 to the CoRE attributes for the MP System Risk. The MP System Risk does not feature a significant risk aversion scaling impact because a relatively small proportion of the observed events rise to the level at which scaling is applicable, and the magnitudes of the consequences are not as high (e.g., multiple-fatality event) as can occur with other risks, such as High Pressure.

For further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply, is provided in Chapter-RAMP-3.

[17] *See* Chapter RAMP-3: Risk Quantification Framework, Section II.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section identifies and describes the controls and mitigations comprising the portfolio of mitigations for MP System Risk and reflects changes to the portfolio expected to occur from the last year of recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). For clarity, a current activity that is included in the plan may be referred to as either a control and/or a mitigation. Table 4 below shows which control activities are in place in 202 and which are expected to be on-going, completed, or new during the 2025-2031 time periods. Because the TY 2024 GRC proceeding established rates through 2027,[18] information through 2027 is calculated as part of the baseline risk, in accordance with D.21-11-009.[19] For the TY 2028 GRC, SDG&E calculated CBRs beginning with TY 2028 and for each Post-Test Year (2029, 2030, and 2031).[20]

Table 4: Medium Pressure Gas System Risk
2024-2031 Control and Mitigation Plan Summary

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C005	Gas Distribution Emergency Department	X	Ongoing
C007	Underperforming Mains and Services	X	Ongoing
C101	Cathodic Protection Program – O&M	X	Ongoing
C107	Cathodic Protection Program – Capital	X	Ongoing
C115	Regulator Station, Valve, Large Meter Set Inspections	X	Ongoing
C124	Regulator Station Installation, Replacement, and Enhancement	X	Ongoing
C131	Leak Repair (O&M/Capital)	X	Ongoing
C134	Pipeline Monitoring	X	Ongoing
C139	Gas Distribution Safety Relocations	X	Ongoing
C144	Human Factors Mitigation – QA/QC Program – Mandated Compliance Activities	X	Ongoing
C150	Code Compliance Mitigation	X	Ongoing

[18] *See* D.24-12-074.

[19] D.21-11-009 at 136 (Conclusion of Law (COL) 7) (providing a definition for "baselines" and "baseline risk").

[20] In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

C169	Human Factors Mitigations – OpQual Training	X	Ongoing
C175	Residential Meter Protection	X	Ongoing
C182	Distribution Risk Evaluation & Monitoring System (DREAMS)	X	Ongoing

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place,"[21] (*i.e.*, activities in this section were in place as of December 31, 2024). Controls that will continue as part of the risk mitigation plan are identified in Table 4 above.

- **C005: Gas Emergency Department**

  When SDG&E is notified of a gas emergency it is critical to respond immediately and take measures to control escaping gas to help mitigate the risk to public safety. To improve gas emergency response time SDG&E established the Gas Distribution Emergency Department (GED), which is an organization consisting of two person crews dedicated to responding to gas emergencies. The GED operates 24/7 in overlapping shifts to provide ample coverage during peak periods of gas emergencies and rapid response regardless of the time or day, which allows them to control escaping gas quickly. These dedicated "specialist" crews responding to gas emergencies reduce the risk of injuries and property damage to both the public and those responding to the incident.

- **C007 Underperforming Mains and Services**

  SDG&E's Underperforming Mains and Services program for pipelines and components encompasses and addresses the following elements, including but not limited to: threaded steel pipe, pipe wrap disbondment cathodic protection performance and components to include oil drip piping removal, Dresser mechanical coupling removal, removal of closed valves between high/medium pressure zones, and removal of pipe in vaults. The evaluation process for identifying underperforming pipelines requiring replacement is based on a risk-

[21] D.18-12-014 at 33.

ranking system. This system considers the following, among other factors: leakage history, pipe age, pipe operating pressure, cathodic protection history and performance, discontinued installation practices, known defects, pipe location relative to population density, among others. Planned pipeline replacements processed under this methodology will culminate in a prioritized list of recommended pipeline replacements. Pipeline replacements will be subsequently planned, with an emphasis on removing pipes with a history of recurring leaks, thereby reducing the highest risk to public safety from pipeline leakage. Although considered best practice at the time, some of the vintage materials and construction practices are known to be more prone to leakage today and are prioritized for replacement. Some of these conditions are described below:

- Prior to 1934, a certain piping in the gas distribution system was joined using threaded couplings. Such threaded pipe exhibits increased susceptibility to leaks at joint connections and a heightened potential for joint failure during seismic events, due to wall thickness reduction caused by thread cutting.
- Steel pipes installed prior to 1955 utilized coal tar asphaltic pipe wrap as the initial layer of corrosion protection. Over time, this early-generation pipe wrap degrades and disbonds from the pipe, resulting in cathodic protection current leaving the pipe around the disbonded coating, thus failing to provide adequate corrosion protection. This lack of protection ultimately leads to increased corrosion and leakage.
- Pipeline oil drip facilities are at risk of excavation damage, as their location and configuration were historically not captured with sufficient detail to identify them precisely on facility maps, leading to potential strikes during nearby work activities.
- Dresser mechanical couplings are susceptible to lateral movement, and over time, the rubber pressure-containing seal degrades. These couplings require lateral support and are not as robust as modern mechanical couplings with rubber mechanical seals. In the event of land movement, pipe separation or rupture may occur, resulting in an incident.

- Block valves between high and medium pressure systems pose an inherent risk if operated erroneously, in an act of sabotage, or if the valve leaks high-pressure gas downstream to the lower maximum allowable operating pressure (MAOP) system, potentially causing an overpressure condition in the downstream system.
- SDG&E has pipelines buried in vaults that may experience corrosion from above-ground facilities, leading to pitting of below-ground piping. SDG&E will assess the coating and the condition of both above-ground and below-ground facilities within the vaults.

- **C101: Cathodic Protection Program – O&M**

  Corrosion is a natural process that can deteriorate steel assets and potentially lead to leaks or asset failure. If a leak migrates to and accumulates in a confined space and a potential ignition source is present or introduced, there is the potential for injuries. Although SDG&E operation groups respond immediately to these leak situations, such conditions have the potential to lead to a pipeline incident. Cathodic protection (CP) coating and monitoring can protect and extend the life of a steel pipeline asset by mitigating corrosion. The application of a CP related low electric current is necessary to overcome local inductive corrosion currents along the pipeline, that left unabated would result in localized corrosion on the pipeline. Cathodic protection can be achieved by the installation of sacrificial anodes[22] or impressed current systems.[23]

  The directives prescribed by state and federal pipeline corrosion control standards[24] include the monitoring of CP areas, remediation of CP areas that are

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[22] A sacrificial anode is designed to be more electronegative than the pipe it is protecting and will "sacrifice" itself to prevent corrosion on the carbon steel pipe.

[23] SDG&E utilizes both impressed current and magnesium anode (galvanic) systems to provide CP to existing pipelines. Impressed current systems utilize a rectifier for the generation of the direct current. Both systems utilize sacrificial anodes (more electronegative than the pipe causing the anode to corrode vs the pipe) as a primary component in the system. Anodes are installed in wells drilled into the surrounding soil by third-party drilling contractors. Each protected pipe segment requires multiple anodes, collectively referred to as an "anode bed." The number of anodes needed to achieve the desired level of protection, and the average life of the anode bed can vary based on pipeline length, coating effectiveness, soil conditions and interference that may occur on the system.

[24] 49 C.F.R. § 192, Subpart I–Requirements for Corrosion Control; GO 112-F.

out of tolerance,[25] and preventative installations to avoid out of tolerance areas. The work in this CP Program constitutes the O&M activities that provide compliance with these regulations, supports the safety and integrity of the gas system, and mitigates risks defined in this RAMP chapter.

- **C107: Cathodic Protection Program - Capital**

  This project represents the capital expenditures associated with the installation of new and replacement CP infrastructure systems and equipment in accordance with state and federal pipeline corrosion control standards.[26] Examples include the installation of impressed current stations, deep well anode beds, magnesium anode systems, installation of isolation joints between pressure districts and the purchase, installation, and maintenance of CP instrumentation and monitoring equipment.

  CP system shorts and current interference typically occur as SDG&E's pipeline components come into contact with water lines or third-party grounding systems that can drain electric current from the pipeline. Other instances of interference include instances near customer meter set assemblies and risers in which a customer may have improperly grounded their own electrical systems or maybe have wrapped a dog or bicycle chain around the riser and meter set. This has the potential to reduce the level of protection and increase depletion of anodes. SDG&E continues to identify necessary modifications to CP systems to shorts and current interference caused by factors. Associated work includes the installation of insulating unions separating CP systems, new rectifiers, anode beds, and test points allowing the CP technician to take CP reads. This control also installs the isolation joints that provide the separation of the CP systems between pressure districts. CP isolation of high and medium pressure systems, as well as conducting specialty CP surveys will reduce the risk of corrosion and subsequent corrosion caused leaks in the distribution pipeline system.

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[25] Out of tolerance areas are defined as areas where CP measures are not efficiently mitigating the effect of the corrosive environment on steel assets.

[26] 49 C.F.R. § 192, Subpart I–Requirements for Corrosion Control; GO 112-F.

Adding to or improving the current CP infrastructure with work activities and expenses will reduce exposure of corrosion to the SDG&E steel pipeline system thus enhancing the integrity of the gas system and mitigating the risks defined in this RAMP chapter.

- **C115: Regulator Station, Valve, Large Meter Set Inspection**

  This project is for inspections and maintenance to regulator stations, critical valves, and large meter sets. Regulator stations reduce the pressure of gas entering the distribution system from high-pressure pipelines to provide a lower pressure used on the distribution pipeline system. A failure of a regulator station due to mechanical failure, corrosion, contamination, or other cause could result in over-pressurization of the gas distribution system, which may compromise the integrity of medium-pressure pipelines and result in a public safety situation as evidenced by recent over-pressure events[27] in the industry.

  Regulator stations are critical control elements in the gas distribution system. Federal regulation 49 CFR § 192.739 requires inspections/tests to be conducted annually, and not to exceed 15 months between inspections, to determine if these devices in good mechanical condition. Functional tests of regulator stations are performed as part of inspections. The pressure checks are done to verify that the station's pressure protection devices perform as designed. If a station does not perform properly, internal maintenance and inspections are conducted. This consists of disassembling the regulator devices and inspecting the internal components for worn or damaged parts. The regulator is cleaned and inspected for corrosion and any faulty parts are replaced.

  SDG&E's O&M practices allow the useful lives of regulator stations to be extended. However, it is prudent to proactively replace regulator stations prior to the end of their useful life to reduce overall system risk. This risk reduction is achieved through improved station design of dual-run regulators which will

[27] For example, the 2018 Merrimack Valley over-pressurization event, *see* National Transportation Safety Board (NTSB), *Overpressurization of Natural Gas Distribution System, Explosions, and Fires, in Merrimack Valley, Massachusetts* (September 13, 2018), *available at:* https://www.ntsb.gov/news/events/Pages/2019-PLD18MR003-BMG.aspx.

reduce the risk of over-pressure and the station's location can be evaluated to reduce the risk of vehicular damage (outside force) or vandalism.

Valve maintenance allows the opportunity to validate that the valves within the system operate at optimum effectiveness which enhances public safety by providing SDG&E with the ability to control the pressure and flow of gas in the system. The maintenance activities may include flushing, lubrication, parts replacement, cleaning, and testing of operability. Valves are installed for control of pressure and flow of gas. Their location and purpose determine their criticality: inlet (aka "fire") valves to regulator stations isolate the high- and medium-pressure systems; emergency valves isolate segments of pipelines in case of pipe damage or for operational purposes; and isolation valves sequester portions of the system in the event of a widespread emergency, such as an earthquake and reduce the impact of resulting pipeline damage.

A valve that is operating appropriately means that, for example, in the case of an earthquake or fire where an area needs to be isolated to reduce the risk of further damage, these valves will operate as intended and fully isolate the area. A second example, which occurs more frequently, is when a pipeline is hit caused by third-party damage, releasing the uncontrolled release of gas; in such cases, these valves can be operated to suspend the flow of gas to the release point to allow completion of the repairs to the pipeline,

Meter set assemblies (MSA) reduce the pressure of natural gas and measure the volume of natural gas delivered to the customer. GO 58-A requires that meters, regulators, and other components be maintained, repaired, and tested periodically to meet customers' capacity requirements, measure gas volume accurately, and deliver natural gas at an adequate pressure for the houseline and home appliances. Additionally, if MSAs are housed in vaults, the vaults must be inspected and repaired, if necessary, to protect the MSA. Should the regulators fail, a household could potentially see a higher pressure of natural gas than intended for end-use infrastructure (*e.g.*, water heater), which could lead to an incident. Scheduled

inspections of MSAs proactively target and reduce the risk of equipment failures, corrosion, and outside force before operation and safety issues arise.

As required by 49 CFR § 192.481, above ground piping facilities must be inspected for atmospheric corrosion no less than once every three calendar years and at intervals not to exceed 39 months. If severe corrosion is found, the piping is replaced. This additional activity reduces the risk of consequent leakage due to the atmospheric corrosion.

- **C124 Regulator Station Installation, Replacement, and Enhancement**
  Regulator stations reduce the pressure of gas entering the distribution system from high pressure supply pipelines to the lower pressures used in the distribution pipeline network. SDG&E has approximately 460 regulator stations. SDG&E's O&M practices help extend the useful lives of regulator stations through annual inspection and maintenance; however, it remains prudent to proactively replace regulator stations prior to the end of their useful life in order to reduce overall system risk. This risk reduction is achieved through improved replacement station design, including the addition of dual-run regulators providing redundancy which will reduce the risk of over-pressure. In addition, the stations' location can be evaluated to reduce the risk of vehicular damage (outside force), vandalism, and risk to employee safety during maintenance due to high traffic levels near the station. Regulator stations are critical control elements in the gas distribution system. Failure of a regulator station could result in under- or over-pressurization of the gas distribution system, resulting in reduced service to customers and/or jeopardizing public safety. Regulator stations are part of SDG&E's continually-aging infrastructure. Presently over 70 percent of the Company's operating regulator stations are 24 years or older. SDG&E prioritizes its older regulator stations for replacement based on risk criteria, some of which are described above. Approximately 3 to 5 stations are replaced on an annual basis.

  In addition to the work described above the Control Center Modernization (CCM) organization is deploying remote control and real-time monitoring at distribution regulator stations, which will provide Gas Control visibility into the dynamic pressures and flows across the gas distribution system. This work includes the

installation of remote real-time automated control valves, pressure sensing equipment, flow measurement, and communication devices. These enhancements will provide Gas Control personnel with comprehensive operational awareness by receiving information from the regulator stations through a centralized data management system to the Gas Control Room. With these enhancements, Gas Control personnel will have improved visibility and control over assets within the distribution system, enabling them to more quickly identify, respond, and remediate abnormal operating pressures. This is intended to help prevent overpressure situations by providing earlier awareness that, in turn, facilitates more timely response.

- **C131: Leak Repair O&M/Capital**

  SDG&E proactively surveys its gas distribution system for leakage at frequencies determined based on the pipe material involved, the operating pressure, whether the pipe is under cathodic protection, and the proximity of the pipe to various population densities as prescribed within 49 CFR § 192.723. A routine leak survey includes surveys at intervals of one or three years for steel and plastic mains. The frequency of this survey is determined by the pipe material and date of installation involved. Annual surveys are scheduled on pipeline infrastructure which are pre-1950 steel and pre-1986 plastic (Aldyl-A) and in business districts, and near public service establishments, such as schools, churches, and hospitals. Three-year survey cycles are typically used for plastic and cathodically protected steel mains and services installed in residential areas.

  If a leak is found during a survey of the gas distribution system, SDG&E takes steps to either remediate or monitor the situation depending on the type of leak classification. A leak will be remediated immediately if the qualified technician conducting the survey determines there is a hazardous condition. If the leak does not create a hazardous situation, SDG&E will monitor the leak. SDG&E has shortened the prescribed timeframe for which leaks will be monitored and scheduled for remediation. The leak survey program has accelerated due to the increased footage to align with SB 1371 based funding and requirements.

- **C134: Pipeline Monitoring**

  SDG&E conducts pipeline monitoring and inspection activities to proactively target risk factors before operation and safety issues arise. These monitoring activities include pipeline patrols, leak surveys, bridge and span inspections, and unstable earth inspections. These inspections are critical since they are intended to observe assets over time to determine if abnormal conditions exist prior to becoming a concern. For example, a span that is no longer coated appropriately due to recent weather conditions can be identified for re-coating before corrosion that could lead to a leak begins. The leak survey monitoring identifies leaks that require repair.

  The monitoring and inspections must follow certain prescribed processes included in Title 49 of the CFR Part 192, and GO 112-F.

- **C139 Gas Distribution Safety Relocations**

  The Gas Distribution Safety Relocations activity addresses the relocation of gas services and gas meters on gas distribution lines due to abnormal operating conditions, such as shallow/exposed services and out-of-compliance gas meter locations, such as meters that are not enclosed. This activity will also assist in managing encroachment infractions for gas distribution pipelines within the Company's pipeline rights of way in compliance with GO 112-F § 143.5 or otherwise affecting the operation and maintenance of the Company's pipeline facilities.

- **C144: Human Factors Mitigation – QA/QC Program – Mandated Compliance Activities**

  In addition to SDG&E's Operator Qualification program that promotes safe and proficient operations, SDG&E performs quality control checks for various pipeline operational activities as mandated by 49 CFR § 192.605 (b8)(c4). During these quality control checks, internal assessors review the work performed by gas pipeline personnel to assess the effectiveness and adequacy of the procedures used in normal operations and maintenance. In addition, the assessors evaluate the conformance of employees to these policies and procedures. The assessors identify if abnormal operating conditions (AOCs) are present and

document whether the employees respond to the AOCs and take appropriate corrective actions.

SDG&E performs quality control assessments on the Company's regulator station, valve, and large meter set inspection and maintenance activities, as well as on pipeline monitoring activities, and cathodic protection activities. These assessments are tracked to communicate lessons learned and to help develop refresher training. Adherence to proper company policies and procedures is intended to mitigate the risk of hazardous conditions developing and also helps increase the overall awareness and response to unsafe activities.

- **C150 Code Compliance Mitigation**

  This project consists of upgrades or additions to facilities to maintain compliance with minimum federal safety standards for gas pipelines in 49 C.F.R. § 192 and state safety standards in GO 112-F. The primary components of this activity are the replacements of Type K-Regulators, replacement of inoperable valves, and installation/replacement of Electronic Pressure Monitors (EPM). Type K-Regulators are regulators that do not have relief valves and for which pressure downstream of the regulator can increase due to either corrosion on the copper washer or the presence of small debris that prevents the regulator from operating properly.

  When a valve has been discovered inoperable through normal maintenance and inspections, it will be reported and then replaced with an operable valve. A valve that is operating properly can mitigate several safety risks. For example, in the case of an earthquake or fire, valves can provide isolation of an area to reduce the risk of the incident. A second more frequently occurring example is when a pipeline incurs damage caused by third-party contact, causing the uncontrolled escape of gas. Valves can be operated to allow for a safe environment, allowing completion of repairs to the pipeline, and minimize the risk of furthering the incident.

  Installations/replacements of EPMs are needed in order to provide warning if a particular gas area is being affected by low- or high-pressure events. EPMs work

by sensing pressure in a main and logging that information. They then relay that information at a regular interval to an internal database giving SDG&E the ability to see the fluctuations in gas pressure throughout the seasons. EPMs also have the ability to send alarm messages to SDG&E's emergency and on call departments if a particular high- or low-pressure threshold is met. This allows SDG&E response crews and on-call gas engineers to know there are potential problems in the system and allows a timely response. As the gas system grows and changes, periodic reviews of existing EPM locations are evaluated to see if a particular EPM should be added, moved, or removed from the system.

- **C169: Human Factors Mitigation – Op Qual**

  All gas pipeline operators are required to create and maintain a written Operator Qualification (Op Qual) program to establish compliance policies for the DOT Operator Qualification Program as required by 49 CFR Subpart N – Qualification of Pipeline Personnel. All employees and contractors performing DOT-covered tasks are required to be pre-qualified under this Op Qual program. This program is reviewed by the Op Qual department prior to performing work on pipelines or pipeline facilities. The Op Qual program requires that employees are trained, initially qualified and subsequently re-qualified every three or five years depending on the task. SDG&E's training frequency conforms to these requirements and the results of the evaluations are recorded, demonstrating employees' knowledge, skills, and abilities of the job requirements and that they are qualified to perform the required tasks. Qualification promotes adherence to proper company policy and procedures and therefore mitigates the risk of hazardous conditions developing and increases the overall awareness and response to unsafe activities.

- **C175 Residential Meter Protection**

  Residential Meter Protection (RMP) addresses the prevention of potential vehicular damage associated with above-ground distribution facilities at residential properties in accordance with 49 C.F.R. § 192.353(a) and GO 112-F. This control minimizes the potential for vehicular damage for above ground gas equipment (*e.g.*, MSA) by placing various forms of physical devices or barriers to mitigate damage in case of a

potential collision. Barriers are intended to be visual, not structural, deterrents and are not intended or capable of stopping all vehicular traffic (especially large vehicles). Where adequate mitigation cannot be achieved, gas equipment can be relocated or removed. Additionally, RMP addresses the concerns PHMSA expressed under its regulations that require operators to address identified threats of low frequency but potentially high consequence events. RMP anticipates there are more than 19,000 additional locations where this mitigation is warranted. To address these 19,000 locations, RMP is expected to last as a project for approximately 20 years.

- **C182: Distribution Risk Evaluation & Monitoring System (DREAMS)**
  The Distribution Risk Evaluation & Monitoring System (DREAMS) was developed to manage the replacement of NSOTA pipes with State-Of-The-Art (SOTA) pipes, pipes, which SoCalGas has undertaken to comply with the DIMP requirements mandated by 49 CFR Part 192, Subpart P to reduce the risk of serious incidents and enhance the overall safety and reliability of the natural gas distribution system. The NSOTA pipe population consists of vintage Aldyl-A pipe, which has been recognized by federal and state regulators as high-risk pipes that necessitate action by pipeline operators.[28] The slow crack growth associated with this Aldyl-A material fundamentally poses a higher level of risk due to the nature of leaks created by this mode of failure.[29] Leak surveys do not completely mitigate the risk as leaks can occur suddenly and result in risk events.[30]

  SoCalGas mitigates the risk associated with vintage Aldyl-A pipe through the execution of pipe placement projects informed by the DREAMS model. The DREAMS model was recently updated with the use of a segment-specific quantitative risk assessment (QRA) algorithm that combines internal datasets and external publicly available data sources, and includes pipe attributes, operational conditions, and potential impact of an incident on the general population, to

[28] CPUC, *Hazard Analysis and Mitigation Report – Aldyl A Polyethylene Gas Pipelines* (June 11, 2014) at 11, *available at:* https://www.cpuc.ca.gov/regulatory-services/safety/gas-safety-and-reliability-branch/pipeline-documents.

[29] *Id.* at 25.

[30] *Id.* at 26.

estimate the safety risk of vintage distribution main pipelines. SDG&E currently has over 1,500 miles of plastic pipe manufactured and used for gas service from the 1960s through the early 1980s that can exhibit a brittle-like cracking characteristic that is associated with a higher risk of failure that could lead to serious incidents and/or fatalities.[31]

The DREAMS model and its results are used to determine appropriate action to address risk for each segment and inform the prioritization of replacement investments. In the absence of an established safety risk threshold from PHMSA and other regulatory bodies, SDG&E has established a threshold of an annual probability greater than 6×10^{-6} of a serious incident for medium pressure distribution main locations. Vintage plastic distribution mains with QRA results that exceed this threshold are targeted for replacement under the DREAMS program.

As SDG&E's gas infrastructure continues to age and more data is accumulated through inspections and other pipeline activities, SDG&E plans to continuously improve risk evaluations to consider not just the current state of risk in the system but also the projected long-term risks. SDG&E monitors the performance of DREAMS pipeline replacements by reviewing benefits and risk reduction achieved through indicators such as leak repair and incident rates related to vintage pipe. Program metrics will be monitored on a continual basis and SDG&E plans to increase or decrease replacement rates based on findings.

B. Changes from 2024 Controls

SDG&E plans to continue each of the existing controls discussed above, and reflected in Table 1, through the 2025-2031 period without any significant changes.

C. Mitigation Programs

SDG&E does not currently foresee implementing new mitigations not described above during the 2025-2031 period.

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[31] CPUC, *Hazard Analysis and Mitigation Report – Aldyl A Polyethylene Gas Pipelines* (June 11, 2014), *available at:* https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/r/8947-ra-doc-10-aldyla.pdf.

D. Climate Change Adaptation

Pursuant to Commission decisions[32] in the Climate Adaptation OIR (R.18-04-019), SDG&E performed a Climate Adaptation Vulnerability Assessment (CAVA) focused on years 2030, 2050, and 2070, with the aim of identifying asset and operational vulnerabilities to climate hazards across the SDG&E system. SDG&E recognizes the need to address climate vulnerabilities to promote safety and reliability of its services and mitigate the increasing climate-related hazards through innovative and community-centric approaches. Some of the climate hazards that will have short- and long-term ramifications in the San Diego region include extreme temperatures, wildfire, inland flooding, coastal flooding and erosion, and landslides. Climate change is recognized as a factor that can drive, trigger, or exacerbate multiple RAMP risks. Implementing climate change adaptation measures and integrating climate vulnerability considerations into RAMP controls and mitigations can enhance system infrastructure longevity and reduce the severity of long-term negative climate impacts. The controls and mitigations described in further detail in this chapter, as shown below, align with the goal of increasing SDG&E's physical and operational resilience to the increasing frequency and intensity of climate hazards. Additional information on the CAVA and a list of climate-relevant controls and mitigations included in RAMP, are provided in Chapter RAMP-5: Climate Change Adaptation.

Table 5: Medium Pressure Gas System Risk
Controls and Mitigations that Align with Increasing Resilience to Climate Hazards

Relevant ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
C134	Pipeline Monitoring	Inland Flooding and Landslides
C139	Gas Distribution Safety Relocations	Inland Flooding and Landslides

E. Foundational Programs

Foundational Programs are "[i]nitiatives that support or enable two or more Mitigation programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[33] SDG&E has one foundational program, Human Factors Mitigations – Op Qual Training. All employees and contractors performing DOT-covered tasks are required to be Operator Qualified to work on SDG&E's gas system per 49 CFR Subpart N –

[32] D.19-10-054; D.20-08-046.

[33] D.24-05-064, Appendix A at A-4.

Qualification of Pipeline Personnel. These DOT-covered tasks prescribe how employees and contractors are to perform their tasks for each of the controls listed in Table 6 below. Below in Table 6 are the foundational programs that are applicable to the MP System Risk and the mitigation activities that are supported.

Below in Table 6 are the Foundational Programs that are applicable to the MP System Risk and the mitigation activities that are supported.

Table 6: Medium Pressure Gas System Risk
Foundational Activities
(Direct, in 2024 $ millions)

ID	Foundational Activity Name	Enabled Control/Mitigation	2025 O&M Costs	2025-2031 Capital Costs
C169	Human Factors Mitigation – Op Qual Training	C005: Gas Emergency Department C007: Underperforming Mains and Services C101: Cathodic Protection Program – O&M C107: Cathodic Protection Program – Capital C115: Reg Station, Valve, Large Meter Set Inspections C124: Regulator Station Repair, Replace, Enhance C131: Leak Repair C134: Pipeline Monitoring C139: Gas Distribution Relocations C144: Human Factor Mitigation – QA/QC Program – Mandated Compliance Activities C150: Code Compliance Mitigation C182: Distribution Risk Evaluation & Monitoring System (DREAMS)	2.116	0

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for MP System Risk, including the associated costs, units, and CBRs. Additional information by Tranche is provided in workpapers. The costs shown are estimated using assumptions provided by SMEs and available data. In compliance with the Phase 3 Decision,[34] for each enterprise risk, SDG&E uses actual results and industry data and when that is not available, supplements the data with SME input. For additional details regarding the data and expertise relied upon in developing these estimates is provided in Attachment B.

Table 7: Medium Pressure Gas System Risk Control and Mitigation Plan – Recorded and Forecast Costs Summary (Direct, in 2024 $000)

ID	Control/Mitigation Name	Recorded Costs		Forecast Costs			
		2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C005	Gas Emergency Department	0	1,555	1,641	0	0	4,923
C007	Underperforming Mains and Services	18,268	0	0	36,984	27,738	0
C101	Cathodic Protection Program – O&M	0	2,278	2,258	0	0	6,774
C107	Cathodic Protection Program – Capital	7,293	0	0	19,826	13,656	0
C115	Reg Station, Valve, Large Meter Set Inspections	0	3,117	3,436	0	0	10,826
C124	Regulator Station Repair, Replace, Enhance	5,091	0	0	18,924	12,996	0
C131	Leak Repair (O&M/Capital)	16,466	3,313	3,313	55,163	43,721	9,939
C134	Pipeline Monitoring	0	4,173	4,173	0	0	12,519
C139	Gas Distribution Safety Relocations	1,820	0	0	6,578	201	0
C144	Human Factors Mitigation – QA/QC Program – Mandate Compliance Activities	0	142	142	0	0	426

[34] D.24-05-064, RDF Row 10.

ID	Control/Mitigation Name	Recorded Costs		Forecast Costs			
		2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C150	Code Compliance Mitigation	3,104	0	0	16,690	11,907	0
C169	Human Factors Mitigation – Op Qual Training	0	2,077	2,337	0	0	7,011
C175	Residential Meter Protection	2,362	0	0	6,744	8,471	0
C182	Distribution Risk Evaluation & Monitoring System (DREAMS)	82,375	660	1,034	199,918	193,008	3,418

Table 8: Medium Pressure Gas System Risk Control & Mitigation Plan – Units Summary

ID	Control/Mitigation Name		Recorded Units		Forecast Units			
	Name	Unit of Measure	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C005	Gas Emergency Department	Responses	0	1,591	1,483	0	0	4,449
C007	Underperforming Mains and Services	Feet	49,218	0	0	102,832	77,124	0
C101	Cathodic Protection Program – O&M	CP and follow up reads	0	23,376	25,520	0	0	76,560
C107	Cathodic Protection Program – Capital	Projects	73	0	0	151	104	0
C115	Reg Station, Valve, Large Meter Set Inspections	Inspections	0	5,673	6,254	0	0	19,702
C124	Regulator Station Repair, Replace, Enhance	Projects	3	0	0	83	57	0
C131	Leak Repair (O&M/Capital)	Leaks Repaired	472	860	860	2,608	2,067	2,580
C134	Pipeline Monitoring	Inspections & Surveys	0	972	972	0	0	2,916
C139	Gas Distribution Safety Relocations	Projects	34	0	0	197	6	0

ID	Control/Mitigation Name		Recorded Units		Forecast Units			
	Name	Unit of Measure	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C144	Human Factors Mitigation – QA/QC Program – Mandate Compliance Activities	Employees	0	4	4	0	0	12
C150	Code Compliance Mitigation	Projects	1,622	0	0	7,789	5,557	0
C169	Human Factors Mitigation – Op Qual Training	Op Quals Trained	0	899	1,056	0	0	3,168
C175	Residential Meter Protection	Projects	2,908	0	0	4,784	6,008	0
C182	Distribution Risk Evaluation & Monitoring System (DREAMS)	Miles	58	0	0	168	123	0

In the table below, CBRs are presented in summary at the mitigation or control level for the Test Year 2028 GRC cycle. CBRs are calculated based on scaled, expected values unless otherwise noted and are calculated for each of the three required discount rates[35] in each year of the GRC cycle and for the Post-Test Years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in workpapers.

Table 9: Medium Pressure Gas System Risk
Cost Benefit Ratio Results Summary (2028-2031)
(Direct, in 2024 $millions)

ID	Control/Mitigation Name	Capital (2028-2031)	O&M (2028-2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C005	Gas Emergency Department	0	$6.6	0.06	0.06	0.06
C007	Underperforming Mains and Services	$37	0	0.37	0.04	0.04

[35] *See* Chapter RAMP-3: for definitions of discount rates, as ordered in the Phase 3 Decision.

ID	Control/Mitigation Name	Capital (2028-2031)	O&M (2028-2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C101	**Cathodic Protection Program – O&M**	0	$9	11.36	11.38	11.32
C107	**Cathodic Protection Program – Capital**	$18.1	0	32.53	18.10	17.82
C115	**Reg Station, Valve, Large Meter Set Inspections**	0	$14.3	0.07	0.08	0.07
C124	**Regulator Station Repair, Replace, Enhance**	$17.8	0	0.12	0.05	0.05
C131	**Leak Repair (O&M/Capital)**	$57.8	$13.3	0.44	0.45	0.44
C134	**Pipeline Monitoring**	0	$16.7	0.03	0.03	0.03
C139	**Gas Distribution Safety Relocations**	$0.3	0	0.11	0.02	0.02
C144	**Human Factors Mitigation – QA/QC Program – Mandate Compliance Activities**	0	$0.6	0.07	0.08	0.07
C150	**Code Compliance Mitigation**	$15.7	0	0.01	~0.00	~0.00
C169	**Human Factors Mitigation – Op Qual Training**	0	$9.3	~0.00	~0.00	~0.00
C175	**Residential Meter Protection**	$11.2	0	0.01	~0.00	~0.00
C182	**Distribution Risk Evaluation & Monitoring System (DREAMS)**	$257.3	$4.5	0.19	0.03	0.03

Bold *indicates a mandated program.*

Tranche-level CBRs by year and in aggregate for each mitigation are provided in workpapers.

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025 and D.16-08-018,[36] SDG&E considered two alternatives to the Risk Mitigation Plan for the MP System Risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this plan considers changes in risk reduction, cost, reasonableness, current conditions, modifications to the plan and constraints, such as budget and resources.

Table 10: Medium Pressure Gas System Risk
Alternative Mitigation Plan – Forecasted Costs Summary
(Direct, in 2024 $millions)

ID	Alternative Mitigation Name	Forecast Costs			
		2025-2028 Capital	PTY Capital	2025-2028 O&M	PTY O&M
A106	CP10 Service Replacement	72	54	0	0
A118	Strategic Valve Replacement	19.2	14.4	0	0

Table 11: Medium Pressure Gas System Risk
Alternative Mitigation Cost Benefit Ratio Results Summary
(Direct, in 2024 $millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A106	CP10 Service Replacement	72	0	0.43	0.04	0.04
A118	Strategic Valve Replacement	19.2	0	0.71	0.18	0.17

A. Alternative 1: CP 10 – Service Replacements

SDG&E considered replacing approximately 20,000 CP10 services rather than continuing to monitor, inspect and maintain them on a ten-year cycle. CP10 services are separately protected service lines that are surveyed on a sampling basis where at least 10% of system inventory is sampled each year, so that the entire system is tested in a 10-year period. However, due to the number of CP10 services in the system, a program targeting complete replacement of CP10 services would exceed $400 million and likely take several decades to complete. As complete replacement of all CP10s is currently infeasible, SDG&E plans to evaluate and quantify the risk

[36] D.18-12-014 at 33-35.

reduction benefits of a risk-based targeted CP10 replacement program. In the interim, CP10s will be replaced based on performance history and current protection levels.

B. Alternative 2: Strategic Valve Placement/Installation

Valves are a critical part of a medium pressure gas system. Valves provide the operator with a means of maintaining the pipeline system through creating temporarily isolated sections of the system and also provide alternative choices in how the operator can operate a pipeline system. Importantly, valves also provide the ability to stop the unintended escape of gas from the pipeline system in an emergency. When properly located, valves can greatly reduce the response time to control escaping gas, thus minimizing the risk to Company employees and the public from the potential consequences of an uncontrolled release of gas. Valves, specified in the design process, are installed in the gas pipeline system in new segments of pipe added over time as a result of customer growth. Each segment of added pipeline is analyzed for the best placement of valves, which is primarily determined through an evaluation of the benefits as described above. However, the valves currently installed on the MP System were based on evaluations conducted when installing pipe. This alternative consists of a comprehensive review of the integrated gas system to look at the possible need for additional valves to expedite emergency response or minimize customer interruptions, as well as the resulting valve installations.

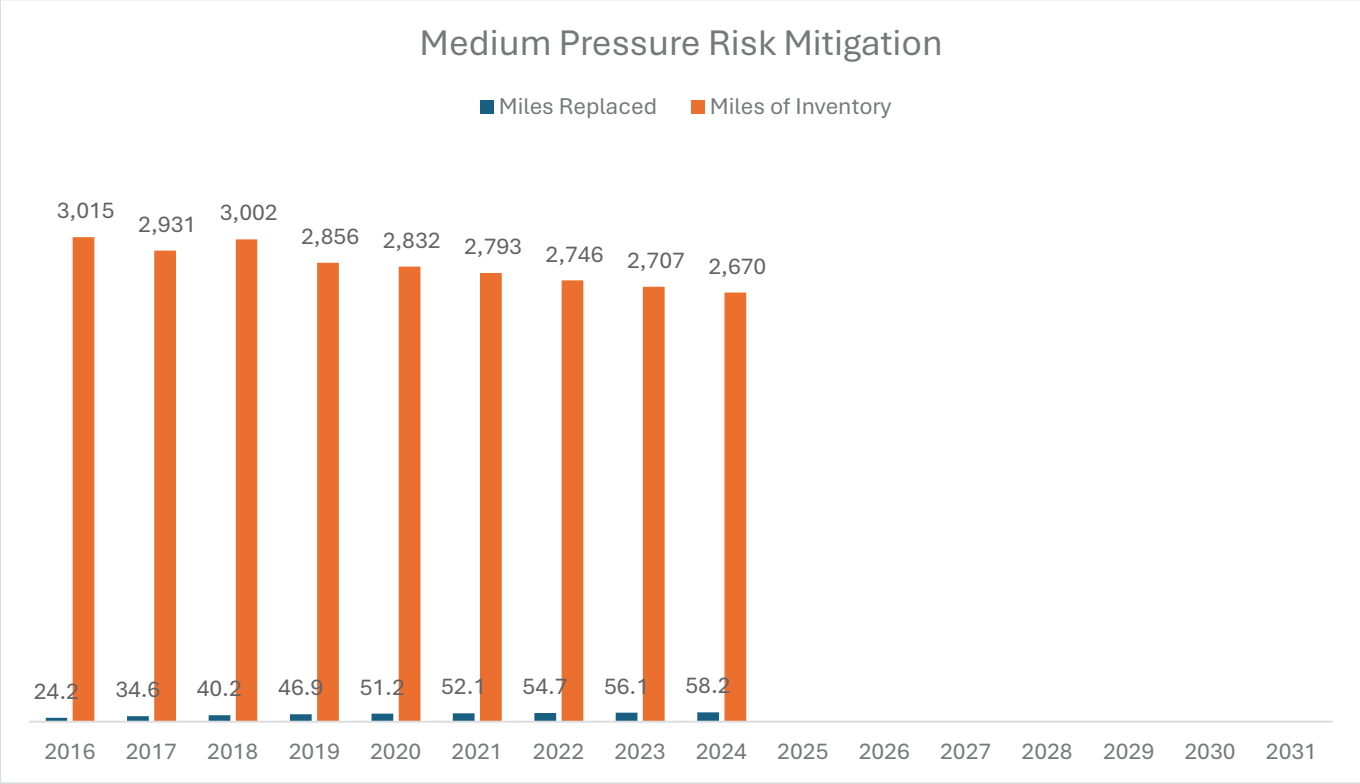
A comprehensive analysis of SDG&E's MP System would use current system maps and modeling tools to identify potential locations for added valves. These additions would enhance safety by reducing the response time to control and isolate gas flow in an emergency, with the added benefit of improved flexibility for pipeline maintenance. Elements of the analysis that would be included are size and pressure of the pipeline, pipeline network considerations such as back-ties and single feeds, long existing back-ties between stranded areas, estimated amount of reduction in the number of customers affected, valve access considerations, and usefulness in aiding the repair and isolation of critical SDG&E gas assets.

However, given the magnitude of this undertaking and the uncertainty of when or if an added valve would be utilized, and the increased risk of 3rd party Non-Op Qualed individuals operating SDG&E valves, SDG&E has elected not to pursue this mitigation. Instead, SDG&E will continue to focus on targeted application of available tooling that can be used where specifically needed on the system to stop the flow of gas at a fraction of the cost.

VI. HISTORICAL GRAPHICS

As directed by the Commission in D.22-10-002, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. A bar chart graphic is employed to depict historical progress. This graphic uses a key DIMP metric that aligns with Company safety goals to illustrate trends in historical progress and identify remaining tasks necessary to continue mitigating risks.

Figure 2
Medium Pressure Gas System: Safety Progress 2016-2024



As described in Section III.A., the DREAMS is a PAAR developed by SDG&E to replace NSOTA pipes with SOTA pipes. The recently updated DREAMS model uses a QRA algorithm that integrates various data sources to estimate the safety risks associated with vintage plastic and bare steel pipelines. Prioritizing pipeline replacements using this model, SDG&E aims to enhance the safety and reliability of the natural gas distribution system.

From 2016 to 2024, SDG&E successfully completed pipeline replacements, improved data tracking, and advanced risk evaluations through DREAMS. The scope of DREAMS has evolved over time with improvements made in data tracking and management, as well as the

execution of pipeline work across the company. With these efforts, combined with improvements to the DREAMS model, SDG&E is enhancing the accuracy of risk assessments, allowing for more precise prioritization of pipeline replacement projects based on identified threats and risks.

From 2025 to 2031, SDG&E plans to continue replacements of vintage plastic and bare steel pipelines to mitigate safety risks.

ATTACHMENTS

ATTACHMENT A

CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates the compliance drivers which underpin identified controls and mitigations.

ID	Control/Mitigation Name	Compliance Driver
C007	Underperforming Main & Services	49 CFR § 192
C101	Cathodic Protection Program – O&M	49 CFR Subpart I
C107	Cathodic Protection Program – Capital	49 CFR Subpart I
C115	Reg Station, Valve, Large Meter Set Inspections	PHMSA, CPUC GO 58A-13B
C124	Regulator Station Repair, Replace, Enhance	49 CFR § 192
C131	Leak Repair (O&M/Capital)	49 CFR § 192
C134	Pipeline Monitoring	49 CFR § 192
C139	Gas Distribution Safety Relocations	49 CFR § 192
C144	Human Factors Mitigation – QA Programs	49 CFR § 192
C150	Code Compliance	49 CFR § 192, GO 112-F
C169	Human Factors Mitigation – Op Qual	GO 112-F
C175	Residential Meter Protection	49 CFR § 192
C182	Distribution Risk Evaluation & Monitoring System (DREAMS) (O&M/Capital)	49 CFR § 192

ATTACHMENT B

MEDIUM PRESSURE GAS SYSTEM - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision RDF Row 10 and Row 29 directs each utility to identify Potential Consequences of a Risk Event using available and appropriate data.[37] Appropriate data may include Company specific data or industry data supplemented by the judgment of the subject matter experts. Provided below is a listing of the inputs utilized as part of this assessment and the description of the data.

Risk Data	**Source Type**	**Source Information**
Likelihood of failure and probability failure results in safety consequence	Internal Model results	Source: Internal DIMP models Definition: Integrity Management Department Internal model that uses internal and industry data
Business District Location Type	External Data	Source: Google maps Definition: Used to determine if national medium pressure incidents occurred in a business district or not to inform consequence modelling
Population Density	External	Agency: US Census Bureau Link: https://www.census.gov/programs-surveys/decennial-census/decade/2020/2020-census-results.html Definition: Used to determine population density in SoCalGas and SDG&E's service territories and locations where national incidents were reported to PHMSA to inform consequence modelling

[37] D.24-05-064, RDF Row 10 and Row 29.

Risk Data	Source Type	Source Information
National Pipeline Incidents (2010-2024)	External Data	Agency: PHMSA Link: https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data Definition: Due to lack of internal data, national data was used to model the number of fatalities and serious injuries from an incident on the medium pressure system.
Meter Outages	Internal Data	Source: GO 112-F quarterly reports and internal database. Definition: Historical data for SoCalGas was used to model likelihood and number of outages as a result of an incident on the medium pressure system.
National Medium Pressure Incident Cost data	External Data	Agency: PHMSA Link: https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-flagged-files Definition: National data was used to estimate costs such as property damage in current year (2024) dollars because internal data was not available
Leak Repair Costs	Internal Data	Source: Distribution Department and SoCalGas SB 1371 filing Link: https://www.socalgas.com/sites/default/files/2022-SoCalGas-SB-1371-Compliance-Plan.pdf Definition: Internal data for leak repair on aboveground assets was available however costs associated with main and service repair were not readily available so previous analysis from SB 1371 Filing was used.

Risk Data	Source Type	Source Information
Average cost of a fatality	External Data	Agency: National Safety Council (NSC) Link: https://injuryfacts.nsc.org/work/costs/work-injury-costs/ Definition: Costs include wage losses, medical expenses, administrative expenses and employer costs, which are not included in the PHMSA costs.
Average Cost of a serious injury	External Data	Agency: CDC Link: WISQARS Cost Of Injury Definition: Wage loss and medical costs associated with non-fatal injuries that require hospitalization that are not included in PHMSA costs.

ATTACHMENT C

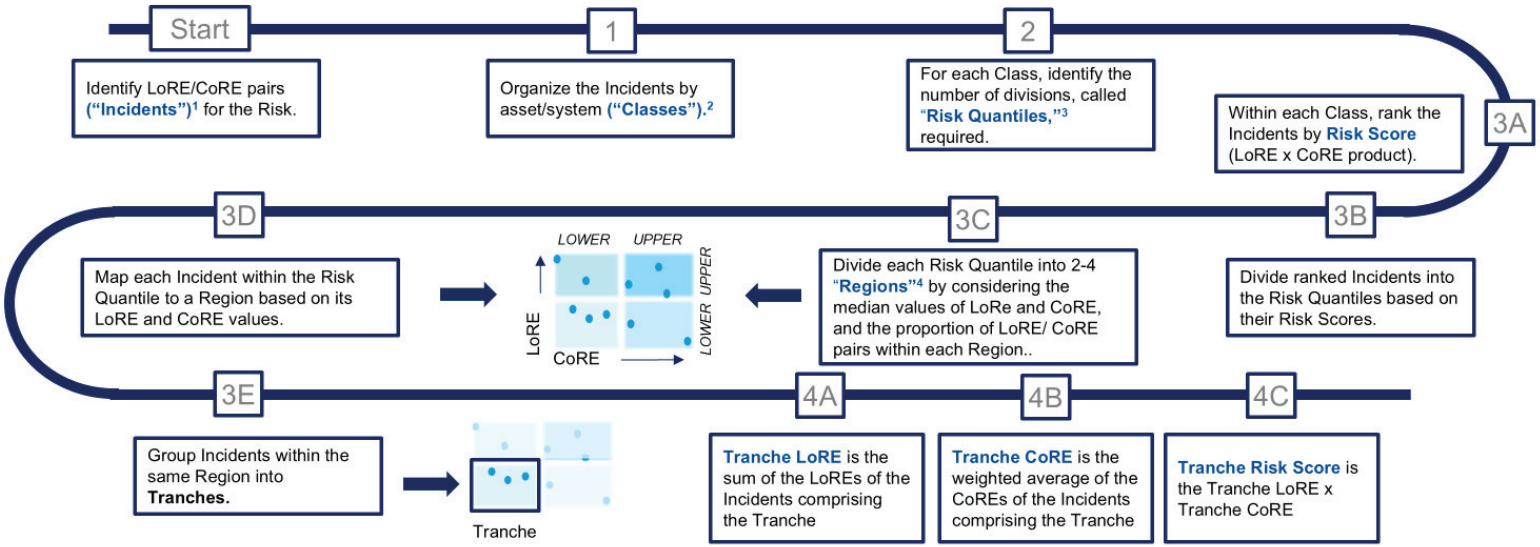
MEDIUM PRESSURE GAS SYSTEM - SUMMARY OF ELEMENTS OF BOW TIE

SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
C005	Gas Emergency Department		PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C007	Underperforming Main & Services	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C101	Cathodic Protection Program – O&M	DT.1, DT.4, DT.5	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C107	Cathodic Protection Program – Capital	DT.1, DT.4, DT.5	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C115	Reg Station, Valve, Large Meter Set Inspections	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C124	Regulator Station Repair, Replace, Enhance	DT.1, DT.2, DT.3, DT.4, DT5, DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C131	Leak Repair (O&M/Capital)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C134	Pipeline Monitoring	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C139	Gas Distribution Safety Relocations	DT.1, DT.2, DT3, DT.4, DT.5, DT.6, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C144	Human Factors Mitigation – QA Programs	DT.1, DT.4, DT.5, DT.6, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C150	Code Compliance	DT.1, DT.2, DT.3, DT.5, DT.6, DT.8	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C169	Human Factors Mitigation - OpQual	DT.1, DT.4, DT.5, DT.6, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C175	Residential Meter Protection	DT.3, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C182	Distribution Risk Evaluation & Monitoring System (DREAMS) (O&M/Capital)	DT.1, DT.2, DT.4, DT.6, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7

ATTACHMENT D

MEDIUM PRESSURE GAS SYSTEM - APPLICATION OF TRANCHING METHODOLOGY

A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP-3: Risk Quantification Framework is provided.



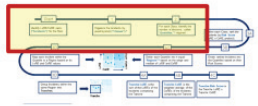
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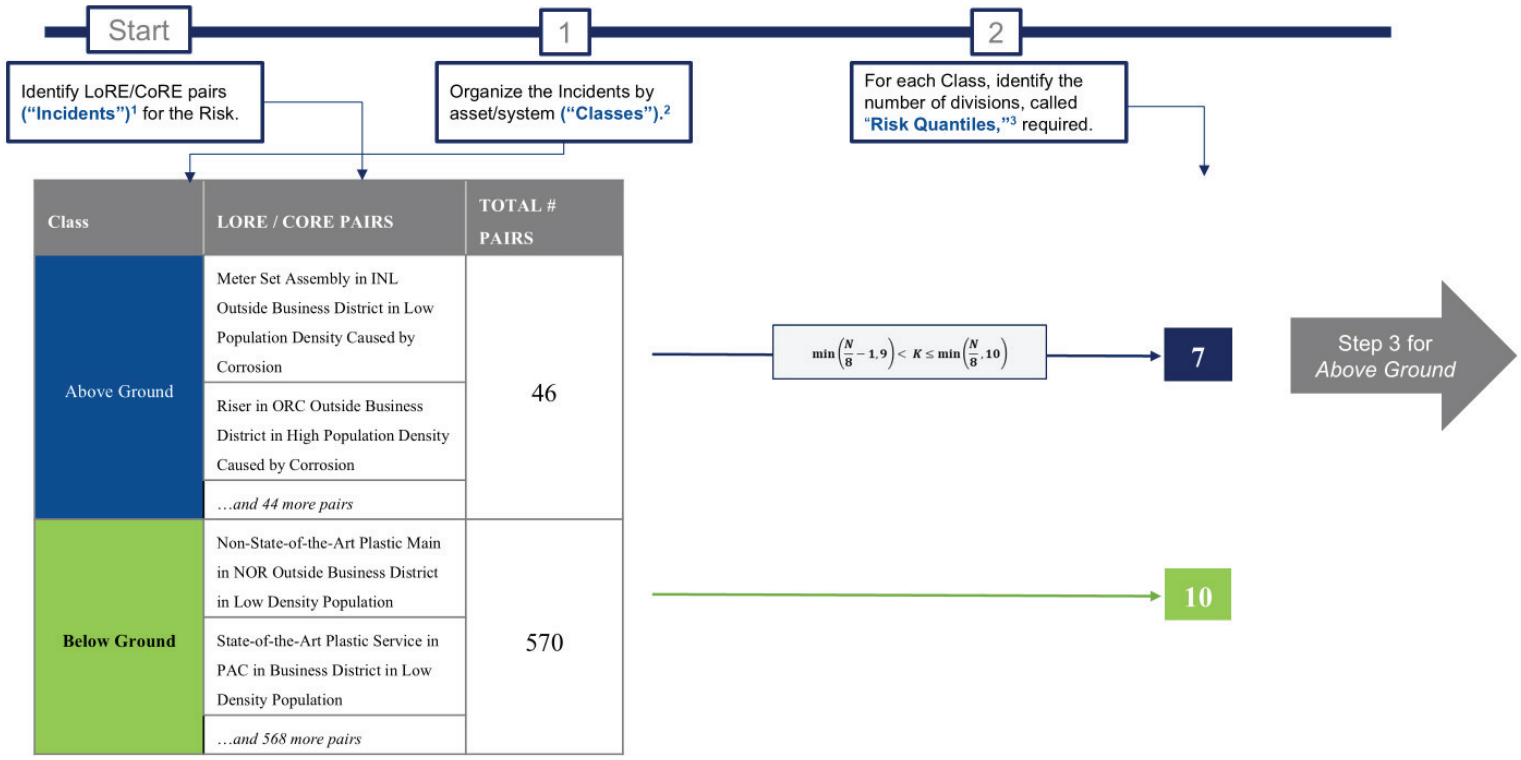
[1]*For example, **Incidents (or "Risk Incidents")** for Medium Pressure are generally modes of failure of medium pressure assets in various environments such as low or high population densities.*

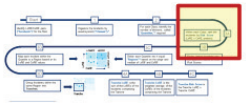
[2]*For example, **Classes (or "Asset Classes")** for Medium Pressure include Above-Ground and Below-Ground.*

[3]***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*

[4]*The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*




Start
1
2
Identify LoRE/CoRE pairs ("Incidents")[1] for the Risk.
Organize the Incidents by asset/system ("Classes").[2]
For each Class, identify the number of divisions, called "Risk Quantiles,"[3] required.
Class
LORE / CORE PAIRS
TOTAL # PAIRS
Above Ground
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Corrosion
Riser in ORC Outside Business District in High Population Density Caused by Corrosion
…and 44 more pairs
46
Below Ground
Non-State-of-the-Art Plastic Main in NOR Outside Business District in Low Density Population
State-of-the-Art Plastic Service in PAC in Business District in Low Density Population
…and 568 more pairs
570
$\min\left(\frac{N}{8}-1,9\right) < K \leq \min\left(\frac{N}{8},10\right)$
7
10
Step 3 for Above Ground

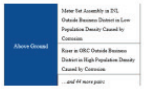


Within each Class, rank the Incidents by **Risk Score** (LoRE x CoRE product).

3A

3B

Divide ranked Incidents into the Risk Quantiles based on their Risk Scores.



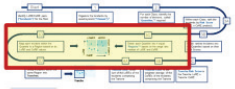
$$\min\left(\frac{N}{8}-1,9\right) < K \leq \min\left(\frac{N}{8},10\right)$$

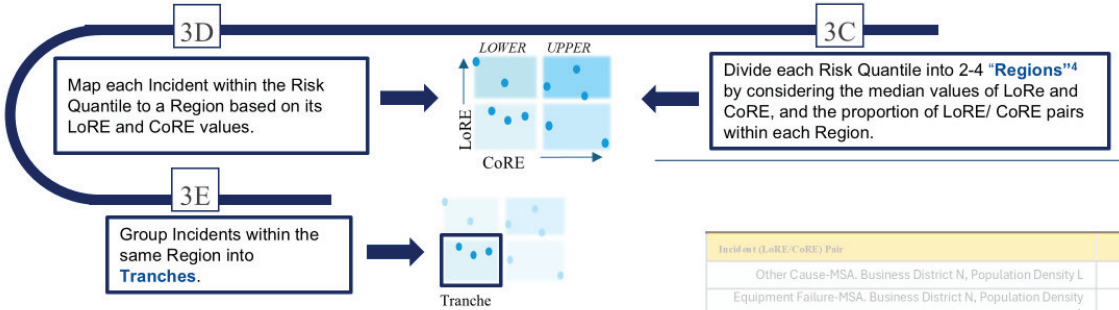
7

From Step 2 for *Above Ground*

3A 3B

Incident (LoRE/CoRE) Pair	Risk Score	Rank	Quantile
Other Cause-MSA. Business District N, Population Density L	587,045	1	#1
Equipment Failure-MSA. Business District N, Population Density L	340,924	2	
Corrosion-RISER. Business District N, Population Density L	181,678	3	
Other Outside Force Damage-MSA. Business District N, Population Density L	169,875	4	
Other Cause-MSA. Business District Y, Population Density L	133,377	5	
Equipment Failure-MSA. Business District Y, Population Density L	106,731	6	
Corrosion-MSA. Business District N, Population Density L	103,507	7	
Overpressure Leak-Reg_Station. Business District None, Population Density None	93,209	8	
Other Outside Force Damage-RISER. Business District N, Population Density L	83,650	9	
Other Outside Force Damage-MSA. Business District Y, Population Density L	66,010	10	#2
Through MSA-Reg_Station. Business District None, Population Density None	61,628	11	
Other Outside Force Damage-RISER. Business District Y, Population Density L	53,325	12	
Other Cause-MSA. Business District N, Population Density H	50,604	13	
Pipe, Weld, or Joint Failure-MSA. Business District N, Population Density L	46,290	14	
Overpressure Leak-Reg_Station. Business District None, Population Density None	44,564	15	
Pipe, Weld, or Joint Failure-MSA. Business District Y, Population Density L	42,434	16	
...	...	17-44	...





3A 3B 3C 3D

Incident (LoRE/CoRE) Pair	Risk Score	Rank	Quantile	Region	Tranche
Other Cause-MSA. Business District N, Population Density L	587,045	1	#1	UL/LC	Above-1-1
Equipment Failure-MSA. Business District N, Population Density L	340,924	2	#1	UL/LC	Above-1-1
Corrosion-RISER. Business District N, Population Density L	181,678	3	#1	LL/UC	Above-1-2
Other Outside Force Damage-MSA. Business District N, Population Density L	169,875	4	#1	LL/UC	Above-1-2
Other Cause-MSA. Business District Y, Population Density L	133,377	5	#1	UL/LC	Above-1-1
Equipment Failure-MSA. Business District Y, Population Density L	106,731	6	#1	UL/LC	Above-1-1
Corrosion-MSA. Business District N, Population Density L	103,507	7	#1	UL/LC	Above-1-1
Overpressure Leak-Reg_Station. Business District None, Population Density None	93,209	8	#1	LL/UC	Above-1-2
Other Outside Force Damage-RISER. Business District N, Population Density L	83,650	9	#1	LL/UC	Above-1-2
Other Outside Force Damage-MSA. Business District Y, Population Density L	66,010	10	#2	LL/UC	Above-2-3
				LL/UC	Above-2-3
Through MSA-Reg_Station. Business District None, Population Density None	61,628	11	#2	LL/UC	Above-2-3
Other Outside Force Damage-RISER. Business District Y, Population Density L	53,325	12	#2	UL/LC	Above-2-4
Other Cause-MSA. Business District N, Population Density H	50,604	13	#2	UL/LC	Above-2-4
Pipe, Weld, or Joint Failure-MSA. Business District N, Population Density L	46,290	14	#2	LL/UC	Above-2-3
Overpressure Leak-Reg_Station. Business District None, Population Density None	44,564	15	#2	UL/LC	Above-2-4
Pipe, Weld, or Joint Failure-MSA. Business District Y, Population Density L	42,434	16	#2	UL/LC	Above-2-4
...	...	17-44	#2	...	...



4A

Tranche LoRE is the sum of the LoREs of the Incidents comprising the Tranche

4B

Tranche CoRE is the weighted average of the CoREs of the Incidents comprising the Tranche

4C

Tranche Risk Score is the Tranche LoRE x Tranche CoRE

	4A	4B	4C	
Incident (LoRE/CoRE) Pair	**Tranche**	**Tranche LoRE**	**Tranche CoRE**	**Tranche Risk Score**
Other Cause-MSA. Business District N, Population Density L	Above-1-1	3165.86	402	1,271,585
Equipment Failure-MSA. Business District N, Population Density L	Above-1-1			
Other Cause-MSA. Business District Y, Population Density L	Above-1-1			
Equipment Failure-MSA. Business District Y, Population Density L	Above-1-1			
Corrosion-MSA. Business District N, Population Density L	Above-1-1			
Corrosion-RISER. Business District N, Population Density L	Above-1-2	211.15	2503	528,413
Other Outside Force Damage-MSA. Business District N, Population Density L	Above-1-2			
Overpressure Leak-Reg_Station. Business District None, Population Density None	Above-1-2			
Other Outside Force Damage-RISER. Business District N, Population Density L	Above-1-2			
Other Outside Force Damage-MSA. Business District Y, Population Density L	Above-2-3	27.41	8228	225,526
Through MSA-Reg_Station. Business District None, Population Density None	Above-2-3			
Other Outside Force Damage-RISER. Business District Y, Population Density L	Above-2-3			
Overpressure Leak-Reg_Station. Business District None, Population Density None	Above-2-3			
Other Cause-MSA. Business District N, Population Density H	Above-2-4	380.88	467	178,002
Pipe, Weld, or Joint Failure-MSA. Business District N, Population Density L	Above-2-4			
Pipe, Weld, or Joint Failure-MSA. Business District Y, Population Density L	Above-2-4			
Corrosion-RISER. Business District Y, Population Density L	Above-2-4			



2025 Risk Assessment Mitigation Phase

(Chapter SDG&E-Risk-4)

Wildfire and PSPS

May 15, 2025

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I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or Company) risk control and mitigation plan for the Wildfire and Public Safety Power Shutoff (PSPS) Risk. This chapter contains information and analysis for this risk that meets the requirements of the California Public Utilities Commission's (CPUC or Commission) Risk-Based Decision-Making Framework (RDF),[1] including the requirements adopted in Decision (D.) 22-12-027 (the Phase 2 Decision) and D.24-05-064 (the Phase 3 Decision). The Wildfire and PSPS Risk is included in this 2025 RAMP report based on a safety risk assessment, further informed by its reliability and financial consequence attributes, consistent with RDF guidance.

This risk chapter describes the basis for selection of the Wildfire and PSPS Risk, controls and/or mitigations to reduce the likelihood and consequence of utility related wildfires and mitigate the impacts of PSPS de-energization events in SDG&E's service territory, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter presents cost and unit forecasts for the risk mitigating activities but does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk-reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation, consistent with the method and process prescribed in the RDF.

In accordance with California Public Utilities (Pub. Util.) Code Section (§) 8386(a), SDG&E constructs, maintains, and operates its electric system in a manner that minimizes the risk of catastrophic wildfire posed by its electric power lines and equipment. Additionally, pursuant to Pub. Util. § 8386(b), SDG&E prepares and submits a Base Wildfire Mitigation Plan (WMP) every three years detailing its preventive strategies and programs, and updates those plans annually. Building on over 15 years of wildfire prevention and mitigation work, SDG&E's 2026-2028 Base WMP[2] continues to focus on reducing wildfire risk and reducing the impact of

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[1] As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A.15-05-002 et al. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

[2] SDG&E's 2026-2028 Wildfire Mitigation Plan (May 2, 2025) (2026-2028 Base WMP), available at https://www.sdge.com/2026-2028-wildfire-mitigation-plan.

PSPS de-energizations on customers.

The risk discussion and quantification presented in this chapter incorporates risk modeling requirements from the Phase 2 and Phase 3 Decisions and the 2026-2028 Wildfire Mitigation Plan Technical Guidelines, as well as additional requirements established by the Office of Energy Infrastructure Safety (Energy Safety) in approving SDG&E's annual WMPs and updates. These include calculating risk scores using maximum consequence values, incorporating extreme weather scenarios into planning models, and implementing third-party recommendations for model improvements. SDG&E's risk framework is used to obtain segment risk ranking, segment CBR analysis, and portfolio analysis. It is used to support investment decisions, including grid hardening initiatives in the High Fire Threat District (HFTD).

In addition to optimizing risk reduction, SDG&E works to align with RAMP and WMP guidelines when developing its long-term wildfire mitigation strategy.[3] To further promote cost-efficient and risk informed investment, SDG&E has enhanced its wildfire risk model, WiNGS-Planning, by incorporating risk-quantification requirements that yield a comprehensive and optimized strategy aligned with the above guidelines. The supporting workpapers for this chapter are also consistent with SDG&E's resulting long-term strategy to mitigate Wildfire and PSPS Risk.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SDG&E's Wildfire Risk is defined as the risk of catastrophic wildfire, initiated by SDG&E equipment, whether through normal operation or failure, that may pose an immediate threat to the communities, the environment, and overall safety resulting in fatalities, widespread property destruction, and a multi-billion-dollar liability. SDG&E defines the PSPS Risk as the risk created from proactive de-energization of infrastructure during extreme fire weather conditions, which can result in negative impacts on customers and communities.

The California Legislature has found that "[t]he increased risk of catastrophic wildfires poses an immediate threat to communities and properties throughout the state,"[4] and "[t]he state

[3] SDG&E is exploring whether to develop an Electrical Undergrounding Plan (EUP) pursuant to Pub. Util. Code section 8388.5 and thus must also include consideration of the EUP guidelines.

[4] Assembly Bill (AB) 1054 (2019-2020), Section 1(a)(1).

has dramatically increased investment in wildfire prevention and response, which must be matched by increased efforts of the electrical corporations."[5] SDG&E's wildfire mitigation efforts are consistent with the mandates of Pub. Util. Code Section 8386, Senate Bill (SB) 901, and AB 1054.

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF requirements, such as General Order (GO) 95, GO 165, FAC-501-WECC, Pub. Util. Code § 451, FAC-003-4, the Migratory Bird Treaty Act, and the Bald and Golden Eagle Protection act. A list of compliance requirements applicable to Wildfire and PSPS Risk is provided in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction calculated under the RDF, such as enhancing operations, enhancing SDG&E's community relationships and partnerships, and preparing for future capacity needs (such as driven by electrification or climate impacts).

2. Risk Overview

SDG&E's service territory is frequently impacted by Santa Ana winds, which have been directly linked to the most significant and devastating wildfires in Southern California, including the recent Los Angeles wildfires in January 2025. These strong offshore winds bring in extremely low humidity and anomalously high temperatures, leading to critically low moisture levels in dry vegetation fuels (such as grasses, shrubs, and trees) and creating highly flammable conditions that significantly increase the risk of catastrophic wildfires. The increased wildfire risk during these extreme fire weather conditions can result in frequent PSPS de-energization events, which are implemented to prevent utility-related ignitions.

In January 2025, SDG&E's service territory experienced multiple waves of extreme Santa Ana winds over a three-week period, with wind gusts exceeding 100 miles per hour, critically low humidity levels, and unprecedented lack of rain in the Southern California region. San Diego County experienced the driest start to the rainy season in the 174 years records have been kept. In response to these threatening wildfire-weather conditions, SDG&E activated its Emergency Operations Center, where it utilized 223 of the nation's most sophisticated weather monitoring stations to continuously track wind speeds and fire weather conditions, helping to make informed and targeted decisions about communities at risk. Wind speeds in the county

[5] AB 1054, Section 2(a).

reached record highs, with 62 of SDG&E's weather monitoring stations exceeding wind-gust records across the territory. PSPS de-energizations were implemented as a crucial last resort wildfire prevention measure in response to unprecedented weather conditions that led to prolonged high-fire risk. These measures were essential for safeguarding lives, property, and entire communities during times of extreme fire risk.

B. Risk Scope

In D.17-12-024,[6] the Commission established the HFTD, defining areas that have a greater potential for wildfires. The HFTD consists of Tier 2 areas, "where there is an elevated risk for destructive utility-associated wildfires," and Tier 3 areas, "where there is an extreme risk for destructive utility-associated wildfires."[7] Approximately 64% of the service territory is in the HFTD. As described in this chapter, the majority of SDG&E's wildfire mitigation initiatives are aimed at risk reduction in the HFTD, however, SDG&E employs some risk mitigation efforts across the service territory, such as vegetation management, and certain mitigations are implemented in a risk-informed manner in non-HFTD areas, such as the Wildland Urban Interface (WUI).

The scope of this chapter includes wildfires that meet the CPUC Fire Incident Data Collection requirements for reporting. In accordance with D.14-02-015,[8] a wildfire must be reported if all three of the following criteria are met:

- A self-propagating fire of material other than electrical and/or communication facilities;
- The resulting fire traveled greater than one linear meter from the ignition point; and
- The utility has knowledge that the fire occurred.

The impacts of PSPS de-energizations to customers during extreme fire weather conditions, and de-energizations caused by Protective Equipment Device Settings (PEDS) are also included in the scope of the overall risk assessment.

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6 D.17-12-024 at 2-3.

7 D.17-12-024 at 2.

8 D.14-02-015, Appendix C at C-3.

C. Data Sources Used in Quantifying Risk Estimates[9]

SDG&E utilized internal data sources to determine a Wildfire and PSPS Risk Pre-Mitigation Risk Value and calculate risk reduction estimates for mitigation activities (which enables estimation of Post-Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used and adjusted to account for the risk characteristics associated with the Company's specific operating locations and service territory to establish a baseline of risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of the Wildfire and PSPS Risk, including SDG&E's risk Bow Tie, which delineates potential Drivers/Triggers and Potential Consequences, followed by a description of the Tranches determined for this risk.

A. Risk Selection

Wildfire and PSPS were identified as a risk in SDG&E's 2021 RAMP and included in the Enterprise Risk Registry (ERR)[10] for 2022, 2023, and 2024. SDG&E's ERR evaluation and selection process is summarized in Chapter RAMP-2, Enterprise Risk Management Framework and in Chapter RAMP-3: Risk Quantification Framework.

SDG&E selected this risk in accordance with the RDF Row 9.[11] Specifically, SDG&E assessed the top risks from the Company's 2024 ERR based on the Consequence of a Risk Event (CoRE) Safety attribute. The Wildfire and PSPS Risk was among the risks presented in SDG&E's list of Preliminary 2025 RAMP Risks on December 17, 2024 at a Pre-Filing Workshop. The Wildfire and PSPS Risk was selected based on the qualification of its Safety risk attribute, as required under the RDF. At the pre-filing workshop, no party expressed opposition to the inclusion of this risk in SDG&E's 2025 RAMP Report.

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[9] Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

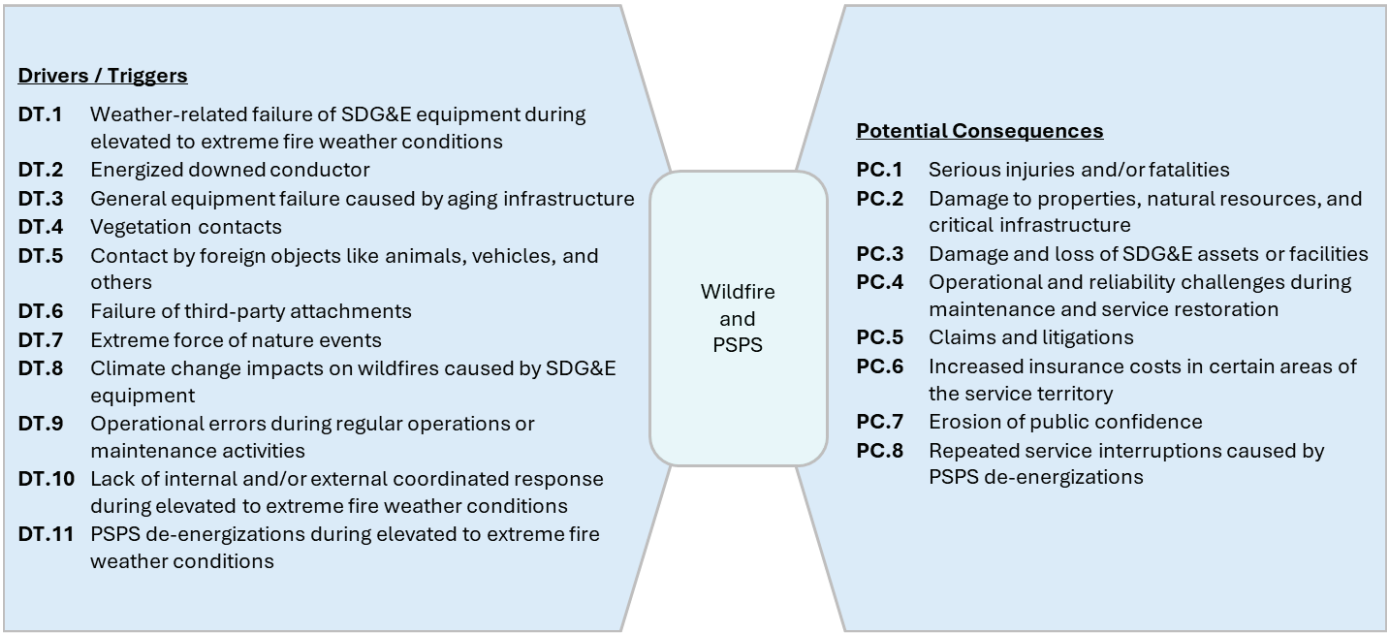
[10] In the 2021 RAMP Report this risk was called Wildfire Involving SDG&E Equipment. The risk definition and elements are unchanged.

[11] D.24-05-064, RDF Row 9 states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars."

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the risk Bow Tie, possible Drivers, Potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that addresses it.[12] As illustrated in the risk Bow Tie shown in Figure 1, the Risk Event (center of the Bow Tie) is a wildfire involving SDG&E equipment that could lead to fatalities, widespread property destruction, and a multi-billion-dollar liability. Additionally, repeated service interruptions caused by PSPS or PEDS de-energization events during fire-weather conditions can result in significant disruption, economic losses, and adverse impacts on community well-being. The left side of the Bow Tie illustrates Drivers/Triggers, and the right side shows the Potential Consequences. SDG&E applies this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to the addressed elements of the risk Bow Tie is provided in Attachment C.

Figure 1: Wildfire and PSPS: Risk Bow Tie



C. Potential Risk Event Drivers/Triggers[13]

When performing a risk assessment for the Wildfire and PSPS Risk, SDG&E identifies potential leading indicators, referred to as Drivers or Triggers, that reflect expected and/or

[12] D.24-05-064, RDF Row 15.

[13] Potential risk event Drivers/Triggers refer to an indication that a risk could occur. They may not reflect actual conditions.

forecasted conditions and may include both external actions as well as characteristics inherent to the asset.[14] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1: Weather-related failure of SDG&E equipment during elevated to extreme fire weather conditions**: Weather plays a large part in the potential failure of SDG&E equipment. Excessive wind, lightning, and exposure to weather over time can degrade the integrity of the electrical components and lead to failure of one or more of the electrical parts, causing a failure of the conductor.
- **DT.2: Energized downed conductor**: A downed conductor (or "wire down") occurs when a conductor drops or breaks from its designed location on a pole and cross arm and ends up on the ground, sometimes in energized mode. A wire down can result from a variety of factors, many of which are outside of SDG&E's control.
- **DT.3: General equipment failure caused by aging infrastructure**: General equipment failure, due to age, can be a source of ignition. Failure of components such as connectors, hot line clamps, and insulators can result in wire failure and end up in a wire down situation, sometimes in energized mode. Other equipment failures can also spark ignitions regardless of whether they lead to wire-down situations.
- **DT.4: Vegetation contact**: During storms and severe wind events, branches are shed by trees in the vicinity of SDG&E facilities. These can fall on conductors, leading to conductor failure or, in the case of palm fronds or other small branches, phase-to-phase contact and a cascade of sparks. In addition, trees that are many feet away from an energized conductor can uproot and fall on the conductor, causing pole and equipment damage, line failure, or sparking.
- **DT.5: Contact by foreign objects like animals, vehicles and other foreign objects**: Foreign objects coming into contact with SDG&E's facilities can also present sources of ignition. For example, Mylar balloons are highly conductive and can cause phase-to-phase faulting on contact, which can cause the conductor

[14] D.24-05-064, RDF Row 10-11.

to fail and land in energized mode, causing arcing and sparking in dry conditions. In addition, vehicular contact can bring down conductors and sometimes the entire pole, resulting in conductors laying on the ground in an energized mode.

- **DT.6: Failure of third-party attachments:** As mandated by the CPUC, SDG&E must allow communication infrastructure providers to attach to utility poles when space is available. These providers might not properly install or inspect their equipment, which can lead to third-party attachment contact with the electrical facilities, leading to fire-related incidents.
- **DT.7: Extreme force of nature events**: SDG&E's overhead electrical facilities are fully exposed to the elements. Significant weather and wind-related events can cause a variety of problems related to equipment failure and downed conductors. Also, continual exposure to natural elements can degrade or weaken key components, which may not be found until the following scheduled inspection and repair cycle.
- **DT.8: Climate change impacts on wildfires caused by SDG&E equipment:** Despite SDG&E's proactive approach to mitigating wildfire risk, expected increases in temperature in the decades to come will likely lead to high-risk fire areas expanding from the foothills and mountains into the lower elevation coastal canyons and wildland urban interfaces. Prolonged periods of drought increase the risk of wildfires occurring, potentially extending the focus of SDG&E's threat monitoring and response efforts. This could lead to more frequent PSPS de-energizations, shifting from primarily dry fall months to more of a year-round concern. The greatest threat would be when conditions are typically driest and most conducive to wildfire outbreaks. These changes in climate trends have already been realized across the region, culminating in a previously unseen wildfire outbreak across coastal San Diego County in May of 2014. Based on the most recent climate change projections, as discussed in the latest Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (AR6), these trends are likely to continue and worsen into the future.[15]

[15] IPCC, Sixth Assessment Report (March 2023), available at https://www.ipcc.ch/assessment-report/ar6/.

- **DT.9: Operational errors during regular operations or maintenance activities**: Operational errors during operations and maintenance activities can lead to switching errors that can cause outages or equipment damage; failing to perform regular inspections or incorrect installation can lead to equipment failure and damage; and non-compliance with standards and insufficient training for personnel can lead to errors in operations and maintenance activities.
- **DT.10: Lack of internal or external coordinated response during elevated to extreme fire weather conditions**: A well-coordinated response to electric utility incidents, such as downed conductors, is crucial for ensuring safety and minimizing damage. Effective coordination can facilitate the suppression of fires and the safe de-energization of electrical equipment, thereby reducing the risk of electrical exposure to first responders and the public. Additionally, it can help prevent the escalation of incidents, leading to more efficient and timely resolutions. Lack of coordination could lead to uncontrolled fires during extreme wind conditions, increasing the risk of widespread damage and posing significant threats to public safety.
- **DT.11: PSPS de-energization during elevated to extreme fire weather conditions:** Operational wildfire risk mitigations such as PSPS de-energizations are implemented during elevated to extreme fire weather conditions. While PSPS de-energizations and other operational mitigations have proven effective, as evidenced by the fact that no significant wildfires have been caused by SDG&E's system since 2007, the inherent wildfire risk remains in the grid and PSPS de-energizations continue to impact SDG&E communities.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed to the right side of the risk Bow Tie provided in Figure 1. SDG&E identifies the Potential Consequences of Wildfire and PSPS Risk by analyzing internal data sources, where available, industry data, and subject matter expertise.[16] These Bow Tie Consequences inform the CoRE component of the risk value. If one or more of the Drivers/Triggers listed above were to result in an incident, the Potential Consequences, in a

[16] D.24-05-064, RDF Row 10.

plausible worst-case scenario, could include:

- **PC.1:** Serious injuries and/or fatalities
- **PC.2:** Damage to properties, natural resources, and critical infrastructure
- **PC.3:** Damage and loss of SDG&E assets or facilities
- **PC.4:** Operational and reliability challenges during maintenance and service restoration
- **PC.5:** Claims and litigations
- **PC.6:** Increased insurance costs in certain areas of the service territory
- **PC.7:** Erosion of public confidence
- **PC.8:** Repeated service interruptions caused by PSPS de-energizations

SDG&E used these Potential Consequences to score the Wildfire and PSPS Risk in developing its 2024 ERR.

E. Evolution of Risk Drivers and Consequences

As specified in the Phase 3 Decision,[17] the following changes to the previous ERR and/or the 2021 RAMP include:

- Inclusion of the PSPS Risk: Risk created from proactively shutting off power to SDG&E customers during extreme fire weather conditions.
- One additional driver/trigger (DT) as well as two potential consequences (PCs) were added to the bow tie depicted in Figure 1 that were not listed in the 2021 RAMP bow tie as follows:

1. Changes to Drivers/Triggers of the Risk Bow Tie

- Added DT.11: PSPS de-energizations during elevated to extreme fire weather conditions

2. Changes to Potential Consequences of the Risk Bow Tie

- Added PC.6: Increased insurance costs in certain areas of the service territory
- Added PC.8: Repeated service interruptions caused by PSPS de-energizations

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and in accordance with Row 14 of the RDF, SDG&E applied the Homogeneous Tranching

[17] D.24-05-064, RDF Row 8.

Methodology (HTM) as outlined in Chapter RAMP-3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:

Table 1: Wildfire and PSPS
Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches HTM
Non-HFTD	3,913 (feeder - segments)	20
HFTD (Tier-2)	472 (feeder-segments)	22
HFTD (Tier-3)	308 (feeder-segments)	22

Attachment D illustrates the derivation of the Tranches, as shown in Table 1 above, in accordance with the HTM. The classes were identified by SDG&E as logical groups of assets and systems based on the Company's operations. These classes also align risk treatments with asset risk profiles reflective of SDG&E's operations. More detailed Tranche information, including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches, is provided in workpapers.

III. PRE-MITIGATION RISK VALUE

In accordance with the RDF Row 19, Table 2 provides the pre-mitigation risk values for the Wildfire and PSPS Risk. Further details, including pre-mitigation risk values by tranche, are provided in workpapers. Explanations of the risk quantification methodology and other higher-level assumptions are provided in Chapter RAMP-3: Risk Quantification Framework.

Table 2: Wildfire and PSPS
Monetized Risk Values
(Direct, in 2024 $ millions)

Risk Aversion	LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]	
		Safety	Reliability	Financial			
Scaled Risk Values	127.02	$1.60	$1.08	$21.10	$23.78	$	3,020.61
Unscaled Risk Values	127.02	$0.47	$1.04	$2.24	$3.75	$	476.42

A. Risk Value Methodology

SDG&E's risk modeling for the Wildfire and PSPS Risk follows RDF guidance[18] for implementing a Cost Benefit Approach, as described below:

1. **Cost Benefit Approach Principle 1 – Attribute Hierarchy (RDF Row 2):** Wildfire and PSPS Risk is quantified in a combined attribute hierarchy as shown in Table 2, such that Safety, Reliability, and Financial are presented based on available, observable and measurable data.
2. **Cost Benefit Approach Principle 2-Measured Observations (RDF Row 3):** Wildfire and PSPS Risk used observable and measurable data in the estimation of CoRE values. SDG&E utilized actual location and number of electrical outages to estimate the likelihood of a wildfire risk event and Technosylva's wildfire modeling software FireSight™[19]to estimate potential ignition size (acres burned) and impact (buildings destroyed) both at and around asset locations within the service territory. This model incorporates historical weather variables, detailed fuel layers, and a 24-hour unsuppressed fire spread model. For PSPS and PEDS, SDG&E utilizes historical customer counts and outage duration records.[20]
3. **Cost Benefit Approach Principle 3-Comparison (RDF Row 4):** Wildfire and PSPS Risk utilized proxy data as provided by various sources including, but not

[18] D.24-05-064, RDF Rows 2-7.

[19] Technosylva, FireSight™, available at https://technosylva.com/products/wildfire-analyst/firesight/.

[20] *See* Chapter RAMP-3: Risk Quantification Framework and Appendix B: Wildfire and PSPS - Reference Material for Quantitative Analyses.

limited to, the Federal per diem[21] rates applicable to San Diego, CA to estimate the potential financial loss experienced by customers affected by a PSPS de-energization event.

4. **Cost Benefit Approach Principle 4-Risk Assessment (RDF Row 5):** SDG&E's Wildfire Consequence model employs a Generalized Pareto Distribution (GPD, a type of Power Law distribution), with a maximum value (truncated), to inform the expected values and tail values of simulated wildfire economic losses. Additionally, SDG&E uses Monte Carlo simulations to estimate the likelihood and Consequences of Wildfire Risk events across every feeder segment within its service territory. This comprehensive approach accurately represents both common and extreme wildfire events and enhances the precision of risk assessments to inform effective mitigation strategies.[22]

5. **Cost Benefit Approach Principle 5-Monetized Levels of Attributes (RDF Row 6):** In accordance with D.22-12-027 and D.24-05-064, RDF Row 6, SoCalGas and SDG&E used a California-adjusted Department of Transportation monetized equivalent to calculate the Safety CoRE attribute at a monetized equivalent of $16.2 million per fatality, $4.1 million per serious injury, and $49 thousand for minor injury;[23] the Electric Reliability CoRE attribute is valued at a monetized equivalent of $3.76 per CMI; and the Financial CoRE attribute is valued at $1 per dollar.[24]

Further information regarding SDG&E's quantitative risk analyses, including raw data, calculations, and technical references are provided in workpapers.

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[21] FederalPay.org, San Diego, California Per Diem Rates for FY 2024, available at https://www.federalpay.org/perdiem/2024/california/san-diego .

[22] *See* Section III.B, *infra*.

[23] *See* D.22-12-027 at 35 ("We adopt Staff's recommendation to require a dollar valuation of the Safety Attribute in the Cost-Benefit Approach in the RDF using the DOT VSL as the standard value.").

[24] *See* Chapter RAMP-3: Risk Quantification Framework, Section II.

6. Cost Benefit Approach Principle 6-Adjusted Attribute Level (Row 7):

Table 3: Wildfire and PSPS
Risk Scaled vs Unscaled Value by CoRE Attribute
(Direct, in 2024 $ millions)

Risk Aversion	Safety	Reliability	Financial	Total
Scaled Risk Values	$ 1.60	$ 1.08	$ 21.10	$ 23.78
Unscaled Risk Values	$ 0.47	$ 1.04	$ 2.24	$ 3.75

The values in Table 3 above are the result of SDG&E applying the risk scaling methodology described in Chapter RAMP-3: Risk Quantification Framework to the CoRE attributes for the Wildfire and PSPS Risk. Further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply, is provided in Chapter-RAMP-3: Risk Quantification Framework.

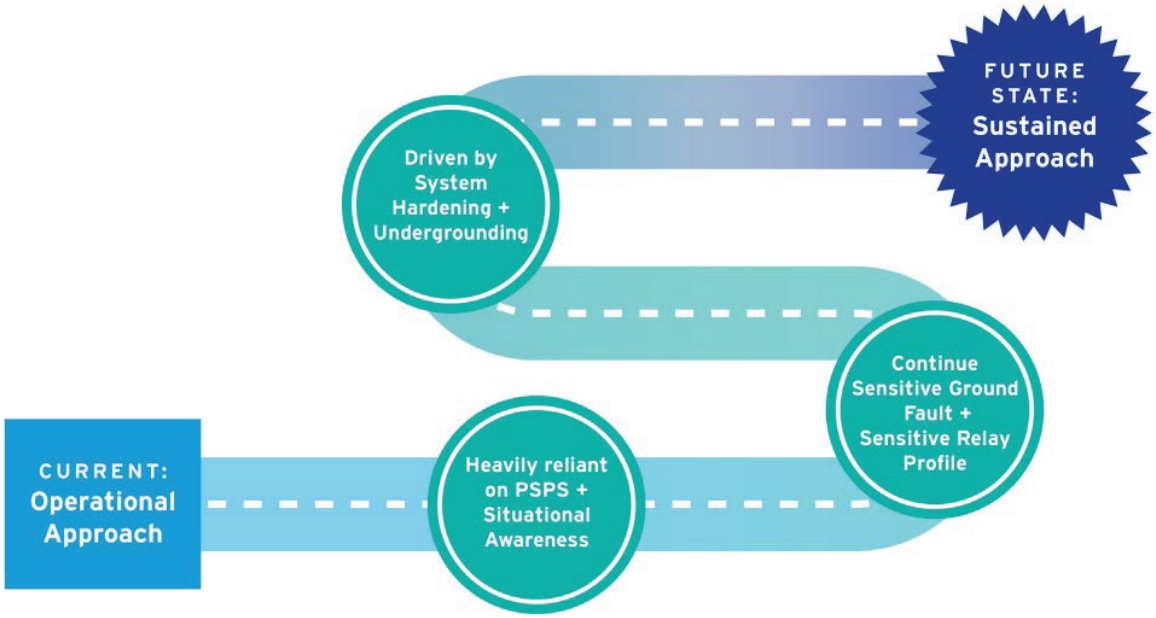
B. Wildfire, PSPS and PEDS Risk Methodology

To enhance system resilience, reduce wildfire risks, and minimize customer disruptions during extreme fire weather conditions, SDG&E developed a comprehensive strategy to identify and mitigate ignition risks. Using a data-driven, risk-based approach, SDG&E identifies, quantifies, and implements tailored mitigation strategies for each location within its service territory, with additional focus on the HFTD. This includes the implementation of systemic risk reduction measures, such as deploying covered conductor and strategic undergrounding, to enhance system resilience, as well as operational risk reduction measures such as inspections, vegetation management, and emergency operations. Additionally, SDG&E performs proactive PSPS during extreme fire weather conditions to further safeguard communities.

SDG&E's long-term wildfire mitigation strategy seeks to transform from an operations-dependent approach of managing Wildfire and PSPS Risk into a sustained approach of targeted, risk-based, and sustained systemic Wildfire and PSPS Risk reduction efforts. The operational approach includes mitigations such as PSPS de-energizations, asset inspections, vegetation management, and other interim grid hardening programs that enable grid monitoring and well-informed situational awareness. A sustained systemic approach includes risk-informed grid hardening programs, such as Strategic Undergrounding and Combined Covered Conductor, that provide a higher level of sustained wildfire risk reduction by mitigating against primary risk

Drivers and reducing the scale, scope, and frequency of PSPS de-energizations without introducing other reliability risks.

Figure 2: Long-Term Risk Reduction Approach



SDG&E continues to enhance its analytics capabilities and improve its risk models to better inform both operational and long-term grid-hardening investment decisions. In alignment with the methodologies and quantifications presented in the 2026-2028 Base WMP,[25] SDG&E's risk assessments adhere to the RDF Framework and Energy Safety's latest modeling requirements, and intervenor and stakeholder feedback is captured where reasonable and possible. Additionally, SDG&E's risk modeling framework provides consistent, transparent, and auditable results to support effective decision-making and strategic planning for wildfire and PSPS risk mitigation. At a high level, SDG&E has expanded its WiNGS-Planning model to accommodate the Cost-Benefit Framework required for the 2025 RAMP filing. This transformation enables a probabilistic framework that quantifies Wildfire, PSPS, and PEDS Risk, as defined below, at the conductor-span level, capturing segment-specific criteria such as weather conditions, customer demographics, asset attributes, and event-specific assumptions.

[25] 2026-2028 Base WMP.

Wildfire Risk: The total annualized impacts from ignitions caused by SDG&E's electrical asset at a specific location for both the expected value (EV) and select percentiles (tail values).

PSPS Risk: The total annualized impacts from a PSPS de-energization at a specific location for both the expected value (EV) and select percentiles (tail values). PSPS Risk is significantly influenced by the topology of the circuit feeder segment and its association with weather stations. Additionally, the number and type of customers, enterprise assumptions, and de-energization-specific assumptions also play crucial roles in determining the risk.

PEDS Risk: The total annualized impacts from Protective Equipment and Device Settings (PEDS) at a specific location for both the EV and select percentiles (tail values). These settings are enabled to minimize or eliminate the chance of an ignition in the event of a fault on electric lines. SDG&E reviews and adjusts these settings annually to improve reliability where possible.

This framework allows SDG&E to evaluate pre-mitigated risk baselines, post-mitigated residual risk levels, cost effectiveness, and tail risk events, and incorporate societal risk aversion into its mitigation selection.

The ongoing risk modeling improvement plan includes an assessment of additional factors such as climate vulnerability and a more detailed analysis of risk Drivers. Furthermore, enhancements to modeling design and architecture are in progress to facilitate the tracking and validation of various model risk components, establish a formalized process for independent reviews, and expand the use of models to inform the selection and prioritization of mitigation initiatives beyond the installation of combined covered conductor and the undergrounding of electric lines.

1. WiNGS-Planning Model

The WiNGS-Planning model calculates Wildfire, PSPS, and PEDS Risks that are incorporated into the overall wildfire and outage program risk components. It was developed to assist in allocating grid hardening initiatives—namely Covered Conductor and Strategic Undergrounding—across the HFTD by evaluating the expected risk and cost of available measures. The primary objective of the WiNGS-Planning model is to identify durable, cost-effective mitigations that reduce wildfire risk and minimize the impacts of PSPS de-

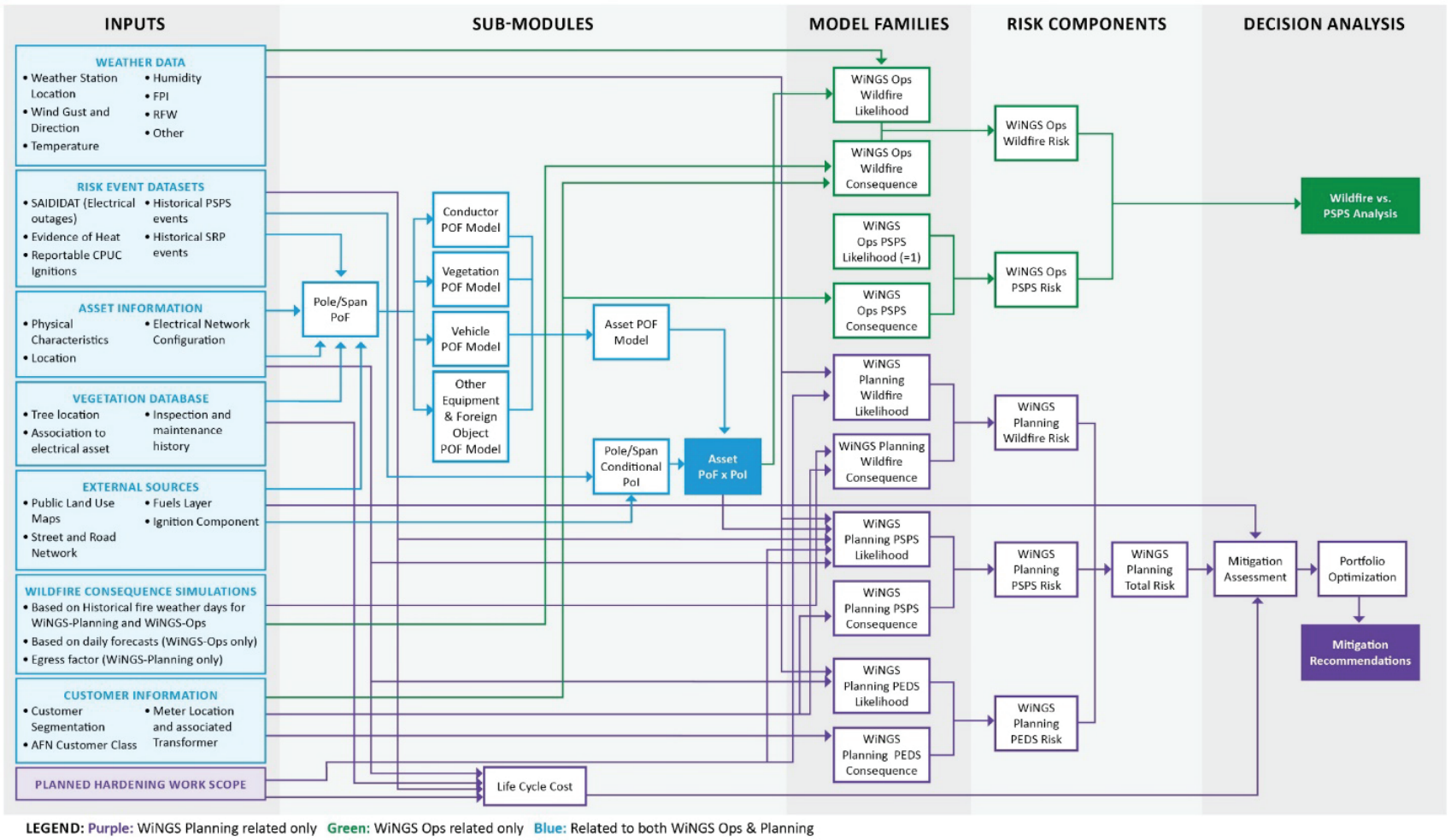
energizations and PEDS-driven outages for SDG&E's customers.

The WiNGS-Planning risk framework has been modified to align with the Cost-Benefit Framework developed for the 2025 RAMP filing.[26] It evaluates risk as a probability distribution of estimated costs at the conductor-span level, which is then aggregated to the feeder-segment level for decision optimization in grid-hardening mitigation selections. The model's output guides investment decisions by performing a cost-benefit analysis for strategic undergrounding and combined cover conductor mitigations.

The risk calculation process for the WiNGS-Planning models is described in Figure 3.

[26] D.22-12-027; D.24-05-064; 2026-2028 Base WMP.

Figure 3: WiNGS Planning Calculation Schematic



LEGEND: Purple: WiNGS Planning related only Green: WiNGS Ops related only Blue: Related to both WiNGS Ops & Planning

WiNGS-Planning utilizes statistical and machine learning models developed with historical electrical outage and ignition data and correlated with historical asset characteristics, vegetation, site-specific conditions, and weather conditions to capture the influence of wind gust and wind direction variables at the time of the outage or ignition. By analyzing these correlations and the influence of other variables, insights into the probability of failure and probability of ignition across various wind gust scenarios can be determined and combined with consequence quantifications to consider the potential impacts of an outage or ignition event. This comprehensive approach allows for an optimized assessment of risk by integrating both the probability of occurrence and the severity of consequences.

The model's risk event probability distributions, developed from a Monte Carlo-based framework, also allow for the simulation of various scenarios of grid hardening initiatives to assess the expected risk reduction at each feeder-segment within the service territory.

The models are trained on a decade of historical records and predict the probability of failure and ignition using 2 years of historical weather and fuels data from the weather station network. Failure and ignition rates are calculated at the pole and span level under diverse weather and fuel conditions, offering a comprehensive overview of potential outcomes. Model outputs are reviewed by risk data scientists, Fire Coordination, Meteorology, and Engineering experts in order to validate the models and identify future improvements.

Several models and sub-models provide insights into Wildfire and PSPS Risk during fire weather conditions to inform PSPS de-energization and long-term grid hardening decisions. These model families integrate numerous inputs across weather, asset, customer information, event-specific assumptions, and other external source data categories, as shown in Figure 3. Models include:

- Likelihood of Failure-and-Ignition Models: Estimate the likelihood of span- and pole-based ignitions based on fault drivers.
- Likelihood of a PSPS de-energization Models: Estimates the likelihood of a disrupted PSPS de-energization based on weather station historical wind gust frequency.
- Likelihood of a PEDS de-energization Model: Estimates the likelihood of an electrical outage caused by enabling PEDS.
- Wildfire Consequence Models: Utilizes simulations of potential wildfire impacts in the service territory based on historical fire weather and forecasted weather conditions.

- PSPS and PEDS Consequence Models: Utilize historical data, subject matter expert assumptions, and the Cost-Benefit Framework to assess the Potential Consequences of utility outages for each Supervisory Control and Data Acquisition (SCADA) sectionalizing device in the HFTD.

2. Data Sources

The WiNGS-Planning model utilizes a comprehensive array of data sources[27] to assess Wildfire, PSPS, and PEDS Risks effectively. It incorporates historical electrical outage and ignition data, including CPUC-reportable ignitions[28] and non-reportable ignitions. These two sets of data are collected from Fire Coordination and District Engineers and are used by subject matter experts to identify patterns and causes of electrical failures and fires. Detailed information about asset characteristics, such as conductor size, material, and type, is used alongside vegetation data to understand the influence of surrounding conditions on fire risk. Site-specific conditions, including historical weather data, such as wind gusts and directions, temperature, and humidity, are integrated to capture the environmental factors contributing to outages and ignitions. The Wildfire Consequence model leverages data from Technosylva,[29] which assesses and aggregates the potential impacts of wildfires at every pole location for circuit segments.

3. Risk Event Drivers

Wildfire Risk is highly situational and is influenced by numerous variables such as weather conditions, vegetation, situational awareness, and suppression resources. Further, the effect of these variables changes through the conditions of a wildfire. For example, suppression resources have no bearing on failure risk, and their effectiveness in the event of a failure-and-ignition is conditioned on factors such as ignition location, weather, and coincidence of other fires. As such, Wildfire Risk modeling must be much more dynamic than the risk modeling for SDG&E's other RAMP risks. Many risk Drivers are also beyond SDG&E's control, including man-made debris, animal contacts, vehicle incidents, and human activities.

While catastrophic wildfires are infrequent (low probability) events, their potential for significant community and environmental impact highlight the importance of comprehensive risk assessment. Advanced modeling techniques and diverse data sources are therefore utilized to

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27 *See* Attachment B, *infra*.

28 D.14-02-015.

29 Technosylva, FireSight™, available at https://technosylva.com/products/wildfire-analyst/firesight/.

better estimate risk. SDG&E also collaborates with industry experts, academic institutions, and government agencies to continually refine these models. SDG&E has also transitioned risk assessments to a probabilistic framework that estimates the likelihood of the full range of potential risk consequences for each feeder segment. This transition involved enhancing SDG&E's risk assessment tools, improving modeling capabilities to address diverse risk scenarios, performing sensitivity analyses, and evaluating the impact of known extreme events. These improvements result in an optimized long-term strategy designed to enhance public safety and minimize customer disruption to customers during extreme fire weather conditions.

The shift to a probabilistic framework in SDG&E's WiNGS-Planning model aligns with the risk modeling requirements set forth by D.24-05-064,[30] the 2026-2028 Wildfire Mitigation Plan Technical Guidelines[31] and additional requirements established by Energy Safety when approving SDG&E's WMPs.[32] [33]

4. Risk Assessment – Wildfire, PSPS & PEDS

SDG&E's risk assessment framework is built around Wildfire, PSPS, and PEDS Risk models, which are integrated into a comprehensive Monte Carlo simulation covering five million simulated years for every asset. This large-scale simulation produces asset-level risk events, which represent the likelihoods for Wildfire, PSPS and PEDS Risks. The following discussion outlines the key probabilistic factors that influence these likelihoods.

For wildfires, the model leverages ignition probabilities, calculated at the asset level, that are calibrated to match observed annual ignition rates from historical records. When an ignition is simulated, it is assigned a random date drawn from a normal distribution spanning eight years of meteorological data. This date determines the specific weather and fuel conditions for the event, which may result in no consequence or, if conditions align, a consequence derived from Technosylva's fire spread simulations for that location and date's weather conditions.

The PSPS model uses 10 years of meteorological data to determine how often wind

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30 D.24-05-064 at 29-33.

31 SDG&E's 2026-2028 Wildfire Mitigation Plan Technical Guidelines, available at https://energysafety.ca.gov/what-we-do/electrical-infrastructure-safety/wildfire-mitigation-and-safety/wildfire-mitigation-plans/2026-28-wildfire-mitigation-plan-guidelines/.

32 SDG&E's 2023-2025 WMP (March 27, 2023) available at https://efiling.energysafety.ca.gov/eFiling/Getfile.aspx?fileid=56955&shareable=true

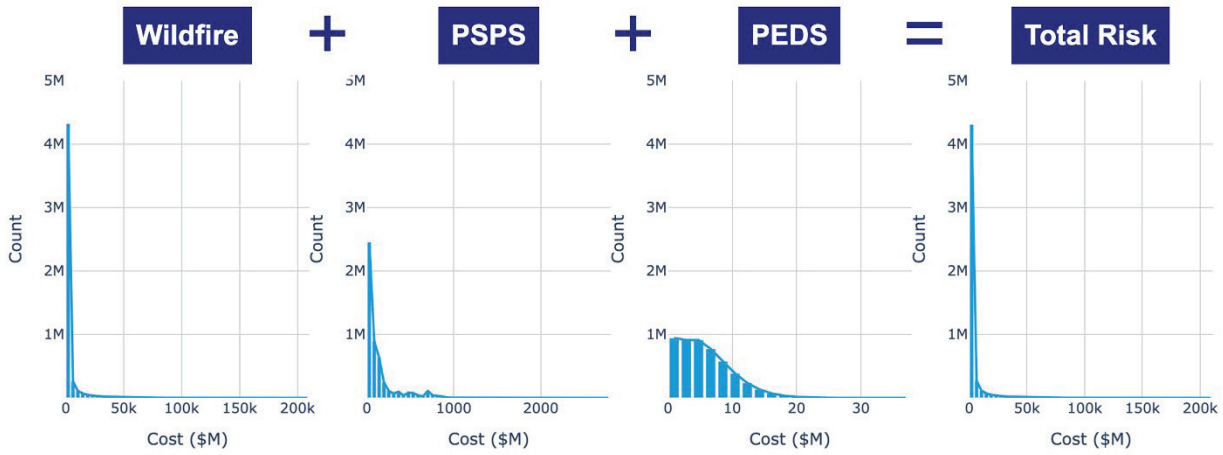
33 *See* 2026-2028 Base WMP at Appendix D: Areas for Continued Improvement.

speeds at each asset's associated weather station exceeded operational alert thresholds. It also accounts for network connectivity. If an upstream asset is unhardened, the risk of de-energization is increased for all downstream assets, whether or not they are hardened. To simulate how PSPS de-energizations unfold, a random value is drawn for each of the high fire days in a simulated year, representing the region-wide wind conditions for that day. All assets whose weather stations exceed their alert thresholds on that day are considered candidates for a PSPS de-energization, mirroring how an Emergency Operations Center (EOC) activation would be triggered during a real de-energization. In line with operational protocols, the model then randomly selects segments representing a number of customers that would be affected by the PSPS de-energization, and these segments are assigned a PSPS cost for that activation. This approach reflects both the physical interconnections of the grid and the practical realities of PSPS operations are reflected in the probability and impact estimates.

The PEDS model uses historical outage data to calculate two statistical distributions: one for the annual frequency of PEDS de-energization and another for the consequence of each event, measured in customer minutes interrupted. For each simulated event, the model samples from the frequency distribution to determine how many PEDS outages would occur and then samples from the consequence distribution to estimate the impact of each event. Because the specific factors that make an asset more likely to cause a PEDS outage are not well understood, these events are assigned randomly to assets throughout the simulation.

Running simulations over a five-million-year time horizon (*e.g.*, five million one-year simulations) was necessary to capture rare-but-consequential events and approach stability in risk estimates. Earlier efforts using 100,000 and 1 million simulated years resulted in material volatility in risk estimates—especially for assets that contained feeder-segments with low likelihoods. By scaling to five million simulated years per asset, the model sufficiently captures infrequent outcomes and supports more stable and representative average annualized risk estimates. However, this scale introduces substantial computational and data management challenges, requiring both high-performance hardware and optimizations in how results are processed, stored, and aggregated while retaining resolution down to the individual asset level. As data availability, modeling best practices, and computational tools continue to advance, SDG&E will be able to further refine these simulations and improve efficiency so that risk estimates remain robust, actionable, and aligned with regulatory expectations.

Figure 4: HFTD Risk Including Risk Aversion Attitude



Once LoRE and CoRE are calculated, Wildfire Risk can be calculated for Wildfire Risk, PSPS Risk, and PEDS Risk:

The Wildfire Risk score is the product of wildfire LoRE and wildfire CoRE

$$WF\ Risk\ =\ WF\ LoRE\ \times\ WF\ CoRE$$

The PSPS Risk score is the product of PSPS LoRE and PSPS CoRE

$$PSPS\ Risk\ =\ PSPS\ LoRE\ \times\ PSPS\ CoRE$$

The PEDS Risk score is the product of PEDS LoRE and PEDS CoRE

$$Overall\ Risk\ =\ WF\ Risk\ +\ PSPS\ Risk\ +\ PEDS\ Risk$$

The Overall Wildfire, PSPS, PEDS Risk is the summation of WF Risk, PSPS Risk, and PEDS Risk.

5. Likelihood of a Risk Event

The LoRE component of WiNGS-Planning leverages a variety of data sources[34] to calculate the likelihood (depicted as a probability distribution) of a risk event occurring in a year. Table 4 summarizes the underlaying statistical, machine learning, and deterministic models utilized in WiNGS-Planning.

[34] *See* Attachment B, *infra*.

Table 4: Likelihood of Risk Event Models

Model Name/ Risk Component	Model Description
Conductor Probability of Failure	This model is a statistical model (log-log regression) that estimates the likelihood and frequency of a conductor failure (*i.e.*, wire down) at every span in the service territory. This model incorporates historical weather conditions, with an emphasis on wind gusts, and correlates these conditions with site-specific factors and asset attributes. This model is designed to support scenario analysis in WiNGS-Planning by predicting historical conductor outages through the input of past weather conditions (backcasting).
Vegetation Probability of Failure	This model is a statistical model (log-log regression) that estimates the likelihood and frequency of a vegetation failure (*i.e.,* tree strike causing a wire down) at every span in the service territory. This model incorporates historical weather conditions, with an emphasis on wind gusts, and correlates these conditions with site-specific factors, asset attributes, and tree inventory data. This model is designed to support scenario analysis in WiNGS-Planning by predicting historical vegetation outages through the input of past weather conditions (backcasting).
Vehicle Contact Probability of Failure	This model is a machine Learning model (XGBoost) that estimates the likelihood of a vehicle contact at the asset location.
Other Equipment & Foreign Object PoF	This is a deterministic model that is used to account for the number of historical outages that do not show a correlation with wind gust conditions or exhibit significant seasonality. This model captures outages resulting from equipment failures that are not related to wind events, such as fuse damages, recloser malfunctions, and transformer issues. It also accounts for outages caused by external forces, including animal interference, balloons, and contact by employees or members of the public. The model also includes random outages due to vandalism, theft, and other unforeseen incidents.
Pole/Span Conditional Probability of Ignition	This model is the annual ignition rate in the HFTD adjusted to account for wind speed, historical tree strikes, vegetation density, asset hardening, and asset health.
Wildfire Likelihood	This model simulates the annual frequency of ignition event occurrences leading to potential wildfires by leveraging probabilistic Probability of Ignition (PoI) values and simulated wind speeds. It is used to help estimate the impact of wildfire risk with the integration with the Wildfire Consequence model.
PSPS Likelihood	This model estimates the probability that a given feeder-segment would be proactively de-energized due to PSPS on a given high-fire day by leveraging historical wind speeds measured at all upstream weather

Model Name/ Risk Component	Model Description
	stations and taking into account the grid-hardening state of the full upstream trace from the given feeder-segment. It also forecasts the number of PSPS de-energizations and leverages the PSPS Consequence attributes to estimate the magnitude of forecasted PSPS de-energizations, including the number of customers de-energized per event.
PEDS Likelihood	This model simulates the annual frequency of PEDS outage impact occurrences in a specific location of the grid.

6. Consequence of a Risk Event

The CoRE is calculated in accordance with the Cost Benefit Framework. Given the occurrence of a risk event (Wildfire, PSPS, or PEDS), this framework is used to estimate the Potential Consequences across the three main attributes (Safety, Reliability, and Financial) to determine a total Consequence value in dollars.

Wildfire Consequence estimations are derived from Technosylva's FireSight™ simulations (also known as WFA-E WRRM). These simulations assess fire behavior at each asset location under historical worst-case fire weather conditions, which is used to devise site-specific mitigation strategies, ensuring that each asset and community is protected based on its unique risk profile and environmental conditions.

In recent years, SDG&E has explored various methods to accurately and comprehensively assess the potential impacts of catastrophic wildfires within its service territory down to the asset-span level. Understanding the potential wildfire consequences under different weather conditions at such a detailed level improves risk assessment, resulting in the development of more effective long-term mitigation strategies, and more informed operational decisions during extreme fire weather conditions.

SDG&E uses a truncated power law distribution model that characterizes wildfire economic losses within its service territory to better understand, predict, and mitigate the impacts of catastrophic wildfires.[35] This methodology is consistent with power law distributions that effectively capture the probability of high-consequence "tail" losses, which are the extreme consequences that occur at the right end of the probability distribution. It is important to include

[35] *See* D.24-05-064 at 54 ("the utility should use a truncated power law distribution to model tail value in wildfire risks, which we consider to be a best practice."); *see also* Findings of Fact 18 and 19.

these rare but highly destructive events in the model in order to determine the most effective long-term investment strategies and operational decisions during extreme fire weather conditions.

SDG&E conducted a comprehensive statistical analysis of historical wildfire records from 2000 to 2023 to assess the financial consequences of wildfire events. Through this analysis, SDG&E determined that a GPD,[36] a type of power law distribution, effectively models the potential economic losses caused by wildfires within its service territory. This study built upon previous research performed by SDG&E that compared the effectiveness of the GPD to the previously utilized Gamma distribution.[37]

SDG&E will review and, if necessary, update its current GPD model using data from the most recent wildfires in Southern California.

Table 5: Return Periods and Expected Financial Losses

#	Return Period [Year]	Probability [%]	Prob. Exceedance [%]	Expected Financial Loss [$B]
0	2	50.00%	50.00%	$ 0.72
1	5	80.00%	20.00%	$ 1.42
2	10	90.00%	10.00%	$ 2.11
3	20	95.00%	5.00%	$ 2.97
4	50	98.00%	2.00%	$ 4.45
5	100	99.00%	1.00%	$ 5.88
6	200	99.50%	0.50%	$ 7.67
7	250	99.60%	0.40%	$ 8.34
8	500	99.80%	0.20%	$ 10.74
9	1000	99.90%	0.10%	$ 13.73
10	max	100.00%	0.00%	$ 25.00

SDG&E's current GPD model indicates an annual average loss (or expected loss per year) of $1.087 billion. A maximum economic loss cap of $25 billion is imposed, which

[36] The following parameters describe the GPD distribution, in millions of dollars, if SciPy Python package is used: Shape parameter (c): 0.31859, loc: 305.34614, and scale: 532.3386, available at https://docs.scipy.org/doc/scipy/reference/generated/scipy.stats.genpareto.html.

[37] A.22-05-015/016, 2024 GRC, Second Revised Prepared Direct Testimony of Gregory S. Flores and R. Scott Pearson (Chapter 2: RAMP to GRC Integration) (June 2023) (Ex. SCG-03-2R-E/SDG&E-03-2R-E) at 9, Appendix B at B-2, B-5, B-10, B-11, and B-16.

represents a realistic estimate of average losses based on historical events and subject matter expertise.

Relying solely on historical estimates to develop mitigation strategies assumes that the worst-case scenario has already occurred within SDG&E's service territory. This approach can be problematic when developing and justifying a long-term hardening strategy, especially one with an assumed lifetime of approximately five decades. A single event like the Witch Fire of 2007, while devastating, may not adequately represent future risks and evolving conditions. Relying on one worst-case instance of wildfire activity to define the existing wildfire risk could underestimate potential future threats. Therefore, a broader range of data must be incorporated, including predictive modeling and climate projections, to result in a comprehensive and resilient wildfire mitigation strategy.

Relying solely on historical data recorded in SDG&E's service territory to develop robust long-term mitigation strategies also introduces bias due to proactive de-energizations (PSPS) that have occurred since 2013. Sole reliance on historical data may also result in wildfire consequence estimates failing to capture the full spectrum of potential outcomes. This limitation is particularly pronounced in regions experiencing extreme fire weather conditions, where evolving environmental factors and escalating wildfire activity could lead to unforeseen scenarios.

To address this known limitation, SDG&E enhanced its Wildfire Consequence model in 2024 by incorporating Technosylva's FireSight™ [38] unsuppressed fire simulations with a 24-hour duration. These simulations are performed at each asset location and consider historical worst-case fire-weather scenarios. By analyzing these conditions, SDG&E estimates the potential size (acres burned) and impact (buildings destroyed) of possible ignitions at each asset. This approach captures detailed site-specific conditions such as wind gusts and directions, fuel layer conditions, and topographical features, providing a comprehensive assessment of wildfire risks.

The transition from an 8-hour to a 24-hour simulation duration is justified by the alignment observed between the GPD model and Technosylva's 24-hour monetized consequence estimates. This alignment is particularly notable for events with return periods below 100 years. Extending the simulation duration to 24 hours allows for a more comprehensive analysis of

[38] Technosylva, FireSight™, available at https://technosylva.com/products/wildfire-analyst/firesight/.

wildfire behavior and impacts, capturing the full progression of fire events over a longer timeframe. This shift not only aligns with SDG&E's GPD, but it also enhances the precision of risk modeling, enabling better-informed decision-making for mitigation strategies and resource allocation.

Table 6: Return Periods and Expected Financial Losses: Comparison of SDG&E's GPD and Technosylva 24-Hour Simulations

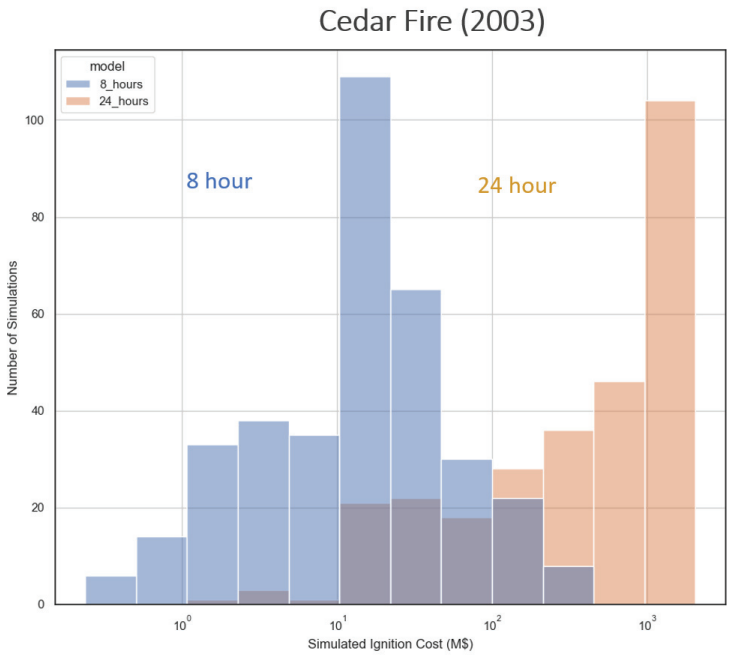
#	Return Period [Year]	Probability [%]	Prob. Exceedance [%]	GPD Expected Financial Loss [$B]	Technosylva 24-hour Expected Financial Loss [$B]
1	20	95.00%	5.00%	$ 2.97	$ 2.51
2	50	98.00%	2.00%	$ 4.45	$ 3.64
3	100	99.00%	1.00%	$ 5.88	$ 4.37
4	200	99.50%	0.50%	$ 7.67	$ 4.99
5	250	99.60%	0.40%	$ 8.34	$ 5.18
6	500	99.80%	0.20%	$ 10.74	$ 5.66
7	1000	99.90%	0.10%	$ 13.73	$ 6.12
8	max	100.00%	0.00%	$ 25.00	$ 10.27
10	AAL	---	---	$ 1.0875	$ 0.6526

SDG&E also compared the monetized values of both Technosylva simulations—8-hour and 24-hour durations—against the two largest wildfires recorded in its service territory under fire-weather conditions: the Cedar Fire (2003) and the Witch Fire (2007). To conduct this analysis, origins of simulated fires were selected from assets located near the starting points of these historical fires and under worst-case fire-weather scenarios. This comparison provided valuable insights into the limitations of the 8-hour simulations, as well as the potential financial impacts and return intervals of similar catastrophic events in both locations.

Figure 5 provides a detailed analysis of the Cedar Fire and Witch Fire, illustrating a histogram with frequency counts (y-axis) of financial impacts on a logarithmic scale (x-axis) for 8-hour and 24-hour Technosylva simulations. This histogram offers a precise visualization of the distribution of simulated financial impacts across varying weather scenarios and simulation durations. Additionally, Figure 5 includes a summary table that presents expected return values at multiple percentiles, specifically focusing on 1-in-10 to 1-in-100-year values. This table delivers a comprehensive analysis of the potential financial consequences of wildfire events in

both locations. Furthermore, Figure 5 references two publicly available sources that provide financial estimates of these significant wildfire events, facilitating a comparison between simulated consequence values and actual historical data. This combined dataset underscores the limitations inherent in the 8-hour simulations and highlights the necessity of incorporating longer-duration simulations for accurate risk assessment and strategic long-term mitigation planning.

Figure 5: Cedar Fire and Witch Fire vs. Technosylva Simulations: Return Intervals and Financial Impacts

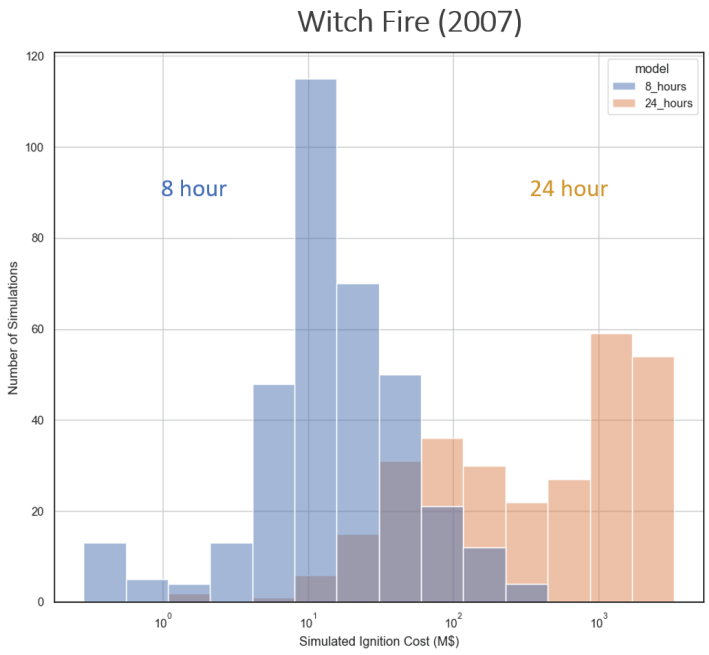


Percentile	Technosylva 8 hour	Technosylva 24 hour
P50	$32	$506
P90	$75	$1,723
P95	$141	$1,785
P98	$224	$1875
P99	$297	$1,990
AAL	$32	$726

Publicly available cost (M$) estimates:

- 2003: $1,331M [1]
- 2025: ~$2,291M

[1] https://en.wikipedia.org/wiki/Cedar_Fire



Percentile	Technosylva 8 hour	Technosylva 24 hour
P50	$14	$399
P90	$61	$2,461
P95	$105	$2,876
P98	$163	$3,087
P99	$220	$3,162
AAL	$28	$857

Publicly available cost (M$) estimates:

- 2007: $1,339M [2]
- 2024: ~$2,031M [2]
- 2025: ~$2,088M

[2] https://en.wikipedia.org/wiki/Witch_Fire

SDG&E is currently collaborating with Technosylva to conduct a sensitivity analysis aimed at evaluating the impact of changing the start and end times of the simulations. Currently, SDG&E uses a midnight-to-midnight simulation period, but to better align with historical peak wind gusts observed during extreme fire weather conditions, SDG&E is evaluating a 6pm-to-6pm simulation period.

Fire weather scenarios used to estimate potential wildfire impacts are evaluated for a selection of 125 days spanning from 2013 to 2021 that represent the worst fire weather days in SDG&E's service territory. The selection of fire weather days is based on the following criteria:

- Historical Data Analysis: Subject matter experts analyze historical weather data from 2013 to 2021 to identify days with extreme fire weather conditions.[39]
- Weather Conditions: Particular attention is given to days with high wind gusts, wind direction, temperature, and humidity levels that contribute to fire risk.
- Asset and Site-Specific Conditions: The conditions of electrical assets and specific site characteristics are considered to understand their vulnerability during extreme weather events.
- FPI: Weather indices such as the FPI are used to quantify and compare fire risk levels on different days.

[39] SDG&E is evaluating the inclusion of days in November 2024 and January 2025 that experienced extreme fire weather conditions.

Technosylva's wildfire modeling incorporates weather variables, detailed fuel layers, and a 24-hour unsuppressed fire spread model to estimate potential ignition size (acres burned) and impact (buildings destroyed) both at and around asset locations within the service territory.

- Safety Attribute: Assumptions for Serious Injuries and Fatalities (SIF) estimates are based on a review of historical wildfire data and are updated when new data is available. To estimate the total number of equivalent fatalities per structure destroyed a 0.00617 factor is assumed. This factor is estimated based on an internal analysis conducted on the CALFIRE dataset. SIFs estimates are translated into monetary values using the methods outlined in Chapter RAMP-3: Risk Quantification Framework.
- Reliability Attribute: Assumptions for Customer Minutes Interrupted (CMI) estimates are derived from a review of historical outage data and are updated as new data becomes available. A 24-hour restoration time is assumed. CMI estimates are translated into monetary values using the methods outlined in Chapter RAMP-3: Risk Quantification Framework.
- Financial Attribute: This attribute is calculated from historical wildfire records (acres burned and structures destroyed). Due to the difficulty of determining the precise financial losses of wildfire events and the lack of a single source of financial impacts from wildfire, subject matter expert assumptions are made when translating acres burned and buildings destroyed into a financial dollar estimate. Wildfire events primarily have costs related to property damage, personal injury or fatality, suppression costs, environmental damage and remediation, lost economic output (including work closures and employee unavailability), and personal relocation.
    - Suppression and restoration cost: $2,350/acres burned[40]
    - Structure destroyed cost: $1,000,000/structure destroyed[41]

Available data is used to approximate financial impacts, and assumptions will continue to be modified as new information becomes available. In addition, partnerships with industry leader companies and academic institutions will continue to better estimate the financial impact of a catastrophic wildfire in SDG&E's communities.

7. Extreme Events and Climate

SDG&E is currently evaluating various approaches to model future wildfire risk, with a

[40] Subject matter expert assumption based on a review of CALFIRE suppression costs incurred from 2000 to 2023. Data for 2024 and 2025, which would include the recent fires in Los Angeles, is not included as suppression costs for these incidents were not available as of February 2025.

[41] Subject matter expert assumption based on a review of publicly available data on the median listing home price in San Diego County as of February 2025.

focus on the projected potential increase in acres burned compared to historical records. By identifying this increase, SDG&E can efficiently update its WiNGS-Planning modeling framework and estimate future wildfire risk scenarios. To project future acres burned, SDG&E is evaluating and testing the model developed by the U.S. Forest Service, as discussed in Prestemon et al. (2022),[42] which predicts monthly area burned in acres for each US Forest Service Region using pseudo-Poisson maximum likelihood models.[43] Forest Service Region 5 comprises federal lands in California, Hawaii, and the U.S. Affiliated Pacific Islands,[44] but Prestemon et al. (2022) specify that the area burned models are for regions of the continental United States (CONUS).[45] Thus, the following area burned model from Prestemon et al. (2022) can be applied to federal lands in California:[46]

$$\text{Acres } burned = e^{708-123lnT_{max}+8.4lnVPD}$$

where *Acres burned* is the monthly area burned in acres, T_{max} is the monthly average of the daily maximum temperature in degrees Kelvin, VPD is the monthly average of the daily average vapor pressure deficit (VPD), and the coefficients are those evaluated by Prestemon et al. (2022) for Forest Service Region 5.[47]

VPD is a measure of how much moisture the air contains relative to the maximum amount of moisture it could hold and is a function of temperature and relative humidity.[48] The coefficients for this parametric model were estimated using 324 observations of monthly area

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[42] Prestemon, J.P., Erin Belval, Sara Brown, Jennifer Costanza, Linda Joyce, Shannon Kay, Mark Lichtenstein, Jeffrey Morisette, Karin Riley, Karen Short. U.S. Department of Agriculture Forest Service. 2022. Technical Appendix: Climate Risk Exposure: Federal Wildfire and Suppression Expenditures. Research and Development, USDA Forest Service. In: White House Office of Management and Budget, Climate Risk Exposure: An Assessment of the Federal Government's Financial Risks to Climate Change (Prestemon et al. (2022)) at 66-118, available at https://bidenwhitehouse.archives.gov/wp-content/uploads/2022/04/OMB_Climate_Risk_Exposure_2022.pdf .

[43] *Id*., Technical Appendix at 74.

[44] USDA, Forest Service, U.S. Department of Agriculture, *About the Area (Region 5, Pacific Southwest Region)* (Accessed April 1, 2025), available at https://www.fs.usda.gov/main/r5/about-region.

[45] Prestemon et al. (2022) at 66-118 and 70.

[46] *Id.,* Technical Appendix at 74.

[47] Prestemon et al. (2022), Technical Appendix, Table B-1, at 93-94.

[48] *Id*., Technical Appendix at 73.

burned and climate data from 2006 to 2018.[49]

Prestemon et al. (2022) used historical climate data and projections from the U.S. Forest Service's 2020 Resources Planning Act Assessment (RPA) climate projections supplemented by additional data from RPA parent datasets.[50] The RPA climate projections are a subset of the MACAv2METDATA set, which is downscaled from the Coupled Model Inter-Comparison Project 5 (CMIP5).[51] Prestemon et al. (2022) state: "The RPA data set contains the historical data (METDATA, 1979-2015), and the historical modeled data (1950-2005) and the future projections (2006-2099) (MACAv2-METDATA) for 5 climate models under two Representative Concentration Pathway scenarios (RCP 4.5 and 8.5) (Table B1)."[52] While Prestemon et al. (2022) used RCPs to develop their model, SDG&E intends to use the Shared Socioeconomic Pathways (SSP) models for its study and for future implementation.

Because Prestemon et al. (2022) area burned model was developed for federal lands in California, rather than for SDG&E's service territory, the prediction of changes in area burned in SDG&E's service territory requires additional consideration and research. This is not a limitation of the model in and of itself, but rather a caveat regarding its suitability for this site-specific application. Prestemon et al. (2022) do note several assumptions and limitations in their models of area burned, stating, "Modeling area burned requires some strong assumptions, that, in the face of a changing climate, could be difficult to justify."[53] Summarily, these limitations and assumptions arise as part of the defined model scope set by Prestemon et al. (2022) and the modeling limitations encountered. For detailed discussion on these items, see the pertinent sections at pages 82-87 of Prestemon et al. (2022). A selection of the authors' acknowledgments includes, but is not limited to, the following:

- "We expect climate change to alter forest and range ecosystem compositions, and vegetation changes will, in turn, alter how many acres burn and how often and intensely they burn. In this analysis, because hazardous fuels are not directly

[49] *Id.*, Technical Appendix, Table B-1, at 93-94.

[50] *Id.,* Technical Appendix at 75-76.

[51] *Id.,* Technical Appendix at 75.

[52] *Id.*

[53] *Id.*, Technical Appendix at 74.

modeled, our models carry an assumption that these vegetation changes will not matter to… area burned…"[54]

- "Our models make long-run projections, without evaluating which factors that are typically assumed fixed might be variable in the long-run, such as fire regimes, biomes, and suppression strategies."[55]
- "Our statistical models of area burned and expenditures are parsimonious, with area burned specified as a function of monthly maximum daily temperature and/or vapor pressure deficit. There is little doubt that potentially influential variables are omitted in our chosen specifications."[56]

Given the known limitations and complexity of accurately incorporating climate change projections into its cost-benefit analysis, SDG&E recognizes the need for further research on and development of the Prestemon et al. (2022) methodology and other relevant approaches, such as the wildfire projections produced by the University of California Merced research team that informed California's Fourth Climate Change Assessment (Westerling (2018)).[57] As discussed in Westerling (2018), these projections developed statistical (*e.g.*, logistic regression, Poisson lognormal, and generalized Pareto distributions) models for large wildfire presence, number, and size under a wide range of future climate change scenarios while also accounting for population and development footprint scenarios. The most recent wildfire projection dataset that is currently available at Cal-Adapt[58] is still based on the outdated CMIP5-based work by Westerling (2018). Efforts are currently underway by the UC Merced research team to update wildfire projections using the latest CMIP6 simulation results, which will be used for the upcoming Fifth Climate Change Assessment (2026).

Consequently, all wildfire risk estimates presented in SDG&E's Wildfire and PSPS workpapers do not account for long-term impacts driven by climate change. This approach keeps estimates grounded in the most current and actionable data available while acknowledging the

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54 *Id.*

55 *Id.,* Technical Appendix at 86.

56 *Id.,* Technical Appendix at 83.

57 Westerling, Anthony Leroy. (University of California, Merced). 2018. *Wildfire Simulations for California's Fourth Climate Change Assessment: Projecting Changes in Extreme Wildfire Events with a Warming Climate*, available at https://www.energy.ca.gov/sites/default/files/2019-11/Projections_CCCA4-CEC-2018-014_ADA.pdf.

58 Cal-adapt, *Explore and analyze climate data from California's Climate Change Assessments*, available at https://cal-adapt.org/.

ongoing efforts to enhance the models with future climate projections.

In the coming months and years, SDG&E plans to investigate the incorporation of climate change factors into its wildfire risk event simulations. This integration is expected to result in potentially higher estimates of acres burned and structures destroyed than those currently used, which will impact the financial attribute of the consequences of a risk event. By accounting for climate change, SDG&E aims to enhance the accuracy and predictive power of its risk models, improving the evaluation of projected scenarios and informing more effective long-term grid-hardening strategies.

In conjunction with climate change, the population is expected to grow more quickly in the HFTDs compared to other areas,[59] with new building construction following a similar trend. Therefore, SDG&E is evaluating the incorporation of population change forecasts into its wildfire risk models. To account for population change, SDG&E intends to develop a scale factor based on forecasted population changes within the HFTD, which will be calculated as the forecasted HFTD population each year divided by the HFTD population in a baseline year. A similar scale factor will be developed for structures destroyed in a wildfire, which will use forecasts of relative changes to housing unit counts as a proxy for the number structures in the HFTD. Additional consideration will be given for buildings subject to wildland-urban interface ignition-resistant construction requirements, which typically apply in designated Fire Hazard Severity Zones; the developed approach will only consider new construction outside of these zones.

In addition, SDG&E does not currently analyze extreme events or highly uncertain scenarios. Instead, the WiNGS-Planning model is designed to incorporate historical weather conditions experienced within the service territory. The model can simulate a variety of weather conditions based on past data, providing a robust framework for risk analysis based on known conditions. By focusing on historical weather patterns, the model can accurately reflect the range of conditions that have been observed over time, allowing for more reliable predictions and effective planning.

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[59] SANDAG Open Data Portal, *San Diego Association of Governments, Series 15 Forecasts Housing Units by 2020 Census Tract* (August 16, 2024) available at https://opendata.sandag.org/Forecast/Series-15-Forecasts-Housing-Units-by-2020-Census-T/k2nk-z5si/about_data.

To model longer-term scenarios with higher uncertainty requires an assessment of the entire service territory beyond the current focus on overhead lines in the HFTD. Furthermore, evaluating extremely low-probability events, including those unrelated to wildfire risk and outside the HFTD, offers minimal benefit. Such events are unlikely to provide significant insights for mitigation prioritization. Conducting these analyses would also necessitate substantial coordination with other agencies to define scenarios, validate inputs, establish credible modeling parameters and model results.

8. PSPS

De-energization of overhead infrastructure for safety of SDG&E's communities during extreme fire weather conditions remains a crucial component of the Company's wildfire mitigation strategy. SDG&E understands the challenges that PSPS events create for customers, communities, and public safety partners, especially during extreme fire conditions when access to electricity is crucial. Therefore, the use of PSPS de-energization is used as a measure of last resort when necessary to promote safety during high wildfire risk conditions. SDG&E's primary objective is to maintain public safety during periods of high-fire weather and minimize the scope, duration, and impact of PSPS de-energizations on as many customers as possible.

To calculate the potential impacts of PSPS de-energizations, the duration of de-energization by feeder segment and the number and type of downstream customers affected by de-energization on each feeder segment are considered. These values are used to determine natural unit values for the three consequence attributes.

- Safety Attribute: Safety consequence is estimated based on historical PSPS de-energizations across California and reviewed to understand the frequency, duration, and magnitude (customers affected) of PSPS de-energizations. As the safety impact of a PSPS de-energization is not the same for all customer types, a Customer Type Value Consequence is estimated to represent different levels of safety impacts. Based on subject matter expert assumptions, different weighting (or scaling factors) is applied to each customer meter to increase the number of SIFs downstream of each SCADA sectionalizing device. Customer Type Value Consequence includes:
    - Critical Facilities and Critical Infrastructure: Customers based on the CPUC's De-energization proceeding definition.
    - Community Vulnerability: Access and Functional Needs (AFN) customers based on the CPUC's definition of AFN Customers

- Other: All other customers that do not fall in either the critical or AFN categories

To estimate the number of SIFs per de-energization, 1 fatality per 10 billion customer minutes de-energized is assumed based on a review of historical PSPS de-energizations in California (2018 to 2021).[60,61,62]

- Reliability Attribute: Subject matter expert assumptions for CMI estimates are based on a review of historical CMI values associated with past PSPS de-energizations in the service territory. These CMI estimates are subsequently monetized using the $/CMI value provided in Chapter RAMP-3.
- Financial Attribute: Per customer and per PSPS de-energization, a potential financial impact is estimated based on subject matter expert assumptions based on the per diem rates applicable to San Diego, CA, for the fiscal year 2024, with the assumption of accommodating four family members per electrical meter. A Commercial and Industrial (C&I) multiplier is also included to quantify the reliability impact of these customers during the PSPS de-energization. For Residential customers, a $482 cost per de-energization is estimated using the per diem rates applicable to San Diego, CA, as of September 2024 with the assumption of accommodating four family members per customer meter. For C&I customers, a $1,446 cost per de-energization is estimated.[63]

9. PEDS

The PEDS Consequence model follows a similar approach to the PSPS CoRE model because it is modeled as a reliability outage occurring during extreme fire weather days. The following assumptions are considered to establish PEDS Consequences:

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60 CPUC, *Utility PSPS Reports: Post-De-energization, Pre-Season and Post-Season*, *available at*: https://www.cpuc.ca.gov/consumer-support/psps/utility-company-psps-reports-post-de-energization-and-post-season.

61 Southern California Edison Company, *PSPS Reports to the CPUC*, *available at:* https://www.sce.com/outage-center/outage-information/psps.

62 Pacific Gas & Electric Company, *Public Safety Power Shutoffs*, *available at:* https://www.pge.com/en/outages-and-safety/safety/community-wildfire-safety-program/public-safety-power-shutoffs.html.

63 For FY 2025 per diem rates for San Diego, California refer to: U.S. General Services Administration (GSA), *FY 2024 per diem rates for ZIP Code. Financial values as of February 2025. A factor of three is assumed for C, available at:* https://www.gsa.gov/travel/plan-book/per-diem-rates/per-diem-rates-results?action=perdiems_report&city=San+Diego&fiscal_year=2024&state=CA&zip=.Financial+values+as+of+February+2025.+A+factor+of+three+is+assumed+for+C&I+customers=.

- Safety Attribute: The same assumptions used for PSPS SIF estimates are applied to the Safety component of PEDS. PEDS duration estimates are derived from a review of historical PEDS outages. These SIF estimates are then converted into monetary values using the monetization methods outlined in Chapter RAMP-3: Risk Quantification Framework, and the same PSPS fatality per customer minute de-energized ratio is assumed.
- Reliability Attribute: Assumptions for CMI estimates are derived from a review of historical PEDS outage data and are updated as new data becomes available. CMI estimates are translated into monetary values using the methods outlined in Chapter RAMP-3: Risk Quantification Framework.
- Financial Attribute: Due to the limited data on the financial impacts of a PEDS outage, SDG&E relies on conservative estimates from subject matter experts. These estimates are based on high-level projections of overhead line patrol costs during periods of elevated or extreme fire weather conditions.

These assumptions are revisited at least once a year, so that they remain accurate and relevant for long-term decision making. Additionally, they may be updated based on new findings and insights, particularly in preparation for future events. This continuous improvement approach helps to refine and enhance wildfire mitigation strategies, providing the highest level of safety and reliability for SDG&E's customers.

10. Risk Aversion

Any probabilistic decision-making framework designed to reduce catastrophic events relies on three primary inputs: the probability of an undesirable event occurring, the consequence of that event, and the expected reduction in risk, which includes selecting appropriate mitigation measures. Additionally, it involves evaluating the residual risk remaining in the system after the mitigation is applied and understanding the lifecycle activities and costs associated with reducing either the probability or the consequence of the event.

At a basic level, the risk of an undesirable event is its probability multiplied by its consequence. As a result, on a probability-weighted basis, the risk of a low-consequence, high-probability event might be the same as the risk of a high-consequence, low-probability event. While equating these risk values may be accepted in some risk assessment frameworks, multiple studies suggest that society—and SDG&E's customers—may not view these risks as

equivalent.[64] To mathematically distinguish between risk preferences, a risk scaling or aversion function is applied. According to the RDF, a Risk Scaling Function "specifies an attitude towards different magnitudes of Outcomes including capturing aversion to extreme Outcomes or indifference over a range of Outcomes."[65] For example, the magnitude of societal aversion toward low-duration outages is generally thought to be less than the aversion toward a catastrophic large scale wildfire that could result in significant injuries and death, community displacement, and billions of dollars in economic damages.

The WiNGS-Planning model captures this aversion towards catastrophic events to properly align the consequences of potential disasters with society's perception of the costs. By incorporating societal risk aversion into the model, SDG&E aligns the community's and SDG&E's intolerance for rare but severe events, such as large-scale wildfires. This approach helps identify locations (feeder-segments) and prioritize mitigation efforts that address the most significant threats to public safety and infrastructure in SDG&E's service territory.

The degree of risk aversion is typically incorporated into a decision model through a mapping function that converts the measurable consequence—whether it be in dollars, fatalities, outages, or other metrics—into an estimated equivalent societal cost. Informed decisions that are indifferent to the range of risk consequence outcomes that are equivalent on a frequency-adjusted basis follow a "risk-neutral" approach, with a 1:1 ratio of consequence to social cost. Conversely, a risk-averse approach maps consequences to societal costs using a convex nonlinear function that disproportionately weights the consequences from high-impact events relative to their frequency, such as a catastrophic wildfire, compared to lower-consequence events that under a risk neutral approach would be considered equivalent.

The primary motivation for incorporating a Risk Aversion function into SDG&E's risk-informed decision framework is to recognize aversion to catastrophic events. These events not only incur substantial costs due to loss of life and physical destruction but also impose

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[64] Griesmeyer, J. M., Simpson, M., and Okrent, D. 1980. Use of risk aversion in risk acceptance criteria?, available at https://doi.org/10.2172/5230500; *see also* Hammerton, M., Jones-Lee, M.W., and Abbott, V. 1982 Technical Note—Equity and Public Risk: Some Empirical Results. Operations Research 30(1):203-207. https://doi.org/10.1287/opre.30.1.203 Griesmeyer, J. M., Simpson, M., and Okrent, D. 1980. Use of risk aversion in risk acceptance criteria?, available at https://doi.org/10.2172/5230500.

[65] D.24-05-064, Appendix A at A-5.

significant intangible social and economic impacts on the affected communities. By integrating the risk aversion framework described in Chapter RAMP-3: Risk Quantification Framework,[66] SDG&E aims to better account for these potential impacts and prioritize wildfire mitigation measures in the riskiest areas of its service territory.

Table 7 illustrates SDG&E's wildfire, PSPS, and PEDS risk levels, measured in millions of dollars in SDG&E's service territory, incorporating a risk aversion attitude at various points of the distribution. Understanding not only the expected average annual loss (AAL) but also the full spectrum of potential outcomes is crucial for risk assessment and selection and prioritization of mitigation. Table 8 illustrates SDG&E's wildfire, PSPS, and PEDS risk levels without SDG&E's risk aversion attitude.

Table 7: Monetized Risk Estimates with Risk Aversion

Percentile	Annual Return Period (Years)	Wildfire Risk (M$)	PSPS Risk (M$)	PEDS Risk (M$)	Overall Utility Risk (M$)
p50	20	$ 14	$ 61	$ 5	$ 168
p98	50	$ 36,061	$ 766	$ 16	$ 36,196
p99	100	$ 51,962	$ 845	$ 18	$ 52,098
p100	---	$ 210,379	$ 2,804	$ 38	$ 211,202
AAL	1	$ 2,883	$ 132	$ 6	$ 3,021

Table 8: Monetized Risk Estimates without Risk Aversion

Percentile	Annual Return Period (Years)	Wildfire Risk (M$)	PSPS Risk (M$)	PEDS Risk (M$)	Overall Utility Risk (M$)
p50	20	$ 14	$ 61	$ 5	$ 155
p98	50	$ 3,235	$ 754	$ 16	$ 3,381
p99	100	$ 4,141	$ 833	$ 18	$ 4,290
p100	---	$ 13,334	$ 2,756	$ 38	$ 13,624
AAL	1	$ 340	$ 131	$ 6	$ 476

SDG&E continuously refines and optimizes model methodology, inputs, assumptions, and technical solutions, including cloud computing and frontend visualizations so that it remains

[66] *See* Chapter RAMP-3: Risk Quantification Framework at 23-25.

a robust tool for grid-hardening decision-making. Additionally, collaborations with stakeholders such as other investor owned utilities, regulatory bodies, and other stakeholders may lead to updates and enhancements in the model.

WiNGS-Planning key assumptions and known limitations are summarized in Attachment E.

C. Risk Informed Strategy and Prioritization

For the past 17 years, SDG&E has avoided utility-related catastrophic wildfires in its service territory, despite being located in an area with some of the highest wildfire risk in the nation. This is, in part, because of its ongoing efforts to target and effectively mitigate risk through data-driven and risk-informed programs tailored to each location. SDG&E employs a data-driven and risk-based approach to identify and implement tailored mitigation strategies that address the unique characteristics and vulnerabilities of each location within its service territory. By prioritizing long-term benefits and lifecycle costs, SDG&E aims to make financially sustainable choices that maximize safety, reliability, and operational efficiency.

SDG&E's long-term risk reduction strategy not only considers the expected reduction in risk through appropriate mitigation measures but also evaluates the residual risk remaining after these mitigations are applied. This strategy involves understanding the lifecycle costs associated with activities that reduce the probability or the consequence of wildfire risk events as well as the impacts of PSPS de-energizations. By analyzing ongoing operations and maintenance activities (*e.g.*, time-based inspections and vegetation management), operational efficiency, and potential savings from avoided risks, SDG&E prioritizes grid-hardening investments that offer the greatest long-term benefits at reasonable cost. The ultimate goal is to reduce wildfire risk, enhance system resilience, lower overall costs, and minimize disruptions for customers, thereby promoting a safer and more reliable energy infrastructure.

SDG&E considers two primary system hardening mitigations: strategic undergrounding of electric lines and installing covered conductor. Strategic undergrounding of electric lines converts overhead systems to underground, providing the dual benefits of significantly reducing utility-related wildfire risk and the need for PSPS de-energizations. Covered conductor is an electrical conductor that is covered with insulating material to reduce the risk of electrical faults and improve safety. This term refers to conductors equipped with three extruded layers: a semi-conducting sheath, an insulating polyethylene sheath, and an abrasion-resistant XLPE external

cover, offering protection against incidental contact.

Although the initial cost of deploying strategic undergrounding exceeds the initial cost of deploying combined covered conductor, an internal analysis of SDG&E's total lifecycle costs, including both installation and long-term operational expenses, revealed that strategic undergrounding is more cost-effective for most feeder segments in the HFTD. Undergrounding significantly reduces or eliminates routine maintenance costs such as vegetation management, wood pole intrusive inspections, drone and overhead visual inspections, and costs associated with PSPS de-energizations. Consequently, undergrounding not only enhances system reliability and safety but also offers substantial long-term financial benefits compared to covered conductor.

1. Mitigation Prioritization and Selection Process

SDG&E's wildfire mitigation strategy continues to provide a hybrid grid hardening approach, aimed at balancing long-term risk reduction with the cost of installing combined covered conductor mitigations and undergrounding of electric infrastructure.

Wildfire Risk Drivers include downed conductors, foreign object/vegetation contacts, and equipment failures. Of these, risk drivers tied to overhead line risk exposure represent the greatest risk. Mitigations that are evaluated in the WiNGS-Planning model are strategic undergrounding of electric lines and installing covered conductor combined with advanced protection settings, as these initiatives are the most effective at reducing risk events on utility equipment. SDG&E's wildfire mitigation strategy continues to provide a hybrid grid hardening approach, aimed at balancing long-term risk reduction with the cost of installing combined covered conductor mitigations and undergrounding of electric infrastructure.

SDG&E conducts a cost-benefit analysis to compare the expected risk reduction and lifecycle costs of Strategic Undergrounding and Combined Covered Conductor, which is used to prioritize grid hardening mitigation. This analysis helps prioritize grid hardening efforts by identifying the most effective and cost-efficient solutions for each feeder segment within Tier 2 and Tier 3 of the HFTD.

Grid hardening measures are chosen for each feeder segment individually, rather than at the Class or Tranche level. This selection process involves evaluating the potential risk reduction estimates, as well as upfront installation and lifecycle costs. Lifecycle costs encompass not only the initial investment in mitigation measures but also the ongoing costs of maintenance,

operations, and potential upgrades. Mitigations are modeled for Combined Covered Conductor and Undergrounding with an assumed lifespan of 55 years to align with the Electrical Undergrounding Plan (EUP) risk modeling reporting requirements established by the Commission and Energy Safety.[67]

By evaluating these costs over the expected lifespan of a project, SDG&E aims to balance maximization of long-term benefits rather than simply minimizing upfront expenditures. Without proper consideration of lifecycle costs, solutions that appear the least costly in the short term may lead to higher overall costs over time due to maintenance, failures, or inefficiencies. Lifecycle cost analysis helps select, justify, or reject mitigation investments and avoids opting for a mitigation simply because it appears to have the lowest up-front costs.

SDG&E utilizes the cost benefit analysis to quantify Wildfire and PSPS Risk baselines and risk reductions and prioritize mitigations at the circuit segment level. This strategy identifies strategic undergrounding as the optimal long-term approach for segments with high Wildfire and/or PSPS Risk due to lifecycle cost benefits as well as the following:

- Undergrounding costs are expected to decrease as efficiencies are gained through implementing new construction technology, reducing trench depths and conduit size when applicable, strategic bidding, and bundling projects.
- While the installation of Combined Covered Conductor can reduce PSPS Risk during low to moderate Santa Ana weather events, it is not effective during extreme fire weather conditions with high wind gusts. Additional PSPS Risk reduction is achieved through undergrounding, which nearly eliminates the risk of overhead lines sparking fires during adverse weather conditions.
- Undergrounding also enhances the resilience and reliability of the electrical grid by protecting infrastructure from environmental hazards such as flying debris, lightning strikes, vegetation and animal contacts. This results in fewer reliability outages, thereby improving overall system performance, ensuring a more stable and dependable power supply for communities.

The WiNGS-Planning model provides a quantitative assessment of Wildfire and PSPS Risk reduction and, based on model data, makes a preliminary recommendation for either Combined Covered Conductor or Undergrounding mitigation at each feeder segment. Once the outputs from WiNGS-Planning are reviewed and approved by the Risk Analytics team, the

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[67] SB 884, Ch. 819 (2021-2022), Section 2(f)(1); *see also* CPUC, Electric Undergrounding Expediting Program – SB 884, available at https://www.cpuc.ca.gov/about-cpuc/divisions/safety-policy-division/risk-assessment-and-safety-analytics/electric-undergrounding-sb-884.

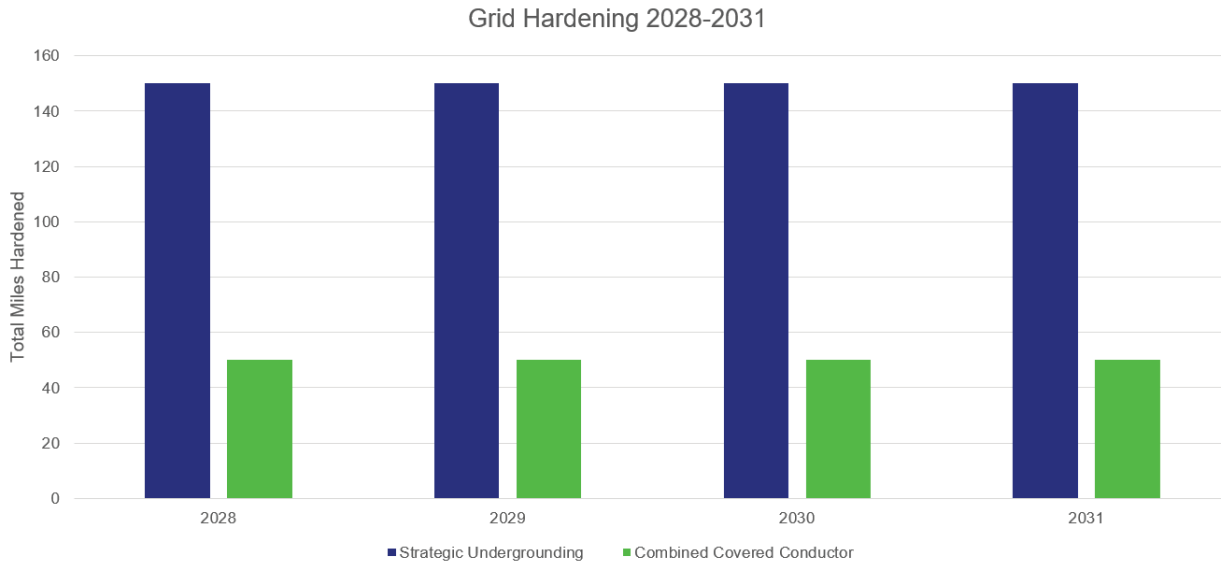
identified mitigations undergo a desktop feasibility analysis informed by subject matter expertise that includes considerations such as geography, routing and trenching, pole loading, asset engineering standards, environmental factors, permitting, and other concurrent hardening projects. Subject matter experts, including Electric System Hardening engineers, fire coordination personnel, meteorologists, risk data scientists, and construction engineers review the cost-benefit ratios.

SDG&E is currently developing an optimization algorithm to identify feeder-segments that could present net cost reduction opportunities if bundled together for implementation and construction. The optimization algorithm selects feeder segment bundles that, when upgraded, would minimize the anticipated residual Wildfire and PSPS Risks while maintaining a cost-benefit ratio greater than 1 (*i.e.*, a net benefit) for the upgraded bundle. The algorithm produces a list of projects consisting of bundled segments eligible for combined covered conductor and undergrounding. Potential cost efficiencies of the identified bundles are then determined, and cost-benefit ratios are updated in order to inform mitigation selection.

2. Overall Risk Reduction

Since 2007, SDG&E has been proactively addressing the risk of catastrophic wildfires within its service territory. SDG&E has invested in state-of-the-art technologies such as weather monitoring systems, high-definition cameras, and satellite imagery to enhance early detection and response capabilities. Additionally, SDG&E has undertaken extensive vegetation management programs, including regular trimming and removal of hazardous trees, to minimize the risk of power lines coming into contact with energized assets. These initiatives are complemented by the installation of combined covered conductor and the strategic undergrounding of power lines in high-risk areas. SDG&E's long-term mitigation strategy takes into account the full portfolio of circuit segments in the HFTD and aims to balance affordability and risk reduction by implementing mitigation investments at a more gradual pace to reach a majority of its wildfire risk reduction and reduce reliance on PSPS de-energizations by 2037. Once grid hardening mitigations are deployed, the remaining risk in the system would be managed through operational mitigations, such as PSPS de-energization and SRP.

Figure 5: Grid Hardening 2028-2031



Risk methodology will continue to be refined and targets will continue to be revised to optimize the portfolio of undergrounding electric lines and installation of combined covered conductor. SDG&E is dedicated to working with industry partners, academic institutions, stakeholder groups, and other IOUs to continually improve its risk models to enhance accurate of the expected impacts of future climate change on Wildfire Risk. SDG&E will revise its current risk model methodology as new scientific data emerges and evaluations are carried out.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section describes the controls and mitigations comprising the portfolio of mitigations for Wildfire and PSPS Risk and reflects expected changes to recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). A current activity that is included in the plan may be referred to as a control and/or a mitigation. Table 9 shows which control activities were in place in 2024 and which are expected to be ongoing, completed, or new during the 2025 to 2031 time period. Because the TY 2024 GRC proceeding established rates through 2027,[68] information through 2027 is calculated as part of the baseline risk, in accordance with D.21-11-009.[69] For the TY 2028 GRC, SoCalGas/SDG&E calculated CBRs

[68] *See* D.24-12-074.

[69] *See,* D.21-11-009 at 136, Conclusion of Law 7 (providing a definition for "baselines" and "baseline risk").

beginning with TY 2028 and for each Post-Test Year (2029, 2030, and 2031).[70]

Table 9: Wildfire and PSPS
2024-2031 Control and Mitigation Plan Summary[71]

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C501	Wireless Fault Indicators	X	Discontinued 2025
C502	Capacitor Maintenance and Replacement Program (SCADA)	X	Completed 2024
C504	Standby Power Program (Fixed Backup Commercial)	X	Ongoing
C506	Microgrids	X	Ongoing
C507	CMP Repairs	X	Ongoing
C508	Advanced Protection	X	Ongoing
C510	Hotline Clamps	X	Merged with Combined Covered Conductor
C512	Customized Resiliency Assessments	X	Ongoing
C516	Generator Assistance Program	X	Ongoing
C518	Strategic Undergrounding	X	Ongoing
C520	Distribution Overhead System Hardening	X	Ongoing
C522	Transmission Overhead Hardening (Distribution Underbuild)	X	Ongoing
C524	Lightning Arrestor Removal/Replacement Program	X	Merged with Combined Covered Conductor
C526	**Distribution Overhead Detailed Inspections**	**X**	**Ongoing**
C528	Distribution Infrared Inspections	X	Discontinued 2026
C530	**Distribution Wood Pole Intrusive Inspections**	**X**	**Ongoing**
C534	Risk-Informed Drone Inspections	X	Ongoing
C536	**Distribution Overhead Patrol Inspections**	**X**	**Ongoing**
C546	Aviation Firefighting Program	X	Ongoing
C548	Wildfire Infrastructure Protection Teams	X	Ongoing
C550	Combined Covered Conductor	X	Ongoing
C552	PSPS Sectionalizing Enhancements	X	Ongoing

[70] In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

[71] Controls/Mitigations identified in this table are organized according to WMP category, as noted in Section IV.A, *infra*.

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C559	LiDAR Flights	X	Ongoing
C564	Distribution Communications Reliability Improvements (DCRI)	X	Discontinued 2026
C565	**Transmission Overhead Detailed Inspections**	**X**	**Ongoing**
C568	Strategic Pole Replacement	X	Ongoing
C569	Cleveland National Forest Fire Hardening		Program Complete – Trailing Costs Only
C570	Expulsion Fuse Replacements	X	Merged with Combined Covered Conductor
C573	Early Fault Detection	X	Ongoing
C576	**Avian Protection**	**X**	**Merged with Combined Covered Conductor**
C537	Off-Cycle Patrol	X	Ongoing
C540	Fuels Management	X	Ongoing
C544	**Pole Clearing**	**X**	**Ongoing**
C551	**Prune and Removal (Clearance)**	**X**	**Ongoing**
C554	**Detailed Inspections**	**X**	**Ongoing**
C555	Vegetation Restoration Initiative	X	Discontinued 2025
C578	QA/QC of Veg Management	X	Ongoing
C561	Fire Potential Index	X	Merged with C572 Situational Awareness and Forecasting
C562	Weather Station Maintenance and Calibration	X	Ongoing
C572	Situational Awareness and Forecasting	X	Ongoing
C556	Engagement with AFN Populations	X	Ongoing
C557	Public Outreach and Education Awareness	X	Ongoing
C560	Mylar Balloon Alternative	X	Completed 2021
C567	Public Emergency Communication Strategy	X	Ongoing
C571	Emergency Preparedness and Recovery Plan	X	Ongoing
C566	Enterprise Data Foundation	X	Ongoing
C575	Vegetation Management Enterprise System	X	Ongoing
C563	Wildfire Mitigation Strategy Development	X	Ongoing
C558	Risk Methodology and Assessment	X	Ongoing
M503	Grounding Banks		New

Bold indicates this control/mitigation includes mandated programs/activities.

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place"[72] (*i.e.,* activities in this section were in place as of December 31, 2024, or have historical costs tied to them). Controls that will continue as part of the risk mitigation plan are identified in Table 9.

Consistent with its 2026-2028 Base WMP, this chapter presents the following categories:

- Grid Design, Operations and Maintenance
- Vegetation Management and Inspections
- Situational Awareness and Forecasting
- Emergency Preparedness, Collaboration and Public Awareness
- Enterprise Systems
- Wildfire Mitigation Strategy
- Risk Methodology and Assessment

1. Grid Design, Operations, and Maintenance

SDG&E's grid hardening programs are aimed at reducing the risk of wildfires caused by utility equipment and minimizing the impacts of PSPS de-energizations on customers. Programs such as the Combined Covered Conductor Program and Strategic Undergrounding Program can prevent risk events from occurring across several drivers such as energized wire down and foreign object contact. Other programs such as the Advanced Protection Program do not prevent risk events but instead reduce the chance that a risk event will result in an ignition by utilizing protection settings and/or equipment that address specific failure modes known to lead to an ignition. Both types of programs reduce LoRE (*i.e*., are preventative), but affect different stages of the ignition-risk sequence.

Other programs, such as the PSPS Sectionalizing Enhancement Program and generator programs, reduce the impacts of PSPS de-energizations on customers. Strategic undergrounding reduces the need for mitigations such as PSPS de-energizations while also reducing the risk of utility-caused wildfires.

SDG&E's inspection and maintenance programs are intended to identify and resolve equipment conditions on the grid before failures occur. Mandatory inspection programs are

[72] D.18-12-014 at 33.

governed by the CPUC's GO 165 and GO 95 and focus on finding and mitigating safety and reliability conditions and are supplemented by risk-informed drone inspections. Maintenance practices generally aim to resolve conditions based on priority level and location, with accelerated remediation timeframes for conditions found on equipment in Tier 3 of the HFTD.

SDG&E's grid design, operations, and maintenance programs include:

- **C501: Wireless Fault Indicators:** Wireless Fault Indicator (WFI) devices are used to monitor electricity distribution lines and locate faults more efficiently and accurately using Low Power Communication Network (LPCN) communication to alert distribution system operators where a fault on a line or circuit has occurred. WFIs can detect faults without having a minimum continuous current on the line and therefore can be used at remote locations that have very little load. Distribution operators can then dispatch electric troubleshooters close to the exact fault location to quickly identify and isolate the fault and begin service restoration. Due to manufacturer upgrades that resulted in incompatibility with current communications (*see* the 2025 WMP Update for details), the WFI program is being discontinued. Installed WFIs will continue to be utilized for situational awareness.
- **C502: Capacitor Maintenance and Replacement Program (SCADA):** The SCADA Capacitors Maintenance and Replacement Program was developed to replace existing non-SCADA capacitors with a more modern SCADA-switchable capacitor or to remove non-SCADA capacitors if not required for voltage or reactive support. The SCADA Capacitors Maintenance and Replacement Program prioritizes replacing or removing fixed capacitors from service and then addresses capacitors with switches. Both types of capacitors will be modernized to a SCADA switchable capacitor, which have a monitoring system to check for imbalances and isolate internal faults before they become catastrophic. SCADA capacitors also have the capacity for remote isolation and monitoring of the system, which provides additional situational awareness during extreme weather conditions. While this program will not reduce capacitor faults, the advanced protection equipment is designed to detect and isolate issues before a capacitor rupture occurs, reducing the failure mode most likely to lead to an

ignition.

- **C504: Standby Power Program (Fixed Backup Power Commercial):** The Standby Power Program targets non-residential customer sites that provide community service in HFTD portions of the service territory and are in regions served by circuits that experience frequent PSPS outages. Depending on site requirements, feasibility, and costs, the program offers backup power solutions to enhance resiliency, including permanent standby generators, permanent backup batteries powered by solar arrays, and related equipment. The program identifies sites based on meter, circuit, and PSPS de-energization, and assesses potential backup power solutions to enhance resiliency of the building and in support of the community it serves to mitigate the impacts of PSPS de-energizations.
- **C506: Microgrids:** The Microgrid Program operates permanent and temporary microgrids (*i.e.*, backup generators) that can be electrically isolated during a PSPS de-energization, thereby maintaining electric service to customers within the microgrid boundary. The majority of microgrids are in the HFTD. Microgrids located outside the HFTD are aimed at reducing PSPS impacts to areas frequently impacted by PSPS de-energizations. SDG&E utilizes weather forecasting technologies to identify locations where pre-determined backup generators and microgrids locations could be engaged during a PSPS de-energization. As part of the pre-determination process for temporary microgrids, backup generators are appropriately sized prior to deployment to maintain adequate load support for impacted customers. Additionally, conventional generators and mobile batteries are deployed to create temporary microgrid solutions to support communities and CRCs and, to the extent feasible, minimize traditional generator run-time during extended PSPS de-energizations. SDG&E plans to install one remote grid by 2028, which will provide standalone, decentralized energy resources and utility infrastructure for continuous, permanent energy delivery in lieu of providing retail distribution services using traditional utility infrastructure (*e.g.*, distribution lines). This remote grid solution can mitigate otherwise costly hardening efforts for long distribution lines with minimal customer loading. The Remote Grid program was approved by the CPUC via Resolution E-5308 on March 21, 2024.

- **C507: CMP Repairs:** SDG&E's Corrective Maintenance Program (CMP) helps mitigate wildfire risk by providing information about the condition of the electric distribution system, including facilities within the HFTD. Potential infractions can then be addressed before they result in a safety or reliability risk event. All equipment is maintained with a time-based inspection cycle and corrective repair work is performed in adherence with, and sometimes exceeding, GO 95 timeframes.
- **C508: Advanced Protection:** The Advanced Protection Program (APP) develops and implements advanced protection technologies within electric substations and on the electric distribution system. It aims to prevent or mitigate the risks of fire incidents, provide better transmission and distribution sectionalization, create higher visibility and situational awareness in fire-prone areas, and allow for the implementation of new relay and automation standards in locations where protection coordination is difficult due to lower fault currents attributed to high impedance faults. Advanced technologies such as microprocessor-based relays with synchrophasor/phasor measurement unit (PMU) capabilities, real-time automation controllers, auto-sectionalizing equipment, line monitors, direct fiber lines, private LTE, and wireless communication radios comprise the portfolio of devices that are installed to allow for a more comprehensive protection system and greater situational awareness in fire-prone areas of the HFTD.
- **C510: Hotline Clamps:** Connectors that have been connected directly to overhead primary conductors, known as hotline clamps (HLCs), are associated with creating a weak connection that could result in a wire down event. This in turn could lead to an energized wire coming into contact with either the ground or a foreign object where it could become a source of ignition. The HLC Replacement Program replaced HLCs that are connected directly to overhead primary conductors with compression, wedge, or other approved connections. HLC connections are installed concurrently with other asset replacement initiatives across the HFTD such as avian protection, fuse replacements, and lightning arrestor replacements. C510 Hotline Clamps will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the

workpapers associated with this chapter.

- **C512: Customized Resiliency Assessments:** The Customized Resiliency Assessments (CRA) Program provides customers frequently impacted by PSPS de-energizations with resiliency assessments. Customers are provided information to help prepare for potential de-energizations and wildfires, such as 211 San Diego, Community Resource Centers, and services offered by Community Based Organizations. Participating customers are also evaluated for potential backup power solutions including permanent and portable options and may be referred to the Generator Assistance Program (GAP) or other programs as appropriate. The program also provides qualifying customers with options to request temporary backup power solutions during periods when SDG&E's Emergency Operations Center (EOC) is activated for potential PSPS de-energizations.
- **C516: Generator Assistance Program:** The GAP offers rebates for portable fuel generators and portable power stations to encourage customers to acquire backup power options to mitigate the impacts of PSPS de-energizations. The target audience is customers who reside within Tiers 2 and 3 of the HFTD and have experienced at least one PSPS de-energization since 2019. Eligible customers receive program materials via mail and email campaigns and are directed to an online portal to verify account information and learn more about the program. In addition, customers enrolled in customer assistance programs are eligible for an enhanced rebate on these backup power solutions. The program also provides the option for customers to receive one rebate for a fuel generator and one rebate for a portable power station to accommodate various backup power needs.
- **C518: Strategic Undergrounding:** The Strategic Undergrounding Program converts overhead systems to underground, providing the dual benefits of significantly reducing wildfire risk and the need for PSPS de-energizations. This program is deployed in the HFTD and considers both Wildfire and PSPS Risk. The Strategic Undergrounding Program is primarily prioritized and scoped through the use of the WiNGS-Planning model, hardening scope considerations, subject matter experts, and local conditions.

  To calculate the wildfire risk reduction for strategic undergrounding of electric

lines, data on historical ignitions associated with underground equipment, pre-mitigation overhead system risk event rates, and ignitions rates were analyzed. Because undergrounding is estimated to be 98.92 percent effective,[73] it does not require concurrent deployment of advanced protection as it will not enhance risk reduction. However, other activities like EFD, enhanced infrared inspections, and Power Quality (PQ) monitoring could be deployed for reliability and infrastructure integrity benefits.

Strategic undergrounding of electric lines is the most effective method of reducing wildfire risk as it reduces the impact of overhead line risk exposure and the likelihood for high winds to adversely impact grid assets. Additionally, it reduces the need for PSPS de-energizations if all overhead exposure in a circuit is undergrounded. Given the high number of overhead miles in the service territory, cost-benefit calculations developed in the WiNGS-Planning model suggest prioritization of strategic undergrounding of electric lines within the HFTD. Data on historic PSPS de-energizations, wind conditions, and other criteria are reviewed to determine where undergrounding of electric lines will have the largest impact to address local risk drivers.

- **C520: Distribution Overhead System Hardening:** The Distribution Overhead System Hardening Program is focused on areas within the HFTD and includes the replacement of wood poles with steel, the replacement of conductors, and in some cases the permanent removal of overhead facilities.
- **C522: Transmission Overhead Hardening (Distribution Underbuild):** Transmission Overhead Hardening replaces wood poles with steel poles, replaces aging conductors with high-strength conductors, and increases conductor spacing in the HFTD to reduce the chance of risk events and ignitions. Distribution Underbuild replaces overhead distribution equipment that is attached to the same poles and along the same route as the work that is completed through overhead transmission hardening. SDG&E achieves cost efficiencies by including Distribution Underbuild work with overhead transmission work, which can

[73] See Attachment F for further details regarding the effectiveness of covered conductor and strategic undergrounding.

combine charges such as design and labor.

- **C524: Lightning Arrestor Removal/Replace Program:** Lightning arrestors are pieces of electrical equipment designed to mitigate the impact of transient overvoltage on the electric system. However, if the overvoltage duration is too long or too high, the arrestor can become thermally overloaded and fail in such a way that they become an ignition source. The Lightning Arrestors Replacement Program installs CAL FIRE-approved lightning arrestors to mitigate the impact of transient overvoltage on the electric system. CAL FIRE-approved lightning arrestors are equipped with an external device that operates prior to the arrestor overloading, greatly reducing the potential of becoming an ignition source. C524 Lightning Arrestor Removal/Replace Program will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the workpapers associated with this chapter.
- **C526: Distribution Overhead Detailed Inspections:** Distribution overhead detailed inspections include a thorough visual assessment of the pole, attachments, and conductor and cables. Where appropriate, individual pieces of equipment may be opened, tested, or operated to assess their condition. In addition, if warranted, the use of infrared or other tools (*e.g.*, drones, binoculars, measurement devices) may be utilized. Inspection records are maintained that include the circuit, area, facility or equipment inspected, the inspector, the date of the inspection, and any problems (or items requiring corrective action) identified during each inspection, as well as the scheduled date of corrective action. Corrective maintenance items identified are prioritized to meet or exceed the timeframes required in GO 95, Rule 18. This prioritization considers the component identified, the location of the structure and surrounding terrain, and the severity of the condition.
- **C528: Distribution Infrared Inspections:** Distribution Infrared Inspections utilizes infrared technology to examine the radiation emitted by connections to find potential issues with a connection before failure. Thermographers capture and assess thermal imagery that may indicate an abnormality on the system. Findings are documented and required repair work is tracked through completion.

- **C530: Distribution Wood Pole Intrusive Inspections:** An intrusive inspection typically involves a visual assessment of the pole for any structural damage or deterioration, a sound and bore of the pole to identify internal cavities, and an excavation around the pole base below the ground line. Below-ground excavation may not be possible where the pole is encased in concrete or where there are other obstacles, such as fences, walls, landscaping or rock. The data is used to calculate the remaining pole strength utilizing industry standards. The pole passes inspection if the calculated remaining strength is greater than 80 percent. If the calculated remaining strength is less than 80 percent, the pole is recommended for reinforcement or replacement.
- **C534: Risk-Informed Drone Inspections:** The Risk-Informed Drone Inspection (RIDI) Program uses drones to collect imagery, improving traditional ground inspections by providing a "birds eye view" of overhead facilities, as well as high resolution imagery of overhead equipment and components. The use of drones to collect imagery enhances an inspector's ability to identify potential fire hazards related to certain types of issues or where conditions such as terrain and vegetation density make full detailed inspections challenging. Issues that are more readily observed by drones include damaged arrestors, damaged insulators, issues with pole top work, issues with armor rods, crossarm or pole top damage, exposed connections, loose hardware, improper splices, and damaged conductors. Images and inspection findings have also been used to build asset identification and damage detection models to support Intelligent Image Processing (IIP) technology, which is used to process imagery data, improve the quality of the RIDI assessments, and enhance the inspection risk prioritization model.
- **C536: Distribution Overhead Patrol Inspections:** Distribution overhead patrol inspections consist of a visual inspection of applicable utility equipment and structures and are designed to identify obvious structural problems and hazards. Distribution overhead patrol inspections may be satisfied by other inspections, such as overhead detailed inspections or risk-informed drone inspections.
- **C546: Aviation Firefighting Program**: The Aviation Firefighting Program focuses on reducing the consequences of wildfires through suppression of fire

spread. Under certain conditions, a wildfire that is not suppressed may grow rapidly and uncontrollably, endangering public safety and electrical infrastructure. Fire agencies could divert local aerial resources to fight wildfires outside of the service territory, leaving the service territory with limited or no aerial firefighting resources. To mitigate this risk, the aviation firefighting program serves as a wildfire suppression resource, ensuring aerial firefighting resources remain available in the region.

- **C548: Wildfire Infrastructure Protection Teams:** Work activities and associated fire mitigations throughout the service territory are designated for specific Fire Potential Index (FPI) ratings (*e.g.*, Normal, Elevated, Extreme, or RFW) as defined in ESP 113.1 SDG&E Operations and Maintenance Wildland Fire Prevention Plan. As the fire potential increases, activities that present an increased risk of ignition have additional mitigation requirements. Where risk cannot be mitigated, work activity might cease. When work activities reach a level of fire risk where a dedicated resource is required, SDG&E uses qualified fire resources with specific training and experience, referred to as CFRs. While these resources can be ordered throughout the year, SDG&E takes the proactive step of supplying field crews with 12 to 17 CFRs once the fire environment and FPI indicate elevated risk, typically from June through the end of November. SDG&E also works to align with the seasonal staffing of local, state, and federal agencies in the service territory. The use of CFRs is not limited to the HFTD, as SDG&E's protocols require a dedicated fire patrol for specific activities when they are performed adjacent to wildland fuels and there is elevated risk present.
- **C550: Combined Covered Conductor:** The Combined Covered Conductor Program replaces bare conductors with covered conductors in the HFTD. Covered conductors are manufactured with an internal semiconducting layer and external insulating ultraviolet-resistant layers to provide incidental contact protection. The WiNGS-Planning model is utilized to prioritize installation within the HFTD. SDG&E performs a comprehensive assessment of existing assets to determine if pole replacements are necessary in conjunction with covered conductor installation based on detailed pole loading calculations. The need for new

electrical equipment, such as fuses, transformers, and lightning arrestors, is also considered and new assets are installed alongside covered conductors. Furthermore, advanced protection solutions like Early Fault Detection (EFD) and Falling Conductor Protection (FCP) are assessed and implemented to enhance the system's effectiveness against various risk drivers. The evaluation of additional sectionalizing devices to minimize the number of customers affected by PSPS de-energizations is also conducted, with new devices potentially being installed. Overhead asset inspections and vegetation management activities also continue on lines with covered conductor. Additionally, PSPS de-energizations and Sensitive Relay Profiles (SRP) may be utilized during periods of extreme fire weather. These additional mitigation measures enhance the effectiveness of covered conductor installations against ignitions to an estimated 58 percent.[74] Covered conductors are effective at reducing risk events on utility equipment and can raise the threshold for PSPS de-energizations to higher wind speeds compared to bare conductor hardening. For example, during the PSPS activation that occurred from December 9 to December 11, 2024, the wind gust threshold was increased from 45 miles per hour to 50 miles per hour for two feeder segments with covered conductor installed.

- **C552: PSPS Sectionalizing Enhancements:** The PSPS Sectionalizing Enhancement Program installs sectionalizing devices in strategic locations, improving the ability to isolate high-risk areas for potential de-energization. For example, switches are installed on predominantly underground circuits, allowing customers on the underground portion of the circuit to remain energized during weather events. Additionally, weather station data is used with sectionalizing devices to target de-energizations to sections of circuits that are experiencing extreme wind events.
- **C559: LiDAR Flights:** Light Detection and Ranging (LiDAR) inspections on distribution lines are primarily used to support grid hardening design efforts. Distribution systems are often changing with joint use additions, customer

[74] *See* Attachment F for further details regarding the effectiveness of covered conductor and strategic undergrounding.

relocations, compliance, reliability and maintenance modifications, conductor creep and pole settling, external development, and other potential hazards, which can impact the ability of the electric line design to mitigate the risk of wildfires. LiDAR surveys provide a cost effective, scalable, and accurate solution for overhead power line analysis, increasing both system reliability and safety. LiDAR funds are spent primarily on post-construction surveys (including auditing contractor activities), then pre-construction designs, and finally vegetation analysis.

- **C564: Distribution Communications Reliability Improvements:** A reliable communication network is necessary for many initiatives that require continuous communication. The current communication system within the HFTD has little bandwidth to support technologies deployed as wildfire mitigations, including Advanced Protection and Falling Conductor Protection. In addition, there are gaps in coverage of third-party communication providers in the rural areas of eastern San Diego County that limit the ability to communicate with field personnel during RFW crew deployments and EOC activations. To mitigate this risk, the DCRI Program was developed to deploy a privately-owned LTE network using licensed radio frequency spectrum, enhancing the reliability of the communication network.
- **C565: Transmission Overhead Detailed Inspections:** For transmission overhead detailed inspections, qualified inspectors (patrollers) visit every structure scheduled for inspection on a 3-year interval cycle, visually assessing all components of the structure and conductor for current and future maintenance requirements. Identified conditions are assigned internal condition codes that are used to prioritize the condition based on the risk and severity. This prioritization considers the component identified, the location of the structure and surrounding terrain, and the severity of the condition. It also prioritizes work to meet or exceed the timeframes required in GO 95, Rule 18. SDG&E notes that the transmission line inspection programs are driven by FERC-jurisdictional projects. This filing provides only the CPUC jurisdictional projects.
- **C568: Strategic Pole Replacement:** The Strategic Pole Replacement program

targets high-risk poles in fire prone areas of the service territory, including Tier 2 and 3 of the HFTD that are gas treated (also known as Cellon treatment) and set in concrete or soil and are otherwise not forecast to be addressed by other programs. Because the average age of gas treated poles is 50 years, these poles are nearing the end of their useful life and are known to have a higher failure potential. Gas treated poles have a higher propensity for dry rot due to the pole's interaction with moisture in the soil, and poles set in concrete are more difficult to inspect. Poles identified through the Pole Loading Remediation Program are also included in the scope of this program. These poles will be replaced or will require pole-top only work to remediate issues identified through pole loading calculations. This may include pole replacement, pole-top re-arrangement, re-tensioning of primary and/or secondary conductor, anchor modifications, or other modifications as necessary.

Permitting, land rights, environmental mitigation, customer concerns, or a combination of these factors can impact the pole replacement and/or pole top work schedule. Where feasible, poles are bundled together to minimize the impact to the community and gain efficiency in the design, environmental, permitting, land rights, and construction process.

- **C569: Cleveland National Forest Fire Hardening:** SDG&E operates and maintains a network of electric facilities located within the Cleveland National Forest (CNF). In 2016, SDG&E received a Master Special Use Permit (MSUP) to operate and maintain these facilities. Specifically, the MSUP allows SDG&E to develop a series of projects and activities aimed at increasing the safety and reliability of existing electric facilities within and near the CNF, including. the fire-hardening of facilities and selective undergrounding of several existing 12-kilovolt (kV) and 69-kV electric facilities spread throughout an approximately 880 square-mile area in the eastern portion of San Diego County. Generally, the CNF program will increase the safety and reliability of SDG&E's system by fire-hardening existing electric infrastructure that currently serves the U.S. Forest Service, emergency service facilities (*i.e.*, fire, communication, and other), campgrounds, homes, businesses, and other customers within the CNF and

surrounding areas. Projects were completed in 2021 and costs included in this chapter are trailing costs to support the CNF Post Line Restoration Project (PLRP), which provides post-construction habitat restoration required by project permits for temporarily impacted mitigatable vegetation communities. This program is complete; however, trailing costs will continue until 2030.

- **C570: Expulsion Fuse Replacements:** Expulsion fuses connected to the distribution system provide protection when the system experiences a fault or overcurrent. These fuses operate by creating a significant expulsion within the fuse, resulting in the fuse opening and isolating the fault, which limits further damage to other equipment. However, this external discharge has the potential to ignite flammable vegetation. The Expulsion Fuse Replacement Program replaced existing expulsion fuses with new, safer expulsion fuses that are approved by CAL FIRE. These new expulsion fuses reduce the discharge expelled into the atmosphere, reducing the chance of a fuse operation leading to an ignition.
- **C570 Expulsion Fuse Replacements** will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the workpapers associated with this chapter.
- **C573: Early Fault Detection:** Electrical equipment failures can cause significant damage, impact customer and employee safety, have high repair costs, and result in extended outages to customers. However, recent advances in power quality waveform analysis, relaying, radio frequency, and other technologies have made it possible for utilities to identify and predict failures before they occur. The EFD Program utilizes various technologies to detect what are known as incipient faults on the system with enough time to locate and potentially fix or replace equipment prior to it permanently failing. These incipient faults occur on failing pieces of equipment long before they fail violently and cause damage to the surrounding area.
- **C576: Avian Protection:** The Avian Protection Program installs avian protection equipment on distribution poles in the service territory to prevent electrocution of birds and to facilitate compliance with federal and state laws. The program is aimed at improving reliability and reducing the risk of faults and wire-down

events associated with avian contact, which can lead to ignitions. Avian protection equipment is installed concurrently with other asset replacement initiatives across the HFTD such as HLC replacements, fuse replacements, and lightning arrestor replacements. C576 Avian Protection will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the workpapers associated with this chapter.

2. Vegetation Management and Inspections

Vegetation management is comprised of the assessment, intervention, and management of vegetation in proximity to electrical infrastructure, including pruning and removal of trees and other vegetation around electrical infrastructure for safety, reliability, and risk reduction. SDG&E's Vegetation Management Program consists of the following activities: Detailed Inspections, Off-Cycle Patrols, Tree Pruning and Removal, Pole Clearing, Auditing, and Fuels Management. These activities involve several components, including tracking and maintaining a database of inventory trees and poles, detailed and off-cycle inspections, pruning and removing trees for conductor clearance, replacing unsafe trees with compatible species, and quality compliance to verify work quality and contractual adherence. The Vegetation Management System (VMS), called PowerWorkz, is used to track and record inventory assets (trees and poles) and manage work activities.

- **C537: Off-Cycle Patrol:** Off-Cycle Patrols are performed in the HFTD. Vegetation within the utility strike zone is assessed for tree growth and hazard potential. Off-Cycle Patrols also target Century plant (*Agave americana*) and bamboo because of their relatively fast and unpredictable growth. The inspector determines any work that is required prior to the next routine scheduled tree pruning based on the Vegetation Management Area's (VMA's) activity schedule. Off-Cycle Patrols are performed by ISA-Certified Arborists who may be internal SDG&E employees (Patrollers) or contracted personnel. Inventory tree records for vegetation that require work are also updated.
- **C540: Fuels Management**: The Fuels Management activity is a discretionary activity performed in the HFTD that reduces risk in high fire threat areas that could result from equipment failure or a wire-down event. This mitigation measure is intended to protect infrastructure in the event of a wildfire that

originates outside of SDG&E rights-of way. The scope of the activity involves thinning vegetation at ground level within a 50-foot radius surrounding the pole. Vegetation is reduced to approximately 30 percent ground cover within the cleared radius. Native and sensitive species are selectively retained where possible. This activity is predominantly performed around poles that are subject to the requirements of Public Resources Code Section 4292 because the ignition risk at these locations is relatively higher due to the equipment on the pole.

- **C544: Pole Clearing:** Pole clearing is a mandatory activity of maintaining a fuel break around power poles that are subject to the clearance requirement by removing vegetation that could ignite or propagate a fire. Pole clearing is required within the State Responsibility Area (SRA) to comply with Public Resources Code Section 4292 for poles that carry specific, "non-exempt" equipment. Non-exempt equipment may arc, spark, or fail, causing hot particles to fall to the ground, potentially resulting in an ignition. Public Resources Code Section 4292 requires clearing of vegetation at ground level within a 10-foot radius from the outer circumference of non-exempt poles and towers (also called "subject" poles and towers). Public Resources Code Section 4292 also requires removal of live vegetation to a height of 8 feet above ground within the 10-foot cylinder, and the removal of dead vegetation within the cylinder up to the height of the conductors. Poles with exempt equipment are not subject to the pole clearing activity.
- **C551: Prune and Removal (Clearance):** Tree pruning and removal is the activity of cutting vegetative material for the purpose of maintaining safe, reliable, and compliant clearance between trees and overhead electrical conductors. The Tree Pruning and Removal Activity follows American National Standards Institute (ANSI) A300 and International Society of Arboricultural (ISA) best management practices. Clearances established at time-of-pruning are determined by multiple factors including species, growth rate, minimum required clearance, wind sway, line sag, proper pruning practices, and tree health and must be sufficient to provide safety and compliance for at least one annual cycle. Enhanced tree pruning is performed within the HFTD where fire risk is considered elevated or extreme. Enhanced clearances are defined as greater than

12 feet from the conductor and exceed the clearance recommended by the CPUC within GO 95, Rule 35 within the HFTD. Enhanced clearances generally pertain to the pruning of targeted species and the removal of any tree species within the HFTD.

- **C554: Detailed Inspections:** Detailed Inspections are performed annually throughout the HFTD and consist of a Level 2 inspection for trees in the utility strike zone. A Level 2 inspection is a 360-degree visual assessment of trees located within the utility strike zone evaluating the crown, trunk, canopy, and above-ground roots for hazards to the overhead electric facilities. The utility strike zone is defined as the area where trees are tall enough to impact the overhead facilities. Detailed inspections are conducted concurrently for distribution and transmission conductors where they are collocated within the utility corridor. Detailed inspections determine whether vegetation will encroach the required minimum clearance distance or otherwise impact the lines within the annual cycle. Detailed Inspections occur annually based on the Master Schedule, which remains static year to year.
- **C555: Vegetation Restoration Initiative:** The Vegetation Restoration Initiative represents multiple programs supporting SDG&E's overall sustainability goal. These programs include the Tree Sustainability Program; Customer Tree Rebate Program; and the Tree Removal/Replacement Program.
    - The Tree Sustainability Program provides SDG&E customers and external stakeholders such as cities, communities, and Tribal governments free trees for planting. This program supports the "right-tree, right-place" philosophy of planting trees that are compatible to grow near power lines.
    - The Customer Tree Rebate Program provides qualifying residential customers rebates that incentivize planting trees to help provide direct environmental, health, and economic benefits. This program was designed for customers in parts of SDG&E's service territory where tree canopy was limited and where planting trees could make a positive impact in a community.
    - The Tree Removal/Replacement Program provides eligible customers the

incentive to allow SDG&E to remove incompatible trees growing near power lines and to provide replacement species that are safe. SDG&E targets palm, eucalyptus, and other fast-growing species that require repeated and costly pruning in order to maintain near power lines.

All three programs help support SDG&E's goal to provision (plant or provide) 100,000 trees in its service territory by 2035.

- **C578: QA/QC of Vegetation Management:** Quality assurance audits of vegetation management activities (Detailed Inspections, Pruning and Removal, and Pole Clearing activities) are performed to measure work quality, contractual adherence, compliance with regulations and standards, and data accuracy. A third-party contractor performs the quality assurance audits of vegetation management activities. QA/QC of Vegetation Management audits.

3. Situational Awareness and Forecasting

Situational awareness and forecasting consists of the Fire Science and Climate Adaptation (FSCA) business unit, tools, and technologies to enhance wildfire preparedness; climate resilience; and collaboration with experts to develop solutions for preventing ignitions, mitigating fire impacts, and building a resilient region.

- **C561: Fire Potential Index:** The Fire Potential Index (FPI) is a daily forecast that is generated to communicate the wildfire potential for any given day, thereby promoting safe and reliable operations. This 7-day forecast classifies fire potential based on weather conditions, fuel states, and historical fire occurrences. The FPI reflects key variables such as the state of native grasses across the service territory (green-up), fuels (ratio of Dead Fuel Moisture component to Live Fuel Moisture component), and weather (sustained wind speed and dew point depression). Each of these variables is assigned a numeric value and those individual numeric values are summed to generate a Fire Potential value from 0 to 17 that expresses the degree of fire threat expected for each of the 7 days included in the forecast. The numeric values are grouped into "Normal," "Elevated," and "Extreme." C561: Fire Potential Index was merged C572 Situational Awareness and Forecasting in 2024. This is reflected in the workpapers associated with this chapter.

- **C562: Weather Station Maintenance and Calibration:** The Weather Station Network consists of 223 strategically placed weather stations across the service territory that transmit data on wind speed, gusts, direction, temperature, and humidity every 10 minutes using cellular and spread spectrum communications. Data is transmitted to SDG&E's publicly available website Weather Awareness System (https://weather.sdgeweather.com/). Furthermore, 217 weather stations (approximately 97 percent) can be remotely enabled to report data every 30 seconds during critical fire weather conditions. Over the past decade, this data has been used to analyze weather patterns within the service territory and to generate statistics such as the 95th percentile, 99th percentile, and maximum values for wind gusts, which are essential for informed decision-making during extreme weather events. These statistics are updated annually to maintain accuracy and relevance.
- **C572: Situational Awareness and Forecasting:** The Fire Science and Climate Adaptation (FSCA) business unit is comprised of meteorologists, climate adaptation advisors, and fire coordinators. This business unit is dedicated to responding to and strategizing for wildfire preparedness activities and climate resilience-related deliverables. The Wildfire and Climate Resilience Center (WCRC), which opened in 2024, brings leading thinkers and problem solvers in academia, government, and the community together to create forward-looking solutions to help prevent ignitions, mitigate the impacts of fires, and ultimately help build a more resilient region.

  Situational awareness and forecasting is supported by various tools and technologies, such as the Weather Station Network, satellites such as GOES-18/-17 and the Advanced Baseline Imager (ABI) that aid in fire detection, and high-performance computing clusters that generate weather data for operations and the FPI, a model that calculates the wildfire potential based on weather, fuel conditions, and historical fire occurrences on any given day, assisting in safe and reliable operations.

4. Emergency Preparedness, Collaboration and Public Awareness

SDG&E's Emergency and Disaster Preparedness Plan (the Company Emergency and

Disaster Preparedness Plan or CEADPP) was developed in compliance with Pub. Util. Code § 768.6(a) as a guide to govern emergency response efforts, including wildfire and PSPS emergency preparedness. This plan is part of the overall emergency response plan framework.

The Wildfire Safety/PSPS Community Awareness campaign educates customers and the general public about the risk of wildfires and PSPS de-energizations through online webinars, Wildfire Safety Fairs, and outreach advisors who work with local community-based organizations to amplify messaging. The Tribal Relations team implements culturally appropriate communications and outreach based on feedback from Tribes via listening sessions, online surveys, and focus groups. During PSPS activations, customer notifications, media updates, in-community signage, and situational awareness postings are used across social media, including social media toolkits that are shared with community partners to reach a broad audience. Assistance and resource access are provided to those who are directly impacted by wildfires and/or PSPS activations. Emergency residential and non-residential customer protections are provided for wildfire victims, as ordered by the CPUC.[75]

SDG&E regularly engages with local governments at various levels. The Regional Public Affairs team engages senior and elected officials while the Emergency Management team works with first responders and other emergency management agencies. SDG&E participates in a series of weekly and monthly meetings with other California IOUs to strategize and align where possible on wildfire and PSPS mitigations. Additionally, the Company has a membership with Chartwell, Inc., a national membership group for gas and electric utilities, that collaborates on problem-solving opportunities and events to help utilities improve customer experience and operational efficiency.

- **C556: Engagement with AFN Populations:** SDG&E conducts a dedicated campaign focused on communicating with customers with AFN. The AFN campaign promotes available resources and services during PSPS de-energizations through its robust support model and partnerships with entities such as 211, Facilitating Access to Coordinated Transportation (FACT), and the Salvation Army. Additionally, the campaign promotes collaboration with local

[75] SDG&E filed Advice Letter 3177-E/2645-G on January 26, 2018, in compliance with Resolution M-4835 dated January 11, 2018, which was approved on February 21, 2018, and made effective December 7, 2018. *See also*D.19-05-039 and D.19-07-015.

Community Based Organizations (CBO) across the service territory, including organizations within SDG&E's Energy Solutions Partner Network.

- **C557: Public Outreach and Education Awareness:** Implementation of outreach and awareness programs is done through approximately 50 CBOs from the Energy Solutions Partner Network that are either located in or serving customers in the HFTD. These CBOs are leveraged to provide notification support before, during, and after an event. SDG&E also partners with several CBOs to jointly host a series of Wildfire Safety Fairs and Mini Wildfire Safety Fairs, which target both HFTD communities and hard-to-reach customers in the HFTD. These events are held in partnership with local organizations and internal departments and share key information about how to prepare for a wildfire, PSPS de-energization, or other potential emergencies. Feedback is also solicited from event attendees and responses are used to improve future outreach efforts.
- **C560: Mylar Balloon Alternative:** SDG&E worked with a major balloon manufacturer to pursue the development of a non-conductive balloon. SDG&E brought expertise in electrical engineering and the distribution power grid, and the balloon manufacturer brought expertise in manufacturing processes and retail commercialization. Both companies worked collaboratively to develop a prototype non-conductive balloon that will not cause an electrical fault when it comes in contact with overhead distribution power lines. They also drafted an industry standard to test balloons to identify whether a balloon will cause a fault to overhead distribution power lines that, if adopted by local authorities, could be used to limit the sale of balloons that don't pass the test.
- **C567: Public Emergency Communication Strategy:** The Wildfire Safety Public Education and Outreach plan increases community resiliency to wildfires and mitigates the impact of PSPS de-energizations. The plan is divided into three phases: prior to, during, and following a wildfire or PSPS de-energization. Prior to an anticipated PSPS de-energization, mass communication efforts focus on educating customers and the public. During a wildfire or PSPS activation, notifications, media updates, in-community signage, and situational awareness postings are used across social media and SDG&E's external-facing online

messaging to provide the latest real-time updates to customers and the general public. Social media toolkits are also developed and shared with community partners to help reach a broader audience. Key communications are available in 22 prevalent languages. Notifications are amplified by SDG&E's expansive AFN CBO partner coalition, made up of trusted agencies within the AFN community, including Residencial Care Facilities, Social Service agencies, and AFN and medical support organizations. After a wildfire or PSPS de-energization, communications to customers and the general public are reviewed and evaluated for future improvements and an engagement survey is sent to all public safety partners. Feedback is then used to improve customer and public communications and outreach efforts for the following year.

- **C571: Emergency Preparedness and Recovery Plan:** SDG&E's CEADPP provides an all-hazards strategic framework that SDG&E personnel rely on to respond effectively using the Incident Command System (ICS) and National Incident Management System (NIMS) (ICS-NIMS) required by federal and state mandates. This plan is developed, updated, and maintained in compliance with GO 166 as modified by D.98-07-097, D.00-05-022, D.12-01-032, D.14-05-020, and D.21-05-019. The CEADPP addresses emergency preparedness, crisis management, and business resumption planning to provide for the safety of employees, contractors, customers, and the public and to provide protection of property in the event of an incident affecting employees, contractors, customers, or other stakeholders.

5. Enterprise Systems

Enterprise Systems are comprehensive, integrated software platforms designed to manage and streamline various business processes and functions across SDG&E. They incorporate advanced technologies and analytics to enhance efficiency, transparency, and decision-making. Key components include:

- Asset Management and Inspection Enterprise System: Utilizes advanced technology and analytics, integrating data from systems such as Asset 360 and IIP to develop and enhance risk-informed strategies and improve transparency in asset management.

- Vegetation Management Enterprise System: Enhances asset tracking, data analytics, and scheduling capabilities to better manage vegetation management activities. It also includes advanced analytics for proactive vegetation inspection.
- Enterprise Data Foundation: Focuses on migrating data from on-premise systems to the Amazon Web Services (AWS) Cloud, ensuring a robust and scalable data infrastructure.
- Risk Assessment Systems: Enhances risk modeling capabilities to better assess and manage potential risks.
- **C566: Enterprise Data Foundation**: The Enterprise Data Foundation is a centralized system designed to manage and optimize data related to wildfire mitigation and asset management. This foundation involves the migration of data from on-premise systems to the AWS cloud, establishing data migration patterns, and implementing processes for data validation, integrity, and data governance to enhance quality throughout the migration journey. The Enterprise Data Foundation advances asset management capabilities, enables the development of advanced analytics, supports data auditability and the development of a WMP data catalog, provides end users with visualization tools to interact with the data effectively, and supports the automation of WMP-related reporting processes. By utilizing combined data, it enhances the ability to manage assets, assess risks, and make informed decisions to optimize business operations.
- **C575: Vegetation Management Enterprise System:** Vegetation Management utilizes the software system PowerWorkz to inventory vegetation and manage inspections. PowerWorkz uses the CityWorks software platform and is the server side where Scheduling Work Orders and Dispatch Work Orders are created and submitted. The mobile application (Epoch) is the mapping interface contractors use for data entry to record completed work. Epoch includes GIS layers, electric infrastructure, land ownership, and parcel information, and houses the electronic records for all tree and pole assets.

6. Wildfire Mitigation Strategy

SDG&E uses a comprehensive approach to wildfire mitigation in its effort to promote public and system safety in the face of increasing fire and PSPS Risks. SDG&E's wildfire

mitigation strategy continues to evolve with enhancements made to risk modeling, and methodology continues to be refined to not only consider initial investments but also conduct a comprehensive and detailed analysis of the lifecycle costs of various mitigation alternatives, ensuring that the most cost-effective and sustainable solutions are implemented. By examining and comparing factors such as operations and maintenance, operational efficiency, and potential savings from avoided risks, SDG&E can prioritize grid-hardening investments that offer the greatest long-term benefits.

- **C563: Wildfire Mitigation Strategy Development:** The Wildfire Mitigation department manages and oversees the wildfire mitigation program, which aims to reduce the risk of wildfires and minimize the impact of PSPS de-energizations on customers. The department leads various wildfire mitigation initiatives, including supporting regulatory and legislative activities related to fire mitigation. It also fosters collaboration efforts with other utilities and external stakeholders and develops innovative ways to advance existing wildfire mitigations. The department also tracks and monitors Wildfire Mitigation program progress and metrics, leads the utility wildfire mitigation maturity model, spearheads vision projects, promotes new methods to enhance fire safety, and explores advancements to drive further improvement and change. This includes tracking WMP activities, complying with reporting requirements, and providing governance specifications and procedures.

7. Risk Methodology and Assessment

Comprehensive risk modeling identifies, quantifies, and mitigates wildfire risks, with the ultimate intent of safeguarding communities and enhancing the resilience of SDG&E's electrical grid. Improving the prediction of potential hazards enables the creation of risk-informed strategies that improve financial planning, situational awareness, and resource allocation. Additionally, risk methodology and assessment aims to develop advanced analytics and predictive models to support ongoing WMP and Risk Management initiatives. This includes the creation of a data lake and machine learning pipelines to leverage readily available cloud machine learning and artificial intelligence capabilities to proactively identify, reduce, and manage wildfire-related risk. It will enhance data quality by utilizing and validating centralized datasets, ensuring the consumption of accurate data in risk models. Additionally, it will expedite

iterations, improving the overall efficiency of the process. There will be a core set of re-usable, cloud-based data science workspaces and tools to enable sustainable and faster model creation and feedback loops that evaluate and validate the utility workload. Additionally, third party consultants and/or contractors are engaged to provide detailed analyses around industry best practices, consequence modeling, independent review, and project management support.

- **C558: Risk Methodology and Assessment:** Risk methodology and assessment focuses on enhancing analytics capabilities and refining risk models to better inform decision-making. The program manages and refines its risk modeling improvement plan, which incorporates the evaluation of additional factors such as climate vulnerability assessment and further segmentation of risk drivers. Additionally, the program enhances modeling design and architecture, enabling the tracking and validation of various model risk components, establishing a formalized process for conducting independent reviews, and expanding the use of models to inform the selection and prioritization of initiatives beyond the installation of covered conductors and undergrounding of electric lines.

B. Changes from 2024 Controls

SDGE plans to discontinue the following controls:

- **C501 Wireless Fault Indicators** will be discontinued because the current wireless fault indicators were discontinued by the manufacturer. These units communicate with On-Ramp but do not communicate with SCADA, which makes them obsolete as a wireless indicator. However, installed WFIs will continue to be used manually by field personnel as a fault indicator.
- **C502 Capacitor Maintenance and replacement program (SCADA)** was completed in 2024.
- **C510 Hotline Clamps, C524 Lightning Arrestor Removal/Replace Program, C570 Expulsion Fuse Replacements, and C576 Avian Protection** will be merged with C550 Combined Covered Conductor beginning in 2025. This is reflected in the workpapers associated with this chapter.
- **C528 Distribution Infrared Inspections** will be discontinued in 2026 because the program yielded an extremely low find rate. In 2024, 6,656 inspections were completed with a Level 1 find rate of 0.045% and a Level 2 find rate of 0.916%.

Infrared technology will continue to be used during routine and responsive patrols and inspections as needed to help identify and mitigate any potential issues.

- **C564 Distribution Communications Reliability Improvements** will be discontinued beginning in 2026, as SDG&E has focused its investments on projects that have the greatest impact on risk reduction in the HFTD. While the DCRI project provides communication for advanced protection projects, it has a lower impact on risk reduction compared to other programs. Communication needs for specific projects will be addressed as they are built out, rather than proactively. Currently, there is no identified replacement for the program.
- **C555 Vegetation Restoration Initiative** has been indefinitely paused beginning in 2025, as SDG&E has focused its investments on projects that have the greatest impact on risk reduction in the HFTD.
- **C560 Mylar Balloon Alternative** was completed in 2021.
- **C561: Fire Potential Index** was merged with C572 Situational Awareness and Forecasting in 2024 in 2024. This is reflected in the workpapers associated with this chapter.

C. Mitigation Programs

SDGE intends to implement the following new mitigation program:

- **M503: Grounding Banks:** This program intends to remove all distribution line grounding banks from 12-kV circuits with overhead HFTD exposure by extension of a new overhead primary neutral conductor. Distribution line grounding banks were installed over several decades until new installations were discontinued in September 2020. Grounding banks were a cost reduction measure that eliminated the need for a primary neutral conductor when new underground subdivisions were added to the system. In compliance with GO 95, they prohibited the reliance on earth grounds to carry line currents during normal operations. However, grounding banks tend to redirect fault current levels for many types of faults, making it more difficult to maintain reliable, consistent operation of protective devices. This may prevent protective devices from accurately detecting safety hazards such as an energized wire down. Therefore, a design constraint was implemented that allowed up to three grounding banks for a given 12-kV circuit

(grounding banks are not installed on 4-kV circuits). Nearly all distribution line grounding banks are installed on poles. Projects under this program will be prioritized to resolve circuits in the HFTD. Circuits with three grounding banks will be prioritized first, circuits with then two grounding banks, then circuits with one grounding bank.

D. Climate Change Adaptation

Pursuant to Commission decisions[76] in the Climate Adaptation OIR (R.18-04-019), SDG&E performed a CAVA focused on the years 2030, 2050, and 2070 with the aim of identifying asset and operational vulnerabilities to climate hazards across the SDG&E system. SDG&E recognizes the need to address climate vulnerabilities with the goals of promoting safety and reliability of its services and mitigating the increasing climate-related hazards through innovative and community-centric approaches. Some of the climate hazards that will have short- and long-term ramifications in the San Diego region include extreme temperatures, wildfire, inland flooding, coastal flooding and erosion, and landslides. Climate change is recognized as a factor that can drive, trigger, or exacerbate multiple RAMP risks. Implementing climate change adaptation measures and integrating climate vulnerability considerations into RAMP controls and mitigations can enhance system longevity and reduce the severity of long-term negative climate impacts. The controls and mitigations described in this chapter align with the goal of increasing SDG&E's physical and operational resilience to the increasing frequency and intensity of climate hazards. All controls and mitigations within the Wildfire and PSPS Risk chapter are applicable to climate adaptation planning due to their alignment with increasing resilience to wildfire. For additional information on the CAVA and a complete list of climate-relevant controls and mitigations included in RAMP, refer to Chapter RAMP-5: Climate Change Adaption.

E. Foundational Programs

Foundational programs are "[i]nitiatives that support or enable two or more Mitigation programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[77] These programs do not directly contribute to risk reduction

[76] D.19-10-054; D.20-08-046.

[77] D.24-05-064, Appendix A at A-4.

but are foundational to SDG&E's wildfire mitigation efforts.

Table 10 lists the Foundational Programs that are applicable to the Wildfire and PSPS Risk and the mitigation activities that they support.

Table 10: Wildfire and PSPS
Foundational Activities
(Direct, in 2024 $ thousands)

ID	Foundational Activity Name	Enabled Control/Mitigation	2025 O&M Costs	2025-2031 Capital Costs
C504	Standby Power Program (Fixed Backup Power Commercial)	All Overhead Programs*	1,000	-
C512	Customized Resiliency Assessment	All Overhead Programs*	3,953	-
C516	Generator Assistance Program	All Overhead Programs*	489	-
C546	Aviation Firefighting Program	All Overhead Programs*	4,503	5,339
C548	Wildfire Infrastructure Protection Teams	All Overhead Programs,* C518 Strategic Undergrounding	4,820	-
C562	Weather Station Maintenance and Calibration	All Overhead Programs,* C518 Strategic Undergrounding	-	7,616
C572	Situational Awareness and Forecasting	All Overhead Programs,* C518 Strategic Undergrounding	4,496	-
C556	Engagement with AFN Populations	All Overhead Programs,* C518 Strategic Undergrounding	1,719	-
C557	Public Outreach and Education Awareness	All Overhead Programs,* C518 Strategic Undergrounding	605	-
C567	Public Emergency Communication Strategy	All Overhead Programs,* C518 Strategic Undergrounding	8,706	9,219
C571	Emergency Preparedness and	All Overhead	21,720	29,592

ID	Foundational Activity Name	Enabled Control/Mitigation	2025 O&M Costs	2025-2031 Capital Costs
	Recovery Plan	Programs,* C518 Strategic Undergrounding		
C566	Enterprise Data Foundation	All Overhead Programs,* C518 Strategic Undergrounding	2,020	43,475
C575	Vegetation Management Enterprise System	All Overhead Programs*	327	-
C563	Wildfire Mitigation Strategy Development	All Overhead Programs,* C518 Strategic Undergrounding	5,045	-
C558	Risk Methodology and Assessment	All Overhead Programs,* C518 Strategic Undergrounding	5,754	27,818
C564	Distribution Communications Reliability Improvements	All Overhead Programs,* C518 Strategic Undergrounding	2,287	10,615

* *All Overhead Programs include the following: C506 Microgrids, C508 Advanced Protection, C520 Distribution Overhead System Hardening, C522 Transmission Overhead Hardening (Distribution Underbuild), C526 Distribution Overhead Detailed Inspections, C536 Distribution Overhead Patrol Inspections, C537 Off-Cycle Patrol, C540 Fuels Management, C544 Pole Clearing (Brushing), C550 Combined Covered Conductor, C551 Prune and Removal (Clearance), C522 PSPS Sectionalizing Enhancements, C554 Detailed Inspections, C565 Transmission Overhead Detailed Inspections, C568 Strategic Pole Replacement, and C573 Early Fault Detection.*

Capital and Operations and Maintenance (O&M) foundational costs are modeled as annual costs per mile in SDG&E's workpapers. Depending on the program, these costs are allocated based on subject matter expert consideration as follows:

1. If a program only affects combined covered conductor, 100% of the cost is assigned to this mitigation and 0% is assigned to strategic undergrounding. For example: C546: Aviation Firefighting Program in Table 10.
2. If a program mostly supports combined covered conductor, 75% of the cost is assigned to this mitigation and 25% is assigned to strategic undergrounding. For example: C567: Public Emergency Communication Strategy in Table 10.
3. If a program supports both combined covered conductor and strategic

undergrounding initiatives, the costs are split equally. For example: C566: Enterprise Data Foundation; C558: Risk Methodology and Assessment in Table 10.

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for Wildfire and PSPS Risk, including the associated costs, units, and CBRs. Additional information by Tranche is provided in workpapers. Costs are estimated using assumptions provided by subject matter expertise and available data. In compliance with the Phase 3 Decision,[78] for each enterprise risk, SDG&E uses actual results and industry data, when available, and supplemented the data with input from subject matter experts. Additional details regarding the data and expertise relied upon in developing these estimates is provided in Attachment B.

Table 11: Wildfire and PSPS
Control and Mitigation Plan –Recorded and Forecast Costs Summary
(Direct, in 2024 $ thousands)

Control/Mitigation		Adjusted Recorded		Estimated			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C501	Wireless Fault Indicators	3	0	0	0	0	0
C502	Capacitor Maintenance and replacement program (SCADA)	189	0	0	0	0	0
C504	Standby Power Program (Fixed Backup Power Commercial)	0	0	1,000	0	0	3,000
C506	Microgrids	7,096	1,019	1,273	910	0	3,819
C507	CMP Repairs	10,298	176	250	48,570	36,915	750
C508	Advanced Protection	11,048	188	188	13,803	2,530	564
C510	Hotline Clamps	684	47	0	146	0	0
C512	Customized Resiliency Assessment	0	3,792	3,953	0	0	11,859
C516	Generator Assistance Program	0	489	489	0	0	1,467
C518	Strategic Undergrounding	213,171	1,069	1,709	517,688	1,038,773	4,410
C520	Distribution Overhead System Hardening	3,564	1,555	420	11,659	280	420

[78] D.24-05-064, RDF Row 10.

Control/Mitigation		Adjusted Recorded		Estimated			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C522	Transmission Overhead Hardening (Distribution Underbuild)	12,460	1	1	17,470	503	3
C524	Lightning Arrestor Removal/Replace Program	2,664	0	0	539	0	0
C526	**Distribution Overhead Detailed Inspections**	**0**	**116**	**801**	**0**	**0**	**2,403**
C528	Dist. System Inspection IR/Corona	0	139	0	0	0	0
C530	**Distribution Wood Pole Intrusive Inspections**	**0**	**73**	**1,451**	**0**	**0**	**5,078**
C534	Risk-Informed Drone Inspections	73,111	31,210	11,053	88,866	38,391	35,295
C536	**Distribution Overhead Patrol Inspections**	**0**	**284**	**284**	**0**	**0**	**852**
C537	Off-Cycle Patrol	0	1,352	1,495	0	0	4,660
C540	Fuels Management	0	3,523	5,445	0	0	16,335
C544	**Pole Clearing (Brushing)**	**0**	**7,121**	**8,998**	**0**	**0**	**28,920**
C546	Aviation Firefighting Program	3,009	7,665	4,503	5,339	0	13,509
C548	Wildfire Infrastructure Protection Teams	0	4,820	4,820	0	0	14,460
C550	Combined Covered Conductor	75,037	1,886	1,832	277,897	170,449	3,894
C551	**Prune and Removal (Clearance)**	**0**	**30,337**	**31,424**	**0**	**0**	**101,279**
C552	PSPS Sectionalizing Enhancements	2,178	0	0	7,875	3,150	0
C554	**Detailed Inspections**	**0**	**3,724**	**4,859**	**0**	**0**	**15,742**
C555	Vegetation Restoration Initiative	0	926	0	0	0	0
C556	Engagement with AFN Populations Total	0	1,496	1,719	0	0	5,157
C557	Public Outreach and Education Awareness	0	530	605	0	0	1,815
C558	Risk Methodology and Assessment	4,745	5,753	5,973	15,896	11,922	17,919
C559	LiDAR Flights	0	31	2,500	0	0	0
C560	Mylar Balloon Alternative	0	2	0	0	0	0
C561	Fire Potential Index	0	0	0	0	0	0

Control/Mitigation		Adjusted Recorded		Estimated			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C562	Weather Station Maintenance and Calibration	116	0	0	352	7,264	0
C563	Wildfire Mitigation Strategy Development	678	4,120	5,306	0	0	15,918
C564	Distribution Communications Reliability Improvements (DCRI)	21,336	796	945	10,615	0	2,833
C565	**Transmission Overhead Detailed Inspections**	**1,043**	**6**	**15**	**4,582**	**3,077**	**45**
C566	Enterprise Data Foundation	7,226	0	2,481	29,057	14,418	7,443
C567	Public Emergency Communication Strategy	16,887	6,996	9,528	9,219	0	28,584
C568	Strategic Pole Replacement	2,445	58	168	31,712	23,784	205
C569	Cleveland National Forest Fire Hardening	1,036	232	1	2,085	173	3
C570	Expulsion Fuse Replacements	206	0	0	601	0	0
C571	Emergency Preparedness and Recovery Plan	3,870	20,970	21,383	29,592	0	64,149
C572	Situational Awareness and Forecasting	0	4,421	4,496	0	0	13,488
C573	Early Fault Detection	3,761	3	3	11,896	4,702	9
C574	Air Quality Station Maintenance	0	0	0	0	0	0
C575	Vegetation Management Enterprise System	622	327	327	0	0	981
C576	**Avian Protection**	**1,066**	**17**	**0**	**599**	**0**	**0**
C578	QA/QC of Veg Mgmt	0	3,206	3,424	0	0	10,778
M503	Grounding Banks	0	0	0	436	1,974	0
Total		**479,549**	**150,476**	**145,122**	**1,137,404**	**1,358,305**	**438,046**

Bold *indicates this control/mitigation includes mandated programs/activities.*

Table 12: Wildfire and PSPS
Control & Mitigation Plan – Units Summary

Control/Mitigation			Adjusted Recorded Units		Estimated Units			
ID	Name	Units of Measure	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C501	Wireless Fault Indicators	Wireless Fault Indicators	0	0	0	0	0	0
C502	Capacitor Maintenance and replacement program (SCADA)	Capacitors replaced	1	0	0	0	0	0
C504	Standby Power Program (Fixed Backup Power Commercial)	No feasible units	0	0	0	0	0	0
C506	Microgrids	Microgrids	0	0	0	1	0	0
C507	CMP Repairs	Poles	422	0	0	1,914	1,455	0
C508	Advanced Protection	Nodes	18	18	18	158	60	54
C510	Hotline Clamps	Hotline Clamps	678	0	0	197	0	0
C512	Customized Resiliency Assessment	Installations	0	0	100	0	0	300
C516	Generator Assistance Program	Rebates Issued	0	0	250	0	0	750
C518	Strategic Undergrounding	Miles UG	112	112	150	178	450	450
C520	Distribution Overhead System Hardening	Jobs completed	1	0	20	6	0	20
C522	Transmission Overhead Hardening (Distribution Underbuild)	No feasible units	7	0	0	21	0	0
C524	Lightning Arrestor Removal/Replace Program	Lightning Arrestors	1,654	0	0	516	0	0
C526	Distribution Overhead Detailed Inspections	HFTD Inspections	0	16,503	11,537	0	0	15,741
C528	Dist. System Inspection IR/Corona	HFTD Inspections	0	0	0	0	0	0
C530	Distribution Wood Pole Intrusive Inspections	HFTD Inspections	0	0	18,373	0	0	64,779
C534	Risk-Informed Drone Inspections	HFTD Inspections	1,992	6,529	6,500	2,335	1,059	19,500

Control/Mitigation			Adjusted Recorded Units		Estimated Units			
ID	**Name**	**Units of Measure**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C536	Distribution Overhead Patrol Inspections	HFTD Patrols	0	86,140	84,678	0	0	254,034
C537	Off-Cycle Patrol	VMA (Vegetation Management Area)	0	106	106	0	0	318
C540	Fuels Management	Structures cleared	0	147	500	0	0	1,500
C544	**Pole Clearing (Brushing)**	**Poles brushed**	**0**	**22,769**	**22,000**	**0**	**0**	**66,000**
C546	Aviation Firefighting Program	N/A	0	0	0	0	0	0
C548	Wildfire Infrastructure Protection Teams	N/A	0	0	0	0	0	0
C550	Combined Covered Conductor	Miles hardened	36	36	50	200	150	150
C551	**Prune and Removal (Clearance)**	**Trees trimmed**	**0**	**90,885**	**91,336**	**0**	**0**	**274,008**
C552	PSPS Sectionalizing Enhancements	Switches installed	18	0	0	25	10	0
C554	**Detailed Inspections**	**Trees inspected**	**0**	**261,975**	**255,000**	**0**	**0**	**765,000**
C555	Vegetation Restoration Initiative	Trees planted	0	0	0	0	0	0
C556	Engagement with AFN Populations Total	No feasible units	0	0	0	0	0	0
C557	Public Outreach and Education Awareness	No feasible units	0	0	0	0	0	0
C558	Risk Methodology and Assessment	No feasible units	0	0	0	0	0	0
C559	LiDAR Flights	Miles	0	0	0	0	0	0
C560	Mylar Balloon Alternative	No feasible units	0	0	0	0	0	0
C561	Fire Potential Index	No feasible units	0	0	0	0	0	0
C562	Weather Station Maintenance and Calibration	Weather sensors	0	0	0	8	6	0
C563	Wildfire Mitigation Strategy Development	No feasible units	0	0	0	0	0	0
C564	Distribution Communications	No feasible units	3	0	0	5	0	0

Control/Mitigation			Adjusted Recorded Units		Estimated Units			
ID	**Name**	**Units of Measure**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
	Reliability Improvements (DCRI)							
C565	**Transmission Overhead Detailed Inspections**	**Inspections**	**14**	**2,940**	**2,224**	**175**	**117**	**0**
C566	Enterprise Data Foundation	No feasible units	0	0	0	0	0	0
C567	Public Emergency Communication Strategy	No feasible units	0	0	0	0	0	0
C568	Strategic Pole Replacement	Poles	40	40	200	800	600	400
C569	Cleveland National Forest Fire Hardening	No feasible units	0	0	0	0	0	0
C570	Expulsion Fuse Replacements	Fuses replaced	188	0	0	311	0	0
C571	Emergency Preparedness and Recovery Plan	No feasible units	0	0	0	0	0	0
C572	Situational Awareness and Forecasting	No feasible units	0	0	0	0	0	0
C573	Early Fault Detection	No feasible units	62	0	0	240	180	0
C574	Air Quality Station Maintenance	Other	0	0	0	0	0	0
C575	Vegetation Management Enterprise System	No feasible units	0	0	0	0	0	0
C576	**Avian Protection**	**Poles protected**	**774**	**774**	**0**	**236**	**0**	**0**
C578	QA/QC of Veg Mgmt	No feasible units	0	0	0	0	0	0
M503	Grounding Banks	Feet	0	0	0	14,300	64,500	0

Table 13 presents a summary of CBRs at the mitigation or control level for the TY-2028 GRC cycle. CBRs are calculated based on scaled, expected values unless otherwise noted, and are calculated for each of the three required discount rates in each year of the GRC cycle and for the post-test years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in.

Table 53: Wildfire and PSPS
Cost Benefit Ratio Results Summary (2028-2031)
(Direct, in 2024 $ millions)

ID	Control/ Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C501	Wireless Fault Indicators	$0.0	$0.0	---	---	---
C502	Capacitor Maintenance and Replacement Program (SCADA)	$0.0	$0.0	---	---	---
C504	Standby Power Program (Fixed Backup Commercial)	$0.0	$4.0	---	---	---
C506	Microgrids	$0.9	$5.1	0.00	0.00	0.00
C507	CMP Repairs	$49.2	$1.0	0.00	0.00	0.00
C508	Advanced Protection	$3.8	$0.7	12.43	7.81	7.81
C510	Hotline Clamps	$0.0	$0.0	---	---	---
C512	Customized Resiliency Assessments	$0.0	$15.8	---	---	---
C516	Generator Assistance Program	$0.0	$2.0	---	---	---
C518	Strategic Undergrounding	$1,393.5	$6.1	33.21	13.23	12.91
C520	Distribution Overhead System Hardening	$ 0.6	$0.8	5.64	2.36	2.36
C522	Transmission Overhead Hardening (Distribution Underbuild)	$4.0	$0.0	0.00	0.00	0.00
C524	Lightning Arrestor Removal/Replacement Program	$0.0	$0.0	---	---	---
C526	**Distribution Overhead Detailed Inspections**	$0.0	$3.2	62.67	62.67	62.67
C528	Distribution Infrared Inspections	$0.0	$0.0	---	---	---

ID	Control/ Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C530	**Distribution Wood Pole Intrusive Inspections**	$0.0	$6.5	16.75	16.87	16.87
C534	Risk-Informed Drone Inspections	$51.2	$46.3	60.38	59.30	59.30
C536	**Distribution Overhead Patrol Inspections**	$0.0	$1.1	190.53	190.53	190.53
C546	Aviation Firefighting Program	$0.0	$18.0	---	---	---
C548	Wildfire Infrastructure Protection Teams	$0.0	$19.3	---	---	---
C550	Combined Covered Conductor	$239.9	$5.7	6.27	4.18	4.06
C552	PSPS Sectionalizing Enhancements	$4.7	$0.0	---	---	---
C559	LiDAR Flights	$0.0	$2.5	---	---	---
C564	Distribution Communications Reliability Improvements (DCRI)	$0.0	$3.8	---	---	---
C565	**Transmission Overhead Detailed Inspections**	$4.2	$0.1	---	---	---
C568	Strategic Pole Replacement	$31.7	$0.4	9.74	4.06	4.06
C569	Cleveland National Forest Fire Hardening	$0.4	$0.0	---	---	---
C570	Expulsion Fuse Replacements	$0.0	$0.0	---	---	---
C573	Early Fault Detection	$6.5	$0.0	157.83	97.17	97.17
C576	**Avian Protection**	$0.0	-	---	---	---
C537	Off-Cycle Patrol	$0.0	$6.2	64.97	64.97	64.97
C540	Fuels Management	$0.0	$21.8	0.60	0.60	0.60
C544	**Pole Clearing**	$0.0	$37.9	15.05	15.05	15.05
C551	**Prune and Removal (Clearance)**	$0.0	$132.7	4.33	4.33	4.33

ID	Control/ Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C554	**Detailed Inspections**	$0.0	$20.6	28.08	28.08	28.08
C555	Vegetation Restoration Initiative	$0.0	-	---	---	---
C578	QA/QC of Veg Management	$0.0	$14.2	---	---	---
C561	Fire Potential Index	$0.0	$0.0	---	---	---
C562	Weather Station Maintenance and Calibration	$7.4	$0.0	---	---	---
C572	Situational Awareness and Forecasting	$0.0	$18.0	---	---	---
C556	Engagement with AFN Populations	$0.0	$6.9	---	---	---
C557	Public Outreach and Education Awareness	$0.0	$2.4	---	---	---
C560	Mylar Balloon Alternative	$0.0	$0.0	---	---	---
C567	Public Emergency Communication Strategy	$0.0	$38.1	---	---	---
C571	Emergency Preparedness and Recovery Plan	$0.0	$85.5	---	---	---
C566	Enterprise Data Foundation	$20.8	$9.9	---	---	---
C575	Vegetation Management Enterprise System	$0.0	$1.3	---	---	---
C563	Wildfire Mitigation Strategy Development	$0.0	$21.2	---	---	---
C558	Risk Methodology and Assessment	$15.9	$23.9	---	---	---
M503	Grounding Banks	$2.4	$0.0	---	---	---

Bold *indicates this control/mitigation includes mandated programs/activities.*

Mitigations without CBR values are represented as ---. Refer to Table 14 for CBR commentary.

Refer to the workpaper for tranche-level CBRs by year and in aggregate for each mitigation.

Table 14 provides additional commentary for control and mitigation programs that did not yield quantifiable CBRs.

Table 14: Wildfire and PSPS
CBR Commentary

ID	Control/Mitigation Name	Commentary
C501	Wireless Fault Indicators	CBR is not calculated as this control/mitigation is being discontinued in 2025
C502	Capacitor Maintenance and Replacement Program (SCADA)	CBR is not calculated as this control/mitigation was completed in 2024
C504	Standby Power Program (Fixed Backup Power Commercial)	Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. Predicting customer demand and location needs is challenging, making it difficult to forecast units and calculate an accurate CBR. Mitigation costs are captured in CBR cost assumptions.
C507	CMP Repairs	The exact locations of CMP repairs are currently unknown, making it difficult to quantify CBR for this program. Mitigation cost is captured in the CBR cost assumptions.
C510	Hotline Clamps	CBR is not calculated as this control/mitigation will be merged with C550 Combined Covered Conductor beginning in 2025.
C512	Customized Resiliency Assessment	Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. Predicting customer demand and location needs for resiliency assessments is challenging, making it difficult to forecast units and calculate an accurate CBR.
C516	Generator Assistance Program	Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. Predicting customer demand and location needs for portable fuel generators is challenging, making it difficult to

ID	Control/Mitigation Name	Commentary
		forecast units and calculate a cost-benefit ratio accurately.
C524	Lightning Arrestor Removal/Replacement Program	CBR is not calculated as this control/mitigation will be merged with C550 Combined Covered Conductor beginning in 2025.
C528	Distribution Infrared Inspections	CBR is not calculated as this control/mitigation will be discontinued in 2026.
C546	Aviation Firefighting Program	Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. Mitigation costs are captured in CBR cost assumptions.
C548	Wildfire Infrastructure Protection Teams	SDG&E adjusts work activities and fire mitigation measures based on FPI ratings and employs qualified fire resources to support field crews during elevated fire risk periods, typically from June to November, aligning with local, state, and federal agencies' seasonal staffing. Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. Mitigation costs are captured in CBR cost assumptions.
C552	PSPS Sectionalizing Enhancements	The exact locations of sectionalizing devices that will be installed through this program are currently unknown, therefore, it is difficult to quantify CBR for this program.
C556	Engagement with AFN Populations	The AFN program does not have a CBR because the diversity of work activities within this program makes it infeasible to identify a single unit of measurement for a CBR.
C557	Public Outreach and Education Awareness	Public outreach and education awareness programs do not have a CBR because the diversity of work activities within this program makes it infeasible to identify a single unit of measurement for a CBR.
C558	Risk Methodology and Assessment	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver
C559	LiDAR Flights	The locations of LiDAR flights are currently

ID	Control/Mitigation Name	Commentary
		unknown, making it difficult to quantify CBR for this program.
C560	Mylar Balloon	CBR is not calculated as control/mitigation was completed in 2024.
C561	Fire Potential Index	CBR is not calculated as this control/mitigation was merged with C572 Situational Awareness and Forecasting in 2024.
C562	Weather Station Maintenance and Calibration	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C563	Wildfire Mitigation Strategy Development	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for this mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C564	Distribution Communications Reliability Improvements (DCRI)	CBR is not calculated as this control/mitigation will be discontinued in 2026.
C565	**Transmission Overhead Detailed Inspections**	CBR is not calculated because the costs of this mitigation are captured as part of C526: Distribution Overhead Detailed Inspections.
C566	Enterprise Data Foundation	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts, and the work within this program makes it infeasible to identify a single unit of measurement for a CBR. Quantifying a CBR for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.

ID	Control/Mitigation Name	Commentary
C567	Public Emergency Communication Strategy	This does not have a CBR because the program encompasses communications and messaging during fires or PSPS de-energizations. The diversity of work activities within this program makes it infeasible to identify a single unit of measurement for a CBR.
C569	Cleveland National Forest Fire Hardening	CBR is not calculated as this control/mitigation is completed.
C570	Expulsion Fuse Replacements	CBR is not calculated as this control/mitigation will be merged with C550 Combined Covered Conductor beginning in 2025.
C571	Emergency Preparedness and Recovery Plan	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C572	Situational Awareness and Forecasting	This does not have a CBR because it is considered foundational to supporting wildfire mitigation efforts. Quantifying a CBR for such a mitigation would be difficult and not beneficial because it cannot be directly tied to reducing a risk driver. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C575	Vegetation Management Enterprise System	This program supports vegetation management activities. The work within this program makes it infeasible to identify a single unit of measurement for a CBR.
C576	Avian Protection	CBR is not calculated as this control/mitigation will be merged with C550 Combined Covered Conductor beginning in 2025.
C578	QA/QC of Veg Management	CBR is not calculated as the costs of this mitigation are captured as part of the C544 Vegetation Detailed Inspection. Mitigation cost is captured in the CBR cost assumptions.
M503	Grounding Banks	CBR is not calculated as this is a new mitigation.

Bold *indicates this control/mitigation includes mandated programs/activities.*

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025, D.16-08-018, and D.18-12-014,[79] SDG&E considered two alternative plans to mitigate Wildfire and PSPS Risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this plan considers changes in risk reduction, costs, reasonableness, current conditions, modifications to the plan and constraints, such as budget and resources.

Table 15: Wildfire and PSPS
Alternative Mitigation Plan Forecasted Costs Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Forecast Costs			
		Capital (2025-2028)	PTY Capital (2029-2031)	O&M (2025-2028)	PTY O&M (2029-2031)
A520	Grid Hardening Alternative 1	574.1	1,368.2	5.7	13.7
A522	Grid Hardening Alternative 2	425.9	680.7	4.3	6.8

Table 16: Wildfire and PSPS
Alternative Mitigation Cost Benefit Ratio Results Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A520	Grid Hardening Alternative 1	$472.9	$4.7	16.21	8.93	8.70
A522	Grid Hardening Alternative 2	$276.6	$2.8	7.99	5.39	5.25

A. Grid Hardening Alternative 1 (A520):

Grid Hardening Alternative 1 considers undergrounding approximately 800 miles of electric lines from 2028 to 2031. This approach is the most effective method for mitigating wildfire risk as it virtually eliminates exposure to overhead line risks and greatly reduces the likelihood of high winds causing damage to grid assets. This leads to a substantial decrease in the

[79] D.18-12-014 at 33-35.

potential for wildfires ignited by electrical infrastructure. However, an all-underground approach presents several challenges. Although not often, projects can be constrained by permitting and terrain issues. Additionally, upfront installation costs are significantly higher than the current plan to mitigate Wildfire and PSPS Risk through a combination of undergrounding electric lines and installing combined covered conductor. Therefore, while the long-term risk reduction of this alternative is substantial, an optimal mix of grid hardening strategies, which includes both undergrounding of electric lines and installation of combined covered conductor, is more justifiable when weighing the potential benefits, risk reduction, and costs. This balanced approach allows for effective mitigation of wildfire risks while addressing the practical constraints of permitting, terrain, resource availability, and financial considerations.

B. Grid Hardening Alternative 2 (A522):

Grid Hardening Alternative 2 considers installing combined covered conductor on approximately 800 miles of electric lines from 2028 to 2031. This will reduce the likelihood of risk events across some of SDG&E's highest risk Drivers such as foreign object contacts, pole and conductor-related failures. However, the inherent overhead exposure and continued need for PSPS implementation result in high residual risk.

Additionally, this alternative is less cost-effective than the mix of grid hardening mitigations in the current plan to mitigate Wildfire and PSPS Risk. The lifecycle costs associated with the installation of combined covered conductor are higher due to ongoing maintenance and the need for periodic replacements. In contrast, an optimal mix of grid hardening strategies, which includes both undergrounding of electric lines and the installation of combined covered conductor, is more justifiable when weighing the potential benefits, risk reduction, and overall costs. This balanced approach provides a more effective and cost-efficient solution for mitigating wildfire risks and ensuring long-term grid reliability.

VI. HISTORICAL GRAPHICS

As directed by the Commission in the Phase 2 Decision, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. A bar chart graphic is employed to depict historical progress. This graphic uses a key metric that aligns with Company safety goals to illustrate trends in historical progress and identify the remaining tasks necessary to continue mitigating risks.

Figure 6: Grid Hardening: Cumulative

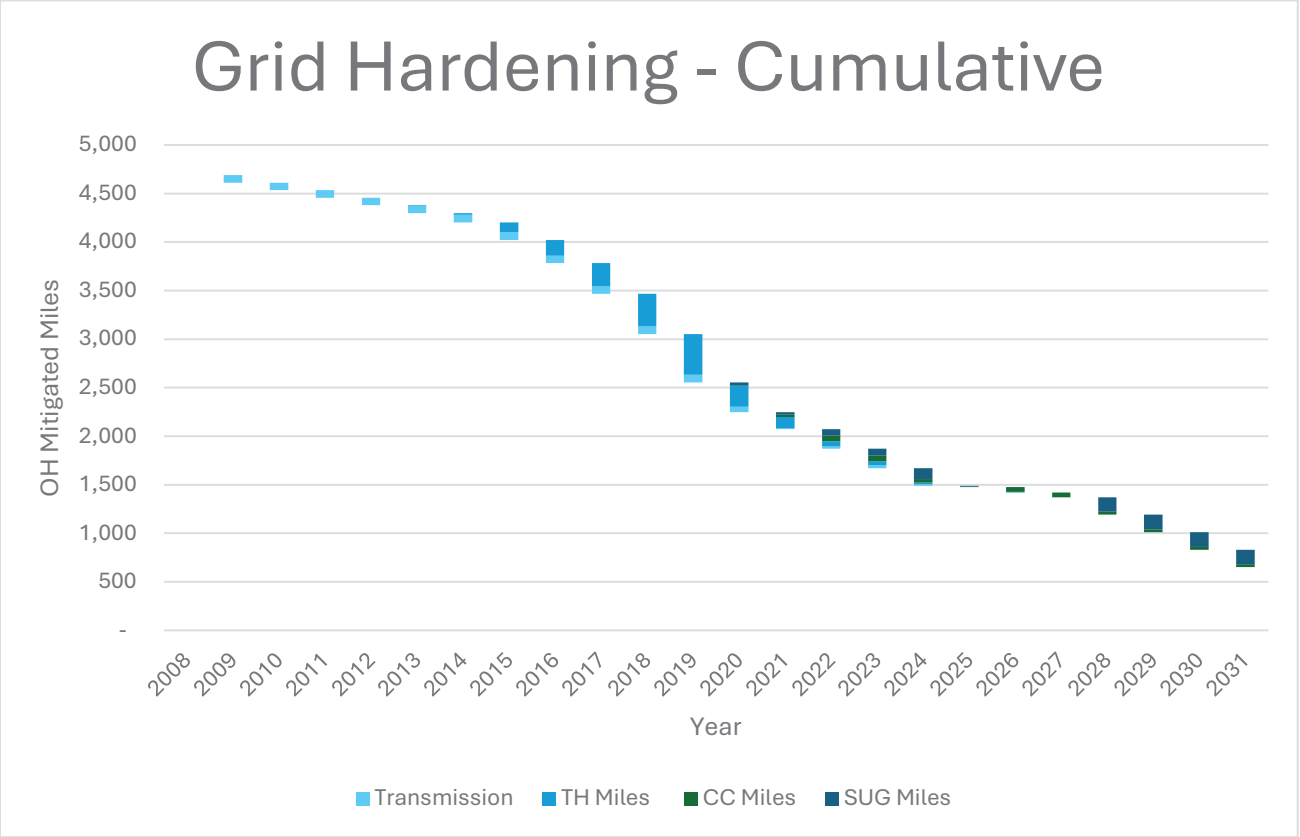
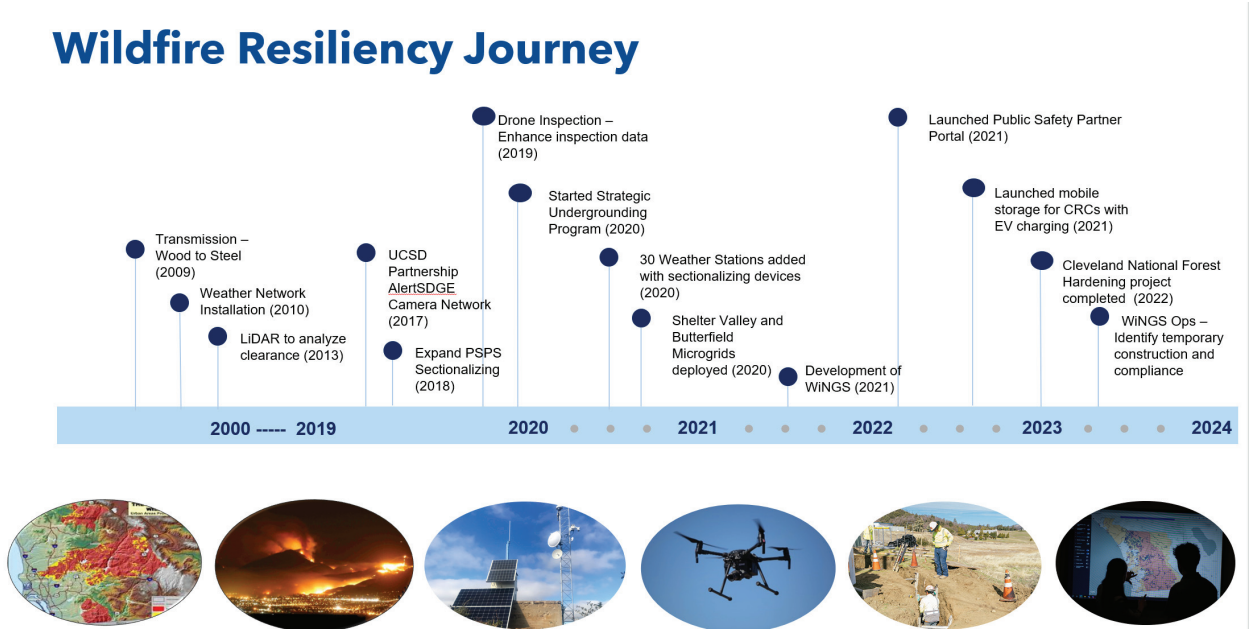


Figure 7 illustrates grid hardening since 2008 and outlines the future grid hardening strategy, showcasing cumulative overhead mileage mitigated through transmission hardening, traditional hardening, covered conductor, and strategic undergrounding.

Figure 7: Wildfire Resiliency Journey



The historical safety work activities completed after the 2003 Cedar Fire and the 2007 Witch Fire using the metrics highlighted in Figure 8 from 2008-2024 include:

- **2009**: Began wood to steel pole hardening on transmission system
- **2010:** Began installation of largest utility-owned weather network, reaching 223 stations
- **2013**: Began using Light Detection and Ranging (LiDAR) to analyze clearance and structural adequacy on the Distribution system
- **2017:** Partnered with University of California San Diego and University of Nevada to build the AlertSDGE Camera Network
- **2018:** Expanded the use of sectionalizing to reduce the impacts of PSPS de-energizations
- **2019:** Initiated a drone inspection program to obtain enhanced inspection data concerning the electric system
- **2020:** Began the Strategic Undergrounding Program
- **2020:** Added 30 weather stations with sectionalizing switches
- **2020:** Deployed Shelter Valley and Butterfield Ranch Microgrids
- **2021:** Began development of Wildfire Next Generation System (WiNGS)

- **2021:** Launched Public Safety Partner Portal
- **2021:** Launched mobile energy storage for Community Resource Centers (CRCs) and Electric Vehicle Charging
- **2022:** Completed Cleveland National Forest (CNF) hardening project
- **2024:** Enhanced WiNGS Ops to identify temporary construction and compliance

The safety work that remains to be done is addressed in the controls/mitigations detailed above in Section IV - 2024-2031 Control and Mitigation Plan.

ATTACHMENTS

ATTACHMENT A
CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates the compliance Drivers that underpin identified controls and mitigations.

ID	Control/Mitigation Name	Compliance Drivers
C526	Distribution Overhead Detailed Inspections	GO 95, GO 165
C530	Distribution Wood Pole Intrusive Inspections	GO 95, GO 165
C536	Distribution Overhead Patrol Inspections	GO 95, GO 165
C565	Transmission Overhead Detailed Inspections	GO 95, GO 165, FAC-501-WECC
C576	Avian Protection	Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, Codes defined by California Department of Fish and Game
C544	Pole Clearing	Pub. Util. Code § 451; Public Resources Code § 4292
C551	Prune and Removal (Clearance)	Pub. Util. Code § 451
C554	Detailed Inspections	G.O. 95, Rule 35; Public Resources Code § 4293; FAC-003-4

ATTACHMENT B
WILDFIRE AND PSPS - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision RDF at Row 10 and Row 29 directs each utility to identify Potential Consequences of a Risk Event using available and appropriate data.[80] Appropriate data may include company specific data or industry data supplemented by the judgement of subject matter experts. For a listing of inputs utilized as part of this assessment and a description of the data, refer to SDG&E's 2026-2028 Base WMP.[81]

The table below indicates data sources for the WiNGS-Planning model:

Category	Attributes	Database	Submodel
Weather Data	Weather station location Wind Gust and Direction Temperature Humidity Fire Potential Index (FPI) Red Flag Warning (RFW) High Wind Warning (HWW) Other	Meteorology San Diego Supercomputer UCSD.	Likelihood of a risk event
Risk Event Datasets	SAIDIDAT (Electrical outages) Evidence of Heat Reportable CPUC Ignitions Historical PSPS de-energizations Historical SRP de-energizations	Network Management System (NMS) SAIDIDAT Fire Coordination Database	Likelihood of a risk event
Asset Information	Physical Characteristics Location Electrical Network Configuration	Oracle GIS data	Likelihood of a risk event
Vegetation Database	Tree species and location Association to electrical asset Inspection and maintenance history	Oracle GIS data	Likelihood of a risk event

[80] D.24-05-064, RDF Row 10 and Row 29.

[81] 2026-2028 Base WMP at Section 5 and Appendix B.

Category	Attributes	Database	Submodel
External Sources	Public Land Use Maps Street and Road Network Fuels Layer Ignition Component	CalTrans Database OSMnx (https://github.com/gboeing/osmnx) https://wxmap.sdsc.edu//	Likelihood of a risk event Consequence of a risk event
Wildfire Consequence Simulations	Technosylva 24-h Historical fire weather days Egress factor		Likelihood of a risk event Consequence of a risk event
Customer Information	Customer Segmentation AFN Customer Class Meter Location and associated Transformer	Customer Information Oracle GIS data	Consequence of a risk event
Planned Hardening Work Scope	Existing in-flight planned UG/CC grid hardening work scope scheduled by Engineering, at the span-year granularity	Project Information (Primavera P6 system)	Likelihood of a risk event

ATTACHMENT C

WILDFIRE AND PSPS - SUMMARY OF ELEMENTS OF BOW TIE

ID	Control/Mitigation Name	Drivers Addressed	Consequences Addressed
C501	Wireless Fault Indicators	DT.1-DT.6	PC.4
C502	Capacitor Maintenance and Replacement Program (SCADA)	DT.1, DT.3	PC.1-PC.4
C504	Standby Power Program (Fixed Backup Commercial)	DT.11	PC.8
C506	Microgrids	DT.11	PC.8
C507	CMP Repairs	DT.1, DT.3, DT.7, DT.6	PC.1-PC-4, PC.7, PC 8
C508	Advanced Protection	DT.1-DT.6 DT.9	PC.1-PC.3
C510	Hotline Clamps	DT.1, DT.3	PC.1-PC.4
C512	Customized Resiliency Assessments	DT.11	PC.7 & PC.8
C516	Generator Assistance Program	DT.11	PC.4
C518	Strategic Undergrounding	DT.1-DT.11	PC.1-PC.8
C520	Distribution Overhead System Hardening	DT.1 - DT.5, DT.7	PC.1-PC.5
C522	Transmission Overhead Hardening (Distribution Underbuild)	DT.1, DT.2, DT.3, DT.7	PC.1-PC.3, PC.8
C524	Lightning Arrestor Removal/Replacement Program	DT.1- DT.3	PC.1-PC.4
C526	Distribution Overhead Detailed Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C528	Distribution Infrared Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C530	Distribution Wood Pole Intrusive Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C534	Risk-Informed Drone Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C536	Distribution Overhead Patrol Inspections	DT.1- DT.6, DT.8, DT.9, DT.11	PC.1-PC-8
C546	Aviation Firefighting Program	DT.7-DT.10	PC.1-PC.7
C548	Wildfire Infrastructure Protection Teams	DT.7-DT.10	PC.1-PC.7

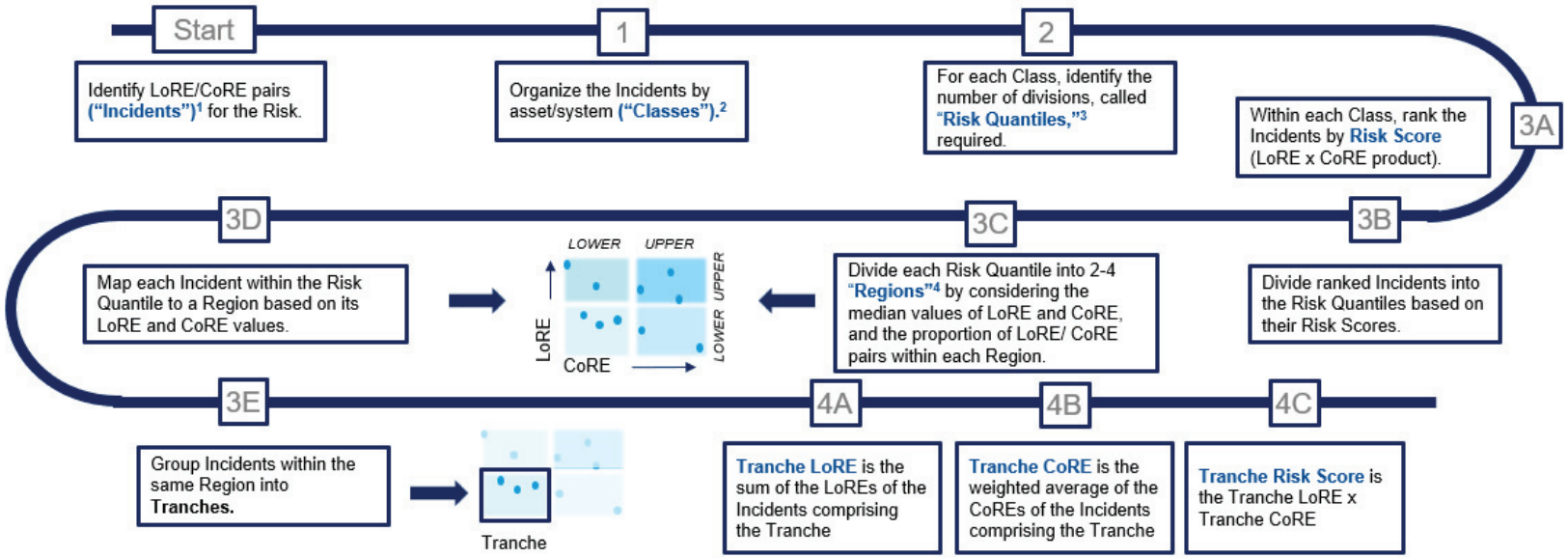
ID	Control/Mitigation Name	Drivers Addressed	Consequences Addressed
C550	Combined Covered Conductor	DT.1-DT.7, DT.10, DT.11	PC.1-PC.8
C552	PSPS Sectionalizing Enhancements	DT.11	PC.7, PC.8
C559	LiDAR Flights	DT.4	PC.4
C564	Distribution Communications Reliability Improvements (DCRI)	DT.1- DT.3	PC.1- PC.4
C565	Transmission Overhead Detailed Inspections	DT.1- DT.3, DT.7, DT.6	PC.1-PC-4, PC.7, PC. 8
C568	Strategic Pole Replacement	DT.1- DT.4, DT.7	PC.1-PC.4
C569	Cleveland National Forest Fire Hardening	N/A- Program Discontinued	
C570	Expulsion Fuse Replacements	DT.1- DT.3	PC.1-PC.4
C573	Early Fault Detection	DT.1- DT.3	PC.1-PC.4
C576	Avian Protection	DT.5	PC.1-PC.4
C537	Off-Cycle Patrol	DT.4	PC.1-PC.6
C540	Fuels Management	DT.4	PC.1-PC.6
C544	Pole Clearing	DT.4	PC.1-PC.6
C551	Prune and Removal (Clearance)	DT.4	PC.1-PC.6
C554	Detailed Inspections	DT.4	PC.1-PC.6
C555	Vegetation Restoration Initiative	N/A- Program Discontinued	
C578	QA/QC of Veg Management	DT.4	PC.1-PC.6
C561	Fire Potential Index	DT.1, DT.7, DT.8, DT.11	PC.4, PC.7, PC.8
C562	Weather Station Maintenance and Calibration	DT.1, DT.7, DT.8, DT.11	PC.4, PC.7, PC.8
C572	Situational Awareness and Forecasting	DT.1, DT.7, DT.8, DT.11	PC.4, PC.7, PC.8
C556	Engagement with AFN Populations	DT.10, DT.11	PC.5, PC.7
C557	Public Outreach and Education Awareness	DT.10, DT.11	PC.5, PC.7
C560	Mylar Balloon Alternatives	N/A- Program Completed	
C567	Public Emergency Communication Strategy	DT.10, DT.11	PC.5, PC.7

ID	Control/Mitigation Name	Drivers Addressed	Consequences Addressed
C571	Emergency Preparedness and Recovery Plan	DT.1, DT.7, DT.10, DT.11	PC.1-PC.3, PC.5-PC.8
C566	Enterprise Data Foundation	DT.1-DT.11	PC.1-PC.8
C575	Vegetation Management Enterprise System	DT.4	PC.1-PC.5
C563	Wildfire Mitigation Strategy Development	DT.1-DT.11	PC.1-PC.8
C558	Risk Methodology and Assessment	DT.1-DT.11	PC.1-PC.8
M503	Grounding Banks	DT.1-DT.6 DT.9	PC.1-PC.3

ATTACHMENT D

APPLICATION OF TRANCHING METHODOLOGY

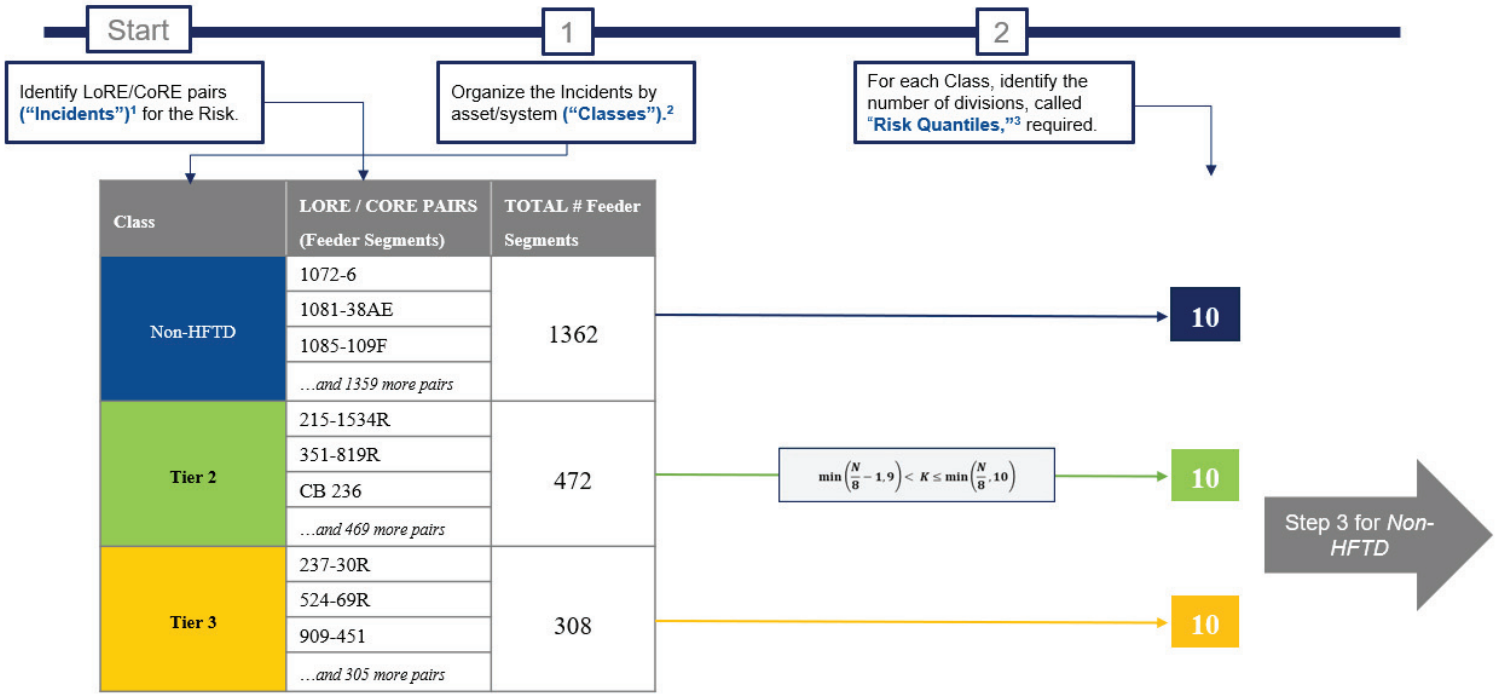
A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP - 3: Risk Quantification Framework is provided.



NOTES

[1]*For example, **Incidents (or "Risk Incidents")** for Wildfire are simulated risk events at the feeder segment level.*
[2]*For example, **Classes (or "Asset Classes")** for Wildfire include Non-HFTD, Tier 2, and Tier 3*
[3]***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*
[4]*The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*




Start
1
2
Identify LoRE/CoRE pairs ("Incidents")[1] for the Risk.
Organize the Incidents by asset/system ("Classes").[2]
For each Class, identify the number of divisions, called "Risk Quantiles,"[3] required.
Class
LORE / CORE PAIRS (Feeder Segments)
TOTAL # Feeder Segments
Non-HFTD
1072-6
1081-38AE
1085-109F
…and 1359 more pairs
1362
Tier 2
215-1534R
351-819R
CB 236
…and 469 more pairs
472
Tier 3
237-30R
524-69R
909-451
…and 305 more pairs
308
$\min\left(\frac{N}{8}-1,9\right) < K \leq \min\left(\frac{N}{8},10\right)$
10
10
10
Step 3 for Non-HFTD



Within each Class, rank the Incidents by **Risk Score** (LoRE x CoRE product). 3A

3B

Divide ranked Incidents into the Risk Quantiles based on their Risk Scores.

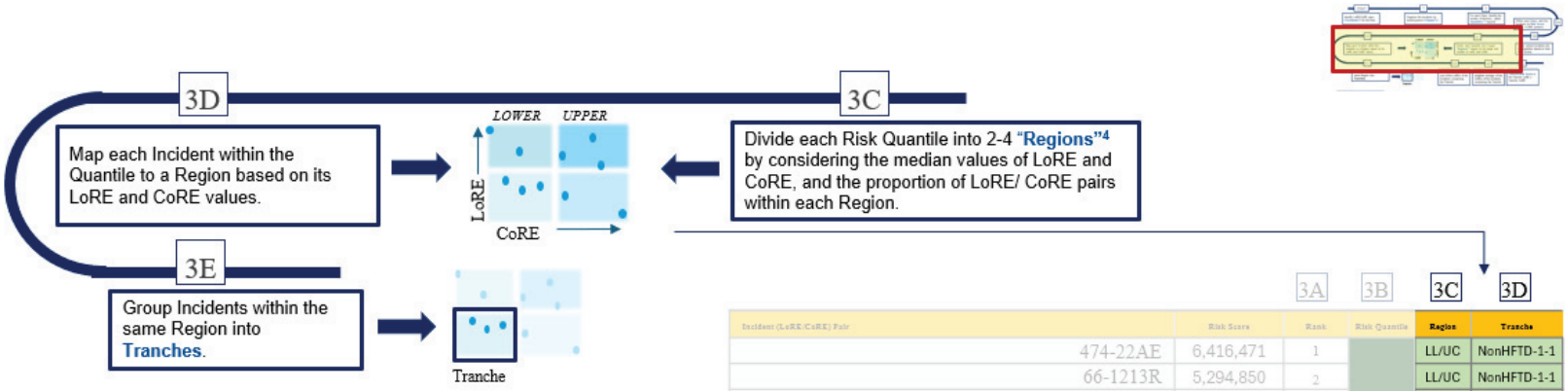


10

From Step 2 for *Non-HFTD*

3A 3B

Feeder Segments	Risk Score	Rank	Risk Quantile
474-22AE	6,416,471	1	#1
66-1213R	5,294,850	2	
305-32R	4,217,523	3	
CB 471	3,795,870	4	
CB 305	2,776,072	5	
305-35R	2,362,924	6	
307-1684R	2,109,886	7	
206-974	1,937,035	8	
221-1251R	1,803,724	9	
288-18	1,711,403	10	
206-953R	1,580,440	11	
474-29	1,506,093	12	
504-1563	1,419,193	13	
410-50R	1,312,433	14	
CB 412	1,304,299	15	
473-36R	1,299,233	16	
63-797R	1,291,049	17	
241-570	1,262,492	18	
CB 590	1,189,056	19	
...	...	20-1362	...



		3A	3B	3C	3D
Incident (LoRE/CoRE) Pair	Risk Score	Rank	Risk Quantile	Region	Tranche
474-22AE	6,416,471	1		LL/UC	NonHFTD-1-1
66-1213R	5,294,850	2		LL/UC	NonHFTD-1-1
305-32R	4,217,523	3		LL/UC	NonHFTD-1-1
CB 471	3,795,870	4		LL/UC	NonHFTD-1-1
CB 305	2,776,072	5		LL/UC	NonHFTD-1-1
305-35R	2,362,924	6		LL/UC	NonHFTD-1-1
307-1684R	2,109,886	7		LL/UC	NonHFTD-1-1
206-974	1,937,035	8		LL/UC	NonHFTD-1-1
221-1251R	1,803,724	9		UL/LC	NonHFTD-1-2
288-18	1,711,403	10	#1	LL/UC	NonHFTD-1-1
206-953R	1,580,440	11		LL/UC	NonHFTD-1-1
474-29	1,506,093	12		LL/UC	NonHFTD-1-1
504-1563	1,419,193	13		LL/UC	NonHFTD-1-1
410-50R	1,312,433	14		LL/UC	NonHFTD-1-1
CB 412	1,304,299	15		LL/UC	NonHFTD-1-1
473-36R	1,299,233	16		LL/UC	NonHFTD-1-1
63-797R	1,291,049	17		LL/UC	NonHFTD-1-1
241-570	1,262,492	18		UL/LC	NonHFTD-1-2
CB 590	1,189,056	19		LL/UC	NonHFTD-1-1
...	...	20-1362	...	...	...



4A

Tranche LoRE is the sum of the LoREs of the Incidents comprising the Tranche

4B

Tranche CoRE is the weighted average of the CoREs of the Incidents comprising the Tranche

4C

Tranche Risk Score is the Tranche LoRE x Tranche CoRE

		4A	4B	4C
Incident (LoRE/CoRE) Pair (Feeder Segment)	Tranche	Tranche LoRE	Tranche CoRE	Tranche Risk Score
474-22AE	NonHFTD-1-1	2.20	29,821,762	65,746,868
66-1213R	NonHFTD-1-1			
305-32R	NonHFTD-1-1			
CB 471	NonHFTD-1-1			
CB 305	NonHFTD-1-1			
305-35R	NonHFTD-1-1			
307-1684R	NonHFTD-1-1			
206-974	NonHFTD-1-1			
288-18	NonHFTD-1-1			
206-953R	NonHFTD-1-1			
474-29	NonHFTD-1-1			
504-1563	NonHFTD-1-1			
410-50R	NonHFTD-1-1			
CB 412	NonHFTD-1-1			
473-36R	NonHFTD-1-1			
63-797R	NonHFTD-1-1			
CB 590	NonHFTD-1-1			
221-1251R	NonHFTD-1-2	4.84	5,119,761	24,782,191
241-570	NonHFTD-1-2			
…	…	…	…	…

ATTACHMENT E

WINGS-PLANNING ASSUMPTIONS AND LIMITATIONS

Assumption	Description	Limitation
Average duration of PSPS de-energization for every SCADA Sectionalizing Device	Historical average PSPS de-energization in the service territory, along with subject matter expertise, is used to determine this value.	Estimating the potential duration of a PSPS de-energization at each SCADA Sectionalizing Device is a complex task as multiple variables are in play (e.g., weather forecast, firefighting resources, existing wildfires, crew availability).
Customer impact scaling factor (Wildfire, PSPS, PEDS Vulnerability)	Subject matter expertise is used to determine a scaling factor to more accurately represent PSPS impacts to the critical and vulnerable population.	There is a lack of reliable data on how to quantify PSPS impacts on customers, specifically to subsets of customers such as critical and vulnerable.
Serious injuries and fatalities (SIFs) per customer minute de-energized	Historical data and subject matter expertise is used to estimate the potential number of fatalities and serious injuries due to a PSPS de-energization.	There is a lack of historical data on serious injuries or fatalities due to PSPS de-energizations in California.
Financial impact during a PSPS de-energization	Subject matter expertise is used to estimate this value based on proxies derived from the federal per diem rate for lodging, meals, and incidentals in San Diego County.	There is a lack of historical data on the financial impacts to SDG&E customers due to PSPS de-energizations.
Number of SIFs per structure destroyed in case of a wildfire	Subject matter expertise is used to estimate this value based on worst-case estimations of acres burned calculated by Technosylva.	This metric is highly dependent on the availability and effectiveness of firefighting resources, the timeliness and clarity of evacuation notices, the specific location of the event, and the prevailing weather conditions.
Outage duration in case of a wildfire	Subject matter expertise is used to estimate this value based on estimates of outage duration and assumed restoration duration.	Estimating restoration time following a catastrophic wildfire is inherently challenging due to the numerous variables involved. The severity of the event plays a crucial role, as more severe wildfires can cause extensive damage to infrastructure, making restoration efforts more complex and time-consuming. Additionally, factors such as the availability of resources, accessibility of affected areas, weather conditions, and the extent of damage to

Assumption	Description	Limitation
		critical infrastructure all contribute to the difficulty in providing accurate restoration time estimates.
Financial impacts in case of a wildfire	Subject matter expertise is used to estimate this value based on simulation outputs of buildings destroyed and acres impacted output.	Property value estimates are based on general assumptions and do not take into account the size, condition, location, or market value of the property.
Annual risk event rates	Historic data is used to normalize wildfire, PSPS, and PEDS risks and quantify expected value averages.	Annual frequency rates do not account for potential future conditions or changes. This means that while the model provides a reliable estimate based on historical data, it may not fully capture the impact of evolving factors such as climate change, new infrastructure developments, or changes in vegetation and land use.
Burn probability	Subject matter experts select these days to balance a representative sample of days with fire weather conditions present in the HFTD. This approach aims to accurately estimate the potential impacts of catastrophic wildfires while considering current weather conditions, community insights, and local knowledge (e.g., terrain, fuels, vegetation). Additionally, it takes into account computational resources, given the time and cost involved in conducting this analysis.	. Subject matter expertise is used to select a representation of the worst fire weather days in the service territory. For the days selected of the worst fire weather days in the service territory, the burn probability is assumed to be 100%.
Wildfire hazard intensity	Data from the 125 worst fire weather days identified by subject matter experts is used by Technosylva to calculate this value. Simulated outputs include flame length, rate of spread, acres burned, buildings	Technosylva's unsuppressed simulations have a duration of 24 hours. Wildfire Consequence values are calculated based on acres burned and structures destroyed.

Assumption	Description	Limitation
	threatened, buildings destroyed, and population impacted.	
PEDS annual frequency	This value is determined using historical data on PEDS outage durations in HFTD portions of the service territory.	This annual frequency may not accurately represent future outage frequencies, as the number of future device installations and outages are unknown and difficult to estimate. SDG&E activates settings only during extreme or elevated fire weather conditions.
PEDS de-energization Consequence values	This value is determined using historical data on PEDS outage durations recorded in the SAIDIDAT database.	Historical duration and CMI estimates may not accurately reflect future PEDS Consequence impact estimates.
Annual PSPS de-energization during high fire risk days	This value is determined using subject matter expertise and historical event records.	The current methodology is calibrated using past PSPS de-energizations and may not adequately account for the increasing frequency and severity of fire weather conditions.
Overhead-to-underground mile conversion rate	This contingency value is applied to non-roadway miles to account for additional miles to underground.	A 20% factor is included to capture the OH to UG conversion factor in the financial model. This value is estimated based on historical data.
Mitigation installation cost-per-mile	Historical grid-hardening data and subject matter expertise are used to determine this value.	This assumption does not take into account site specific attributes.
Mitigation efficacy rates	Data on efficacy studies for each mitigation option is used to determine this value.	Limited to available internal risk event data and subject matter estimates of risk reduction.
Hardening-State Station Alert Speed Thresholds	Operational wind gust thresholds determined during the latest PSPS are used to determine this value.	Qualitative factors taken into account during PSPS de-energization are not accounted for that may alter alert speed thresholds.

ATTACHMENT F
STRATEGIC UNDERGROUNDING AND COMBINED COVERED CONDUCTOR MITIGATION EFFECTIVENESS

Mitigation effectiveness is calculated using a comprehensive methodology that combines field data, benchmarking, collaboration with other IOUs, and subject matter expertise. Field data involves analyzing historical outage data, failure modes, location, grid configuration, and CPUC Reportable and Non-Reportable Ignitions. Due to the relatively low number of incidents, subject matter expertise is utilized to assess potential risk reduction and reliability improvements. This multi-faceted approach provides a thorough evaluation of mitigation effectiveness, providing an estimation of mitigation's impact on wildfire risk to guide decisions on long-term hardening strategies.

Tables F-1 and F-2 detail the calculation of the effectiveness of strategic undergrounding and covered conductor as wildfire mitigation measures across various risk drivers.

Table F-1: Strategic Undergrounding Mitigation Effectiveness

OH Distribution Ignition drivers		Total Number of Dist Ignitions (2019-2024)	SME UG effectiveness (%)	Estimated Ignitions reduced by SUG	Comments
Equipment	Conductor Failure	68	100%	68	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
Equipment	OH Equipment (Non Conductor)	348	100%	348	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
Equipment	UG Fuse Failure	1	95%	0.95	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas.
Equipment	UG Transformer Failure	2	95%	1.9	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas.
Equipment	Switch Failure (UG, sub surface)	1	95%	0.95	SDG&E has not experienced any reportable ignitions in the 2019-2024 period for this ignition driver, therefore, "1" was used for the total number of ignitions to account for the possibility of an asset-related ignition.
Equipment	Equip Failure (Tee Connector)	5	95%	4.75	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas.
Equipment	UG Cable Failure	18	95%	17.1	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas.
Equipment	UG Connection	4	95%	3.8	The enclosed nature of underground structures is assumed to help contain any ignition, preventing

OH Distribution Ignition drivers		Total Number of Dist Ignitions (2019-2024)	SME UG effectiveness (%)	Estimated Ignitions reduced by SUG	Comments
	Device Failure				spread to surrounding areas.
External	Vehicle Contact (Pole)	16	100%	16	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
External	Vehicle Contact (Surface Structure)	5	95%	4.75	Although vehicle contacts can occur on surface structures associated with UG segments, there are significantly fewer overall surface structures (no poles, no wires, and no associated equipment).
Equipment	OH Equipment Failure Unknown	20	100%	20	Ignitions with no information in Primary or Secondary Cause. (unknown) With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
Equipment	OH to UG connection	10	95%	9.5	The transition from OH to UG is done via a pole with cable going up the pole. Compared to bare wire on an overhead system, a transition pole has less ignition risk due to the wire being an underground cable, which is insulated.
External	All Other OH	174	99%	172.26	This category accounts for potential factors in the overhead system that could impact underground equipment (e.g., contamination and non-utility fires). The effectiveness rate is higher than the OH to UG connection rate because it is assumed that the enclosed nature of underground structures offers better protection and containment of potential ignitions, preventing them from spreading to surrounding areas.

OH Distribution Ignition drivers		Total Number of Dist Ignitions (2019-2024)	SME UG effectiveness (%)	Estimated Ignitions reduced by SUG	Comments
External	Other OH Contact	45	100%	45	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
External	Other UG Contact	4	75%	3	The effectiveness rate accounts for potential ignitions caused by dig-ins near underground structures. This assumption is based on the understanding that the enclosed nature of underground structures helps contain any ignition, preventing spread to surrounding areas.
External	Vegetation Contact	58	95%	55.1	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas. The effectiveness rate accounts for potential vegetation contacts such as roots growing and encroaching on underground structures.
External	Balloon Contact	22	100%	22	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
External	Animal Contact (OH)	25	100%	25	With the removal of overhead (OH) assets, it is assumed that there will be zero ignition incidents.
External	Animal Contact (UG)	1	80%	0.8	The enclosed nature of underground structures is assumed to help contain any ignition, preventing spread to surrounding areas. 80% effectiveness is assumed to account for potential contact in the underground assets.
	Total	**827**		**818.86**	

To calculate the effectiveness of strategic undergrounding, the total number of ignitions estimated to be reduced by strategic undergrounding is divided by the total for the number of distribution ignitions, as shown in the following equation:

$$\text{SUG Mitigation Effectiveness} = \frac{Ignitions\ Reduced}{Total\ Ignitions} = \frac{818.86}{827} = 99.02\%$$

Therefore, the effectiveness of strategic undergrounding due to mitigations that were completed from 2019-2024 is 99.02%.

Table F-2: Covered Conductor Mitigation Effectiveness

Distribution Risk Driver	CPUC Reportable and Non-Reportable Ignitions							Avg. Risk Events per Year	2024/2025 SME Risk Reduction (%)	Estimated Ignitions reduced by CCC
	2019	2020	2021	2022	2023	2024	Total			
Animal Contact	4	6	1	1	2	1	15	2.50	90%	2.25
Balloon Contact	2	6	6	5	1	2	22	3.67	90%	3.30
Vehicle Contact	4	6	2	1	1	2	16	2.67	90%	2.40
Vegetation Contact	12	18	7	4	5	12	58	9.67	90%	8.70
Other contact[a]	3	7	6	12	4	13	45	7.50	50%	3.75
Conductor	9	12	10	10	13	14	68	11.33	90%	10.20
Equipment-Non conductor[b]	81	65	49	52	59	42	348	58.00	39%	22.62
Other All[c]	42	31	27	27	20	27	174	29.00	10%	2.90
Undetermined[d]	4	6	5	2	1	2	20	3.33	70%	2.33
Total	**161**	**157**	**113**	**114**	**106**	**115**	**766**	**127.67**	**---**	**58.45**

a. Other contacts include external contacts caused by SDG&E or non-SDG&E personnel, customers, and foreign objects (excluding animals, balloons, vegetation, and vehicles) in overhead electrical equipment.
b. Equipment-Non conductor includes electrical equipment like lightning arrestors, fuses, and transformers.
c. Other All includes contamination, dig-ins, vandalism, and non-utility fires.
d. Undetermined includes outages/Ignitions with no information in Primary or Secondary Cause.

To calculate the effectiveness of Covered Conductor, the total number of ignitions estimated to be reduced by Covered Conductor is divided by the average number of risk events per year, as shown in the following equation:

$$Covered\ Conductor\ Mitigation\ Effectiveness = \frac{58.45}{127.67} \times 100 = 45.8\%$$

To determine the overall effectiveness of Combined Covered Conductor mitigation, the effectiveness of the Covered Conductor (45.8%) is combined with the impact of Falling Conductor Protection (FCP) and Early Fault Detection (EFD) mitigations. The mitigation effectiveness of FCP on all system outages is estimated at 8% using a similar methodology as the Covered Conductor, while EFD's effectiveness is estimated at 16%, based on asset location, installation, and historical risk event data.

$$Combined\ Effectiveness = 1 - [(1 - CC\ Efficacy) \times (1 - FCP\ Efficacy) \times (1 - EFD\ Efficacy)]$$

$$Combined\ Effectiveness = 1 - [(1 - 0.458) \times (1 - 0.08) \times (1 - 0.16)] = 58.1\%$$

The mitigation effectiveness for Combined Covered Conductor is therefore calculated to be 58.0%. Reference Section 6.1.3.3.5 Measuring Effectiveness of Mitigation Initiatives[82] and SDGE-25U-04 Continuation of Grid Hardening Joint Studies in 2026-2028 Base WMP.[83]

SDG&E will continue to review these mitigation effectiveness analyses based on reportable and non-reportable ignitions for Combined Covered conductor, Strategic Undergrounding, and combined mitigation effectiveness.

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[82] 2026-2028 Base WMP at 104.

[83] 2026-2028 Base WMP, Appendix D at 30.

2025 Risk Assessment Mitigation Phase

(Chapter SDG&E-Risk-5)

Electric Infrastructure Integrity

May 15, 2025

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I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or Company) risk control and mitigation plan for the Electric Infrastructure Integrity (EII) Risk. This chapter contains information and analysis for this risk that meet the requirements of the California Public Utilities Commission's (Commission or CPUC) Risk-Based Decision-Making Framework (RDF),[1] including the requirements adopted in Decision (D.) 22-12-027 (Phase 2 Decision) and D.24-05-064 (Phase 3 Decision). The EII Risk is included in the 2025 RAMP Report based on a safety risk assessment, further informed by its reliability and financial consequence attributes, consistent with RDF guidance. This risk chapter describes the basis for selection of the EII Risk, the controls and/or mitigations put forth to reduce the likelihood or consequence of this risk, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter also presents cost and unit forecasts for the risk mitigating activities, but it does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation, consistent with the method and process prescribed in the RDF.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SDG&E's EII Risk is defined as the risk of an asset failure caused by degradation, age, operation outside of design criteria due to unexpected events or field conditions (*e.g.*, force of nature), or an asset no longer complying with the latest engineering standards, which may result in a public safety or reliability incident.

2. Risk Overview

One of SDG&E's recognized safety risks for employees, customers, and the public pertains to electric infrastructure. SDG&E continually aims to improve its electric infrastructure and educational outreach regarding safety measures related to energized lines, both overhead and

[1] As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A.15-05-002 *et al*. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

underground. The residual risk of electric infrastructure failures causing safety, environmental, or major reliability incidents has remained stable over recent years, which is evidenced by SDG&E winning its 19th consecutive ReliabilityOne "Best in the West" award.[2] SDG&E has developed strong controls through programs such as the Corrective Maintenance Program (CMP) and its proactive reliability measures such as the pole, cable, switch and aging substation infrastructure replacement programs. Other controls include the consistent review and updating of its Construction Standards. It is through these controls that SDG&E continues to mitigate its EII Risk and mitigate growth in residual risks.

The EII Risk can be characterized by several potential scenarios, for example the occurrence of an energized wire-down event, which was used for risk impact and frequency scoring that involves asset failures. An energized wire-down event is one of SDG&E's primary concerns with respect to its overhead equipment and involves an energized overhead conductor (*i.e.*, a wire) falling from its support equipment and resting on the ground or on a foreign object. If an employee, contractor, or the public comes into contact with an energized wire, the results can be fatal. Accordingly, SDG&E continues to take proactive measures to determine the cause of any wire-down events and has a dedicated team reviewing all wire-down events to determine the root cause and identify any trends to potentially trigger the development of a new reliability program. There are various Drivers of wire-down events, such as third-party contact, acute weather causing foreign object contact, or extensive stress, aged infrastructure, and degradation of connectors. These Drivers/Triggers are further discussed below. SDG&E's risk control and mitigation plan aims to mitigate these Drivers/Triggers and thereby reduce the incidence of EII risk events.

Asset age and equipment characteristics (*e.g.*, wire type) are relevant attributes with respect to the rate of decline of electric infrastructure integrity. Aged assets can be affected by severe wearing due to weathering and electrical and mechanical forces. They may also consist of outdated technologies, not being able to provide the benefits of various improvements made to equipment over time such as safer design/installation techniques, technology advancements, material quality, and improved functionality. Also, it may be more difficult to maintain and operate aged assets due to a lack of spare parts and vendor support and reduction in internal experience operating the asset. Given these conditions, aged infrastructure generally is operated

[2] SDGE Today, SDG&E receives top honors for outstanding reliability in the west & national system resiliency award (November 14, 2024) available at https://www.sdgetoday.com/R1.

with heightened caution, sometimes using special procedures, for the safety of workers and the public.

SDG&E's risk control and mitigation plan focuses on safety and reliability measures designed to protect its employees, customers, and the public. The controls and mitigations in SDG&E's risk control and mitigation plan are intended to address various EII-related events. Other risks associated with this chapter are discussed in the following risk chapters: Employee Safety, Contractor Safety, and Excavation Damage. These other risk chapters focus on mitigations that address education, communication, training, and other internal procedural enhancements, while this EII Risk chapter focuses on infrastructure improvement risk mitigation activities and costs. Risk reduction benefits from the infrastructure improvements discussed in this chapter also impact the human safety risks addressed in SDG&E's Employee Safety and Contractor Safety chapters.

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF requirements, such as those from the California Code of Regulations and General Orders (GO). A list of compliance requirements applicable to SDG&E's EII Risk is provided in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction calculated under the RDF, such as enhancing operations, promoting public trust in the communities we operate, and preparing for future capacity needs (such as driven by electrification or climate impacts).

B. Risk Scope

SDG&E's EII Risk analysis considers the risk of an electric asset failure due to internal or external factors, which results in serious injuries, fatalities, and/or reliability impacts, and the associated financial costs of remediation and restoration. This EII Risk chapter focuses primarily on risks and mitigations unrelated to wildfire mitigation, predominately outside of SDG&E's High Fire Threat District (HFTD). Wildfire-related risks and mitigations are covered in SDG&E's "Wildfire and PSPS" risk chapter (SDG&E-Risk-4). However, where the same type of mitigation activities are included in both the Wildfire chapter and this EII chapter, the costs included herein have been allocated according to HFTD and non-HFTD percentages (unless otherwise noted), consistent with SDG&E's Wildfire Mitigation Plan. For example, vegetation management is performed across SDG&E's entire service territory. Vegetation management, therefore, appears as an activity performed to reduce risk in both SDG&E-Risk-4 and this chapter, as a reliability

mitigation. The costs associated with the vegetation management activities in this chapter only include the non-HFTD percentage of costs.

C. Data Sources Used to Quantify Risk Estimates[3]

SDG&E utilized internal data sources to determine the EII Risk's Pre-Mitigation Risk Value and calculate risk reduction estimates for mitigation activities (which enables estimation of Post Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used, as appropriate, and adjusted to account for the risk characteristics associated with the Company's specific operating locations and service territory. For example, certain types of incident events have not occurred within the SoCalGas and SDG&E service territories. Expanding the quantitative data sources to include industry data where such incidents have been recorded is appropriate to establish a baseline of risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of EII Risk, including a risk Bow Tie, which delineates potential Drivers/Triggers and Potential Consequences, followed by a description of the Tranches determined for this risk.

A. Risk Selection

EII was included as a risk in SDG&E's 2021 RAMP and was included in the 2022, 2023 and 2024 Enterprise Risk Registries (ERR).[4] SDG&E's ERR evaluation and selection process is summarized in Chapter RAMP-2, Enterprise Risk Management Framework and in Chapter RAMP-3 Risk Quantification Framework.

SDG&E selected this risk in accordance with the RDF Row 9.[5] Specifically, SDG&E assessed the top risks from the Company's 2024 ERR based on the Consequence of a Risk Event (CoRE) Safety attribute. The EII Risk was among the risks presented in SDG&E's list of Preliminary 2025 RAMP Risks on December 17, 2024 at a Pre-Filing Workshop. EII was selected

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[3] Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

[4] In the 2021 RAMP Report this risk was called Electric Infrastructure Integrity. The risk definition is unchanged.

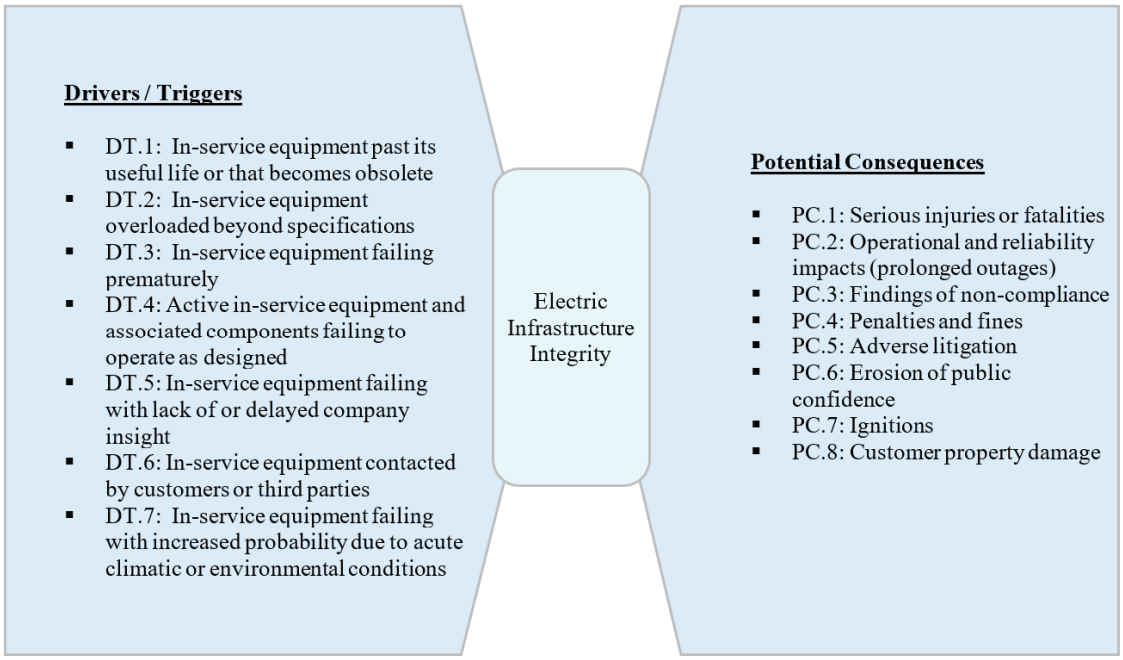
[5] D.24-05-064, RDF Row 9, states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars.".

electively, as it did not qualify based on the Safety attribute alone. Prior to the Workshop, SDG&E provided SPD and interested parties the monetized Risk Value[6] for Electric Infrastructure Integrity, including Reliability and Financial CoRE values, which identified EII as SDG&E's highest valued[7] risk at the time. At the pre-filing workshop, no party expressed opposition to inclusion of this risk in SDG&E's 2025 RAMP Report.

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the risk Bow Tie, possible Drivers, Potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that addresses it.[8] As illustrated in the risk Bow Tie shown below in Figure 1, the Risk Event (center of the Bow Tie) is Electric Infrastructure Integrity, the left side of the Bow Tie illustrates Drivers/Triggers that could cause an Electric Infrastructure Integrity event, and the right side shows the Potential Consequences of an Electric Infrastructure Integrity event. SDG&E applies this framework to identify and summarize the information provided in Figure 1 below. A mapping of each mitigation to the addressed elements of the risk Bow Tie is provided in Attachment C.

Figure 1
Electric Infrastructure Integrity Risk: Risk Bow Tie



[6] D.24-05-064, RDF Row 12.

[7] At the December 17, 2024 Pre-Filing Risk Selection Workshop, preliminary SDG&E RAMP Risks were presented without the risk-adjusted scaling function applied.

[8] D.24-05-064, RDF Row 15.

C. Electric Infrastructure Integrity: Risk Bow Tie Potential Risk Event Drivers/Triggers[9]

When performing a risk assessment for the EII Risk, SDG&E identifies potential leading indicators, referred to as Drivers or Triggers, that reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to the asset.[10] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1: In-service equipment past its useful life or that becomes obsolete**: Electric assets are usually in service for several decades and possibly for several years beyond the book life of the asset. The age of a specific asset is a common key indicator for failure of the electric asset because the mechanical strength and characteristics of the asset may have diminished over time. These assets can also be considered obsolete when new or updated safety, construction, and operational standards have been established in the industry or within the Company.

- **DT.2: In-service equipment overloaded beyond specifications**: Electric assets are designed and constructed per SDG&E standards and in accordance with CPUC General Orders and other local or national requirements. Assets often are designed and constructed to exceed the requirements set forth by these standards; however, field conditions, such as excessive forces exerted on poles due to acute natural forces (*e.g.*, high winds above recorded values), may stress the infrastructure and cause failures.

- **DT.3: In-service equipment failing prematurely**: SDG&E's electric assets such as underground cables, substation transformers, and overhead connectors are supplied by various manufacturers. These assets undergo routine quality testing from their respective manufacturers and operate within their design criteria; however, it is reasonable to expect some subsets to fail over time, under conditions near the upper limits of their design ratings, or for reasons unknown to SDG&E.

- **DT.4: Active in-service equipment and associated components failing to operate as designed**: Due to their sensitive nature, electric assets that are expected to operate based on protection settings to mitigate or reduce the impacts of an asset failure can be expected either to fail periodically or not to operate as designed. These failures or delays in operation may cause the assets the protection settings are designed to protect to experience more damage or to extend an expected isolated event.

- **DT.5: In-service equipment failing with lack of or delayed company insight**: Assets outside of design standards or original construction that does not result in an outage or visibility to SDG&E can lead to an extended exposure to the public (*e.g.*,

[9] An indication that a risk could occur. It does not reflect actual or threatened conditions.

[10] D.24-05-064, RDF Row 10-11.

a leaking transformer). Failure of these systems may cause prolonged or undetected risk exposure to the public.

- **DT.6: In-service equipment contacted by customers or third parties**: SDG&E's electric facilities may be contacted by members of the public or other third parties. An incident of this type may involve energized overhead distribution primary conductor during the occurrence of a wire-down event or while the conductor is intact and operating under normal operating conditions.

- **DT.7: In-service equipment failing with increased probability due to acute climatic or environmental conditions**: Although it is reasonable to expect some subsets of in-service electric assets to fail, acute weather events or environmental conditions may pose added risks to SDG&E's operations. Adverse weather events extend the normal outage response time, due to limited resources or unsafe field conditions to assess and mitigate damage.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed to the right side of the risk Bow Tie. SDG&E identifies the Potential Consequences of this risk by analyzing internal data sources, where available, industry data, and subject matter expertise (SME).[11] These Bow Tie Consequences inform the CoRE component of the risk value. If one or more of the Drivers listed above were to result in an incident, the Potential Consequences, in a plausible worst-case scenario, could include:

- **PC.1:** Serious injuries or fatalities
- **PC.2:** Operational and reliability impacts (prolonged outages)
- **PC.3:** Findings of non-compliance
- **PC.4:** Penalties and fines
- **PC.5:** Adverse litigation
- **PC.6:** Erosion of public confidence
- **PC.7**: Ignitions
- **PC.8:** Customer property damage

These Potential Consequences were used by SDG&E in the scoring of the EII Risk during the development of its 2024 ERR.

E. Evolution of Risk Drivers and Consequences

As specified in the Phase 3 Decision,[12] the following changes to the previous ERR and/or the 2021 RAMP include:

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[11] D.24-05-064, RDF Row 10.

[12] D.24-05-064, RDF Row 8.

1. Changes to Drivers/Triggers of the Risk Bow Tie

- **DT.1: In-service equipment past its useful life or that becomes obsolete** – minor grammatical wording change from 2021's "In-service equipment past its useful life or becomes obsolete"
- **DT.2: In-service equipment overloaded beyond specifications** – more descriptive wording change from 2021's "Equipment in-service beyond design specifications"
- **DT.7: In-service equipment failing with increased probability due to acute climatic or environmental conditions** – slightly more emphasis on probability versus just volume from 2021's "In-service equipment failing in large volume due to acute climates or environmental conditions"

2. Changes to Potential Consequences of the Risk Bow Tie

- **PC.2: Operational and reliability impacts (prolonged outages)** – minor plural wording change from 2021's "Operational and reliability impact (prolonged outages)"
- **PC.7: Ignitions** – newly added for 2025
- **PC.8: Customer property damage** – newly added for 2025

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and in accordance with Row 14 of the RDF, SDG&E applied the Homogeneous Tranching Methodology (HTM) as outlined in Chapter RAMP - 3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:

Table 1: Electric Infrastructure Integrity Risk Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches
Emergency Restoration (Non-UG)	55	12
Overhead	64	16
Substation	22	6
Underground	38	11
Vegetation	22	6
Other	79	18
TOTAL	**280**	**69**

Attachment D illustrates the derivation of the Tranches, as shown in Table 1 above, in accordance with the HTM. The classes were identified by SDG&E as logical groups of assets and systems based on the Company's operations. These classes also align risk treatments with asset

risk profiles reflective of SDG&E's operations. More detailed Tranche information, including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches, is provided in workpapers.

III. PRE-MITIGATION RISK VALUE

In accordance with the RDF Row 19, the table below provides the pre-mitigation risk values for the EII Risk. Further details, including pre-mitigation risk values by Tranche, are provided in workpapers. Explanations of the risk quantification methodology and other higher-level assumptions are provided in Chapter RAMP-3 Risk Quantification Framework.

Table 2: Electric Infrastructure Integrity Risk
Monetized Risk Values
(Direct, in 2024 $millions)

LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]
	Safety	Reliability	Financial		
1,653.73	<$0.00	$0.22	$0.02	$0.2	$398.05

A. Risk Value Methodology

SDG&E's risk modeling for the EII Risk follows RDF guidance[13] for implementing a Cost Benefit Approach, as described below:

1. **Cost Benefit Approach Principle 1 - Attribute Hierarchy (RDF Row 2):** EII Risk is quantified in a combined attribute hierarchy as shown in the table above, such that Safety, Reliability, and Financial are presented based on available, observable, and measurable data.

2. **Cost Benefit Approach Principle 2 - Measured Observations (RDF Row 3):** EII Risk used observable and measurable data in the estimation of CoRE values. SDG&E utilized internal outage data for the period 2015- 2024 (SAIDIDAT)[14] to represent natural units for incidence of outages within SDG&E electric infrastructure. Additionally, EII Risk leveraged SIF data to estimate safety incidents.

3. **Cost Benefit Approach Principle 3 - Comparison (RDF Row 4):** EII Risk utilized proxy data as **provided** by various sources including, but not limited to, the Center for Disease Control (to determine financial impacts associated with injuries)**.**

4. **Cost Benefit Approach Principle 4 - Risk Assessment (RDF Row 5):** Probabilities of future events were derived based on internal recorded data from past years, as described in the preceding paragraphs.

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[13] D.24-05-064, RDF Rows 2-7.

[14] SAIDIDAT is SDG&E's internal database for forced outage records, including key data such as system average interruption duration index (SAIDI) values.

5. **Cost Benefit Approach Principle 5 - Monetized Levels of Attributes (RDF Row 6):** In accordance with D.22-12-027 and D.24-05-064, RDF Row 6, SoCalGas and SDG&E used a California-adjusted Department of Transportation monetized equivalent to calculate the Safety CoRE attribute at a monetized equivalent of $16.2 million per fatality, $4.1 million per serious injury, and $49 thousand for minor injury;[15] the Electric Reliability CoRE attribute is valued at a monetized equivalent of $3.76 per CMI; and the Financial CoRE attribute is valued at $1 per dollar.[16]

Further information regarding SDG&E's quantitative risk analyses, including raw data, calculations, and technical references are provided in workpapers.

6. **Cost Benefit Approach Principle 6-Adjusted Attribute Level (RDF Row 7):**

Table 3: Electric Infrastructure Integrity Risk
Scaled vs Unscaled Value by CoRE Attribute
(Direct, in 2024 $ millions)

	Safety	Reliability	Financial	Total
Unscaled Risk Value	$7.72	$364.07	$26.26	$398.05
Scaled Risk Value	$7.72	$364.07	$26.26	$398.05

The values in the table above are the result of SDG&E applying the risk scaling methodology described in Chapter RAMP-3 to the CoRE attributes for EII Risk.

Further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply is provided in Chapter-RAMP-3.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section identifies and describes the controls and mitigations comprising the portfolio of mitigations for the EII Risk and reflects changes expected to occur from the last year of recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). For clarity, a current activity that is included in the plan may be referred to as either a control and/or a mitigation. Table 4 below shows which control activities are in place in 2024, and which are expected to be on-going, completed, or new during the 2025-2031 time period. Because the TY 2024 GRC proceeding established rates through 2027,[17] information through 2027 is

[15] *See* D.22-12-027 at 35 ("We adopt Staff's recommendation to require a dollar valuation of the Safety Attribute in the Cost-Benefit Approach in the RDF using the DOT VSL as the standard value.").

[16] *See* Chapter RAMP-3: Risk Quantification Framework, Section II.

[17] *See* D.24-12-074.

calculated as part of the baseline risk, in accordance with D.21-11-009.[18] For the TY 2028 GRC, SDG&E calculated CBRs beginning with TY 2028 and for each Post-Test Year (PTY) (2029, 2030, and 2031).[19]

Table 4: Electric Infrastructure Integrity Risk
2024-2031 Control and Mitigation Plan Summary

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C201	Proactive Overhead Conductor Program	X	Ongoing
C202	Underground Cable Replacement Program (Proactive)	X	Ongoing
C206	Tee Modernization Program	X	Ongoing
C208	Replacement of Live Front Equipment	X	Ongoing
C210	DOE Switch Replacement	X	Ongoing
C212	GO165 Corrective Maintenance Program Underground	X	Ongoing
C215	Electric Public Safety Communications	X	Ongoing
C226	Distribution Substation Proactive Asset Program	X	Ongoing
C234	4 kV Reliability Program	X	Ongoing
C236	Distribution Overhead Switch Replacement Program	X	Ongoing
C240	Avian Protection Program	X	Ongoing
C248	Strategic Pole Replacement Program	X	Ongoing
C250	Substation Reliability for Distribution Components	X	Ongoing
C251	GO165 Corrective Maintenance Program Overhead	X	Ongoing
C252	Management of Overhead Distribution Service (Non-CMP)	X	Ongoing
C253	Restoration of Service	X	Ongoing
C254	Underground Cable Replacement Program - Reactive	X	Ongoing
C256	Management of Underground Distribution Service (Non-CMP)	X	Ongoing
C257	Distribution Substation Responsive Asset Replacement	X	Ongoing
C258	Emergency Equipment Purchase	X	Ongoing
C261	Power Quality Monitor Deployment and Replacement	X	Ongoing

[18] *See,* D.21-11-009 at 136, Conclusion of Law 7 (providing a definition for "baselines" and "baseline risk").

[19] In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C262	Distribution Substation SCADA Expansion	X	Ongoing
C263	Wireless Fault Indicator	X	Ongoing
C267	Damage Prevention Activities Electric Underground	X	Ongoing
C268	Substation Inspection and Maintenance Program	X	Ongoing
C269	Distribution Circuit Reliability	X	Ongoing
C270	SCADA Capacitors	X	Ongoing
C551	Prune and Removal (Clearance)	X	Ongoing
C554	Detailed Inspections	X	Ongoing
C578	QA/QC of Veg Management	X	Ongoing
M1	Transformer Load Monitoring Driven Transformer Replacement		New

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place"[20] (*i.e.*, activities in this section were in place as of December 31, 2024). Controls that will continue as part of the risk mitigation plan are identified in Table 4 above.

- **C201: Proactive Overhead Conductor Program:**

The purpose of SDG&E's Proactive Overhead Conductor Program is to systematically identify and upgrade existing overhead electric infrastructure. Failure of the assets could put the public at risk of energized contact with a fallen conductor and result in a significant unplanned outage. The deteriorated assets may also not have the original load carrying capabilities as designed. Further, this proactive replacement of overhead conductors builds on SDG&E's commitment to support electrification goals by providing capacity for expanding electric services delivered to downstream customers.

To identify and prioritize those locations where an overhead conductor upgrade is necessary, this program considers 1) Historical data collected from actual wire-down events and CMP Records, 2) a review of those spans that lack protection, 3) environmental factors including high winds and accelerated corrosion in coastal areas, 4) frequency of wire downs in adjacent or similar locations, and 5) electric load on the conductor relative to its capacity, which not only

[20] D.18-12-014 at 33.

indicate the need for capacity upgrades, but can also be an indicator of mechanical stress (cyclic heating/cooling) and/or premature aging of the conductors (ohmic heating).

This program replaces existing assets with assets that have been designed to current, upgraded construction standards. The assets targeted in this scope (typically small wire copper spans) were designed and constructed decades ago. Current standards call for stronger (*i.e.*, higher tensile strength) and/or covered conductor. The designs may also deploy advanced protection and/or fault detection schemes. The existing assets are replaced with those designed to current construction standards, providing the benefit of improved design techniques.

This program is also intended to proactively replace high-risk overhead conductors prone to wire-down events measured by failure rates, historic wire-down events, CMP records and lack of protection (fuse or advanced technology) that are in proximity to the public (*e.g.*, schools, freeways, high profile areas) that could put the public at risk of energized contact. SDG&E utilizes new construction standards, such as stronger (*i.e.*, higher tensile strength) and/or covered conductor, to decrease the likelihood of a wire-down event, and designs risk mitigation strategies for each circuit with the intent of achieving the greatest risk reduction for energized wire-down events by reconductoring and deploying advanced protection and/or detection schemes. Altogether, this decreases the likelihood of an energized wire-down event while also promoting sufficient capacity of the system.

In other areas, where small-capacity wire may not feasibly be replaced, at-risk connectors, sleeves, and single-phase spans of small wire (*i.e.*, commonly known failure points) are replaced as needed.

- **C202: Underground Cable Replacement Program (Proactive):**

SDG&E currently performs reactive replacement of underground unjacketed and lead-jacketed cable. Underground cable failures have become one of the largest contributors to customer outages in the last few years.

The reactive program (C254, below) identifies and replaces failed equipment. This program (C202) takes a proactive approach by replacing underground cable that has been identified to have a relatively higher probability of failure based on electric reliability circuit analysis and cable failure data.

In the absence of a physical or other system indicator of the location of the failure, the fault-finding process can be lengthy and place undue stress on adjacent components. Through a process colloquially known as “thumping”, the electrical components are exposed to voltage

surges, which, over time, may weaken the insulation of the cable. Ultimately, the stress imposed through the process of finding the fault may prematurely age adjacent, non-faulted components; in turn, the likelihood of failure increases, or at least the expected service life of these components is consequently shortened. Through proactive replacement of underground cable, such testing can be avoided.

This proactive replacement improves service to existing customers by proactively replacing cable in the underground system before an unplanned outage occurs. Planned outages can be resolved more quickly (by removing the time needed to find the faulted cable) and more targeted in their scope, reducing the overall burden on customers compared to an unplanned outage.

- **C206: Tee Modernization Program:**

SDG&E's Tee Modernization Program involves the proactive at-risk identification and replacement of 600-amp tee connectors. Tee connector failures have become the largest contributors to customer outages in the last few years.

600-amp tees are used as underground connections in handholes, manholes, and at switch terminations. Tee failures occur along feeder cables, causing forced outages to large customer counts that require extensive reconstruction to permanently restore the outage.

In a similar manner as discussed for proactive underground cable above, the process of fault-finding related to tee failures can stress non-fault components, increasing or accelerating the risk of failure. Through proactive replacement of 600-amp tee connectors, such hostile testing can be avoided. Additionally, tees can fail violently (*e.g.*, tee failure could lead to an arc flash), which may pose a serious safety risk to our field personnel and the public.

This proactive replacement improves service to existing customers by proactively replacing 600-amp tees in the underground system before an unplanned outage occurs. Planned outages can be resolved more quickly and more targeted in their scope, reducing the overall burden on customers compared to an unplanned outage.

- **C208: Replacement of Live Front Equipment:**

"Live front" equipment has the primary connections exposed with no insulative covering. Thus, when the equipment is opened, there are energized (live) conductors present. The Live Front Equipment Replacement program aims to identify and replace live front equipment.

SDG&E does not permit work on energized live front equipment. As a result, switch plans are used to operate unenergized (dead) front or remote-operated equipment elsewhere on the

system, to create electric isolation for a job or for safe operation of the live front equipment. However, this typically exposes additional customers to outages. Through proactive replacement of this equipment, future outages can be more focused in scope, improving reliability.

- **C210: DOE Switch Replacement:**

SDG&E's "do not operate energized" (DOE) Switch Replacement Program aims to systematically replace underground and overhead switches that are deemed unsafe for energized operation of the internal mechanical units. SDG&E utilizes inspection programs to identify these types of switches. These inspections include visual inspections, infrared (IR) inspection to detect points of potential overheating, measurement of switch lubrication, and physical exercising. Upon inspection, if a switch is found to not be safe for continued operation, field experts will make the determination to replace the switch with an appropriate superior or equivalent asset, depending on field conditions and reliability impact.

Distribution switch inoperability during an outage can extend the impact of an outage to the next upstream protection device, causing a prolonged and expanded outage. Use of the next upstream device adds customers to the outage, *i.e.*, those customers between the corroded switch and the next upstream device. Replacement of these switches allows for a reduced customer impact when isolation devices are needed during planned and unplanned outages.

- **C212: GO165 Corrective Maintenance Program Underground:**

Deterioration of underground equipment could increase likelihood of asset failure (*e.g.*, a broken cable rack) and cause potential risks, including injury or death, to the public and workers. Deteriorated equipment may also increase volume and frequency of forced distribution outages, possibly creating risks for public safety. As this program is mandated per GO 165, non-compliance poses risk of regulatory action, including fines. Underground equipment/connectors are inspected by infrared technology (upon entry of facility) per an internal standard Engineering Standard Practice 120 (ESP 120) and replaced accordingly.

The inspection of AGDF/AGLF (above ground, dead front and live front pad-mounted equipment) consists of a detailed external and internal visual inspection of pad-mounted facilities to identify conditions out of compliance with GO 128. The most obvious types of condition that presents a significant hazard to the public and employees are severe corrosion, possible wire entry, and identifying oil leaks. These are the types of conditions that SDG&E is continually looking for.

Additionally, this program includes detailed inspection of subsurface structures (manholes, vaults, primary hand-holes and subsurface enclosures) containing electric distribution equipment. Structures with only cable taps, splices or pass-throughs are not required by GO 165, but are still inspected as part of SDG&E's inspection program. The program's detailed inspection of these facilities identifies conditions out of compliance with GO 128 (Rules for Construction of Underground Electric Supply and Communication Systems). The most obvious examples of a condition that could present a significant hazard to the public and employees are severe structural deterioration, an unsecure entryway, and working space issues.

SDG&E performs this type of inspection on approximately 25,400 structures per year. The top five conditions found on this type of inspection are as follows:

- EXT/INT High Voltage Sign Missing;
- External Working Space Sign Missing;
- Weeds/Trees/Bushes/Dirt or Obstacle;
- Possible Wire Entry to Energized/Exposed Parts; and
- ID/Circuit/Switch Number Missing or Incorrect.

- **C215: Electric Public Safety Communications:**

Through a dedicated outreach campaign, SDG&E provides education to customers and the general public about the dangers and risks associated with electricity and working in proximity to SDG&E's electrical equipment and delivery infrastructure. This is primarily accomplished through a variety of integrated tactics, including bill messaging, organic and paid social media, television, out-of-home (*e.g.*, billboards & bus shelters), print and digital advertising, press releases, messaging on company website (including internal company employee site, PowerUp) and warning signage near electric facilities. Primary electric safety topics include, but are not limited to: 1) metallic balloons, 2) downed powerlines, 3) 10' powerline clearance, 4) electrical equipment (*i.e.*, pad-mounted equipment) and 5) accessory dwelling unit (ADU) inspections for meter service, rewires and panel upgrades. The annual budget for SDG&E's Natural Gas & Electric Safety marketing campaign is $750,000, with roughly half ($375,000) dedicated to electric safety topics. Due to communications taking many forms as seen above, it was infeasible to develop a single unit of measure for this control.

- **C226: Distribution Substation Proactive Asset Program:**

This is a proactive distribution substation equipment replacement or addition program that will improve safety and reliability related to the replacement of obsolete and problematic

substation equipment with costs under or around roughly $2M. Similar to C250, this program covers individual equipment with limited spare parts which introduces risk to the system. Due to the variety of equipment being replaced, it was infeasible to develop a single unit of measure for this control.

- **C234: 4 kV Reliability Program:**

The purpose of SDG&E's 4 kV modernization program is to systematically improve the reliability for customers currently serviced by 4 kV circuits. The 4 kV system makes up over 20% of SDG&E distribution circuits (by circuit count) and represents approximately 5% of SDG&E system load and overall distribution system length. The 4 kV package or "unit" substation 4 kV substations, half of which are over 50 years old, present a distinct reliability risks for customers serviced by 4 kV circuits due to higher failure rates of those units. Further, when there is an outage on a 4 kV circuit, there are limited options to transfer 4 kV load to adjacent circuits (most of which are 12 kV). All of these factors create the potential for more frequent and extended duration outages on 4 kV circuits.

The scope of the program focuses on removing 4 kV packages or "unit" substations, modernizing other aging substation infrastructure as needed, and provision of new step-down transformers as appropriate. To further improve reliability, customers may be cutover from 4 kV to 12 kV as part of the redesign and rearrangement of the 4 kV Circuit. Where necessary, the scope of the program will also include replacing small and aging wire.

- **C236: Distribution Overhead Switch Replacement Program:**

SDG&E's Distribution Overhead Switch Replacement Program aims to replace overhead distribution switches that have shown signs of severe or quickly advancing corrosion that may lead to catastrophic switch failure. The state of the switch may pose safety risks to field operating personnel, due to potential flash or overexertion by the employee during the physical operation of the switch. To mitigate the likelihood of a catastrophic switch failure, SDG&E may be forced to operate the next upstream protection device instead, causing a prolonged and expanded outage.

SDG&E has identified through quantitative risk modeling various data attributes that characterize high-risk switches and has prioritized several switches that can be removed in the near term to avoid failure. For example, SDG&E's engineering analyses of failed overhead switches have determined that various switches often fail due to excessive corrosion of major components. Switches have failed in as little as eight years of operation along the dense salt fog coast. Specifically, Distribution switches have a higher propensity for failure and/or inoperability

in high corrosion areas, for example, in the area SDG&E identifies as "Contamination District One" (which includes assets within two miles of the coast). While switches within Contamination District One experience the highest rate of failure, failures can and do occur across the service territory.

Distribution switch inoperability during an outage can extend the impact of an outage to the next upstream protection device, causing a prolonged and expanded outage. Use of the next upstream device adds customers to the outage, *i.e.*, those customers between the corroded switch and the next upstream device. Replacement of these switches allows for a reduced customer impact when isolation devices are needed during planned and unplanned outages.

Antiquated single phase disconnect switches are targeted to be replaced with 1) newer model disconnects with superior material specifications, 2) three-phase gang-operated switches (mitigating ferro resonance over-voltages and flashovers), or 3) three-phase remote operable switches. Switch replacements may also require simultaneous or subsequent upgrades to relevant equipment such as poles, crossarms, wires, guys, and other hardware.

- **C240: Avian Protection Program:**

SDG&E's Avian Protection Program involves identifying and retro-fitting, rearranging, or building-to standard distribution poles in SDG&E's service territory to prevent electrocution and potential collisions of birds with our facilities and to facilitate compliance with the following federal and state laws: (1) Migratory Bird Treaty Act (16 U.S.C. §§ 703-712), (2) Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668-668d), and (3) the California Fish and Game Code (Cal. Fish and Game Code §§ 3503, 3503.5, 3511, 3513). The project will also harden the system and reduce the risk of wire-down events associated with avian electrocutions, improve SDG&E reliability and customer service, and align with Avian Power Line Interaction Committee (APLIC) Guidelines. The plan will primarily address known bird contacts, in which case we will identify and resolve potential avian risk.

- **C248: Strategic Pole Replacement Program:**

The Strategic Pole Replacement Program focuses on the replacement of gas-treated poles that are in proximity to the public (*e.g.*, schools, freeways, high profile areas) that could put the public at risk of energized contact. The purpose of this program is to target high-risk poles located throughout the service territory that are gas treated and are set in concrete and steel reinforced, steel reinforced and set in soil, or set in soil, and are not being addressed by other programs. These poles are nearing the end of their useful life and are known to have a higher failure

potential. Gas treated poles have a higher propensity for dry rot due to the pole's interaction with the moisture in the soil, and poles set in concrete are more difficult to inspect and determine the integrity of the pole.

This program replaces the existing assets with assets that have been designed to current and updated construction standards. The assets targeted in this scope were designed and constructed decades ago. Therefore, the replacement of these assets with those designed to current construction standards provides the benefit of improved design techniques and modern equipment and construction methods. Replacement of these assets will also avoid unplanned outages that would result from the failure of the pole during normal operation.

- **C250: Substation Reliability for Distribution Components:**

The following projects focus primarily on distribution substation transformers, capacitors, and circuit breaker replacements. Substations are essential to the daily operation of the electric system and must be kept in reliable condition. Modern substation infrastructure can rely on protective relaying devices to operate correctly and strategically isolate substation equipment in order to minimize the impact of an outage and increase reliability. Failure to maintain a substation in reliable condition can impact reliability and limit operational flexibility. Qualified Electric Workers (QEW) can also be subject to electric safety hazards such as arcing, high voltage induction stray voltages, and mechanical safety hazards associated with working with heavy equipment (*e.g.*, circuit breakers) and in confined spaces, such as in metal clad switchgear.

Proactive planning is therefore required for the replacement of equipment that has exhausted its useful life. Proactive planning and replacement will allow the distribution system to continue operating at optimum conditions and maintain its reliability, shorten outage times, and allow for operational flexibility to the system. The following substations have been identified as having limited operational flexibility and needing work to be performed under this program. Below is a list of individual substations planned to perform a proactive replacement:

- Chicarita 12 kV Breaker and Capacitor Replacements;
- Laguna Niguel 12 kV Breaker and Capacitor Replacements;
- Scripps 12 kV Breaker and Capacitor Replacements;
- Coronado 69/12 kV Transformer Replacement;
- Batiquitos 12 kV Breaker and Capacitor Replacements;
- Cabrillo 12 kV Switchgear Replacements;
- Ash 12 kV Breaker and Transformer Replacement;

- Genessee 12 kV Replacements;
- Trabuco 12 kV Replacements;
- Rincon 12 kV Bus tie and Transformer Replacements;
- Vista Remove from Service; and
- Granite 12 kV Breaker and Switchgear Replacements.

Due to the variety of equipment being replaced and the variances per project, it was infeasible to develop a single unit of measure for this control.

- **C251: GO165 Corrective Maintenance Program Overhead:**

SDG&E's GO 165 Distribution Inspect and Repair program replaces wood poles after identifying compromised poles from GO 165 wood pole intrusive inspections. In lieu of the existing program, short- and long-term deterioration of overhead equipment could increase the likelihood of asset failure (*e.g.*, broken poles) and cause potential risks, including injury or death, to the public and workers. Degraded equipment could also increase the volume and frequency of forced distribution outages, potentially creating risks for public safety. As this program is mandated per GO 165, non-compliance poses a risk of regulatory action, including fines. SDG&E's Overhead (OH) Visual Inspection program utilizes GO 95, Rules for Overhead Electric Line Construction, as its basis for identifying non-conformances. The OH Visual Inspection looks for a variety of conditions that could impact public and employee safety, structural integrity, and system reliability. The OH Visual Inspection consists of a detailed, walk-around inspection of all distribution poles, pole-mounted facilities with primary and secondary conductors, Communication Infrastructure Provider (CIP) attachments, and distribution equipment on transmission poles. These inspections identify conditions that are out of compliance with GO 95. On average, SDG&E performs approximately 45,000 OH visual inspections on its electric distribution system per year. For an OH visual inspection, the top five conditions found are as follows:

- Damaged/Missing Sign;
- Damaged/Missing/Incorrect Station Pole ID;
- Damaged Ground Molding;
- Damaged/Missing High Voltage signs; and
- Pole steps lower than 10 feet.

SDG&E also performs a Pole Intrusive Inspection on each wood electric distribution pole. Any pole 15 years of age or older is inspected intrusively. The form of the intrusive inspection is

normally an excavation about the pole base and/or a sound and bore inspection of the pole at ground line. Currently, treatment is applied in the form of ground-line pastes and/or internal pastes. SDG&E performs these inspections on a 10-year cycle. The 10-year cycle fulfills the requirements of GO 165, which are: (1) all poles over 15 years of age are intrusively inspected within ten years; and (2) all poles that previously passed intrusive inspection are to be inspected intrusively again on a 20-year cycle.

SDG&E is responsible for performing the wood pole integrity inspections, applying wood preservative treatments, and installing mechanical (steel) reinforcements. The type of treatment is dependent upon the age of the pole, the individual inspection history, and the overall condition of the structure. SDG&E's Vegetation Management group administers the wood pole intrusive inspection and treatment program. For this program, SDG&E performs approximately 20,000 wood pole intrusive inspections annually. There are three findings from this type of inspection. They are:

- Pole replacement;
- Pole reinforcement (with steel); and
- No corrective action needed.

- **C252: Management of Overhead Distribution Service (Non-CMP):**

This project is required to reinforce the electric overhead distribution system infrastructure by responsive action to system damages, deterioration, and unsafe conditions outside normal restoration of service. The overall objective is to maintain continuity of safe and reliable customer service. This project provides for the reconstruction of existing overhead distribution facilities as necessary, to:

- Correct improper voltage conditions.
- Replace overhead facilities that are non-compliant with OH safety and reliability standards.
- Make emergency repairs not normally associated with restoration of service.
- Repair or replace deteriorated or unsafe equipment not found through the "Corrective Maintenance Program."
- Install fault indicators/fusing/switching equipment, as necessary.
- Install a barrier around the pole to prevent reoccurrence.

- **C253: Restoration of Service:**

SDG&E, as an investor-owned utility, has an obligation to serve. This control is required to accomplish restoration of electric service due to system interruptions caused by severe inclement weather conditions, fires, equipment failures, damages caused by a third party and any other event that results in a customer loss of power caused by assets owned by SDG&E. This project provides for the reconstruction of existing overhead and underground distribution facilities as necessary to restore electric service to customers. The funds within this budget cover all costs associated with the following factors:

  - Storm Damage (rain/wind/fire, for example).
  - Extensive damage to electric distribution facilities by others (car/equipment contacts, for example).
  - Emergency repairs of facilities required for service restoration (e.g., cable or equipment failures).

- **C254: Underground Cable Replacement Program – Reactive:**

SDG&E's underground cable replacement program is designed to identify and reactively replace equipment during outages on the distribution system. This project is required to support SDG&E's obligation to serve, by funding the restoration of electric service after system interruptions caused by underground cable failures involved in severe inclement weather conditions, equipment failures and damages caused by a third party.

- **C256: Management of Underground Distribution Service (Non-CMP):**

This project is required to reinforce the electric underground distribution system infrastructure by responsive action to system damages, deterioration, and unsafe conditions outside normal restoration of service. The overall objective is to maintain continuity of safe and reliable customer service. This project provides for the reconstruction of existing underground distribution facilities as necessary to:

  - Correct improper voltage conditions.
  - Replace non-compliant underground facilities.
  - Make emergency repairs not normally associated with restoration of service.
  - Repair or replace deteriorated or unsafe equipment not found through the Corrective Maintenance Program or C254: Underground Cable Replacement Program - Reactive.

- Install fault indicators, fusing, or switching equipment as necessary to maintain service reliability.

- **C257: Distribution Substation Responsive Asset Replacement:**

This is a reactive project for electrical distribution substation facilities that have failed, intended to maintain the integrity and reliability of the distribution substation. General project categories include:

- Safety related improvements; and
- Replacement of failed equipment

Due to this control being reactive and the variety of equipment addressed, it was infeasible to develop a single unit of measure for this control.

- **C258: Emergency Equipment Purchase:**

This is a reactive spare/portable project intended for a speedier restoration of service to our customers following outages caused by equipment failures. The number of aging transformers and switchgear on the SDG&E system is at a level for which additional failures can be expected, despite efforts to replace the equipment before failure. In addition, there can be lengthy lead times for replacement units, during which time the spares and portable equipment are necessary. This project addresses long lead time by purchasing emergency spare and mobile equipment as needed.

Due to this control being reactive and the variety of equipment addressed, it was infeasible to develop a single unit of measure for this control.

- **C261: Power Quality Monitor Deployment and Replacement:**

SDG&E's Power Quality (PQ) Monitor Deployment and Replacement project is the continued deployment of power quality monitors that can remotely monitor and capture data that support incipient fault detection, distribution and substation asset management, operations, and power quality investigations. These devices are foundational to SDG&E's ability to monitor the system, develop root cause analysis to investigate issues on the system, and locating and identifying faulty equipment before it fails. Applications are under development to support advanced capabilities, including predictive fault analytics and automated fault locating, which will have a direct positive impact on the system reliability, customer service and asset management. The PQ monitoring system provides benefits, as follows:

- Provides distribution system power quality health information, including RMS voltage, voltage and current transient events, system harmonics (including spectra), real and reactive power flow, power factor, flicker, and

others.

- Provides logging and notification for events occurring on transmission, distribution and customer systems that are perceptible at the distribution substation.
- Provides advanced analytics processes, including incipient fault detection (fault anticipation or predictive fault analysis) and advanced fault locating.
- Provides a data source with analytics for historical events and steady state trends.
- Provides data collected via the substation PQ monitoring system that is regularly utilized by several engineering and other departments within the company.

- **C262: Distribution Substation SCADA Expansion:**

This program installs, upgrades, and expands Supervisory Control and Data Acquisition (SCADA) systems at SDG&E's distribution substations, which is foundational to how SDG&E monitors the system, enhances SDG&E's situational awareness, and improves response to adverse circuit conditions. Benefits of installing SCADA within the substation includes faster faulted circuit identifications, faster isolation of faulted electric distribution circuits, higher accuracy fault locating, and improved system performance. This program replaces aging and obsolete remote terminal units (RTUs), relays, and associated interdependent equipment with state-of-the art devices, which improve SCADA integration and protection features in a small footprint, providing for more cost-effective design, installation, and maintenance.

- **C263: Wireless Fault Indicator:**

Wireless fault indicators are a proven technology that helps narrow the search area to determine where a system failure has occurred, so SDG&E can quickly identify a search area and dispatch crews to find system failures. This technology is important to SDG&E's operational mitigation measures that improve reliability and the customer experience.

SDG&E routinely reviews results of sensitive relay outages to identify the need and locations for new wireless fault indicator locations. Locations may change based on new information and past findings. Wireless fault indicators are typically placed on bifurcations in SDG&E's system or midway on a section of conductor that does not have SCADA devices to provide real-time notification of loss of current or faults downstream. Examples include a location where a feeder splits but only has a SCADA switch in one direction downstream. Adding a

wireless fault indicator to the other direction provides more complete information on the status of all conductors downstream. Overhead to underground and underground to overhead unfused transitions and downstream of non-SCADA substations are also valuable applications.

- **C267: Damage Prevention Activities Electric Underground:**

The purpose of the Damage Prevention Activities – Underground Electric is to prevent damage to electric infrastructure caused by third-party excavators. Two primary locate-and-mark activities are listed below:

  - Locating and marking underground electric facilities before excavation occurs.
  - Providing staff support for compliance and improvement.

The first of these activities, damage prevention activities – underground electric, refers to the physical act of locating and marking underground facilities. SDG&E has been moving towards in-sourcing work related to locate-and-mark activities. In 2024, SDG&E responded to over 210,000 locate and mark ticket requests. By providing a visual indication of the location of underground facilities, the excavator has the necessary information to excavate safely.

The second activity is providing daily damage prevention staff support to operations by interpreting policies, tracking compliance, evaluating tools, equipment, and new technologies, providing refresher training, and tracking and trending locate-and-mark data to proactively identify areas for improvement. This is a critical risk reduction activity that directly supports the field locator personnel in their daily activities and leads to more accurate and timely responses to locate and mark tickets and reduction in damages. This collection of Damage Prevention Activities – Underground Electric ultimately provides the excavator with the necessary information to avoid hitting or damaging electric facilities.

- **C268: Substation Inspection and Maintenance Program:**

SDG&E's Substation Inspection and Maintenance Program promotes safety for SDG&E personnel, SDG&E contractors, and the public by providing a safe operating and construction environment for each substation. Goals of this program include: meeting all of the requirements of GO 174, achieving a level of safety satisfactory to SDG&E's health and safety programs, assuring compliance with all regulatory requirements, and maintaining reliable service for electric customers. This is accomplished through routine inspections at reoccurring cycles and corrective maintenance when issues requiring action are identified. Detailed Substation Inspections are conducted monthly or bimonthly, consisting of thorough visual inspections of individual

equipment condition, attempting to identify any problems such as cracks, leaks, contamination, damage, or nonstandard fluid levels or pressures. Substation Infrared Inspections are conducted annually to identify overheating not visible during typical inspections, which may be indicative of issues or irregularities preceding failure. Corrective Maintenance is performed to repair or otherwise address all issues identified during inspections.

- **C269: Distribution Circuit Reliability:**

This program helps mitigate the EII Risk by expanding the distribution SCADA-switching infrastructure and/or removing reliability deficiencies on a distribution circuit. This program allows for the addition of the equipment necessary and/or the re-arrangement of circuit(s) to improve service reliability of electric customers and maintain reliability standards. Electric service reliability will deteriorate in the absence of comprehensive remedial solutions offered by these projects and consistent review of distribution circuits.

- **C270: SCADA Capacitors:**

The SCADA capacitors program will replace existing non-SCADA capacitors with a more modern SCADA switchable capacitor. The current capacitors are designed to provide continuous voltage and power factor correction for the distribution system. During a failure of a capacitor from either mechanical, electrical, or environmental overstress, an internal fault is created resulting in internal pressure and the potential to rupture the casing, which could create a potential safety hazard to employees and the public.

The modernization of these capacitors will introduce a monitoring system to check for imbalances and internal faults and to open based on the protection settings. In addition, the SCADA capacitor will provide a method for remote isolation and monitoring of the system, providing additional situational awareness during extreme weather conditions. The program first prioritizes replacing or removing from service fixed capacitors within the system and then addressing capacitors with switches. Both types of capacitors will be modernized to a SCADA switchable capacitor.

This program focuses on construction outside the HFTD. SDG&E expects that system faults associated with capacitor failures would decrease over time as a result of this program.

- **C551: Prune and Removal (Clearance):**

Tree pruning and removal is the activity of cutting vegetative material (branches, limbs, trunk) for the purpose of maintaining safe, reliable, and compliant clearance between trees and overhead electrical conductors. The Tree Pruning and Removal Activity follows American

National Standards Institute (ANSI) A300 and International Society of Arboricultural (ISA) best management practices. Clearances established at time-of-pruning are determined by multiple factors including species, growth rate, minimum required clearance, wind sway, line sag, proper pruning practices, and tree health. Clearances established at time-of-pruning must be sufficient to provide safety and compliance for at least one annual cycle.

- **C554: Detailed Inspections:**

Detailed Inspections are performed annually throughout the HFTD and consist of a Level 2 inspection. A Level 2 inspection is a 360-degree visual assessment of trees located within the utility strike zone evaluating the crown, trunk, canopy, and above-ground roots for hazards to the overhead electric facilities. Trees in the utility strike zone are assessed for tree growth and hazard potential. The utility strike zone is defined as the area where trees are tall enough to impact the overhead facilities. Detailed inspections are conducted concurrently for distribution and transmission conductors where they are collocated within the utility corridor. Detailed inspections determine whether vegetation will encroach the required minimum clearance distance or otherwise impact the lines within the annual cycle.

Detailed Inspections occur annually based on a Master Schedule, which remains static year to year. Detailed Inspections may be performed by either ISA-Certified or non-ISA Certified Arborists. During inspection activity, the electronic records for inventory trees are updated.

- **C578: QA/QC of Veg Management:**

Quality assurance audits of vegetation management activities are performed to measure work quality, contractual adherence, compliance with regulations and standards, and data accuracy. A third-party contractor performs the quality assurance audits of vegetation management activities. QA/QC of Vegetation Management audits, Detailed Inspections, Pruning and Removal, Pole Clearing activities. Due to the variety of QA/QC tasks completed, it was infeasible to develop a single unit of measure for this control.

B. Changes from 2024 Controls

SDG&E plans to make the following changes through the 2025-2031 period. These changes are reflective of programs that are discontinued, have adjusted scope, or have moved RAMP chapters.

SDG&E plans to discontinue the control previously named “Field SCADA RTU Replacement.” The Field SCADA RTU Replacement Project is anticipated to end prior to the RAMP period starting in 2028. With fewer than six PME switches remaining as potential upgrade

candidates, the project is expected to be completed by 2026, ensuring all necessary upgrades are addressed before the RAMP period begins.[21]

SDG&E has combined the Proactive and Reactive controls for Live Front to Dead Front Conversions into a single control now named "C208 Replacement of Live Front Equipment." Any conversion of live front to dead front equipment will be prioritized based on the reliability impact of each location. "Reactive" work would not be permitted when a comparable location offers greater reliability benefit and could be converted instead.

SDG&E has reduced the number of GO165 controls from three to two. The new controls are C212 GO165 Corrective Maintenance Program Underground and C251 GO165 Corrective Maintenance Program Overhead. These controls replaced "GO165 Corrective Maintenance Program Underground", "GO165 Manhole Vault Restoration Program", and "GO165 Pole Replacement Reinforcement". Since "GO165 Pole Replacement Reinforcement" focused on overhead issues it was just renamed to C251 GO165 Corrective Maintenance Program Overhead. "GO165 Corrective Maintenance Program Underground" and "GO165 Manhole Vault Restoration Program" focused on underground so the controls were combined into C212 GO165 Corrective Maintenance Program Underground.

Control C215 Electric Public Safety Communications was previously captured in the Customer & Public Safety chapter and has been added to the EII chapter to align with the Drivers and Consequences presented in this chapter.

Control C267 Damage Prevention Activities Electric Underground was previously captured in the Excavation Damage (Dig-In) on the Gas System RAMP chapter and has been added to the EII chapter to align with the Drivers and Consequences presented in this chapter.

Control C551 Prune & Removal (clearance), C554 Detailed Inspections, and C578 QA/QC of Veg Management were previously captured as a single control (C6 Vegetation Management) in the EII chapter and has been split into three separate controls to better align with the specific activities that take place under the vegetation management umbrella.

C. Mitigation Programs

SDG&E intends to implement the following new mitigation program:

[21] SDG&E is not funding this project past 2024.

- **M1: Transformer Load Monitoring Driven Transformer Replacement:**

To address the discrepancies and data gaps in our Transformer Load Monitoring (TLM) data, SDG&E has included in this RAMP Report a program aimed at enhancing the reliability of transformer utilization assessments. This initiative will focus on closing existing TLM data gaps, identifying transformers at high risk of overload during major heat events, and proactively replacing or upsizing these transformers. By implementing this program, we aim to mitigate the risk of significant outages and improve our response capabilities, especially in light of current challenges in the electrical equipment supply chain.[22]

D. Climate Change Adaptation

Pursuant to Commission decisions[23] in the Climate Adaptation OIR (R.18-04-019), SDG&E performed a Climate Adaptation Vulnerability Assessment (CAVA) focused on years 2030, 2050, and 2070, with the aim of identifying asset and operational vulnerabilities to climate hazards across the SDG&E system. SDG&E recognizes the need to address climate vulnerabilities to promote safety and reliability of its services and mitigate the increasing climate-related hazards through innovative and community-centric approaches. Some of the climate hazards that will have short- and long-term ramifications in the San Diego region include extreme temperatures, wildfire, inland flooding, coastal flooding and erosion, and landslides. Climate change is recognized as a factor that can drive, trigger, or exacerbate multiple RAMP risks. Implementing climate change adaptation measures and integrating climate vulnerability considerations into RAMP controls and mitigations can enhance system infrastructure longevity and reduce the severity of long-term negative climate impacts. The controls and mitigations described in further detail in this chapter, as shown below, align with the goal of increasing SDG&E's physical and operational resilience to the increasing frequency and intensity of climate hazards. Additional information on the CAVA and a list of climate-relevant controls and mitigations included in RAMP, are provided in Chapter RAMP-5: Climate Change Adaptation.

Table 5: Electric Infrastructure Integrity Risk
Controls and Mitigations that Align with Increasing Resilience to Climate Hazards

Relevant ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
C202	Underground Cable Replacement Program (Proactive)	Wildfires

[22] SDG&E does not present forecasted costs for this mitigation program as it is still identifying the full scope of work needed to accomplish the mitigation and evaluating various solutions.

[23] D.19-10-054; D.20-08-046.

Relevant ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
C250	Substation Reliability for Distribution Components	Extreme Temperatures, Inland Flooding, and Coastal Flooding
C253	Restoration of Service	Extreme Temperatures, Wildfires, Inland Flooding, and Coastal Flooding
C254	Underground Cable Replacement Program - Reactive	Wildfires
C262	Distribution Substation SCADA Expansion	Wildfires
C263	Wireless Fault Indicator	Extreme Temperatures
C269	Distribution Circuit Reliability	Extreme Temperatures
C270	SCADA Capacitors	Wildfires
C551	Prune & Removal (Clearance)	Wildfires
C554	Detailed Inspections	Wildfires
C578	QA/QC of Veg Management	Wildfires
M1	Transformer Load Monitoring Driven Transformer Replacement	Extreme Temperatures

E. Foundational Programs

Foundational Programs are "[i]nitiatives that support or enable two or more mitigation programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[24] The EII Risk chapter determined that there are no foundational programs. C551, C554, and C578 are all vegetation management programs and work together as a whole with the main activity of prune and removal (C551) mitigating the risk. All other controls have the associated costs and activities as part of the control itself.

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for EII Risk, including the associated costs, units, and CBRs. Additional information by Tranche is provided in workpapers. The costs shown are estimated using assumptions provided by SMEs and available data. In compliance with the Phase 3 Decision,[25] for each enterprise risk, SDG&E uses actual results and industry data and when that is not available, supplements the data with SME input. Additional details regarding the data and expertise relied upon in developing these estimates is provided in Attachment B.

[24] D.24-05-064, Appendix A at A-4.

[25] D.24-05-064, RDF Row 10.

Table 6: Electric Infrastructure Integrity Risk
Risk Control and Mitigation Plan – Recorded and Forecast Costs Summary
(Direct, in 2024 $ thousands)

Control/Mitigation		Adjusted Recorded		Estimated			
ID	**Name**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C201	Proactive Overhead Conductor Program	291	0	0	8,061	24,183	0
C202	Underground Cable Replacement Program (Proactive)	3,308	0	0	5,219	15,657	0
C206	Tee Modernization Program	4,922	0	0	2,419	7,257	0
C208	Replacement of Live Front Equipment	64	0	0	1,878	5,634	0
C210	DOE Switch Replacement	2,325	0	0	4,726	14,178	0
C212	**GO165 Corrective Maintenance Program Underground**	25,917	0	0	88,848	66,636	0
C215	Electric Public Safety Communications	0	395	1,363	0	0	4,089
C226	Distribution Substation Proactive Asset Program	1,731	0	0	2,500	9,146	0
C234	4 kV Reliability Program	223	0	0	456	1,368	0
C236	Distribution Overhead Switch Replacement Program	352	0	0	679	2,037	0
C240	**Avian Protection Program**	14	0	0	21	63	0
C248	Strategic Pole Replacement Program	13	0	0	1,200	3,600	0
C250	Substation Reliability for Distribution Components	3,282	0	0	24,421	37,036	0
C251	**GO165 Corrective Maintenance Program OH**	20,003	0	0	85,612	64,209	0
C252	Management of Overhead Distribution Service (Non-CMP)	10,966	0	0	44,672	33,504	0
C253	Restoration of Service	10,353	0	0	40,116	30,087	0
C254	Underground Cable Replacement Program - Reactive	7,217	0	0	28,468	21,351	0
C256	Management of	6,220	0	0	18,852	14,139	0

Control/Mitigation		Adjusted Recorded		Estimated			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
	Underground Distribution Service (Non-CMP)						
C257	Distribution Substation Responsive Asset Replacement	1,573	0	0	8,009	10,810	0
C258	Emergency Equipment Purchase	961	0	0	8,430	4,000	0
C261	Power Quality Monitor Deployment and Replacement	285	0	0	2,096	3,622	0
C262	Distribution Substation SCADA Expansion	413	0	0	2,772	3,132	0
C263	Wireless Fault Indicator	0	0	0	160	1,122	0
C267	**Damage Prevention Activities Electric Underground**	0	4,729	5,167	0	0	17,007
C268	**Substation Inspection and Maintenance Program**	0	1,656	2,180	0	0	6,540
C269	Distribution Circuit Reliability	1,729	0	0	1,959	5,877	0
C270	SCADA Capacitors	225	0	0	1,174	3,522	0
C551	**Prune and Removal (Clearance)**	0	30,337	31,423	0	0	101,275
C554	**Detailed Inspections**	0	3,724	4,859	0	0	15,742
C578	**QA/QC of Veg Mgmt**	0	3,206	3,424	0	0	10,778

Bold *indicates a mandated program.*

Table 7: Electric Infrastructure Integrity Risk
Risk Control & Mitigation Plan – Units Summary

Control/Mitigation		Adjusted Recorded Units			Estimated Units			
ID	Name	Units of Measure	2024 Capita	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C201	Proactive Overhead Conductor Program	Miles	0	0	0	7	21	0
C202	Underground Cable Replacement Program (Proactive)	Miles	19	0	0	28	84	0
C206	Tee Modernization Program	Terminators	253	0	0	119	357	0

Control/Mitigation		Adjusted Recorded Units			Estimated Units			
ID	**Name**	**Units of Measure**	**2024 Capita**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C208	Replacement of Live Front Equipment	Terminators	0	0	0	34	102	0
C210	DOE Switch Replacement	Switches Replaced	16	0	0	20	60	0
C212	**GO165 Corrective Maintenance Program Underground**	Jobs Completed	1,867	0	0	6,276	4,707	0
C215	Electric Public Safety Communications	No Feasible	0	0	0	0	0	0
C226	Distribution Substation Proactive Asset Program	No Feasible	0	0	0	0	0	0
C234	4 kV Reliability Program	Miles	0	0	0	1	3	0
C236	Distribution Overhead Switch Replacement Program	Switches Replaced	4	0	0	19	57	0
C240	**Avian Protection Program**	Poles	0	0	0	10	30	0
C248	Strategic Pole Replacement Program	Poles Replaced	0	0	0	40	120	0
C250	Substation Reliability for Distribution Components	No Feasible	0	0	0	0	0	0
C251	**GO165 Corrective Maintenance Program OH**	Poles	1,391	0	0	5,624	4,218	0
C252	Management of Overhead Distribution Service (Non-CMP)	Jobs Completed	101	0	0	2,912	2,184	0
C253	Restoration of Service	Jobs Completed	776	0	0	8,300	6,225	0
C254	Underground Cable Replacement Program - Reactive	Jobs Completed	277	0	0	2,420	1,815	0
C256	Management of	Jobs	265	0	0	2,740	2,055	0

Control/Mitigation		Adjusted Recorded Units			Estimated Units			
ID	**Name**	**Units of Measure**	**2024 Capita**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
	Underground Distribution Service (Non-CMP)	Completed						
C257	Distribution Substation Responsive Asset Replacement	No Feasible	0	0	0	0	0	0
C258	Emergency Equipment Purchase	No Feasible	0	0	0	0	0	0
C261	Power Quality Monitor Deployment and Replacement	Nodes	7	0	0	98	216	0
C262	Distribution Substation SCADA Expansion	Other	0	0	0	11	18	0
C263	Wireless Fault Indicator	Wireless Faults	0	0	0	75	525	0
C267	**Damage Prevention Activities Electric Underground**	Tickets	0	193,436	232,583	0	0	765,641
C268	**Substation Inspection and Maintenance Program**	Inspections	0	0	2,051	0	0	6,153
C269	Distribution Circuit Reliability	Switches	3	0	0	14	42	0
C270	SCADA Capacitors	Capacitors	0	0	0	14	42	0
C551	**Prune and Removal (Clearance)**	Trees Trimmed	0	90,885	91,336	0	0	274,008
C554	**Detailed Inspections**	Trees Inspected	0	261,975	255,000	0	0	765,000
C578	**QA/QC of Veg Mgmt**	No Feasible	0	0	0	0	0	0

***Bold** indicates a mandated program.*

In the table below, CBRs are presented in summary at the mitigation or control level for the TY 2028 GRC cycle. CBRs are calculated based on scaled, expected values, unless otherwise

noted, and are calculated for each of the three required discount rates[26] in each year of the GRC cycle and for the Post-Test Years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in workpapers.

Table 8: Electric Infrastructure Integrity Risk
Cost Benefit Ratio Results Summary (2028-2031)
(Direct, in 2024 $ millions)

ID	Control/Mitigation Name	Capital (2028-2031)	O&M (2028-2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C201	Proactive Overhead Conductor Program	$32.25	$0	0.40	0.16	0.12
C202	Underground Cable Replacement Program (Proactive)	$20.88	$0	16.82	7.89	6.08
C206	Tee Modernization Program	$9.68	$0	8.59	3.36	2.52
C208	Replacement of Live Front Equipment	$7.51	$0	0.14	0.06	0.04
C210	DOE Switch Replacement	$18.90	$0	5.83	2.78	2.10
C212	**GO165 Corrective Maintenance Program – Underground**	**$88.85**	**$0**	**7.83**	**3.64**	**2.83**
C215	Electric Public Safety Communications	$0	$5.45	0.40	0.41	0.38
C226	Distribution Substation Proactive Asset Program	$11.65	$0	1.18	0.51	0.38
C234	4 kV Reliability Program	$1.82	$0	5.26	2.25	1.70
C236	Distribution Overhead Switch Replacement Program	$2.71	$0	113.84	46.55	34.37
C240	**Avian Protection Program**	$0.09	$0	0.98	0.39	0.30
C248	Strategic Pole Replacement Program	$4.80	$0	0.52	0.24	0.18
C250	Substation Reliability for Distribution Components	$48.11	$0	0.30	0.13	0.10
C251	**GO165 Corrective Maintenance Program**	**$85.61**	**$0**	**3.02**	**1.12**	**0.94**

[26] *See* Chapter RAMP-3 for definitions of discount rates, as ordered in the Phase 3 Decision.

ID	Control/Mitigation Name	Capital (2028-2031)	O&M (2028-2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
	-Overhead					
C261	Power Quality Monitor Deployment and Replacement	$5.09	$0	182.85	129.21	108.78
C262	Distribution Substation SCADA Expansion	$4.18	$0	50.95	36.69	30.48
C263	Wireless Fault Indicator	$1.28	$0	136.22	98.61	81.47
C267	**Damage Prevention Activities Underground**	$0	$22.17	1.42	1.46	1.35
C268	**Substation Inspection and Maintenance**	$0	$8.72	2.27	1.93	2.16
C269	Distribution Circuit Reliability	$7.84	$0	86.15	41.06	31.12
C270	SCADA Capacitors	$4.70	$0	0.36	0.30	0.26
C551 C554 C578	**Prune & Removal Detailed Inspections QA/QC of Veg Mngmt**	**$0**	**$167.51**	**0.06**	**0.07**	**0.06**

Bold *indicates a mandated program*

Tranche-level CBRs by year and in aggregate for each mitigation are provided in workpapers.

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025, D.16-08-018, and D.18-12-014,[27] SDG&E considered two alternatives to the risk mitigation plan for the EII Risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this plan considers changes in risk reduction, cost, reasonableness, current conditions, modifications to the plan and constraints, such as budget and resources.

Table 9: Electric Infrastructure Integrity Risk
Alternative Mitigation Plan –Forecasted Costs Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Forecast Costs			
		2025-2028 Capital	PTY Capital	2025-2028 O&M	PTY O&M
A234	4 kV to 12 kV Conversion Program	$3.3	$9.11	0	0
A210	DVC Switch Program	$0.035	$0.071	0	0

[27] D.18-12-014 at 33-35.

Table 10: Electric Infrastructure Integrity Risk
Alternative Mitigation Cost Benefit Ratio Results Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A234	4 kV to 12 kV Conversion Program	$3.1M	0	1.08	0.44	0.34
A210	DVC Switch Program	$0.035	0	207.94	83.69	62.98

A. A234: 4 kV to 12 kV Conversion Program

Control C234 "4 kV Reliability Program" mitigation described above focuses on eliminating the riskiest infrastructure, *i.e.*, 4 kV package substations, and is more cost-effective than the alternative at addressing the most critical reliability and safety risks without the extensive resource requirements of a full circuit upgrade.

The alternative approach described here would remove the 4 kV distribution system from service and replace it and upgrade to modern 12 kV standards, completely rebuilding the circuits. The scope of the program includes both the removal the 4 kV package unit substations and additional upgrades of existing 4 kV assets to 12 kV. These additional upgrades include replacing all service transformers and small and aging wire. While this method ensures comprehensive modernization of the distribution system, it is more costly and resource intensive.

B. A210: DVC Switch Program

The Distribution Overhead Switch Replacement Program replaces overhead distribution switches that have shown signs of severe or quickly emerging corrosion that may lead to catastrophic switch failure. Overhead switches within high corrosion areas (Contamination District One) have the highest propensity for failure.

The cost-benefit calculation for the Distribution Overhead Switch Replacement Program (C236) is a representative value, based on analysis of planned projects. These projects were identified by SDG&E through an analysis of the "worst-performing" circuits (as measured by outage history). The overhead switches on the identified circuits were both prone to corrosion and, if inoperable, could excessively increase the scope of an outage.

In this alternative, SDG&E considered a program that would replace distribution overhead switches that benefit customers living within the Disadvantaged and Vulnerable Communities

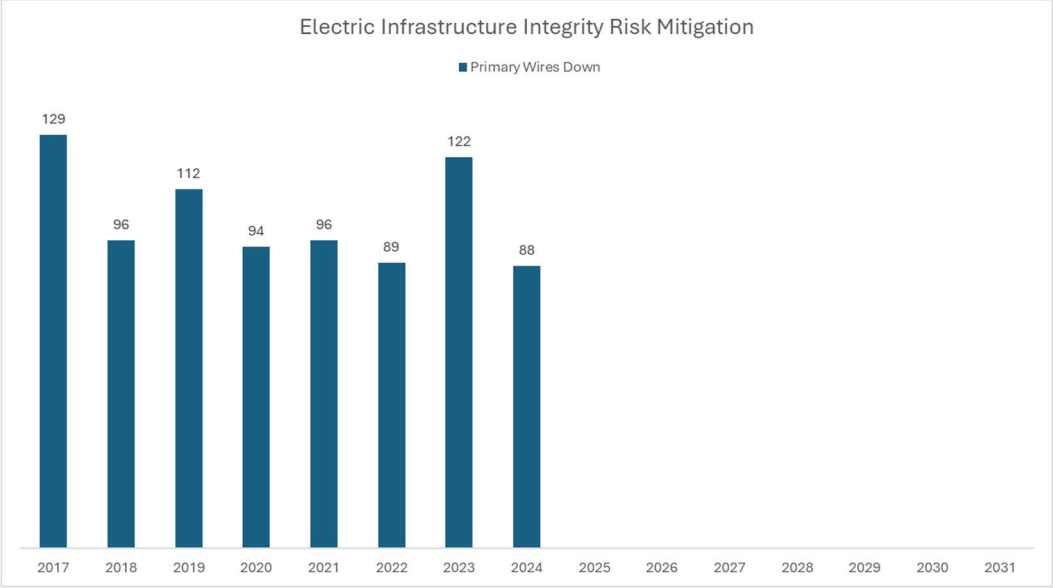
(DVCs) only as opposed to the general service territory to which this control would apply.[28] The limited scope of this alternative program was used a subset of those projects described in the preceding paragraph. While the cost-benefit calculation on a per project basis is higher for this small subset of projects within the DVC, the total risk mitigated through the alternative DVC Switch program is much lower. The increased reduction in total risk mitigated of C236 vs. the Alternative Program (DVCs Only) is attributable to the fact that the safety and outage risk are not bound nor isolated within DVC boundaries. To optimize the amount of risk mitigated, SDG&E would prioritize the replacements based on a review of circuit performance (outage history) and circuit layout (those circuits with limited switching capabilities).

Ultimately, this DVC Switch Program is not included in SDG&E's risk control and mitigation plan for EII Risk because limiting the scope of the program would hamper SDG&E's ability to thoroughly address the safety and outage risks due to inoperability of overhead switches.

VI. HISTORICAL GRAPHICS

As directed by the Commission in the Phase 2 Decision, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. A bar chart graphic is employed to depict historical progress. This graphic uses a key metric that aligns with Company safety goals to illustrate trends in historical progress and identify remaining tasks necessary to continue mitigating risks.

Figure 2
Electric Infrastructure Integrity Risk: Safety Progress 2016-2024



[28] *See* Chapter RAMP-Appendix 4: Environmental Social Justice (ESJ) Pilot Study.

The historical safety work activities completed using the above metric from 2016-2024 include:

- SDG&E continuously invests in public safety communications, including the "Don't touch downed wires. Call 911." campaign and the annual safety training for firefighters and police.
- SDG&E publishes ESP-007, ensuring systematic review for every wire down event.
- SDG&E established the Electric Risk Analysis Review Committee, requiring investigations to determine the root cause of a wire down event, as well as identify system improvements or work methods changes needed to proactively reduce the risk of wire downs.
- 2018 SDG&E revises the Design Manual to encourage the elimination of light duty wire, especially in high wind areas.
- 2020 SDG&E proactively replaces 2 miles of Conductor as part of 4 kV Modernization.
- 2021 SDG&E proactively replaces 8 miles of OH Conductor via the OPS Budget.
- 2021 SDG&E discontinues purchasing single-strand #6 Copper Wire and moves in-service equipment to Field Maintenance Only.
- 2021 SDG&E proactively replaces 7 miles of Conductor as part of 4 kV Modernization.
- 2022 SDG&E enhances the existing Equipment Failure Report Process, ensuring hands-on inspection of failed components by qualified personnel.
- 2022 SDG&E proactively replaces 7 miles of OH Conductor via the OPS Budget.
- 2023 SDG&E proactively replaces 1 mile of Conductor as part of 4 kV Modernization.
- 2024 SDG&E proactively replaces 4.33 miles of OH Conductor via the OPS Budget.

The safety work that remains to be done for the above metric in 2025-2031 Control and Mitigation Plan includes:

- 2028 SDG&E plans to invest in early fault detection through the power quality program to target failing OH equipment.
- 2028-2030 SDG&E plans to replace 26.76 miles of OH Conductor via the EII Programs.
- 2031-2032 SDG&E plans to replace 17.84 miles of OH Conductor via the EII Programs.

ATTACHMENTS

ATTACHMENT A
CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates the compliance Drivers that underpin identified controls and mitigations.

ID	Control/Mitigation Name	Compliance Driver
C212	GO165 Corrective Maintenance Program Underground	GO-165
C240	Avian Protection Program	Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, California Fish and Game Code
C251	GO165 Corrective Maintenance Program Overhead	GO-165
C267	Damage Prevention Activities Electric Underground	California Code of Regulations Section 4216, GO-128
C268	Substation Inspection and Maintenance Program	GO-174
C551	Prune and Removal (Clearance)	GO-95, GO-165, Public Resources Code Section 4293, NERC FAC-003, OSHA
C554	Detailed Inspections	GO-95, GO-165, Public Resources Code Section 4293, NERC FAC-003, OSHA
C578	QA/QC of Veg Management	GO-95, GO-165, Public Resources Code Section 4293, NERC FAC-003, OSHA

ATTACHMENT B

ELECTRIC INFRASTRUCTURE INTEGRITY - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision RDF Row 10 and Row 29 directs each utility to identify Potential Consequences of a risk event using available and appropriate data.[29] Appropriate data may include Company specific data or industry data supplemented by the judgment of subject matter experts. Provided below is a listing of the inputs utilized as part of this assessment and a description of the data.

Risk Data	Source Type	Source Information
Pre-Mitigation Risk Value: LoRE	Internal Data	Source Name: SAIDIDAT Description: 10-year outage history provided expansive representation of nearly all failure modes in electric distribution.
Post-Mitigation Risk Value: LoRE	Internal, External Data, and Internal SME	Description: Previous installations for similar technologies was utilized for effectiveness estimations. External data was leveraged for newer technologies with limited internal data supplanted with SME input with territory specific expertise.
Pre-Mitigation Risk Value: CoRE, Safety	External Data, SIF Data	Department: Department of Transportation (DOT) Description: Value per Statistical Life (VSL) value is derived by replicating DOT's methodology. VSL is leveraged to estimate Safety Consequence based on the severity of injury.
Pre-Mitigation Risk Value:	Internal, External Data	Source Name: SAIDIDAT and

[29] D.24-05-064, RDF Row 10 and Row 29.

Risk Data	Source Type	Source Information
CoRE, Reliability		Lawrence Berkeley National Laboratory (LBNL) Description: 10-year outage history provided expansive representation of nearly all failure modes in electric distribution. LBNL estimates monetized value of CMI.
Pre-Mitigation Risk value: CoRE, Financial	External, Internal Data	Agency: CDC Source Name: Statistics Query and Reporting System, Internal Cost of Restoration Data Description: CDC data used to estimate the financial impacts of safety events. Internal Cost of restoration data is used to estimate financial costs to restore service based on fault type.

ATTACHMENT C

ELECTRIC INFRASTRUCTURE INTEGRITY - SUMMARY OF ELEMENTS OF BOW TIE

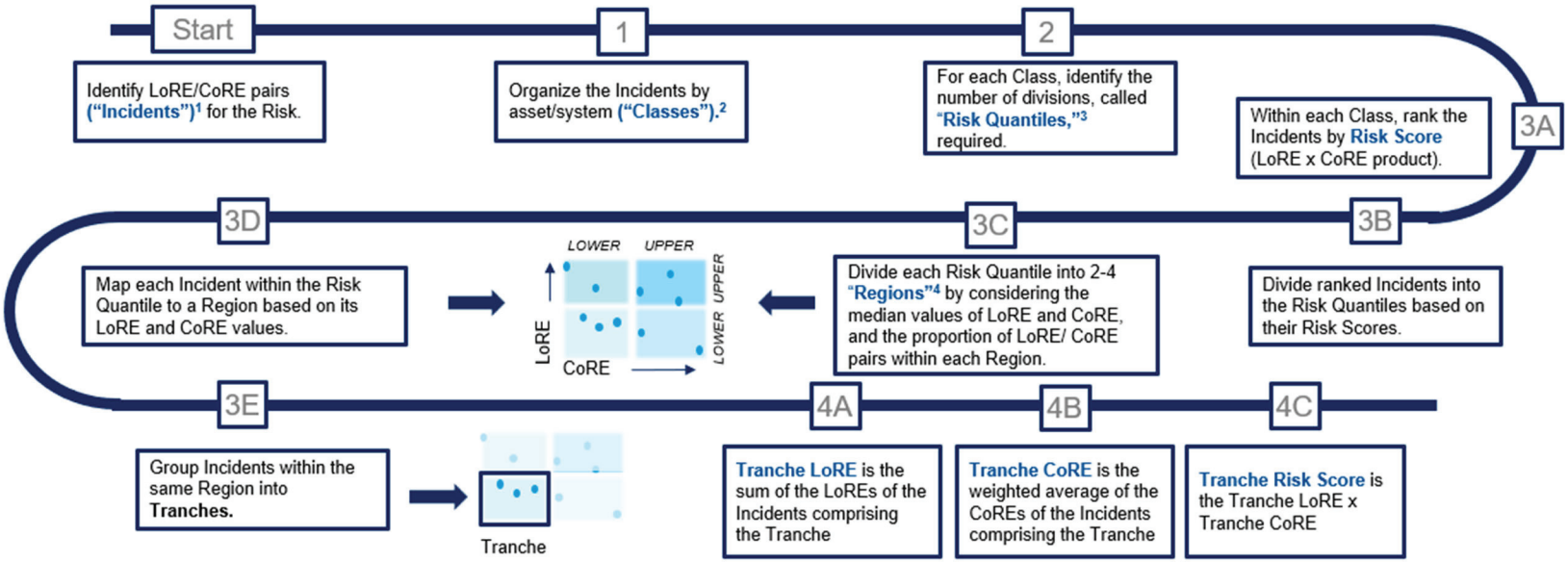
SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
C201	Proactive Overhead Conductor Program	1,2,3,6,7	1,2,6,7,8
C202	Underground Cable Replacement Program (Proactive)	1,2,3,7	2,6
C206	Tee Modernization Program	1,2,3,7	2,6
C208	Replacement of Live Front Equipment	1,6	1,2,6
C210	DOE Switch Replacement	1,2,3,4	1,2,6
C212	GO165 Corrective Maintenance Program Underground	1,2,3,5,7	1,2,3,4
C215	Electric Public Safety Communications	6	1,2,5,6
C226	Distribution Substation Proactive Asset Program	1,2,3,4,5	2
C234	4 kV Reliability Program	1,2,3,4,5,6,7	1,2,6,7
C236	Distribution Overhead Switch Replacement Program	1,2,3,4,7	1,2,6
C240	Avian Protection Program	6	2,3,4,6,7
C248	Strategic Pole Replacement Program	1,3,6,7	1,2,6,8
C250	Substation Reliability for Distribution Components	1,2,3,4,5	2
C251	GO165 Corrective Maintenance Program Overhead	1,2,3,5,6,7	1,2,3,4,5,6
C252	Management of Overhead Distribution Service (Non-CMP)	1,2,3,5,6,7	1,2
C253	Restoration of Service	1,2,3,4,5,7	2,3,6
C254	Underground Cable Replacement Program - Reactive	1,2,3,7	2,6
C256	Management of Underground Distribution Service (Non-CMP)	1,2,3,5,7	1,2
C257	Distribution Substation	1,2,3,4,5	2

SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
	Responsive Asset Replacement		
C258	Emergency Equipment Purchase	1,2,3,4,5	2,6
C261	Power Quality Monitor Deployment and Replacement	1,2,3,4,5,7	1,2
C262	Distribution Substation SCADA Expansion	5	2
C263	Wireless Fault Indicator	5	2
C267	Damage Prevention Activities Electric Underground	6	1,2,5,6
C268	Substation Inspection and Maintenance Program	1,2,3,4,5	1,2,3
C269	Distribution Circuit Reliability	1,2	2
C270	SCADA Capacitors	1,4,5	1,2,7,8
C551	Prune & Removal (Clearance)	3,4,7	1,3,5,6,7,8
C554	Detailed Inspections	See C551	See C551
C578	QA/QC of Veg Management	See C551	See C551
M1	Transformer Load Monitoring Driven Transformer Replacement	1,2,3,4,5,7	1,2,5,6,7

ATTACHMENT D

ELECTRIC INFRASTRUCTURE INTEGRITY - APPLICATION OF TRANCHING METHODOLOGY

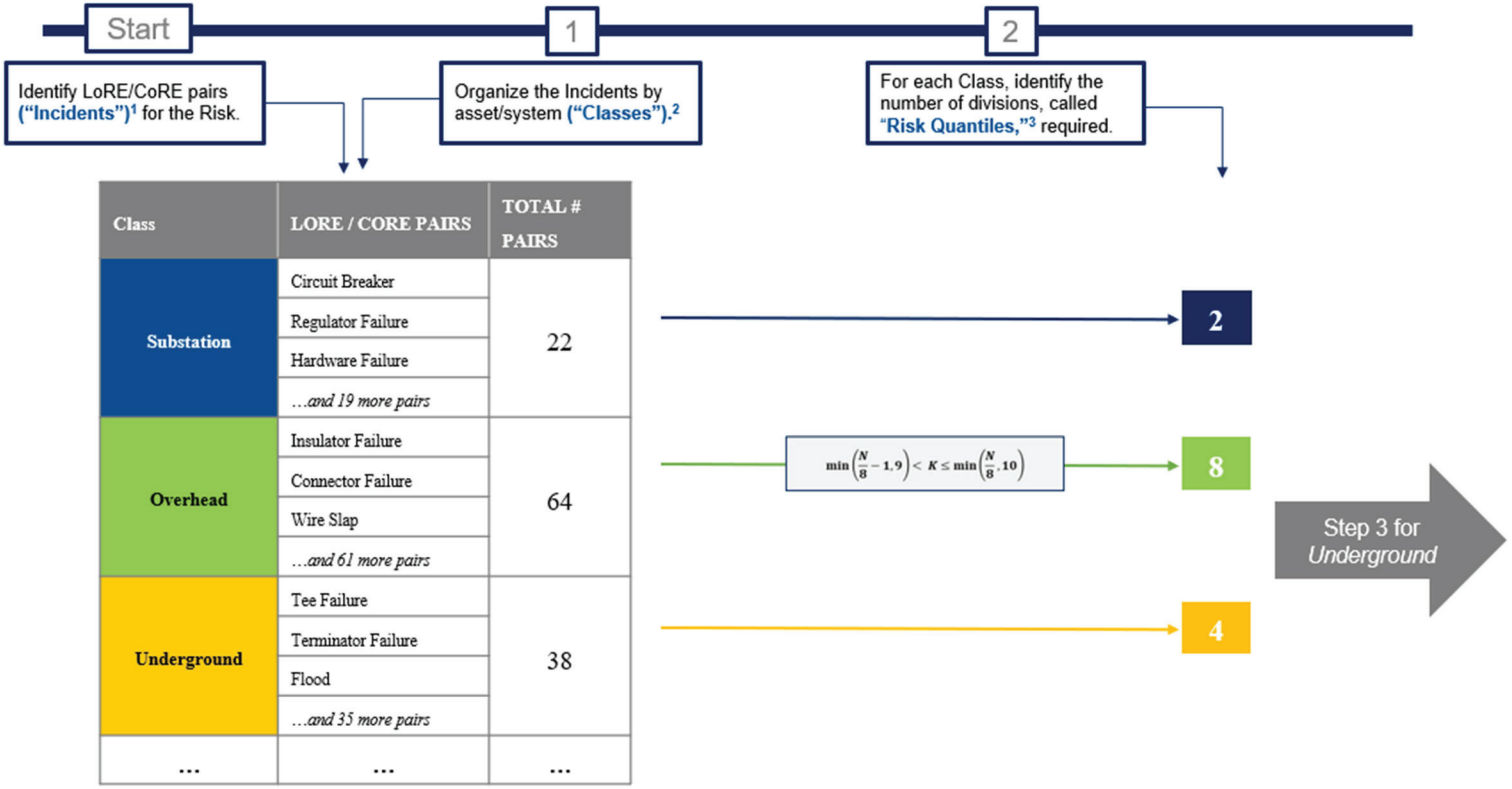
A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP - 3: Risk Quantification Framework is provided.



NOTES

[1]*For example, **Incidents (or "Risk Incidents")** for Electric Infrastructure Integrity (EII) are generally fault types.*
[2]*For example, **Classes (or "Asset Classes")** for EII include Overhead Lines/Components, Underground Lines/Components, and Substations.*
[3]***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*
[4]*The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*




Start
1
2
Identify LoRE/CoRE pairs ("Incidents")[1] for the Risk.
Organize the Incidents by asset/system ("Classes").[2]
For each Class, identify the number of divisions, called "Risk Quantiles,"[3] required.
Class
LORE / CORE PAIRS
TOTAL # PAIRS
Substation
Circuit Breaker
Regulator Failure
Hardware Failure
…and 19 more pairs
22
Overhead
Insulator Failure
Connector Failure
Wire Slap
…and 61 more pairs
64
Underground
Tee Failure
Terminator Failure
Flood
…and 35 more pairs
38
…
…
…
2
$\min\left(\frac{N}{8}-1,9\right) < K \leq \min\left(\frac{N}{8},10\right)$
8
4
Step 3 for Underground



Within each Class, rank the Incidents by **Risk Score** (LoRE x CoRE product). 3A

3B

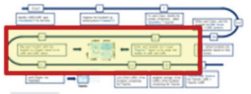
Divide ranked Incidents into the Risk Quantiles based on their Risk Scores.

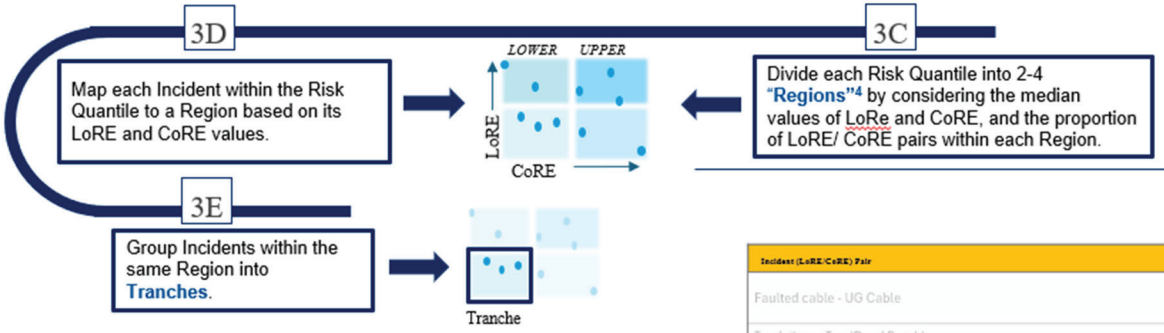


4

From Step 2 for *Underground*

		3A	3B
Incident (LoRE/CoRE) Pair	**Risk Score**	**Rank**	**Quantile**
Faulted cable - UG Cable	$73,119,740	1	#1
Tee failure - Tee (Dead Break)	$45,463,730	2	
Tee failure - T-Connector	$24,613,000	3	
Heavy equipment contact/dig-in - UG Cable	$5,411,415	4	
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Bushing	$3,041,075	5	
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Connector	$2,182,681	6	
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - LBE	$2,064,993	7	
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Cable Rack	$1,749,512	8	
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - SPLICE	$1,524,344	9	
Tee failure - Other	$1,184,403	10	
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Elbow	$976,652	11	#2
SDG&E contractor heavy equipment contact/dig-in - UG Cable	$948,685	12	
SDG&E crew heavy equipment contact/dig-in - UG Cable	$789,001	13	
Pothead failure - UG Cable	$673,989	14	
Undetermined (severe weather) - UG Cable	$630,126	15	
Flashover due to contamination/overload/tracking - UG Cable	$544,072	16	
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Tee (Dead Break)	$517,002	17	
Terminator failure/contact - TERMINATOR	$458,565	18	
Go-back (additional outage taken to complete repairs) - UG Cable	$360,286	19	





3A 3B 3C 3D

Incident (LoRE/CoRE) Pair	Risk Score	Rank	Quantile	Region	Tranche
Faulted cable - UG Cable	$73,119,740	1	#1	UL/LC	Underground-2
Tee failure - Tee (Dead Break)	$45,463,730	2		UL/UC	Underground-1
Tee failure - T-Connector	$24,613,000	3		UL/UC	Underground-1
Heavy equipment contact/dig-in - UG Cable	$5,411,415	4		UL/UC	Underground-1
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Bushing	$3,041,075	5		LL/UC	Underground-4
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Connector	$2,182,681	6		LL/LC	Underground-3
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - LBE	$2,064,993	7		UL/LC	Underground-2
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Cable Rack	$1,749,512	8		LL/LC	Underground-3
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - SPLICE	$1,524,344	9		LL/LC	Underground-3
Tee failure - Other	$1,184,403	10		LL/UC	Underground-4
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Elbow	$976,652	11	#2	LL/UC	Underground-5
SDG&E contractor heavy equipment contact/dig-in - UG Cable	$948,685	12		UL/LC	Underground-6
SDG&E crew heavy equipment contact/dig-in - UG Cable	$789,001	13		UL/LC	Underground-6
Pothead failure - UG Cable	$673,989	14		LL/UC	Underground-5
Undetermined (severe weather) - UG Cable	$630,126	15		LL/UC	Underground-5
Flashover due to contamination/overload/tracking - UG Cable	$544,072	16		LL/UC	Underground-5
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Tee (Dead Break)	$517,002	17		LL/UC	Underground-5
Terminator failure/contact - TERMINATOR	$458,565	18		UL/LC	Underground-6
Go-back (additional outage taken to complete repairs) - UG Cable	$360,286	19		UL/LC	Underground-6



4A

Tranche LoRE is the sum of the LoREs of the Incidents comprising the Tranche

4B

Tranche CoRE is the weighted average of the CoREs of the Incidents comprising the Tranche

4C

Tranche Risk Score is the Tranche LoRE x Tranche CoRE

Incident (LoRE/CoRE) Pair	Quantile	Tranche	4A Tranche LoRE	4B Tranche CoRE	4C Tranche Risk Score
Tee failure - Tee (Dead Break)	#1	Underground-1	111.2	$678,850	$75,488,146
Tee failure - T-Connector					
Heavy equipment contact/dig-in - UG Cable					
Faulted cable - UG Cable		Underground-2	374.2	$200,921	$75,184,733
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - LBE					
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Connector		Underground-3	23.6	$231,209	$5,456,536
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Cable Rack					
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - SPLICE					
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Bushing					
Tee failure - Other		Underground-4	4.1	$1,030,604	$4,225,477
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Elbow	#2	Underground-5	4	$835,460	$3,341,841
Pothead failure - UG Cable					
Undetermined (severe weather) - UG Cable					
Flashover due to contamination/overload/tracking - UG Cable					
UG connector failure (splice/rack/tap/shoofly/sleeve/probe/LBE/bushing) - Tee (Dead Break)					
SDG&E contractor heavy equipment contact/dig-in - UG Cable		Underground-6	16.9	$151,274	$2,556,536
SDG&E crew heavy equipment contact/dig-in - UG Cable					
Terminator failure/contact - TERMINATOR					
Go-back (additional outage taken to complete repairs) - UG Cable					



2025 Risk Assessment Mitigation Phase

(Chapter SDG&E-Risk-6)

Employee Safety

May 15, 2025

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Attachment B: Employee Safety - Reference Material for Quantitative Analyses
Attachment C: Employee Safety - Summary of Elements of Bow Tie
Attachment D: Application of Tranching Methodology

Chapter SDGE-Risk-6: Employee Safety

I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or the Company) risk control and mitigation plan for the Employee Safety Risk. This chapter contains information and analysis that meet the requirements of the California Public Utilities Commission's (Commission or CPUC) Risk-Based Decision-Making Framework (RDF),[1] including the requirements adopted in Decision (D.) 22-12-027 (Phase 2 Decision) and D.24-05-064 (Phase 3 Decision). The Employee Safety Risk is included in the 2025 RAMP Report based on a safety risk assessment, further informed by its reliability and financial consequence attributes, consistent with RDF guidance. This risk chapter describes the basis for selection of the Employee Safety Risk, the controls and/or mitigations put forth to reduce the likelihood or consequence of this risk, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter presents cost and unit forecasts for the risk mitigating activities, but it does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk-reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation, consistent with the method and process prescribed in the RDF.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SDG&E's Employee Safety Risk is defined as the risk of an incident, involving one or more on-duty employees, that causes injury, illness or fatality to a company employee.

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF requirements, such as those from the CPUC, Cal/OSHA, or PHMSA (including but not limited to subparts of Rule 49 Code of Federal Regulations) as well as

[1] As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A.15-05-002 et al. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

industry leading best practices such as American Petroleum Institute Recommended Practice (API RP) 1173. A list of compliance requirements applicable to the Employee Safety Risk is provided in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction calculated under the RDF, such as enhancing operations and promoting public trust in the communities SDG&E serves.

2. Risk Overview

Safety is a core value and is foundational to SDG&E's operations. SDG&E defines safety as the presence of controls for known hazards, actions to anticipate and guard against unknown hazards, and the commitment to continuously improve SDG&E's ability to recognize and mitigate hazards. Safety requires strong ongoing leadership commitment and active engagement from all employees. SDG&E focuses on safety through the lenses of employee safety, contractor safety, public safety, and infrastructure safety. SDG&E has an unwavering commitment to its employees to sustain its safety-first culture and maintain a safe work environment. Every employee has a role to play with respect to safety and is empowered and encouraged to stop work, raise safety concerns, and report near misses. Safety is not compromised for production, customer satisfaction, or any other goal, and no activity is so important that it should jeopardize safety. SDG&E's culture and commitment to continuous safety improvement, as supported by the controls and mitigations identified within this chapter, takes a proactive and preventative approach and are designed to manage its Employee Safety Risk.

B. Risk Scope

SDG&E's Employee Safety Risk analysis considers the risk of an incident involving one or more on-duty employees that causes minor[2] or serious injury/illness[3] or fatality to a company employee.

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[2] Minor injury or illness is one that does not meet the criteria for a serious injury as defined by Cal/OSHA.

[3] Cal/OSHA defines a serious injury or illness as "any injury or illness occurring in a place of employment or in connection with any employment that requires inpatient hospitalization for other than medical observation or diagnostic testing, or in which an employee suffers an amputation, the loss of an eye, or any serious degree of permanent disfigurement, but does not include any injury or illness or death caused by an accident on a public street or highway, unless the accident occurred in a construction zone."8 CCR § 330(h).

C. Data Sources Used to Quantify Risk Estimates[4]

SDG&E utilized internal data sources to determine an Employee Safety Risk Pre-Mitigation Risk Value and calculate risk reduction estimates for mitigation activities (which enable estimation of Post Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used as appropriate and adjusted to account for the risk characteristics associated with the Company's specific operating locations and service territory. For example, certain types of incident events have not occurred within the SoCalGas and SDG&E service territories. Expanding the quantitative data sources to include industry data where such incidents have been recorded is appropriate to establish a baseline of risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of the Employee Safety Risk, including its risk Bow Tie, which delineates potential Drivers/Triggers and Potential Consequences, followed by a description of the Tranches determined for this risk.

A. Risk Selection

The Employee Safety Risk was included as a risk in SDG&E's 2021 RAMP[5] and was included in the 2022, 2023, and 2024 Enterprise Risk Registries (ERR). SDG&E's ERR evaluation and selection process is summarized in Chapter RAMP-2, Enterprise Risk Management Framework and in Chapter RAMP-3 Risk Quantification Framework.

SDG&E selected this risk in accordance with the RDF Row 9.[6] Specifically, SDG&E assessed the top risks from the Company's 2024 ERR based on the Consequence of a Risk Event

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4 Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

5 In the 2021 RAMP Report, Chapter SDG&E-Risk-8, this risk was called Incident Involving an Employee ("IIE"). The risk definition for Employee Safety Risk in this RAMP was changed from the IIE risk in the 2021 RAMP Report to remove limiting, causal language regard "non-adherence to Company policies, procedures, and programs, or by external factors". The elements of Employee Safety Risk have been expanded to be more comprehensive and to align with the Contractor Safety risk chapter.

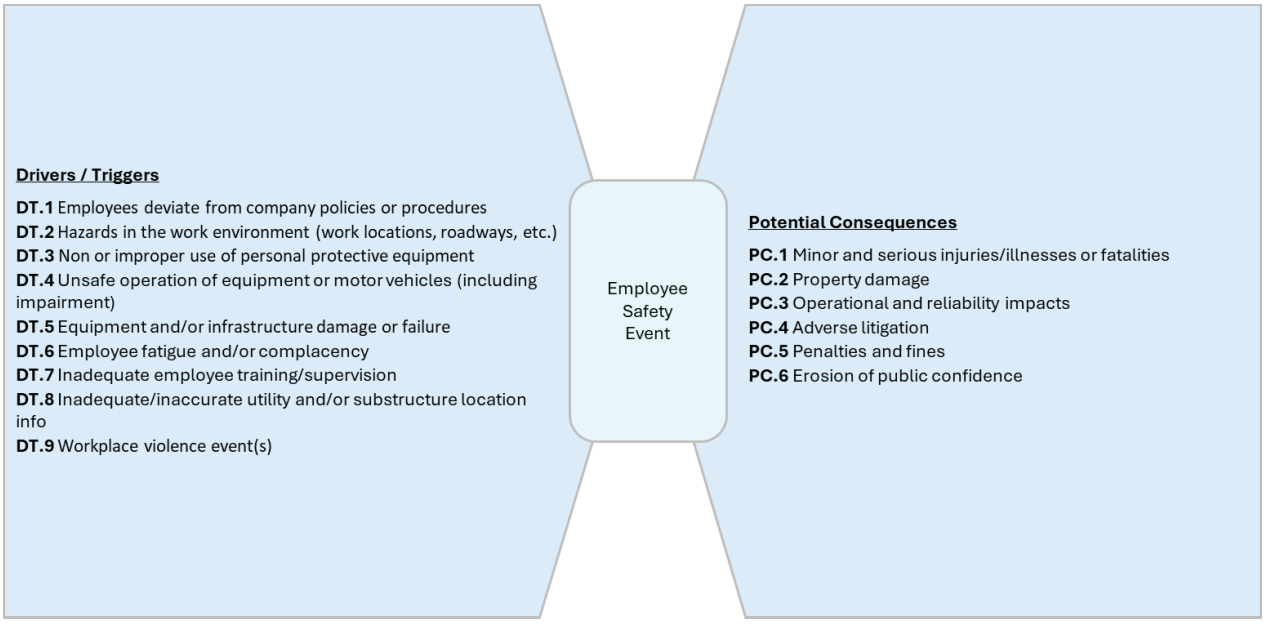
6 D.24-05-064, RDF Row 9 states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars . . .".

(CoRE) Safety attribute. The Employee Safety Risk was among the risks presented in SDG&E's list of Preliminary 2025 RAMP Risks on December 17, 2024 at a pre-filing workshop. Employee Safety Risk was selected based on the qualification of its Safety risk attribute, as required under the RDF. At the pre-filing workshop, no party expressed opposition to inclusion of this risk in SDG&E's 2025 RAMP Report.

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the risk Bow Tie, possible Drivers, Potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that addresses it.[7] As illustrated in the Bow Tie shown below in Figure 1, the Risk Event (center of the Bow Tie) is the Employee Safety Risk that could cause a safety-related event, the left side of the Bow Tie illustrates possible Drivers/Triggers that could lead to the Employee Safety Risk, and the right side shows the Potential Consequences of the Employee Safety Risk. SDG&E applies this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to the elements of the risk Bow Tie is provided in Attachment C.

Figure 1
Employee Safety: Risk Bow Tie



[7] D.24-05-064, RDF Row 15.

C. Potential Risk Event Drivers/Triggers[8]

When performing a risk assessment for the Employee Safety Risk, SDG&E identifies possible causes, referred to as Drivers or Triggers, that reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to the asset.[9] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1 – Employees deviate from policies or procedures:** SDG&E has many safety-related policies and procedures for employees to follow. Failure of someone to adhere to safety policies and procedures could result in a safety-related event.
- **DT.2 – Hazards in the work environment (work locations, roadways, etc.):** Unsafe work environments (*e.g.*, work locations, roadways and parking places, customer premises, confined spaces), unsafe gas equipment conditions, Polychlorinated Biphenyls (PCB), lead from paint, asbestos, and fumigation chemicals, for example, could each lead to a safety-related event.
- **DT.3 – Non or improper use of personal protective equipment:** Safety equipment serves to protect employees and contractors from avoidable injuries. Failure to wear personal protection and safety equipment can lead to a safety-related event.
- **DT.4 – Unsafe operation of equipment or motor vehicles (including impairment):** Failure to follow the law and/or other applicable safety practices while operating equipment or company vehicles could result in a safety-related event.
- **DT.5 – Equipment and/or infrastructure damage or failure:** Damage to gas or electric equipment or infrastructure and/or their failure could lead to a safety-related event.
- **DT.6 – Employee fatigue/complacency:** Employee fatigue or complacency

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[8] An indication that a risk could occur. It does not reflect actual or threatened conditions.

[9] D.24-05-064, RDF Row 10-11.

could lead to a safety-related event

- **DT.7** – **Inadequate employee training/supervision:** Failure to provide adequate safety training could result in a safety-related event.
- **DT.8** – **Inadequate or inaccurate information on utility and/or substructure location information:** Having the correct and current information about the equipment or substructures being worked on is important to working safely. Incorrect or inadequate equipment/substructure information may lead to a safety-related event.
- **DT**. **9** – **Workplace violence event(s):** Threats of workplace violence (*e.g.*, active shooter threats, disgruntled employee threats) can lead to a safety-related event.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed to the right side of the risk Bow Tie. SDG&E identifies the potential Consequences of the Employee Safety Risk by analyzing internal data sources, where available, industry data,[10] and subject matter expertise (SME).[11] These Potential Consequences inform the CoRE component of the risk value. If one or more of the Drivers/Triggers listed above were to result in a safety-related event, the Potential Consequences, in a plausible worst-case scenario, could include:

- PC.1 – Minor and serious injuries/illnesses[12] or fatalities
- PC.2 - Property damage
- PC.3 - Operational and reliability impacts
- PC.4 - Adverse litigation
- PC.5 - Penalties and fines
- PC.6 - Erosion of public confidence

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[10] Industry data includes data found in SDG&E's annual Safety Performance Metrics Report (SPMR) and Centers for Disease Control and Prevention (CDC), *Web-based Injury Statistics Query and Reporting System (WISQARS) Cost of Injury*, *available at:* https://wisqars.cdc.gov/cost/?y=2023&o=MORT&i=0&m=20810&g=00&s=0&u=TOTAL&u=AVG&t=COMBO&t=MED&t=VPSL&a=5Yr&g1=0&g2=199&a1=0&a2=199&r1=MECH&r2=INTENT&r3=NONE&r4=NONE.

[11] D.24-05-064, RDF Row 10.

[12] 8 CCR § 330(h).

These Potential Consequences were used by SDG&E in the scoring of the Employee Safety Risk during the development of its SDGE's 2024 ERR.

E. Evolution of Its Drivers and Consequences

As specified in the Phase 3 Decision, the following changes to the previous ERR and/or the 2021 RAMP include:[13]

1. Changes to Drivers/Triggers of the Risk Bow Tie

- DT.1 - Employees deviate from policies or procedures is revised to include 2021 RAMP bow tie driver, "*DT.12 - Inadequate use of job-site safety plans or analysis.*"
- DT.2 - Hazards in the work environment (work locations, roadways, etc.) is revised to include 2021 RAMP bow tie driver, "*DT.7 - Employee impairment due to environmental factors.*"
- DT.7 - Inadequate employee training/supervision is revised to include 2021 RAMP bow tie drivers, "*DT.9 - Lack of oversight of employees' work*" and "*DT.10 - New/transferred employee inexperience.*"
- DT.9 - Added threat of a "workplace violence event(s)" as a Driver/Trigger: SDG&E's ERR includes workplace violence as a separately identified risk. That risk is defined as an intentional incident which results in emotional or physical harm to employees or customers. Because the controls for workplace violence event are employee focused, this risk was reclassified for purposes of this RAMP as a Driver/Trigger limited in scope to Employee Safety Risk.

2. Changes to Potential Consequences of the Risk Bow Tie

- PC.1 - Added "minor injuries" and "illnesses" to serious injuries and fatalities consequence, which was not included in the 2021 RAMP Bow Tie for Employee Safety Risk. Minor injuries and illnesses are included as attributes that were used in determining the safety risk value which is required by D.24-05-064, RDF Row 9, and therefore were added to consequences for the 2025 RAMP Bow Tie.

[13] D.24-05-064, RDF Row 8.

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and on accordance with Row 14 of the RDF, SDG&E applied the Homogeneous Tranching Methodology (HTM) as outlined in Chapter RAMP - 3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:[14]

Table 1: Employee Safety Risk Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches
Electric Operations	1	1
Gas Operations	1	1
Motor Vehicle Incidents	1	1
Office of the Customer	1	1
Admin / Miscellaneous	1	1
Workplace Violence	2	2
TOTAL	**7**	**7**

Attachment D illustrates the derivation of the Tranches, as shown in Table 1 above, in accordance with the HTM. The classes were identified by SDG&E as logical groups of events that can lead to Employee Safety Risk events. These classes also align risk treatments with risk profiles reflective of SDG&E's operations. More detailed Tranche information, including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches, is provided in workpapers.

III. PRE-MITIGATION RISK VALUE

In accordance with the RDF Row 19, the table below provides the pre-mitigation risk values for the Employee Safety Risk. Further details, including pre-mitigation risk values by Tranche, are provided in workpapers. Explanations of the risk quantification methodology and other higher-level assumptions are provided in Chapter RAMP-3 Risk Quantification Framework.

[14] SDG&E notes that Employee Safety Risk, as a human-safety risk, does not feature the natural segmentation characteristics that asset-based risks do, which limits the number of viable Tranches (essentially to one Tranche per class).

Table 2: Employee Safety Risk
Monetized Risk Values
(Direct, in 2024 $ millions)

LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]
	Safety	Reliability	Financial		
118.58	$0.084	$0.00	$0.01	$0.094	$11.16

A. Risk Value Methodology

SDG&E's risk modeling for the Employee Safety Risk follows RDF guidance[15] for implementing a Cost Benefit Approach, as described below:

1. **Cost Benefit Approach Principle 1 – Attribute Hierarchy (RDF Row 2):** The Employee Safety Risk is quantified in a combined attribute hierarchy as shown in the table above, such that Safety, Reliability, and Financial are presented based on available, observable and measurable data.
2. **Cost Benefit Approach Principle 2 – Measured Observations (RDF Row 3):** SDG&E utilized internal incident data to represent natural units for employee injuries. These injuries were classified as either Minor, Serious, or Unsurvivable and assigned the corresponding FAA fractional VSL value (0.003, 0.253, and 1.0, respectively) as described in Volume 1, Chapter 3.
3. **Cost Benefit Approach Principle 3 – Comparison (RDF Row 4):** The Employee Safety Risk utilized proxy data as provided by various sources including, but not limited to, the Federal Bureau of Investigation (for workplace violence), Bureau of Labor Statistics (to determine a proration of SDG&E's employee base versus the national working population), the Center for Disease Control (to determine financial impacts associated with injuries), Indiana University of Pennsylvania (to determine impact of data analysis), and National Safety Council (to estimate costs associated with motor vehicle incidents). Please refer to Attachment B for specific details regarding these sources.
4. **Cost Benefit Approach Principle 4 – Risk Assessment (RDF Row 5):** Data distributions were not applicable for the proxy-driven risk events modeled for the

[15] D.24-05-064, RDF Rows 2-7.

Workplace Violence and Motor Vehicle Incident components of this risk. For those incidents, probabilities of future events were derived based on internal recorded data from past years or supplemented with national data where applicable (to estimate likelihood of a workplace violence incident).

5. **Cost Benefit Approach Principle 5 – Monetized Levels of Attributes (RDF Row 6):** In accordance with D.22-12-027 and D.24-05-064, RDF Row 6, SDG&E used a California-adjusted Department of Transportation monetized equivalent to calculate the Safety CoRE attribute at a monetized equivalent of $16.2 million per fatality, $49 thousand per minor injury, and $4.1 million per serious injury;[16] and the Financial CoRE attribute is valued at $1 per dollar.[17] Gas and Electric Reliability are quantified as $0 due to the lack of empirical and proxy data supporting these consequences occurring from employee safety incidents.

Further information regarding SDG&E's quantitative risk analyses, including raw data, calculations, and technical references are provided in workpapers.

6. **Cost Benefit Approach Principle 6 – Adjusted Attribute Level (RDF Row 7):**

Table 3: Employee Safety Risk
Risk Scaled vs Unscaled Value by CoRE Attributes
(Direct, in 2024 $ millions)

	Safety	Reliability	Financial	Total
Unscaled Risk Value	$9.73	$0	$1.17	$10.90
Scaled Risk Value	$9.99	$0	$1.17	$11.16

The values in the table above are the result of SDG&E applying the risk scaling methodology described in Chapter RAMP-3 to the CoRE attributes for the Employee Safety Risk. The Employee Safety Risk does not feature a significant risk aversion scaling impact because a relatively small proportion of the observed events rise to the level at which scaling is applicable, and the magnitudes of the consequences are not as high (*e.g.*, multiple-fatality event) as can occur with other risks.

[16] *See* D.22-12-027 at 35 ("We adopt Staff's recommendation to require a dollar valuation of the Safety Attribute in the Cost-Benefit Approach in the RDF using the DOT VSL as the standard value.").

[17] S*ee* Chapter RAMP-3: Risk Quantification Framework, Section II.

Further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply is provided in Chapter RAMP-3.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section identifies and describes the controls and mitigations comprising the portfolio of mitigations for the Employee Safety Risk and reflects changes expected to occur from the last year of recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). For clarity, a current activity that is included in the plan may be referred to as either a control and/or a mitigation. Table 4 below shows which control activities are in place in 2024 and which are expected to be on-going, completed, or new during the 2025-2031 time periods. Because the TY 2024 GRC proceeding established rates through 2027,[18] information through 2027 is calculated as part of the baseline risk, in accordance with D.21-11-009.[19] For the TY 2028 GRC, SDG&E calculated CBRs beginning with TY 2028 and for each Post-Test Year (PTY) (2029, 2030, and 2031).[20]

Table 4: Employee Safety Risk
2024-2031 Control and Mitigation Plan Summary

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C317	**Employee Safety Training & Field Safety Oversight Programs**	X	Ongoing
C323	Safety Culture Survey, Recognition & Awards	X	Ongoing
C319	Safety Management System Implementation and Management	X	Ongoing
C328	**Safety Compliance & Industrial Hygiene Program**	X	Ongoing
C326	**Workplace Violence Prevention Programs**	X	Ongoing
M303	Enhanced Risk Informed Employee Safety Training & Field Safety Oversight Programs		2025[21]
M305	Safety Management System Maturity &		2025

[18] *See* D.24-12-074.

[19] *See,* D.21-11-009 at 136 (Conclusion of Law (COL) 7) (providing a definition for "baselines" and "baseline risk").

[20] In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

[21] This is the planned in-service year for the mitigation.

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
	Improvement: Enhanced Safety Communication & Safety Data Analytics		
M311	Establish Incident Investigation and Cross-functional Event Learning Teams		2025

Bold *indicates this control/mitigation includes mandated programs/activities.*

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place"[22] (*i.e.,* activities in this section were in place as of December 31, 2024). Controls that will continue as part of the risk mitigation plan are identified in Table 4, above.

C317: Employee Safety Training & Field Safety Oversight Programs:

Employee safety oversight and training programs are crucial for maintaining a safe work environment and reducing Employee Safety Risk. This is particularly important in the gas and electric utility sectors due to the often-high-risk nature of the work. Implementing comprehensive safety programs can reduce safety-related events for employees, confirming they are trained, equipped, and informed on how to perform their tasks safely. It also enhances the safety of the communities SDG&E serves.

SDG&E's employee safety training and field safety oversight programs include Serious Injury and Fatality (SIF) Prevention, High Energy Control Assessments (HECA), Smith System® Defensive Driving Training, Close Quarter Maneuvering Drivers Training, and implementation of SDG&E's Emergency Action Plan and Injury and Illness Prevention Program. These programs provide the necessary training and awareness to systematically identify potential hazards in the workplace. By recognizing potential risks and hazards early, SDG&E can take proactive measures to mitigate them and reduce Employee Safety risk.

SIF Prevention – SDG&E's SIF Prevention Program focuses on identifying and mitigating risks that could lead to serious injuries or fatalities by applying the Edison Electric Institute Safety Classification and Learning (SCL) model to consistently classify safety incidents and near misses. This program increases the number of learning opportunities and allows

[22] D.18-12-014 at 33.

SDG&E to further assess incidents with the potential to cause serious injuries or fatalities (PSIF). PSIFs also offer an opportunity for shared learning, which is necessary to advance toward SIF elimination. This proactive approach helps prevent the most severe types of workplace accidents and reduces the likelihood of life-threatening incidents, helping employees return home safely each day.

High Energy Control Assessments (HECA) – SDG&E introduced Field Safety Engagements as a new measurable metric in 2024. Field Safety Engagements are jobsite observations that incorporate HECA and involve an assessment of activities where high energy hazards[23] are present to assess whether appropriate direct controls are present to reduce or eliminate exposure and mitigate the risk of an employee safety event. For example, a Field Safety Engagement performed of employees working in a roadside excavation could identify third-party vehicle traffic as a high energy hazard and assess whether controls, such as signage and cones, are adequate to prevent serious injury or fatality to SDG&E's workforce.

Field Safety Advisors - SDG&E's Field Safety Advisors are safety professionals that support operational teams and assist client groups with analyzing safety trends and developing solutions to reduce the risk of safety-related events. They provide a variety of safety training, participate in incident reviews and investigations, perform site safety assessments (including Field Safety Engagements) and recommend controls that affect the safety, health, and well-being of employees, contractors, and the public. Field Safety Advisors may also perform Safety Officer duties during emergency events.

Safe Driving Programs – SDG&E employees, on average, drive over 16 million miles a year. SDG&E's safe driving training programs aim to increase a driver's safety awareness to prevent and minimize the risk of motor vehicle incidents. With senior management's commitment and employee involvement, SDG&E is promoting a safety culture committed to safe driving. This commitment includes written policies and procedures, vehicle telematics data collection and analytics, review of motor vehicle incidents, a department of motor vehicles license pull program to confirm that all employees driving on behalf of SDG&E or on SDG&E property are properly licensed, safe drivers training, and development of training materials to

[23] High-energy hazards include gravity (*e.g.*, suspended load), mechanical (*e.g.*, heavy equipment), pressure (*e.g.*, explosion), electrical (*e.g.*, arc flash), and ground disturbance (*e.g.*, excavation or trench).

reinforce safe driving principles. SDG&E's vehicle telematics data, driving observation data, incident review, and employee feedback help drive continuous improvement of SDG&E's safe driving training programs.

Successful completion of the Smith System® Initial Defensive Driving training course is a requirement for all employees who drive company vehicles as a requirement of their job, or who drive more than 3,000 miles per year for work-related activities. The Smith System® Defensive Driving Program was founded on the principle that most crashes are preventable if the right driving habits are learned, practiced, and applied consistently. Smith System® combines classroom and behind-the-wheel instruction to increase an experienced driver's safety awareness and change poor driving habits. It teaches drivers defensive driving techniques to anticipate and avoid potential hazards on the road and reduces the risk of vehicle accidents, improving road safety for employees and the public. Identified employees are required to complete the Smith System® Refresher annually to maintain their training certification.

Close Quarter Maneuvering Drivers Training is an SDG&E course that was customized from the Smith System® Advanced Backing, Parking, and Close Quarters Maneuvering course. During this in-house training, advanced backing and close quarter maneuvering are learned during 30-minute classroom discussion and a 2.5-hour driving course using the vehicle driven for work. The driving course includes blind spot identification, and serpentine and diminishing cone courses. This training focuses on developing and/or improving skills and techniques to maneuver safely in challenging driving environments. Initial training is provided for identified operational employees who drive company vehicles as a requirement of their job and is subsequently conducted by request or as needed.

Collectively, these employee safety training and field safety oversight programs help foster a workplace environment where safety is a priority, encouraging employees to be vigilant and proactive about their own and others' safety. It also demonstrates SDG&E's commitment to employee safety, mental health, and well-being. These programs not only protect employees but also contribute to the overall success and sustainability of the Company.

C323: Safety Culture Survey, Recognition & Awards:

A strong culture of safety is crucial for proactive and preventative Employee Safety Risk mitigation and serves as the foundation for all of SDG&E's Employee Safety Risk controls and mitigations. SDG&E details its safety culture efforts, goals and objectives in Chapter RAMP-4.

SDG&E's efforts to assess, understand, sustain, and continuously improve its culture of safety include hosting an annual Start Strong Safety Event and an annual Safety Congress and award ceremony to recognize and reinforce the importance of safe behavior and a "safety first" mindset. SDG&E also conducts regular surveys of its workforce to identify strengths and opportunities for improvement.

Since 2010, SDG&E has utilized the National Safety Council (NSC) safety barometer survey to help measure and understand its safety culture. The NSC survey, issued to all employees, solicits employee perceptions across six fundamental safety performance categories: Management Commitment, Supervisor Engagement, Employee Involvement, Safety Support Activities, Safety Support Climate, and Organizational Climate. SDG&E's overall percentile score of 93.4 in 2022, its most recent NSC survey, indicates that SDG&E scored higher across the six fundamental safety performance categories than 93.4% of the companies in NSC's 1,500 company.[24] To continue to improve its safety programs and culture, SDG&E shares survey results with its employees and identifies focus areas for action planning. Since 2021, SDG&E has also participated in the Office of Energy Infrastructure Safety (OEIS) annual wildfire safety culture assessment. OEIS assessment reports are similarly used to drive action planning and safety improvements.

SDG&E recognizes the importance of fostering and sustaining a strong culture of safety. The Company's safety commitment is demonstrated through its actions, allocation of resources, and organizational governance. A mature safety culture, as defined in Investigation (I.) 15-08-019, includes:

- A clearly articulated set of principles and values with a clear expectation of full compliance.
- Effective communication, continuous education, and testing.
- Uniform compliance by every individual in the organization, with effective safety metrics, recognition, compensation, and accountability for deviating or performing at, above, or below the standard of compliance.

[24] For a broad measurement of the survey results, an overall percentage score was provided by NSC to provide an overall perception of SDG&E's safety culture. Average response scores were compared with 1,500 businesses in the NSC Database for each of the 50 NSC safety barometer questions across the six safety performance categories to develop an overall percentage score.

- Continuous reassessment of hazards and reevaluation of norms and practices.[25]

SDG&E's leadership actively builds trust through non-punitive measures, a commitment to reducing high-risk conditions, leveraging data to identify risks, and advancing as a learning organization. SDG&E continuously works to advance its safety culture and measure the effectiveness of the initiatives. Current activities include:

Annual Start Strong Event: Starting in January 2023, SDG&E hosts an annual "Start Strong" safety event for approximately 1,400 operational (field) employees. This event, in partnership with IBEW Local 465, emphasizes SDG&E's joint commitment to safety and sets clear expectations for the year. Key objectives include all employees understanding their role in safety and to foster psychological safety where all employees are empowered and feel comfortable speaking up, raising safety concerns, submitting near misses, and stopping the job whenever they are unsure how to safely perform a task.

Annual Safety Congress and Safety Leadership Award Ceremony: SDG&E currently has approximately 60 Safety Committees (34 office-based, 27 field-based committees) that represent their respective work location or department. Safety Committees meet regularly to discuss safety topics and identify actionable items to promote safety across their teams. Since 2002, SDG&E has held an annual Safety Congress, which provides a platform for the Safety Committee members and other safety leaders to collaborate and share insights through networking and workshops. Each year at the Safety Congress, SDG&E recognizes outstanding safety leaders with the prestigious Gary Tehan Safety Leadership Award (individual award), Grant Valentine Team Safety Award, and the new Office Safety Leadership Awards, honoring individuals and teams who exemplify SDG&E's safety vision.

Safety awards and recognition play a crucial role in fostering a strong safety culture for several reasons:

1. **Motivation and Engagement:** Recognizing employees for their safety efforts motivates them to continue prioritizing safety in their daily tasks. It also engages employees by making them feel valued and appreciated for their contributions to a safer work environment.

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[25] I.15-08-019, Order Instituting Investigation on the Commission's Own Motion to Determine Whether Pacific Gas and Electric Company and PG&E Corporation's Organizational Culture and Governance Prioritize Safety (September 2, 2025) at 5.

2. **Positive Reinforcement:** Safety awards serve as positive reinforcement, encouraging employees to adopt and maintain safe behaviors. This reinforcement helps to establish and sustain a culture where safety is a core value.
3. **Encouraging Best Practices:** By highlighting and rewarding exemplary safety practices, awards and recognition programs encourage other employees to follow suit. This dissemination of best practices leads to overall improvements in safety performance across the organization.
4. **Building a Safety-First Mindset:** Regular recognition of safety achievements helps to embed a safety-first mindset within the organization. Employees become more aware of the importance of safety and are more likely to prioritize it in their decision-making processes.
5. **Boosting Morale:** Recognition programs boost employee morale by acknowledging their hard work and dedication to safety. High morale contributes to a more positive and productive work environment.
6. **Demonstrating Organizational Commitment:** When an organization consistently recognizes and rewards safety achievements, it demonstrates a genuine commitment to safety. This commitment builds trust and confidence among employees, stakeholders, and the community.

Overall, safety awards and recognition are vital for promoting a proactive safety culture and ensuring safety remains a value in SDG&E's work.

C319: Safety Management System Implementation & Management:

An effective Safety Management System (SMS) provides a structured approach to identifying, assessing, and mitigating Employee Safety Risk. This systematic process helps proactively address potential hazards to prevent injury or incident. SDG&E is continuing its company-wide implementation and management of its SMS, comprised of a business framework, integrated operating model, governance structure and processes that apply the elements of API RP 1173.[26] SDG&E's SMS further aligns and integrates safety management,

[26] While API RP 1173 was developed for natural gas pipeline operators, SDG&E adapted this recommended practice for broader electric and gas utility application. Accordingly, absent an electric industry-equivalent, SDG&E applies this adapted version of API RP 1173 to both its gas and electric operations.

risk management, asset management, and emergency management across all operations for continued safety improvement and "connects the dots" to collectively manage safety risk. SDG&E began operating within an SMS in 2020. The SMS builds asset, risk, and safety management into all aspects of work from initial engineering and design, employee training, installation, operation, and maintenance of its utility infrastructure, to the safe and reliable delivery of electric and gas service to customers. SDG&E's SMS is comprised of company-wide processes for effective risk-based decision-making in daily operations. It aligns operational safety for gas and electric services with API RP 1173 standards, incorporating elements from ISO 31000 for risk management, ISO 55000 for asset management, and the Incident Command System for emergency management, along with OSHA's traditional safety principles. This comprehensive approach fosters a proactive safety program to continually enhance SDG&E's safety performance and safety culture to protect the safety of employees, contractors, and the communities SDG&E serves.

Within the SMS, SDG&E's safety focus expands beyond employee and contractor occupational safety principles to include heightened focus on public safety, asset safety, system safety, environmental safety, cyber safety, and psychological safety for continuous, sustainable improvement of SDG&E's safety performance and safety culture. SDG&E's SMS governance structure leverages a cross-functional team including leaders from gas operations, electric operations, employee safety, contractor safety, customer safety, public safety, asset management, risk management, and emergency management.

An effective SMS requires extensive, ongoing employee awareness and engagement efforts. SDG&E continually enhances and delivers SMS awareness and training. Creation of an employee communication, engagement and training program is necessary to achieve full understanding and cultural adoption of SMS with its broader safety focus on all safety pillars: People Safety, Risk Identification & Management, Asset Safety, Gas & Electric Operations, and Emergency Preparedness/Incident Response.

Stakeholder engagement and feedback are also essential elements of an effective SMS and are integrated into the SMS's continuous improvement framework. SDG&E's SMS undergoes regular review to measure its effectiveness and identify opportunities for improvement. Continued implementation, management and improvement of SDG&E's SMS offers numerous benefits for employee safety and risk reduction. Key benefits include:

- **Proactive Risk Management**: SDG&E's SMS helps systematically identify potential risks and hazards to allow for early intervention before incidents occur. By establishing safety protocols, the SMS reduces the frequency and severity of workplace incidents, leading to a safer environment.
- **Enhanced Communication and Collaboration**: SDG&E's SMS framework breaks down silos with increased two-way communication, cross-functional collaboration and information sharing.
- **Fostering a Culture of Safety**: Encouraging open communication about safety concerns helps build a culture where employees feel valued and empowered to report potential risks and hazards.
- **Continuous Improvement**: Regular assessments of safety performance and safety culture help identify areas for improvement, fostering a culture of continuous learning.
- **Safer Work Environment**: SDG&E's commitment to safety promotes safe work practices leading to improved safety performance.

By integrating safety, risk, and asset management, SDG&E is creating a holistic approach that protects employees, contractors, and the public by leveraging enhanced data collection and analysis, increased collaboration and information sharing, two-way communication, focus on building trust, psychological safety and safety culture, and implementation of safety processes that follow the Plan-Do-Check-Act cycle.

C328: Safety Compliance & Industrial Hygiene Program:

SDG&E's Safety Compliance and Industrial Hygiene Program plays a crucial role in employee safety. This program is comprised of oversight and management activities related to safety and industrial hygiene compliance, along with continuously improving to meet new and evolving regulations. The main components of SDG&E's Safety Compliance and Industrial Hygiene Program include:

Occupational Health & Safety Training: SDG&E provides comprehensive safety, health, emergency, and regulatory training. Regular training and education keep employees updated on best practices and new regulations. Believing in proactive measures, SDG&E develops and provides extensive in-person and online safety and health training via a Learning Management System (LMS). Accessible anytime, from any location, the LMS tracks completion

of online courses to confirm compliance. Safety training courses cover a range of occupational hazards and their controls, including confined spaces, arc flash, hot work, hazardous energy, operating cranes, workplace violence, and Personal Protective Equipment. Industrial hygiene training courses include respiratory protection, hearing conservation, protection from wildfire smoke, infectious materials, radio frequency, heat illness, hazard communication, asbestos, silica, and lead and metals.

Employee Safety Handbook & Standards: SDG&E's Employee Safety Handbook & Standards is a collection of information, instructions, standards, and procedures intended to provide guidance on safe work practices. These safety standards and procedures establish the framework and guidance for employee safety performance. Within the Handbook is SDG&E's Injury and Illness Prevention Program (IIPP), a comprehensive, written plan for preventing workplace injuries and illnesses and includes the following elements:

- Management commitment/assignment of responsibility;
- Safety communication system with employees;
- Compliance system for safe work practices;
- Scheduled inspections/evaluation system;
- Accident and illness investigation;
- Procedures for correcting unsafe or unhealthy conditions;
- Safety and health training instruction; and
- Recordkeeping and documentation.

Cal/OSHA regulatory requirements are incorporated in several stand-alone safety standards which are reviewed and updated at least every five years or when regulatory or procedural changes are implemented, whichever comes first.

Industrial Hygiene Program: SDG&E has a robust Industrial Hygiene Program in compliance with Cal/OSHA regulations. Industrial Hygienists are responsible for monitoring changes in employee safety and health regulations, developing internal safety procedures to confirm compliance with the applicable regulations, and managing Company-wide implementation of key industrial hygiene programs, such as Hazard Communication, Hearing Conservation, Respiratory Protection, Wildfire Smoke Protection, Radiofrequency Protection, Ventilation, Indoor and Outdoor Heat Illness Prevention, Silica Dust Control, and Asbestos and Lead Exposure Management.

A Comprehensive Environmental & Safety Compliance Management Program: SDG&E uses an Environmental & Safety Compliance Management Program (ESCMP) to address compliance requirements, awareness, goals, monitoring, and verification related to all applicable environmental, health and safety laws, rules and regulations, training, and Company standards, in accordance with the internationally accepted environmental management system standard, ISO 14001.[27] With ESCMP, SDG&E implements annual facility environmental and safety self-assessments and inspections, tracks corrective actions identified in these activities to closure, provides environmental and safety trainings to employees, tracks documentation of safety incidents and completion of incident-related corrective actions, and monitors completion of mandatory safety meetings. The objectives are to identify, correct, and remediate workplace hazards, confirm employee accomplishment of compliance training, and develop lessons learned to share with employees, with the ultimate goal to reduce injuries and illnesses.

Program Enhancements: SDG&E regularly reviews and assesses the effectiveness of its programs and identifies opportunities for continuous improvement. SDG&E plans to enhance its Safety Compliance & Industrial Hygiene Program to further develop and improve its safety programs including: Fall Protection, Arc Hazard Management, and Excavation and Trenching. These programs contain elements that necessitate detailed engineering analysis to continually assess the effectiveness of existing controls and enable them to stay current with advancing technologies to maintain employee safety. SDG&E also plans to implement new and existing programs, such as centralized PPE review and approval processes across business units, and enhancements to audits of high-energy activities. SDG&E also plans to enhance the program by improving tracking, logistics, and overall management of SDG&E's occupational health and safety programs including prescription protective eyewear, respiratory protection, and hearing conservation. These program enhancements would provide several important risk reduction benefits including:

- **Reduction in Workplace Injuries/Illnesses:** Comprehensive safety and training programs equip employees to recognize hazards and implement safe practices, mitigating the risk of accidents and injuries/illnesses.
- **Enhanced Emergency Response:** Preparing employees to respond effectively to

[27] *See* Industrial Organization for Standardization (ISO), *Environmental management systems – Requirements with guidance for use* (2015), *available at:* https://www.iso.org/standard/60857.html.

emergencies, such as gas leaks or electrical failures can mitigate the impact of such incidents.

- **Compliance with New and Emerging Regulations:** Regular training provides employees with the knowledge and awareness to comply with safety regulations, enhancing overall operational safety.
- **Enhanced Safety Culture:** Ongoing training fosters a culture of safety within the organization, encouraging employees to prioritize safety and look out for one another, which can further reduce risk.

In summary, SDGE's Safety Compliance & Industrial Hygiene Program helps identify and mitigate hazards to reduce the incidence of workplace injuries and occupational illnesses. These programs protect employees and enhance overall morale and safety culture.

C326: Workplace Violence Prevention:

SDG&E defines workplace violence as any act of violence or threat of violence occurring in the workplace that is likely to result in injury, psychological trauma, or stress. To prevent such incidents, SDG&E has a comprehensive workplace violence prevention program focusing on physical security through measures like surveillance systems, physical barriers, and controlled access to facilities. Regular inspections and annual training sessions are conducted to address unsafe conditions and practices, aiming to enhance protective measures at Company facilities. Physical Security measures include:

- **Surveillance Systems**: These include hardware and software designed to deter, delay, detect, assess, communicate, and respond to potential threats. Technologies used include Closed Circuit Television (CCTV) systems, video analytics, perimeter intrusion detection systems, and bi-directional speakers. CCTV systems consist of cameras, recorders, control equipment, and displays for real-time monitoring and forensic investigations.
- **Access Control Systems**: These systems limit or detect access to facilities and are integrated across all security layers. They separate common areas from higher security areas or critical assets, using electronic control systems (like proximity card readers or electronic keys) and mechanical locks/keys.
- **Physical Barriers:** Structures such as berms, fences, walls, gates, vehicle anti-ramming measures (bollards, engineered planters, benches, landscaping boulders),

window barriers, ravines, drainage ditches, specified entry/exit points, and security doors are used to deter and delay adversaries.

- **Inspections:** Proactive facility inspections were conducted when the program was first established and continue after a workplace violence incident. To address deficiencies found during inspections, engineering and work practice controls are implemented to minimize employee exposure to workplace violence hazards.
- **Training:** All Company employees receive annual training on workplace violence risks and prevention measures.

SDG&E's workplace violence prevention program offers several key benefits for employee safety and overall workplace well-being, including:

- **Reduced Risk of Injury or Death**: The most critical benefit is the reduction in the risk of physical harm to employees. By identifying and mitigating potential threats, the program helps prevent potential workplace violence incidents.
- **Improved Employee Morale and Productivity**: A safe work environment fosters a sense of security among employees, which can lead to higher morale and increased productivity.

Overall, a workplace violence prevention program is a proactive approach to creating a safer, more supportive work environment.

B. Changes from 2024 Controls

SDG&E plans to continue each of the existing controls discussed above, and reflected in Table 4, through the 2025-2031 period without any significant changes. For C328, SDG&E plans to deploy enhancements to improve fall protection, arc flash, and excavation programs and to implement new and existing programs, such as a sustainable PPE review and approval process.

C. Mitigation Programs

SDG&E intends to implement the following mitigation programs during the 2025 – 2031 period. These mitigation programs are intended to enhance and strengthen SDG&E's current employee safety programs by focusing on high energy hazards, serious injuries and fatalities to continually advance SDG&E's safety culture and mature as a learning organization.

M303: Enhanced, Risk Informed, Employee Safety Training & Field Safety Oversight Programs:

SDG&E plans to expand its current employee safety training and field safety oversight programs (described above at C317) to advance HECA and high energy hazard awareness across the organization. This risk-informed focus includes deployment of cross-functional HECA employee training, increased communication and resources around high energy hazards, and utilization of risk management and data analytics technology platform(s) with ongoing software licensing costs for improved Employee Safety Risk identification and mitigation.

SDG&E continually reviews, measures, and assesses the effectiveness of its safety programs and takes a proactive and preventative approach to Employee Safety Risk. In 2024, SDG&E introduced HECA and set a targeted goal to perform a limited number of assessments to gain knowledge and understanding of the process. SDG&E plans to expand its current field safety oversight program to further implement and expand HECA across the organization, including deployment of training and awareness programs.

Expanding the current field safety oversight program to mature HECA and high energy hazard awareness is crucial for several reasons:

- **Enhanced Safety Performance**: HECA is a method of measuring performance by assessing the extent to which front-line employees are protected against potentially life-altering hazards. By identifying high energy hazards and providing corresponding direct controls, SDG&E can further mitigate the risk of serious injuries or fatalities
- **Consistent Measurement**: HECA provides a standardized method for measuring safety performance within and across companies. This consistency contributes to safety metrics that are reliable and comparable, which is important for making informed decisions and improving safety protocols.
- **Improved Risk Management**: Utilizing a risk management and data analytics technology platform allows for better identification, assessment, and mitigation of high energy hazards. This technology can provide real-time data and insights, enabling proactive measures to help prevent accidents and enhance overall safety.
- **Cross-Functional Training**: Deploying cross-functional HECA employee training to field employees promotes awareness of high energy hazards and the

necessary controls. This comprehensive training will foster a culture of safety so that all field employees are equipped to handle potential risks.

Additionally, SDG&E plans to expand its field safety oversight program by leveraging data analytic software as tools. Together, HECA and enhanced data analytic capabilities will allow SDG&E to make more data-driven and risk-prioritized decision-making. By leveraging data analytics, SDG&E can track safety performance, identify trends, and make data-driven decisions to improve safety measures. This approach not only enhances safety with proactive and preventative measures but also optimizes resource allocation and operational efficiency.

M305: Safety Management System Maturity and Improvement: Enhanced Safety Communications & Safety Data Analytics:

As stated above, in C319, SDG&E began operating within a Safety Management System starting in 2020. SDG&E plans to advance the maturity of its SMS with enhanced two-way safety communication and enhanced safety data analytics capabilities. This mitigation would improve proactive and predictive Employee Safety Risk mitigation. SDG&E's SMS incorporates risk-based decision-making by focusing on high risk, high consequence events and incorporates SIF potential assessments and HECAs. These efforts are aligned and integrated with M303 and will incorporate data analysis from HECAs to proactively mitigate risk of high energy hazards. Specifics on SDG&E's enhanced SMS safety communications and data analytics are discussed below.

Enhanced Safety Communications: SDG&E's SMS provides the framework for systematically managing safety-related activities, and effective communication informs stakeholders about their roles and responsibilities within this framework, promoting a comprehensive and cohesive approach to safety. This mitigation increases the frequency of two-way safety communications, enhances the content (*e.g.*, greater use of video messaging), and leverages technology advancements for greater effectiveness. SDG&E plans to grow this function and serve as a centralized resource for safety communications. This would provide consistency in communications and processes. Effective two-way safety communications are a critical element of an effective SMS. Benefits include:

- **Enhanced Hazard Identification & Reporting**: When communication flows both ways, employees and contractors feel empowered to report hazards and near-misses. This helps in identifying potential risks early, allowing for timely

interventions.

- **Improved Safety Culture**: Open communication fosters a culture of trust and transparency. Employees and contractors are more likely to engage in safety practices and feel responsible for their own and their colleagues' safety.
- **Informed Decision-Making**: Leadership can make risk-informed decisions when they have accurate and comprehensive information from all levels of the organization. This includes feedback from frontline workers who are often the first to notice potential safety issues.
- **Increased Compliance**: Clear and consistent communication allows everyone to understand safety policies and procedures. This reduces the likelihood of non-compliance and the associated risks.
- **Continuous Improvement**: Feedback loops allow for continuous improvement of safety protocols. Employees can provide insights on protocol effectiveness, leading to more effective safety measures.
- **Emergency Preparedness**: In the event of an emergency, effective communication provides that information is quickly and accurately disseminated, enabling a coordinated and efficient response.
- **Employee Morale and Engagement**: When employees feel heard and valued, their morale and engagement levels increase. This can lead to higher productivity and a more positive work environment.

Enhanced Safety Data Analytics: Safety data analytics play a crucial role within the API RP 1173 framework and SDG&E's Safety Management System. SDG&E plans to enhance its SMS safety data analytic capabilities by leveraging risk management software. This new software (either developed in-house or procurement of third-party software) would be a centralized resource to improve employee safety. For instance, in 2024 SDG&E began conducting Field Safety Engagements to gather jobsite observations of high energy hazards to assess whether adequate controls are in place. A new risk management software tool would allow SDG&E to assess the outputs of these observations (*i.e.*, data trends and analysis) for earlier potential risk identification and proactive, preventative action. Advancing the maturity of SDG&E's SMS through improved safety data analytics offers several employee safety benefits, including:

- **Data-Driven Insights**: Enhanced analytics can identify trends and patterns in safety incidents, allowing organizations to proactively address potential risks before they escalate.
- **Ongoing Learning**: Regular analysis of safety data allows organizations to learn from past incidents and near misses, fostering a culture of continuous improvement.
- **Adaptability**: Enhanced analytics enable organizations to quickly adapt to new safety challenges and regulatory changes, ensuring ongoing compliance and safety.
- **Reduction in Incidents and Injuries**: By identifying potential risks earlier and implementing targeted interventions, organizations can reduce the number of workplace incidents and injuries.

By integrating these enhancements, SDG&E can create a more resilient and responsive SMS that protects employees and enhances overall operational effectiveness.

M311: Establish Event Learning Teams:

To continually advance as a learning organization, SDG&E plans to establish Event Learning Teams, which will be internal cross-functional teams leveraging existing subject matter experts (SMEs) to assess internal and external safety-related events, including SIF and SIF-potential incidents. These Event Learning Teams will support incident investigation and determine the root cause(s) and other contributing factors, as well as benchmark against internal practices and procedures, and identify opportunities to apply lessons learned for continued safety improvement. This mitigation will improve response to systemic issues and reduce the risk of re-occurrence of similar incidents in the future.

SDG&E aims to form these Event Learning Teams with current employees, providing them with the necessary training, tools, and resources to investigate safety-related events. Additionally, SDG&E plans to leverage and incorporate third-party TapRoot® training, tools, and resources to training Event Learning Teams appropriately.[28]

[28] TapRoot® incident investigation training is a structured program designed to teach individuals and teams how to effectively analyze and address the root causes of workplace incidents. The training focuses on using the TapRoot® System, which is a systematic approach to identifying and solving problems to prevent future occurrences.

Benefits of establishing Event Learning Teams include:

- **Enhanced Risk Identification and Mitigation:** By investigating and evaluating safety-related events, these teams can identify lessons learned and proactively identify related potential risks and hazards, implementing preventative measures to prevent or reduce future incidents and injuries. This is part of SDG&E's comprehensive Safety Management System focused on continuous safety improvement.
- **Improved Safety Culture:** By demonstrating leadership's commitment to safety, building trust, fostering a learning environment, and promoting psychological safety, these Teams will enhance the overall safety culture. This encourages employees to report safety concerns and near misses.
- **Comprehensive Incident Analysis:** Conducting thorough assessments of internal and external safety-related events to determine root causes and contributing factors and benchmarking against internal practices and procedures allows for continuous safety improvement.
- **Resource Allocation and Training:** Providing the necessary training, technology, and resources enables teams to be well-equipped to conduct safety assessments and implement effective safety measures.

Overall, the establishment of internal cross-functional Event Learning Teams, supported by training, technology, and resources, is a strategic approach to enhancing safety and mitigating risks while fostering a culture of continuous improvement.

D. Climate Change Adaptation

Pursuant to Commission decisions[29] in the Climate Adaptation OIR (R.18-04-019), SDG&E performed a Climate Adaptation Vulnerability Assessment (CAVA) focused on years 2030, 2050, and 2070, with the aim of identifying asset and operational vulnerabilities to climate hazards across the SDG&E system. SDG&E recognizes the need to address climate vulnerabilities to promote safety and reliability of its services and mitigate the increasing climate-related hazards through innovative and community-centric approaches. Some of the climate hazards that will have short- and long-term ramifications in the San Diego region include

[29] D.19-10-054; D.20-08-046.

extreme temperatures, wildfire, inland flooding, coastal flooding and erosion, and landslides. Climate change is recognized as a factor that can drive, trigger, or exacerbate multiple RAMP risks. Implementing climate change adaptation measures and integrating climate vulnerability considerations into RAMP controls and mitigations can enhance system infrastructure longevity and reduce the severity of long-term negative climate impacts. The controls and mitigations described in further detail in this chapter, as shown below, align with the goal of increasing SDG&E's physical and operational resilience to the increasing frequency and intensity of climate hazards. Additional information on the CAVA and a complete list of climate-relevant controls and mitigations included in RAMP are provided in Chapter RAMP-5: Climate Change Adaptation.

Table 5: Employee Safety Risk
Controls and Mitigations that Align with Increasing
Resilience to Climate Hazards

Relevant ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
C317	Employee Safety Training & Field Safety Oversight Programs	Extreme Temperatures
C328	Safety Compliance & Industrial Hygiene Program	Extreme Temperatures, Wildfires
M303	Enhanced, Risk Informed, Employee Safety Training & Field Safety Oversight Programs	Extreme Temperatures

E. Foundational Programs

Foundational Programs are "[i]nitiatives that support or enable two or more Mitigation programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[30] There are no Foundational Programs applicable for the Employee Safety Risk and the mitigation activities that are supported.

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for the Employee Safety Risk including the associated costs, units, and CBRs. Additional information by Tranche is provided in workpapers. The costs shown are estimated using assumptions provided by SMEs and available data. In compliance with the Phase 3

[30] D.24-05-064, RDF at A-4.

Decision,[31] for each enterprise risk, SDG&E uses actual results and industry data and when that is not available, supplements the data with SME input. Additional details regarding the data and expertise relied upon in developing these estimates is provided in Attachment B.

Table 6: Employee Safety Risk Control and Mitigation Plan – Recorded and Forecast Costs Summary (Direct, in 2024 $ thousands)

Control/Mitigation		Adjusted Recorded		Forecast Costs			
ID	**Name**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C317	**Employee Safety Training & Field Safety Oversight Programs**	0	1,108	1,138	0	0	3,414
C319	Safety Management System (SMS) Implementation & Management	0	605	605	0	0	1,815
C323	Safety Culture Survey Recognition & Awards	0	841	819	0	0	2,457
C326	**Workplace Violence Prevention Programs**	702	0	0	10,200	7,650	0
C328	**Safety Compliance & Industrial Hygiene Program**	0	940	1,230	0	0	3,690
M303	Enhanced Risk Informed Employee Safety Training & Field Safety Oversight Programs	0	0	420	0	0	1,260
M305	Safety Mgmt System Maturity & Improvement: Enhanced Safety Communication & Safety Data Analytics	0	0	348	0	0	1,044

[31] D.24-05-064, RDF Row 10.

Control/Mitigation		Adjusted Recorded		Forecast Costs			
ID	**Name**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
M311	Establish Incident Investigation & Cross-functional Event Learning Teams	0	21	21	0	0	63
Total		**702**	**3,515**	**4,581**	**10,200**	**7,650**	**13,743**

Bold *indicates this control/mitigation includes mandated programs/activities.*

Table 7: Employee Safety Risk
Control & Mitigation Plan – Units Summary

Control/Mitigation		Recorded Units			Forecast Units			
ID	**Name**	**Unit of Measure**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C317	**Employee Safety Training & Field Safety Oversight Programs**	FTEs	0	7	7	0	0	21
C319	Safety Management System (SMS) Implementation & Management	FTEs	0	3	3	0	0	9
C323	Safety Culture Survey Recognition & Awards	FTEs	0	2	2	0	0	6
C326	**Workplace Violence Prevention Programs**	Projects	6	0	0	52	39	0
C328	**Safety Compliance & Industrial Hygiene Program**	FTEs	0	4	3	0	0	9
M303	Enhanced Risk Informed Employee Safety Training & Field Safety Oversight Programs	FTEs	0	0	3	0	0	9
M305	Safety Mgmt System Maturity & Improvement: Enhanced Safety Communication &	FTEs	0	0	2	0	0	6

Control/Mitigation		Recorded Units			Forecast Units			
ID	**Name**	**Unit of Measure**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
	Safety Data Analytics							
M311	Establish Incident Investigation & Cross-functional Event Learning Teams	Employees Trained	0	15	15	0	0	45

Bold *indicates this control/mitigation includes mandated programs/activities.*

In the table below, CBRs are presented in summary at the mitigation or control level for the TY 2028 GRC cycle. CBRs are calculated based on scaled, expected values, unless otherwise noted, and are calculated for each of the three required discount rates[32] in each year of the GRC cycle and for the Post-Test Years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in workpapers.

Table 8: Employee Safety Risk
Cost Benefit Ratio Results Summary (2028-2031)
(Direct, in 2024 $ millions)

ID	Control/Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C317	**Employee Safety Training & Field Safety Oversight Programs**	$0	$4.6	1.65	1.76	1.65
C323	Safety Culture Survey Recognition & Awards	$0	$3.3	0.43	0.46	0.44
C319	Safety Management System Implementation and Management	$0	$2.4	1.05	1.13	1.06
C328	**Safety Compliance & Industrial Hygiene Program**	$0	$4.9	0.92	0.99	0.93
C326	**Workplace Violence Prevention Programs**	$10.2	$0	0.23	0.24	0.23
M303	Enhanced Risk Informed	$0	$1.7	1.97	2.10	1.98

[32] *See* Chapter RAMP-3 for definitions of discount rates, as ordered in the Phase 3 Decision.

ID	Control/Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
	Employee Safety Training & Field Safety Oversight Programs					
M305	Safety Management System Maturity & Improvement: Enhanced Safety Communication & Safety Data Analytics	$0	$1.4	2.65	2.82	2.65
M311	Establish Incident Investigation and Cross-functional Event Learning Teams	$0	$0.08	1.06	1.13	1.07
A391	Incident Investigation & Event Learning Dedicated Support Team	$0	$3.3	0.03	0.03	0.03
A392	Employee Safety Enhanced Safety Validation Program	$0	$2.1	0.06	0.06	0.06

Bold *indicates this control/mitigation includes mandated programs/activities.*

PTranche-level CBRs by year and in aggregate for each mitigation are provided in workpapers.

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025, D.16-08-018, and D.18-12-014,[33] SDG&E considered two alternatives to the risk mitigation plan for Employee Safety Risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this plan considers changes in risk reduction, cost, reasonableness, current conditions, modifications to the plan and constraints, such as budget and resources.

[33] *See, e.g.,* D.18-12-014 at 33-35.

Table 9: Employee Safety Risk
Alternative Mitigation Plan Forecast Costs Summary
(Direct, in 2024 $ thousands)

Alternative Mitigation		Forecast Costs			
ID	**Name**	**2025-2028 Capital**	**PTY Capital**	**2025-2028 O&M**	**PTY O&M**
A391	Incident Investigation & Event Learning Dedicated Support Team	0	0	3,268	2,452
A392	Enhanced Safety Validation Program	0	0	2,108	1,581
Total		**0**	**0**	**5,376**	**4,033**

Table 10: Employee Safety Risk
Alternative Mitigation Cost Benefit Ratio Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A391	Incident Investigation & Event Learning Dedicated Support Team	$0	$0.80	0.03	0.03	0.03
A392	Enhanced Safety Validation Program	$0	$0.53	0.06	0.06	0.06

A. Alternative 391: Incident Investigation & Event Learning Dedicated Support Team Mitigation

This is an alternative approach to SDG&E's planned mitigation, M311. As discussed above in M311, SDG&E believes establishing Event Learning Teams will provide added safety risk mitigation and further advance its culture of continuous learning and improvement. SDG&E assessed an alternative approach to M311 that includes having a dedicated team to perform incident investigations, assess internal and external safety-related events to determine the root cause and other contributing factors, benchmark against internal practices and procedures, and identify opportunities to apply lessons learned for continued safety improvement. Employee safety benefits of establishing Event Learning Teams include those listed in M311 above.

In consideration of identifying solutions to advance its culture of learning and continuous improvement, SDG&E evaluated the creation of a dedicated support team in lieu of leveraging existing cross-functional subject matter experts as planned in M311. Having a fully dedicated Event Learning Team would provide similar risk reduction benefits as leveraging existing SMEs.

This alternative approach envisions additional employee resources dedicated solely to performing assessments of internal and external safety-related events, leveraging TapRoot® training[34] and software tools. The benefits of establishing a fully dedicated Event Learning Team are similar to those described for M311. A fully dedicated team, as opposed to the cross-functional team planned for M311, could perform more in-depth and/or additional incident investigations, resulting in additional Event Learnings each year. Having this fully dedicated team would increase the subject matter expertise of those employees working full-time on incident investigations.

SDG&E does not currently plan to implement this approach as M311 provides a better cost-benefit analysis. After reviewing effectiveness of implementation of the mitigation activity planned in M311, SDG&E may reassess its approach and plan a fully dedicated support team in the future, if warranted.

B. Alternative 392: Enhanced Safety Validation Program Mitigation

This is an alternative to SDG&E's current Safety Compliance & Industrial Hygiene Program, described above in C328. SDG&E's current C328 promotes compliance with all necessary regulatory and safety requirements. To verify compliance, SDG&E leverages its Environmental, Health and Safety Management Program (ESCMP). ESCMP is utilized to inspect, educate, train, and monitor the effectiveness of environmental, health and safety activities in accordance with the internationally accepted standard, ISO 14001. ESCMP addresses compliance requirements, awareness, goals, monitoring and verification related to all applicable environmental, health and safety laws, rules and regulations, and company standards. SDG&E has an annual ESCMP Certification process, which involves submitting information into the database used to collect and record employee and facility compliance. In January of each year, ESCMP information is submitted into an online system for year-end approval and certification for the prior calendar year. ESCMP has been refined and improved and matured over the years and is still in place at SDG&E.

As previously stated, SDG&E's current ESCMP applies to environmental, health and

[34] TapRoot® incident investigation training is a structured program designed to teach individuals and teams how to effectively analyze and address the root causes of workplace incidents. The training focuses on using the TapRoot® System, which is a systematic approach to identifying and solving problems to prevent future occurrences.

safety laws, rules and regulations, and company standards. This alternative mitigation would include expanded and revised assessment, training, and verification processes beyond the current compliance and regulatory requirements covered by ESCMP to include additional safety best practices. As SDG&E has matured beyond a "compliance-driven" culture, further expanding ESCMP beyond compliance-driven requirements could support continued safety culture maturity. Increased Employee Safety Risk reduction benefits from this alternative mitigation could include improved ability to proactively identify and mitigate hazards, further reducing risk of employee injury or illness. Overall, going beyond the current ESCMP processes could reduce Employee Safety Risk by improving identification and mitigation of risk.

This approach would require additional employee resources. While SDG&E believes there may be added risk reduction benefit in implementing this approach, it is not currently planned due to affordability concerns. SDG&E may reassess its approach and plan a fully dedicated support team in the future, if warranted.

VI. HISTORICAL GRAPHIC

As directed by the Commission in the Phase 2 Decision, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. A bar chart graphic is employed to depict historical progress. This graphic uses a key metric that aligns with Company safety goals to illustrate trends in historical progress and identify the remaining tasks necessary to continue mitigating risks.

Figure 2

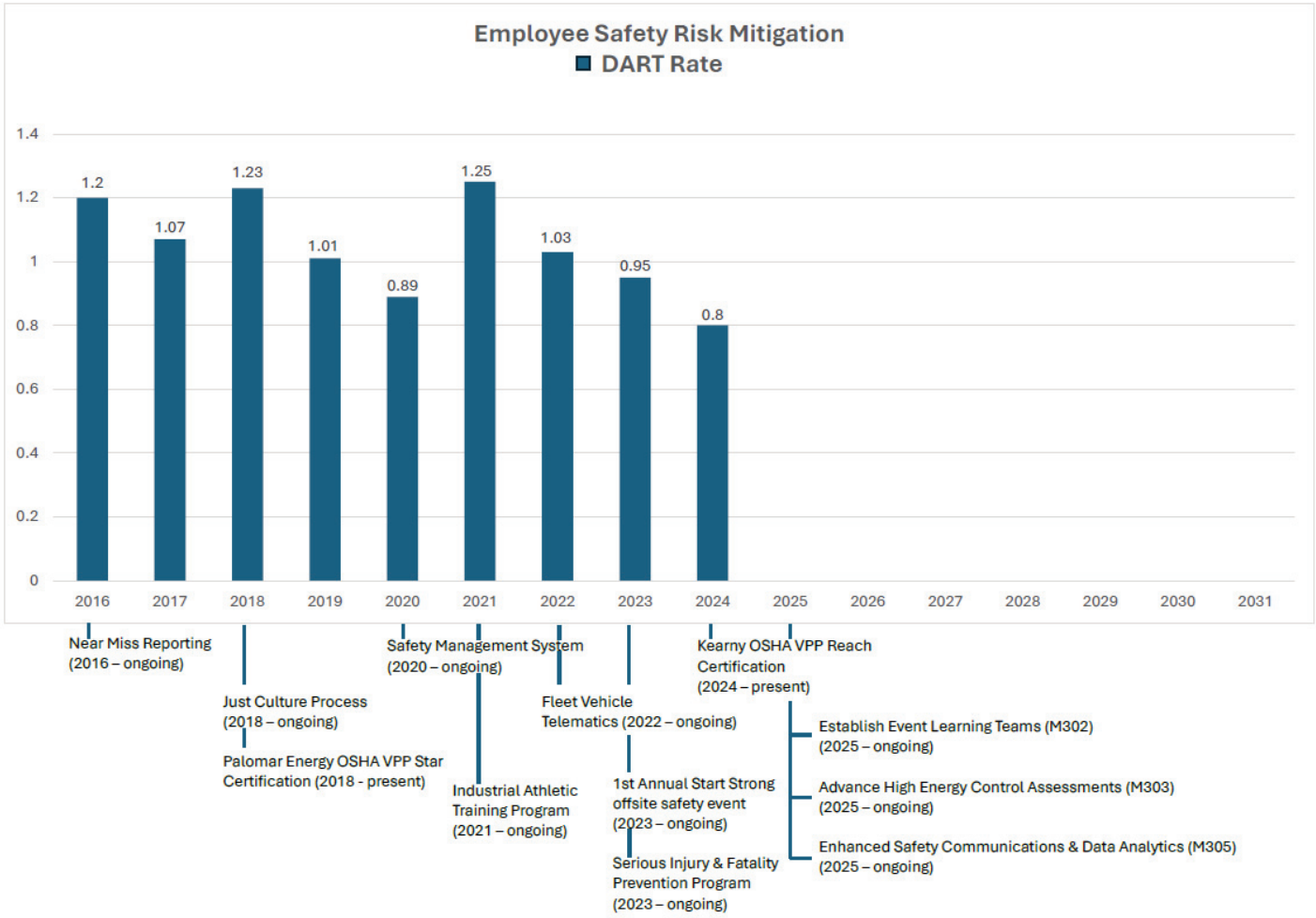


Figure 2 above shows the historical safety work activities completed using the Employee Days Away, Restricted and Transfer (DART) Rate[35] from 2016-2024. DART Rate is calculated based on the number of OSHA-recordable injuries resulting in Days Away from work and/or Days on Restricted Duty or Job Transfer, and hours worked. (DART Rate = DART Cases times 200,000 divided by employee hours worked.)

The safety work that remains to be done is described above in Section IV. 2024-2031 Control and Mitigation Plan.

[35] Employee DART Rate is Metric No. 14 in SDG&E's 2024 Safety Performance Metrics Report, filed on April 1, 2025.

ATTACHMENTS

ATTACHMENT A

CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates the compliance Drivers that underpin identified controls and mitigations.

ID	Control/Mitigation Name	Compliance Driver(s)
C317	Employee Safety Training & Field Safety Oversight Programs	Cal/OSHA Title 8
C328	Safety Compliance & Industrial Hygiene Program	Cal/OSHA Title 8
C326	Workplace Violence Prevention	Cal/OSHA Workplace Violence Prevention Act, California Labor Code
M311	Establish Incident Investigation and Cross-functional Event Learning Teams	Cal/OSHA Title 8

ATTACHMENT B

EMPLOYEE SAFETY - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision at RDF Row 10 and Row 29 directs each utility to identify Potential Consequences of a Risk Event using available and appropriate data.[36] Appropriate data may include Company specific data or industry data supplemented by the judgment of subject matter experts. Provided below is a listing of the inputs utilized as part of this assessment and the description of the data.

Risk Data	Source Type	Source Information
Mandatory Safety Training	External Data	Agency: Harvard Business Review Link: https://hbr.org/2024/09/safety-should-be-a-performance-driver Description: Mandatory safety training reduces worker injury rates by 15% to 18% fewer incidents (of any type) than you would have without this program.
TRC Rate Safety Management System (SMS)	External Data	Agency: Indiana University of Pennsylvania Link: https://www.sciencedirect.com/science/article/pii/S0001457513002972 Description: Safety Management System has an effectiveness of 9%.
Injury and Illness Prevention Program	External Data	Agency: OSHA Link: https://www.osha.gov/sites/default/files/OSHAwhite-paper-january2012sm.pdf Description: OSHA estimates that implementation of injury and illness prevention programs will reduce injuries by 15 percent to 35 percent for employers who do not now have safety and health programs.
Business Case for Safety and Health	External Data	Agency: OSHA Link: https://www.osha.gov/businesscase/benefits Description: Found that OSHA inspections with penalties of Pennsylvania manufacturing facilities reduced injuries by an average of 19-24% annually.

[36] D.24-05-064, RDF Row 10 and Row 29.

Risk Data	Source Type	Source Information
Workplace Violence Prevention Programs	External Data	Agency: Bureau of Justice Statistics Link: https://bjs.ojp.gov/content/pub/pdf/wv09.pdf Description: National Crime Victimization Survey, 2002-2011, an estimated ~51.5% of national workplace violence incidents are caused by individuals that are stranger or unknown to the victim.
Financial Consequences	External Data	Agency: Centers for Disease Control and Prevention Link: https://wisqars.cdc.gov/cost/?y=2022&o=TAR&i=0&m=3000&g=00&s=0&u=TOTAL&u=AVG&t=COMBO&t=MED&t=LIFE&t=WORK&a=5Yr&g1=0&g2=199&a1=0&a2=199&r1=MECH&r2=INTENT&r3=NONE&r4=NONE&c1=NONE&c2=NONE Description: Centers for Disease Control and Prevention estimated the cost of the injury as per the cause.
Enhanced, Risk Informed Employee Safety Training & Field Safety Oversight Programs	Internal SME Data	Description: Reduces SIFs by 0.5 per year.
Safety Culture Survey, Recognition & Awards	Internal OSHA rate	Description: Comparison between 2016 to 2024 OSHA rate.
Enhanced Safety Communications & Safety Data Analytics	Internal SME data	Description Reduces SIFs by 0.5 per year.
Establish Incident Investigation and Cross-functional Event Learning Teams	Internal LTI rate	Description: Comparison between 2016 to 2024 LTI rate.

ATTACHMENT C

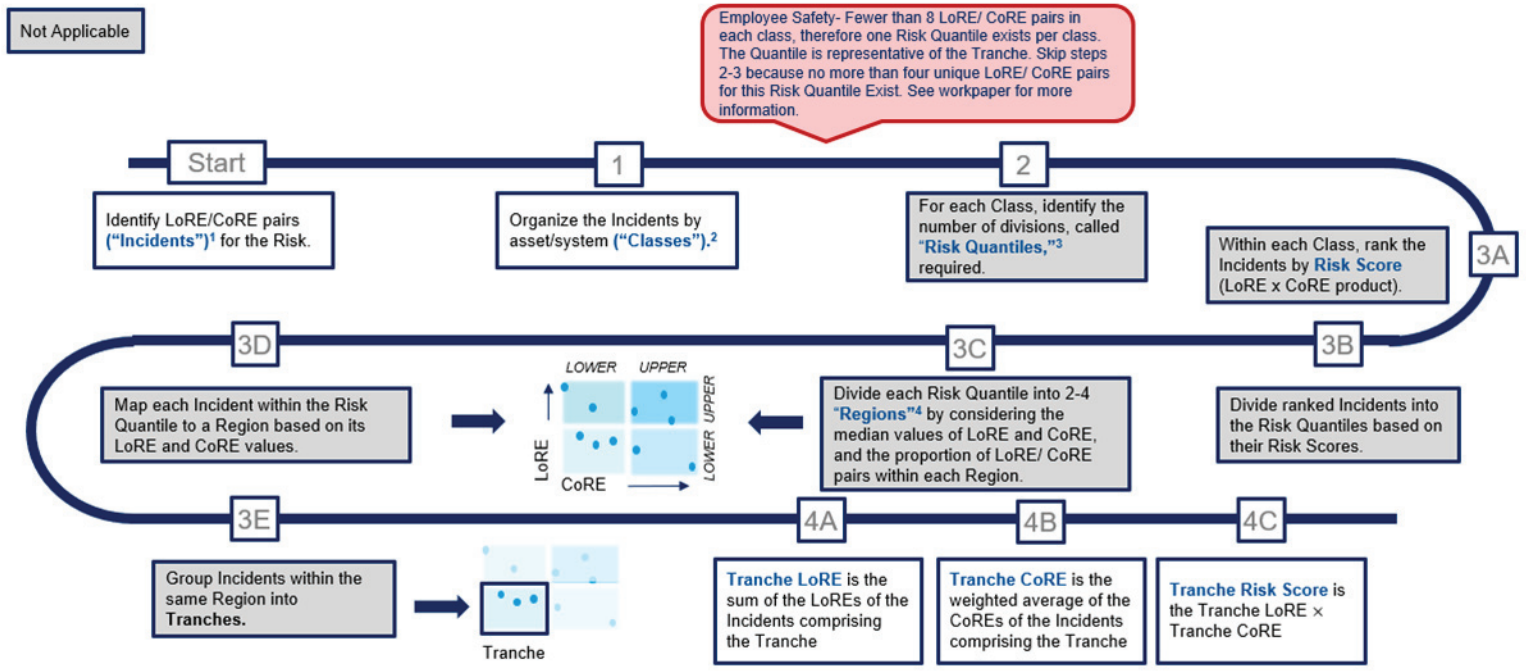
EMPLOYEE SAFETY - SUMMARY OF ELEMENTS OF BOW TIE

SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
C317	Employee Safety Training & Field Safety Oversight Programs	DT.1 - DT.9	PC.1, PC.2, and PC.3
C323	Safety Culture Survey, Recognition & Awards	DT.1 - DT.9	PC.1, PC.2, and PC.3
C319	Safety Management System Implementation & Management	DT.1 - DT.9	PC.1, PC.2, and PC.3
C328	Safety Compliance & Industrial Hygiene Program	DT.1, DT.2, DT.3, DT.6, DT.7, and DT.9	PC.1, PC.2, and PC.3
CTBD	Workplace Violence Prevention	DT.1, DT.2, and DT.9	PC.1, and PC.2
M303	Enhanced Risk Informed Employee Safety Training & Field Safety Oversight Programs	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7, and DT.9	PC.1, PC.2, and PC.3
M305	Safety Management System Maturity & Improvement: Enhanced Safety Communication & Safety Data Analytics	DT.1 - DT.9	PC.1, PC.2, and PC.3
M311	Establish Incident Investigation and Cross-functional Event Learning Teams	DT.1 - DT.9	PC.1, PC.2, and PC.3

ATTACHMENT D

APPLICATION OF TRANCHING METHODOLOGY

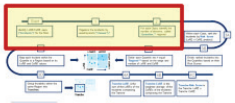
A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP-3: Risk Quantification Framework is provided.



NOTES

[1]*For example, **Incidents (or "Risk Incidents")** for Employee refer to safety incidents.*
[2]*For example, **Classes (or "Asset Classes")** for Employee Safety include Electric Ops, Gas Ops, Motor Vehicle Incidents, Office of Customer, Workplace Violence, Admin/Miscellaneous .*
[3]***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*
[4]*The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*

Not Applicable



Start

1

2

Identify LoRE/CoRE pairs ("Incidents")[1] for the Risk.

Organize the Incidents by asset/system ("Classes").[2]

For each Class, identify the number of divisions, called "Risk Quantiles,"[3] required.

Class	LORE / CORE PAIRS	TOTAL # PAIRS
Electric Ops	Electric Ops	1
Gas Ops	Gas Ops	1
Motor Vehicle Incidents	Motor Vehicle Incident	1
Office of Customer	Office of Customer	1
Admin/ Miscellaneous	Admin/Miscellaneous	1
Workplace Violence	Active Shooter Event	2
	In Person Event	

$$\min\left(\frac{N}{8}-1,9\right) < K \leq \min\left(\frac{N}{8},10\right)$$

1

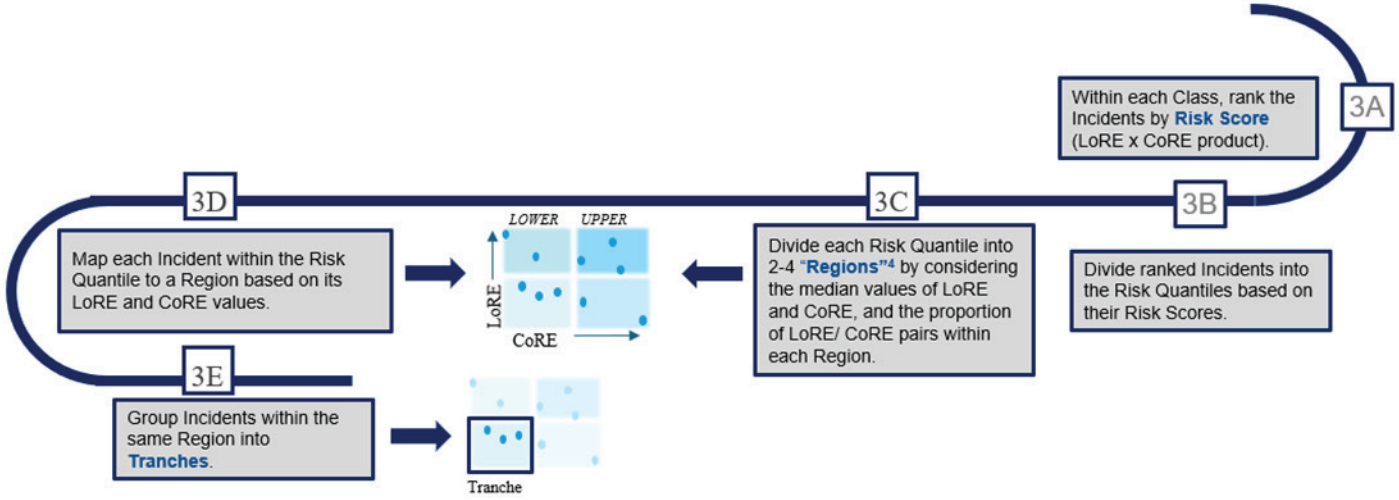
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1

Skip step 2-3
Continue to Step 4

Not Applicable





Not Applicable



4A

Tranche LoRE is the sum of the LoREs of the Incidents comprising the Tranche

4B

Tranche CoRE is the weighted average of the CoREs of the Incidents comprising the Tranche

4C

Tranche Risk Score is the Tranche LoRE x Tranche CoRE

					4A	4B	4C
Class	**Risk Quantile**	**Incident (LoRE/CoRE) Pair**	**Risk Quantile Region**	**Tranche**	**Tranche LoRE**	**Tranche CoRE**	**Tranche Risk Score**
Electric Ops	1	Electric Ops	None	Electric Ops	39.00	$0.11M	$4.46M
Gas Ops	1	Gas Ops	None	Gas Ops	14.89	$0.06M	$0.84M
Motor Vehicle Incident	1	Motor Vehicle Incident	None	Motor Vehicle Incident	41.89	$0.06M	$2.45M
Office of Customer	1	Office of Customer	None	Office of Customer	13.56	$0.09M	$1.23M
Admin/Miscellaneous	1	Admin/Miscellaneous	None	Admin/Miscellaneous	8.33	$0.11M	$0.93M
Workplace Violence	1	In Person Event	UL / LC	WPV-1	0.91	$0.87M	$0.79M
		Active Shooter Event	LL / UC	WPV-2	0.003	$140.62M	$0.42M

2025 Risk Assessment Mitigation Phase

(Chapter SDG&E-Risk-7)

Contractor Safety

May 15, 2025

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Chapter SDGE-Risk-7: Contractor Safety

I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or the Company) risk control and mitigation plan for the Contractor Safety Risk. This chapter contains information and analysis for this risk that meet the requirements of the California Public Utilities Commission's (Commission or CPUC) Risk-Based Decision-Making Framework (RDF),[1] including the requirements adopted in Decision (D.) 22-12-027 (Phase 2 Decision) and D.24-05-064 (Phase 3 Decision). Contractor Safety Risk is included in the 2025 RAMP Report based on a safety risk assessment, further informed by its reliability and financial consequence attributes, consistent with the RDF guidance. This risk chapter describes the basis for selection of Contractor Safety Risk, the controls and/or mitigations put forth to reduce the likelihood or consequence of this risk, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter presents cost and unit forecasts for the risk mitigating activities, but it does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk-reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation consistent with the method and process prescribed in the RDF.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SDG&E's Contractor Safety Risk is defined as the risk of an incident involving one or more on-duty contractors or subcontractors while conducting work on behalf of SDG&E that results in injury or fatality.

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF requirements, such as those from the Occupational Safety and Health Administration (OSHA), the CPUC and their relevant investigations, rulemakings, and orders

[1] As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A. 15-05-002 et al. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

instituting rulemakings (OIRs). A list of compliance requirements applicable to the Employee Contractor Risk is provided in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction as prescribed by the RDF, such as enhancing operations and promoting public trust in the communities SDG&E serves.

2. Risk Overview

Safety is a core value and is foundational to SDG&E's operations. SDG&E defines safety as the presence of controls for known hazards, actions to anticipate and guard against unknown hazards, and the commitment to continuously improve SDG&E's ability to recognize and mitigate hazards. SDG&E focuses on safety through the lenses of employee safety, contractor safety, public safety, and infrastructure safety.

SDG&E relies on support from its contractors to perform a significant amount of construction related work on its electric and gas infrastructure assets located throughout its service territory. Such work is frequently performed in public space and is impacted by external factors, such as vehicular traffic in populated areas. Contractors support SDG&E during normal operating conditions as well as during emergency situations resulting from events, such as wildfires, Public Safety Power Shutoffs (PSPS), Red Flag Warnings (RFW) and other emergency events. SDG&E has many safety-related policies and procedures for contractors to follow, as discussed further below.

SDG&E's culture and commitment to continuous safety improvement, as supported by the controls and mitigations identified within this chapter, takes a proactive and preventative approach and are designed to manage its Contractor Safety Risk.

B. Risk Scope

SDG&E's Contractor Safety Risk analysis considers the risk of a work-related – as defined by California Occupational Safety and Health Administration (Cal/OSHA) – safety incident involving a Class 1 Contractor(s) that causes minor[2] or serious injury/illness[3] or fatality

[2] Minor injury or illness is one that does not meet the criteria for a serious injury as defined by Cal/OSHA.

[3] Cal/OSHA defines a serious injury or illness as "any injury or illness occurring in a place of employment or in connection with any employment that requires inpatient hospitalization for other than medical observation or diagnostic testing, or in which an employee suffers an amputation, the loss of an eye, or any serious degree of permanent disfigurement, but does not include any injury or illness or death caused by an accident on a public street or highway, unless the accident occurred in a construction zone." Cal. Code Regs. Tit. 8, § 330(h) (2020).

while conducting work on behalf of SDG&E. SDG&E defines Class 1 Contractors as a contractor engaged to perform work that can reasonably be anticipated to expose the Contractor's employees, subcontractors, SDG&E employees, or the general public to one or more hazards that have the potential to result in a Serious Safety Incident.[4] Examples of a Class 1 Contractor include contractors performing work involving energized equipment or hazardous chemicals.[5]

C. Data Sources Used to Quantify Risk Estimates [6]

SDG&E utilized internal data sources to determine the Contractor Safety Risk Pre-Mitigated Risk Value and calculate risk reduction estimates for mitigation activities (which enables estimation of Post Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used, as appropriate, and adjusted to account for the risk characteristics associated with the Company's specific operating locations and service territory. For example, certain types of incident events have not occurred within the SoCalGas and SDG&E service territories. Expanding the quantitative data sources to include industry data where such incidents have been recorded is appropriate to establish a baseline of risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of the Contractor Safety Risk, including a risk Bow Tie, which delineates potential Drivers/Triggers and Potential Consequences, followed by a description of the Tranches determined for this risk.

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[4] SDG&E's Class 1 Contractor Safety Manual defines a "Serious Safety Incident" as "a work-connected injury or illness occurring in a place of employment or in connection with any employment that requires inpatient hospitalization for other than medical observation or in which an employee suffers a loss of any member of the body or suffers any serious degree of permanent disfigurement.," *available at:* https://www.sdge.com/sites/default/files/SDGE%20-%20Contractor%20Safety%20Manual%20-%20Class%201%20Contractors%2012-21-2020.pdf

[5] All references to "contractors" herein are referencing Class 1 contractors only.

[6] Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

A. Risk Selection

The Contractor Safety Risk was included as a risk in SDG&E's 2021 RAMP and was included in the 2022, 2023 and 2024 Enterprise Risk Registries (ERR).[7] SDG&E's ERR evaluation and selection process is summarized in Chapter RAMP-2, Enterprise Risk Management Framework and in Chapter RAMP-3 Risk Quantification Framework.

SDG&E selected this risk in accordance with the RDF Row 9.[8] Specifically, SDG&E assessed the top risks from the Company's 2024 ERR based on the Consequence of a Risk Event (CoRE) Safety attribute. The Contractor Safety Risk was among the risks presented in SDG&E's list of Preliminary 2025 RAMP Risks on December 17, 2024 at a pre-filing workshop. The Contractor Safety Risk was selected based on the qualification of its Safety risk attribute, as required under the RDF. At the pre-filing workshop, no party expressed opposition to inclusion of this risk in SDG&E's 2025 RAMP Report.

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the risk Bow Tie, possible Drivers, Potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that addresses it.[9] As illustrated in the risk Bow Tie shown below in Figure 1, the Risk Event (center of the Bow Tie) is a Contractor Safety Risk that could lead to a safety-related event, the left side of the Bow Tie illustrates Drivers/Triggers that could lead to the Contractor Safety Risk, and the right side shows the Potential Consequences of the Contractor Safety Risk. SDG&E applies this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to the addressed elements of the risk Bow Tie is provided in Attachment C.

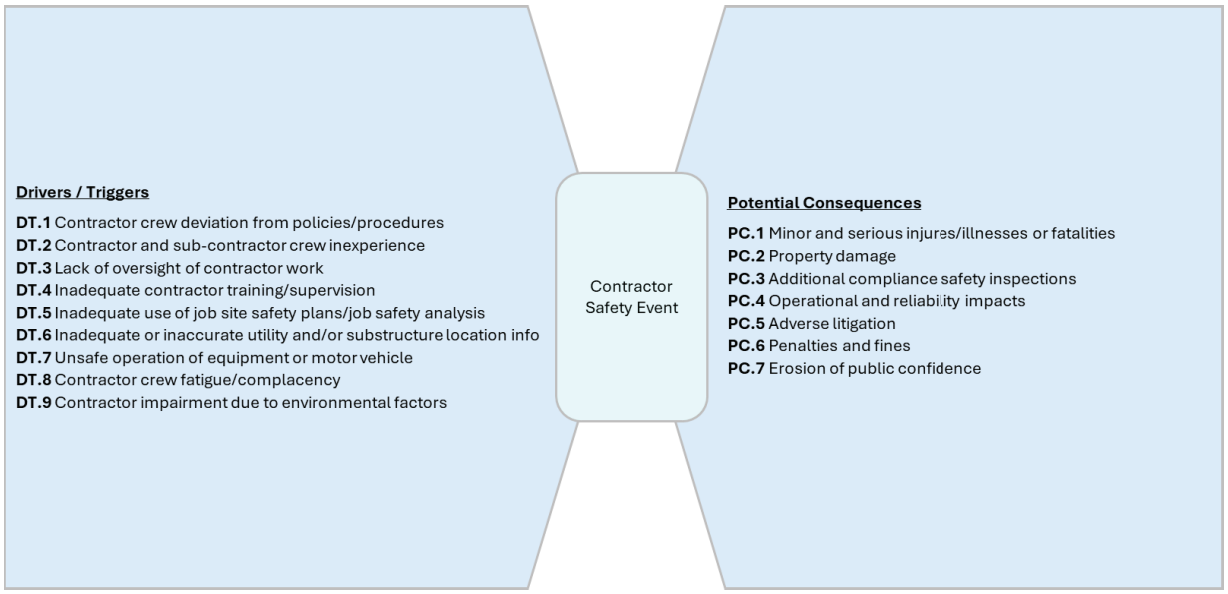
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7 In the 2021 RAMP Report, Chapter SDG&E-Risk-4, this risk was called Incident Involving a Contractor. The risk definition and elements are unchanged.

8 D.24-05-064, RDF Row 9, states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars."

9 D.24-05-064, RDF Row 15.

Figure 1
Contractor Safety Risk: Risk Bow Tie



C. Potential Risk Event Drivers/Triggers[10]

When performing a risk assessment for the Contractor Safety Risk, SDG&E identifies potential causes, referred to as Drivers or Triggers, that reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to the Contractor Safety Risk.[11] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1 – Contractor crew deviation from policies/procedures:** SDG&E has many safety-related policies and procedures for employees and contractors to follow. Failure of a contractor to adhere to a company safety policy or procedure could result in a safety-related event.
- **DT.2 – Contractor and sub-contractor crew inexperience:** Contractors and sub-contractors used by SDG&E are expected to hire experienced employees to perform the work required. Failure of contractors to hire and utilize experienced employees for their work could lead to a safety-related event.

[10] An indication that a risk could occur. It does not reflect actual or threatened conditions.

[11] D.24-05-064, RDF Row 10-11.

- **DT.3 – Lack of oversight of contractor work:** Oversight by SDG&E is an integral part of managing work performed by contractors, not only from a work quality perspective, but also to verify that safe work practices are being followed. A lack of oversight of a contractor's work could lead to departures from safe work practices and result in a safety-related event.
- **DT.4 – Inadequate contractor training/supervision:** SDG&E expects its contractors and subcontractors to train and supervise their employees to reduce the likelihood of an incident. Inadequate training or the lack of sufficient supervision could be a cause of a safety-related event.
- **DT.5 – Inadequate use of job site safety plans/job safety analysis:** Insufficient knowledge of the work environment or improper planning for potential job hazards may lead to a safety-related event while on the job.
- **DT.6 – Inadequate or inaccurate utility and /or substructure location information:** Contractors need to have the proper information about the assets or systems they work on for the benefit of SDG&E. Inadequate or inaccurate utility and/or substructure information could lead to a safety-related event.
- **DT.7 – Unsafe operation of equipment or motor vehicles:** Contractors may utilize their own company vehicles and equipment, or vehicles and equipment owned by SDG&E. The unsafe operation of such could lead to a safety-related event.
- **DT.8 – Contractor crew fatigue/complacency:** Contractors working excessive hours can create unsafe work environments. Also, complacency may reduce the level of awareness to hazards, which could lead to a safety-related event.
- **DT.9 – Contractor impairment due to environmental factors:** Factors such as heat, night work, high-risk work locations (*e.g*. busy roadways), etc., could lead to a contractor becoming impaired, and as a result could potentially lead to a safety-related event.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed to the right side of the risk Bow Tie. SDG&E identifies the Potential Consequences of the Contractor Safety Risk by analyzing internal data

sources where available, industry data,[12] and subject matter expertise (SME).[13] These Bow Tie Consequences inform the CoRE component of the risk score. If one or more of the Drivers/Triggers listed above were to result in a safety-related event, the Potential Consequences, in a plausible worst-case scenario, could include:

- PC.1 – Minor and serious injuries/illnesses or fatalities
- PC.2 - Property damage
- PC.3 - Additional compliance safety inspections
- PC.4 - Operational and reliability impacts
- PC.5 - Adverse litigation
- PC.6 - Penalties and fines
- PC.7 - Erosion of public confidence

These Potential Consequences were used by SDG&E in the scoring of the Contractor Safety Risk during the development of its 2024 ERR.

E. Evolution of Risk Drivers and Potential Consequences

As specified in the Phase 3 Decision,[14] regarding changes to the previous ERR and/or the 2021 RAMP, the title of the risk from the 2021 RAMP has changed from "Incident Involving a Contractor" to "Contractor Safety." No changes to the Drivers/Triggers have been made to the Contractor Safety ERR since the 2021 RAMP. However, changes to the Potential Consequences include:

1. Changes to Potential Consequences of the Risk Bow Tie

- PC.1 - Added "minor injuries" and "illnesses" to serious injuries and fatalities Consequence, which was not included in the 2021 RAMP Bow Tie for the Contractor Safety Risk. Minor injuries and illnesses are included as attributes that were used in determining the safety risk value which is required by D.24-05-064,

[12] Industry data includes data from SDG&E's annual Safety Performance Metrics Report (SPMR) and Centers for Disease Control and Prevention (CDC), *Web-based Injury Statistics Query and Reporting System (WISQARS) Cost of Injury*, *available at:* https://wisqars.cdc.gov/cost/?y=2023&o=MORT&i=0&m=20810&g=00&s=0&u=TOTAL&u=AVG&t=COMBO&t=MED&t=VPSL&a=5Yr&g1=0&g2=199&a1=0&a2=199&r1=MECH&r2=INTENT&r3=NONE&r4=NONE.

[13] D.24-05-064, RDF Row 10.

[14] D.24-05-064, RDF Row 8.

RDF Row 9, and therefore were added to Potential Consequences for the 2025 RAMP Bow Tie.

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and in accordance with Row 14 of the RDF, SDG&E applied the Homogeneous Tranching Methodology (HTM) as outlined in Chapter RAMP-3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:[15]

Table 1: Contractor Safety Risk Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches
Electric Operations	1	1
Gas Operations	1	1
Construction Management	1	1
Vegetation Management	1	1
Miscellaneous	1	1
TOTAL	**5**	**5**

Attachment D illustrates the derivation of the Tranches, as shown in Table 1 above, in accordance with the HTM. The classes were identified by SDG&E as logical groups based on the Company's operations. These classes also align risk treatments with risk profiles reflective of SDG&E operations. More detailed Tranche information, including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches, is provided in workpapers.

III. PRE-MITIGATION RISK VALUE

In accordance with the RDF Row 19, the table below provides the pre-mitigation risk values for the Contractor Safety Risk. Further details, including pre-mitigation risk values by Tranche, are provided in workpapers. Explanations of the risk quantification methodology and

[15] Note that Contractor Safety Risk, as a human-based safety risk, does not feature the natural segmentation characteristics that asset-based risks do, which limits the number of viable Tranches (essentially to one Tranche per class).

other higher-level assumptions are provided in Chapter RAMP-3 Risk Quantification Framework.

Table 2: Contractor Safety Risk
Monetized Risk Values
(Direct, in 2024 $ millions)

LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]
	Safety	Reliability	Financial		
61.17	$0.23	$0.00	$0.01	$0.24	$14.56

A. Risk Value Methodology

SDG&E's risk modeling for the Contractor Safety Risk follows RDF guidance[16] for implementing a Cost Benefit Approach, as described below:

1. **Cost Benefit Approach Principle 1 – Attribute Hierarchy (RDF Row 2):** Contractor Safety Risk is quantified in a combined attribute hierarchy as shown in the table above, such that Safety, Reliability, and Financial are presented based on available, observable, and measurable data.
2. **Cost Benefit Approach Principle 2 – Measured Observations (RDF Row 3):** Contractor Safety Risk used observable and measurable data in the estimation of CoRE values. SDG&E utilized internal incident data to represent natural units for contractor injuries. These injuries were classified as either Minor, Serious, or Unsurvivable and assigned the corresponding fractional VSL value (0.003, 0.253, and 1.0, respectively) as described in Chapter RAMP-3.
3. **Cost Benefit Approach Principle 3 – Comparison (RDF Row 4):** Contractor Safety Risk utilized proxy data as provided by various sources including, but not limited to, Bureau of Labor Statistics (to determine a proration of SDG&E's contractor base versus the national working population), Social Science Research Network (to determine impact of manual entries rather than a statistical software), and Accident Analysis and Prevention from Indiana University of

[16] D.24-05-064, RDF Rows 2-7.

Pennsylvania (to determine impact of data analysis). Please refer to Attachment B for specific details regarding these sources.

4. **Cost Benefit Approach Principle 4 – Risk Assessment (RDF Row 5):** Data distributions were not applicable for the proxy-driven risk events modeled for the Contractor Safety Risk components. For those components, probabilities of future events were derived based on internal recorded data from past years or supplemented with national data where applicable.

5. **Cost Benefit Approach Principle 5 – Monetized Levels of Attributes (RDF Row 6):** In accordance with D.22-12-027 and D.24-05-064, RDF Row 6, SDG&E used a California-adjusted Department of Transportation monetized equivalent to calculate the Safety CoRE attribute at a monetized equivalent of $16.2 million per fatality, $49 thousand per minor injury, and $4.1 million per serious injury;[17] and the Financial CoRE attribute is valued at $1 per dollar.[18] Gas and Electric Reliability are quantified as $0 due to the lack of empirical and proxy data supporting reliability consequences occurring from employee safety incidents.

Further information regarding SDG&E's quantitative risk analyses, including raw data, calculations, and technical references are provided in workpapers.

6. **Cost Benefit Approach Principle 6 – Adjusted Attribute Level (RDF Row 7):**

Table 3: Contractor Safety Risk
Risk Scaled vs Unscaled Value by CoRE Attributes
(Direct, in 2024 $ millions)

	Safety	Reliability	Financial	Total
Unscaled Risk Value	$13.76	$0	$0.80	$14.56
Scaled Risk Value	$13.76	$0	$0.80	$14.56

The values in the table above are the result of SDG&E applying the risk scaling methodology described in Chapter RAMP-3 to the CoRE attributes for the Contractor Safety Risk. Contractor Safety does not feature risk aversion scaling impact because no observed

[17] *See* D.22-12-027 at 35 ("We adopt Staff's recommendation to require a dollar valuation of the Safety Attribute in the Cost-Benefit Approach in the RDF using the DOT VSL as the standard value.").

[18] S*ee* Chapter RAMP-3: Risk Quantification Framework, Section II.

events rise to the level at which scaling is applicable, and the magnitudes of the consequences are not as high (*e.g.*, multiple-fatality event) as can occur with other risks.

For further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply, please refer to Chapter RAMP-3.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section identifies and describes the controls and mitigations for the Contractor Safety Risk and reflects changes expected to occur from the last year of recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). For clarity, a current activity that is included in the plan may be referred to as either a control or a mitigation. Table 4 below shows which control activities are in place in 2024, and which are expected to be on-going, completed, or new during the 2025-2031 time periods. Because the TY 2024 GRC proceeding established rates through 2027,[19] information through 2027 is calculated as part of the baseline risk, in accordance with D.21-11-009.[20] For the TY 2028 GRC, SDG&E calculated CBRs beginning with TY 2028 and for each Post-Test Year (PTY) (2029, 2030, and 2031).[21]

Table 4: Contractor Safety Risk
2024-2031 Control and Mitigation Plan Summary

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C301	**Class 1 Contractor Safety Program**	X	Ongoing
C304	**Contractor Safety Field Oversight**	X	Ongoing
M307	Risk Informed Class 1 Contractor Safety Program Management		2025[22]

Bold *indicates this control/mitigation includes mandated programs/activities.*

[19] *See* D.24-12-074.

[20] *See,* D.21-11-009 at 136, Conclusions of Law 7 (providing a definition for "baselines" and "baseline risk").

[21] In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

[22] This is the planned in-service year for the mitigation.

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place"[23] *(i.e.,* activities in this section were in place as of December 31, 2024). Controls that will continue as part of the risk mitigation plan are identified in Table 4 above.

C301: SDG&E Contractor Safety Program:

The SDG&E Contractor Safety Program oversees and manages Class 1 contractors to confirm work is being performed safely and risk is being managed effectively. This program is primarily managed by SDG&E's Contractor Safety Services (CSS). SDG&E's CSS team is made up of both internal and contracted resources to support the various activities to confirm contractors are working safely. SDG&E operating groups also have field safety oversight responsibilities for all construction work being performed by Class 1 Contractors working for their respective groups. Field Safety Oversight (C304) is discussed below.

For purposes of the Contractor Safety Program, SDG&E institutes a number of safeguards to confirm that all contracted work is performed in accordance with Cal OSHA regulations, applicable laws, Commission Orders, such as General Order (GO) 95, Rules for Overhead Electric Line Construction, and GO 128 Rules for Construction of Underground Electric Supply and Communications Systems. Safeguards include:

- **Safety Requirements**: Adherence to the Contractor Safety Program Standard for SDG&E and the Class 1 Contractor Safety Manual to confirm each group is adhering to the same requirements and/or standards.
- **Administrative Activities**: Administrative activities associated with Class 1 Contractor work such as educating contractors and internal resources on the program requirements, assisting with program compliance, and following up with contractors that fall out of compliance.
- **Contractor Pre-Qualification**: Pre-qualification of all Class 1 Contractors according to SDG&E's Contractor Safety Program.
- **Safety Pre-Work**: Requiring Pre-work Safety Meeting Notices and Acknowledgement Forms. Notifications to contractors of known hazards,

[23] D.18-12-014 at 33.

followed by meetings with contractors to discuss hazards and mitigations that are jointly acknowledged before performing work.

- **Contract Requirements**: All new and existing contracts and Master Service Agreements (MSAs) between SDG&E and a contractor state that compliance with SDG&E's Class 1 Contractor Safety Manual is a requirement of the contract terms and conditions. SDG&E currently uses certain third-party administration tools to verify that contractors comply with SDG&E's established safety requirements according to the Class 1 Contractor Safety Manual and the MSA contractual requirements.

SDG&E leverages third-party software administrator, ISNetworld, to monitor risk in a cost-effective manner. ISNetworld is used to house and verify the established SDG&E pre-qualification requirements for Class 1 Contractors. It contains historical safety-related performance for all Class I contractors who perform work for SDG&E. ISNetworld also gives SDG&E a place to communicate with contractors. ISNetworld monitors new and changing Cal/OSHA requirements, verifies SDG&E's Class 1 Contractors meet minimum Cal/OSHA requirements for written safety programs for the work performed, and grades Class 1 Contractors according to the pre-qualification criteria SDG&E establishes. The nationwide-level data captured by the third-party administration program is reviewed by SDG&E to standardize the pre-qualification process as well as for selection of Class 1 contractors. Absent third-party software administration tools, SDG&E would need additional resources and dedicated support to perform these activities.

SDG&E strives to promote a positive safety culture with its contractors through outreach, education, and collaboration. SDG&E starts with its Company culture, values, and the way it does business. SDG&E not only establishes touchpoints throughout the year with contractors but identifies items during the year where collaboration or improvement should be reviewed and implements mitigation measures for any identified gaps. SDG&E holds an Annual Contractor Safety Summit and Contractor Safety Quarterly Meetings to provide a forum to share industry leading best practices with contractors, communicate new requirements, gives contractors the opportunity to collaborate with SDG&E on safety, and foster an improved safety culture for contractors and SDG&E. The Contractor Safety Summit is a broad-scoped meeting with focused attendance from SDG&E and Class 1 Contractor senior leadership. The quarterly safety

meetings are attended by SDG&E and Class 1 Contractor senior leadership, but field-level personnel are also encouraged to attend.

Additionally, SDG&E engages its internal workforce and Class 1 Contractors with periodic safety culture assessments to better gauge where it is with the safety culture and maturity of the Contractor Safety Program. The results of these assessments are used for action planning and upcoming initiatives targeted to improve safety and cultural gaps.

SDG&E's Contractor Safety Program offers several key benefits that help reduce safety risks, including:

1. **Hazard Identification and Mitigation**: A structured contractor safety program reduces the risk of safety-related events by promoting safe work practices so that potential hazards are identified and addressed before contractors begin work.
2. **Compliance with Regulations**: The Program confirms that contractors comply with relevant safety regulations and standards, reducing the risk of safety-related events.
3. **Enhanced Communication**: The Program encourages and provides opportunities for clear communication channels between SDG&E and its Class 1 Contractors, which improve the dissemination of safety protocols and procedures so that everyone is on the same page with respect to safety.
4. **Training Verification**: Regular safety training for contractors confirms they are aware of the latest safety practices and protocols, which helps in maintaining a safe working environment.
5. **Incident Reduction**: By proactively managing safety, SDG&E can reduce the number of safety-related events and near-misses, leading to a safer workplace.
6. **Improved Safety Culture**: SDG&E's strong Contractor Safety Program fosters a culture of safety among contractors, encouraging them to prioritize safety in their daily activities.

C304: Contractor Safety Field Oversight

The Contractor Safety Field Oversight program confirms contracted work being performed on behalf of SDG&E is being performed safely and risk is being managed effectively. SDG&E's CSS oversees safety for all operating groups that use Class 1 Contractors, including Contractor Safety Field Oversight. Contractor Safety Field Oversight uses mostly contracted

safety professionals. Internal resources are also used to support the data received by new Class 1 Contractors and business units in order to pre-qualify, process, track, trend, and communicate safety data. Contractor Safety Field Oversight contracted safety professionals perform field level safety assessments on Class 1 Contractors who perform work on behalf of SDG&E. Contractor Safety Field Oversight duties include, but are not limited to, the following:

Safety inspections/observations: This is a proactive measure to observe and confirm contractors are working in accordance with appropriate work methods. If at-risk behaviors are identified they are documented, tracked, and corrected.

Incident/Near Miss response, review, and investigation: When an incident occurs, a CSS Team Lead dispatches the appropriate individual to document the incident initial findings. Initial findings are used in conjunction with reviewing contractors' incident reports to confirm accuracy.

Pre-work safety meetings: Contractor Safety Field Oversight safety professionals perform jobsite reviews with all parties involved to identify potential hazards and mitigations prior to work starting and also review site specific safety plans when SDG&E requires contractors to submit them.

Contractor Safety Scorecard: SDG&E's CSS team collects and utilizes the field level data submitted from Class 1 contractors working on SDG&E projects in order to supply a safety grade for future work. This is a proactive approach to SDG&E's contractor vetting and selection process.

B. Changes from 2024 Controls

SDG&E plans to continue each of the existing controls discussed above, and reflected in Table 4, through the 2025-2031 period without significant changes.

C. Mitigation Programs

SDG&E's mitigation program is intended to enhance and strengthen SDG&E's current Contractor Safety Program to continually advance its safety culture and mature as a learning organization. SDG&E intends to implement the following mitigation program:

- **M307:** Risk Informed Class 1 Contractor Safety Program Management

M307: Risk Informed Class 1 Contractor Safety Program Management

SDG&E regularly reviews, measures, and assesses the effectiveness of its safety programs and takes a proactive and preventative approach to safety. SDG&E plans to enhance

its Class 1 Contractor Safety Program by implementing High Energy Control Assessments (HECAs). Introduction of HECAs would provide enhanced data analytic capabilities for proactive and preventive action. Additionally, SDG&E plans to expand its Class 1 Contractor Safety Program by leveraging data analytic software and tools. Risk reduction benefits would include:

1. **Enhanced Safety Performance**: HECA is a method of measuring performance by assessing the extent to which front-line employees are protected against life-threatening hazards. By identifying high energy hazards and ensuring corresponding direct controls, SDG&E could further mitigate the risk of serious injuries or fatalities.
2. **Consistent Measurement**: HECA provides a standardized method for measuring safety performance within SDG&E and externally. This consistency allows for reliable and comparable safety metrics, which is essential for making informed decisions and improving safety protocols.
3. **Improved Risk Management**: Utilizing a risk management and data analytics technology platform allows for better identification, assessment, and mitigation of high-energy hazards. This technology can provide real-time data and insights, enabling proactive measures to prevent accidents and enhance overall safety.

Together, HECA and enhanced data analytic capabilities will allow SDG&E to make more data-driven and risk-prioritized decisions. By leveraging data analytics, SDG&E can track safety performance, identify trends, and make more data-driven decisions to improve safety measures. This approach not only enhances safety with proactive and preventative measures but also optimizes resource allocation and operational efficiency.

SDG&E's planned expansion of its Contractor Safety Program with internal resources will advance HECA operationalization and predictive data analytics. Additional internal resources should improve review of new incoming data, assist with development of mitigation measures, as well as enhance internal and external safety communication. The planned expansion of the program would also allow for improved HECA training of safety observers in the field for the purpose of enhancing efficiency and consistency of data collection to support reduction of SIF events.

D. Climate Change Adaptation

Pursuant to Commission decisions[24] in the Climate Adaptation OIR (R.18-04-019), SDG&E performed a Climate Adaptation Vulnerability Assessment (CAVA) focused on years 2030, 2050, and 2070, with the aim of identifying asset and operational vulnerabilities to climate hazards across the SDG&E system. SDG&E recognizes the need to address climate vulnerabilities to promote the safety and reliability of its services and mitigate the increasing climate-related hazards through innovative and community-centric approaches. Some of the climate hazards that will have short- and long-term ramifications in the San Diego region include extreme temperatures, wildfire, inland flooding, coastal flooding and erosion, and landslides. Climate change is recognized as a factor that can drive, trigger, or exacerbate multiple RAMP risks. Implementing climate change adaptation measures and integrating climate vulnerability considerations into RAMP controls and mitigations can enhance system infrastructure longevity and reduce the severity of long-term negative climate impacts. The controls and mitigations described in further detail in this chapter, as shown below, align with the goal of increasing SDG&E's physical and operational resilience to the increasing frequency and intensity of climate hazards. Additional information on the CAVA and a list of climate-relevant controls and mitigations included in RAMP are provided in Chapter RAMP-5: Climate Change Adaptation.

Table 5: Contractor Safety Risk
Controls and Mitigations that Align with Increasing Resilience to Climate Hazards

Relevant ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
M307	Risk Informed Class 1 Contractor Safety Program Management	Extreme Temperatures

E. Foundational Programs

Foundational Programs are "[i]nitiatives that support or enable two or more Mitigation programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[25] There are no Foundational Programs that are applicable to the Contractor Safety Risk and the mitigation activities that are supported.

[24] D.19-10-054; D.20-08-046.

[25] D.24-05-064, RDF at A-4.

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for the Contractor Safety Risk, including the associated costs, units, and CBRs. Additional information by Tranche is provided in workpapers. The costs shown are estimated using assumptions provided by SMEs and available data. In compliance with the Phase 3 Decision,[26] for each enterprise risk, SDG&E uses actual results and industry data, and when that is not available, supplements the data with SME input. Additional details regarding the data and expertise relied upon in developing these estimates are provided in Attachment B.

Table 6: Contractor Safety Risk
Control and Mitigation Plan Recorded and Forecast Costs Summary
(Direct, in 2024 $ thousands)

Control/Mitigation		Adjusted Recorded		Forecast Costs			
ID	**Name**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C301	**Class 1 Contractor Safety Program**	0	1,018	1,092	0	0	3,276
C304	**Contractor Safety Field Oversight**	4,754	0	0	19,212	14,409	0
M307	Risk Informed Class 1 Contractor Safety Program Management	0	0	184	224	168	552
Total		**4,754**	**1,018**	**1,276**	**19,436**	**14,577**	**3,828**

Bold *indicates this control/mitigation includes mandated programs/activities.*

Table 7: Contractor Safety Risk
Control & Mitigation Plan – Units Summary

Control/Mitigation		Recorded Units			Forecast Units			
ID	**Name**	**Unit of Measure**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C301	**Class 1 Contractor Safety Program**	FTEs	0	6	6	0	0	18
C304	**Contractor Safety Field Oversight**	Class 1 Contractor Hours	7,249,839	0	0	28,999,356	21,749,517	0

[26] D.24-05-064, RDF Row 10.

Control/Mitigation		Recorded Units			Forecast Units			
ID	Name	Unit of Measure	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
M307	Risk Informed Class 1 Contractor Safety Program Management	FTEs	0	0	1	4	3	3

Bold *indicates this control/mitigation includes mandated programs/activities.*

In the table below, CBRs are presented in summary at the mitigation or control level for the TY 2028 GRC cycle. CBRs are calculated based on scaled, expected values, unless otherwise noted, and are calculated for each of the three required discount rates[27] in each year of the GRC cycle and for the post-test years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in workpapers.

Table 8: Contractor Safety Risk
Cost Benefit Ratio Results Summary (2028-2031)
(Direct, in 2024 $ millions)

ID	Control/Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C301	**Class 1 Contractor Safety Program Oversight**	$0.0	$4.4	2.87	3.06	2.87
C304	**Contractor Safety Field Oversight**	$19.2	$0.0	2.14	2.28	2.14
M307	Risk Informed Class 1 Contractor Safety Program Management	$0.22	$0.74	0.45	0.48	0.45
A394	Contractor Safety Data Analytics & Support	$0.0	$1.9	0.53	0.57	0.53
A395	Dedicated Contractor Safety Field Oversight Team	$12.7	$0.0	1.51	1.61	1.51

Bold *indicates this control/mitigation includes mandated programs/activities.*

Tranche-level CBRs by year and in aggregate for each mitigation are provided in workpapers.

[27] *See* Chapter RAMP-3 for definitions of discount rates, as ordered in the Phase 3 Decision.

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025, D.16-08-018, and D.18-12-014[28] SDG&E considered two alternatives to the risk mitigation plan for the Contractor Safety Risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this plan considers changes in risk reduction, cost, reasonableness, current conditions, modifications to the plan, and constraints, such as budget and resources.

Table 9: Contractor Safety Risk
Alternative Mitigation Plan Forecast Cost Summary
(Direct, in 2024 $ thousands)

Alternative Mitigation		Forecast Costs			
ID	**Name**	**2025-2028 Capital**	**PTY Capital**	**2025-2028 O&M**	**PTY O&M**
A394	Contractor Safety Data Analytics & Support	0	0	1,980	1,485
A395	Dedicated Contractor Safety Field Oversight Team	12,708	9,531	0	0
Total		**12,708**	**9,531**	**1,980**	**1,485**

Table 10: Contractor Safety Risk
Alternative Mitigation Costs Benefit Ratio Results Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A394	Contractor Safety Data Analytics & Support	$0	$495	0.53	0.57	0.53
A395	Dedicated Contractor Safety Field Oversight Team	$3,177	$0	1.51	1.61	1.51

A. Alternative 394: Contractor Safety Data Analytics & Support

This is an alternative approach to M307. As described above, SDG&E plans to expand its Class 1 Contractor Safety Program by leveraging data analytic software and internal resources to implement HECAs and assess the output of the assessment data. Introduction of HECAs would mitigate Contractor Safety Risk and provide enhanced data analytic capabilities for proactive and preventive action. Risk reduction benefits of M307 are described above.

[28] *See, e.g.,* D.18-12-014 at 33-35.

In developing its planned mitigation (M307), SDG&E assessed the option of leveraging additional fully dedicated internal personnel to manually collect safety observation, inspection and HECA data in lieu of the planned technology to provide a centralized data resource and risk software. Without data analytic software, as included in M307, SDG&E would need to dedicate additional employee resources not accounted for in M307 to manually collect and assess data in lieu of the data analytic software. Having a larger internal dedicated team of data specialists to collect and assess HECA data could enhance the Contractor Safety Program by improving identification and mitigation of risks associated with high energy hazards. Key risk reduction benefits, in addition to those identified above, include:

- **Enhanced Hazard Identification**: HECA data helps in identifying high-energy hazards that might not be immediately obvious. Having a larger team to assess and follow-up could allow for additional proactive risk identification and mitigation.
- **Improved Control Measures**: Having a larger team to assess the effectiveness of existing controls could allow for implementation of more robust measures and controls to mitigate high energy risks.
- **Enhanced Data-Driven Decision Making**: HECA data provides a comprehensive understanding of risk factors, enabling smarter, data-driven decisions during the design and planning stages of projects. A larger support team could improve data-driven decision making for supported teams such as SDG&E's Engineering, Design, Operations and Planning teams.
- **Benchmarking and Continuous Improvement**: Regular assessment and benchmarking of high energy controls facilitate continuous improvement in safety practices, helping to set and achieve incremental safety goals. A larger team could engage in additional benchmarking efforts industry wide.
- **Focused Safety Discussions**: HECA data can guide focused crew discussions about the adequacy of controls before work begins. A larger support team could improve communication of potential hazards and precautions.
- **Reduced At-Risk Exposures**: By identifying gaps in control measures and addressing them promptly, HECA data helps reduce the rate of at-risk exposures, thereby lowering the likelihood of serious injuries or fatalities. A larger support

team could improve processes for tracking and follow-up on identified gaps or at-risk exposures.

Overall, having a larger data collection and analytic support team in lieu of a smaller team that leverages data analytic software as included in M307, to collect, review and access HECA data is a proactive approach to HECA management and contractor safety. However, this approach would require more resources and would not provide the risk reduction benefit of having centralized data analytic software and technology to identify and assess risk company-wide. A centralized safety data repository offers several risk reduction benefits that would not be present with this Alternative Mitigation, including:

1. **Improved Data Accuracy**: Centralizing data allows for updates to be made in one place, reducing the risk of inconsistencies and errors.
2. **Enhanced Security**: With data stored in a single location, it is easier to apply and monitor security protocols, access controls, and permissions uniformly.
3. **Risk-Informed Decision-Making**: Access to comprehensive and up-to-date information helps in identifying patterns and trends, leading to more informed decisions.
4. **Increased Efficiency**: Centralized data is easier to access and manage, reducing the time and effort needed to find and update information.
5. **Standardization**: A centralized repository can adopt global data standards, improving the consistency and interoperability of data across different systems.
6. **Reduced Duplication**: By consolidating data, organizations can avoid redundant data collection and storage, leading to more efficient use of resources.

These benefits collectively contribute to a more secure, efficient, and reliable safety data management system, ultimately reducing risks associated with data handling and decision-making. As such, SDG&E is not currently pursuing a larger team to manually collect and manage safety data in lieu of a centralized data management system.

B. Alternative 395: Dedicated Contractor Safety Field Oversight Team Mitigation

This is an alternative approach associated with C301 and C304. As described above in C301 and C304, SDG&E's Contractor Safety Program oversees and manages Class 1 Contractors to confirm work is being performed safely and risk is being managed effectively. This program is primarily managed by SDG&E's CSS department and is comprised of both

internal and contracted resources to support the various activities to confirm contractors are working safely.

This Alternative Mitigation would include adding internal resources (vs. contracted support staff) to support these contractor field safety oversight activities. A dedicated team of internal resources would be present in the field to oversee contractor work to promote safe work practices, including field safety observations and engagements, contractor event documentation, pre-construction meetings, and weekly/monthly meetings.

Having a dedicated team of internal support for these efforts could provide several risk reduction benefits, including:

1. **Hazard Identification and Mitigation**: An internal field safety oversight team could promote safe work practices and potentially improve identification of potential hazards for mitigation before contractors begin work.
2. **Compliance with Regulations**: An internal field safety oversight team could continue SDG&E's current practice of confirming and validating that all contractors comply with relevant safety regulations and standards, potentially reducing the likelihood of safety incidents.
3. **Enhanced Communication**: An internal field safety oversight team could provide enhanced two-way safety communication. Clear communication channels between SDG&E and its Class 1 Contractors improves the dissemination of safety protocols and procedures so that everyone is on the same page with respect to safety.
4. **Increased Training Verification**: An internal field safety oversight team could provide improved continuity of verification of training records as internal resources would remain on staff whereas contracted field safety support functions may decrease as projects conclude. Regular safety training for contractors confirms they are aware of the latest safety practices and protocols, which helps in maintaining a safe working environment.
5. **Potential Incident Reduction**: An internal field safety oversight team could serve as additional resources for proactive safety management. The level of contracted support varies as projects start and end. Use of internal resources could

support administrative functions on a continuous basis and assist with proactive safety management to potentially reduce incidents and near misses.

While this Alternative approach could provide several risk reduction benefits, it is not currently planned as SDG&E believes the approach described above in C301 and C304 provides more benefits. Given the fluctuation in workload and the required expertise to perform contractor safety oversight functions across various work types, SDG&E leverages contracted support in lieu of internal resources. Internal employees provide less flexibility to make adjustments based on work scope, workload, and required skill set. Therefore, this Alternative Mitigation is not currently planned.

VI. HISTORICAL GRAPHIC

As directed by the Commission in the Phase 2 Decision, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. A bar chart graphic is employed to depict historical progress. This graphic uses a key metric that aligns with Company safety goals to illustrate trends in historical progress and identify remaining tasks necessary to continue mitigating risks.

Figure 2
Contractor Safety Risk Mitigation
DART Rate

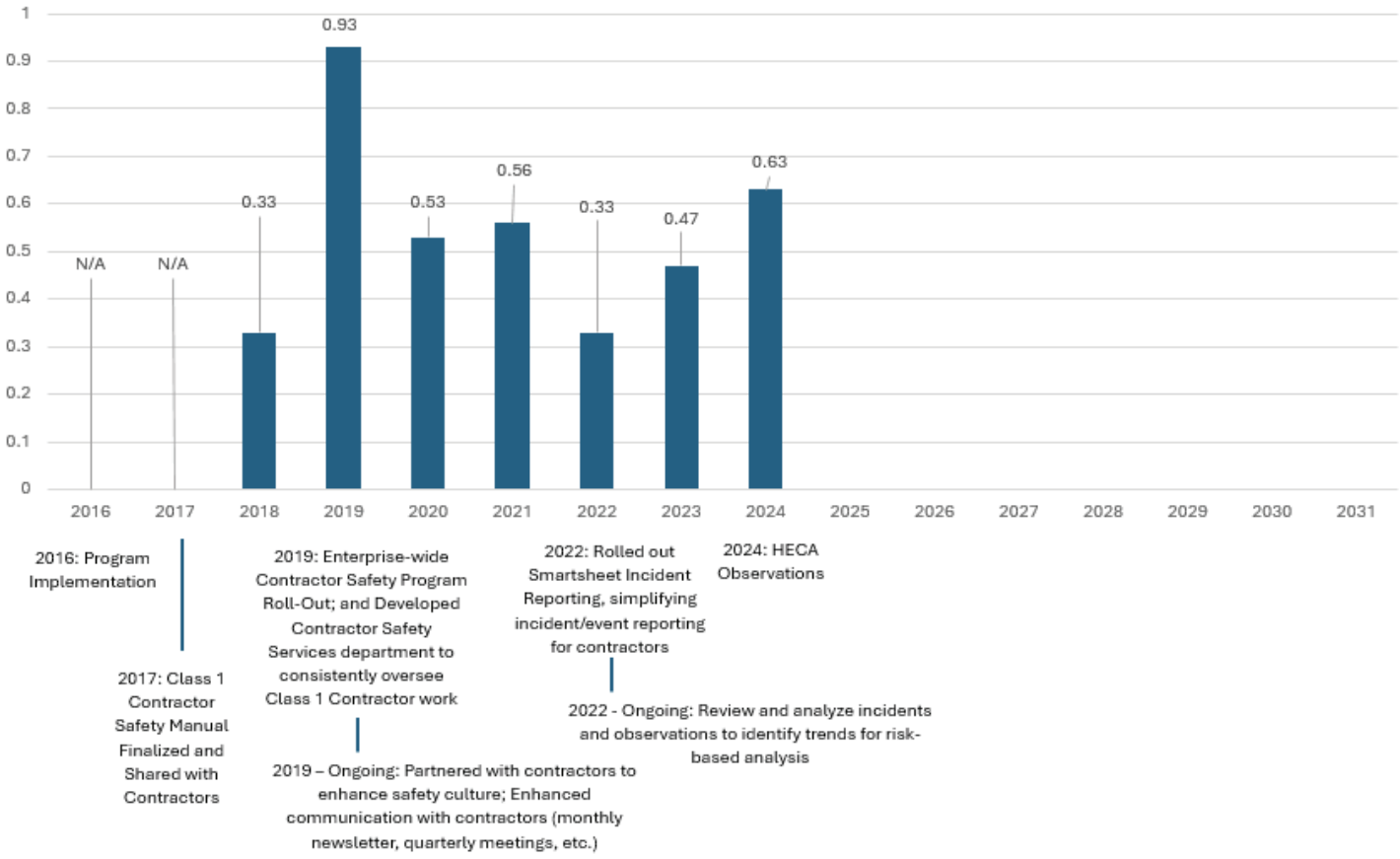


Figure 2 above shows the historical safety work activities completed using the Contractor Days Away, Restricted and Transfer (DART) Rate[29] from 2016-2024. SDG&E began tracking DART Rate for Class 1 Contractors in 2018. The DART Rate is calculated based on the number of OSHA-recordable injuries resulting in Days Away from work and/or Days on Restricted Duty or Job Transfer, and hours worked. (DART Rate = DART Cases times 200,000 divided by contractor hours worked.)

The safety work that remains to be performed is addressed in the controls/mitigations detailed above.

[29] Contractor DART Rate is Metric No. 19 in SDG&E's 2024 Safety Performance Metrics Report, filed on April 1, 2025.

ATTACHMENTS

ATTACHMENT A
CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates the compliance Drivers that underpin identified controls and mitigations.

ID	Control/Mitigation Name	Compliance Driver
C301	Class 1 Contractor Safety Program	CPUC

ATTACHMENT B

CONTRACTOR SAFETY - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision at RDF Row 10 and Row 29 directs each utility to identify Potential Consequences of a Risk Event using available and appropriate data.[30] Appropriate data may include Company specific data or industry data supplemented by the judgment of subject matter experts. Provided below is a listing of the inputs utilized as part of this assessment and a description of the data applied.

Risk Data	Source Type	Source Information
OSHA Industry Rates	External Data	Agency: Bureau of Labor Statistics Link: https://www.bls.gov/web/osh/table-1-industry-rates-national.htm#soii_n17_as_t1.f.1 Description: Comparing SDG&E OSHA rate to industries OSHA rate.
TRC Rate Safety Management System (SMS)	External Data	Agency: Indiana University of Pennsylvania Link: https://www.sciencedirect.com/science/article/pii/S0001457513002972#sec0060 Description: Safety Management System has an effectiveness of 9%.
The Role of Statistical Software in Data Analysis	External Data	Department: Social Science Research Network Link: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2532326 Description: Statistical Software has an 80% positive impact on their research result as compared manual data entry.
Financial Consequences	External Data	Agency: Centers for Disease Control and Prevention Link: https://wisqars.cdc.gov/cost/?y=2022&o=TAR&i=0&m=3000&g=00&s=0&u=TOT

[30] D.24-05-064, RDF Row 10 and Row 29.

Risk Data	Source Type	Source Information
		AL&u=AVG&t=COMBO&t=MED&t=LIFE&t=WORK&a=5Yr&g1=0&g2=199&a1=0&a2=199&r1=MECH&r2=INTENT&r3=NONE&r4=NONE&c1=NONE&c2=NONE Description: Centers for Disease Control and Prevention estimated the cost of the injury as per the cause.
Contractor Safety Program Oversight	Internal SME Data	Description: Hiring all the employees rather than the contractor would be 20% less effective.

ATTACHMENT C

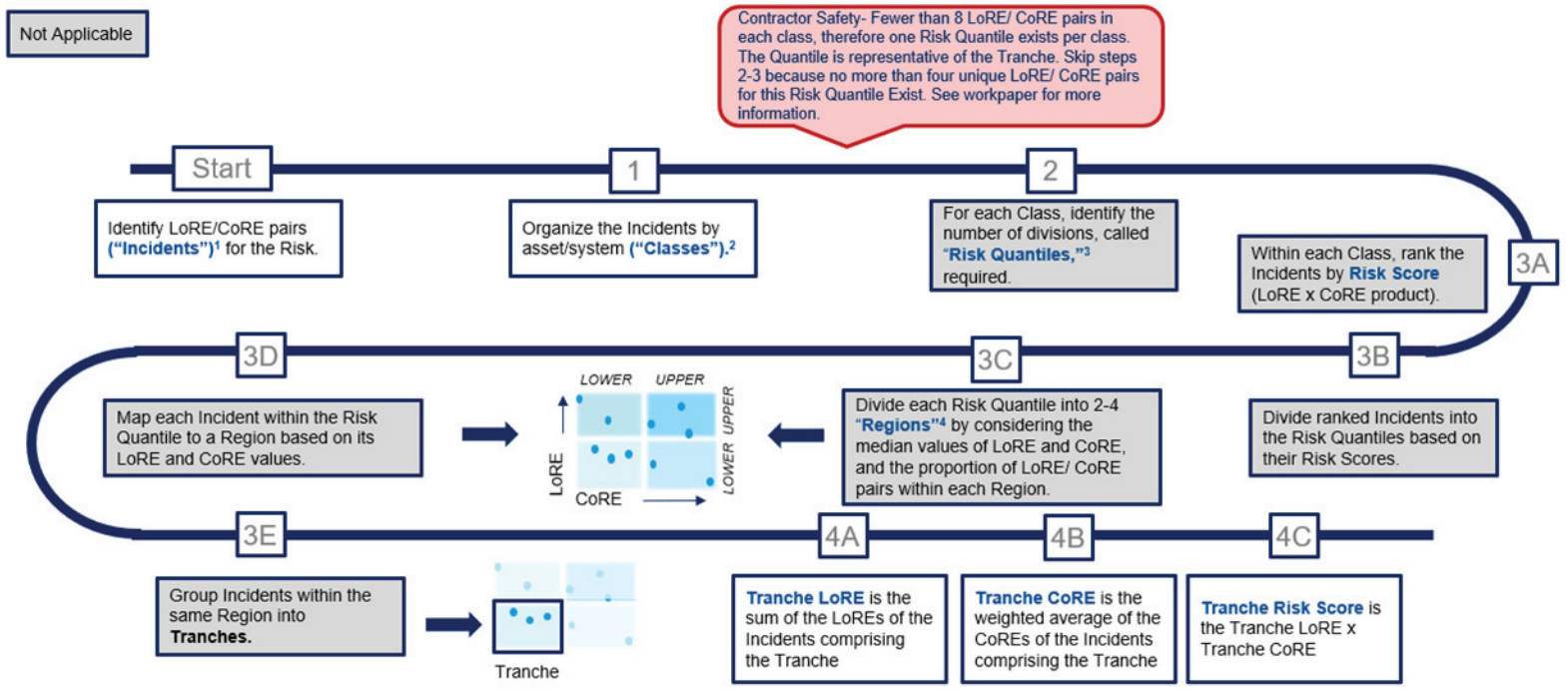
CONTRACTOR SAFETY - SUMMARY OF ELEMENTS OF BOW TIE

SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
C301	Class 1 Contractor Safety Program Management	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7, DT.8, and DT.9	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, and PC.7
C2	Contractor Safety Field Oversight	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7, DT.8, and DT.9	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, and PC.7
M1	Risk Informed Class 1 Contractor Safety Program Management	DT.1, DT.2, DT.3, DT.4, DT.5, and DT.7	PC.1, PC.2, PC.4, PC.5, PC.6, and PC.7

ATTACHMENT D

CONTRACTOR SAFETY - APPLICATION OF TRANCHING METHODOLOGY

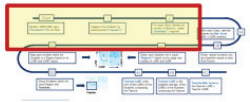
A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP - 3: Risk Quantification Framework is provided.



NOTES

[1]*For example, **Incidents (or "Risk Incidents")** for Contractor refer to safety incidents.*
[2]*For example, **Classes (or "Asset Classes")** for Contractor Safety include Electric Ops, Gas Ops, Vegetation Management, Construction Management, Miscellaneous .*
[3]***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*
[4]*The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*

Not Applicable



Start

1

2

Identify LoRE/CoRE pairs **("Incidents")**[1] for the Risk.

Organize the Incidents by asset/system **("Classes").**[2]

For each Class, identify the number of divisions, called **"Risk Quantiles,"**[3] required.

Class	LORE / CORE PAIRS	TOTAL # PAIRS
Electric Ops	Electric Ops	1
Gas Ops	Gas Ops	1
Vegetation Management	Vegetation Management	1
Construction Management	Construction Management	1
Miscellaneous	Miscellaneous	1

$$\min\left(\frac{N}{8}-1,9\right) < K \leq \min\left(\frac{N}{8},10\right)$$

1

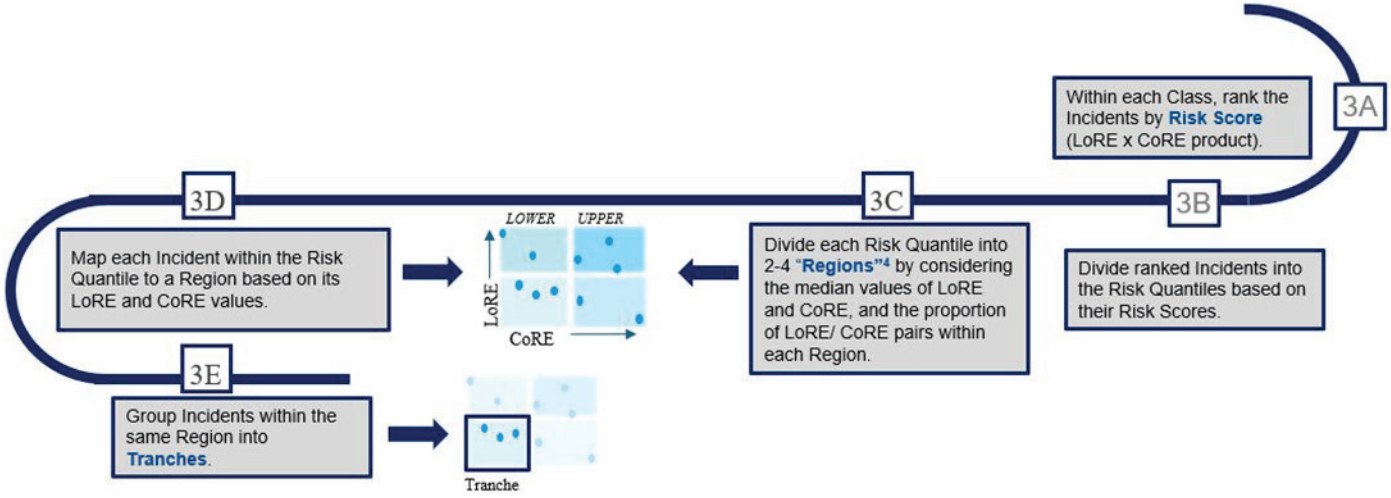
1

1

Skip step 2-3
Continue to Step 4

Not Applicable





Not Applicable



4A

Tranche LoRE is the sum of the LoREs of the Incidents comprising the Tranche

4B

Tranche CoRE is the weighted average of the CoREs of the Incidents comprising the Tranche

4C

Tranche Risk Score is the Tranche LoRE x Tranche CoRE

					4A	4B	4C
Class	**Risk Quantile**	**Incident (LoRE/CoRE) Pair**	**Risk Quantile Region**	**Tranche**	**Tranche LoRE**	**Tranche CoRE**	**Tranche Risk Score**
Electric Ops	1	Electric Ops	None	Electric Ops	5.0	$0.19M	$0.97M
Gas Ops	1	Gas Ops	None	Gas Ops	10.50	$0.53M	$5.59M
Vegetation Management	1	Vegetation Management	None	Vegetation Management	7.50	$0.24M	$1.78M
Construction Management	1	Construction Management	None	Construction Management	15.83	$0.23M	$3.62M
Miscellaneous	1	Miscellaneous	None	Miscellaneous	22.33	$0.12M	$2.61M



2025 Risk Assessment Mitigation Phase

(Chapter SCG-Risk-8/SDG&E-Risk-8)
Cybersecurity

May 15, 2025

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I. INTRODUCTION

The purpose of this chapter is to present Southern California Gas Company (SoCalGas) and San Diego Gas & Electric Company's (SDG&E) (collectively, the Companies) risk control and mitigation plan for the Cybersecurity Risk.[1] This chapter contains information and analysis for this risk that meet the requirements of the California Public Utilities Commission's (Commission or CPUC) Risk-Based Decision-Making Framework (RDF),[2] including the requirements adopted in Decision (D.) 22-12-027 (Phase 2 Decision) and D.24-05-064 (Phase 3 Decision). Although the Cybersecurity Risk does not meet the minimum requirements for mandatory inclusion under the RDF, this risk is included in the 2025 RAMP Report because of its significant reliability consequences. This risk chapter describes the basis for selection of Cybersecurity Risk, the controls and/or mitigations put forth to reduce the likelihood or consequence of this risk, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter presents cost and unit forecasts for the risk mitigating activities, but it does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk-reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation consistent with the method and process prescribed in the RDF.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SoCalGas's and SDG&E's Cybersecurity Risk refers to the risk of a major cybersecurity incident, which results in disruptions to electric or gas operations (Supervisory Control And Data Acquisition (SCADA) system, supply, transmission, distribution) and/or damage or disruption to Company operations (*e.g.*, human resources, payroll, billing, customer services), reputation, or disclosure of sensitive customer or Company data.

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[1] This risk chapter is identical for SoCalGas and SDG&E because the Cybersecurity Risk is managed centrally for the Companies.

[2] As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A.15-05-002 et al. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF requirements, such as those from North American Electric Reliability Corporation's (NERC) Critical Infrastructure Protection (CIP) standards and the Transportation Security Administration's (TSA) Security Directive (SD). A list of compliance requirements applicable to Cybersecurity is provided in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction calculated under the RDF, such as protecting customers, and promoting public trust in the community.

2. Risk Overview

Cybersecurity is critical to the safe and reliable delivery of electric and gas service to customers, including critical infrastructure providers in Southern California (*e.g.*, financial services, telecommunication providers, other utilities). The Companies' service territories include millions of people, one of the nation's busiest ports, some of the country's largest cities, critical military bases, numerous defense contractors and small businesses.

Cybersecurity is a unique risk, as compared to other risks driven by operations and asset management, because it deals with intelligent adversaries that are attempting to achieve their objectives by gaining access to Company systems or information through artifice or other improper means. In addition, gaining information about the Companies' security controls and mitigation plans could be useful to an adversary—not only to directly harm the Companies and their stakeholders, including customers, but also to undermine broader national security and economic stability by exploiting vulnerabilities in critical infrastructure. Cybersecurity threats have continued to increase and have become more complex and impactful year over year. For these reasons, publishing the Companies' Cybersecurity-related controls, intelligence, strategies, and tactics in the public record could aid those adversaries, the bad actors that are attempting to disrupt the Companies' systems and society at large. Sensitive details associated with the content of this chapter are available upon Commission request for discussion in person.

The criticality of Cybersecurity is evidenced by the breadth of adversaries the Companies face. These adversaries include diverse types of threat actors with varying intent to cause harm; they are not just criminal entities or hackers looking to make a political statement or achieve financial gain. They also include advanced adversaries, often aligned to nation-states, that are targeting critical infrastructure for economic exploit, espionage, or covert action in preparation for some overt act (*e.g.*, disrupting energy supply). The Companies current and planned

investment in Cybersecurity are prudent and reasonable to address this existing and growing threat.

Adversaries continue to use an evolving and increasingly more sophisticated set of tools and strategies to conduct attacks on the energy sector. Their suite of capabilities includes advanced malware, complex phishing attacks, identification of non-public vulnerabilities, and ransomware, among others. The Companies' strategy to counter rapidly evolving Cybersecurity threats must be flexible and enable adaption over time. Later in this narrative the discussion delves deeper into these threats and provides recent examples. Accordingly, timely and accurate Cybersecurity Threat Intelligence (CTI) is key to staying abreast of this ever-changing threat landscape. SoCalGas and SDG&E rely on federal, state, and local government partnerships for intelligence feeds along with peer utility industry relationships and private (subscription) based services for Industrial Control Systems (ICS) CTI. The Companies also obtain CTI from a variety of entities and sources, including Information Sharing and Analysis Centers (ISACs), the Federal Bureau of Investigations (FBI), Federal Energy Regulatory Commission (FERC), Department of Energy (DOE), Department of Homeland Security (DHS), Cybersecurity & Infrastructure Security Agency (CISA), Transportation Security Administration (TSA) and other U.S. intelligence community agencies. Information from threat intelligence sources in the utility industry continues to reveal adversaries that are employing advanced tradecraft in their attempts to access the nation's utility systems.

The next section examines the evolving threat landscape, with a focus on vulnerabilities in the Energy sector, which include the gas, bulk power grid, and renewable energy sectors and outlines specific risks to the Companies.

B. Threat Landscape

The cybersecurity threat landscape includes sophisticated adversaries like state-sponsored groups Volt Typhoon and Salt Typhoon (linked to Chinese intelligence) and Fancy Bear (APT28) from Russia, targeting Operational Technology (OT) and ICS environments and critical infrastructure. Cybercriminal organizations, such as the Z-Pentest hacker group, are increasingly attacking OT environments, including water treatment plants, and ransomware syndicates are exploiting these critical systems for higher payouts. Insider threats from employees or contractors with legitimate access also pose significant risks through credential exposure or social engineering schemes.

C. Tactics, Techniques, and Procedures

Tactics, Techniques, and Procedures (TTPs) refer to the specific methods and strategies used by cyber threat actors to achieve their objectives. TTPs include:

- **Remote Access Exploitation**: Attackers use brute-force attacks on Virtual Private Networks (VPNs) and exploit improperly configured remote access capabilities to access critical OT environments.
- **Vishing and Impersonation:** Spoofed calls to executives, impersonating IT staff or vendors, collect sensitive information using advanced voice phishing tactics.
- **Trojanized Software[3] and Watering-Hole Attacks:[4]** Malware in trusted software or websites targets specific organizations, similar to APT28 Fancy Bear campaigns.
- **Reconnaissance and Social Engineering:** Detailed mapping of organizational structures and employee behaviors using spear-phishing, spoofed phone numbers, and tailored watering-hole attacks.
- **Persistent and Adaptive Campaigns:** Persistent adversaries refine methods, focusing on credential theft, bypassing Multi-Factor Authentication (MFA), and data exfiltration.
- **HMI Manipulation:** Targeting programmable logic controllers (PLCs) with human-machine interfaces (HMIs) instead of exploiting zero-day vulnerabilities.
- **Disinformation Campaigns:** Groups like the Cyber Army of Russia (CAR) use disinformation alongside operational attacks, exaggerating control over critical infrastructure to spread propaganda.

D. Key Cyber Threat Vectors

Cybersecurity threat vectors, or attack vectors, are methods or mechanisms cybercriminals use to gain illegal, unauthorized access to computer systems and networks. Common threat vectors include:

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[3] "Trojanized software" refers to legitimate software that has been maliciously altered to include a Trojan horse. A Trojan horse is a type of malware that disguises itself as a benign application but performs harmful activities once installed, such as stealing data or providing unauthorized access to the attacker.

[4] A "watering-hole attack" involves compromising a specific website or group of websites that are frequently visited by the target victims. The attacker infects these sites with malware, which then infects the visitors' systems. The goal is to target a particular group or organization by exploiting their common online habits.

- **Ransomware and Targeted ICS Attacks**: Ransomware gangs prioritize OT environments to disrupt energy delivery systems, leveraging their critical nature to demand higher ransoms.
- **Denial-of-Service (DoS) Attacks**: Persistent DoS attacks degrade ICS and OT system communications, often serving as a precursor to more severe attacks.
- **Third-Party Equipment and Supply Chain Risks**: Vulnerabilities in foreign-manufactured transformers and other components, flagged for embedded backdoors, present ongoing risks.

E. Specific Risks to the Companies

Threats specific to the energy industry include:

- **Vulnerabilities in Renewable Energy Systems**: The FBI has warned of increased cyber threats to renewable energy infrastructure as the sector expands. Adversaries target wind and solar farms, exploiting less mature security controls compared to traditional power grids.
- **Remote Access and Internet-Facing Devices**: Increasing reliance on remote access solutions introduces risks such as credential theft, brute-force attacks, and vishing schemes targeting remote workers and administrators.
- **Vendor and Supply Chain Exploitation**: Attackers compromise third-party vendors to infiltrate utility systems. Vulnerabilities in equipment sourced from foreign manufacturers exacerbate these risks.
- **Reconnaissance and Targeted Social Engineering**: Threat actors conduct sophisticated reconnaissance and launch tailored spear-phishing campaigns against high-level executives, leveraging spoofed communication channels and impersonation tactics.

F. Examples of Attacks Targeting Victims in the United States

1. OT Attacks on Utility Infrastructure

Title: *APT28 Infiltrates Texas Water Utility*

- **Link:** https://apnews.com/article/texas-muleshoe-water-systems-cyberattacks-russia-5f388bf0d581fc8eb94b1190a7f29c3a
- **Summary: July 2020:** APT28 infiltrated a Texas water utility's OT systems through misconfigured remote access points. The attackers manipulated HMIs, disrupting operations and causing a water system to overflow. This incident exposed significant vulnerabilities in OT segmentation and inadequate access

control measures, highlighting the need for improved cybersecurity protocols in critical infrastructure.

***Title**: Colonial Pipeline hack explained: Everything you need to know*

- **Link**: https://www.techtarget.com/whatis/feature/Colonial-Pipeline-hack-explained-Everything-you-need-to-know
- **Summary: May 2021**: The Colonial Pipeline, a major U.S. fuel pipeline supplying nearly 45% of the East Coast's fuel, was forced to shut down after a ransomware attack by the group DarkSide. The attackers exploited a compromised VPN password, leading to widespread fuel shortages and emergency declarations across multiple states. The incident marked one of the most significant cyberattacks on U.S. critical infrastructure and highlighted the urgent need for stronger cybersecurity in the energy sector.

***Title:** CAR Sabotages Texas Water Utilities*

- **Link:** https://www.wired.com/story/cyber-army-of-russia-reborn-sandworm-us-cyberattacks/
- **Summary: April 2024:** CAR, potentially linked to APT44 Sandworm, released videos showing their ability to manipulate HMIs for water utility control systems in Abernathy and Muleshoe, Texas. This attack underscored the risks posed by poor access controls and unsecured OT interfaces, emphasizing the need for enhanced security measures to protect critical water infrastructure.

***Title:** CAR Targets Indiana Wastewater Plant*

- **Link:** https://www.cnn.com/2024/04/22/politics/russia-linked-hacking-group-targets-indiana-water-plant/index.html
- **Summary: April 2024:** CAR claimed responsibility for sabotaging the Tipton West Wastewater Treatment Plant in Indiana. The group demonstrated their capability to remotely access and manipulate critical infrastructure, raising concerns about the security of wastewater treatment facilities and the potential for significant environmental and public health impacts.

***Title:** Z-Pentest Disrupts Arkansas Water Treatment*

- **Link:** https://industrialcyber.co/utilities-energy-power-water-waste/hackers-target-arkansas-city-water-treatment-plant-prompting-federal-investigation/
- **Summary: September 2024:** The Z-Pentest hacker group forced hydraulic systems into manual control at a water treatment facility in Arkansas City, disrupting operations. This attack highlighted the growing sophistication of

cybercriminals targeting OT systems and the urgent need for robust cybersecurity defenses to protect essential services.

2. Attacks on IT

Title: *Volt Typhoon Targets Texas Power Grid*

- **Link:** https://www.mysanantonio.com/news/local/article/power-grid-attack-18551459.php
- **Summary: Summer 2023:** Chinese hackers, part of the Volt Typhoon campaign, attempted to access Texas power grid infrastructure, targeting the Public Utility Commission (PUC) of Texas and the Electric Reliability Council of Texas (ERCOT). Although no successful breaches were found, the attack highlighted vulnerabilities in the power grid and the need for enhanced cybersecurity measures to protect critical infrastructure.

Title: *Halliburton Cyberattack*

- **Link:** https://www.cybersecuritydive.com/news/halliburton-cyberattack/725065/
- **Summary: August 2024:** Halliburton, a leading energy services provider, experienced a cyberattack that led to the proactive shutdown of certain systems. The company notified law enforcement and confirmed that energy services were not impacted. This incident underscored the importance of cybersecurity in the energy sector and the need for rapid response protocols.

Title: *ENGlobal Ransomware Attack*

- **Link:** https://therecord.media/energy-industry-contractor-ransomware-disruption
- **Summary: November 2024:** ENGlobal, an energy sector vendor, faced a ransomware attack that involved illegal access and encryption of data files. The company restricted access to its IT systems to contain and remediate the attack. This incident marked the third disruptive cyberattack on Texas-based energy sector providers since August 2024, highlighting the persistent threat of ransomware.

Title: *BHI Energy Ransomware Attack*

- **Link:** https://www.bleepingcomputer.com/news/security/us-energy-firm-shares-how-akira-ransomware-hacked-its-systems/
- **Summary: May 2023:** BHI Energy, part of Westinghouse Electric Company, was attacked by the Akira ransomware gang. The attackers stole 690GB of data, including the company's Windows Active Directory database.

Title: *Lazarus Group Exploits VMWare Horizon*

- **Link:** https://www.bleepingcomputer.com/news/security/north-korean-lazarus-hackers-take-aim-at-us-energy-providers/
- **Summary: September 2022:** The North Korean APT group Lazarus exploited VMWare Horizon servers to infiltrate energy providers in the US, Canada, and Japan. They used custom malware for data theft and system control, highlighting the sophisticated and versatile attack strategies employed by Lazarus and the significant threats posed to critical infrastructure.

G. Examples of Attacks Targeting Victims Globally

1. OT Attacks on Utility Infrastructure

Title: *Dragonfly Infiltrates US and European Energy Firms*

- **Link:** https://www.bleepingcomputer.com/news/security/sabotage-warning-issued-on-hackers-hiding-deep-inside-energy-sector /
- **Summary: September 2017:** The Dragonfly group infiltrated several U.S. and European energy firms, positioning themselves to potentially sabotage critical infrastructure. They used common computer management tools and mundane malware, shifting focus from learning about energy facilities to gaining access to operational systems. This attack raised concerns about the group's ability to control key SCADA equipment and other operational systems.

2. Attacks on IT

Title: *EDP Ransomware Attack*

- **Link:** https://www.bleepingcomputer.com/news/security/edp-energy-giant-confirms-ragnar-locker-ransomware-attack/
- **Summary: April 2020:** The Portuguese energy giant EDP was attacked by the Ragnar Locker ransomware group, leading to unauthorized access and data theft. The attackers demanded a ransom of over $10 million. EDP implemented enhanced security measures and involved law enforcement authorities to investigate the breach and prevent future incidents.

Title: Enel Group Ransomware Attack

- **Link:** https://www.bleepingcomputer.com/news/security/enel-group-hit-by-ransomware-again-netwalker-demands-14-million/
- **Summary: October 2020:** Enel Group, a multinational energy company, was hit by the Netwalker ransomware group, demanding $14 million. The attackers

threatened to leak stolen data to pressure Enel into paying the ransom. This incident highlighted the persistent threat of ransomware to large corporations and the significant financial and operational risks involved.

Title: *Shell Data Breach*

- **Link:** https://www.bleepingcomputer.com/news/security/energy-giant-shell-discloses-data-breach-after-accellion-hack/
- **Summary: March 2021:** Shell disclosed a data breach after attackers compromised its secure file-sharing system, affecting personal data and information from Shell companies and stakeholders. The Clop ransomware gang and FIN11 were identified as the groups behind the attack, exploiting a zero-day vulnerability in the Accellion File Transfer Appliance (FTA).

Title*: Suncor Energy's Petro-Canada Subsidiary Breach*

- **Link:** https://www.cybersecuritydive.com/news/suncor-hackers-breached-petro-canada-customer-data/685365/
- **Summary: June 2023:** Suncor Energy confirmed a cybersecurity breach affecting its Petro-Canada subsidiary. Hackers accessed basic information of Petro-Points members, disrupting credit and debit card purchases and car wash services.

Title*: Schneider Electric Ransomware Attack*

- **Link:** https://www.bleepingcomputer.com/news/security/energy-giant-schneider-electric-hit-by-cactus-ransomware-attack/
- **Summary: January 2024:** Schneider Electric was hit by the Cactus ransomware gang, disrupting its Resource Advisor cloud platform and stealing sensitive data. The attack highlighted the significant threat posed by ransomware to critical infrastructure and the importance of robust cybersecurity measures.

Title: *Schneider Electric Developer Platform Breach*

- **Link:** https://www.bleepingcomputer.com/news/security/schneider-electric-confirms-dev-platform-breach-after-hacker-steals-data/
- **Summary: November 2024:** Schneider Electric confirmed a breach of its developer platform by the Hellcat ransomware gang, leading to the theft of 40GB of data. The attackers used exposed credentials to access the server and demanded $125,000 to prevent the data from being leaked.

Title: *X_Trader Supply Chain Attack*

- **Link:** https://www.bleepingcomputer.com/news/security/critical-infrastructure-also-hit-by-supply-chain-attack-behind-3cx-breach/
- **Summary: April 2023:** North Korean-backed threat group used a trojanized installer for X_Trader software to deploy malware, impacting critical infrastructure organizations in the U.S. and Europe. The attack highlighted the risks associated with supply chain vulnerabilities and the need for robust cybersecurity measures.

Title: *Clop Ransomware Attack on Siemens Energy*

- **Link:** https://www.bleepingcomputer.com/news/security/siemens-energy-confirms-data-breach-after-moveit-data-theft-attack/
- **Summary: June 2023:** Siemens Energy confirmed a data breach from Clop ransomware attacks exploiting a MOVEit Transfer vulnerability. While data was stolen, no critical information was compromised, and business operations remained unaffected. This incident is part of a broader wave of Clop attacks affecting numerous organizations.

Title: *Darkside Ransomware Attack on Brazilian Utilities*

- **Link:** https://www.bleepingcomputer.com/news/security/eletrobras-copel-energy-companies-hit-by-ransomware-attacks/
- **Summary: February 2021:** Eletrobras and Copel, major Brazilian utilities, suffered ransomware attacks by Darkside. The attacks led to data theft and temporary suspension of some operations, highlighting the significant threat ransomware poses to critical infrastructure and the importance of robust cybersecurity measures.

H. Risk Scope

SoCalGas and SDG&E's Cybersecurity Risk analysis considers the scope noted in Table 1 below.

Table 1
Cybersecurity Risk Scope

	Cybersecurity Risk
In-Scope:	The scope of this risk includes gas and electric control systems, all company data and information systems, operational technology systems, and related processes.

I. Data Sources Used to Quantify Risk Estimates[5]

SoCalGas and SDG&E utilized internal data sources to determine a Cybersecurity Risk Pre-Mitigation Risk Value and calculate risk reduction estimates for mitigation activities (which enables estimation of Post Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used, as appropriate and adjusted to account for risk characteristics associated with the Companies' specific operating locations and service territories. For example, certain types of incident events have not occurred within the SoCalGas and SDG&E service territories. Expanding the quantitative data sources to include industry data where such incidents have been recorded is appropriate to establish a baseline of risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of the Cybersecurity Risk, including a risk Bow Tie, which delineates potential Drivers/Triggers and Potential Consequences, followed by a description of the Tranches determined for this risk.

A. Risk Selection

The Cybersecurity Risk was included as a risk in SoCalGas's and SDG&E's 2021 RAMP and was also included in the Companies' 2022, 2023, and 2024 Enterprise Risk Registries (ERR).[6] SoCalGas's and SDG&E's ERR evaluation and selection process is summarized in Chapter RAMP-2, Enterprise Risk Management Framework and in Chapter RAMP-3 Risk Quantification Framework.

SoCalGas and SDG&E selected this risk in accordance with the RDF Row 9.[7] Specifically SoCalGas and SDG&E assessed the top risks from the Companies' 2024 ERRs based on the Consequence of a Risk Event (CoRE) Safety attribute. The Cybersecurity Risk was among the risks presented in SoCalGas's and SDG&E's list of Preliminary 2025 RAMP Risks

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[5] Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

[6] In the 2021 RAMP Report this risk was called "(Chapter SCG/SDG&E-Risk-6) Cybersecurity." The risk definition and elements are unchanged.

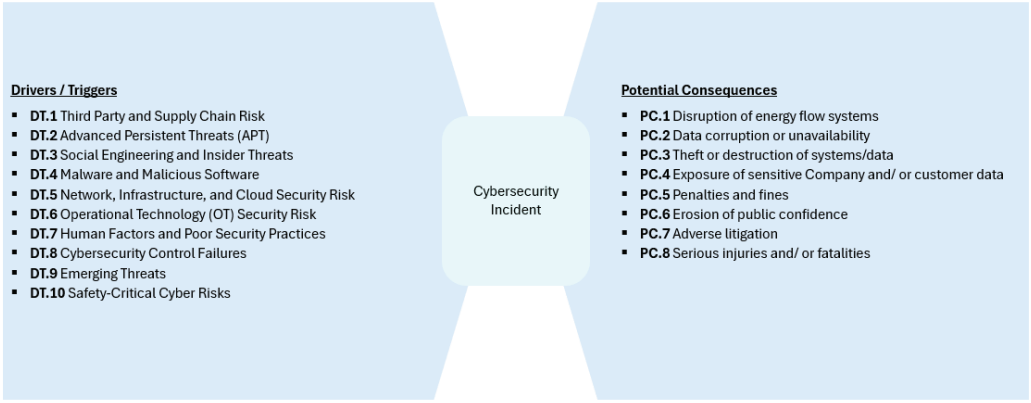
[7] D.24-05-064, RDF Row 9 states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars."

on December 17, 2024 at a Pre-Filing Workshop. Cybersecurity was selected electively, as it did not qualify based on the Safety risk attribute alone. At the pre-filing workshop, no party expressed opposition to inclusion of this risk in SoCalGas's or SDG&E's 2025 RAMP Reports.

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the risk Bow Tie, possible Drivers, Potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that addresses it.[8] As illustrated in the risk Bow Tie shown below in Figure 1, the Risk Event (center of the Bow Tie) is a Cybersecurity event, the left side of the Bow Tie illustrates Drivers/Triggers that could lead to a Cybersecurity event, and the right side shows the Potential Consequences of a Cybersecurity event. SoCalGas and SDG&E applied this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to the addressed elements of the risk Bow Tie is provided in Attachment C.

Figure 1
Cybersecurity Risk: Risk Bow Tie



C. Potential Risk Event Drivers/Triggers[9]

When performing a risk assessment for the Cybersecurity Risk, SoCalGas and SDG&E identify potential leading indicators, referred to as Drivers or Triggers, that reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to

[8] D.24-05-064, RDF Row 15.

[9] An indication that a risk could occur. It does not reflect actual or threatened conditions.

the asset.[10] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1: Third Party and Supply Chain Risk**: Risks introduced through external partners, vendors, and supply chains are common and can have widespread impacts.
- **DT.2: Advanced Persistent Threats (APT)**: Highly sophisticated and targeted attacks that can cause significant damage over a prolonged period.
- **DT.3: Social Engineering and Insider Threats**: Human factors often present the greatest risk, as they can bypass technical controls through manipulation or exploitation.
- **DT.4: Malware and Malicious Software**: Widespread and varied, malware can cause extensive damage, from data breaches to operational disruptions.
- **DT.5: Network, Infrastructure, and Cloud Security Risk**: Compromises in these areas can lead to widespread access and control issues, affecting multiple systems and data.
- **DT.6: Operational Technology (OT) Security Risk**: Risks in OT environments can lead to significant operational disruptions, especially in critical infrastructure sectors.
- **DT.7: Human Factors and Poor Security Practices**: Inadequate security behaviors, policies, and mistakes by employees that can lead to security breaches.
- **DT.8: Cybersecurity Control Failures**: Failures or malfunctions in security controls, such as IDS/IPS, firewalls, and other security tools, that can lead to missed alerts and undetected intrusions.
- **DT.9: Emerging Threats**: New and evolving threats can be unpredictable and may not be fully understood or mitigated by existing defenses.
- **DT.10: Safety-Critical Cyber Risks**: Inadequate cybersecurity measures in safety-critical systems and processes, such as job site safety plans and job safety analysis, which can lead to vulnerabilities that compromise both safety and security.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed to the right side of the risk Bow Tie. SoCalGas and SDG&E identify the Potential Consequences of this risk by analyzing internal data sources where available, industry data, and subject matter expertise (SME).[11] These Bow Tie Consequences inform the CoRE component of the risk value. If one or more of the Drivers listed

[10] D.24-05-064, RDF Row 10-11.

[11] D.24-05-064, RDF Rows 10-11.

above were to result in an incident, the Potential Consequences, in a plausible worst-case scenario, could include:

- PC.1 - Disruption of energy flow systems
- PC.2 - Data corruption or unavailability
- PC.3 - Theft or destruction of systems/data
- PC.4 - Exposure of sensitive Company and/ or customer data
- PC.5 - Penalties and fines
- PC.6 - Erosion of public confidence
- PC.7 - Adverse litigation
- PC.8 - Serious injuries and/ or fatalities

While this risk chapter primarily addresses internal threats to the companies and their customers, a large-scale disruption in the Companies' ability to deliver energy could also pose significant societal impacts, particularly to public health and safety, including:

- Economic disruption
- Infrastructure and transportation system failures, including critical facilities such as hospitals or water treatment plants
- Heightened vulnerability of at-risk populations

These Potential Consequences were used by SoCalGas and SDG&E in the scoring of the Cybersecurity Risk during the development of their 2024 ERRs.

E. Evolution of Its Drivers and Consequences

As specified in the Phase 3 Decision,[12] the following changes to the previous ERR and/or the 2021 RAMP include:

1. Changes to Drivers/Triggers of the Risk Bow Tie

- **DT.1: Third Party and Supply Chain Risk**: Risks introduced through external partners, vendors, and supply chains are common and can have widespread impacts.
- *This driver was not included in the 2021 RAMP. Given the heightened activity from this threat vector, third party and supply chain risk was included as an event Driver/Trigger.*
- **DT.2: Advanced Persistent Threats (APTs)**: Highly sophisticated and targeted attacks that can cause significant damage over a prolonged period.

[12] D.24-05-064, RDF Row 8.

- *This driver was not included in the 2021 RAMP. APTs has been added as a Driver/Trigger for a cybersecurity incident because of their highly sophisticated and targeted nature. APTs are capable of causing significant damage over extended periods, making them particularly dangerous.*
- **DT.3: Social Engineering and Insider Threats**: Human factors often present the greatest risk, as they can bypass technical controls through manipulation or exploitation.
- *This driver was not included in the 2021 RAMP. Although Social Engineering and Insider Threats encompass various other Drivers and Triggers, such as human error, malicious software, access failures, and cyber control failures, it was added as a Driver/Trigger because human factors often present the greatest risk to security. Phishing and other social engineering attacks are among the most common and effective attack techniques.*
- **DT.4: Malware and Malicious Software**: Widespread and varied, malware can cause extensive damage, from data breaches to operational disruptions.
- *Two Drivers from the 2021 RAMP were merged to form this driver: (Manipulated data or integrity failure)* Any unintended changes to data as the result of a storage, retrieval or processing operation, including malicious intent, unexpected hardware failure, and human error.

  and
- *(Malicious software intrusion)* Any malicious program or code that is harmful to systems. For example, malware seeks to invade, damage, or disable computers, computer systems, networks, tablets, and mobile devices, often by taking partial control over a device's operations.
- **DT.5: Network, Infrastructure, and Cloud Security Risk**: Compromises in these areas can lead to widespread access and control issues, affecting multiple systems and data.
- *Two Drivers from the 2021 RAMP were merged to form this driver:* (*Infrastructure or availability failure*) An unplanned, severe, extensive and/or large-scale system outage caused by a cybersecurity- related event or incident.

  and
- *RAMP 2021 (Equipment loss or theft)* A type of data breach where there is a loss of a laptop, mobile device, or storage device such as backup tapes, hard drives, and flash drives whether by accidental loss or through malicious intent.
- **DT.6: Operational Technology (OT) Security Risk**: Risks in OT environments can lead to significant operational disruptions, especially in critical infrastructure sectors.
- *This driver was changed from the 2021 RAMP, which had: (Operational system failure)* A system failure occurring due to a cybersecurity event/incident, causing the system to freeze, reboot, function counter to its design or stop functioning.

- **DT.7: Human Factors and Poor Security Practices**: Inadequate security behaviors, policies, and mistakes by employees that can lead to security breaches.
- *Two Drivers from the 2021 RAMP were merged to form this driver: (Access control or confidentiality failure)* Inability to effectively perform identification, authentication and authorization of users and entities by evaluating required login credentials that can include passwords, personal identification numbers (PINs), biometric scans, security tokens or other authentication factors.
- *RAMP 2021 (Human error (e.g., clicking on a phishing email)* An accidental cybersecurity event/incident conducted by a human.
- **DT.8: Cybersecurity Control Failures**: Failures or malfunctions in security controls, such as Intrusion Detection Systems (IDS) or Intrusion Prevention Systems (IPS), firewalls, and other security tools, that can lead to missed alerts and undetected intrusions.
- *This driver was changed from the 2021 RAMP, which had: (Cybersecurity control failure)* A general failure of a cybersecurity control(s). *E.g.*, a vulnerability scanner ceases functioning, allowing an exploitable vulnerability to go unnoticed in the environment.
- **DT.9: Emerging Threats**: New and evolving threats can be unpredictable and may not be fully understood or mitigated by existing defenses.
- *This driver was not included in the 2021 RAMP. Emerging Threats was added as a Driver/Trigger for a cybersecurity incident because these threats are new, evolving, and often unpredictable. Examples of emerging threats include use of AI and quantum computing.*
- **DT.10: Safety-Critical Cyber Risks**: Inadequate cybersecurity measures in safety-critical systems and processes, such as job site safety plans and job safety analysis, which can lead to vulnerabilities that compromise both safety and security.
- *This driver was not included in the 2021 RAMP. Safety-Critical Cyber Risks was added as a new Driver/Trigger for a Cybersecurity Risk because inadequate cybersecurity in safety-critical systems can lead to vulnerabilities that compromise both safety and security, potentially causing accidents, data breaches, and operational disruptions.*

2. Changes to Potential Consequences of the Risk Bow Tie

- There were no changes to Potential Consequences.

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and in accordance with Row 14 of the RDF, SoCalGas and SDG&E applied the Homogeneous Tranching Methodology (HTM) as outlined in Chapter RAMP - 3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:

Table 2
Cybersecurity Risk Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches
Tier 1	1	1
Tier 2	1	1
Tier 3	1	1
Tier 4	1	1
TOTAL	**4**	**4**

Attachment D illustrates the derivation of the Tranches, as shown in Table 2 above, in accordance with the HTM. The classes were identified by SoCalGas and SDG&E as logical groups of assets and systems based on the Companies' operations. These classes also align risk treatments with asset risk profiles reflective of SoCalGas's and SDG&E's operations. More detailed Tranche information, including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches, is provided in workpapers.

III. PRE-MITIGATION RISK VALUE

In accordance with the RDF Row 19, Table 3 below provides the pre-mitigation risk values for Cybersecurity Risk. Further details, including pre-mitigation risk values by Tranche, are provided in workpapers. Explanations of the risk quantification methodology and other higher-level assumptions are provided in Chapter RAMP-3 Risk Quantification Framework.

Table 3
Cybersecurity Risk Monetized Risk Values
(Direct, in 2024 $ millions)

Company	LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]
		Safety	Reliability	Financial		
SoCalGas	0.59	$0.003	$215.70	$4.73	$220.44	$129.02
SDG&E	0.51	$0.69	$3,466.54	$8.14	$3,475.37	$1,775.20
SoCalGas and SDG&E[13]	1.10	$0.32	$1,730.65	$6.32	$1,737.29	$1,904.22

A. Risk Value Methodology

SoCalGas's and SDG&E's risk modeling for the Cybersecurity Risk follows RDF guidance[14] for implementing a Cost Benefit Approach, as described below:

- **Cost Benefit Approach Principle 1 – Attribute Hierarchy (RDF Row 2):** Cybersecurity Risk is quantified in a combined attribute hierarchy as shown in Table 3 above, such that Safety, Reliability, and Financial are presented based on available, observable, and measurable data.
- **Cost Benefit Approach Principle 2 – Measured Observations (RDF Row 3):** The Cybersecurity Risk used observable and measurable data in the estimation of CoRE values. SoCalGas and SDG&E utilized a combination of internal and external data to estimate the consequence in terms of natural units (*e.g.*, fatalities, serious injuries, meters out, and customer minutes interrupted [CMI]) that occur as the result of a risk event.
- **Cost Benefit Approach Principle 3 – Comparison (RDF Row 4):** Cybersecurity Risk utilized proxy data from various sources including, but not limited to, Business Continuity Institute, IBISWorld, NetDiligence Cyber Claims Study, IBM Cost of a Data Breach (2024), Department of Energy, and National Institute of Health, to estimate the financial impacts, safety, and reliability impacts of cybersecurity incidents. Reference materials are further detailed in Attachment B.
- **Cost Benefit Approach Principle 4 - Risk Assessment (RDF Row 5):** Data sources used for Cybersecurity Risk – as described in the preceding paragraphs – were sufficient to model probability distributions for use in estimating risk values.
- **Cost Benefit Approach Principle 5 – Monetized Levels of Attributes (RDF Row 6):** In accordance with D.22-12-027 and D.24-05-064, RDF Row 6,

[13] SoCalGas and SDG&E individual Company risk values are provided for informational purposes only. All mitigation benefits and the resulting cost-benefit ratios are assessed using the Companies' combined risk scores. *See* Cybersecurity workpapers for more information.

[14] D.24-05-064, RDF Rows 2-7.

SoCalGas and SDG&E used a California-adjusted Department of Transportation monetized equivalent to calculate the Safety CoRE attribute at a monetized equivalent of $16.2 million per fatality, $4.1 million per serious injury, and $49 thousand for minor injury;[15] the Electric Reliability CoRE attribute is valued at a monetized equivalent of $3.76 per CMI; Gas Reliability is valued at a monetized equivalent of $3,868 per gas meter outage; and the Financial CoRE attribute is valued at $1 per dollar.[16]

- **Cost Benefit Approach Principle 6 – Adjusted Attribute Level (RDF Row 7):**

Table 4
Cybersecurity Risk Scaled vs Unscaled Value by CoRE Attribute
(Direct, in 2024 $ millions)

SoCalGas	Safety	Reliability	Financial	Total
Unscaled Risk Value	$0.002	$18.84	$2.29	$21.13
Scaled Risk Value	$0.002	$126.25	$2.77	$129.02
SDG&E	**Safety**	**Reliability**	**Financial**	**Total**
Unscaled Risk Value	$0.34	$139.09	$2.80	$142.23
Scaled Risk Value	$0.35	$1,770.69	$4.16	$1,775.20
SoCalGas and SDG&E	**Safety**	**Reliability**	**Financial**	**Total**
Unscaled Risk Value	$0.34	$157.93	$5.09	$163.36
Scaled Risk Value	$0.35	$1,896.94	$6.93	$1,904.22

Table 4 depicts the results of applying the risk scaling methodology described in Chapter RAMP-3 to the CoRE attributes for the Cybersecurity Risk. For the Cybersecurity Risk it is driven by the Reliability and Financial attributes due to the increase in the risk of Cybersecurity. Further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply, is provided in Chapter-RAMP-3.

Further information regarding SoCalGas's and SDG&E's quantitative risk analyses, including raw data, calculations, and technical references are provided in workpapers.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section identifies and describes the controls and mitigations comprising the portfolio of mitigations for Cybersecurity Risk and reflects changes expected to occur from the last year of recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). For clarity, a current activity that is included in the plan may be referred to as either a

[15] *See* D.22-12-027 at 35 ("We adopt Staff's recommendation to require a dollar valuation of the Safety Attribute in the Cost-Benefit Approach in the RDF using the DOT VSL as the standard value.").

[16] *See* Chapter RAMP-3: Risk Quantification Framework, Section II.

control and/or a mitigation. Table 5 below shows which control activities are in place in 2024 and which are expected to be on-going, completed, or new during the 2025-2031 periods. Because the TY 2024 GRC proceeding established rates through 2027,[17] information through 2027 is calculated as part of the baseline risk, in accordance with D.21-11-009.[18] For the TY 2028 GRC, SoCalGas and SDG&E calculated CBRs beginning with TY 2028 and for each Post-Test Year (PTY) (2029, 2030, and 2031).[19]

Table 5
Cybersecurity Risk 2024-2031 Control and Mitigation Plan Summary

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C801	Perimeter Defenses	X	Ongoing
C802	Internal Defenses	X	Ongoing
C803	Sensitive Data Protection	X	Ongoing
C804	Operational Technology (OT) Cybersecurity	X	Ongoing
C805	IT Infrastructure Modernization	X	Ongoing

Bold *indicates this control/mitigation includes mandated programs/activities.*

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place"[20] (*i.e.* activities in this section were in place as of December 31, 2024). Controls that will continue as part of the risk mitigation plan are identified in Table 5 above. The controls for Cybersecurity are evaluated at the program level due to the availability of data, the rapidly changing threats, and applicable counter measures. As mentioned in the Risk Overview section above, sharing specific details of the individual risk mitigation activity can provide adversaries crucial information that could aid their ability to disrupt Company systems. Therefore, the level of granularity for quantifying Cost-Benefit Ratios is currently at the operational program level (*i.e.*, Perimeter Defenses, Internal Defenses, Sensitive Data Protection, OT Cybersecurity, and IT Infrastructure Modernization), rather than each individual risk mitigation activity for the Cybersecurity Risk.

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17 *See* D.24-12-074.

18 *See* D.21-11-009 at 136, Conclusion of Law 7 (providing a definition for "baselines" and "baseline risk").

19 In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

20 D.18-12-014 at 33.

- **C801: Perimeter Defenses**

The Perimeter Defenses program includes activities that the Companies take to protect the external access points of their internal information technology systems. Perimeter Defenses are designed to prevent attacks, protect the integrity of, and detect unauthorized access to the Companies' internal information technology systems. The information technology environment includes the entire business technology system, including email, information storage, billing and customer records among others. The operational technology environment also uses Perimeter Defenses to protect operational technology assets.

A robust set of controls at the perimeter of corporate systems contributes to the Companies' *defense-in-depth* strategy. The purpose of the defense-in-depth strategy is to manage risk with diverse defenses so that if one layer of defense turns out to be inadequate, the additional layers of defense will prevent and detect further impacts and/or a potential breach.

Perimeter Defenses are an important component of defense-in-depth but can only reduce the probability of an adversary having unauthorized access to internal systems and data (*i.e.*, the LoRE). This control includes enhancements to firewalls and other intrusion protection measures to maintain the risk at the current manageable level and keep up with the increasing potential threats to the Companies' perimeter.

Perimeter Defenses reduce the frequency or probability of successful attacks. As a security strategy, it accomplishes this by limiting access to authorized users, reducing the likelihood that malicious code will enter the information technology environment, and delaying or frustrating potential attackers. This strategy also helps the Companies to understand the number of pathways into or out of the perimeter while simultaneously monitoring the perimeter in real time.

Accordingly, the Perimeter Defenses control addresses several Drivers/Triggers outlined above in Figure 1 including: DT.1: Third Party and Supply Chain Risk; DT.2: Advanced Persistent Threats (APT); DT.3: Social Engineering and Insider Threats; DT.4: Malware and Malicious Software; DT.5: Network, Infrastructure, and Cloud Security Risk; DT.6: Operational Technology (OT) Security Risk; DT.7: Human Factors and Poor Security Practices; DT.8: Cybersecurity Control Failures; DT.9: Emerging Threats; DT.10: Safety-Critical Cyber Risks; PC.1: Disruption of energy flow systems; PC.3: Theft or destruction of systems/data; PC.4:

Exposure of sensitive Company and/ or customer data; PC.5: Penalties and fines; PC.6: Erosion of public confidence; PC.8 Serious injuries and/ or fatalities.

Perimeter Defenses projects included within this control include:

- Network security and firewall infrastructure upgrades;
- Web Application Firewall Protection;
- Distributed Denial of Service Protection;
- Cloud application and infrastructure security;
- Endpoint monitoring and protection; and
- Perimeter Defense mechanisms.

- **C802: Internal Defenses**

Internal Defense program activities are designed to detect and prevent unauthorized users, those misusing authorized credentials, and malicious software (*i.e.*, malware) from propagating inside of the perimeter, moving within the IT system or into the OT system. Enhancements to the Companies' IT and OT systems' Access Management system reduces the risk to internal assets, systems, and the likelihood and impact of a Cybersecurity incident.

As another layer of *defense-in-depth*, the activities within this category include investments that directly reduce the risk to internal assets and information. The controls in this category are designed to detect unauthorized users from moving laterally or vertically within the IT system or into the OT system, in turn improving the ability to identify and respond to threats more quickly. The enhancements to the IT and OT systems' Access Management system allow the Companies to keep the current risk level steady.

Based on the foregoing, Internal Defenses address several Drivers/Triggers and Potential Consequences including: DT.2: Advanced Persistent Threats (APT); DT.3: Social Engineering and Insider Threats; DT.4: Malware and Malicious Software; DT.5: Network, Infrastructure, and Cloud Security Risk; DT.6: Operational Technology (OT) Security Risk; DT.7: Human Factors and Poor Security Practices; DT.8: Cybersecurity Control Failures; DT.9: Emerging Threats; DT.10: Safety-Critical Cyber Risks; PC.1: Disruption of energy flow systems; PC.2: Data corruption or unavailability; PC.3: Theft or destruction of systems/data; PC.4: Exposure of sensitive Company and/ or customer data; PC.5: Penalties and fines; PC.6: Erosion of public confidence; PC.7: Adverse litigation; PC.8: Serious injuries and/ or fatalities.

Internal Defenses projects presented in this control include:

- Endpoint Security Monitoring;
- Threat and Vulnerability Management;
- Third Party External Privileged Access Management;
- Data Loss Prevention (DLP);
- Identity & Access Management Enhancements;
- Cloud Access Security;
- Attack Surface Management; and
- Security Conformance Monitoring and Automation.

- **C803: Sensitive Data Protection**

Sensitive Data Protection is a core component of the Companies' *defense-in-depth* strategy for Cybersecurity Risk. The Sensitive Data Protection projects outlined below enhance technology to reduce the risk of unauthorized access. The Sensitive Data Protection control helps reduce the risk of unauthorized access to the Companies' information by understanding where sensitive data is stored, how it is transmitted, and how it is used. This helps to further protect customer and Company information. The activities for this control help the Companies continue to prudently manage sensitive data.

Sensitive Data Protection addresses several Drivers/Triggers and Potential Consequences including: DT.1: Third Party and Supply Chain Risk; DT.2: Advanced Persistent Threats (APT); DT.3: Social Engineering and Insider Threats; DT.4: Malware and Malicious Software; DT.7: Human Factors and Poor Security Practices; DT.8: Cybersecurity Control Failures; DT.9: Emerging Threats; PC.2: Data corruption or unavailability; PC.3: Theft or destruction of systems/data; PC.4: Exposure of sensitive Company and/ or customer data; PC.5: Penalties and fines; PC.6: Erosion of public confidence; PC.7: Adverse litigation.

The Companies' current control activities target sensitive data within information technology systems, including laptops and other mobile computing devices.

Sensitive Data Protection controls are designed to include:

- Identity Access Management Enhancements;
- Data Loss Prevention & Enhancements;
- Forensics Infrastructure Enhancements;
- Mobile Device Security; and

- Data Crawler Technology.

- **C804: Operational Technology (OT) Cybersecurity**

The OT Cybersecurity program focuses on securing the electric and gas control systems for the Companies. OT environments enable critical business functions, including safe and reliable energy delivery to customers throughout the service territory. OT Cybersecurity requires a specialized approach to balance operational needs with Cybersecurity Risk. Improving asset management helps identify unauthorized systems, which could potentially be a source of an attack. Anomaly detection, endpoint detection, and security event monitoring improve visibility into the OT environment, which allows for faster response and remediation. Enhanced secure access technologies help reduce the risk of unauthorized access. These risk mitigation activities strengthen the Companies' capabilities by securing the foundation of OT security. Additionally, these enhancements are necessary to maintain a secure OT system and mitigate the increasing potential threat to that critical system.

This specialized OT Cybersecurity addresses several Drivers/Triggers and Potential Consequences including: DT.1: Third Party and Supply Chain Risk; DT.2: Advanced Persistent Threats (APT); DT.3: Social Engineering and Insider Threats; DT.4: Malware and Malicious Software; DT.5: Network, Infrastructure, and Cloud Security Risk; DT.6: Operational Technology (OT) Security Risk; DT.7: Human Factors and Poor Security Practices; DT.8: Cybersecurity Control Failures; DT.9: Emerging Threats; DT.10: Safety-Critical Cyber Risks; PC.1: Disruption of energy flow systems; PC.2: Data corruption or unavailability; PC.3: Theft or destruction of systems/data; PC.5: Penalties and fines; PC.6: Erosion of public confidence; PC.8: Serious injuries and/ or fatalities.

The Companies' Cybersecurity program prioritizes OT controls, including: the management of its existing technology assets, improving threat intelligence and vulnerability management, and securing the communication infrastructure. The Companies are focused on maintaining a secure operational environment to support safe, reliable gas and electric systems and service.

The Companies' OT Cybersecurity projects presented in this control include:

- OT network security enhancements;
- OT asset management;
- OT sensor deployment and monitoring;

- OT vulnerability management; and
- OT security platform enhancements.
- **C805**: **IT Infrastructure Modernization**

One of the fundamental practices that supports a strong Cybersecurity program is the refresh of technology, both hardware and software, at regular intervals, to minimize risks posed by obsolete technologies that lead to security risks. This is frequently referred to as "Foundational Technology Systems Lifecycle Management."

Technology lifecycles are short and require frequent upgrades to meet modern security standards and capabilities. In addition to technology obsolescence, this approach also addresses security obsolescence. Security obsolescence refers to cybersecurity tools and processes that are no longer effective or potentially could create new vulnerabilities.

Vulnerabilities inherent in legacy technology can provide a foothold for entry or movement within the Companies' environment. Failure to invest in modern technologies could degrade the value of modern investments due to compatibility restrictions. Replacing legacy technology is a necessary method of managing Cybersecurity Risk.

In addition, there are fundamental control activities required to support and effectively manage the Cybersecurity capabilities listed in the previous sections. These fundamental activities referenced in the Operations & Maintenance (O&M) forecast (*see* Section E below) support the capital investments.

This chapter is intended to address the Company's core cybersecurity investments; it does not encompass every capital or expense item that may mitigate cybersecurity risk (for example, certain electric-operations sensor or OT upgrade projects are accounted for under their respective risk domains). Because many cyber-related expenditures overlap with other functions, the RAMP values attributed to this section are comparatively lower. Nevertheless, each investment described herein directly contributes to the reduction of enterprise risk, rather than serving solely as an infrastructural prerequisite.

The following controls are representative, but not exhaustive, of the core measures through which the Company reduces cybersecurity risk:

- Security Policy Framework
- Risk Management and Assessment
- Cybersecurity Awareness and Training

- Security Assessment and Vulnerability Management
- Asset Management
- Protective Technologies (Network, User, Application)
- System Authentication Services (*e.g.*, public key infrastructure (PKI))
- Security Operations Center (SOC), which:
    - Continuously monitors security-related events across systems and applications;
    - Detects anomalies and escalates confirmed security incidents;
    - Investigates and responds to incidents; and
    - Conducts regular exercises and drills to validate incident-response capabilities.

IT Infrastructure Modernization addresses several Drivers/Triggers and Potential Consequences outlined above in Figure 1 including: DT.2: Advanced Persistent Threats (APT); DT.3: Social Engineering and Insider Threats; DT.4: Malware and Malicious Software; DT.5: Network, Infrastructure, and Cloud Security Risk; DT.9: Emerging Threats; PC.2: Data corruption or unavailability; PC.4: Exposure of sensitive Company and/ or customer data; PC.6: Erosion of public confidence; PC.8: Serious injuries and/ or fatalities.

The projects presented in this control include:

- Technology refreshes, including, but not limited to:
    - Infrastructure;
    - Operating systems;
    - Middleware; and
    - Applications.
- System maintenance to confirm continued secure configurations, patching, upgrading, among others.
- Use of effective architecture and other mechanisms to confirm high availability and service continuity for critical systems.

B. Changes from 2024 Controls

SoCalGas and SDG&E plan to continue each of the existing controls discussed above, and reflected in Table 5, through the 2025-2031 period. The identified Drivers, Consequences,

and controls categories do not change significantly,[21] however, as discussed above, the specific mitigation projects within the controls must continually change and evolve as existing threats evolve and become more sophisticated and as new Cybersecurity threats emerge.

C. Mitigation Programs

SoCalGas and SDG&E do not currently foresee implementing new mitigations not described above during the 2025-2031 period. As noted above in the Risk Overview section, gaining information about the Companies' control and mitigation plan for Cybersecurity Risk could be useful to an adversary therefore it is presented at a summary level. That is, the mitigations represent broad categories of controls rather than individual projects to avoid disclosing information to adversaries. The broad control categories are intended to capture emerging Cybersecurity threats, and the projects within the existing controls continually change and evolve in response to new and changing threats.

D. Climate Change Adaptation

In assessing Cybersecurity Risk, controls and/or mitigations that address climate adaptation planning were determined to be inapplicable (from the perspective of climate exposure, asset sensitivity, and asset adaptive capacity). A list of climate-relevant controls and mitigations is provided in Volume 1, Chapter RAMP-5: Climate Change Adaptation.

E. Foundational Programs

Foundational Programs are "[i]nitiatives that support or enable two or more Mitigation programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[22] For the Cybersecurity Risk there are no activities that meet this definition of a Foundational Program.

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[21] In its 2021 RAMP filing, SoCalGas and SDG&E referred to the IT Infrastructure Modernization control as Obsolete IT Infrastructure and Asset Replacement. The controls are substantively the same.

[22] D.24-05-064, Appendix A at A-4.

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for Cybersecurity Risk, including the associated costs,[23] units, and CBRs. Additional information by Tranche is provided in workpapers. The costs shown are estimated using assumptions provided by SMEs and available data. In compliance with the Phase 3 Decision,[24] for each enterprise risk, SoCalGas and SDG&E use actual results and industry data and when that is not available, supplement the data with SME input. Additional details regarding the data and expertise relied upon in developing these estimates is provided in Attachment B.

Table 6
SoCalGas Cybersecurity Risk Control and Mitigation Plan

Recorded and Forecast Costs Summary (Direct, in 2024 $ thousands)							
Control/Mitigation		Adjusted Recorded		Forecast			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C801	Perimeter Defenses	1,991	3,851	4,091	79,297	29,174	12,993
C802	Internal Defenses	11,879	8,625	8,982	62,665	66,759	26,946
C803	Sensitive Data Protection	2,998	0	0	5,400	9,720	0
C804	Operational Technology (OT) Cybersecurity	338	0	0	18,449	13,778	0
C805	IT Infrastructure Modernization	9,113	0	0	12,299	9,929	0
Total		**26,319**	**12,476**	**13,073**	**178,110**	**129,360**	**39,939**

Bold *indicates this control/mitigation includes mandated programs/activities.*

[23] Cybersecurity Risk is centrally managed and includes Shared Services and Shared Assets that are allocated and billed to the entity or entities receiving those services or using the asset. Shared Assets are recorded on the financial records of the Company that receives the most service or use from the asset. In this 2025 RAMP Application costs are presented where they are incurred, before allocations.

[24] D.24-05-064, RDF Row 10.

Table 7
SDG&E Cybersecurity Risk Control and Mitigation Plan

Recorded and Forecast Costs Summary (Direct, in 2024 $ thousands)							
Control/Mitigation		**Adjusted Recorded**		**Forecast**			
ID	**Name**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C801	Perimeter Defenses	0	1,103	1,346	0	0	4,038
C802	Internal Defenses	116	10,284	10,724	2,789	1,458	31,722
C803	Sensitive Data Protection	0	527	526	0	0	1,578
C804	Operational Technology (OT) Cybersecurity	3,897	0	0	14,764	11,100	0
C805	IT Infrastructure Modernization	0	0	0	18,900	0	0
Total		**4,013**	**11,914**	**12,596**	**36,453**	**12,558**	**37,338**

Bold *indicates this control/mitigation includes mandated programs/activities.*

Table 8
SoCalGas Cybersecurity Risk Control & Mitigation Plan

Recorded and Forecast Units[25] Summary							
Control/Mitigation		**Recorded Units**		**Forecast Units**			
ID	**Name**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C801	Perimeter Defenses	25,000	12	14	100,000	75,000	42
C802	Internal Defenses	25,000	12	15	100,000	75,000	45
C803	Sensitive Data Protection	25,000	0	0	50,000	50,000	0
C804	Operational Technology (OT) Cybersecurity	25,000	0	0	100,000	75,000	0
C805	IT Infrastructure Modernization	25,000	0	0	100,000	75,000	0

Bold *indicates this control/mitigation includes mandated programs/activities.*

[25] For capital, the unit of measure is Users Protected, for O&M, the unit of measure is Full-Time Equivalents (FTEs).

Table 9
SDG&E Cybersecurity Risk Control & Mitigation Plan

Recorded and Forecast Units[26] Summary							
Control/Mitigation		Recorded Units		Forecast Units			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C801	Perimeter Defenses	0	5	6	0	0	18
C802	Internal Defenses	25,000	29	30	50,000	25,000	90
C803	Sensitive Data Protection	0	3	3	0	0	9
C804	Operational Technology (OT) Cybersecurity	25,000	0	0	100,000	75,000	0
C805	IT Infrastructure Modernization	0	0	0	50,000	0	0

Bold *indicates this control/mitigation includes mandated programs/activities.*

In Table 10 below, CBRs are presented in summary at the mitigation or control level for the TY 2028 GRC cycle.[27] CBRs are calculated based on scaled, expected values unless otherwise noted, and are calculated for each of the three required discount rates[28] in each year of the GRC cycle and for the Post-Test Years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in workpapers.

Table 10
Cybersecurity Risk Cost Benefit Ratio Results Summary
2028-2031
(Direct, in 2024 $ millions)

ID	Control/Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C801	Perimeter Defenses	$58	$22	103.98	97.52	87.83
C802	Internal Defenses	$88	$79	33.71	32.54	29.31
C803	Sensitive Data Protection	$10	$2	236.70	227.09	204.55

[26] For capital, the unit of measure is Users Protected, for O&M, the unit of measure is Full-Time Equivalents (FTEs).

[27] A combined CBR for SoCalGas and SDG&E is presented for each mitigation or control. Cybersecurity Risk is managed centrally for the Companies.

[28] *See* Chapter RAMP-3 Risk Quantification Framework for definitions of discount rates, as ordered in the Phase 3 Decision.

ID	Control/Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C804	Operational Technology (OT) Cybersecurity	$32	$0	220.11	213.21	192.03
C805	IT Infrastructure Modernization	$21	$0	197.04	182.04	163.97

Bold *indicates this control/mitigation includes mandated programs/activities.*

Tranche-level CBRs by year and in aggregate for each mitigation are provided in workpapers.

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025, D.16-08-018, and D.18-12-014[29] SoCalGas and SDG&E considered two alternatives to the Risk Mitigation Plan for Cybersecurity Risk. The risk mitigation plan for the Cybersecurity Risk is defined as the planned portfolio of control programs. Typically, analysis of alternatives occurs when designing the portfolio to obtain the best result or product for the cost. The alternatives analysis considers changes in risk reduction, cost, reasonableness, current conditions, modifications to the plan and constraints, such as budget and resources.

The Companies considered two alternative portfolios of mitigation activities in addition to the planned portfolio control program to address the Companies' Cybersecurity Risk. The alternative portfolios were analyzed in the context of CBRs, as outlined in the tables below.

For the alternative analysis, the Companies analyzed the effectiveness of three portfolios:

1. The risk mitigation plan for the Cybersecurity Risk (the Plan);
2. Alternative Portfolio 1; and
3. Alternative Portfolio 2.

To create these three different portfolios, the Companies first assessed the potential impact of each capital project under consideration, identifying each as high/medium/low impact based on several criteria:

- The project implementation's impact on the maturity of cybersecurity at the Companies;

[29] *See, e.g.,* D.18-12-014 at 33-35.

- The extent to which each project addresses recommendations from Critical Security Controls (CSC) 18,[30] ICS-CERT,[31] and other frameworks;
- The extent to which each project addresses threats to cybersecurity of high impact and likelihood;
- The effectiveness in mitigating a credible attack impacting safety, and;
- The urgency or time horizon for the project's implementation to assess how quickly a project needs to be completed or the specific timeframe within which it should be implemented. Projects with higher urgency or shorter time horizons are prioritized to address immediate cybersecurity threats and vulnerabilities.

After each project was tagged as high/medium/low impact, the following three portfolios were developed: The risk mitigation plan for the Cybersecurity Risk, Alternative Portfolio 1 and Alternative Portfolio 2.

A. The Risk Mitigation Plan for the Cybersecurity Risk

The Companies' risk mitigation plan includes a mix of high impact and medium impact projects. The identified high-impact and medium-impact projects were grouped into the five programs described above, as applicable:

1. Perimeter Defenses;
2. Internal Defenses;
3. Sensitive Data Protection;
4. Operational Technology Cybersecurity; and
5. IT Infrastructure Modernization.

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[30] CSC-18: The Customer Information System CSC version 8 includes 18 prioritized measures designed to enhance cybersecurity posture. These controls cover areas such as asset management, software inventory, data protection, secure configurations, account and access management, vulnerability management, audit logging, and penetration testing, available at https://www.cisecurity.org/controls.

[31] ICS-CERT: The Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) provides a control system security focus in collaboration with US-CERT, available at *https://us-cert.cisa.gov/ics* to:

- Conduct vulnerability and malware analysis.
- Provide onsite support for incident response and forensic analysis.
- Provide situational awareness in the form of actionable intelligence.
- Coordinate the responsible disclosure of vulnerabilities/mitigations.
- Share and coordinate vulnerability information and threat analysis through information products and alerts.

The quantitative analysis conducted by the Companies shows that the Companies' Plan of high- and medium-impact projects is the most cost-effective portfolio for managing the increase in Cybersecurity Risk, as is demonstrated by the CBRs compared to other alternative portfolios.

B. Alternative Portfolio 1

The Companies' Alternative Portfolio 1 consists of high impact projects only. The identified high-impact projects were grouped into the same five programs described above, as applicable. The quantitative analysis conducted by the Companies shows that the Companies' Alternative Portfolio 1, comprising only high-impact projects, is estimated to have a slightly higher CBR than the Plan when considering the CBR of the individual categories. However, this portfolio does not provide enough risk reduction to address the increasing rate of Cybersecurity Risk. The effectiveness of the projects in this alternative portfolio is lower than the projected growth rate of the risk. If Alternative Portfolio 1 is executed, Cybersecurity Risk will increase compared to the Companies' risk mitigation plan.

C. Alternative Portfolio 2

Alternative Portfolio 2 consists of all cybersecurity projects under consideration (*i.e.,* high-impact, medium-impact and low-impact). Whereas the Companies' risk mitigation plan includes high- and medium-impact projects, and Alternative Portfolio 1 includes only high-impact projects, Alternative Portfolio 2 includes all projects that the Companies have currently identified. Alternative Portfolio 2 has the highest cost, with the most risk reduction. Alternative Portfolio 2 has a CBR lower than the Companies' Plan since the additional projects in the portfolio (the low-impact projects not included in the Companies' risk mitigation plan for the Cybersecurity Risk) provide an incremental benefit; however, that incremental benefit is less effective relative to its incremental cost.

D. Costs and Cost Benefit Ratios (CBRs) for Alternative Portfolios

The costs and CBRs for Alternative Portfolio 1 and Alternative Portfolio 2 are presented in the tables that follow.[32]

[32] A combined CBR for SoCalGas and SDG&E is presented for each mitigation or control. Cybersecurity Risk is managed centrally for the Companies.

Table 11
SoCalGas Cybersecurity Risk Alternative Mitigation Plan

Alternative Mitigation Forecasted Costs Summary (Direct, in 2024 $ thousands)					
Alternative Mitigation		Forecasted			
ID	Name	2025-2028 Capital	PTY Capital	2025-2028 O&M	PTY O&M
A801	Alternative Portfolio 1	166,013	120,531	51,745	39,945
A802	Alternative Portfolio 2	184,110	133,112	51,745	39,945

Table 12
SDG&E Cybersecurity Risk Alternative Mitigation Plan

Alternative Mitigation Forecasted Costs Summary (Direct, in 2024 $ thousands)					
Alternative Mitigation		Forecasted			
ID	Name	2025-2028 Capital	PTY Capital	2025-2028 O&M	PTY O&M
A801	Alternative Portfolio 1	36,454	12,558	49,494	37,341
A802	Alternative Portfolio 2	36,454	12,558	49,494	37,341

Table 13
Cybersecurity Risk Alternative Mitigation Cost Benefit Ratio Results Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A801	Alternative Portfolio 1					
	C801: Perimeter Defenses	29.3	5.4	105.29	98.69	88.88
	C802: Internal Defenses	17.9	19.7	34.23	33.02	29.74
	C803: Sensitive Data Protection	0.0	0.5	243.34	233.43	210.25
	C804: Operational Technology (OT) Cybersecurity	6.9	0.0	223.51	216.43	194.92
	C805: IT Infrastructure Modernization	11.4	0.0	199.20	183.92	165.65
A802	Alternative Portfolio 2					
	C801: Perimeter Defenses	29.3	5.4	103.28	96.86	87.25
	C802: Internal Defenses	19.7	19.7	33.59	32.41	29.19
	C803: Sensitive Data Protection	0.0	0.5	232.90	223.34	201.18
	C804: Operational Technology (OT) Cybersecurity	6.9	0.0	219.38	212.43	191.33
	C805: IT Infrastructure Modernization	11.5	0.0	195.46	180.63	162.70

VI. HISTORICAL PROGRESS GRAPHIC

As directed by the Commission in the Phase 2 Decision, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. The historical progress graphic for SoCalGas's and SDG&E's Cybersecurity Risk mitigation programs and activities aligns with safety goals to illustrate trends in historical progress and identify remaining tasks necessary to continue mitigating risks.

Figure 2 below shows SoCalGas's and SDG&E's cybersecurity rating score by BitSight.[33] Cybersecurity rating services, like BitSight, evaluate an organization's cybersecurity posture by continuously monitoring and assessing various risk factors and provide a security score (or rating) that reflects an organization's overall security performance. Security rating services provide an objective, data-driven view of an organization's cybersecurity program, developing cybersecurity ratings by analyzing networks, assets, and vulnerabilities in real-time. Similar to a credit score, which reflects a business's creditworthiness based on its financial history and ability to repay debts, cybersecurity rating services offer a security score that indicates the organization's ability to manage and mitigate Cybersecurity Risks. The score allows external stakeholders such as investors, financial institutions, and government agencies to gauge how effectively an organization is protecting against potential threats. For example, insurance companies may use these ratings to determine premiums and coverage limits or regulators may utilize these ratings to assess compliance with cybersecurity regulatory obligations. BitSight uses a scale from 250 to 900 to rate organizations based on their security performance.

Recent studies have demonstrated a correlation between a cybersecurity rating and the risk of a cybersecurity incident.[34] BitSight compared its ratings to publicly disclosed data breaches and concluded that companies with a rating of 400 or lower were five times more likely to experience a publicly disclosed data breach than companies with a rating of 700 or higher[35]

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[33] *See* Bitsight, available at https://www.bitsight.com/about/our-story.

[34] *See* Bitsight, Bitsight Security Ratings Correlate to Breaches, available at https://help.bitsighttech.com/hc/en-us/articles/360011652613-Bitsight-Security-Ratings-Correlate-to-Breaches#Marsh-McLennan.

[35] *See* Bitsight, Bitsight Security Ratings Correlated to Breaches, Data Sheet, available at https://www.bitsight.com/resources/datasheet-bitsight-security-ratings-correlate-breaches.

and that its ratings are indicative of the risk of data breach. A Marsh McLennan Cyber Risk Analytics Center (Marsh McLennan) study identified a clear correlation between lower security ratings and higher likelihood of cybersecurity incidents.[36] An analysis by Verisk (formerly known as AIR Worldwide) demonstrated that organizations with ratings of 700 or greater had a breach probability of less than 1%, while those with ratings below 500 had a probability of nearly 3%.[37] As shown in Figure 2, for the period 2016 through 2024 SoCalGas and SDG&E's BitSight cybersecurity rating score ranged from 683 to 794.

Figure 2
Cybersecurity Risk Historical Progress Graphic
BitSight Cybersecurity Rating Score

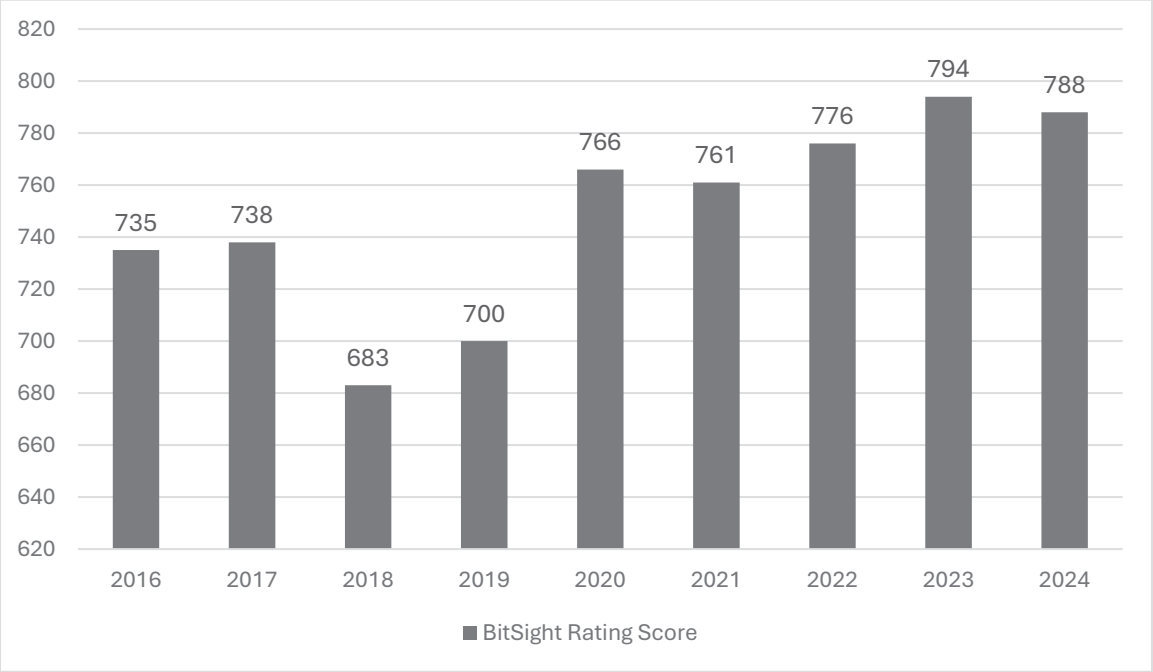


Figure 3 below presents an overview of certain cybersecurity risk mitigation programs and activities implemented during this period.

[36] *See* Bitsight, New Study Finds Significant Correlation Between Bitsight Analytics and Cybersecurity Incidents (October 25, 2022), available at https://www.bitsight.com/blog/new-study-finds-significant-correlation-between-bitsight-analytics-and-cybersecurity-incidents.

[37] *See* Bitsight, Bitsight Security Ratings Correlate to Breaches, Verisk: Correlation to Breach, available at https://help.bitsighttech.com/hc/en-us/articles/360011652613-Bitsight-Security-Ratings-Correlate-to-Breaches#Marsh-McLennan.

Figure 3
Cybersecurity Risk Historical Progress Graphic
Cybersecurity Mitigation Programs and Activities

Perimeter Defenses	Intenal Defenses	Sensitive Data Protection	OT Cybersecurity	IT Infrastrucutre Modernization
•Firewall upgrades and process automation •Distributed Denial of Service Protection •Internet of Things (IoT) Sensors •Perimeter Defense mechanisms	•Endpoint Security Monitoring •Threat and Vulnerability Management •Insider Threat Detection and User Behavior Analytics •Incident Management Improvements •Supply Chain Risk Management •Cloud Access Security	•Identity Access Management Enhancements •Data Loss Prevention & Enhancements •Mobile Device Security •Data Crawler Technology	•OT Network Anomaly Detection •OT Advanced Security Incident Management (SIEM) and Analytics •OT Malware Defense •OT Secure Remote Connection	•Technology refreshes of Infrastructure, Operating systems, Middleware, Applications •System maintenance to confirm continued secure configurations, patching, upgrading, among others

Additionally, for the period 2022 through 2024, SoCalGas and SDG&E remediated more than 2.6 million cybersecurity vulnerabilities to mitigate potential security threats. The number of cybersecurity vulnerabilities remediated refers to the total count of security weaknesses or flaws in a system, network, or application that have been identified and successfully fixed. This metric is crucial for understanding how effectively an organization is addressing and mitigating potential security threats. In the realm of threat and vulnerability management, zero-day vulnerabilities represent a significant challenge. These are security flaws that are unknown to the software vendor and can be exploited by attackers before a patch is available. The Citrix Bleed vulnerability is an example, affecting numerous organizations before it was identified and addressed.[38] While the Companies implement robust security measures to mitigate known vulnerabilities, zero-day vulnerabilities create a critical gap between the time they are exploited and the time they are remediated. This gap underscores the importance of proactive monitoring,

[38] The Citrix Bleed vulnerability (CVE-2023-4966) was a critical flaw that allowed unauthenticated, remote attackers to obtain valid session tokens from the device's memory, enabling them to bypass authentication. This vulnerability was actively exploited, leading to significant security risks for affected organizations. *See* ITPRO, What is Citrix Bleed and should you be worried? (October 26, 2023), available at https://www.itpro.com/security/cyber-attacks/what-is-citrix-bleed-and-should-you-be-worried.

rapid response strategies, and continuous improvement in security practices to minimize potential threats. The safety work that remains to be done is addressed in the controls/mitigations detailed above in Section IV. 2024-2031 Control and Mitigation Plan.

ATTACHMENTS

ATTACHMENT A

CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates some examples of the compliance Drivers that underpin identified controls and mitigations. This is not a complete list.

ID	Control/Mitigation Name	Compliance Driver
C801	Perimeter Defenses	NERC Critical Infrastructure Protection (CIP) Standards, TSA Security Directive (SD)
C802	Internal Defenses	NERC CIP Standards, TSA SD
C803	Sensitive Data Protection	NERC CIP Standards, California Consumer Privacy Act (CCPA), TSA SD
C804	Operational Technology (OT) Cybersecurity	NERC CIP Standards, TSA SD
C805	IT Infrastructure Modernization	NERC CIP Standards, TSA SD

ATTACHMENT B

CYBERSECURITY - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision RDF at Row 10 and Row 29 directs each utility to identify Potential Consequences of a Risk Event using available and appropriate data.[39] Appropriate data may include Company specific data or industry data supplemented by the judgment of subject matter experts. Provided below is a listing of the inputs utilized as part of this assessment and the description of the data.

Risk Data	Source Type	Source Information
Cyber Attack Impact Per Year	External Data	Agency: Business Continuity Institute Link: https://www.thebci.org/news/cyber-attacks-rise-in-volume-as-attackers-revolutionise-their-attack-vectors.html#:~:text=Increase%20in%20volume%20and%20methods,to%20a%20successful%20cyber%2Dattack Description: Expected Likelihood of Cyberattack with Limited Impact Per Year
Data Violations in the Utilities Industry	External Data	Agency: Statista Link: https://www.statista.com/statistics/1318379/us-number-of-private-data-compromises-by-industry/ Description: Industry Due to Cyberattacks in 2023
Reportable Cyberattacks that could have affected Electric System	External Data	Agency: Department of Energy, Report on Electric Emergency and Disturbance Events, 2022 – 2023 (available upon request) Description: Number of reportable electric cyberattacks that could have affected electric system reliability (2022 - 2023)
People Affected by Blackout	External Data	Agency: Department of Energy

[39] D.24-05-064, RDF Row 10 and Row 29.

Risk Data	Source Type	Source Information
		Link: https://www.energy.gov/oe/august-2003-blackout#:~:text=August%2014%20and%2015%2C%202003,50%20million%20customers%20were%20impacted Description: Number of People affected by the August 2003 blackout
Fatalities Attributed to Blackout	External Data	Agency: Reuters Link: https://www.reuters.com/article/business/healthcare-pharmaceuticals/spike-in-deaths-blamed-on-2003-new-york-blackout-idUSTRE80Q07H/ Description: Number of Fatalities occurred during August 2003 blackout
Financial Impact to Public	External Data	Agency: Net Diligence Link: https://netdiligence.com/wp-content/uploads/2023/10/2023-NetDiligence-Cyber-Claims-Study_v1.1.pdf Description: Financial Impact to the public due to a cybersecurity attack.
Cost of Data Breach	External Data	Agency: IBM Link: https://www.ibm.com/downloads/documents/us-en/107a02e94948f4ec Description: Financial Impact to the public because of the data breach

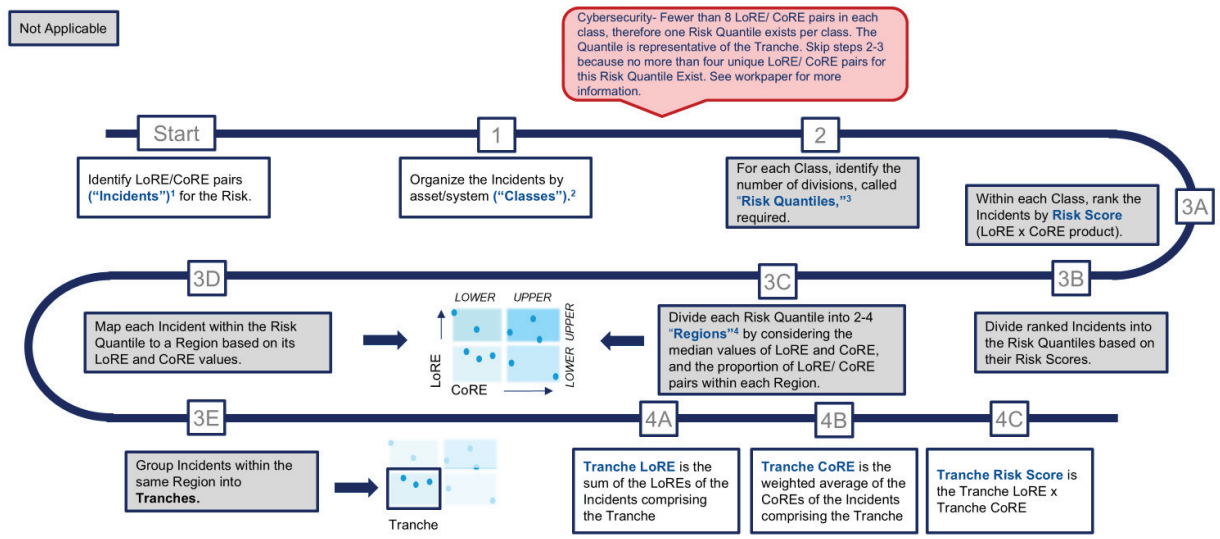
ATTACHMENT C

CYBERSECURITY - SUMMARY OF ELEMENTS OF BOW TIE

SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
C801	Perimeter Defenses	DT.1; DT.2; DT.3; DT.4; DT.5; DT.6; DT.7; DT.8; DT.9; DT.10	PC.1; PC.3; PC.4; PC.5; PC.6; PC.8
C802	Internal Defenses	DT.2; DT.3; DT.4; DT.5; DT.6; DT.7; DT.8; DT.9; DT.10	PC.1; PC.2; PC.3; PC.4; PC.5; PC.6; PC.7; PC.8
C803	Sensitive Data Protection	DT.1; DT.2; DT.3; DT.4; DT.7; DT.8; DT.9	PC.2; PC.3; PC.4; PC.5; PC.6; PC.7
C804	Operational Technology (OT) Cybersecurity	DT.1; DT.2; DT.3; DT.4; DT.5; DT.6; DT.7; DT.8; DT.9; DT.10	PC.1; PC.2; PC.3; PC.5; PC.6; PC.8
C805	IT Infrastructure Modernization	DT.2; DT.3; DT.4; DT.5; DT.9	PC.2; PC.4; PC.6; PC.8

ATTACHMENT D:
CYBERSECURITY - APPLICATION OF TRANCHING METHODOLOGY

A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP - 3: Risk



NOTES

[1] *For example, **Incidents (or "Risk Incidents")** for Cybersecurity events may include incursions that lead to adverse outcomes*

[2] *For example, **Classes (or "Asset Classes")** for Cybersecurity include Internal Defense, Perimeter Defense, Sensitive Data Protection, OT Cybersecurity, IT Infrastructure Modernization.*

[3] ***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*

[4] *The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*

Not Applicable



Start

1

2

Identify LoRE/CoRE pairs ("Incidents")[1] for the Risk.

Organize the Incidents by asset/system ("Classes").[2]

For each Class, identify the number of divisions, called "Risk Quantiles,"[3] required.

Class	LORE / CORE PAIRS	TOTAL # PAIRS
Tier 1	Tier 1 Event	1
Tier 2	Tier 2 Event	1
Tier 3	Tier 3 Event	1
Tier 4	Tier 4 Event	1

$$\min\left(\frac{N}{8}, 19\right) < K \leq \min\left(\frac{N}{8}, 10\right)$$

1

1

1

Skip step 2-3
Continue to Step 4

Not Applicable



3A

Within each Class, rank the Incidents by Risk Score (LoRE x CoRE product).

3B

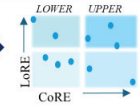
Divide ranked Incidents into the Quantiles based on their Risk Scores.

3C

Divide each Risk Quantile into 2-4 "Regions"[4] by considering the median values of LoRe and CoRE, and the proportion of LoRE/ CoRE pairs within each Region.

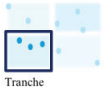
3D

Map each Incident within the Quantile to a Region based on its LoRE and CoRE values.



3E

Group Incidents within the same Region into Tranches.





4A **Tranche LoRE** is the sum of the LoREs of the Incidents comprising the Tranche

4B **Tranche CoRE** is the weighted average of the CoREs of the Incidents comprising the Tranche

4C **Tranche Risk Score** is the Tranche LoRE x Tranche CoRE

Class	Risk Quantile	Incident (LoRE/CoRE) Pair	Risk Quantile Region	Tranche	4A Tranche LoRE	4B Tranche CoRE	4C Tranche Risk Score
Tier 1	1	Tier 1 Event	None	Tier 1	0.78	$0.01M	$0.01M
Tier 2	1	Tier 2 Event	None	Tier 2	0.191	$5.29M	$1.01M
Tier 3	1	Tier 3 Event	None	Tier 3	0.085	$892.71M	$75.69M
Tier 4	1	Tier 4 Event	None	Tier 4	0.04	$45,687.82M	$1,827.51M





2025 Risk Assessment Mitigation Phase

APPENDIX 1

Glossary of Terms

May 15, 2025

APPENDIX 1

GLOSSARY OF TERMS

A.	Application
AAL	Average Annual Loss
AB	Assembly Bill
ABI	Advanced Baseline Imager
AFN	Access and Functional Needs
AIS	Abbreviated Injury Scale
ALARP	As Low As Reasonably Practical
ALR	Anodeless Risers
ANSI	American National Standards Institute
AOC	Abnormal Operating Conditions
AP	Assessment Plan
API	American Petroleum Institute
API RP	American Petroleum Institute Recommended Practice
APLIC	Avian Power Line Interaction Committee
APP	Advanced Protection Program
APTs	Advanced Persistent Threats
ASC	Advisory Safety Council
ASME	American Society of Mechanical Engineers
AWS	Amazon Web Services
BCF	Billion Cubic Feet
BESS	Battery Energy Storage Systems
BPS	Bulk Power System
BSRP	Bare Steel Replacement Program
BY	Base Year
C&I	Commercial and Industrial
CAB	Cellulose Acetate Butyrate
CA-ISO	California Independent System Operator
Cal/OSHA	California Occupational Safety and Health Administration
CalEnviroScreen	California Communities Environmental Health Screening Tool
CalGEM	California Geologic Energy Management Division
CARB	California Air Resources Board
CAVA	Climate Adaptation Vulnerability Assessment
CBA	Cost-Benefit Approach
CBO	Community Based Organizations
CBOWG	Community-Based Organization Working Group
CBR	Cost Benefit Ratio
CC	Covered Conductor
CCC	Combined Covered Conductor
CCM	Control Center Modernization
CCR	California Code of Regulations
CCTV	Closed Circuit Television
CDC	Centers for Disease Control and Prevention

CEADPP	Company Emergency and Disaster Preparedness Plan
CEI	Climate Equity Index
CEJST	Climate and Economic Justice Screening Tool
CEP	Community Engagement Plan
CES4	CalEnviroScreen 4.0
CFF	Cross-Functional Factor
CFR	Code of Federal Regulations
CGA	Common Ground Alliance
CISA	Cybersecurity & Infrastructure Security Agency
CMI	Customer Minute of Interruption
CMIP5	Coupled Model Inter-Comparison Project 5
CMP	Corrective Maintenance Program
CNF	Cleveland National Forest
COF	Consequence of Failure
COL	Conclusion of Law
Commission	California Public Utility Commission
CONUS	Continental United States
CoRE	Consequence of Risk Event
CP	Cathodic protection
CPI	Consumer Price Index
CPI-U	Consumer Price Index for all Urban Consumers
CPRT	Contractor Performance Response Team
CPS	Current Population Survey
CPUC	California Public Utility Commission
CRA	Customized Resiliency Assessments
CRC	Community Resource Centers
CSB	Chemical Safety Board
CSO	Chief Safety Officer
CSS	Contractor Safety Services
CTI	Cybersecurity Threat Intelligence
CUPA	Certified Unified Program Agency
CVI	Climate Vulnerability Index
CVM	Climate Vulnerability Metric
CWSAC	Community Wildfire Safety Advisory Council
D&A	Drug and Alcohol
D.	Decision
D.20-01-002	Rate Case Plan Decision
DAC	Disadvantaged Communities
DACAG	Disadvantaged Communities Advisory Group
DAFWP	Drug & Alcohol-Free Workplace Policy
DAMPP	Drug & Alcohol Misuse Prevention Plan
DART	Employee Days Away, Restricted and Transfer
DCRI	Distribution Communications Reliability Improvements
DHS	Department of Homeland Security
DIRT	Damage Information Reporting Tool

DLP	Data Loss Prevention
DOE	Department of Energy
DoS	Denial-of-Service
DOT	Department of Transportation
DPA	Damage Prevention Analyst
DREAMS	Distribution Risk Evaluation & Monitoring System
DRIP	Distribution Riser Inspection Program
DRS	District Regulator Station
DT	Driver/Trigger
DVC	Disadvantaged and Vulnerable Communities
EAM	Enterprise Asset Management
ECA	Engineering Critical Assessment
EFD	Early Fault Detection
EFV	Excess Flow Valve
EII	Electric Infrastructure Integrity
EJI	Environmental Justice Index
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EPM	Electronic Pressure Monitors
ERCOT	Electric Reliability Council of Texas
ERM	Enterprise Risk Management
ERR	Enterprise Risk Registry
ERS	Essential Reliability Services
ESC	Executive Safety Council
ESCMP	Environmental and Safety Compliance Management Program
ESJ	Environmental and Social Justice
ETS	Electrical Test Station
EUP	Electrical Undergrounding Plan
EV	Expected Value
Ex.	Exhibit
FAA	Federal Aviation Administration
FACT	Facilitating Access to Coordinated Transportation
FBI	Federal Bureau of Investigations
FCC	Federal Communications Commission
FCP	Falling Conductor Protection
FERC	Federal Energy Regulatory Commission
FOF	Findings of Fact
FPI	Fire Potential Index
FSCA	Fire Science and Climate Adaptation
FTA	File Transfer Appliance
FTE	Full-Time Equivalents
GAP	Generator Assistance Program
GED	Gas Distribution Emergency Department
GIPP	Gas Infrastructure Protection Program
GO	General Order

GPD	Generalized Pareto Distribution
GQCM	Gas Compliance Quality Management
GRC	General Rate Case
GRI	Gas Research Institute
GRID	General Rate Case Integrated Database
GSA	U.S. General Services Administration
HCA	High Consequence Areas
HECA	High Energy Control Assessments
HFTD	High Fire-Threat District
HLC	Hotline Clamps
HMI	Human-Machine Interfaces
HP	High Potential
HP Risk	High Pressure Gas System Risk
HPI	Healthy Places Index 3.0
HTM	Homogeneous Tranching Methodology
HWW	High Wind Warning
I.	Investigation
I.19-06-014	Safety Culture OII
IAEA	International Atomic Energy Agency
IAQ	Indoor Air Quality
ICE	Interruption Cost Estimator
ICP	Incentive Compensation Plan
ICS	Industrial Control Systems
IDS	Intrusion Detection Systems
IIE	Incident Involving an Employee
IIP	Intelligent Image Processing
IIPP	Injury and Illness Prevention Program
ILI	In-Line-Inspection
IOU	Investor-Owned Utility
IPCC	Intergovernmental Panel on Climate Change
IPS	Intrusion Prevention Systems
IR	Infrared
ISA	International Society of Arboricultural
ISACs	Information Sharing and Analysis Centers
ISN	ISNetworld®
ISO	Organization for Standardization
kV	Kilovolt
LACDPH	LA County Department of Public Health
LBNL	Lawrence Berkley National Laboratory
LiDAR	Light Detection and Ranging
LMS	Learning Management System
LOF	Likelihood of Failure
LoRE	Likelihood of a Risk Event
LPCN	Low Power Communication Network
M&R	Meter & Regulator

MAIS	Maximum Abbreviated Injury Scale
MAOP	Maximum Allowable Operating Pressure
MAVF	Multi Attribute Value Function
MFA	Multi-Factor Authentication
MFL	Magnetic Flux Leakage
MIP	Microgrid Incentive Program
MP	Medium Pressure
MP System Risk	Medium Pressure Gas System
MS SQL	Microsoft Structured Query Language
MSA	Master Service Agreements
MSL	Metalskin Liners
MSUP	Master Special Use Permit
MW	Megawatt
MWE	Median Weekly Earnings
NERC	North American Electric Reliability Corporation
NERC CIP	North American Electric Reliability Corporation's Critical Infrastructure Protection
NIMS	National Incident Management System
NMS	Network Management System
NRI	FEMA National Risk Index
NSC	National Safety Council
NSOTA	Non-State-of-the-Art
NTSB	National Transportation Safety Board
NU	Natural Units
O&M	Operations & Maintenance
OEIS	Office of Energy Infrastructure Safety
OIR	Order Instituting Rulemaking
OP	Ordering Paragraph
OP Qual	Operator Qualification
OSHA	Occupational Safety and Health Administration
OT	Operational Technology
PC	Potential Consequence
PCB	Polychlorinated Biphenyls
PEDS	Protective Equipment Device Settings
PG&E	Pacific Gas and Electric Company
Phase 2 Decision	D.22-12-027
Phase 3 Decision	D.24-05-064
PHMSA	Pipeline and Hazardous Materials Safety Administration
PINs	Personal Identification Numbers
PIR	Potential Impact Radius
PKI	Public Key Infrastructure
PLCs	Programmable Logic Controllers
PLRP	Post Line Restoration Project
PMU	Phasor Measurement Unit
PoI	Probability of Ignition

PPE	Personal Protective Equipment
PQ	Power Quality
PSIF	Potential to Cause Serious Injuries or Fatalities
PSP	Pilot Study Plan
PSPS	Public Safety Power Shutoff
PTTA	Phase 3 Tranching Approach
PTY	Post Test Year
Pub. Util. Code	California Public Utilities Code
PUC	Public Utility Commission
QA	Quality Assurance
QEW	Qualified Electric Workers
QRA	Quantitative Risk Analytics
R.	Rulemaking
R.18-04-019	Climate Adaptation OIR
R.21-10-001	Order Instituting Investigation into SoCalGas's Organizational Culture
RAMP	Risk Assessment and Mitigation Phase
RAVS	Review and Verification Services
RCP	Rate Case Plan
RDF	Rate-Based Decision-Making Framework
RFP	Request for Proposal
RFW	Red Flag Warning
RIDI	Risk-Informed Drone Inspection
Risk OIR	R.20-07-013
RMP	Residential Meter Protection
RMPP	Residential Meter Protection Project
RMV	Rupture Mitigation Valves
RO	Repeat Offender
RPA	Resources Planning Act Assessment
RSE	Risk-Spend Efficiency
RTU	Remote Terminal Units
Rules	Commission's Rules of Practice and Procedure
Safety Culture OII	I.19-06-014
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SCE	Southern California Edison
SCL	Safety Classification and Learning
SDG&E	San Diego Gas & Electric Company
SED	Safety Enforcement Division
SIF	Serious Injury and Fatality
SIMP	Storage Integrity Management Program
SIMPBA	Storage Integrity Management Program Balancing Account
SIMS	Safety Information Management System
SIP	System Improvement Plan

SLIP	Sewer Lateral Inspection Program
S-MAP	Safety Model Assessment Proceeding
SME	Subject Matter Expert
SMS	Safety Management System
SMYS	Specified Minimum Yield Strength
SoCalGas	Southern California Gas Company
SOTA	State-Of-The-Art
SPD	Safety Policy Division
SPMR	Safety Performance Metrics Report
SRA	State Responsibility Area
SRP	Sensitive Relay Profiles
SSP	Shared Socioeconomic Pathway
SUG	Strategic Undergrounding
TIMP	Transmission Integrity Management Program
TLM	Transformer Load Monitoring
TRA	Ticket Risk Analysis
TSA	Transportation Security Administration
TTPs	Tactics, Techniques, and Procedures
TY	Test Year
UICS	Utility Incident Command System
USA	Underground Service Alert
USB	Underground Safety Board
UT	Ultrasonic Testing
Valve Rule	Valve Installation and Minimum Rupture Detection Standards Rule
VMA	Vegetation Management Area
VMS	Vegetation Management System
VPD	Vapor Pressure Deficit
VPNs	Virtual Private Networks
VSL	Value of Statistical Life
WACC	Weighted Average Cost of Capital
WCRC	Wildfire and Climate Resilience Center
WF	Wildfire and PSPS
WFI	Wireless Fault Indicator
WiNGS	Wildfire Next Generation System
WISQARS	Web-based Injury Statistics Query and Reporting System
WMP	Wildfire Mitigation Plan
WUI	Wildland Urban Interface





2025 Risk Assessment Mitigation Phase

APPENDIX 2

RAMP Requirements Roadmap

May 15, 2025

2025 RAMP REQUIREMENTS COMPLIANCE ROADMAP

Unless otherwise indicated, the compliance citation applies to both SoCalGas and SDG&E

The tables that follow provide a general list of the RAMP requirements set forth in relevant Commission decisions that informed the content and presentation of SoCalGas's and SDG&E's 2025 RAMP Reports and/or workpapers and a roadmap to the general areas where those requirements are addressed. This list is not intended to capture every requirement, rather, it is provided as general guidance to help the reader navigate the Reports.

I. 2025 RAMP Report Requirements

D.18-12-014 – Settlement Decision

Topic	Requirement	Compliance
General	1. Identify top risks based on assessments for safety, reliability and financial attributes.	• Vol 1 RAMP-1 • Vol 1 RAMP-2
General	2. Describe the controls or mitigations currently in place to create a baseline for understanding how safety mitigation improves over time.	• Vol 2 All Risk Chapters
General	3. Present a plan for improving the mitigation of each risk.	• Vol 2 All Risk Chapters
General	4. Present two alternative mitigation plans that were considered.	• Vol 2 All Risk Chapters • Workpapers
General	5. Present an early stage "risk mitigated to cost ratio" or related optimization.	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters • Workpapers
General	6. Identify lessons learned in the current round to apply in future rounds.	• Vol 1 RAMP-1 • Vol 1 RAMP-3
General	7. Use required probabilistic analysis and continue to move towards more probabilistic analysis.	• *See* RDF Row 5 • Vol 1 RAMP-3 • Workpapers
General	8. Continue to move towards improved data collection, provide a timeline for improvement.	• *See Data Availability Assessment. Report* filed on 12/6/24.

General	9. Describe Company's safety culture, executive engagement, organization and compensation policies.	• Vol 1 RAMP-4
General	10. Respond to immediate or short-term crises outside of the RAMP and GRC process.	• Vol 1 RAMP-4
D.21-11-009 - S-MAP Phase 1, Tracks 1 & 2		
Topic	**Requirement**	**Compliance**
Controls and Mitigations	OP1b. Each IOU shall evaluate all mitigations for efficacy and efficiency, whether the mitigation is "in process" or newly proposed; and	• Vol 2 Risk Chapters • Workpapers
Controls and Mitigations	OP1c. Each IOU shall calculate ~~RSEs~~ CBRs for all mitigations, including controls that are ongoing.	• Vol 1 RAMP-3 • Vol 2 Risk Chapters • Workpapers
PSPS Events	The IOUs shall treat PSPS events as a risk within the RDF framework, not just as a mitigation, just as they would for any other risk to safety, reliability, and finances. Similar to other risks, the IOUs shall address the likelihood and consequences of PSPS events in the RDF and in future RAMP filings.	• Vol 1 RAMP-1 • Vol 2 SDG&E-Risk-4: Wildfire and PSPS • Workpapers
Baselines	OP1d: Each IOU shall establish baselines for mitigation measures as follows: • The baseline is a reference point in time at the start of the new General Rate Case (GRC) cycle. • The baseline risk as applied to RAMP and GRC proceedings refers to the amount of residual risk evaluated at the baseline (i.e. at the start of the new GRC cycle) after taking into account all risk reduction benefits from all risk mitigation activities projected to have been performed by the start of the new GRC cycle. • The projected risk mitigation activities include those that are classified by the IOUs as controls, as well as all mitigation	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters • Workpapers

	activities for which the IOUs are seeking approval and/or funding in the current or upcoming RAMP and GRC applications.	
Foundational Programs	OP1e: Each IOU shall include the cost of foundational programs in their mitigation ~~RSE~~ CBR calculations if the aggregate cost over the upcoming GRC funding period of the foundational programs supporting a portfolio of risk mitigations exceeds the following: For SDG&E, for its electric and other operations, the lesser of $5 million, or 20 percent of the cost of the portfolio of enabled mitigations, subject to a minimum of $2.5 million for the percentage test; For SDG&E, for its gas operations, the lesser of $2.5 million, or 20 percent of the cost of the portfolio of enabled mitigations, subject to a minimum of $0.5 million for the percentage test; and, For SoCalGas, the lesser of $5 million, or 20 percent of the cost of the portfolio of enabled mitigations, subject to a minimum of $1 million for the percentage test.	• Vol 2 All Risk Chapters • Workpapers
Costs of Foundational Elements	OP1g: Each IOU shall incorporate the costs of foundational elements into the ~~RSEs~~ CBRs they present in their next RAMP filing, shall clearly and transparently explain and justify their chosen distribution of foundational costs to mitigations, and shall comply with applicable requirements of Decision (D.) 18-12-014 to explain their rationale and assumptions in categorizing foundational costs.	• Vol 2 All Risk Chapters • Workpapers

D.22-10-002 – S-MAP Phase 1 Track 3 & 4, Attachment A		
Topic	**Requirement**	**Compliance**
Updating Cost and Other Information	19. The IOU's RAMP cost estimates shall include funding levels, unit costs, the scope of mitigation programs, and the source of estimates. • Where standard work units and unit costs are not available, the utilities will include an explanation as to why they are not available."	• Vol 2 All Risk Chapters • Workpapers
Historical Graphics	20. The IOUs shall provide graphics of historical progress in their RAMP reports that clearly illustrate what safety work has been accomplished and what work remains to be done. The graphics should be consistent with the IOU's safety goals and should provide information on risk mitigations and progress over at least the two immediately preceding RAMP cycles.	• Vol 2 All Risk Chapters
D.22-12-027 – S-MAP Phase 2 Decision		
Topic	**Requirement**	**Compliance**
Value of Statistical Life (VSL) Calculation	Each IOU shall apply the most current published United States Department of Transportation (DOT) value of a statistical life (VSL), adjusted for the base year of their respective RAMP filing, as the standard value in expressing the Safety Attribute described in Appendix A in dollars. OP2: a.1) If applicable, each IOU shall justify its choice of an alternative VSL within the high and low ranges provided by the United States Department of Health and Human Services and provide a sensitivity analysis for the Cost-Benefit Ratio impact of its choice compared to the standard DOT VSL	• Vol 1 RAMP-1 • Vol 1 RAMP-3 • Vol 2 All Risk Chapters • Workpapers

Value of Injury Prevention	OP2: a.ii) Each IOU shall apply one of two following methods for the dollar valuation of injury prevention, as defined in Appendix A, depending on the availability of data: (1) a serious injury as 0.25 of a fatality, or (2) the injury severity level using DOT estimates for the value of injury prevention as indicated here…….	• Vol 1 RAMP-1 • Vol 1 RAMP-3 • Vol 2 All Risk Chapters • Workpapers
Electric Reliability Attribute	OP2: Each IOU shall use the most current version of the Lawrence Berkeley National Laboratory (LBNL) Interruption Cost Estimate (ICE) Calculator to determine a standard dollar valuation of electric reliability risk for the Reliability Attribute included in Appendix A. OP2 b.i) If applicable, each IOU shall justify its choice of an alternative model by providing an analysis comparing the results of its preferred alternative model to the results using the ICE Calculator.	• Vol 1 RAMP-1 • Vol 1 RAMP-3 • Vol 2: SDG&E-Risk-4, Risk-5 and SCG/SDG&E Risk-8 • Workpapers
Gas Reliability Attribute	OP2: c) Each IOU shall apply a dollar value for gas reliability based on the implied value from their most recent Multi-Attribute Value Function Risk Score calculation presented in their most recent RAMP or shall justify its choice of an alternative model by providing an analysis comparing the results of its preferred alternative model to the results using the implied values. If using the implied value from its most recent RAMP … for SDG&E and SoCalGas, use the 2021 RAMP filings,…	• Vol 1 RAMP-3 • Vol 1 RAMP-3 • Vol 2 SCG-Risk-1, 2, 3, and 4 • Vol 2 SDG&E-Risk-1, 2, and 3 • Workpapers
Environmental and Social Justice Pilot Study	OP 5 …Southern California Gas Company (SoCalGas), and San Diego Gas & Electric Company (SDG&E) (collectively investor-owned utilities or IOUs) shall each conduct an Environmental and Social Justice (ESJ) Pilot Study that includes consideration of Disadvantaged and Vulnerable Communities (DVCs)as defined in this decision and shall file the results of their Pilot studies as described in this decision with their next Risk Assessment Mitigation Phase (RAMP) filing.	• Vol 1 RAMP-1 • Appendix 4

Environmental and Social Justice Pilot Study CBO Feedback	OP 5 The IOUs shall provide timely information to Commission Energy Division Staff, who will consult with the Disadvantaged Communities Advisory Group (DACAG) and the Community-Based Organization Working Group (CBOWG) or their designees, prior to finalizing their ESJ Pilot Study plans. The IOUs shall work with Commission Energy Division Staff to make sure each utility's ESJ Pilot Study plan is on an appropriate DACAG and CBOWG meeting agenda in time for these groups to provide meaningful feedback on the plans. The IOUs shall each hold a public webinar on their ESJ Pilot Study during the planning phase of the pilot as described in this decision.	• Vol 1 RAMP-1 • Appendix 4
ESJ Pilot Study Wildfire Smoke	OP 7 …San Diego Gas & Electric Company, and Southern California Gas Company shall use public studies of the health impacts of wildfire smoke available in 2023 and thereafter to structure their risk methodology related to evaluating the estimated impacts from wildfire smoke in their Environmental and Social Justice Pilot Studies.	• Appendix 4
D.24-05-064 S-MAP Phase 3 Decision		
Topic	**Requirement**	**Compliance**
Post Test Year Forecasting Requirement	All Controls and Mitigation programs must include CBRs in each of the GRC post-test years as well as an aggregate CBR for the entire post-test year period and the entire GRC period, by Tranche.	• Vol 1 RAMP-1 • Vol 2 RAMP-3 • Vol 2 All Risk Chapters • Workpapers
Climate Change Approaches	OP 3: Climate Adaptation and Vulnerability Assessment report, as required in D.20-08- 046, should be identified in the IOU's RAMP filings; d) should seek to avoid, if possible, any long-term asset investment strategy that would be at risk in the future because of climate change impacts.	• Vol 1 RAMP-5 • Vol 2 Risk Chapters, as applicable

Climate Change Approach - Data Analysis and Workpapers	May quantitatively consider climate change impacts in their Risk Assessment and Mitigation Phase (RAMP) filings, including through use of forecasts and Subject Matter Expert input. a) Data and analysis used for this purpose shall meet the data standards indicated in Decision 19-10-054 and more generally as adopted in Rulemaking 18-04-019 or a successor proceeding, as discussed in this decision, and must be provided in full in work papers submitted at the time of the RAMP filing	• NA
Climate Change Approach	b) When quantitatively considering climate change impacts in the RAMP filing, the IOUs should clearly identify the known climate hazards considered	• NA
Climate Change comportment with CAVA	c) Any assets identified by an IOU as at risk or vulnerable to climate change in its most recent Climate Adaptation and Vulnerability Assessment report, as required in D.20-08- 046, should be identified in the IOU's RAMP filings;	• Vol 1 SCG RAMP-5 • Vol 1 SDG&E RAMP-5 • Vol 2 SCG-Risk-2, 3, 4, 5, and 6 Vol 2 SDG&E Risk- 2, 3, 4, 5, and 7
D.24-05-064 – Phase 3 Attachment A		
Topic	**Requirement**	**Compliance**
Building a Cost Benefit Approach – Step 1A, Row 2	Principle 1. Attribute Hierarchy: Attributes are combined in a hierarchy, such that the primary Attributes are typically labels or categories and the sub-Attributes are observable and measurable.	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters • Workpapers
Building a Cost Benefit Approach – Step 1A, Row 3	Principle 2. Measured Observations: Each sub-Attribute has Levels expressed in Natural Units that are observable during ordinary operations and as a Consequence of the occurrence of a Risk Event.	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters
Building a Cost Benefit Approach – Step 1A, Row 4	Principle 3. Comparison: Use a measurable proxy for an Attribute that is logically necessary but not directly measurable. This principle only applies when a necessary Attribute is not directly measurable. For example, a measure of the number of complaints about	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters/ Attachment B where applicable • Workpapers

	service received can be used as a proxy for customer satisfaction."	
Building a Cost Benefit Approach – Step 1A, Row 5	Principle 4. Risk Assessment: When Attribute Levels that result from the occurrence of a Risk Event are uncertain, assess the uncertainty in the Attribute Levels by using expected value or percentiles, or by specifying well-defined probability distributions, from which expected values and tail values can be determined. Monte Carlo simulations or other similar simulations (including calibrated subject expertise modeling), among other tools, may be used to satisfy this principle.	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters/Attachment B • Workpapers
Building a Cost Benefit Approach – Step 1A, Row 6	Principle 5. Monetized Levels of Attributes: Apply a monetized value to the Levels of each of the Attributes using a standard set of parameters or formulas, from other government agencies or industry sources, as determined by the Phase II Decision Adopting Modifications to the Risk-Based Decision-Making Framework Adopted in D.18-12-014 and Directing Environmental and Social Justice Pilots in Rulemaking (R.) 20-07-013. A utility may deviate from the agreed upon standard set of parameters or formulas by submitting a detailed explanation as to why the use of a different value would be more appropriate. The use of a different set of parameters or formulas to determine the Monetized Levels of Attributes requires an analysis comparing the results of its "equivalent or better" set of parameters or formulas against the results of the agreed upon standard set of parameters or formulas"	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters • Workpapers
Building a Cost Benefit Approach – Step 1A, Row 7	Principle 6. Risk Adjusted Attribute Levels: Apply a Risk Scaling Function to the Monetized Levels of an Attribute or Attributes (from Row 6) to obtain Risk-Adjusted Attribute Levels. The Risk Scaling Function is an adjustment made in the risk model due to different magnitudes of Outcomes, which can capture aversion or indifference	• Vol 1 RAMP-3 • Vol 2 SDGE-Risk-4 • Workpapers

	towards those Outcomes. The Risk Scaling Function can be Linear or convexly non-Linear. For example, the Risk Scaling Function is Linear to express indifference if avoiding a given change in the Monetized Attribute Level does not depend on the Attribute Level. Alternatively, the Risk Scaling Function is convexly non-Linear to express aversion if a change in the Attribute level results in an increasing rate of change in the Risk-Adjusted Monetized Attribute Level as the Level of the Attribute increases.	
Benefit Approach – Step 1A, Row 7	When completing Rows 5 and 24 in the RDF, if a utility chooses to address tail risk using the power law or other statistical approach and chooses to present Risk-Adjusted Attribute Levels by relying on a convex scaling function, then it must supplement its analysis by also presenting Risk-Adjusted Attribute Levels by relying on a Linear scaling function.	• Vol 1 RAMP-3 • Vol 2 SDG&E-Risk-4 • Workpapers
Identify Risks for the Enterprise Risk Register Step 1B, Row 8	Risk Identification and Definition: Utilities' risks are defined in their respective Enterprise Risk Registers. The Enterprise Risk Register is the starting point for identifying the risks that will be included in the RAMP. The process for determining these risks will be described in the RAMP. The RAMP will consider risks using the same risk definitions as in the ERR.	• Vol 1 RAMP-2 • Vol 1 RAMP-3 • Vol 2 – All Risk Chapters
	Each RAMP filing will highlight any changes to the ERR from the previous RAMP or GRC filings	• Vol 1 RAMP-2 • Vol 2 All Risk Chapters
Risk Assessment and Risk Ranking in Preparation for RAMP Step 2A, Row 9	Risk Assessment: Using the Cost-Benefit Approach developed in accordance with Step 1A, for each Risk included in the Enterprise Risk Register, the utility will compute a monetized Safety Risk Value using only the Safety Attribute. The utility will sort its ERR Risks in descending order by the monetized Safety Risk Value. For the top 40% of ERR risks with a Safety Risk Value greater than zero dollars, the utility will compute a monetized Risk Value using at least the	• Vol 1 RAMP-1 • Vol 1 RAMP-2 • Vol 1 RAMP-3

	Safety, Reliability and Financial Attributes to determine the output for Step 2A. The output of step 2A, along with input from stakeholders described in Row 12 below, will be used to decide which risks will be addressed in the RAMP.	
Identification of Potential Consequences of Risk Event Step 2A, Row 10	The identified potential Consequences of a Risk Event should reflect the unique characteristics of the utility. For each enterprise risk, the utility will use actual results, available and appropriate data (e.g., Pipeline and Hazardous Materials Safety Administration data), and/or Subject Matter Experts (SMEs) to identify potential Consequences of the Risk Event, consistent with the Cost-Benefit Approach developed in Step 1A. The utility should use utility specific data, if available. If data that is specific to the utility is not available, the utility must supplement its analysis with subject matter expertise. Similarly, if data reflecting past results are used, that data must be supplemented by SME judgment that takes into account the Benefits of any Mitigations that are expected to be implemented prior to the GRC period under review in the RAMP submission.	• Vol 2 All Risk Chapters, Attachment B • Workpapers
Identification of the Frequency of the Risk Event Step 2A, Row 11	The identified Frequency of a Risk Event should reflect the unique characteristics of the utility. For each enterprise risk, the utility will use actual results and/or SME input to determine the annual Frequency of the Risk Event. The utility should use utility specific data, if available. If data that is specific to the utility is not available, the utility must supplement its analysis with subject matter expertise. In addition, if data reflecting past results are used, that data must be supplemented by SME judgment that takes into account the Benefits of any Mitigations that are expected to be implemented prior to the GRC period under review in the RAMP submission.	• Vol 2 All Risk Chapters, Attachment B • Workpapers

	The utility will take into account all known relevant Drivers when specifying the Frequency of a Risk Event. Drivers should reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to the asset. For example, where applicable, Drivers may include: the presence of corrosion, vegetation, dig-ins, earthquakes, windstorms or the location of a pipe in an area with a higher likelihood of dig-ins.	
Selecting Enterprise Risks for RAMP Step 2B, Row 12	Risk Selection Process for RAMP: Using the analysis performed in Step 2A, the utility will preliminarily select risks to be included in the RAMP. The utility will host a publicly noticed workshop, to be appropriately communicated to interested parties and at a minimum, should include the CPUC's Safety Policy Division (SPD), to gather input from SPD, other interested CPUC staff, and interested parties to inform the determination of the final list of risks to be included in the RAMP. Based on input received from SPD, other interested CPUC staff, and interested parties, the utility will make its determination of the final list of risks to be addressed in its RAMP. The rationale for taking or disregarding input during the workshop will be addressed in the utility's RAMP.	• Vol 1 RAMP-1 • Vol 1 RAMP-2 • Vol 1 RAMP-3
Calculation of Risk Step 3, Row 13	For purposes of the Step 3 analysis, pre- and post-mitigation risk will be calculated by multiplying the Likelihood of a Risk Event (LoRE) by the Consequences of a Risk Event (CoRE). The CoRE is the sum of each of the Risk-Adjusted Attribute Values using the utility's full Cost-Benefit Approach.	• Vol 2 All Risk Chapters
Definition of Risk Events and Tranches Step 3, Row 14	Detailed pre- and post-mitigation analysis of Mitigations will be performed for each risk selected for inclusion in the RAMP. The utility will endeavor to identify all asset groups or systems subject to the risk and each Risk Event associated with the risk. For example, if	• Vol 1 RAMP 3 • Vol 2 All Risk Chapters, Attachment D • Appendix 3

	Steps 2A and 2B identify wildfires associated with utility facilities as a RAMP Risk Event, the utility will identify all Drivers that could cause a wildfire and each group of assets or systems that could be associated with the wildfire risk, such as overhead wires and transformers.	• Workpapers
	For each Risk Event, the utility will subdivide the group of assets or the system associated with the risk into Tranches. Risk reductions from Mitigations and Cost Benefit Ratios will be determined at the Tranche level, which gives a more granular view of how Mitigations will reduce Risk.	
	The determination of Tranches will generally be based on how the risks, as a product of LoRE and CoRE, and assets are managed by each utility, data availability and model maturity, and strive to achieve as deep a level of granularity as reasonably possible. The rationale for the determination of Tranches, or for a utility's judgment that no Tranches are appropriate for a given Risk Event, will be presented in the utility's RAMP submission.	
	For the purposes of the risk analysis, all of the elements (i.e., assets or system) that are scoped for a given RAMP and GRC Application and contained within the identified Tranche would be considered to have homogeneous risk profiles, meaning they should have the same LoRE and CoRE.	
	The best practice for determining the homogeneity of risk profiles in reporting Tranches is the use of quintiles of LoRE and quintiles of CoRE, resulting in 25 reporting tranches. The utility can and should submit more granular data in workbooks included with RAMP and GRC filings if it is available. If the assets or system associated with a given risk are less than 25 in number, the utility may use an alternative means of determining homogeneity of risk profiles,	

	including quartiles or other smaller divisions of LoRE and CoRE, but this alternative means must be described in detail in the RAMP filing.	
	If a utility desires to use an alternative determination of Tranches not reflecting 25 homogenous risk profiles based on LoRE and CoRE, or they wish to use a percentile ranking approach that would result in more than 25 reporting Tranches, the utility must submit a White Paper describing their preferred method for determining Tranches and relevant workpapers to SPD no later than 45 days before their first pre-RAMP workshop and must serve the White Paper to the service list of R.20-07-013 or a successor proceeding as well as the service list of the utility's most recent RAMP application no later than 45 days before their first pre-RAMP workshop. Staff and parties may provide input on the IOU's White Paper within the 21 days of the submittal. The utility must also include the White Paper in its RAMP filing, clearly indicating any changes to the previously served version. An IOU may submit this White Paper without prejudice to the right of parties to the RAMP or GRC to challenge such alternative determination of tranches.	• Vol 1 RAMP-3 • Appendix 3 • Workpapers
Bow Tie Step 3, Row 15	For each risk included in the RAMP, the utility will include a Bow Tie illustration. For each Mitigation presented in the RAMP, the utility will identify which element(s) of its associated Bow Tie the Mitigation addresses.	• Vol 1 RAMP-2 • Vol 2 All Risk Chapters
Expressing Effects of a Mitigation, Step 3, Row 16	The effects of a Mitigation on a Tranche will be expressed as a change to the Tranche-specific pre-mitigation values for LoRE and/or CoRE. The utility will provide the pre- and post-mitigation values for LoRE and CoRE determined in accordance with this Step 3 for all Mitigations subject to this Step 3 analysis.	• Vol 1 RAMP-3 • Appendix C • Workpapers

Determination of Pre-Mitigation LoRE by Tranche Step 3, Row 17	The pre-mitigation LoRE is the probability that a given Risk Event will occur with respect to a single element of a specified Tranche over a specified period of time (typically a year) in the planning period, before a future Mitigation is in place.	• Instructional, informs workpapers
Determination of Pre-Mitigation CoRE Step 3, Row 18	The pre-mitigation CoRE is the sum of each of the pre-mitigation Risk-Adjusted Attribute Values using the utility's full Cost-Benefit Approach. The CoRE is calculated using the full Cost-Benefit Approach tool constructed consistent with Step 1A above.	• Instructional, informs workpapers
Determination of Post-Mitigation LoRE Step 3, Row 20	The monetized pre-mitigation risk value will be calculated as the product of the pre-mitigation LoRE and the pre-mitigation CoRE for each Tranche subject to the identified Risk Event.	• Instructional, informs workpapers
Determination of Post-Mitigation CoRE Step 3, Row 21	The post-mitigation LoRE calculation will be conducted at the same level of granularity as the pre-mitigation risk analysis within Step 3. The calculated value is the probability of occurrence of a Risk Event after the future Mitigation is in place.	• Instructional, informs workpapers
Measurement of Post-Mitigation Monetized Risk Value Step 3, Row 22	The monetized post-mitigation risk value will be calculated as the product of the post-mitigation LoRE and post-mitigation CoRE for each Tranche subject to the identified Risk Event.	• Instructional, informs workpapers
Measurement of Risk Reduction Provided by Mitigation Step 3, Row 23	The risk reduction provided by a risk mitigation will be measured as the difference between the values of the monetized pre-mitigation risk value and the monetized post-mitigation risk value.	• Instructional, informs workpapers

Use of Expected Value for CoRE; Supplemental Calculations Step 3, Row 24	In the case of wildfire risks, if the utility choose to present an Alternative Analysis regarding tail value, the utility: (a) should use a truncated power law distribution method as a best practice by conducting multiple tests of truncation values to determine goodness of fit to existing data and then include the results in their RAMP application; and, (b) may use an alternative modeling method to the truncated power law, and submit to SPD and serve to the service list of R.20-07-013, or a successor proceeding, and the utility's most recent RAMP application proceeding a White Paper and related workpapers clearly justifying its approach no later than 45 days before its first pre-RAMP workshop. Staff and parties may provide input on the IOU's White Paper within 21 days of the submittal. The utility must also include the White Paper in its RAMP filing, clearly indicating any modifications to the earlier served version.	• Instructional, informs workpapers • Vol 2 SDG&E Risk-4
Cost-Benefit Ratios Calculation Step 3, Row 25	The Cost-Benefit Ratio calculation should be calculated by dividing the dollar value of Mitigation Benefit by the Mitigation cost estimate. • The values in the numerator and denominator should be present values to ensure the use of comparable measurements of Benefits and costs. • The Benefits should reflect the full set of Benefits that are the results of the incurred costs. When calculating CBRs for each mitigation, the IOUs must provide the following three scenarios: a) Societal Discount Rate Scenario b) Weighted-Average Cost of Capital Discount Rate Scenario, and c) Hybrid Discount Rate Scenario For capital programs, the costs in the denominator should include incremental expenses made necessary by the capital investment.	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters • Appendix 5 • Instructional, informs workpapers

Mitigation Strategy Presentation in the RAMP and GRC Step 3, Row 26	The utility's RAMP filing will provide a ranking of all RAMP Mitigations by Cost-Benefit ratios. In the GRC, the utility will provide a ranking of Mitigations by Cost Benefit Ratios, as follows: (1) For Mitigations addressed in the RAMP, the utility will use risk reduction estimates, including any updates, and updated costs to calculate Cost-Benefit Ratios and explain any differences from its RAMP filing; (2) For Mitigations that require Step 3 analysis under and consistent with Row 28, the utility will include the Cost-Benefit Ratios, calculated in accordance with Step 3, in the ranking of Mitigations by Cost-Benefit Ratios. In the RAMP and GRC, the utility will clearly and transparently explain its rationale for selecting Mitigations for each risk and for its selection of its overall portfolio of Mitigations. The utility is not bound to select its Mitigation strategy based solely on the Cost-Benefit Ratios produced by the Cost-Benefit Approach. Mitigation selection can be influenced by other factors including, but not limited to, funding, labor resources, technology, planning and construction lead time, compliance requirements, Risk Tolerance thresholds, operational and execution considerations, and modeling limitations and/or uncertainties affecting the analysis. In the GRC, the utility will explain whether and how any such factors affected the utility's Mitigation selections.	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters • Appendix 5 • Workpapers
Dynamic Analysis Step 3, Row 27	If LoRE or CoRE is expected to change substantially over time due to factors such as asset age, asset condition, and varying effect of Mitigation over time, these changes should be specified and	• Vol 1 RAMP-3 • Workpapers

	incorporated into the calculation of monetized pre- and post-mitigation risk values and Cost-Benefit Ratios. One means of incorporating these changes is by the use of the dynamic analysis demonstrated by the Joint Intervenors in the test drive problems for high pressure gas pipelines for PG&E and SoCalGas/SDG&E in Phase 2 of A.15-05-002 et al	
Transparency in RAMP and GRC – Results can be understood Step 3, Row 29	Inputs and computations for the Steps described in this document should be clearly stated and defined in RAMP and, when applicable, the GRC. The sources of inputs should be clearly specified. When SME judgment is used, the process that the SMEs undertook to provide their judgment should be described. Any questionnaire or document used to solicit SME judgment will be made available to the CPUC and parties upon request. The utility should specify all information and assumptions that are used to determine both monetized pre- and post-mitigation risk values.	• Vol 1 RAMP-3 • Vol 2 All Risk Chapters, Attachment B and Attachment D • Workpapers
Sensitivity Analysis Step 3, Row 30	The utility will identify critical parameters and assumptions made in performing the risk analysis and explain why such parameters are critical. The utility will be prepared to complete a sensitivity analysis of its results when requested. Intervenors may request sensitivity analyses via the discovery process.	• Vol 1 RAMP-3



2025 Risk Assessment Mitigation Phase

APPENDIX 3

White Paper Describing Alternative Tranching Method

May 15, 2025





White Paper Describing Alternative Tranching Method of Southern California Gas Company and San Diego Gas & Electric Company

November 1, 2024

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I. Introduction and Purpose

This paper describes Southern California Gas Company (SoCalGas) and San Diego Gas & Electric Company's (SDG&E) (together, the Companies) approach to tranching risk for their respective Risk Assessment and Mitigation Phase (RAMP) application and report to be filed with the California Public Utilities Commission (CPUC or Commission) in May 2025.[1]

By initiating Rulemaking (R.) 20-07-013 the Commission set in motion an iterative and collaborative process of risk-based evaluation and prioritization of safety-based utility activity and risk mitigation. Through the phased approach of the Safety Model Assessment Proceeding (S-MAP) and the resultant Risk-Based Decision-Making Framework (RDF), the utilities, intervenors, and the Commission continue to participate in shaping an evolving construct that informs the Commission regarding safety related forecasted and risk mitigation spending through the RAMP and related assessment reports.[2] Decision (D.) 24-05-064 (the Phase 3 Decision) provides the most current guidance and revisions to the RDF while affording flexibility such that the utilities can consider the most appropriate method of evaluating and presenting certain of their data.[3] Specifically, as being presented here, the RDF's Cost Benefit Approach[4] offers the utilities the option to use an approach adopted by the Commission in the Phase 3 Decision, or to develop and adopt an alternative approach to the tranching of its risk portfolio, and explain the alternative approach through a white paper provided a minimum of 45 days prior to the date of its pre-RAMP workshop. Staff and parties have 21 days from submittal to provide input on the White Paper, and the alternative approach will be discussed in the Companies' RAMP Risk workshop. SoCalGas and SDG&E appreciate the opportunity to present an alternative tranching methodology to support the thoughtful consideration and transparent assessment by the Commission and intervenors of the broad portfolio of risks and mitigation activities to be presented in their respective RAMP reports.

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1 A "tranche" is a "[a] logical disaggregation of a group of assets (physical or human) or systems into subgroups with like characteristics for purposes of risk assessment." D.21-11-009, Appx. D. For purposes of this whitepaper, "tranching" refers to the act of dividing assets into tranches to be used in RAMP analysis.

2 Risk Spend Accountability Report (RSAR), Safety Performance Metric Report (SPMR), and the Risk Mitigation Accountability Report (RMAR).

3 Another example of options afforded in the Cost Benefit Approach is the alternative to the Department of Transportation Value of a Statistical Life (VSL) and dollar value of electric and gas reliability (Phase 2 Decision); and tail risk consequence modeling (Phase 3 Decision).

4 D.24-05-064, Appendix A "Risk-Based Decision Framework".

As described herein, the Companies' tranching approach is designed to promote the following goals to advance the Commission's overall RDF objectives:

- Achieve data-driven results;
- Promote increased transparency and granularity;
- Establish measurable LoRE and/or CoRE distinction between tranches;
- Align with and inform risk mitigation efforts compatible with the Companies' existing and prospective operating procedures; and
- Result in homogenous risk profiles (to the extent possible based on available data).

The Companies tested the development of tranches in accordance with the Commission's Risk-Based Decision-Making Framework RDF Cost Benefit Approach, Step 3, Row 14, as recently revised via the Phase 3 Decision (Phase 3 Tranching Approach). The results of this testing, discussed further below, indicate the methodology may not best enable achievement of the Commission's RDF objectives.

Following testing of the Phase 3 Tranching Approach (PTTA), the Companies developed and describe herein an alternative Homogenous Tranching Method (or HTM) that they believe is better suited to the achievement of Commission's RDF objectives. This methodology, to be used to develop their 2025 RAMP reports, builds upon the PTTA and provides greater flexibility such that it can be applied to all of the Companies' diverse RAMP risks.[5] The HTM is designed to prevent potential information loss observed in PTTA testing, by identifying the specific Risk Profiles (Classes) targeted by the Risk-Treatment,[6] the particular risk levels within Classes that the Risk Treatment predominantly reduces, and the specific LoRE/CoRE regions within those risk levels that are most affected.[7] Importantly, the HTM enhances the ability of the Commission to identify the "riskiest portions of [a utility's]

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[5] The Companies met with the Commission's Safety Policy Division (SPD) staff on September 10, 2024 and October 14, 2024 to discuss their observations and HTM approach.

[6] According to the International Organization for Standardization (ISO) 31000:2018, risk treatment involves the process of selecting and implementing measures to modify risk. This can include avoiding the risk, taking or increasing the risk to pursue an opportunity, removing the risk source, changing the likelihood, changing the consequences, sharing the risk, or retaining the risk by informed decision. For purposes of this whitepaper, the Companies use the term "risk treatment" to refer to a risk control or mitigation in the RAMP context.

[7] LoRE is the likelihood of a risk event. D.21-11-009, Appx. D at 2. CoRE refers to the consequences of a risk event. *Id*. at 1. A LoRE/CoRE pairing is a likelihood and resulting consequence of a risk event that can be combined in an ordered pair and plotted on an x-y plane, and a LoRE/CoRE region is a collection of LoRE/CoRE pairs that are in relatively close proximity to one another on an x-y plane.

infrastructure and/or management system," consistent with the Phase 3 Decision's stated objectives.[8]

Section II of this paper describes the PTTA testing, results, and observations leading to the development of the HTM and this whitepaper.

Section III describes the HTM approach the Companies have developed to tranche their risks, which include preliminary RAMP Risks, including Medium Pressure Gas, High Pressure Gas, Gas Excavation Damage, Gas Storage (SoCalGas only), Wildfire & PSPS (SDG&E only), Electric Infrastructure Integrity (EII) (SDG&E only), Employee Safety, Contractor Safety, and Cybersecurity.

The Companies note that analysis of risks and preparation for their respective RAMP filings are ongoing. Thus, the results used for purposes of testing the PTTA and for developing and testing the HTM are preliminary and subject to further adjustment and assessment.

II. The Phase 3 Decision's Tranching Methodology (PTTA): Testing, Observations, and Challenges

A. The PTTA: Definition and Objectives

The Phase 3 Decision adopted the PTTA for tranching (segmenting) risks and "requir[es utilities] to use this approach to determine tranches in most cases," while allowing for flexibility.[9] The PTTA is described in the Phase 3 Decision as follows:

> The best practice for determining the homogeneity of risk profiles in reporting Tranches is the use of quintiles of LoRE and quintiles of CoRE, resulting in 25 reporting tranches. The utility can and should submit more granular data in workbooks included with RAMP and GRC filings if it is available, but that more granular data shall be aggregated into at least 25 reporting tranches with homogeneous risk profiles. If the assets or system associated with a given risk are less than 25 in number, the utility may use an alternative means of determining homogeneity of risk profiles, including quartiles or other smaller divisions of LoRE and CoRE, but this alternative means must be described in detail in the RAMP filing.
>
> If an IOU prefers to determine tranches not based on homogeneous risk profiles using LoRE and CoRE quintiles, or they wish to use a percentile ranking approach that would result in more than 25 reporting tranches, the IOU must submit a White Paper describing its preferred method for

[8] D.24-05-064 at 28.

[9] D.24-05-064 at 26-27.

> determining tranches along with relevant workpapers to SPD no later than 45 days before their first pre-RAMP workshop and must serve the White Paper to the service list of R.20-07-013 on the same timeframe. Staff and Parties may provide input on the IOU's White Paper on an alternative approach to creating tranches within 21 days of the submittal. This alternative approach to creating tranches shall be discussed in the pre-RAMP workshop, a requirement that reflects the first of the IOUs' two proposed approaches. The IOU must also include the White Paper in its RAMP filing, clearly indicating any changes to the previously served version.[10]

The PTTA articulates, among other things, two core objectives for tranching:

1) The number of tranches for each risk should be the result of pairing each of five equal Likelihood of Risk Event subdivisions (LoRE quintiles) with each of five equal Consequence of Risk Event subdivisions (CoRE quintiles), or a total of twenty-five tranches,[11] and

2) Each resultant tranche should feature "homogeneity of risk profiles;" that is, all of the events within a tranche should be similarly "risky" and have the same LoRE and CoRE.

Further, the Risk OIR Phase 3 Decision concludes that the approach should provide benefits to "understand[ing] if a utility is requesting funding for mitigations in the riskiest portions of their infrastructure and/or management system," as follows:[12]

> Filing of RAMP analyses using LoRE/CoRE quintile tranches will aid the Commission and [help] parties understand if a utility is requesting funding for mitigations in the riskiest portions of their infrastructure and/or management system. This is essential if the Commission is to ensure strategic targeting of mitigations such that the greatest risk reduction benefits are achieved at the lowest cost, while taking into account the need to minimize risks as quickly as possible. Ensuring the greatest risk reduction benefits are achieved at the lowest cost is essential to ensuring just, reasonable, and affordable rates.

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[10] D.24-05-064 at 26-27.

[11] Quintiles are achieved when a grouping is divided into five (5) equal subgroups. Alternatively, the Companies understand from their meetings with SPD that SPD considers other "quantile" subdivisions - such as quartiles (four equal subgroups) or terciles (three equal subgroups) – to be consistent with the PTTA.

[12] D.24-05-064 at 28.

B. Testing the PTTA

With the intent of understanding, empirically, the implications of fitting real data into the PTTA, the Companies tested the PTTA on preliminary unscaled model results for SoCalGas medium-pressure gas pipeline system (MP Gas) and SDG&E Wildfire without PSPS, as well as for a randomly generated risk example from a uniform distribution.

Specifically, the Companies divided the LoREs and CoREs into "quintiles" consistent with the above-described methodology. A quintile is defined as a quantile for the special case of five equal proportions.[13] Although the quintile concept inherently reflects equal divisions, the Phase 3 Decision did not provide clear guidance on how to accomplish proportional "equality."

The Companies interpret the term "equal" such that the modelled LoREs and expected value CoREs would each be divided into five groups of near-equal size.[14] This is accomplished using percentiles, *i.e.*, by sorting the LoREs from smallest to largest and then defining group boundaries at the 20%, 40%, 60%, and 80% LoRE quantiles. This process can be repeated using the CoREs to obtain the CoRE quintiles. Each LoRE and corresponding CoRE can be expressed as an ordered pair (*i.e.,* ($LoRE_i$, $CoRE_i$)) and plotted on an x-y axis, with a 5x5 grid to demarcate the boundaries for the LoRE and CoRE quintiles. In this graphical representation, there would be a near equal number of LoRE/CoRE pairs in each column (the quintiles of LoRE) and a near equal number of LoRE/CoRE pairs in each row (the quintiles of CoRE) (*see* Figure 1, 2 and 3 below). This maximizes the likelihood of having an equal number of pairs within each LoRE/CoRE tranche, thereby reducing the likelihood of having empty tranches[15] or tranches with a disproportionately high number of pairs.

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[13] *See, e.g.,* Cambridge Dictionary, *available at* https://dictionary.cambridge.org/us/dictionary/english/quintile (defining quintile as "one of five equal measurements that a set of things can be divided into").

[14] The term "near-equal" alludes to the fact that dividing into five equal groups may not be possible. For example, in the case where the number of points is not evenly divisible by 5, it is not possible that all 5 groups will have the exact same number of points.

[15] An empty tranche results from developing 25 tranches in accordance with the PTTA approach and determining that certain of the tranches have no actual risk associated with them. An empty tranche is essentially no tranche at all – *i.e.,* it is a dummy tranche that is created solely for the purpose of adhering to the PTTA. For this reason, the Companies have adopted an approach that avoids empty tranches.

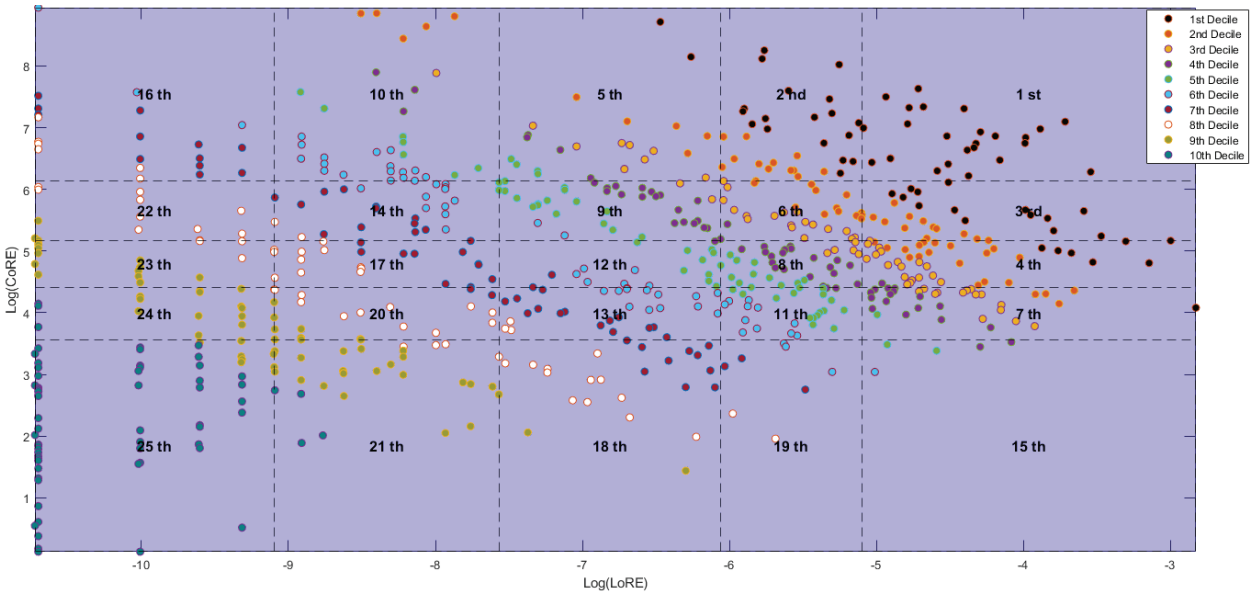


Figure 1. Preliminary Unscaled Wildfire without PSPS Log-Log plot of LoRE/Expected CoRE Quintile Approach. For added information, the pairs are identified by color to which risk decile they belong to. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

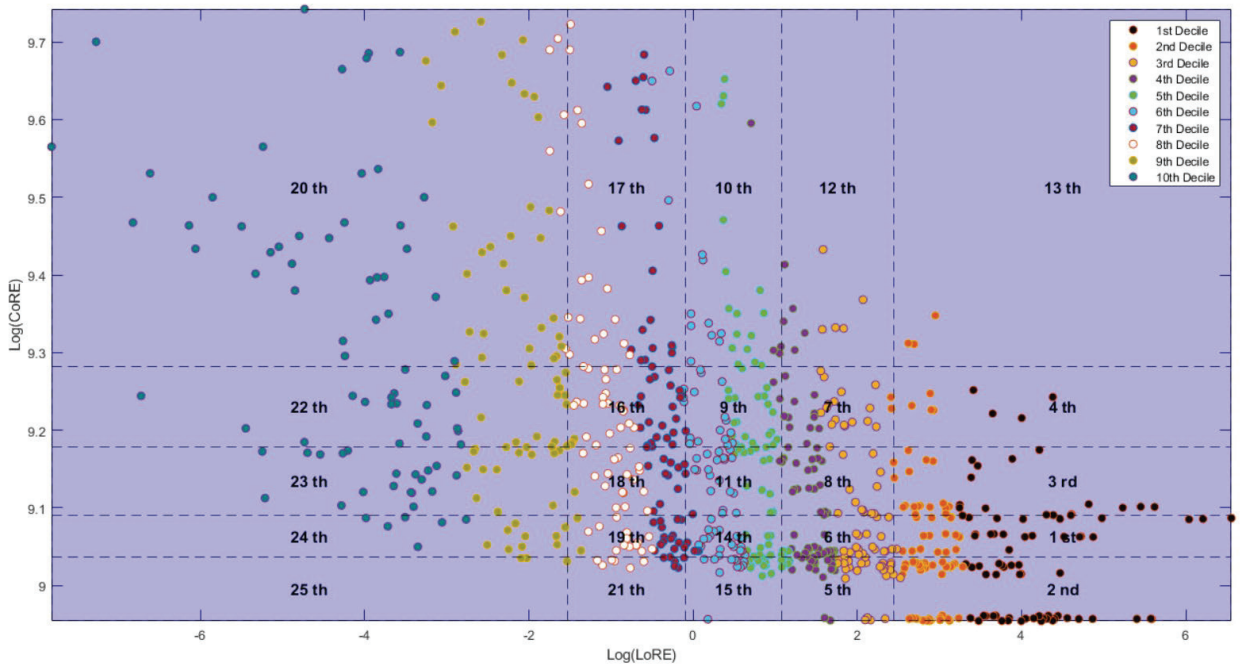


Figure 2. Preliminary Unscaled SoCalGas Medium Pressure Pipe Mains and Services Log-Log plot of LoRE/Expected CoRE Quintile Approach. For added information, the pairs are identified by color to which risk decile they belong to. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

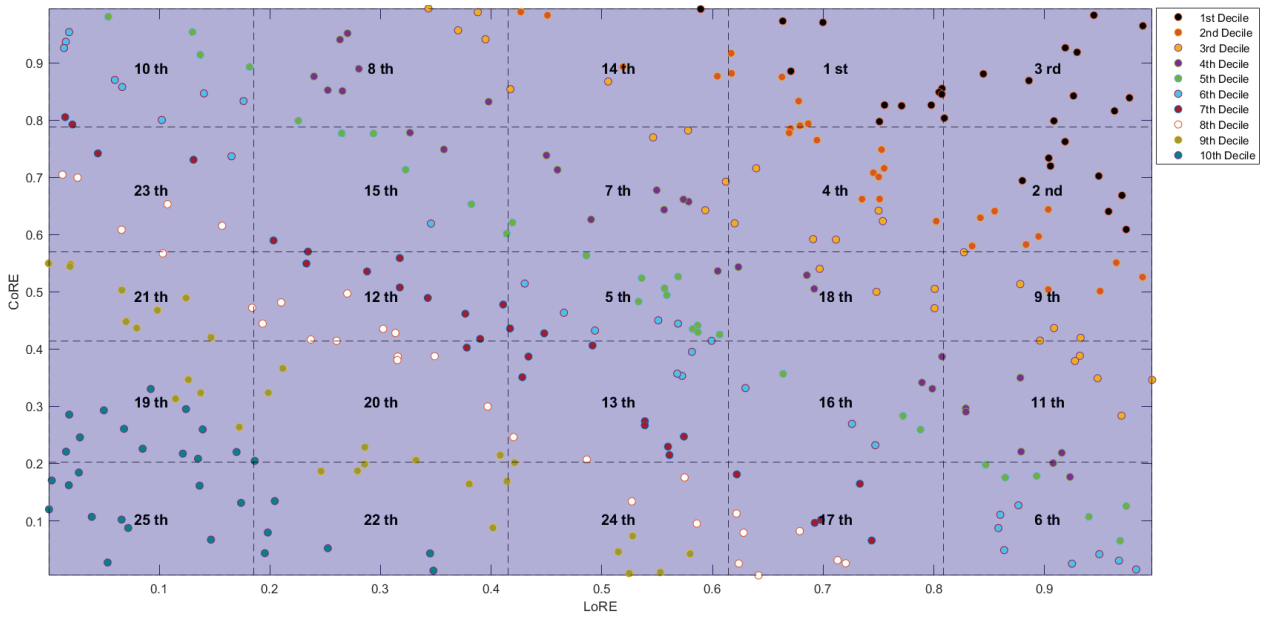


Figure 3. Randomly Generated LoRE/ CoRE pairs from a uniform distribution. For added information, the pairs are identified by color to which risk decile they belong to. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

Conversely, an alternative interpretation of "equal" could involve dividing the LoREs and CoREs into five groups with equidistant boundaries (*e.g.*, if the dataset ranges from 0 to 50, the groups would be defined by values between 0-10, 10-20, etc.) Unless the data is perfectly uniformly distributed, however, this method would not result in an equal number of LoREs or CoREs in each quintile, making it impossible to have an equal number of pairs within each tranche. For instance, if one LoRE quintile has 20 values and another has 10, graphically, one column would have 20 pairs and another would have 10 pairs. Consequently, it would be impossible for the 10 tranches resulting from dividing these two columns by the CoRE quintile boundaries to have an equal number of pairs.

Even with a near-equal number of LoRE/CoRE pairs along a single dimension, SoCalGas and SDG&E still observed that, unless these pairs are scattered in a precisely uniform manner in both dimensions, the groups necessarily will have an unequal number of pairs in each quintile tranche and may result in empty tranches. For example, the 5x1 tranche (*i.e.*, the 5th LoRE column from left and 1st CoRE row from the bottom) in Figure 1 holds only five pairs, while the 5x2 tranche holds over 30 pairs. Even in the case of a uniformly distributed example, as seen in Figure 3, the number of pairs vary from one quintile tranche to the next, which demonstrates that a precise uniform distribution of the LoRE/CoRE pairs is an extreme case. This effect can lead to both clustering and sparsity in the data. For example, a tranche might exhibit a relatively high total risk score compared to other tranches due to a dense concentration of LoRE/CoRE pairs. However, these pairs may not necessarily correspond to the highest risk segments within that risk chapter.

C. Observations: Information Loss

The analysis reveals inconsistencies between the PTTA objective to develop tranches with "homogeneity of risk profiles" and the guidance to produce twenty-five tranches reflective of each possible pairing of LoRE and CoRE quintiles.[16]

SoCalGas and SDG&E observed that the risk (LoRE x CoRE) of similar levels will scatter across many quintile tranches. As a result, a quintile tranche can aggregate the highest risk pairs with some of the lowest risk pairs. In Figure 1, the Companies see that the first decile risks are mixed with the fifth decile risks. By "decile of risk," the Companies mean that the risks computed from the LoRE/CoRE pairs are divided into 10 risk quantiles. This is done by ordering the risks from highest to lowest and then grouping them into 10 nearly equal groups. The first decile represents the top 10% of risk, the second decile represents the next top 10% of risk, and so on. This type of aggregation can lead to potentially minimizing the presence of risk with respect to specific assets.

The Companies also observe that broadly applying the PTTA to an entire risk chapter could mix unlike risk profiles in a way that does not best represent the differences in risk profiles of the assets within the risk. For example, SoCalGas's Medium Pressure system includes a variety of above and below ground assets such as pipeline mains and services, regulator stations, risers, and meter set assemblies (MSAs). Applying a tranching algorithm to the entire system could result in gas mains, regulators, and risers being grouped together into a single tranche. This approach does not best represent risk profiles, as these assets require different risk treatments and largely are not physically connected. Therefore, while these assets may be regarded under the same RAMP risk chapter (*i.e.,* Medium Pressure Gas System), it makes sense to view the assets separately. This is consistent with the Phase 3 Decision's intended benefit of the PTTA, in part, to identify "the riskiest portions of [a utility's] infrastructure and/or management system. . . ."[17]

Overall, the Companies observed that many of the resultant tranches include a heterogeneous mix of risk events, often related to multiple asset types with uncorrelated risk treatments. Consequently, the resulting PTTA tranches are not homogenous. This ultimately limits the ability of this methodology to support the Commission's risk-informed decision-making objectives.

D. The Challenge: Preventing Information Loss and Meeting RDF Objectives

In light of the findings of their PTTA analysis, the Companies developed an alternative

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[16] *See* D.24-05-064 at 26-27.

[17] D.24-05-064 at 28.

HTM.[18] The Companies will apply the HTM to all their RAMP risks to provide greater transparency and better inform the Commission and interested stakeholders. To prevent the information loss and lack of risk homogeneity identified during testing of the PTTA and ultimately better-inform the Commission's decision-making process, the HTM strives to achieve three objectives:

1. Promote homogeneity of risk profiles within tranches;
2. Establish tranches on the basis of LoRE x CoRE pairings; and
3. Better align the tranches with risk treatments.

The HTM allows for a risk to be broken down into Classes, or groups of assets with similar risk profiles. The method further disaggregates the risk within a Class into different risk levels, and then divides the risk levels into similar LoRE/CoRE regions. This offers the advantage of identifying the specific Risk Profiles (Classes) targeted by the Risk-Treatment, the particular risk levels within these Classes that the treatment predominantly reduces, and the specific LoRE/CoRE regions within those risk levels that are most affected.

III. The Homogenous Tranche Method (HTM)

A. The HTM Delivers Homogenous Risk Profiles and Other RDF Objectives

The HTM alternative provides a rigorously defined algorithm that addresses unfavorable PTTA observations while delivering, where possible, "homogenous risk profiles," meaning all of the elements within the tranche should be of the same risk profile, at the same risk quantile, and divided into similar LoRE/CoRE regions. The HTM aims to meet this objective while preserving the critically distinct characteristics within the risk. As a result, when a risk-treatment is analyzed, it is clear what risk profile (*e.g.*, gas regulators), what level of risk (*e.g.*, the top 20%), and of which LoRE/CoRE nature (*e.g.*, lower LoRE/upper CoRE) are most affected. This provides a clearer picture of risk treatment that enhances the Commission's ability to identify the "riskiest portions of [a utility's] infrastructure and/or management system," consistent with the Phase 3 Decision's stated objectives.[19]

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[18] D.24-05-064, Appendix A, Step 3 provides that utilities "may use an alternative modeling method to the truncated power law and submit to SPD and serve to the service list of R.20-07-013, or a successor proceeding, and the utility's most recent RAMP application proceeding a Whitepaper and related workpapers clearly justifying its approach no later than 45 days before its first pre-RAMP workshop."

[19] D.24-05-064 at 28.

B. The Step-by-Step Methodology and Graphical Representations

The HTM approach differs from the PTTA at the outset by identifying each of the Classes that make up the risk.

The steps for the HTM are as follows:[20]

Step 1. Organize the granular level risk and associated LoRE/CoRE pairs, the starting LoRE/CoRE pairs, into groups, referred to as "Classes," based on similar risk profiles (*e.g.*, Mains, Regulators, Risers).

Step 2. Within each Class, rank the risk scores (LoRE x CoRE) into quantiles using the following algorithm. A K-quantile is defined here as a quantile of order K (*e.g.*, tercile (2-quantile), quartile (4-quantile)). And N is defined here as the number of starting LoRE/CoRE pairs within the Class.

1) If N is less than 8, then $K = 1$ and you can move to Step 3.

2) If *N* is not less than 8, find the whole number K such that the following inequality is satisfied:

$$\min\left(\frac{N}{8} - 1{,}9\right) < K \leq \min\left(\frac{N}{8}, 10\right),$$

then continue to Step 3.

Step 3. For each risk K-quantile from Step 2, create up to four homogenous LoRE/CoRE Tranches. These will be the final tranches of the HTM.

1) If no more than four unique LoRE/CoRE pairs for this Risk Quantile exist, then the Risk Quantile is the final Tranche and sub-Steps 2-3 do not apply. Note, if there are no more than four unique LoRE/CoRE pairs, then one can simply examine the values of those LoREs/CoREs and grouping them is no longer necessary.

2) Separate the Risk Quantile into regions using the median of the LoRE and the median of the CoRE. This will separate the LoREs into two groups of near-equal numbers where about half are less than the LoRE median, and the other is greater than the median.

[20] Any further developments or adjustments to the HTM steps that result from the Companies' continued development and preparation of their RAMP presentations will appear in their respective RAMP filings.

For values equal to the median, decide which group (lower LoRE or upper LoRE) will produce the greater balance of the starting pairs. Do the same for the CoREs. Since there are at least five unique LoRE/CoRE pairs, this will produce at least two LoRE/CoRE homogeneous regions.

3) Dissolve any region with a relatively low number of LoRE/CoRE pairs compared to other regions. One way this can be achieved is by computing the Euclidean distance to every LoRE/CoRE pair in the other regions. Then the closest point (nearest neighbor) will determine which tranche the pair should be recategorized into.

4) As a result, there will be two to four Tranches for each Risk Quantile. The homogenous profiles for each risk K-quantile will be from the following:

   1. Lower LoRE/Upper CoRE
   2. Upper LoRE/Lower CoRE
   3. Upper LoRE/Upper CoRE
   4. Lower LoRE/Lower CoRE

Step 4. For each final Tranche, T_i, define the LoRE(T_i) as the sum of the LoREs from the starting LoRE/CoRE pairs that make up T_i. Then define the CoRE(T_i) as the sum of all the Risks from the starting LoRE/CoRE divided by LoRE(T_i).

Figures 4-6 illustrate the HTM applied to two of the Company's unscaled preliminary risks: Wildfire without PSPS and Medium Pressure Mains and Services excluding Excavation (Medium Pressure Pipe). For Medium Pressure Pipe, two approaches are shown: 1) treating everything as one class, skipping step 1 of the HTM algorithm, and 2) defining four hypothetical classes for step 1. Wildfire without PSPS is treated as a single class, so only one HTM example is provided.

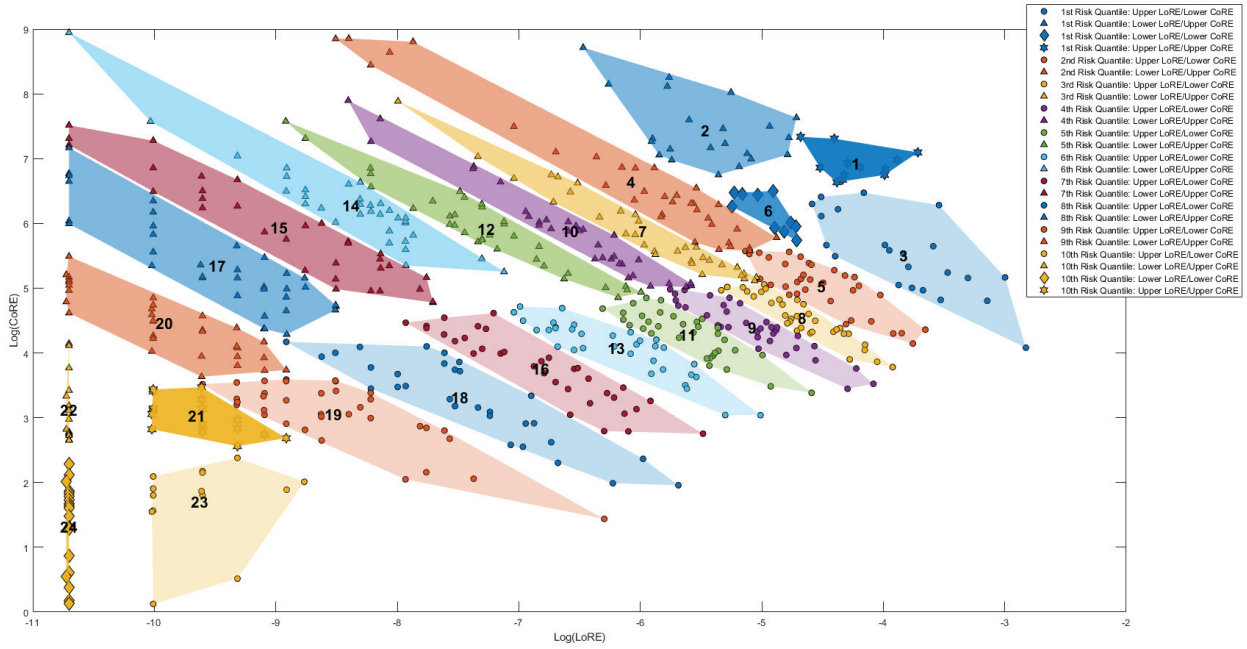


Figure 4. Preliminary Unscaled Wildfire without PSPS Log-Log plot of LoRE/Expected CoRE Alternative Homogenous Tranche Method. Here Wildfire without PSPS is a Class as defined in Step 1 of the HTM algorithm. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

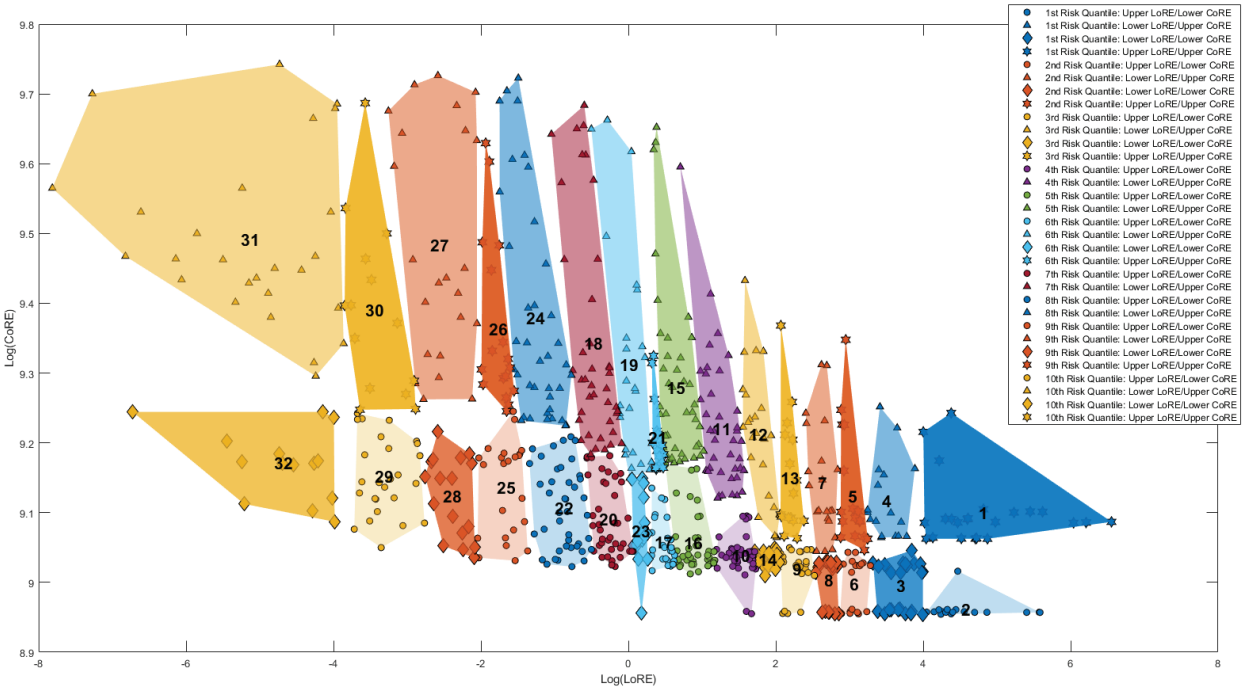


Figure 5. Preliminary Unscaled SoCalGas Medium Pressure Pipe Log-Log plot of LoRE/Expected CoRE Alternative Homogenous Tranche Method. Here for comparison reasons, Step 1 of the HTM algorithm is skipped and the entire dataset is treated as one Class. The numbers within the tranche regions define the order of the tranches from the highest resulting risk to the lowest.

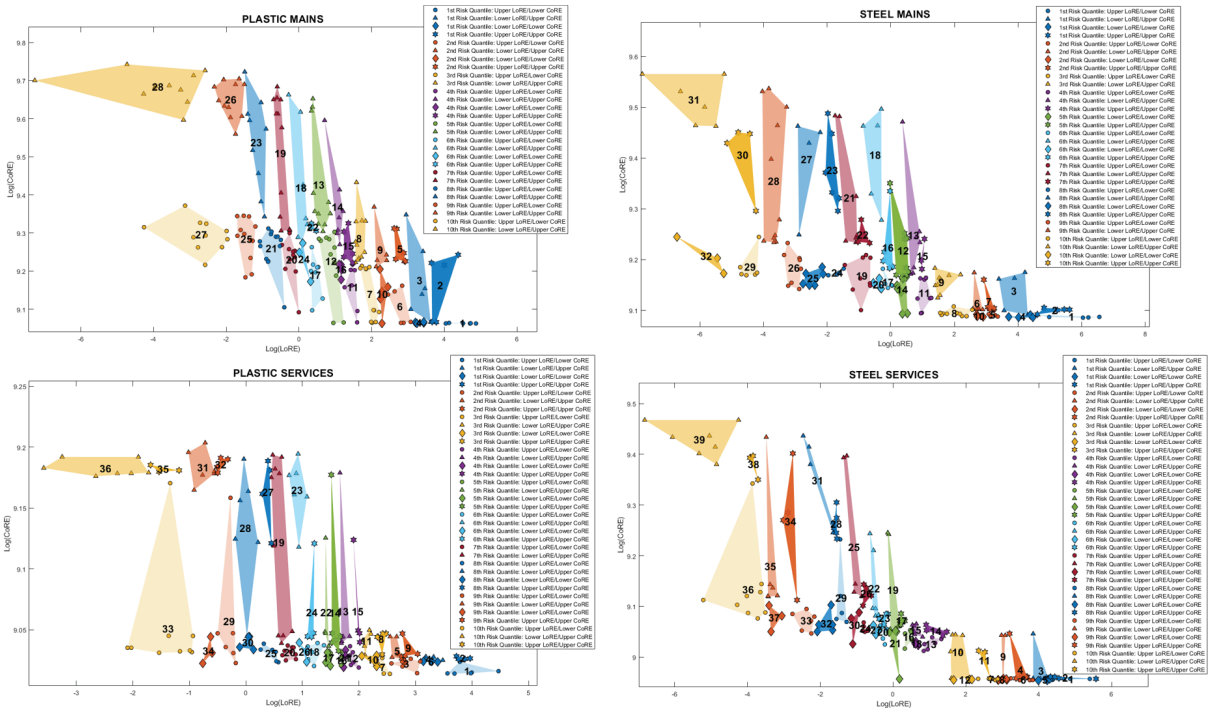


Figure 6. Preliminary Unscaled SoCalGas Medium Pressure Pipe Log-Log plot of LoRE/Expected CoRE Alternative Homogenous Tranche Method. Here for illustration of Step 1 of the HTM algorithm, four hypothetical classes are identified. The numbers within the tranche regions for each class define the order of the tranches from the highest resulting risk to the lowest within that Class.

C. Methodology Applicability

The HTM is intended for use with all RAMP risks, at varying levels. Specifically, as of the time of this White Paper's submission, the Companies anticipate that there is sufficient granularity of modeling for the five RAMP risks referenced below for the algorithm to be used to define the final tranches into 2-4 LoRE/CoRE regions as defined in sub-step 4 of step 3. The five preliminary RAMP risks are:

1. Wildfire & PSPS (SDG&E only)
2. Electric Infrastructure Integrity (SDG&E only)
3. Gas Excavation
4. High Pressure Gas
5. Medium Pressure Pipe

It is anticipated that certain RAMP risks, however, will lack the granularity of modeling to break down beyond Step 1 of the HTM algorithm. In other words, these risks feature a low number of starting LoRE/CoRE ordered pairs. After defining the similar risk profiles (Classes), for example Office personnel vs. Field personnel, if there are no more than four LoRE/CoRE pairs per Class, those pairs define the final tranches of those Classes within the risk. At the time of submitting this whitepaper, SoCalGas and SDG&E expect this to be the case for the following four preliminary RAMP risks:

1. Employee Safety
2. Contractor Safety
3. Cybersecurity
4. Gas Storage (SoCalGas only)

IV. Conclusion

Consistent with Commission guidance, the Companies submit this White Paper to present their alternative approach to tranching risks for their respective RAMP reports and additionally will be presenting this methodology at their December 2024 pre-RAMP workshop, where the Companies will also present their preliminary RAMP risks. As discussed in this paper, the Companies believe the HTM approach better achieves the Commission's RDF objectives in that it promotes data-driven results and increased transparency and granularity; establishes measurable LoRE and/or CoRE distinction between tranches; aligns with and informs risk mitigation efforts compatible with the Companies' existing and prospective operating procedures; and results in homogenous risk profiles (to the extent possible based on available data). The Companies are continuing to assess and analyze risks in preparation of their respective RAMP reports. Thus, results modeled here are preliminary and will be updated in the Company's respective RAMP reports.

2025 Risk Assessment Mitigation Phase

APPENDIX 4

Environmental Social Justice (ESJ)

Pilot Study

May 15, 2025

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I. INTRODUCTION AND SUMMARY REQUIREMENTS OF THE ESJ PILOT STUDY

San Diego Gas & Electric Company (SDG&E) prepared this Environmental and Social Justice (ESJ) Pilot Study at the direction of the California Public Utilities Commission (Commission or CPUC), in accordance with Decision (D.) 22-12-027 (the Phase 2 Decision) in ongoing Rulemaking (R.) 20-07-013 (the Risk OIR). The Phase 2 Decision requires SDG&E and the other large California energy utilities[1] to "conduct an [ESJ] Pilot Study that includes consideration of Disadvantaged and Vulnerable Communities (DVCs)[2] as defined in this decision and […] file the results of their Pilot studies as described in this decision"[3] with their next RAMP filing.

The Risk OIR Phase 2 Scoping Memo provides an opportunity for considering potential impacts on ESJ communities, including the potential impacts on achieving any of the nine goals set forth in the Commission's ESJ Action Plan.[4] The CPUC adopted an ESJ Action Plan in February 2019 as a comprehensive strategy and framework for addressing ESJ issues in each CPUC proceeding.[5] The ESJ Action Plan's "focus[es] on equity, defined as 'increasing access to power, redistributing and providing additional resources, and eliminating barriers to opportunity, to empower low-income communities of color to thrive and reach full potential.'"[6]

The ESJ Action Plan "require[s utilities] to overlay planned infrastructure mitigations on the CalEnviroScreen map to identify what portions of the mitigations would occur within

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1 Southern California Gas Company (SoCalGas), Pacific Gas and Electric Company (PG&E), and Southern California Edison Company (SCE).

2 D.20-08-046 at 108, Conclusions of Law (COL) 2, The Commission defines a DVC as: Top 25% of census tracts according to CalEnviroScreen (CES); California Tribal lands; Census tracts with median household incomes less than 60% of state median income; Census tracts that score in the highest 5% of Pollution Burden within CalEnviroScreen, but do not receive an overall CalEnviroScreen score due to unreliable public health and socioeconomic data.

3 D.22-12-027 at 65-67, Ordering Paragraph (OP) 5.

4 R.20-07-013, Assigned Commissioner's Phase II Scoping Memo and Ruling Extending Statutory Deadline (April 13, 2022) at 5.

5 CPUC adopted the most recent version 2.0 of the ESJ Action Plan on April 7, 2022. More information and links to the ESJ Action Plan versions are *available at* https://www.cpuc.ca.gov/news-and-updates/newsroom/environmental-and-social-justice-action-plan.

6 D.22-12-027 at 42.

disadvantaged communities when geographic locations of proposed mitigations are known."[7] The Phase 2 Decision confirms "CalEnviroScreen" refers to the Office of Environmental Health Hazard Assessment's (OEHHA) geospatial California Communities Environmental Health Screening Tool,[8] which must be used in identification of DVC communities in addition to median income, tribal lands, and pollution burden. SDG&E utilizes the DVC map in Figure 1 to fulfill this requirement.

The Phase 2 Decision also requires SDG&E and other utilities to work with the CPUC's Energy Division Staff and consult with the Disadvantaged Communities Advisory Group (DACAG) and the Community-Based Organization Working Group (CBOWG) prior to finalizing their ESJ Pilot Study plans, assessing "each utility's ESJ Pilot Study plan is on an appropriate DACAG and CBOWG meeting agenda in time for these groups to provide meaningful feedback on the plans" so that "a public webinar on their ESJ Pilot Study during the planning phase of the pilot,"[9] with the following action items to be addressed in each ESJ Pilot Study:

- Action Item #1: Consider equity in the evaluation of consequences and risk mitigation within the Risk-Based Decision-Making Framework (RDF), using the most current version of CalEnviroScreen to better understand how risks may disproportionately impact some communities more than others;
- Action Item #2: Consider investments in clean energy resources in the RDF, as possible means to improve safety and reliability and mitigate risks in DVCs;
- Action Item #3: Consider mitigations that improve local air quality and public health in the RDF, including supporting data collection efforts associated with Assembly Bill 617 regarding community air protection program;
- Action Item #4: Evaluate how the selection of proposed mitigations in the RDF may impact climate resiliency in DVCs;

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7 CPUC, *Environmental & Social Justice Action Plan Version 2.0* (April 7, 2022), Appendix A, ESJ Action Item 4.1.4 at 43, *available at:* https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/news-and-outreach/documents/news-office/key-issues/esj/esj-action-plan-v2jw.pdf.

8 D.22-12-027 at 42 (citing CalEnviroScreen refers to the OEHHA, California Communities Environmental Health Screening Tool, *available at* https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40).

9 *Id.* at 65-67 (OP 5).

- Action Item #5: Evaluate if estimated impacts of wildfire smoke included in the RDF disproportionately impact DVCs;
- Action Item #6: Estimate the extent to which risk mitigation investments included in the RDF impact and benefit DVCs independently and in relation to non-DVCs in the IOU service territory; and
- Action Item #7: Enhance outreach and public participation opportunities for DVCs to meaningfully participate in risk mitigation and climate adaptation activities consistent with Decision 20-08-046.[10]

In accordance with the instructions set forth in the Phase 2 Decision, SDG&E has complied with all requirements and submits the following results of its ESJ Pilot Study.[11]

II. EXECUTIVE SUMMARY

About SDG&E

For more than 140 years, SDG&E has provided safe and reliable energy to the 3.7 million community members that depend on us today. In addition to providing safe and reliable energy infrastructure, SDG&E is committed to helping California meet its ambitious carbon neutrality goal of reaching net-zero greenhouse gas emissions (GHG) by 2045. This commitment includes SDG&E adopting its own sustainability strategy and goal to reach net zero GHG emissions by 2045.[12] To that end, SDG&E published a California economy-wide decarbonization roadmap in April 2022, which showed that a holistic pathway to electrification and cleaner fuels is needed to mitigate climate change.[13] SDG&E maintains its unwavering commitment to clean, safe, and reliable energy while recognizing that energy costs are important to families, businesses, and our

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[10] *Id.*

[11] Also in accordance with D.22-12-027, SDG&E will submit a White Paper summarizing its ESJ Pilot Study within two months of its RAMP filing deadline, which will: (1) identify areas for further exploration and challenges they faced incorporating ESJ into the RDF; (2) discuss how to better target mitigations that improve local air quality; and (3) explore how to better target mitigations that improve climate resilience in disadvantaged and vulnerable communities. D.22-12-027 at 67 (OP 6).

[12] SDG&E, *Building a Better Future: Our Commitment to Sustainability* (October 2020) (Sustainability Strategy), *available at:* https://www.sdge.com/sites/default/files/documents/SDG%26E%20Sustainability%20Report_0.pdf.

[13] SDG&E, *The Path to Net Zero: A Decarbonization Roadmap for California* (April 2022), *available at*: https://www.sdge.com/sites/default/files/documents/path_to_net_zero.pdf?nid=21961.

local communities. Energy affordability remains top of mind as SDG&E advances decarbonizing California in a just and equitable manner.

ESJ Pilot Study Plan

In accordance with the Phase 2 Decision, Ordering Paragraph 5, SDG&E held the following workshops jointly with SoCalGas to review their ESJ Pilot Study Plans.[14]

- CBOWG Workshop – July 12, 2024
- DACAG Workshop – July 19, 2024
- Public Workshop – August 12, 2024

SDG&E appreciates these key engagements and stakeholder feedback, which included several important recommendations. Through this engagement, SDG&E affirmed its proposed approach to focus this ESJ Pilot Study on two risks: 1) Wildfire & Public Safety Power Shutoff (PSPS) and 2) Electric Infrastructure Integrity (EII).[15] As discussed in more detail below, (i) the Wildfire and PSPS Risk refers to the risk of a catastrophic wildfire, especially those initiated by SDG&E equipment, and/or PSPS events; and (ii) the EII Risk is the risk of an asset failure or an asset no longer complying with the latest engineering standards resulting in a public safety or reliability incident.

One of the recommendations from the workshops is for SoCalGas and SDG&E to consider alternative community vulnerability screening tools to help identify vulnerable geographic areas and populations across SoCalGas's and SDG&E's service territories. As a result of this feedback, SDG&E considered several other screening tools, described in Section III *infra*. At the suggestion of Safety Policy Division Staff, SDG&E contacted Michael Méndez, PhD, Assistant Professor of Environmental Policy & Planning, University of California, Irvine, on the wildfire smoke issue referenced in Action Item #5.[16] Dr. Méndez referred SDG&E to David Eisenman, MD, Internal Medicine, University of California, Los Angeles. Dr. Eisenman recommended a research paper, which SDG&E reviewed as discussed in Action Item #5.

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[14] Recordings and workshop material *available at* www.cpuc.ca.gov/about-cpuc/divisions/safety-policy-division/risk-assessment-and-safety-analytics/risk-assessment-mitigation-phase/sempra-ramp/sempra-2025-ramp/environmental-and-social-justice-pilots.

[15] *See* SDG&E's Chapter SDG&E-Risk-4: Wildfire and PSPS and Chapter SDG&E-Risk-5: Electric Infrastructure Integrity for further risk and mitigation definitions.

[16] Dr. Michael Méndez from UC Irvine (http://www.michaelanthonymendez.com/); *see* Section VIII *infra* for more information.

SDG&E also included Cost-Benefit Ratios (CBRs) as part of their analysis in the ESJ Pilot Study, consistent with Action Item #6's requirement to "[e]stimate the extent to which risk mitigation investments included in the RDF impact and benefit DVCs independently and in relation to non-DVCs in the IOU service territory" and Safety Policy Division (SPD) guidance in PG&E's RAMP proceeding.[17]

Key Findings from the ESJ Pilot Study

Action Item #1: Risk Impacts in DVCs.

- Wildfire and PSPS: Within the DVCs in the SDG&E service territory, approximately 745 miles of the electric distribution system and about 9,000 customer electric meters are in the High Fire Threat District (HFTD). About 26% of HFTD Tier-3 Wildfire and PSPS Risk exists in these DVC areas, with a lower percentage (5%) in HFTD Tier-2. SDG&E estimates total annual Wildfire and PSPS Risk to be $3,020 million in its service territory overall, with about $540 million in these DVC areas or 18% of the exposure. In the SDG&E service territory, DVCs make up less than 10% of HFTD square mileage, with Tribal Lands making up the majority of DVCs in HFTD, and these areas have 31% of risk.
- Electric Infrastructure Integrity: About 7% of miles in the electric distribution system are in DVCs in SDG&E's service territory, which includes approximately 150,000 DVC customer electric meters. SDG&E estimates total annual EII Risk to be about $398 million with about $28 million in DVCs or 7%. DVCs make up approximately 7% of total service area square mileage and they bear an approximately proportionate amount of EII Risk compared to their area (7%).

Action Item #2: SDG&E's Clean Energy Resource Investments in DVCs

- Wildfire and PSPS: – Two notable safety and reliability controls that consider clean energy are Microgrids, when integrated with renewable sources, and Standby Power Program, when permanent solutions include renewable batteries charged by renewable sources. The Access and Functional Need (AFN) customer

[17] *See* D.22-12-027 at 67 (OP 5(f)); *see also* CPUC, *Safety Policy Division Evaluation Report on PG&E 2024 RAMP Application (A.) 24-05-008* (November 8, 2024) at 36, *available at:* spd-evaluation-report-2024-pge-ramp-final-with-attachments.pdf.

classification, which has significant overlap with DVC (all CalEnviroScreen census tracts have AFN population), is a criteria consideration for microgrid project selection. AFN is also relevant to other ESJ Pilot Study controls and mitigations in this risk.

- Electric Infrastructure Integrity: SDG&E maintains a system that will better support electrification and clean energy investments. EII Risk treatments mainly entail electric infrastructure upgrades to support public safety and reliability. Other areas of SDG&E's electric infrastructure planning and development may more directly support public health and air quality, such as capacity-driven electric distribution upgrade programs and overhead to underground electric distribution programs.

Action Item #3: Air Quality, Public Health & Assembly Bill (AB) 617

- The AB 617 communities in SDG&E service territory (11 census tracts with a population of 47,554) are all considered DVC communities and consist of portside communities and communities along the southwest area of the U.S.-Mexico border (see Figures 6 and 7 *infra*). Since 2017, SDG&E has been working with California Air Resources Board (CARB) and other stakeholders to implement AB 617 and help the Community Air Protection Programs be effective at reducing emissions.
- Wildfire and PSPS: While no Wildfire or PSPS control relates directly to improved air quality or public health, such controls do relate to technologies, communications, and partnerships to inform the public (including DVCs) about air quality so that they can make risk-informed decisions to manage their health and well-being.
- Electric Infrastructure Integrity: Because the scope of EII controls and mitigations are mostly focused on improving or preserving system reliability, there are no controls or mitigations directly related to improving local air quality or public health for this risk.

Action Item #4: How RAMP Mitigations May Impact Climate Resiliency – This topic is addressed in greater detail in SDG&E's Chapter RAMP-5: Climate Change Adaptation and in SDG&E's Climate Adaptation and Vulnerability Assessment (CAVA).[18]

- Wildfire and PSPS – Wildfire is identified as a Climate Hazard for electric distribution, transmission, substation, communication, facilities assets, and gas assets (pressure pipes, medium-pressure pipes, regulators, compressors, and valves). All controls and mitigations in the Wildfire and PSPS Chapter are intended to reduce utility-caused wildfires, thus all impact climate resiliency in and outside of DVCs in HFTD.
- Electric Infrastructure Integrity – Several controls for this risk facilitate infrastructure hardening, which consider the effects of climate change and extreme weather. Such programs include but are not limited to enhancements in system protection, vegetation management, and restoration of service. Substation Reliability for Distribution (Control 250) has a greater CBR for substations that are located in or serve DVCs. Other planned investments are proportionately applied to DVC communities or have similar impacts to both DVC and non-DVC communities.

Action Item #5: Wildfire Smoke – SDG&E lacks adequate information to make predictive estimates regarding Wildfire Smoke and defers to industry experts such as government, academia, and fire agencies to develop models or calculations. SDG&E's comprehensive wildfire mitigation efforts, including but not limited to infrastructure hardening, situational awareness, and emergency operations, are key ways to mitigate the risk of wildfire smoke and are described in Chapter SDG&E-Risk-4: Wildfire and PSPS.

Action Item #6: Mitigation Impacts & Benefits

- Wildfire and PSPS – During 2028-2031, SDG&E plans to underground approximately 600 miles of overhead systems in HFTD, including 125 miles, or 21%, directly benefitting DVCs in the HFTD, resulting in an estimated wildfire risk reduction in these areas of 99% and near elimination of the need for PSPS.

[18] Pursuant to D.20-08-046 and D.24-08-005, SDG&E's submitted its 2025 CAVA on May 15, 2025.

- Electric Infrastructure Integrity – SDG&E focused its analysis of RAMP controls and mitigations on three programs: 1) C236 Distribution Overhead Switch Replacement, 2) C250 Substation Reliability for Distribution, and 3) C269 Distribution Circuit Reliability. In some cases, and as discussed below, the mitigations directly benefit more customers in high-population density DVCs, resulting in relatively higher CBRs.
    - Approximately 13% of system circuit miles planned for C236 Distribution Overhead Switch Replacement are located in or serve DVCs. SDG&E forecasts approximately $303,000 of program costs to be spent on overhead switches that serve DVCs. On these circuits, approximately 7,200 customer meters are in DVCs, compared to 49,000 in non-DVCs.
    - Approximately 6% of system circuit miles planned for the C250 Substation Reliability for Distribution program are located in or serve DVCs. SDG&E forecasts $2.5 million of program costs to be spent on substations serving DVCs as part of the program. On these circuits, approximately 16,000 customer meters are in DVCs, compared to 242,000 in non-DVCs.
    - Approximately 6% of system circuit miles planned for the C269 Distribution Circuit Reliability program are located in or serve DVCs. SDG&E forecasts $242,000 of program costs to be spent on distribution reliability for circuits serving DVCs as part of the program. On these circuits, approximately 2,000 customer meters are in DVCs, compared to approximately 28,000 in non-DVCs.

<u>Action Item #7: Outreach and Public Participation</u>

- Wildfire and PSPS – The Wildfire and PSPS controls having elements of customer outreach and engagement focus on program awareness and participation, awareness of community resources and services, and data and information available to them before, during and after times of crisis. Some of the controls are supported by CBOs, potentially increasing their effectiveness in DVC areas.

- Electric Infrastructure Integrity – One EII control provides robust customer education about the dangers and risks associated with electricity and working in proximity to SDG&E's electrical equipment and infrastructure. This control is applied across SDG&E's service territory, in both DVC and non-DVC communities.

III. DISADVANTAGED AND VULNERABLE COMMUNITIES IN SDG&E SERVICE TERRITORY

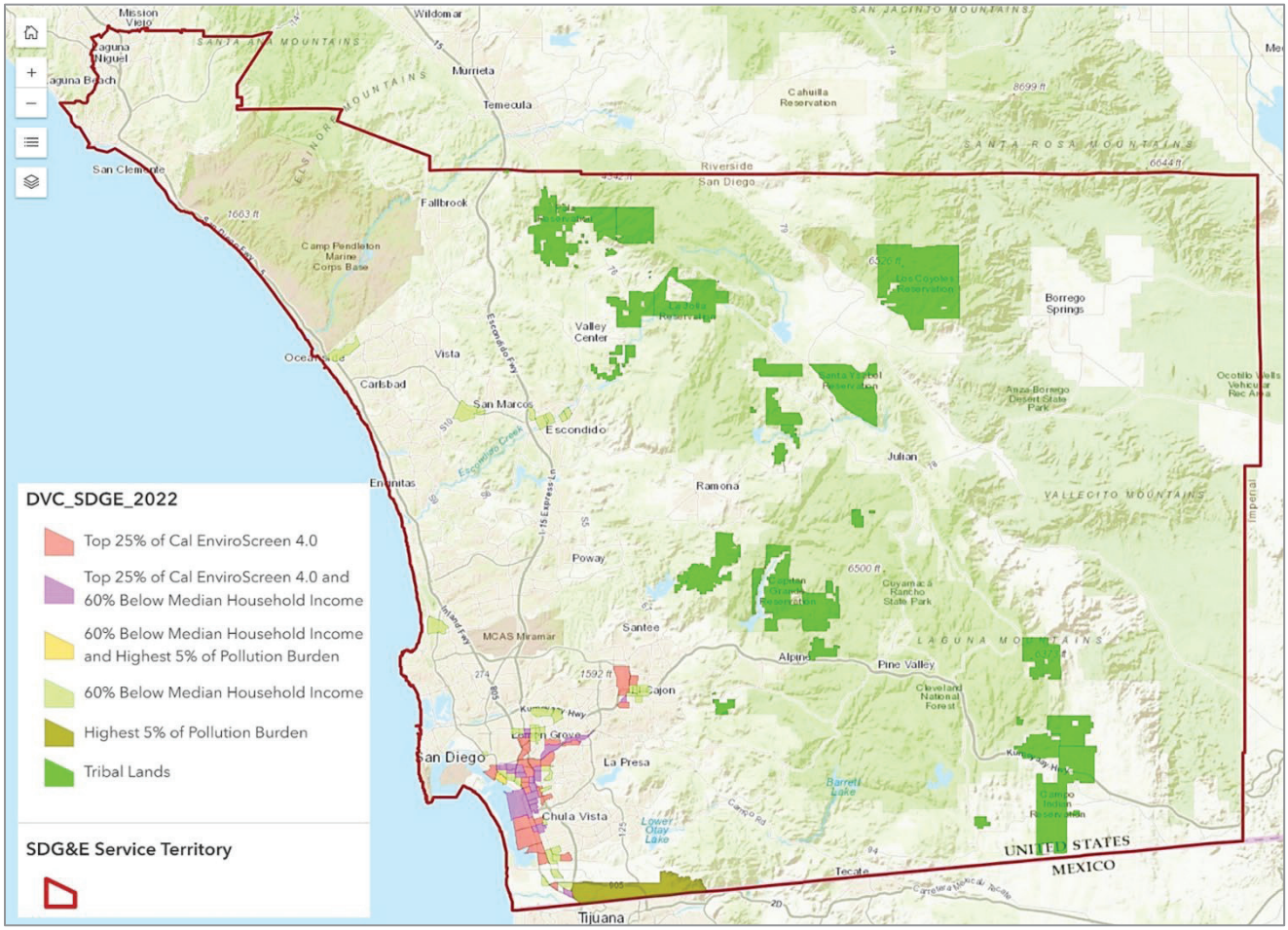
For the ESJ Pilot Study, SDG&E used CalEnviroScreen 4.0 map to identify the relevant DVCs, as illustrated in Figure 1.[19] The CalEnviroScreen 4.0 map identifies the DVC population as

- California tribal lands;
- Communities in the 25% highest scoring census tracts of CalEnviroScreen;
- Census tracts that score in the highest 5% of Pollution Burden within CalEnviroScreen, but do not receive an overall CalEnviroScreen score due to unreliable public health and socioeconomic data; and
- Census tracts with median household incomes less than 60% of state median income.

There are no DVCs in the Orange County portion of SDG&E's service territory (northwest region of Figure 1).

[19] Figure 1 is excerpted from the OEHHA, California Communities Environmental Health Screening Tool, *see* Map of CalEnviroScreen 4.0, *available at* https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40).

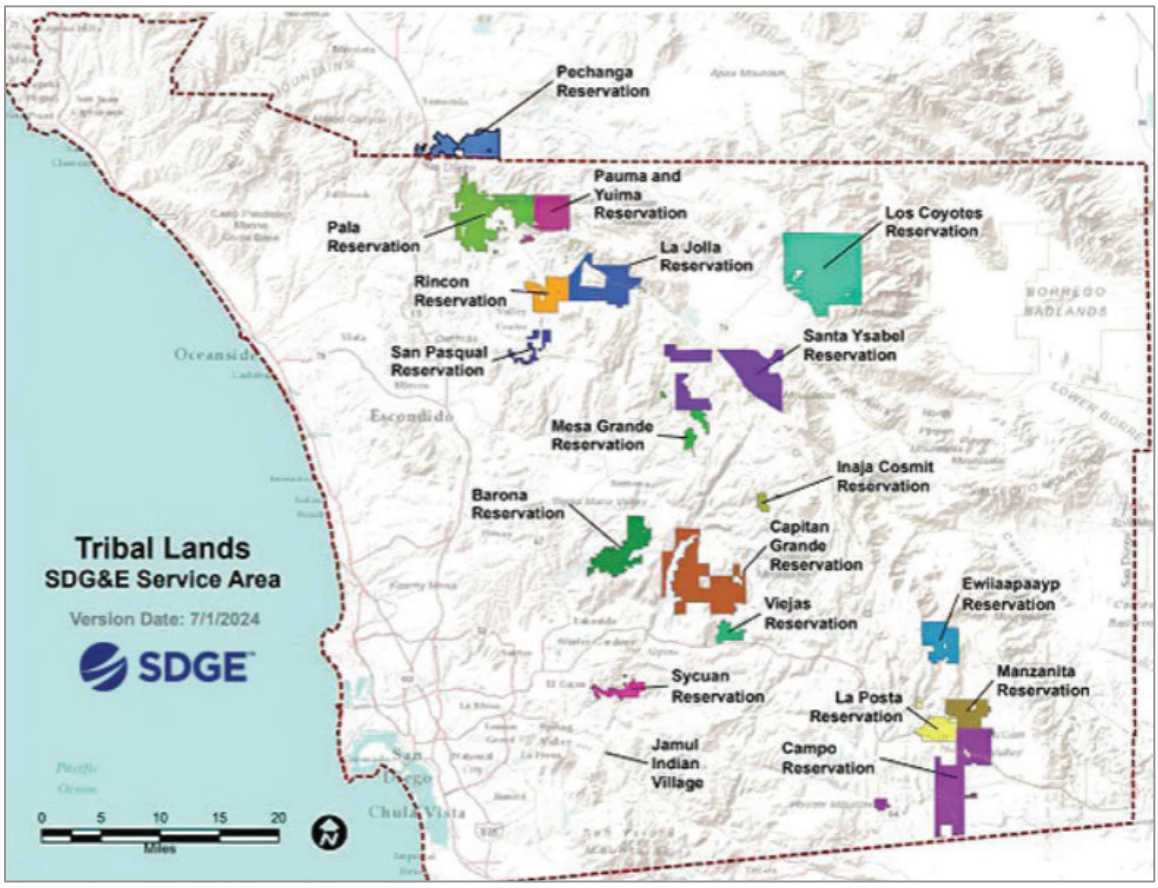
Figure 1 - Disadvantaged and Vulnerable Communities in SDG&E Service Territory



SDG&E is proud to be an energy partner to the 17 Tribal Nations within the Company's service territory and are illustrated in Figure 2.[20] San Diego County is home to the highest number of reservations in the United States.

[20] Figure 2 also recognizes the Capitan Grande and Pechanga reservations. *See* SDG&E, SDG&E Tribal Relations, Serving Tribal Nations, *available at* http:/www.sdge.com/tribal-relations.

Figure 2 - Tribal Lands in SDG&E Service Territory



During the ESJ Pilot Study public workshops (described *supra* Section II), SDG&E was asked to consider vulnerability screeners in addition to CalEnviroScreen 4.0. SDG&E analyzed the following nine (9) additional vulnerable community screening tools and data.

1. Climate and Economic Justice Screening Tool;
2. California Healthy Places Index 3.0;
3. City of San Diego Climate Equity Index;
4. CDC/ASTDR Environmental Justice Index;
5. Environmental Defense Fund US Climate Vulnerability Index;
6. OEHHA DAC – defined by Senate Bill (SB) 535 (minus Tribal Areas);
7. FEMA National Risk Index;
8. AB 617 Communities; and

9. CARB Climate Vulnerability Metric.

In general, each of the above-identified tools provided a slightly different screening to identify DVCs in SDG&E's service territory than CalEnviroScreen 4.0. These tools use different criteria to identify vulnerable communities, making a direct comparison of each screening tool difficult. When the results of vulnerability screening by all nine tools are considered in the aggregate, the defined DVC area expands to a larger community level than the census tract level viewpoint provided by CalEnviroScreen 4.0. Considering the above, SDG&E agrees that CalEnviroScreen is an effective tool to identify DVCs and agrees with the CPUC's requirement to use it for purposes of this ESJ Pilot Study.[21]

IV. ACTION ITEM #1: RISK IMPACTS

Consider equity in the evaluation of consequences and risk mitigation within the Risk-Based Decision-Making Framework (RDF), using the most current version of CalEnviroScreen to better understand how risks may disproportionately impact some communities more than others.

SDG&E evaluated the forecasted Potential Consequences and risk mitigations related to the Wildfire and PSPS and EII Risks in the identified DVCs. To address both Risk and control/mitigation impacts to DVCs, SDG&E focused on the risk analysis for Action Item #1 and evaluated applicable controls and mitigations in Action Item #6 for the same risk categories.

Wildfire and PSPS

For the purposes of this RAMP Report, SDG&E's Wildfire Risk is defined as "the risk of catastrophic wildfire, initiated by SDG&E equipment, whether through normal operation or failure, that may pose an immediate threat to the communities, the environment, and overall safety resulting in fatalities, widespread property destruction, and a multi-billion-dollar liability."[22] SDG&E defines PSPS Risk as "the risk created from proactive de-energization of

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[21] D.22-12-027 at 65-67 (OP 5); *see also* CPUC, *Environmental & Social Justice Action Plan Version 2.0* (April 7, 2022) Appendix A, ESJ Action Item 4.1.4 at 43, *available at:* https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/news-and-outreach/documents/news-office/key-issues/esj/esj-action-plan-v2jw.pdf.

[22] *See* Chapter SDG&E-Risk-4: Wildfire and PSPS, Section I.A.

infrastructure during extreme fire weather conditions, which can result in negative impacts on customers and communities."[23]

Wildfire and PSPS Risk focuses on the primary electric distribution system contained within the HFTD, and EII Risk focuses on the primary electric distribution system contained in the non-HFTD portion of the SDG&E's service area. The main analysis SDG&E performed for Action Item #1 overlaid SDG&E's primary electric distribution system data within SDG&E's identified DVC map.

SDG&E's Wildfire and PSPS Risk reduction is focused on our HFTD Tier-2 and Tier-3 areas and finds the majority of DVCs in HFTD are Tribal Lands. SDG&E overlaid its primary electric distribution system data within the HFTD and DVC maps and measured the intersection of electric distribution lines through these census tract and tribal land polygons. Approximately 745 miles of the electric distribution system[24] overlaps with DVCs in HFTD. Of this, approximately 9,100 customer meters are in DVCs, as shown in Table 1.

To understand proportional impacts, SDG&E used GIS to analyze the total area of HFTD DVCs, in square miles, and compared it to the total HFTD square mileage.

About 26% of Tier-3 Wildfire and PSPS risk is in DVC areas, with a lower percentage (5%) in Tier-2. SDG&E estimates $540 million of DVC Risk in HFTD. DVCs make up less than 10% of HFTD square mileage, with Tribal Lands being the majority of DVCs in HTFD, and they bear a disproportionate amount of risk compared to their area – approximately 31%.

Table 1 - Wildfire and PSPS Risk: DVC and non-DVC in HFTD (2024 $)

	DVC Customer Meters	Baseline Risk (M$)	DVC Risk (M$)	Non-DVC Risk (M$)	DVC Risk (%)
HFTD Tier-2	3,320	$988	$49	$939	5%
HFTD Tier-3	5,794	$1,905	$491	$1,414	26%
Total HFTD	**9,114**	**$2,893**	**$540**	**$2,353**	**31%**

SDG&E's risk analysis focused on customer meter counts. SDG&E understands there could be discrepancies between census tract populations and customer meter count. However,

[23] *Id.*

[24] This estimate includes overhead and underground mileage.

using customer meters for the analysis is useful because no additional hypothetical assumptions are necessary to extrapolate the results to census tract populations.

Electric Infrastructure Integrity

For the purposes of this RAMP Report, SDG&E's EII Risk is defined as the risk of an asset failure caused by degradation, age, operation outside of design criteria due to unexpected events or field conditions (*e.g.*, force of nature), or an asset no longer complying with the latest engineering standards, which results in a public safety or reliability incident.

SDG&E's EII Risk reduction prioritizes safety and reliability measures designed to protect its employees, customers, and the public. Since this risk is primarily concentrated on the distribution system, the ESJ Pilot Study also focuses on these areas.

SDG&E overlaid the electric distribution system to the DVC map for Action Item #1 and used census tract and tribal land polygons to measure the intersection of electric distribution line through these polygons. While EII Risk is concentrated on SDG&E's primary distribution system, EII Risk also exists outside of the distribution system. However, by examining the total mileage of primary electric distribution inside and outside DVCs, SDG&E uses estimates to find total EII Risk in DVCs using a percentage-based approach.

To understand proportional impacts, SDG&E used GIS to analyze the total area of DVCs, in square miles, compared to the square mileage of SDG&E's total service territory.

Approximately 7% of the electric distribution system miles overlap with DVCs, with approximately 150,000 customer meters located in DVCs and 1.34 million meters located in non-DVC areas. Total annual EII Risk is estimated at approximately $398 million. Using the percentage-based approach, SDG&E estimates $28 million of EII Risk relates to DVC areas. DVCs make up approximately 7% of total service area square mileage and they bear an approximately proportionate amount of EII Risk compared to their area (7%).

V. ACTION ITEM #2: CLEAN ENERGY INVESTMENTS

Consider investments in clean energy resources in the RDF, as possible means to improve safety and reliability and mitigate risks in DVCs.

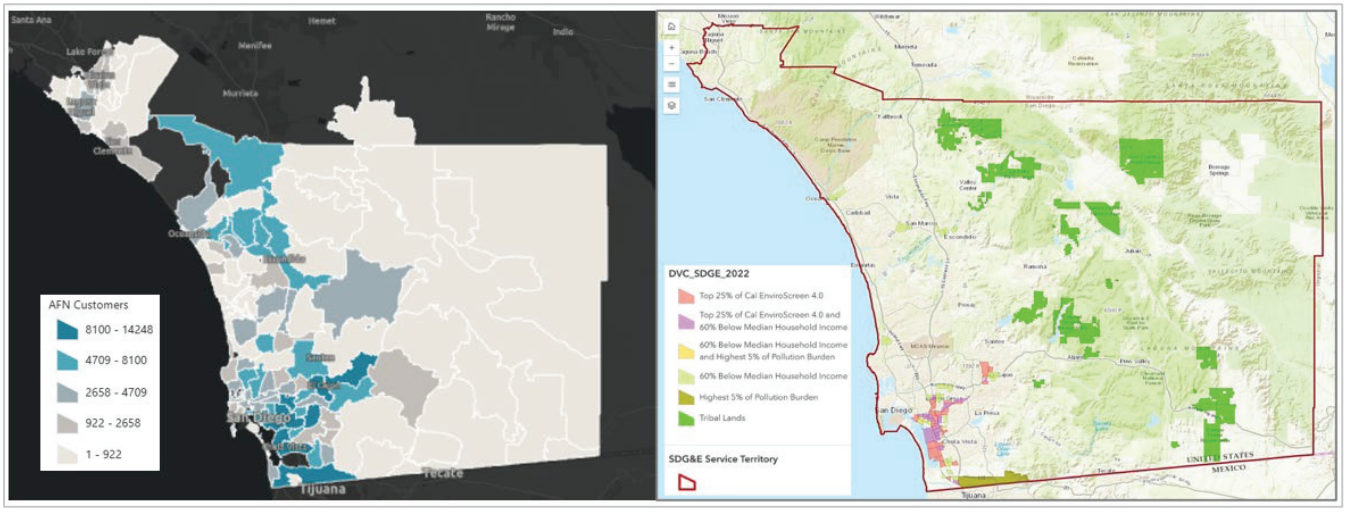
SDG&E considered 2025 RAMP programs that address clean energy resources and, where applicable, evaluated if and how DVCs could benefit from these projects by improving safety and/or reliability, or general risk reduction.

Wildfire and PSPS

For Wildfire and PSPS, the two risks that support clean energy investments are C506 Microgrids, and C504 Standby Power Program (Fixed Backup Power Commercial).

C506 Microgrids is the control that best supports clean energy within the Wildfire and PSPS Risk mitigation portfolio. Microgrids are a critical component to SDG&E's efforts to keep customers energized during planned and unplanned outages. Microgrids are small electric grids that can operate independently from the larger grid. They are supportive of clean energy when integrated with a network of distributed energy resources, like solar panels and energy storage. AFN customers are a prioritization factor when identifying projects. Figure 3 depicts how AFN customers have significant overlap with DVC, namely in densely populated urban areas. Every CalEnviroScreen DVC census tract in SDG&E's service territory has AFN population ranging between 126 to 2,025 per census tract (and 4% to 33% of the population of each).

Figure 3 - SDG&E AFN (left – zip code based) and DVC (right – census track based)



The C504 Standby Power Program (Fixed Backup Power Commercial) control offers backup power solutions to enhance resiliency. This control is supportive of clean energy when the solutions include permanent backup batteries when powered or charged by clean energy sources such as solar arrays. DVC benefits will depend on location and clean energy sources.

Electric Infrastructure Integrity

Several of the EII controls focus on modernizing SDG&E's distribution system outside of HFTD, which ultimately supports building and maintaining clean energy infrastructure,

including substations, underground tee connectors, and supervisory control and data acquisition (SCADA) capacitors, for example. EII Risk mitigations mainly entail electric infrastructure upgrades to support public safety and reliability. Other areas of SDG&E's electric infrastructure planning and development may more directly support public health and air quality. For example, capacity-driven electric distribution upgrade programs may facilitate EV adoption that results in carbon emission reductions. Proactive overhead-to-underground electric distribution conversion programs may also reduce utility truck rolls associated with mandated overhead inspection and maintenance activities, resulting in reduced carbon emissions.

Examples of Non-RAMP Activities

SDG&E is committed to clean energy efforts. Some examples of these efforts outside of the focus of RAMP include the following.

- SDG&E Path to Net Zero – A Decarbonization Roadmap for California (April 2022);[25]
- SDG&E Microgrid and Battery Energy Storage Systems (BESS);[26]
- Microgrid Incentive Program (MIP) – Customer/Community Owned;
- Hydrogen Innovation;[27]
- Hydrogen-fueled Fleets for Business;[28]
- Vehicle-to-Grid (V2G);[29] and
- Electric Program Investment Charge (EPIC)[30] Program.

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[25] SDG&E, *Path to Net Zero, A Decarbonization Roadmap for California* (April 2022) *available at* www.sdge.com/sites/default/files/documents/netzero2.pdf.

[26] SDG&E, *Battery Energy Storage Systems (BESS) and Microgrids*, Fact Sheet, *available at* https://www.sdge.com/sites/default/files/BESS%20and%20Microgrids%20-%20Fact%20Sheet%20%281%29.pdf.

[27] SDG&E, *Hydrogen Innovation*, *available at* www.sdge.com/more-information/environment/sustainability-approach/hydrogen-innovation.

[28] SDG&E, *Hydrogen-fueled Fleets for Business*, *available at* www.sdge.com/more-information/environment/sustainability-approach/hydrogen-innovation/hydrogen-fueled-fleets-business.

[29] SDG&E, *Vehicle Grid Integration*, *available at* http://sdge.com/V2G.

[30] SDG&E, *Electric Program Investment Charge, Pioneering clean energy technology*, *available at* www.sdge.com/epic.

VI. ACTION ITEM #3: AIR QUALITY, PUBLIC HEALTH, AND ASSEMBLY BILL (AB) 617

Consider mitigations that improve local air quality and public health in the RDF, including supporting data collection efforts associated with Assembly Bill 617 regarding community air protection program.

SDG&E evaluated how EII and Wildfire/PSPS controls and mitigations may impact local air quality and public health, with specific emphasis on AB 617 communities.[31]

Background

Two communities, the International Border Community[32] and Portside Environmental Justice Neighborhoods[33] in San Diego have been selected by the CARB Board to participate in the Community Air Protection Program, and SDG&E considered mitigations that improve local air quality and public health in these areas.

The AB 617 census tracts and neighborhoods within SDG&E's service territory are provided in Table 2. Figure 4 shows the location of the AB 617 Portside Environmental Justice Neighborhoods. Figure 5 shows the location of the AB 617 International Border Community.

In total, there are 11 census tracts with a population of 47,554 people. These tracts are also DVC communities.

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[31] CARB, *Community Air Protection Program, available at:* https://ww2.arb.ca.gov/capp/about. In response to AB 617 (C. Garcia, Chapter 136, Statutes of 2017), CARB established the Community Air Protection Program (CAPP). CAPP's focus is to reduce exposure in communities most impacted by air pollution..

[32] CARB, *International Border Community, available at:* https://ww2.arb.ca.gov/our-work/programs/community-air-protection-program/communityhub-2-0/international-border-community.

[33] CARB, *Portside Environmental Justice Neighborhoods, available at:* https://ww2.arb.ca.gov/our-work/programs/community-air-protection-program/communityhub-2-0/portside-environmental-justice.

Table 2 - AB 617 Census Tracts in SDG&E Service Territory

Census Tract	Neighborhood	Population (CalEnviroScreen 4.0)
6073005000	Barrio Logan	2,195
6073005100	Downtown	7,702
6073003902	Logan Heights / SE SD	4,388
6073003901	Logan Heights / SE SD	4,379
6073003603	Logan Heights / SE SD	3,907
6073003601	Logan Heights / SE SD	3,006
6073004000	Logan Heights / SE SD	4,513
6073003502	Logan Heights / SE SD	4,754
6073004700	Logan Heights / SE SD	1,703
6073011602	National City	3,900
6073021900	National City	7,107

Figure 4 - Community Hub 2.0 / AB 617 Portside Environmental Justice Neighborhoods

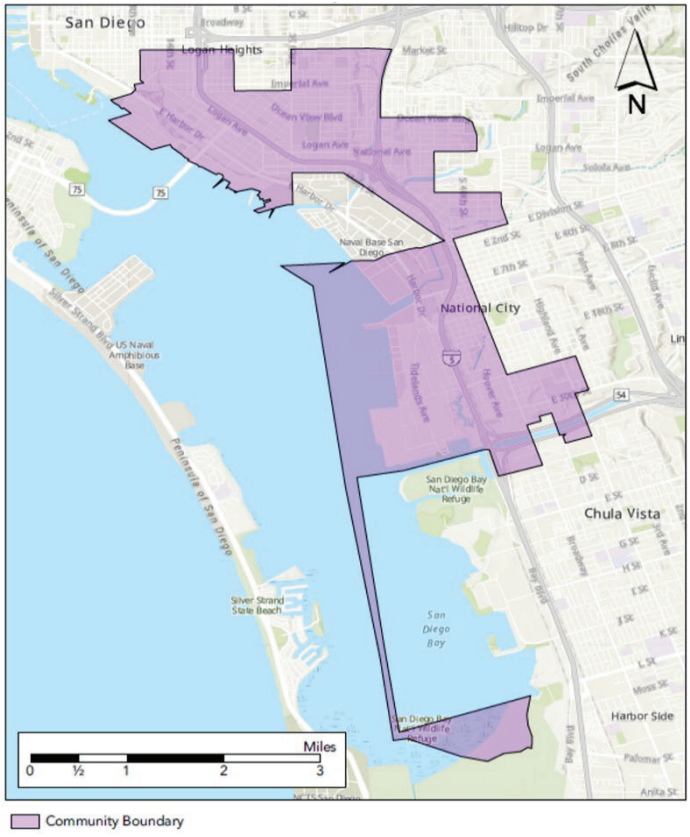
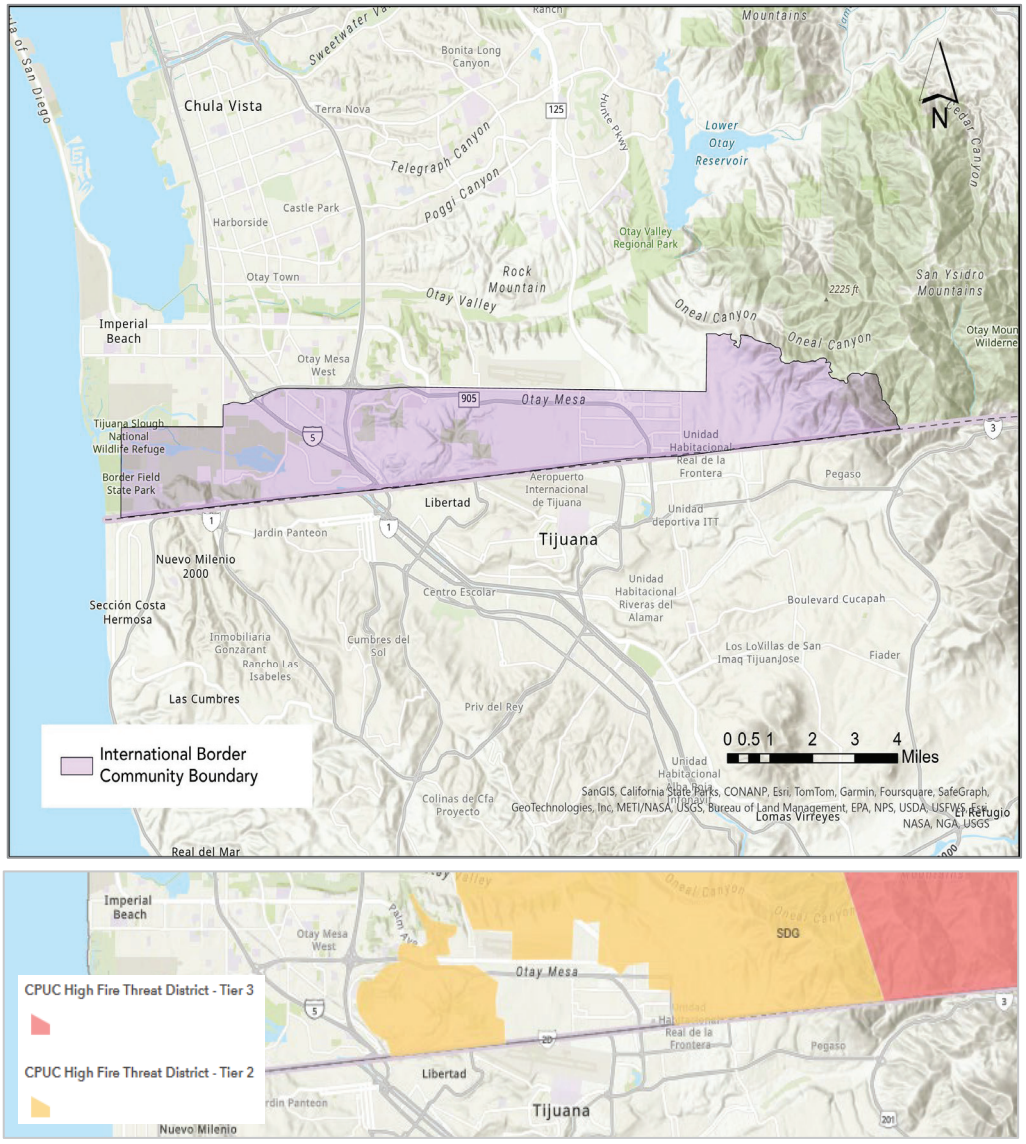


Figure 5 - CommunityHub 2.0 / AB 617 International Border Community & SDG&E HFTD 2 & 3



Since 2017, SDG&E has been working with CARB and other stakeholders to implement AB 617 and help the Community Air Protection Programs be effective at reducing emissions. Each community has a Community Emissions Reduction Program (CERP).[34,35] Within each, SDG&E is an important partner in the implementation of the AB 617 program in San Diego's disadvantaged communities.

AB 617 also requires compilation and submittal of emissions inventories for various industrial sources in the state (independent of location). SDG&E has been reporting its annual toxic and criteria emissions from its air permitted equipment (*i.e.,* combustion turbines at power plants and diesel engines at Construction & Operations (C&O) centers) to the Air Pollution Control District (APCD). For the annual reports submitted over the last few years, APCD has concluded that SDG&E-targeted sites are low-risk and do not pose any significant impacts to receptors (residential and commercial sites near the SDG&E-targeted sites).

Wildfire and PSPS

While no 2025 RAMP controls and/or mitigations are designed for the express purpose of improving air quality or public health, the activities and programs discussed in the Wildfire and PSPS Chapter provide information about weather and air quality conditions that can increase public awareness of conditions and enable them to take self-preservation action.

For example, the Wildfire and PSPS Risk Chapter describes a group of controls that focus on Situational Awareness and Forecasting,[36] which help SDG&E monitor current wildfire, weather, and environmental conditions. The Emergency Preparedness, Collaboration and Public Awareness control provides public information before, during and after a Wildfire or PSPS event.[37] Together, monitoring and communication of current conditions help provide information and awareness of potentially adverse air quality conditions. Air Quality monitors

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[34] San Diego County Air Pollution Control District, *Community Emissions Reduction Plan, Portside Environmental Justice Neighborhoods* (Phase II, July 2021), *available at:* www.sdapcd.org/content/dam/sdapcd/documents/capp/cerp/Portside-Environmental-Justice-CERP-July-2021.pdf.

[35] San Diego County Air Pollution Control District, *International Border Communities, San Ysidro & Otay Mesa, Community Emissions Reduction Program* (March 2024), *available at:* ww2.arb.ca.gov/sites/default/files/2024-07/IBCSC%20CERP%2003.29.24.pdf.

[36] *See* Chapter SDG&E-Risk-4: Wildfire and PSPS, Section III.

[37] *See id.*

are a technology that, while not specifically mentioned, is a component of the Safety Compliance and Industrial Hygiene Program in the Employee Safety Chapter (SDG&E-Risk-6, C328). These monitors help support risk informed decisions for the safety of SDG&E employees and are also utilized by the Fire Science and Climate Adaptation (FSCA) business unit as a tool to support enhanced situational awareness. Finally, the data from these AQI monitors are also made available to the public, to raise awareness and promote risk-informed decision-making on exposure to air quality levels.

The Wildfire and PSPS controls that support this action item are discussed as follows. Note that the easternmost area of the International Border Community in Figure 5 is near the HFTD; therefore, that population may be applicable to any discussion about HFTD customers.

- C572 Situational Awareness and Forecasting is supported by various tools and technologies. Some of these technologies include cameras that are publicly accessible that could provide real-time visuals of smoke-related air quality conditions. Additional information about the cameras is provided in Action Item #5, which discusses SDG&E's Wildfire Mitigation Plan. Other tools that can provide public awareness and forecasting information include weather data, indexes and metrics, and fire detection.
- C328 Safety Compliance & Industrial Hygiene Program, presented as part of the Employee Safety Chapter, includes the deployment of Air Quality monitors – another tool that is used for situational awareness and employee safety. These monitors are also made accessible to the public and are discussed in more detail in Action Item #5.

Electric Infrastructure Integrity

As noted above, EII Risk mitigations mainly entail electric infrastructure upgrades to support public safety and reliability. Other areas of SDG&E's electric infrastructure planning and development may more directly support public health and air quality. For example, capacity-driven electric distribution upgrade programs may facilitate EV adoption that results in carbon emission reductions. Proactive overhead-to-underground electric distribution conversion programs may also reduce utility truck rolls associated with mandated overhead inspection and maintenance activities, resulting in reduced carbon emissions.

Examples of Non-RAMP Activities

SDG&E also engages in non-RAMP efforts to improve air quality and public health for its entire service territory, including DVCs and the AB 617 communities, by partnering with and supporting programs such as the following:

- CERP – Portside Environmental Justice Neighborhoods;[38]
- CERP – International Border Communities;[39]
- SDG&E Integrated Resource Plan - Minimizing Criteria Air Pollutants in DAC;[40]
- SDG&E Integrated Resource Plan - DAC Mitigations;[41]
- CAPP Participation;[42]
- Fleet / Zero-Emission Vehicles (ZEV);[43]
- Community Impact Platform;[44] [45] and
- Tree Planting & Programs.[46]

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[38] San Diego County Air Pollution Control District, *Community Emissions Reduction Plan, Portside Environmental Justice Neighborhoods* (Phase II, July 2021), *available at:* www.sdapcd.org/content/dam/sdapcd/documents/capp/cerp/Portside-Environmental-Justice-CERP-July-2021.pdf.

[39] San Diego County Air Pollution Control District, *International Border Communities, San Ysidro & Otay Mesa, Community Emissions Reduction Program* (March 2024), *available at:* ww2.arb.ca.gov/sites/default/files/2024-07/IBCSC%20CERP%2003.29.24.pdf.

[40] R.20-05-003, 2022 Individual Integrated Resource Plan of SDG&E, Public Version (November 1, 2022) at 78-83.

[41] *Id*. at 36-38.

[42] *Id.* at 82.

[43] SDG&E, *SDG&E's Sustainability Strategy, available at:* https://www.sdge.com/more-information/environment/sustainability-approach.

[44] SDG&E, *SDG&E's Community Impact Platform Earns CIO 100 Award* (March 30, 2022), *available at:* https://www.sdgetoday.com/news/sdges-community-impact-platform-earns-cio-100-award.

[45] Sempra, *SDG&E's Digital Tool for Advancing Environmental Justice Named a Fast Company 2022 World Changing Idea* (May 10, 2022), *available at:* https://www.sempra.com/sdges-digital-tool-advancing-environmental-justice-named-fast-company-2022-world-changing-idea.

[46] SDG&E, *SDG&E Celebrates Arbor Day with New Milestone – 45,000 Trees Planted Since 2021* (April 26, 2024), *available at:* www.sdgetoday.com/news/sdge-celebrates-arbor-day-new-milestone-45000-trees-planted-2021.

VII. ACTION ITEM #4: CLIMATE RESILIENCY

Evaluate how the selection of proposed mitigations in the RDF may impact climate resiliency in DVCs.

SDG&E's 2025 CAVA identifies Wildfire as a Climate Hazard, which provides the foundation to this action item.[47] Climate vulnerabilities must be addressed with the goals of providing safe and reliable service and mitigating the increasing risk through innovative and community-centric approaches. As part of the CPUC's ongoing Climate Adaptation OIR, the CPUC, California IOUs, and various stakeholders and consultants are working to identify a climate and community resilience measurement that can be utilized within the CAVA framework, ultimately feeding into the RAMP and GRC. With new developments, SDG&E will work to utilize and align efforts across proceedings that ultimately aim to incorporate DVC and equity concerns into risk-informed decision-making. For additional information on the CAVA and a complete list of climate controls and mitigations included in RAMP, see Volume 1, Chapter SDG&E RAMP-5 Climate Change Adaptation.

Wildfire and PSPS and EII controls and mitigations may impact climate resiliency within DVCs, as follows:

Wildfire and PSPS

CAVA identifies wildfire as a climate-related hazard for electric distribution, transmission, substations, communication, facilities assets, and gas assets including pressure pipes, medium-pressure pipes, regulators, compressors, and valves. All controls and mitigations in Chapter RAMP-1 Wildfire and PSPS support climate resiliency. Action Item #6 details the strategic underground control for Wildfire and PSPS Risk and DVCs.

Electric Infrastructure Integrity

Several of the EII controls focus on hardening, modernizing, and maintaining the electric infrastructure, which will ultimately be supportive of climate resilience.

- C250 Substation Reliability for Distribution Components – Substations are essential to the daily operation of the electric system. Modern substation infrastructure relies on protective relaying devices to strategically isolate substation equipment to minimize the impact of an outage and increase reliability.

[47] *See discussion in* SDG&E's 2025 CAVA, submitted pursuant to D.20-08-046 and D.24-08-005 on May 15, 2025.

Proactive planning and replacement will allow the distribution system to continue operating at optimum conditions and maintain its reliability, shorten outage times, and allow for operational flexibility to the system. This control could improve climate resilience to extreme temperatures, inland flooding, and coastal flooding. Impacts to DVC are discussed in Action Item #6.

- C253 Restoration of Service provides the reconstruction of overhead and underground distribution facilities that are damaged due to a variety of drivers including Climate Hazards such as wildfire and inland flooding. While this control responds to events as they occur, SDG&E also proactively prepares for event response under advisement from the Meteorology department, attempting to optimize costs and risk reduction as a regular practice with prearranged readiness for responding to these widespread events. This control could improve climate resilience to extreme temperatures, wildfires, inland flooding, and coastal flooding and is applied equally to the entire service territory.
- C254 Underground Cable Replacement Program – Reactive replaces underground cable and restores service after cable failures involved in severe weather conditions and other factors. This control could improve climate resilience to wildfires. This control is performed within the entire service territory.
- C262 Distribution Substation SCADA Expansions – Installs SCADA within the substation enables faster faulted circuit identifications, faster isolation of faulted electric distribution circuits, higher accuracy fault locating, and improved system performance. This control could improve climate resilience to wildfires. This control is performed within the entire service territory.
- C263 Non-HFTD Wireless Fault Indicator – Helps narrow search areas of system failures so SDG&E can quickly identify faults and dispatch crews, improving reliability and customer support. Enables a more complete system view enabling status information of all conductors downstream. This control could improve climate resilience to extreme temperatures. This control is performed within the entire service territory.
- C269 Distribution Circuit Reliability – By expanding the distribution SCADA-switching infrastructure and/or removing reliability deficiencies on a distribution

circuit, the infrastructure will be well-controlled and operated during times of climate emergencies. This control could improve climate resilience to extreme temperatures. Impacts to DVC are discussed in Action Item #6.

- C270 SCADA Capacitors – These modern capacitors can monitor imbalances and internal faults and provide a method for remote isolation, enabling situational awareness and response during extreme weather conditions. This control could improve climate resilience to wildfires. This control is performed within the entire service territory.
- C533 Vegetation Management Enterprise System – Maintaining and managing vegetation within the service territory is a critical component of wildfire mitigation efforts. This control could improve climate resilience to wildfires. This control is performed within the entire service territory.

VIII. ACTION ITEM #5: WILDFIRE SMOKE

Evaluate if estimated impacts of wildfire smoke included in the RDF disproportionately impact DVCs.

For this action item, SDG&E took steps to accomplish the following:

- Identify current sources of publicly available smoke / air quality models;
- Review current research (with primary focus on research published in 2023 or 2024) as to how smoke relates to DVC communities, and report on findings;
- Discuss approach academia; and
- Review relevant information from SDG&E's 2026-2028 Wildfire Mitigation Plan (WMP).[48]

Background

SDG&E's core wildfire mitigation efforts are aimed at reducing the risk of ignition, or the incidence of ignition evolving into a catastrophic wildfire. These efforts have the simultaneous effect of reducing the impacts of wildfire smoke. While SDG&E is recognized as a utility leader in preventing utility-caused wildfires, it does not have expertise on the science of smoke impacts (which are not utility-specific). SDG&E defers to leaders in the field (such as the

[48] SDG&E's 2026-2028 Wildfire Mitigation Plan (May 2, 2025) (2026-2028 Base WMP), *available at* https://www.sdge.com/2026-2028-wildfire-mitigation-plan.

Federal government, state agencies and universities) for the mission/focus, tools, and resources to study and advance research on this topic. Utility-specific research presents several challenges, including the difficulty of accurately identifying and quantifying the potential number of SDG&E customers impacted by smoke related to utility-caused wildfires and assessing the extent of the effects on both customers and the environment. The complexity arises, for example, from the variability in wildfire behavior, identifying and quantifying the type of material burned, the duration of the fire, the diverse locations and existing characteristics of the customers impacted, and the difficulty in predicting long-term environmental impacts.

SDG&E is committed to collaborating with Safety Policy Division, Energy Safety, academia, and intervenors to accurately assess the impact of wildfire smoke on air quality, health, and the environment, and consider incorporating this impact into the risk and cost-benefit calculations.

2025 RAMP Controls Addressing Smoke

Within Chapter SDG&E-Risk-4: Wildfire and PSPS, SDG&E discusses the control measure: C572 Situational Awareness and Forecasting, describing the Air Quality Management Program that monitors particulate matter from wildfire smoke. It does not forecast smoke impacts and the mitigation is for the safety of employees and the general public – inclusive but not specifically for DVC. In addition, air quality stations and cameras are discussed in greater detail in SDG&E's 2026-2028 Base WMP in sections 10.2.1.2 Air Quality Station and 10.4.1.2 Cameras.

Review of Recent Smoke-Related Studies

Studies show that vulnerable communities may be more susceptible to the adverse impacts of wildfire smoke in the event of a catastrophic wildfire, due to potential challenges in transportation/mobility, shelter/air conditioning and purifying technologies, working conditions / locations, reduced access to healthcare, etc. As technology, such as AI, and more sophisticated models leveraging AI are developed to help forecast smoke travel paths, there is hope that earlier notification, effective resource allocation and targeted actions could be identified.

SDG&E reviewed the following publicly available studies on health impacts of wildfire smoke in Table 3.

Table 3 - Reviewed Publicly Available Studies on Health Impacts of Wildfire Smoke

Model	**Link**
NASA "Wildfire Digital Twin" Pioneers New AI Models and Streaming Data Techniques for Forecasting Fire and Smoke	https://science.nasa.gov/science-research/science-enabling-technology/nasa-wildfire-digital-twin-pioneers-new-ai-models-and-streaming-data-techniques-for-forecasting-fire-and-smoke/
It's the Smoke, Not the Fire | AJPH | Vol. 113 Issue 7	https://ajph.aphapublications.org/doi/10.2105/AJPH.2023.307327
Social Vulnerability in US Communities Affected by Wildfire Smoke, 2011 to 2021	https://ajph.aphapublications.org/doi/full/10.2105/AJPH.2023.307286
A Comparison of Smoke Modelling Tools Used to Mitigate Air Quality Impacts from Prescribed Burning	https://www.nwfirescience.org/sites/default/files/publications/A%20comparison%20of%20smoke%20modelling%20tools%20used%20to%20mitigate%20air%20quality%20impacts%20from%20prescribed%20burning.pdf
Tainted Air	https://socialecology.uci.edu/news/tainted-air
Policy Brief: Local Air Quality Monitoring During Wildfire Events: Reducing Hazardous Exposures for Farmworkers	https://socialecology.uci.edu/sites/default/files/users/mkcruz/policybrief_draft4_080824.pdf
Air Quality Monitoring and the Safety of Farmworkers in Wildfire Mandatory Evacuation Zones	https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2024GH001033
CARB 2022 Scoping Plan for Achieving Carbon Neutrality (2022 Scoping Plan)	https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp_1.pdf
CARB 2022 Scoping Plan Appendix K: Climate Vulnerability Metric (CVM)	https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp-appendix-k-climate-vulnerability-metric_0.pdf
CARB 2022 Scoping Plan Appendix G: Public Health	https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp-appendix-g-public-health.pdf
Why It's So Hard to Forecast Wildfire Smoke	http://www.newyorker.com/science/elements/why-its-so-hard-to-forecast-wildfire-smoke
Fire Intensity and spRead forecAst (FIRA): A Machine Learning Based Fire Spread Prediction Model for Air Quality Forecasting Application	https://doi.org/10.1029/2024GH001253
Exploring spatial heterogeneity in synergistic effects of compound Climate Hazards: Extreme heat and wildfire smoke on cardiorespiratory hospitalizations in California	https://www.science.org/doi/10.1126/sciadv.adj7264
Wildfires, Compound Extreme Events, Climate Change, and Cardiovascular Health Impacts of Fine Particulate Matter From Wildfire Smoke on Respiratory and Cardiovascular Health in California	https://www.jacc.org/doi/epdf/10.1016/j.jacc.2025.01.009
Smoke and COVID-19 case fatality ratios during California wildfires	https://iopscience.iop.org/article/10.1088/1748-9326/ac4538
USC scientists use AI to predict a wildfire's next move	https://today.usc.edu/using-ai-to-predict-wildfires/

Model	Link
High-Resolution Smoke Forecasting for the 2018 Camp Fire in California Fire and Smoke Model Evaluation Experiment (FASMEE)—Phase 2	https://journals.ametsoc.org/view/journals/bams/103/6/BAMS-D-20-0329.1.xml
Disruptions from Wildfire Smoke: Vulnerabilities in Local Economies and Disadvantaged Communities in the U.S	https://www.frbsf.org/wp-content/uploads/sites/3/disruptions-from-wildfire-smoke-cdrb06.pdf
Wildfire smoke impacts respiratory health more than fine particles from other sources: observational evidence from Southern California	https://www.frbsf.org/wp-content/uploads/sites/3/disruptions-from-wildfire-smoke-cdrb06.pdf

Discussions with Academia

During the Public Workshop, SPD recommended that SDG&E contact Dr. Michael Méndez from UC Irvine, a professor whose latest research focuses on climate-induced disasters and social vulnerability. Through discussions with Dr. Méndez, SDG&E understands his agreement with SDG&E's approach to the action item. Dr. Méndez suggested that SDG&E contact David Eisenman, who, upon contact, recommended "It's the Smoke, Not the Fire," which SDG&E included in the research.

External Smoke-Related Tools and Models

SDG&E reviewed current public studies on wildfire smoke, as well as several tools and models that inform the public about wildfire smoke conditions. Table 4 summarizes these tools and models.

Table 4 - Selected Smoke Related Tools and Models

Model	Type	Owner / Developer	Link
HRRR-Smoke	Forecast	NOAA	https://apps.gsl.noaa.gov/smoke/index.html
HYSPLIT / HEIMS	Forecast	NOAA	www.arl.noaa.gov/hysplit/smoke-forecasting
ALERTCalifornia	Real-Time Data	UCSD with **SDG&E Cameras**	https://cameras.alertcalifornia.org
SDG&E AQI Monitors & Weather Awareness System	Real-Time Data	**SDG&E**	https://sdgeweather.com
PurpleAir	Real-Time Data	Purple Air with **SDG&E AQI Monitors**	https://map.purpleair.com

Model	Type	Owner / Developer	Link
AirNow Fire & Smoke Map	Real-Time Data	EPA	www.airnow.gov/fires/using-airnow-during-wildfires
Google Maps – Wildfire Layer	Real-Time Data	Google	www.google.com/maps
Google Maps – Air Quality Layer	Real-Time Data	Google	www.google.com/maps
AQview 3.0	Real-Time Data	CARB	https://aqview.arb.ca.gov/
Smoke Ready CA App	Real-Time Data & Limited Forecast	CARB	https://ww2.arb.ca.gov/smokereadyca
SD APCB Website	Real-Time Data (Simple)	SD APCB	www.sdapcd.org/content/sdapcd/air-quality/air-quality-forecast.html http://sd.sdapcd.org/airvision
CalFire Smoke & Haze Forecast	Real-Time Data & Limited Forecast	CalFire	https://www.fire.ca.gov/incidents
Fire and Resource Assessment Program (FRAP) Map	Static Map of Fire Risk	CalFire	www.fire.ca.gov/what-we-do/fire-resource-assessment-program/fire-probability-for-carbon-accounting
High Fire Threat Districts (HFTD)	Static Map of Fire Risk	CPUC	https://egis.fire.ca.gov/FireProbability

2026-2028 Wildfire Mitigation Base Plan

Within SDG&E's 2026-2028 Base WMP, SDG&E discusses Air Quality Stations (Section 10.2.1.2) and Cameras and AI Technology (Section 10.4.1.2) as a way to monitor smoke.

IX. ACTION ITEM #6: MITIGATION IMPACTS & BENEFITS

Estimate the extent to which risk mitigation investments included in the RDF impact and benefit DVCs independently and in relation to non-DVCs in the IOU service territory.

SDG&E evaluated applicable Wildfire and PSPS and EII controls and mitigations with respect to the DVCs, to determine their benefits compared to the larger service territory.

Wildfire and PSPS

SDG&E's primary objective is to promote public safety by preventing ignitions during periods of high-fire weather and minimizing the scope, duration, and impact of PSPS on as many customers as possible. Proactive de-energization of overhead infrastructure for safety remains an

important component of SDG&E's wildfire mitigation strategy. SDG&E recognizes the challenges that de-energization events pose for customers, communities, and public safety partners, particularly in DVC communities. Therefore, the use of PSPS de-energization is a measure of last resort with the need to promote safety during high fire risk conditions affecting DVC communities.

C518 Strategic Undergrounding

SDG&E continues to advocate for the deployment of strategic undergrounding in DVC communities instead of covered conductor deployment due to its superior wildfire risk reduction effectiveness (99%), which nearly eliminates the need for PSPS de-energizations during extreme fire weather. Additionally, the cost-effectiveness of strategic undergrounding is evident when comparing lifecycle costs of these two grid mitigation alternatives due to the continuous maintenance and inspections required for above-ground infrastructure, as well as the ongoing operational and economic costs associated with PSPS de-energizations.

Proposed circuits for strategic undergrounding were layered onto SDG&E's DVC map to identify locations where circuits served DVCs as shown in Figure 6. Through this analysis, SDG&E finds the only DVCs intersecting with the strategic undergrounding control are Tribal Lands.

In this RAMP and for years 2028-2031, SDG&E's mitigation plan includes undergrounding approximately 600 miles of overhead conductor, including 127 miles in the DVC shown in Table 5. The selection of these locations is based on SDG&E's WiNGS-Planning model that utilizes the Cost-Benefit Approach and evaluates wildfire, PSPS, and PEDS impacts at the span/segment level where evaluation of the risk benefit (in dollars) and installation and maintenance costs are performed to evaluate risk buy-down and cost-effectiveness of the projects.

Figure 6 - Strategic Undergrounding Circuits Scoped and DVC Intersection

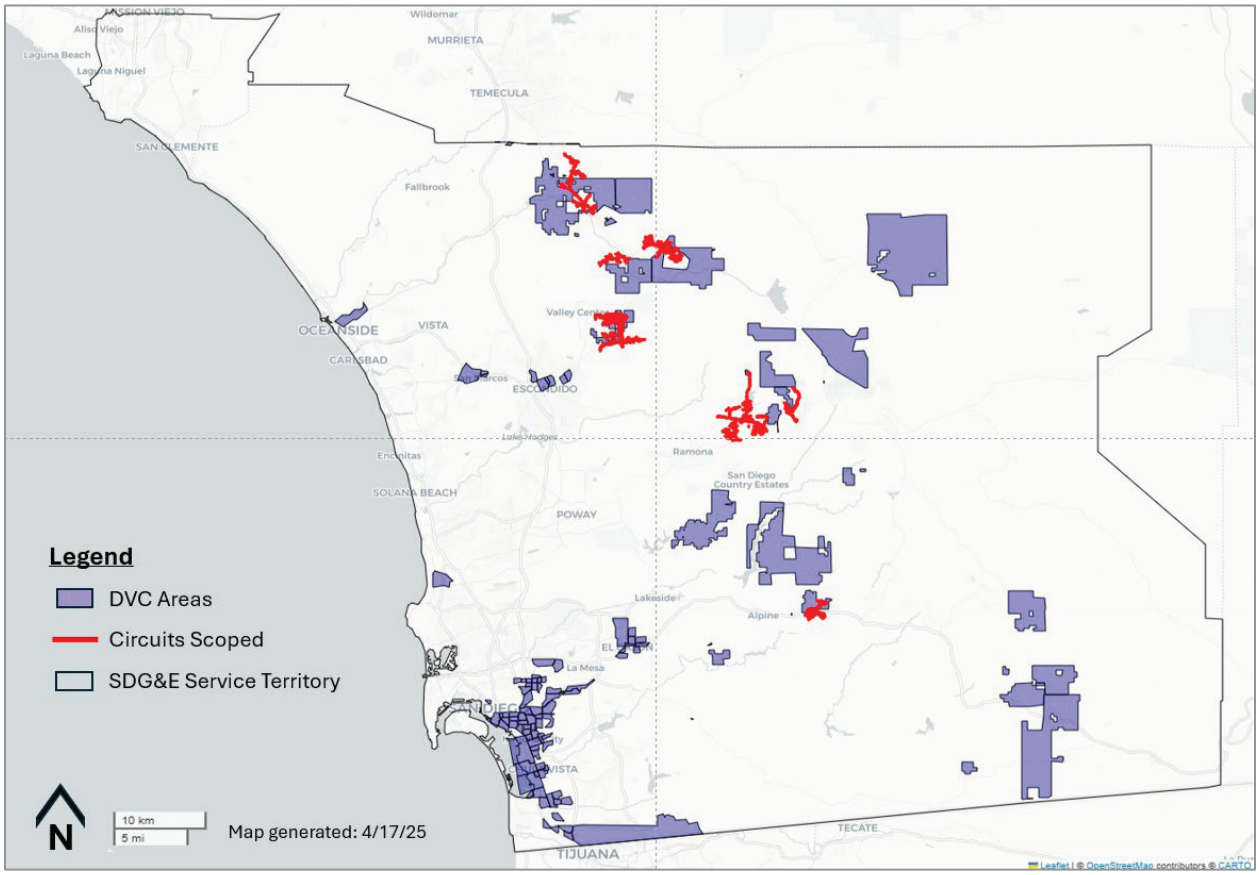


Table 5 - DVC Impacts of Undergrounding Overhead Conductor (2024 $)

Name	Feeder ID	Feeder-Segment	Total Customers[49] in feeder-segment	Total Customers[50] downstream of feeder segment	Total OH Miles	Baseline Risk (M$)	Risk Reduced (M$)	Risk Reduction (%)	PV Risk Reduced (M$) Year 55	PV Total Cost Capital + O&M (M$) Year 55	SUG CBR WA CC
San Pasqual Reservation	1030	1030-20R	140	283	15.91	25.24	24.82	98.3	$ 375.71	$ 32.22	11.6
San Pasqual Reservation	1030	1030-42R	293	697	16.91	28.31	27.81	98.2	$ 420.87	$ 34.33	12.2
Pala Reservation	217	217-835R	87	154	18.55	10.65	10.40	97.6	$ 173.00	$ 41.23	4.2
Mesa Grande Reservation	222	222-1433R	16	16	6.19	9.58	9.41	98.1	$ 149.29	$ 13.13	11.3
Mesa Grande Reservation	237	237-30R	296	296	32.13	65.30	64.18	98.2	$ 971.31	$ 65.04	14.9

[49] Customer meter counts.

[50] Customer meter counts.

Name	Feeder ID	Feeder-Segment	Total Customers[49] in feeder-segment	Total Customers[50] downstream of feeder segment	Total OH Miles	Baseline Risk (M$)	Risk Reduced (M$)	Risk Reduction (%)	PV Risk Reduced (M$) Year 55	PV Total Cost Capital + O&M (M$) Year 55	SUG CBR WA CC
Viejas Reservation	358	358-682F	172	173	10.58	37.48	36.91	98.4	$ 613.81	$ 23.56	26.0
Rincon Reservation	215	CB215	0	492	0.15	0.13	0.13	99.8	$ 2.22	$ 0.33	6.6
Rincon Reservation	215	215-38R	80	492	6.51	5.42	5.34	98.5	$ 88.76	$ 14.48	6.1
La Jolla Reservation Pauma and Yuima Reservation	214	214-1122R	223	355	20.17	26.19	25.70	98.1	$ 371.00	$ 38.95	9.5
Totals			1,307	2,958	127.1	208.3	204.7	98.4	$3,165.97	$ 263.28	12.0

Electric Infrastructure Integrity

SDG&E focused the DVC mitigations analysis on the following three control programs. These were selected because SDG&E possessed granular data to distinguish between DVCs and non-DVCs. In addition, they have varied impacts to DVC areas.

- C236 Distribution Overhead Switch Replacement Program
  - C236 Alternative 2
- C250 Substation Reliability for Distribution
- C269 Distribution Circuit Reliability

SDG&E finds, for the three EII control programs selected, that CBRs for DVC are typically higher than the whole program CBRs.[51] However, these DVC-specific controls address less than a quarter of the overall risk reduction in each control. Focusing only on DVCs would not lead to a substantial reduction in EII Risk for the entire service territory.

DVCs are geospatial in the form of census tracts and tribal lands, thus, SDG&E used GIS analysis to understand how EII Risks could impact DVCs. Program location data overlaid with SDG&E's DVC map identified locations where assets could affect DVCs. If DVC areas were found to overlap with the asset or be connected to the same circuit as the asset, DVCs were

[51] SDG&E is providing CBR information in response to CPUC, *Safety Policy Division Evaluation Report on PG&E 2024 RAMP Application (A.)24-05-008* (November 8, 2024) at 36, *available at:* https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/safety-policy-division/reports/spd-evaluation-report-2024-pge-ramp-final-with-attachments.pdf.

considered to be served by the asset. Including the connected circuit is valuable as the program impacts its immediate location as well as the surrounding area. SDG&E estimated the overlap of connected circuit miles inside a DVC to create a percentage-based calculation.

SDG&E's C236 Distribution Overhead Switch Replacement Program aims to replace overhead distribution switches that have shown signs of severe or quickly emerging corrosion that may lead to catastrophic switch failure. To mitigate the likelihood of a catastrophic switch failure, SDG&E may operate the next upstream protection device instead, causing a prolonged and expanded outage. Replacement of these switches allows for a reduced customer impact when isolation devices are needed during planned and unplanned outages. Program overhead switch location data were overlaid with SDG&E's DVC map to identify locations where the assets' connected circuits serve DVCs, as shown in Figure 7.

Figure 7 - C236 Distribution Overhead Switch Replacement - Circuits Scoped and DVC Intersection

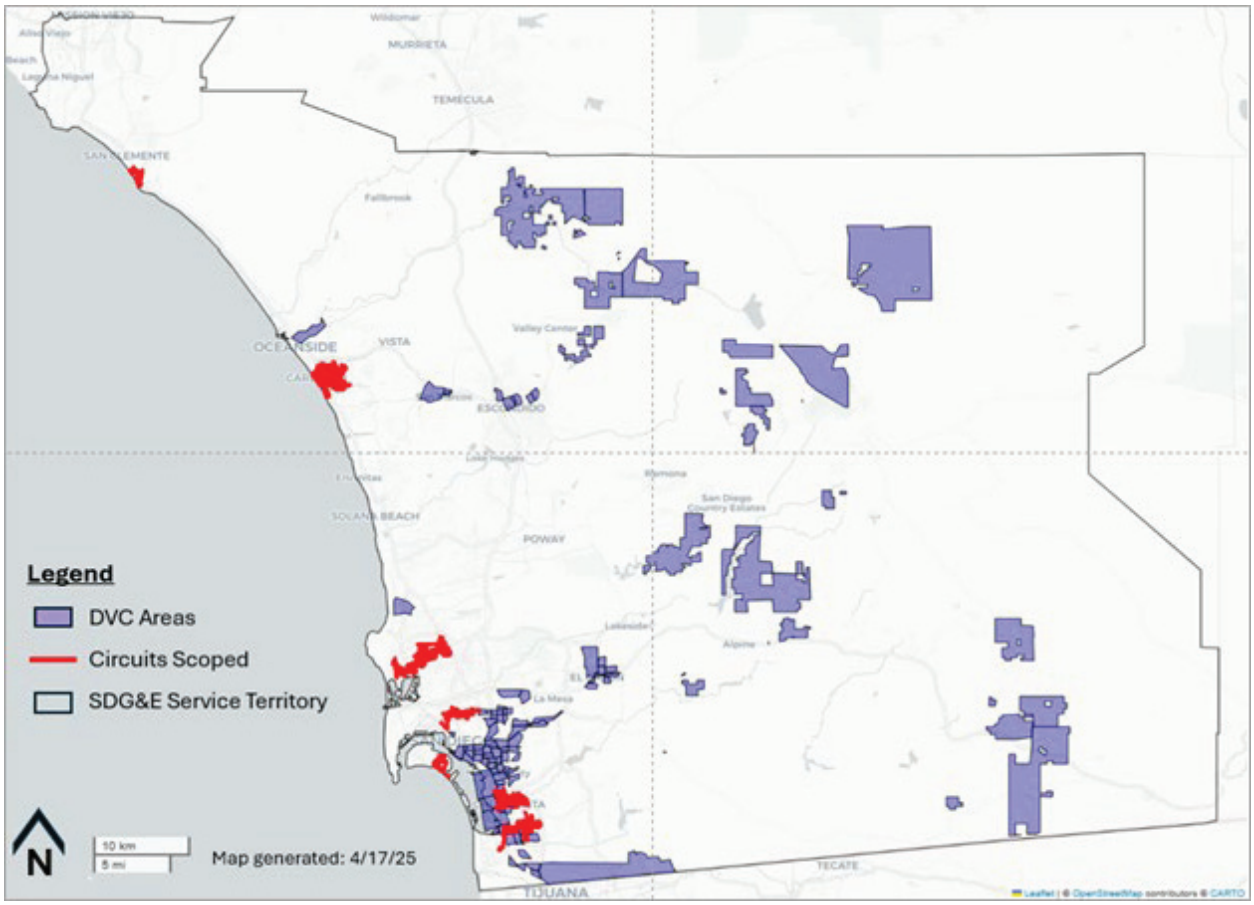


Figure 7 shows approximately 13% of C236 connected circuits overlapping with DVCs, of which SDG&E forecasts about $303,000 of 2028-2031 program costs[52] to be spent on overhead switches that serve DVCs. SDG&E forecasts approximately $21 million on risk reduction[53] in DVCs overhead switch replacement from 2028-2031. On these circuits, approximately 7,200 customer meters are in DVCs, compared to 49,000 in non-DVCs. The program has nineteen (19) projects forecasted in 2028, with 4 projects serving DVCs.

In the A210 Alternative 2, SDG&E considered a program that would only replace distribution overhead switches that benefit customers living within the DVC. The limited scope of this alternative program was developed using a subset of those projects. This is discussed further in EII Chapter SDG&E-Risk-5.

Program CBRs are shown in Table 6 with Alternative 2 to highlight DVC vs non-DVC.

Table 6 - 2028-2031 CBRs for C236 Distribution Overhead Switch Replacement and Alternative 2

Controls	Total Cost (2028-2031)	Total Benefit (2028-2031)	DVC Overlap[54]	DVC Cost (2028-2031)	DVC Benefit (2028-2031)	CBR
C236 WACC	$2,097,334	$72,087,537	13%	$272,653	$9,371,380	34.37
C236 Hybrid	$2,097,334	$97,634,825	13%	$272,653	$12,692,527	46.55
C236 Societal	$2,788,719	$317,462,544	13%	$362,534	$41,270,131	113.84
A210 - DVC Only - WACC	$84,709	$5,334,798	100%	$84,709	$5,334,798	62.98
A210 - DVC Only - Hybrid	$84,709	$7,176,654	100%	$84,709	$7,176,654	84.72
A210 - DVC Only - Societal	$109,810	$22,833,584	100%	$109,810	$22,833,584	207.94

The CBR is higher for DVC in C236 but reduces about $23 million of risk in 2028-2031 using the societal discount, compared to $317 million total C236 program risk (7%).

SDG&E's C250 Substation Reliability for Distribution Components aims to mitigate substation risk as substations play a critical role in our electric grid. Asset age and equipment characteristics (e.g., transformer type) can be predictable and impactful asset data leading to the

[52] Averaged 2028-2031 costs for each discount rate, applied DVC percentage (13%).

[53] Averaged 2028-2031 benefits for each discount rate, applied DVC percentage (13%).

[54] Control distribution miles overlapping with DVCs.

natural decline of substation electric infrastructure integrity. Program substation location data and their connected circuits were overlaid with SDG&E's DVC map to identify locations where a substation serves DVCs, as shown in Figure 8.

Figure 8 - C250 Substation Reliability for Distribution - Substations Circuits Scoped and DVC Intersection

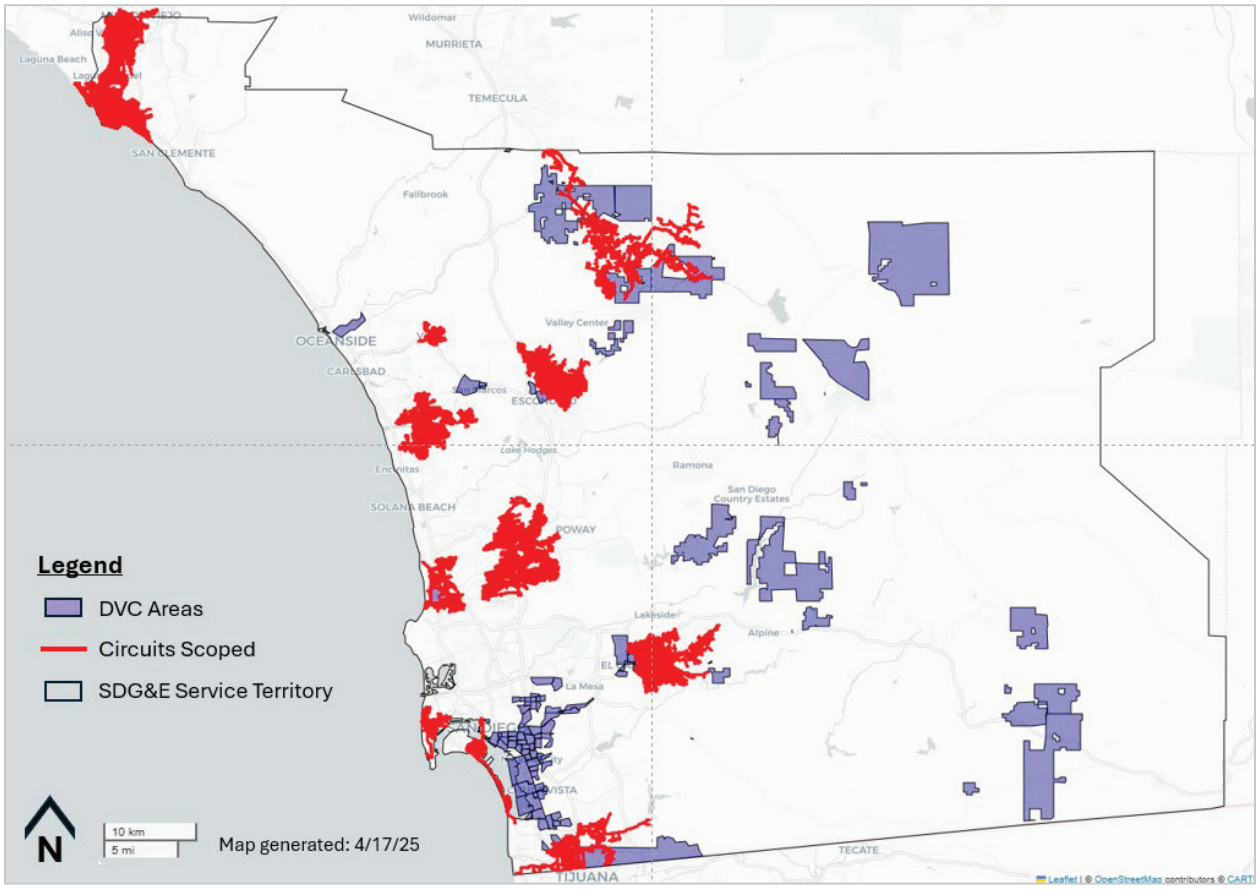


Figure 8 shows approximately 6% of C250 substations connected circuits overlapping with DVC, of which SDG&E forecasts about $2.5 million of 2028-2031 program costs[55] to be spent on substations serving DVCs. SDG&E forecasts approximately $580,000 on risk reduction[56] in DVCs for substation reliability 2028-2031. On these circuits, approximately 16,000 customer meters are in DVCs, compared to 242,000 in non-DVCs. Four (4) of the 15

[55] Averaged 2028-2031 costs for each discount rate, applied DVC percentage (6%).

[56] Averaged 2028-2031 benefits for each discount rate, applied DVC percentage (6%).

substations in this control were tagged as located in or serving a DVC. SDG&E has 14 circuit breakers and 3 power transformers targeted for replacement at these substations.

With substations, SDG&E can isolate the specific CBRs for DVCs. C250 program CBRs are shown in Table 7, with the top three rows showing all program substations and the bottom three rows analyzing the substations serving DVCs.

Table 7 - 2028-2031 CBRs for C250 - Substation Reliability for Distribution - DVC and All Service Territory

Control	Total Cost (2028-2031)	Total Benefit (2028-2031)	DVC Overlap[57]	DVC Cost (2028-2031)	DVC Benefit (2028-2031)	CBR
C250 WACC	$37,000,090	$5,435,724	6%	$2,220,005	$326,143	0.15
C250 Hybrid	$37,000,090	$6,802,719	6%	$2,220,005	$408,163	0.18
C250 Societal	$49,441,516	$16,754,119	6%	$2,966,491	$1,005,247	0.34
C250 DVC Substations - WACC	$2,745,982	$1,178,267	21%	$567,112	$243,341	0.43
C250 DVC Substations - Hybrid	$2,745,982	$1,474,581	21%	$567,112	$304,537	0.54
C250 DVC Substations - Societal	$3,381,603	$3,631,682	21%	$698,383	$750,030	1.07

While the CBR is higher for the DVC portion of C250, reducing about $3.6 million of risk in 2028-2031 using the societal discount, the total program risk reduction of $16.7 million (22%) is higher compared to only looking at the DVC portion by itself.

SDG&E's C269 Distribution Circuit Reliability program helps mitigate the EII Risk by expanding the distribution SCADA-switching infrastructure and/or removing reliability deficiencies on a distribution circuit. This program allows for the addition of equipment necessary and/or the re-arrangement of circuit(s) to improve service reliability of electric customers and maintain reliability standards. Electric service reliability deteriorates in the absence of comprehensive remedial solutions offered by these projects and consistent review of distribution circuits. Program circuit data was layered onto SDG&E's DVC map to identify locations where assets and their connected circuits serve DVCs, as shown in Figure 9.

[57] Control distribution miles overlapping with DVC.

Figure 9 - C269 - Distribution Circuit Reliability - Circuits Scoped and DVC Intersection

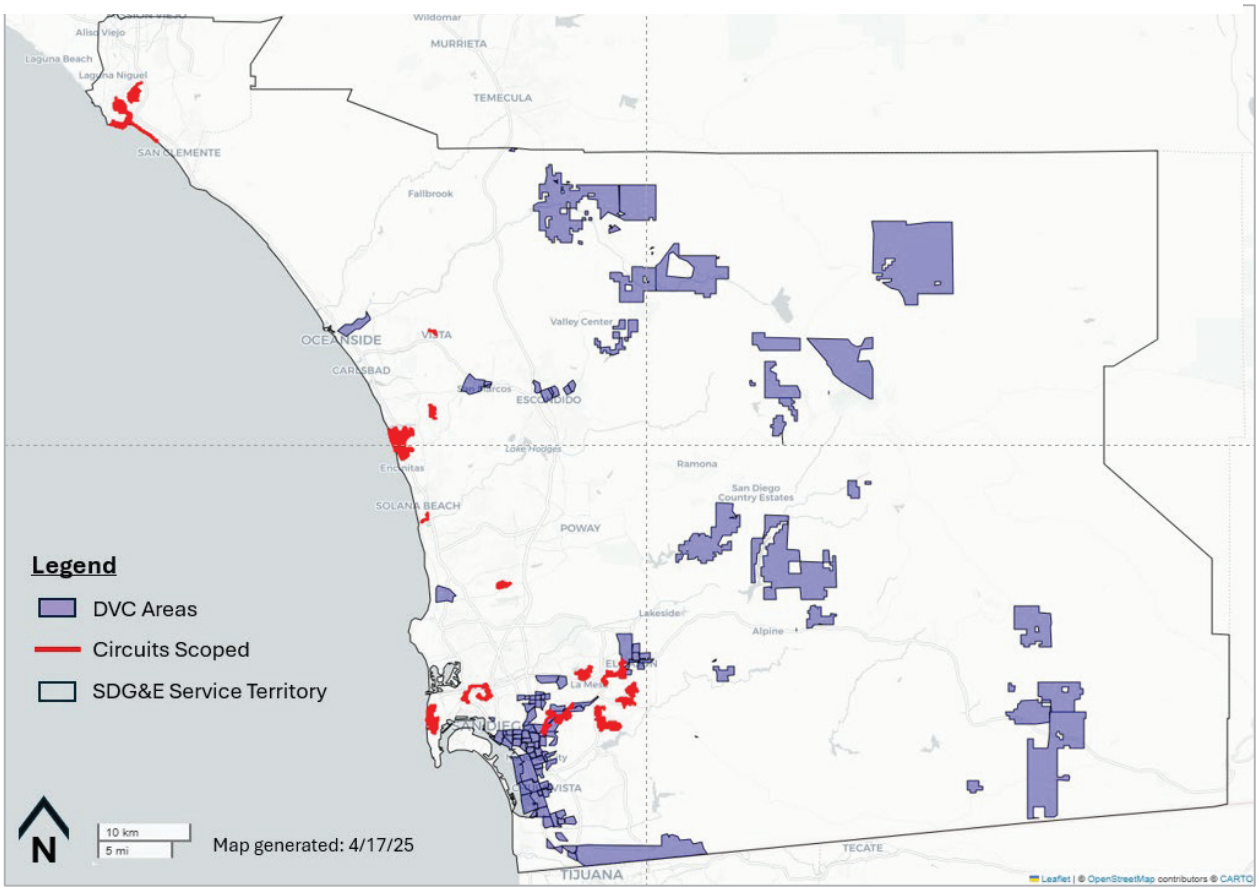


Figure 9 shows approximately 6% of C269 connected circuit mileage overlapping with DVCs, of which SDG&E forecasts about $242,000 of 2028-2031 program costs[58] to be spent on distribution circuit reliability serving DVCs. SDG&E forecasts approximately $13.5 million[59] on risk reduction in DVCs for distribution circuit reliability 2028-2031. On these circuits, approximately 2,000 customer meters are in DVCs, compared to approximately 28,000 in non-DVCs. The program preliminarily has 14 projects forecasted in 2028, with 3 projects serving DVCs.

The program CBRs shows no distinction from all circuits and DVC CBRs as shown in Table 8.

[58] Averaged 2028-2031 costs for each discount rate, applied DVC percentage (6%).

[59] Averaged 2028-2031 benefits for each discount rate, applied DVC percentage (6%).

Table 8 - 2028-2031 CBRs for C269 - Distribution Circuit Reliability - DVC and All Service Territory

Control	Total Cost (2028-2031)	Total Benefit (2028-2031)	DVC Overlap[60]	DVC Cost (2028-2031)	DVC Benefit (2028-2031)	CBR
C269 WACC	$3,628,086	$112,910,857	6%	$217,685	$6,774,651	31.12
C269 Hybrid	$3,628,086	$148,983,010	6%	$217,685	$8,938,981	41.06
C269 Societal	$4,824,084	$415,606,648	6%	$289,445	$24,936,399	86.15

Examples of Non-RAMP Activities

SDG&E's Climate Adaptation Vulnerability Assessment includes details about the Climate Intelligence Platform (CIP), which uses digital twin technology for a granular geospatial visualization of the CAVA findings.[61] The CIP overlays Climate Hazard data (e.g., extreme heat index, inland flooding, sea level rise) onto a fine-grained hexagonal grid along with DVCs, SDG&E's assets to visualize climate vulnerability across multiple time horizons (2030, 2050, 2070) and across different emission-linked climate change scenarios.

X. ACTION ITEM #7: OUTREACH & PUBLIC PARTICIPATION

Enhance outreach and public participation opportunities for DVCs to meaningfully participate in risk mitigation and climate adaptation activities consistent with Decision 20-080046.

SDG&E summarizes relevant outreach and public participation opportunities from its Community Engagement Plan, discusses outreach and public participation controls from the Wildfire and PSPS Risk and the EII Risk, and supplements the discussion with references to similar SDG&E activities outside of RAMP.

Community Engagement Plan / CAVA Outreach

SDG&E's CAVA addresses the requirements set forth in the CPUC Climate Adaptation OIR (R.18-04-019), among them the requirements to conduct community engagement in all DVCs (see Figure 10) and file a Community Engagement Plan (CEP)[62] every four years. SDG&E's community engagement approach, as detailed in the CEP, centers around key

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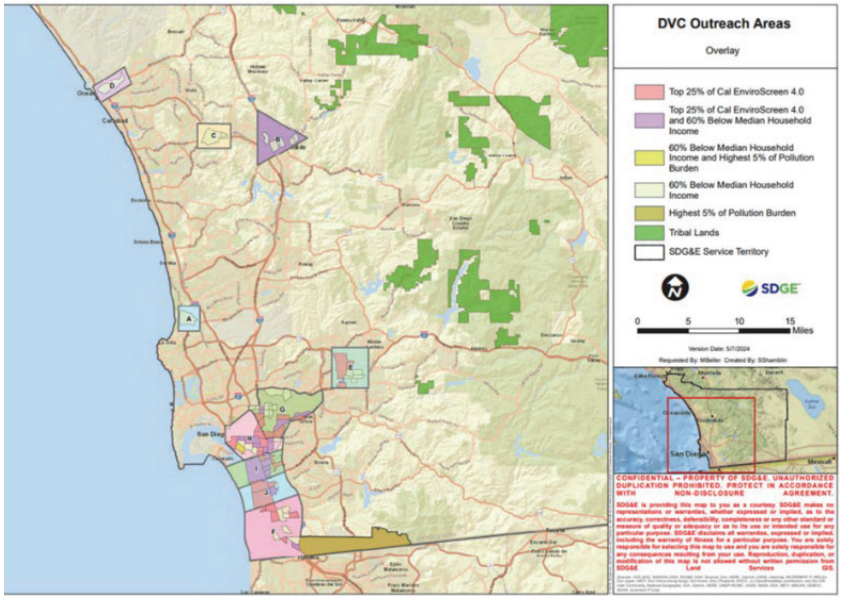
60 Control distribution miles overlapping with DVC.

61 *See discussion in* SDG&E's 2025 CAVA, submitted pursuant to D.20-08-046 and D.24-08-005 on May 15, 2025.

62 R.18-04-019, SDG&E Community Engagement Plan (May 15, 2024), *available at* https://www.sdge.com/sites/default/files/regulatory/R1804019_SDGE%20CEP.pdf.

foundational principles, which includes: (1) partnering with trusted Community-Based Organizations (CBOs) to facilitate mutually beneficial networks; (2) working with Tribal Nations, centering the two-way exchange of information between SDG&E and tribes, for which the foundation is reciprocity and respect; and (3) considering a set of elements in the organization of outreach events, such as the provision of both in-person and virtual meeting options, the availability of food while upholding support to local vendors, the potential inclusion of incentives in the form of giveaways or raffles, and the creation of partnerships and the use of trusted community spaces. Outreach efforts help facilitate the meaningful inclusion and participation of communities in the CAVA process and support informed decision-making that incorporates climate and equity concerns.

Figure 10 - SDG&E Community Engagement Plan (CEP) - DVC Outreach Areas



Wildfire and PSPS

There are several RAMP Wildfire and PSPS controls that provide outreach to communities (including DVC) to participate in risk control activities. While several of the controls increase public awareness, the following are most supportive of meaningful participation. SDG&E strives to reach all customers, including DVC, in the most effective way, and in many instances, through multiple channels.

- C506 Microgrids – DVC is one of the selection criteria for targeting locations within the Microgrid Incentive Program (MIP).[63]
- C512 Customized Resiliency Assessments provide customers frequently impacted by PSPS de-energizations with resiliency assessments to better understand their resiliency to de-energizations and their awareness of services and resources. Provides information about PSPS, resiliency options, services, and resources available to them. This mitigation is provided to DVC and non-DVC customers equally (outside of the PSPS frequency).
- C516 Generator Assistance Program – Eligible customers receive program materials via mail and email campaigns and are directed to an online portal to learn more about the program. Customers enrolled in the California Alternate Rates for Energy (CARE) program are eligible for an enhanced rebate. This mitigation is provided to DVC and non-DVC customers equally.
- C572 Situational Awareness and Forecasting – Provides situational awareness that customers can access that is delivered through various tools and technologies. Among the capabilities available to the public are monitors of particulate matter from wildfire smoke and a network of cameras to provide visual assessments. SDG&E's Weather Awareness System and Fire Potential Index (FPI) is available for customers to see current and forecasted susceptibility metrics to provide them with situational awareness of risk to customers. This mitigation is available to DVC and non-DVC customers equally.
- C556 Engagement with AFN Populations – SDG&E conducts a dedicated campaign focused on communicating with AFN customers, promoting PSPS resources and services through its partnerships and robust support model. Because of the large overlap of AFN customers with DVC communities, the DVC community is a beneficiary of this control.
- C557 Public Outreach and Education Awareness – Outreach and awareness programs are delivered through SDG&E's approximately 50 CBO Energy Solutions Partner Network, providing supports before, during and after wildfire,

[63] D.23-04-034.

PSPS, and other potential emergency events. DVC benefits will be dependent upon the activity and outreach success CBO that serve them.

- C567 Public Emergency Communication Strategy – The Wildfire Safety Public Education and Outreach plan increases community resiliency to wildfires and mitigates the impact of PSPS de-energizations. Media updates, in-community signage, and situational awareness postings are used across social media and SDG&E's external-facing blog to provide the latest real-time updates to customers and the general public. Social media toolkits are also developed and shared with community partners to help amplify and reach a broader audience. This mitigation is provided to DVC and non-DVC customers equally, however certain community partners could provide additional benefit to DVC.

Electric Infrastructure Integrity

The EII control that provides safety outreach to the public (including DVC) to increase awareness of the risk and encourage the public to take actions for personal safety is described below.

- C215 Electric Public Safety Communications – Through a dedicated marketing campaign, SDG&E provides education to customers and the general public about the dangers and risks associated with electricity and working in proximity to SDG&E's electrical equipment and delivery infrastructure. This is primarily accomplished through a variety of integrated tactics, including bill messaging, organic and paid social media, television, out-of-home (*e.g.*, billboards & bus shelters to reach those who might not have bills nor access to traditional media), print and digital advertising, press releases, messaging on company website (including internal company employee site, PowerUp) and warning signage near electric facilities.

This control is performed across the entire service territory.

Examples of Non-RAMP Activities

SDG&E conducts several types of community outreach, including specialized focus on vulnerable communities. Some of the efforts to engage the public and encourage participation in services and offerings are as follows.

- Outreach to DAC[64] – a population with large overlap of DVC;[65]
- Partnerships and strategy identified in "Equity-First Community Engagement for Climate Adaptation Planning Efforts;"[66]
- Annual Support to Access and Functional Needs (AFN)[67] Population During PSPS[68] (a larger population that includes DVC, see Figure 11 below);
- Tribal Outreach – in 2024, SDG&E conducted over 100 meetings with tribes; and
- Community Based Organizations (CBO) Outreach – in 2024, SDG&E participated in over 700 booth events and presentations reaching over 90,000 customers.

64 OEHHA, *SB 535 Disadvantaged Communities, available at:* https://oehha.ca.gov/calenviroscreen/sb535.

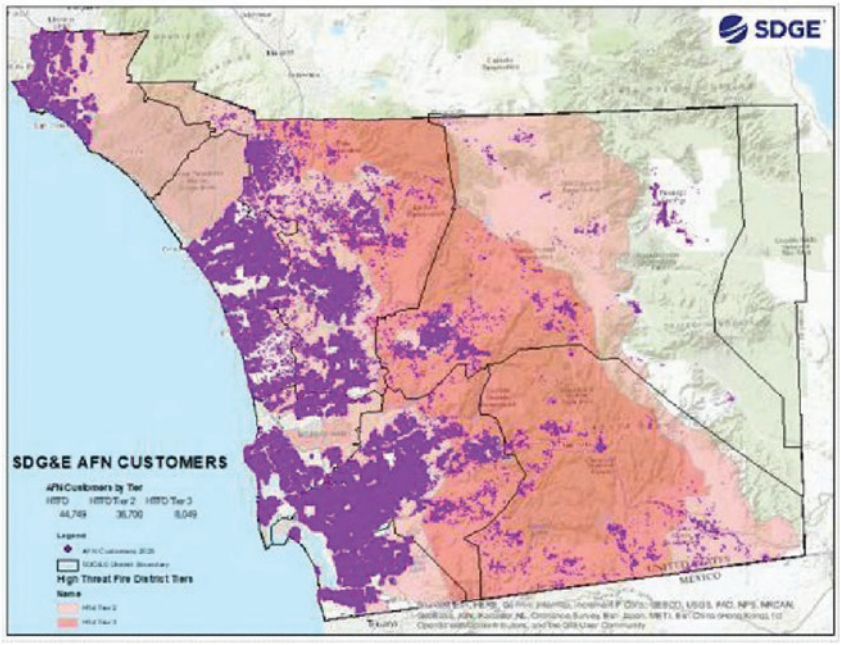
65 R.20-05-003, 2022 Individual Integrated Resource Plan of SDG&E, Public Version (November 1, 2022) at 81.

66 SDG&E, *Development & Recommendations for Equity-First Community Engagement for Climate Adaptation Planning Efforts* (2023), *available at:* www.sdge.com/sites/default/files/documents/FINAL_Framework%20Outline%20%26%20Development_04192023.pdf.

67 SDG&E, *Commitment to Supporting Accessibility, available at:* www.sdge.com/access-and-functional-needs-afn .

68 R.18-12-005, SDG&E 2025 Plan to Support Access and Functional Needs Populations During Public Safety Power Shutoffs (January 31, 2025).

Figure 11 - SDG&E AFN Customer Locations



XI. CONCLUSION

The goal of the ESJ Pilot Study Plan was to evaluate the impact of selected risks and mitigation activities to DVC and how those topics compare to non-DVC areas. To accomplish that, SDG&E focused on applying the CPUC's six Action Items to two risks: 1) Wildfire and PSPS; and 2) EII. SDG&E also reviewed recent studies and models of smoke impacts to DVCs.

In assessing risk by geographic region, the results show Wildfire and PSPS impacted the Tribal Nations the most, due to that DVC sub-group's location within the HFTD. EII Risk was most impactful to the other (non-Tribal) DVC communities due to the population densities within the boundaries of the controls. Planned EII Risk mitigation investments in DVCs are proportional to the percentage of DVC customer meters.

The controls and mitigation programs of both risks identify potential benefits to DVCs. To effectively manage the risks from an enterprise and service territory-wide perspective, SDG&E's risk reduction strategy entails implementing risk reduction programs within various DVC and non-DVC communities.

The Action Items that addressed Clean Energy and Air Quality/Public Health were difficult to consider within the focus and objectives of RAMP. While SDG&E has several non-RAMP activities associated with these topics, they are not the focus of the safety, reliability, and financial risk attributes of RAMP. Therefore, some of the controls and mitigations that

addressed these topics may provide yet-to-be quantified benefits that are not within RAMP's current scope.

Regarding Action Item #5 (Smoke Impacts), SDG&E maintains that the company is not an expert on forecasting smoke impacts to DVC communities nor otherwise. SDG&E is willing to be a participant in future studies but defers to subject matter leaders to perform the studies and subsequent analysis.

Finally, with regard to DVC outreach and public participation described in Action Item #7, SDG&E recently increased the frequency of several public engagement activities involving Wildfire and PSPS Risk, driven by inputs from the CBO network. The EII mitigation portfolio also has an outreach activity focusing on public safety, and while it does not have a specific DVC focus, SDG&E takes pride in its efforts to reach all communities and customer types in their communications. In addition, SDG&E's Community Engagement Plan is consistent with this ESJ Pilot Study Action Item with respect to climate adaptation and vulnerability engagement.

SDG&E is exploring the best approach to incorporate and apply the key takeaways from its CAVA into its RAMP and GRC efforts, recognizing the potential insights and intersectionality with this ESJ Pilot Study. This effort will continue in the near term, with consideration for inclusion in other applicable regulatory policy filings as part of a broader, integrated data-driven approach to grid and community resilience. Technological innovations and digital tools like SDG&E's Climate Intelligence Platform discussed in SDG&E's CAVA may provide further insights into this intersection (climate, asset, and community) of vulnerabilities in our service territory through the lens of future climate scenarios. Outputs from this digital solution may also help inform SDG&E's upcoming ESJ whitepaper and climate resilience measures that are fit for purpose, bolstering the resilience of SDG&E's grid and the communities it serves.

SDG&E will further discuss lessons learned in its upcoming White Paper, consistent with the requirements of the Phase 2 Decision.[69]

[69] D.22-12-027 at 67 (OP 6).

2025 Risk Assessment Mitigation Phase

APPENDIX 5

Cost Benefit Ratio Rankings

May 15, 2025

APPENDIX 5

***Bold** font indicates this control/mitigation includes mandated programs/activities.*

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Societal Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
Cybersecurity	C803	Sensitive Data Protection	236.7
Cybersecurity	C804	Operational Technology (OT) Cybersecurity	220.1
Cybersecurity	C805	IT Infrastructure Modernization	194.0
Wildfire and PSPS	C573	Early Fault Detection	191.4
Wildfire and PSPS	**C536**	**Distribution Overhead Patrol Inspections**	**190.3**
EII	C261	Power Quality Monitor Deployment and Replacement	182.4
High Pressure Gas System	**C104**	**Cathodic Protection - Capital**	**141.5**
EII	C263	Non-HFTD Wireless Fault Indicator	136.2
EII	C236	Distribution Overhead Switch Replacement Program	113.8
Cybersecurity	C801	Perimeter Defenses	104.0
EII	C269	Distribution Circuit Reliability	86.2
Wildfire and PSPS	C534	Risk-Informed Drone Inspections (RIDI)	70.0
Wildfire and PSPS	**C537**	**Off-Cycle Patrol**	**65.0**
Wildfire and PSPS	**C526**	**Distribution Overhead Detailed Inspections**	**63.9**
EII	C262	Distribution Substation SCADA Expansion	50.9
Cybersecurity	C802	Internal Defenses	33.7
Wildfires and PSPS	C518	Strategic Undergrounding (SUG)	33.2
Medium Pressure Gas System	**C107**	**Cathodic Protection Program-Capital**	**32.5**
Wildfire and PSPS	**C554**	**Vegetation Detailed Inspections**	**28.1**
High Pressure Gas System	**C132**	**Pipeline Maintenance**	**24.3**
Wildfire and PSPS	N/A	SUG +CCC	23.6
High Pressure Gas System	**C108**	**Cathodic Protection - Maintenance**	**21.5**
Wildfire and PSPS	C508	Falling Conductor Protection (FCP)	19.3
Wildfire and PSPS	**C530**	**Distribution Wood Pole Intrusive Inspections**	**17.4**
EII	C202	Underground Cable Replacement Program (Proactive)	16.8
Wildfire and PSPS	**C544**	**Pole Clearing**	**15.1**
High Pressure Gas System	**C136**	**Compressor Stations - Capital**	**12.2**

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Societal Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
Medium Pressure Gas System	**C101**	**Cathodic Protection Program - Maintenance**	**11.4**
Wildfire and PSPS	C568	Sensitive Protection Relay Profile (SPRP)	8.8
EII	C206	Tee Modernization Program	8.6
EII	**C212**	**GO165 Corrective Maintenance Program - Underground**	**7.8**
Wildfire and PSPS	C550	Combined Covered Conductor (CCC)	6.3
Excavation Damage	**C002**	**Damage Prevention Activities - Gas**	**6.2**
EII	C210	DOE Switch Replacement Underground	5.8
EII	C234	4kV Reliability Program	5.3
Wildfire and PSPS	**C551**	**Prune and Removal (Clearance)**	**4.3**
Excavation Damage	**C004**	**Damage Prevention Mapping**	**4.3**
Medium Pressure Gas System	**C131**	**Leak Repair**	**3.2**
EII	**C251**	**GO165 Corrective Maintenance Program - Non-HFTD Overhead**	**3.0**
Contractor Safety	**C301**	**Class 1 Contractor Safety Program**	**2.9**
Employee Safety	M305	Safety Mgmt System Maturity & Improvement: Enhanced Safety Communication & Safety Data Analytics	2.6
EII	C268	**Substation Inspection and Maintenance**	**2.3**
High Pressure Gas System	C133	**Leak Repair**	**2.2**
Contractor Safety	C304	Contractor Safety Field Oversight	2.1
Employee Safety	M303	Enhanced Risk-Informed Employee Safety Training & Field Safety Oversight Programs	2.0
EII	**C267**	**Damage Prevention Activities Underground**	**1.9**
Employee Safety	**C317**	**Employee Safety Training & Field Safety Oversight Programs**	**1.6**
High Pressure Gas System	**C125**	**Pipeline Relocation/Replacement**	**1.4**
Medium Pressure Gas System	**C134**	**Pipeline Monitoring**	**1.4**
High Pressure Gas System	**C171**	**Integrity Assessments & Remediation**	**1.3**
EII	C266	Distribution Substation Proactive Asset Program	1.2

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Societal Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
High Pressure Gas System	**C155**	**Measurement & Instrumentation Maintenance**	**1.1**
High Pressure Gas System	C010	Pipeline Monitoring Technologies	1.1
Employee Safety	M311	Establish Incident Investigation & Cross-functional Event Learning Team	1.1
Employee Safety	C319	Safety Management System (SMS) Implementation & Management	1.1
EII	**C240**	**Aviation Protection Program**	**1.0**
Employee Safety	**C328**	**Safety Compliance & Industrial Hygiene Program**	**0.9**
High Pressure Gas System	**C013**	**Gas Transmission Safety Rule - MAOP Reconfirmation**	**0.8**
Excavation Damage	**C001**	**Damage Prevention Strategies**	**0.7**
Wildfire and PSPS	C540	Fuel Management	0.6
EII	C248	Strategic Pole Replacement Program (Non-HFTD)	0.5
Contractor Safety	M307	Risk Informed Class 1 Contractor Safety Program Management	0.4
Employee Safety	C323	Safety Culture Survey Recognition & Awards	0.4
EII	C201	Proactive Overhead Conductor Program	0.4
EII	C215	Electric Public Safety Communications	0.4
Medium Pressure Gas System	**C007**	**Underperforming Mains and Services**	**0.4**
EII	C270	SCADA Capacitors	0.4
High Pressure Gas System	**C151**	**Measurement & Regulation Station Capital**	**0.4**
High Pressure Gas System	**C126**	**Shallow/Exposed Pipe Remediations**	**0.4**
EII	C250	Substation Reliability for Distribution Components	0.3
High Pressure Gas System	**C142**	**Compressor Station - Maintenance**	0.3
Excavation Damage	**C003**	**Damage Prevention - Public Awareness**	**0.3**
Employee Safety	**C326**	**Workplace Violence Prevention Programs**	**0.2**
Medium Pressure Gas System	**C182**	**Distribution Risk Evaluation & Monitoring System (DREAMS)**	**0.2**
EII	C208	Replacement of Live Front Equipment – Proactive	0.1
Medium Pressure Gas System	**C124**	**Regulator Station Installation Replacement & Enhancement**	**0.1**

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Societal Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
Medium Pressure Gas System	**C139**	**Gas Distribution Safety Relocations**	**0.1**
High Pressure Gas System	**C118**	**Rupture Mitigation Valve Installation - Valve Rule**	**0.1**
Medium Pressure Gas System	**C115**	**Regulator Station Valve and Large Meter Set Inspection**	**0.1**
Medium Pressure Gas System	**C144**	**Human Factors Mitigation – QA/QC Program – Mandate Compliance Activities**	**0.1**
Medium Pressure Gas System	C005	Gas Distribution Emergency Department	0.1
EII	C551	Trim & Removal - Vegetation Management	0.1
Medium Pressure Gas System	C150	Code Compliance Mitigation	0.0
Medium Pressure Gas System	**C175**	**Residential Meter Protection**	**0.0**
Medium Pressure Gas System	**C169**	**Human Factors Mitigations - Operator Qualification Training**	**0.0**
Wildfire and PSPS	C522	Transmission Overhead Hardening (Distribution Underbuild)	0.0
Wildfire and PSPS	C506	Microgrids	0.0
Wildfire and PSPS	C520	Distribution Overhead System Hardening	0.0

***Bold** font indicates this control/mitigation includes mandated programs/activities.*

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Hybrid Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
Cybersecurity	C803	Sensitive Data Protection	227.1
Cybersecurity	C804	Operational Technology (OT) Cybersecurity	213.2
Wildfire and PSPS	C536	**Distribution Overhead Patrol Inspections**	**190.3**
Cybersecurity	C805	IT Infrastructure Modernization	182.0
High Pressure Gas System	C104	**Cathodic Protection - Capital**	151.7
EII	C261	Power Quality Monitor Deployment and Replacement	129.2
Wildfire and PSPS	C573	Early Fault Detection	120.0

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Hybrid Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
EII	C263	Non-HFTD Wireless Fault Indicator	98.6
Cybersecurity	C801	Perimeter Defenses	97.5
Wildfire and PSPS	C534	Risk-Informed Drone Inspections (RIDI)	70.0
Wildfire and PSPS	**C537**	**Off-Cycle Patrol**	**65.0**
Wildfire and PSPS	**C526**	**Distribution Overhead Detailed Inspections**	**63.3**
EII	C236	Distribution Overhead Switch Replacement Program	46.6
EII	C269	Distribution Circuit Reliability	41.1
EII	C262	Distribution Substation SCADA Expansion	36.7
Cybersecurity	C802	Internal Defenses	32.5
Wildfire and PSPS	**C554**	**Vegetation Detailed Inspections**	**28.1**
High Pressure Gas System	**C132**	**Pipeline Maintenance**	**25.9**
High Pressure Gas System	**C108**	**Cathodic Protection - Maintenance**	**23.0**
Medium Pressure Gas System	**C107**	**Cathodic Protection Program - Capital**	**18.1**
Wildfire and PSPS	**C530**	**Distribution Wood Pole Intrusive Inspections**	**17.6**
Wildfire and PSPS	**C544**	**Pole Clearing**	**15.1**
Wildfire and PSPS	C518	Strategic Undergrounding (SUG)	13.2
Wildfire and PSPS	C508	Falling Conductor Protection (FCP)	12.2
Medium Pressure Gas System	C101	**Cathodic Protection Program - Maintenance**	11.4
Wildfire and PSPS	N/A	SUG+CCC	11.0
EII	C202	Underground Cable Replacement Program (Proactive)	7.9
Excavation Damage	**C002**	**Damage Prevention Activities - Gas**	**6.6**
High Pressure Gas System	**C136**	**Compressor Stations - Capital**	**5.5**

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Hybrid Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
Wildfire and PSPS	C551	**Prune and Removal (Clearance)**	**4.3**
Wildfire and PSPS	C550	Combined Covered Conductor (CCC)	4.2
Wildfire and PSPS	C568	Sensitive Protection Relay Profile (SPRP)	3.7
EII	**C212**	**GO165 Corrective Maintenance Program – Underground**	**3.6**
EII	C206	Tee Modernization Program	3.4
Contractor Safety	C301	**Class 1 Contractor Safety Program**	**3.1**
Employee Safety	M305	Safety Mgmt System Maturity & Improvement: Enhanced Safety Communication & Safety Data Analytics	2.8
EII	C210	DOE Switch Replacement Underground	2.8
High Pressure Gas System	C113	**Leak Repair**	**2.4**
Contractor Safety	C304	Contractor Safety Field Oversight	2.3
EII	C234	4kV Reliability Program	2.3
Employee Safety	M303	Enhanced Risk-Informed Employee Safety Training & Field Safety Oversight Programs	2.1
EII	**C267**	**Damage Prevention Activities Underground**	**2.0**
EII	**C268**	**Substation Inspection and Maintenance**	**1.9**
Employee Safety	**C317**	**Employee Safety Training & Field Safety Oversight Programs**	**1.8**
Excavation Damage	**C004**	**Damage Prevention Mapping**	**1.5**
Medium Pressure Gas System	**C134**	**Pipeline Monitoring**	**1.4**
High Pressure Gas System	**C171**	**Integrity Assessments & Remediation**	**1.2**

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Hybrid Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
High Pressure Gas System	**C155**	**Measurement & Instrumentation Maintenance**	**1.2**
Employee Safety	**M311**	**Establish Incident Investigation & Cross-functional Event Learning Team**	**1.1**
Employee Safety	C319	Safety Management System (SMS) Implementation & Management	1.1
EII	**C251**	**GO165 Corrective Maintenance Program - Non-HFTD Overhead**	**1.1**
Employee Safety	**C328**	**Safety Compliance & Industrial Hygiene Program**	**1.0**
High Pressure Gas System	C010	Pipeline Monitoring Technologies	0.8
Excavation Damage	**C001**	**Damage Prevention Strategies**	**0.7**
Wildfire and PSPS	C540	Fuel Management	0.6
High Pressure Gas System	C125	**Pipeline Relocation/Replacement**	0.5
EII	C226	Distribution Substation Proactive Asset Program	0.5
Contractor Safety	M307	Risk Informed Class 1 Contractor Safety Program Management	0.5
Employee Safety	C323	Safety Culture Survey Recognition & Awards	0.5
EII	C215	Electric Public Safety Communications	0.4
EII	**C240**	**Aviation Protection Program**	**0.4**
Medium Pressure Gas System	**C131**	**Leak Repair**	**0.4**
High Pressure Gas System	**C142**	**Compressor Station - Maintenance**	**0.3**
EII	C270	SCADA Capacitors	0.3
Excavation Damage	**C003**	**Damage Prevention - Public Awareness**	**0.3**

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Hybrid Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
High Pressure Gas System	**C013**	**Gas Transmission Safety Rule - MAOP Reconfirmation**	**0.3**
Employee Safety	**C326**	**Workplace Violence Prevention Programs**	**0.2**
EII	C248	Strategic Pole Replacement Program (Non-HFTD)	0.2
High Pressure Gas System	**C151**	**Measurement & Regulation Station Capital**	**0.2**
EII	C201	Proactive Overhead Conductor Program	0.2
EII	C250	Substation Reliability for Distribution Components	0.1
High Pressure Gas System	**C126**	**Shallow/Exposed Pipe Remediations**	**0.1**
Medium Pressure Gas System	**C115**	**Regulator Station Valve and Large Meter Set Inspection**	**0.1**
Medium Pressure Gas System	**C144**	**Human Factors Mitigation – QA/QC Program – Mandate Compliance Activities**	**0.1**
EII	**C551**	**Trim & Removal - Vegetation Management**	**0.1**
Medium Pressure Gas System	C005	Gas Distribution Emergency Department	0.1
EII	C208	Replacement of Live Front Equipment – Proactive	0.1
Medium Pressure Gas System	**C124**	**Regulator Station Installation Replacement & Enhancement**	**0.1**
Medium Pressure Gas System	**C007**	**Underperforming Mains and Services**	**0.0**
High Pressure Gas System	**C118**	**Rupture Mitigation Valve Installation - Valve Rule**	**0.0**
Medium Pressure Gas System	**C182**	**Distribution Risk Evaluation & Monitoring System (DREAMS)**	**0.0**
Medium Pressure Gas System	**C139**	**Gas Distribution Safety Relocations**	**0.0**

SDG&E Mitigation Cost Benefit Ratios (2028-2031) Hybrid Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
Medium Pressure Gas System	**C175**	**Residential Meter Protection**	**0.0**
Medium Pressure Gas System	**C150**	**Code Compliance Mitigation**	**0.0**
Medium Pressure Gas System	**C169**	**Human Factors Mitigations – Operator Qualification Training**	**0.0**
Wildfire and PSPS	C522	Transmission Overhead Hardening (Distribution Underbuild)	0.0
Wildfire and PSPS	C506	Microgrids	0.0
Wildfire and PSPS	C520	Distribution Overhead System Hardening	0.0

***Bold** font indicates this control/mitigation includes mandated programs/activities.*

SDG&E Mitigation Cost Benefit Ratios (2028-2031) WACC Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
Cybersecurity	C803	Sensitive Data Protection	204.6
Cybersecurity	C804	Operational Technology (OT) Cybersecurity	192.0
Wildfire and PSPS	**C536**	**Distribution Overhead Patrol Inspections**	**190.3**
Cybersecurity	C805	IT Infrastructure Modernization	164.0
High Pressure Gas System	C104	**Cathodic Protection - Capital**	**141.8**
Wildfire and PSPS	C573	Early Fault Detection (EFD)	120.0
EII	C261	Power Quality Monitor Deployment and Replacement	108.8
Cybersecurity	C801	Perimeter Defenses	87.8
EII	C263	Non-HFTD Wireless Fault Indicator	81.5
Wildfire and PSPS	C534	Risk-Informed Drone Inspections (RIDI)	70.0
Wildfire and PSPS	**C537**	**Off-Cycle Patrol**	65.0
Wildfire and PSPS	**C526**	**Distribution Overhead Detailed Inspections**	63.3
EII	C236	Distribution Overhead Switch Replacement Program	34.4
EII	C269	Distribution Circuit Reliability	31.1
EII	C262	Distribution Substation SCADA Expansion	30.5

SDG&E Mitigation Cost Benefit Ratios (2028-2031) WACC Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
Cybersecurity	C802	Internal Defenses	29.3
Wildfire and PSPS	**C554**	**Vegetation Detailed Inspections**	**28.1**
High Pressure Gas System	**C132**	**Pipeline Maintenance**	**24.3**
High Pressure Gas System	**C108**	**Cathodic Protection - Maintenance**	**21.5**
Medium Pressure Gas System	**C107**	**Cathodic Protection Program - Capital**	**17.8**
Wildfire and PSPS	**C530**	**Distribution Wood Pole Intrusive Inspections**	**17.6**
Wildfire and PSPS	**C544**	**Pole Clearing**	**15.1**
Wildfire and PSPS	C518	Strategic Undergrounding (SUG)	12.9
Wildfire and PSPS	C508	Falling Conductor Protection (FCP)	12.2
Medium Pressure Gas System	**C101**	**Cathodic Protection Program - Maintenance**	**11.3**
Wildfire and PSPS	N/A	SUG+CCC	10.7
Excavation Damage	**C002**	**Damage Prevention Activities - Gas**	**6.2**
EII	C202	Underground Cable Replacement Program (Proactive)	6.1
Wildfire and PSPS	**C551**	**Prune and Removal (Clearance)**	**4.3**
High Pressure Gas System	**C136**	**Compressor Stations - Capital**	**4.3**
Wildfire and PSPS	C550	Combined Covered Conductor (CCC)	4.1
Wildfire and PSPS	C568	Sensitive Protection Relay Profile (SPRP)	3.7
Contractor Safety	**C301**	**Class 1 Contractor Safety Program**	**2.9**
EII	**C212**	**GO165 Corrective Maintenance Program - Underground**	**2.8**
Employee Safety	M305	Safety Mgmt System Maturity & Improvement: Enhanced Safety Communication & Safety Data Analytics	2.7
EII	C206	Tee Modernization Program	2.5
High Pressure Gas System	**C113**	**Leak Repair**	**2.2**
EII	**C268**	**Substation Inspection and Maintenance**	**2.2**
Contractor Safety	C304	Contractor Safety Field Oversight	2.1
EII	C210	DOE Switch Replacement Underground	2.1
Employee Safety	M303	Enhanced Risk-Informed Employee Safety Training & Field Safety Oversight Programs	2.0
EII	**C267**	**Damage Prevention Activities Underground**	**1.8**

SDG&E Mitigation Cost Benefit Ratios (2028-2031) WACC Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
EII	C234	4kV Reliability Program	1.7
Employee Safety	**C317**	**Employee Safety Training & Field Safety Oversight Programs**	**1.7**
Medium Pressure Gas System	**C134**	**Pipeline Monitoring**	**1.4**
Excavation Damage	**C004**	**Damage Prevention Mapping**	**1.1**
High Pressure Gas System	**C171**	**Integrity Assessments & Remediation**	**1.1**
High Pressure Gas System	**C155**	**Measurement & Instrumentation Maintenance**	**1.1**
Employee Safety	**M311**	**Establish Incident Investigation & Cross-functional Event Learning Team**	**1.1**
Employee Safety	C319	Safety Management System (SMS) Implementation & Management	1.1
EII	**C251**	**GO165 Corrective Maintenance Program - Non-HFTD Overhead**	**0.9**
Employee Safety	**C358**	**Safety Compliance & Industrial Hygiene Program**	**0.9**
Excavation Damage	**C001**	**Damage Prevention Strategies**	**0.7**
High Pressure Gas System	C010	Pipeline Monitoring Technologies	0.7
Wildfire and PSPS	C540	Fuel Management	0.6
Contractor Safety	M307	Risk Informed Class 1 Contractor Safety Program Management	0.4
Employee Safety	C323	Safety Culture Survey Recognition & Awards	0.4
High Pressure Gas System	**C125**	**Pipeline Relocation/Replacement**	**0.4**
EII	C226	Distribution Substation Proactive Asset Program	0.4
EII	C215	Electric Public Safety Communications	0.4
Medium Pressure Gas System	**C131**	**Leak Repair**	**0.3**
High Pressure Gas System	**C142**	**Compressor Station - Maintenance**	**0.3**
EII	**C240**	**Aviation Protection Program**	**0.3**
Excavation Damage	**C003**	**Damage Prevention - Public Awareness**	**0.3**
EII	C270	SCADA Capacitors	0.3
Employee Safety	**C326**	**Workplace Violence Prevention Programs**	**0.2**
High Pressure Gas System	**C013**	**Gas Transmission Safety Rule - MAOP Reconfirmation**	**0.2**

SDG&E Mitigation Cost Benefit Ratios (2028-2031) WACC Discount Rate: CBRs Ranked Highest to Lowest			
RISK CHAPTER NAME	**ID**	**CONTROL/MITIGATION NAME**	**CBR**
EII	C248	Strategic Pole Replacement Program (Non-HFTD)	0.2
High Pressure Gas System	**C151**	**Measurement & Regulation Station Capital**	**0.1**
EII	C201	Proactive Overhead Conductor Program	0.1
EII	C250	Substation Reliability for Distribution Components	0.1
Medium Pressure Gas System	**C115**	**Regulator Station Valve and Large Meter Set Inspection**	**0.1**
Medium Pressure Gas System	**C144**	**Human Factors Mitigation – QA/QC Program – Mandate Compliance Activities**	**0.1**
Medium Pressure Gas System	C005	Gas Distribution Emergency Department	0.1
EII	**C551**	**Trim & Removal - Vegetation Management**	**0.1**
High Pressure Gas System	**C126**	**Shallow/Exposed Pipe Remediations**	**0.0**
Medium Pressure Gas System	**C124**	**Regulator Station Installation Replacement & Enhancement**	**0.0**
EII	C208	Replacement of Live Front Equipment – Proactive	0.0
High Pressure Gas System	**C118**	**Rupture Mitigation Valve Installation - Valve Rule**	**0.0**
Medium Pressure Gas System	**C007**	**Underperforming Mains and Services**	**0.0**
Medium Pressure Gas System	**C182**	**Distribution Risk Evaluation & Monitoring System (DREAMS)**	**0.0**
Medium Pressure Gas System	**C139**	**Gas Distribution Safety Relocations**	**0.0**
Medium Pressure Gas System	**C175**	**Residential Meter Protection**	**0.0**
Medium Pressure Gas System	**C150**	**Code Compliance Mitigation**	**0.0**
Medium Pressure Gas System	**C169**	**Human Factors Mitigations – Operator Qualification Training**	**0.0**
Wildfire and PSPS	C522	Transmission Overhead Hardening (Distribution Underbuild)	0.0
Wildfire and PSPS	C506	Microgrids	0.0
Wildfire and PSPS	C520	Distribution Overhead System Hardening	0.0