BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of San Diego Gas & Electric Company (U 902 M) to Submit Its 2021 Risk Assessment and Mitigation Phase Report.	Application No.

APPLICATION OF SAN DIEGO GAS & ELECTRIC COMPANY (U 902 M) TO SUBMIT ITS 2021 RISK ASSESSMENT AND MITIGATION PHASE REPORT

Laura M. Earl
San Diego Gas & Electric Company
8330 Century Park Court, CP32D
San Diego, CA 92123
Telephone: (858) 654-1541
Fax: (619) 699-5027
Email: learl@sdge.com

Counsel for San Diego Gas & Electric Company

May 17, 2021

TABLE OF CONTENTS

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Application of San Diego Gas & Electric Company (U 902 M) to Submit Its 2021 Risk Assessment and Mitigation Phase Report.	Application No.

APPLICATION OF SAN DIEGO GAS & ELECTRIC COMPANY (U 902 M) TO SUBMIT ITS 2021 RISK ASSESSMENT AND MITIGATION PHASE REPORT

I. INTRODUCTION

In compliance with California Public Utilities Commission (Commission or CPUC) Decisions (D.) 14-12-025, D.16-08-018, D.18-12-014, and D.20-01-002, and the Commission's Rules of Practice and Procedure (Rules), San Diego Gas & Electric Company (SDG&E) hereby submits its 2021 Risk Assessment Mitigation Phase (RAMP) Application and the attached RAMP Report, the first step in its submission of the test year (TY) 2024 General Rate Case (GRC).[1] The purpose of SDG&E's RAMP Report is to "examine [SDG&E's] assessment of its key risks and its proposed programs for mitigating those risks."[2] This filing is submitted in accordance with the Commission's recently updated GRC Rate Case Plan, set forth in D.20-01-002, and presents a Report on SDG&E's safety risks in the manner required by D.18-12-014 (the Safety Model Assessment Proceeding [S-MAP] Decision), and the Settlement Agreement adopted therein (collectively, the Settlement Decision).[3]

II. BACKGROUND AND PROCEDURAL HISTORY

On November 14, 2013, the California Public Utilities Commission (Commission) opened Rulemaking (R.) 13-11-006, *Order Instituting Rulemaking to Develop a Risk-Based*

[1] D.20-01-002 (the Rate Case Plan Decision) required SDG&E and Southern California Gas Company (SoCalGas) (collectively, the Companies) to concurrently file their RAMP Applications and Reports by May 15, 2021. D.20-01-002 at 55 (Table 4). Because May 15, 2021 fell on a day the Commission offices were closed, SDG&E and SoCalGas have timely filed their RAMP Applications and Reports on the first business day thereafter (pursuant to Rule 1.15), on May 17, 2021.

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

[3] D.18-12-014 adopted the Settlement Agreement with modifications and reflects the minimum required elements to be used by the utilities for risk and mitigation analysis in their RAMP and GRC proceedings. Additionally, D.18-12-014 continued and modified requirements previously established in D.16-08-018 and the risk-based decision-making frameworks adopted in D.14-12-025.

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 Case Plan (RCP) for the energy utilities' GRCs, in which utilities request funding for safety-related activities. Further, Senate Bill 705 was passed, leading to Public Utilities (P.U.) 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."[4] In 2014, the California Legislature amended the P.U. 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."[5]

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, Pacific Gas & Electric Company (PG&E), and Southern California Edison (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.

On December 2, 2019, SoCalGas and SDG&E (the Companies) filed their joint 2019 RAMP Report in I.19-11-010/-011 (cons.) (the 2019 RAMP Proceeding), which was intended to inform their respective TY 2022 General Rate Cases. Subsequent to the filing, the Commission

[4] P.U. Code § 963(b)(3).

[5] P.U. Code § 750.

issued the Rate Case Plan Decision (on January 16, 2020), which modified the GRC cycles of the large energy utilities. The Rate Case Plan Decision eliminated the Companies' TY 2022 GRCs and required SDG&E and SoCalGas to file a petition for modification of A.17-10-007 (cons.), to add attrition years 2022 and 2023 to the Companies' TY 2019 GRC cycle. In light of these events, the Commission issued D.20-09-004 (the 2019 RAMP Decision), which closed the 2019 RAMP Proceeding and required that "Information and lessons learned from the 2019 RAMP Report should instead be utilized to further refine the RAMP process and the next RAMP submission of SoCalGas and SDG&E."[6] The instant Application and Report are filed in accordance with the Rate Case Plan Decision and the 2019 RAMP Decision and will inform the Companies' upcoming TY 2024 GRC applications.

III. CONSOLIDATION OF SDG&E'S AND SOCALGAS'S RAMP APPLICATION PROCEEDINGS

As noted above, the Rate Case Plan Decision required the Companies to concurrently file their RAMP Applications and Reports by May 15, 2021.[7] SDG&E and SoCalGas share the same parent company, Sempra Energy. Specific chapters in SDG&E's and SoCalGas's respective RAMP Reports describe the same or similar facts and circumstances and are jointly sponsored. Consistent with past proceedings and Rule 7.4, SDG&E and SoCalGas anticipate the consolidation of their respective RAMP proceedings, as consolidation would promote efficiency and avoid scheduling conflicts. Therefore, SDG&E and SoCalGas plan to expeditiously move to consolidate their RAMP proceedings under Rule 7.4 upon initiation of the proceedings, unless the Commission or assigned Administrative Law Judge(s) does so *sua sponte*.[8]

IV. OVERVIEW OF SDG&E'S AND SOCALGAS'S RAMP REPORTS

The instant RAMP proceeding is considered the first phase of each Company's next (TY 2024) GRC. "The purpose of the RAMP is to examine the utility's assessment of its key risks and its proposed programs for mitigating those risks."[9] The assessment is largely based on past incidents for the Companies and their industries. SDG&E's Report presents nine risk

---

6 D.20-01-002 at 2.

7 D.20-01-002 at 55 (Table 4).

8 *See, e.g.*, I.19-11-010/-011 (cons.), Administrative Law Judge's Ruling Consolidating Proceedings and Setting Prehearing Conference Schedule (November 21, 2019) *passim*.

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

chapters (eight of which are specific to SDG&E), and SoCalGas's Report presents seven risk chapters (six of which are specific to SoCalGas). Each Company's Report also contains one joint risk chapter (Cybersecurity).

While developing their respective reports, SoCalGas and SDG&E met with stakeholders and held two public workshops on October 15, 2020, and January 27, 2021, to discuss their approach to the RAMP Reports. The Companies also held a pre-filing technical sub-workshop on November 17, 2020. The pre-filing workshops were intended to gather input from stakeholders and provide stakeholders with an overview of certain aspects of the RAMP Reports.

From past lessons learned and the workshops, SoCalGas and SDG&E made a number of improvements since the 2019 RAMP filing. Most notably, these RAMP Reports include the use of a new major attribute, Stakeholder Satisfaction, beyond the three required attributes (for the first time in the state), add a new sub-attribute (acres burned), increase the number and percent of activities that have Risk Spend Efficiencies (RSE), add descriptions in instances an RSE could not be calculated, and make a number of other updates.

V. ROADMAP OF CHAPTERS WITHIN REPORT

The RAMP Report, appended to this Application, begins with the following introductory chapters, which lay the foundation of this filing and explain the methodologies used throughout:[10]

SDG&E Introductory Chapters	
Chapter	**Subject**
RAMP-A	Overview and Approach (SoCalGas/SDG&E)
RAMP-B	Enterprise Risk Management Framework (SDG&E)
RAMP-C	Risk Quantification Framework and Risk Spend Efficiency (SoCalGas/SDG&E)
RAMP-D	Safety Culture, Organizational Structure, Executive and Utility Board Engagement, and Compensation Policies Related to Safety (SDG&E)
RAMP-E	Lessons Learned (SoCalGas/SDG&E)

[10] Chapters RAMP-A, RAMP-C, and RAMP-E are jointly sponsored by SoCalGas and SDG&E; Chapters RAMP-B and RAMP-D are company-specific.

The Introductory Chapters are organized as follows:

- **RAMP-A (joint)** provides an overview of the requirements for the Companies' RAMP Reports, how the Companies have met the requirements, and changes and updates to the Companies' 2021 RAMP Reports, including incorporation of intervenor comments and workshop feedback. RAMP-A also provides an overview of the Reports' guiding principles and the organization of each risk chapter.
- **RAMP-B** presents SDG&E's Risk Management Framework, explains the selection of RAMP risks, and discusses continuous improvement and changes to the Enterprise Risk Registry since 2019.
- **RAMP-C (joint)** explains the quantitative methodology used for establishing the Companies' Multi-Attribute Value Function (MAVF) and Risk Spend Efficiency (RSE) calculations.
- **RAMP-D** discusses SDG&E's strong safety culture, specifically the safety structure, executive and board involvement in safety, and compensation policies related to safety.
- **RAMP-E (joint)** discusses the lessons learned by SoCalGas and SDG&E in developing the RAMP Reports and reviewing the RAMP filings of SCE and PG&E. RAMP-E also describes and responds to additional feedback received from stakeholders during the Companies' 2019 RAMP proceeding and pre-filing workshops.

SDG&E's RAMP risk chapters are presented as identified below, numbered in descending order by the total risk score, as presented at the Companies' January 27, 2021, workshop.

SDG&E RAMP Risk Chapters	
Chapter	**Subject**
SDG&E-Risk-1	Wildfire Involving SDG&E Equipment
SDG&E-Risk-2	Electric Infrastructure Integrity
SDG&E-Risk-3	Incident Related to the High Pressure System (Excluding Dig-in)

SDG&E-Risk-4	Incident Involving a Contractor
SDG&E-Risk-5	Customer and Public Safety – Contact with Electric Equipment
SDG&E-Risk-6/SCG-Risk-6	Cybersecurity
SDG&E-Risk-7	Excavation Damage (Dig-In) on the Gas System
SDG&E-Risk-8	Incident Involving an Employee
SDG&E-Risk-9	Incident Related to the Medium Pressure System (Excluding Dig-in)

Chapter RAMP-B describes these Risk Chapters and explains how they were selected for inclusion in the RAMP Report.

SDG&E's RAMP Report also includes a volume of Cross-Functional Factors (CFF) that provide additional information regarding safety-related initiatives associated with several of SDG&E's RAMP risks, as follows:

SDG&E Cross-Functional Factor Volume	
Introduction	
SDG&E-CFF-1	Asset Management
SDG&E-CFF-2	Climate Change Adaptation, Energy System Resilience and GHG Emissions
SDG&E-CFF-3	Emergency Preparedness and Response and Pandemic
SDG&E-CFF-4/SCG-CFF-4	Foundational Technology Systems
SDG&E-CFF-5	Physical Security
SDG&E-CFF-6	Records Management
SDG&E-CFF-7	Safety Management System
SDG&E-CFF-8	Workforce Planning / Qualified Workforce

For awareness, SoCalGas's concurrently filed Application organizes the RAMP Risk and CFFs in its Report as follows:

SCG RAMP Risk Chapters	
Chapter	**Subject**
SCG-Risk-1	Incident Related to the High Pressure System (Excluding Dig-in)
SCG-Risk-2	Excavation Damage (Dig-In) on the Gas System
SCG-Risk-3	Incident Related to the Medium Pressure System (Excluding Dig-in)
SCG-Risk-4	Incident Related to the Storage System (Excluding Dig-in)
SCG-Risk-5	Incident Involving an Employee
SCG-Risk-6/SDG&E-Risk-6	Cybersecurity
SCG-Risk-7	Incident Involving a Contractor

SCG Cross-Functional Factor Volume	
Chapter	**Subject**
SCG-CFF-1	Asset and Records Management
SCG-CFF-2	Energy Resilience
SCG-CFF-3	Emergency Preparedness and Response and Pandemic
SCG-CFF-4/SDG&E-CFF-4	Foundational Technology Systems
SCG-CFF-5	Physical Security
SCG-CFF-6	Safety Management System
SCG-CFF-7	Workforce Planning / Qualified Workforce

VI. STATUTORY AND PROCEDURAL REQUIREMENTS

SDG&E files this Application according to D.18-12-014 and D.20-01-002, Section 701 of the Public Utilities Code, and Article 2 of the Commission's Rules of Practice and Procedure.

A. Rule 2.1(A) - Legal Name

San Diego Gas & Electric Company is a corporation organized and existing under the laws of the State of California. SDG&E is engaged in the business of providing electric service in a portion of Orange County and electric and gas service in San Diego County. SDG&E's principal place of business is 8330 Century Park Court, San Diego, California 92123.

B. Rule 2.1(b) - Correspondence

Correspondence or communications, including any data requests, regarding this Application should be addressed to:

Joseph M. McCawley
GRC Program Manager
SAN DIEGO GAS & ELECTRIC COMPANY
8326 Century Park Court
San Diego, California 92123
Telephone: (858) 503-5302
Fax: (858) 654-1789
Email: JMcCawley@sdge.com

with copies to:

Laura M. Earl
Senior Counsel, Legal Regulatory
SAN DIEGO GAS & ELECTRIC COMPANY
8326 Century Park Court
San Diego, CA 92123
Telephone: (858) 654-1541
Fax: (619) 699-5027
Email: LEarl@sdge.com

C. Rule 2.1(c)

1. Proposed Category of Proceeding

In accordance with Rule 7.1, SDG&E requests that this Application be categorized as ratesetting pursuant to Commission Rule of Practice and Procedure 1.3(e) and 7.1(e)(2).

2. Need for Hearings

SDG&E does not believe that evidentiary hearings on SDG&E's RAMP are necessary and notes that evidentiary hearings are not contemplated by the Commission's proceeding schedule in D.20-01-002.

3. Issues to be Considered

The principal issues to be considered are whether:

- The Commission should adopt the Companies' proposed schedule for the Safety Policy Division (SPD)[11] or other appropriate Commission staff to evaluate and issue a report on SDG&E's RAMP Report and for parties to file comments, consistent with the Rate Case Plan Decision's revised filing schedule[12]; and
- The Commission should expeditiously close this proceeding upon such time as the SPD submits its report and parties have submitted all scheduled comments, in late December 2021, to permit SDG&E and SoCalGas the opportunity to consider SPD's evaluation and other parties' comments prior to the filing of the Companies' TY 2024 GRC applications in May 2022, consistent with the Rate Case Plan Decision's stated intent.[13]

4. Proposed Schedule

In accordance with the scheduling requirements set forth in the Rate Case Plan Decision, SDG&E proposes the following schedule be adopted for this proceeding. D.14-12-025 also includes two public workshops in the RAMP schedule: one following a utility's RAMP submission and another following the issuance of the Commission staff report. Accordingly, SDG&E provides a proposed schedule in accordance with the Rate Case Plan Decision and the events in D.14-12-025. SoCalGas is also proposing the same schedule in its concurrently filed RAMP application, in anticipation of a consolidated proceeding.

---

[11] D.20-01-002 at Appendix B adopted a revised GRC application filing schedule, which included events related to RAMP. The revised schedule references a report on the utility's RAMP submission by the Safety and Enforcement Division (SED). Subsequent to the adoption of D.20-01-002, the Risk Assessment section that is responsible for this report has migrated from the Safety and Enforcement Division to the SPD. *See* Safety Policy Division Review of San Diego Gas & Electric's 2020 Safety Performance Metrics Submittal Pursuant to Decision 19-04-020 at 2, available: https://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/Safety/Risk_Assessment/SPM/Evaluation%20of%20SDGandE's%202020%20Safety%20Performance%20Metrics%20Report.pdf.

[12] D.20-01-002 at 49, Table 3 ("Adopted Revised GRC Application Filing Schedule").

[13] D.20-01-002 at 48 (stating the Commission's intent to "create additional time for SED and parties to complete their review of the utility's RAMP farther in advance of the subsequent GRC filing date, so that the utility has as much time as possible to meaningfully incorporate the results of this review in its GRC application.").

Proposed Procedural Schedule	
Event	**Proposed Date**
Application Filed	5/17/2021
Workshop on the Companies' Applications	6/15/2021
Protests or Responses	Approx. 6/16/2021
Reply to Protests or Responses	Approx. 6/28/2021
Prehearing Conference	July 2021
Assigned Commissioner Scoping Memo and Ruling	7/30/2021
SPD Staff Report	9/1/2021
Workshop on SPD Staff Report	9/15/2021
Opening Comments on Companies' Applications and SPD Report	11/15/2021
Reply Comments	12/1/2021
Companies file their respective Test Year 2024 GRC Applications	5/15/2022

D. Rule 2.2 - Articles of Incorporation

A copy of SDG&E's Restated Articles of Incorporation as last amended, presently in effect and certified by the California Secretary of State, was previously filed with the Commission on September 10, 2014, in connection with SDG&E Application 14-09-008, and is incorporated herein by reference.

VII. SERVICE

A copy of this Application has been served on the following service lists:

1. R. 20-07-013, Order Instituting Rulemaking to Further Develop a Risk-Based Decision-Making Framework for Electric and Gas Utilities;
2. A17-10-007 and A.17-10-008 (consolidated), SoCalGas's and SDG&E's 2019 General Rate Case Applications; and
3. I.19-11-010 and I.19-11-011 (consolidated) SoCalGas's and SDG&E's 2019 RAMP Order Instituting Investigation.

Pursuant to the Commission's *COVID-19 Temporary Filing and Service Protocol for Formal Proceedings*, paper copies of e-filed documents will not be mailed to Administrative Law Judges or to parties on the service lists. An electronic copy will be transmitted to the Chief Administrative Law Judge.

VIII. RELIEF SOUGHT

SDG&E respectfully requests:

- The Commission direct the SPD or other appropriate Commission staff to adopt the Companies' proposed schedule to review SDG&E's and SoCalGas's RAMP Reports and issue a report and for parties to file comments, consistent with the requirements of D.14-12-025 and D.20-01-002; and
- The Commission expeditiously close this proceeding upon such time as the SPD submits its report and parties have submitted all scheduled comments, in late December 2021, to permit SDG&E and SoCalGas the opportunity to consider SPD's report and other parties' comments prior to the Companies' filing of their upcoming TY 2024 GRC applications, in May 2022, consistent with D.20-01-002.

IX. CONCLUSION

SDG&E respectfully requests that the Commission provide the relief sought in Section VIII above.

Respectfully submitted,

/s/ *Laura M. Earl*

Laura M. Earl
San Diego Gas & Electric Company
8330 Century Park Court, CP32D
San Diego, CA 92123
Telephone: (858) 654-1541
Fax: (619) 699-5027
Email: learl@sdge.com

May 17, 2021

Counsel for San Diego Gas & Electric Company

OFFICER VERIFICATION

I, Michael M. Schneider, declare the following:

I am an officer of San Diego Gas & Electric Company and am authorized to make this verification on its behalf. I am informed and believe that the matters stated in the foregoing **APPLICATION OF SAN DIEGO GAS & ELECTRIC COMPANY (U 902-M) TO SUBMIT ITS 2021 RISK ASSESSMENT AND MITIGATION PHASE REPORT** are true to my own knowledge, except as to matters which are therein stated on information and belief, and as to those matters, I believe them to be true.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed on May 17, 2021 at San Diego, California.

By: */s/ Michael M. Schneider*
Michael M. Schneider

SDG&E RAMP REPORT

Risk Assessment Mitigation Phase

(SCG/SDG&E-RAMP-A)

Overview and Approach

May 17, 2021

TABLE OF CONTENTS

RAMP-A: OVERVIEW AND APPROACH

I. RAMP OVERVIEW

A. Introduction

San Diego Gas & Electric Company (SDG&E) and Southern California Gas Company (SoCalGas) (individually, Company, and collectively, Companies) present their respective 2021 Risk Assessment Mitigation Phase (RAMP) Reports (or Report). The 2021 RAMP Reports continue the Companies' risk-informed decision-making framework processes and the journey of the California investor-owned utilities' (IOUs) efforts over the past several years by incorporating in this Report the "quantitative approach to risk assessment and risk prioritization"[1] approved by the Commission in D.18-12-014, the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement Decision (Settlement Decision).

The instant RAMP proceedings are considered the first phase of each Company's next General Rate Case (GRC), Test Year (TY) 2024. "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 2021 RAMP Reports focus on each Company's key safety risks and the current and proposed activities to help mitigate those risks. Specifically, SDG&E's Report presents nine risk chapters (eight of which are specific to SDG&E), SoCalGas's Report presents seven risk chapters (six of which are specific to SoCalGas), and each Company's Report contains one joint risk chapter (Cybersecurity).

RAMP-A provides an overview of

- the requirements for the Companies' RAMP Reports (including the ten major components and the workshop requirement);
- how the Companies have met the requirements;
- changes and updates to the Companies' 2021 RAMP Reports, along their development timeline, including responses to intervenor comments and workshop feedback;
- the guiding principles behind the Reports; and
- the organization of each risk chapter.

---

1 Decision (D.)18-12-014 at 28.

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

The selection of RAMP risks is described in each Company's RAMP Chapter B. Each identified RAMP risk is discussed in detail in the individual risk chapters associated with a particular risk event[3] and complies with the directives in the Settlement Decision, as discussed below and in Chapter C.

B. Summary of RAMP Requirements

Although these are not the Companies' first RAMP Reports implementing the methodologies and processes adopted in the Settlement Decision,[4] the 2021 RAMP Reports will be the first associated with a subsequently filed GRC Application for the Companies.[5] The 2021 RAMP Reports were developed in accordance with Commission guidance and the directives adopted in D.14-12-025, D.16-08-018, the Settlement Decision, and D.20-09-004.[6] The Reports also reflect lessons learned from the Companies' 2019 RAMP Reports as well as from the RAMP filings of Pacific Gas and Electric Company (PG&E) and Southern California Edison Company (SCE). As required by the RAMP 2019 Final Decision, the Reports also "address and consider…the comments and suggestions by intervenors regarding the 2019 RAMP Report and further improvement of the RAMP process."[7]

---

[3] D.18-12-014 at Attachment A, A-2 – A-4, provides a glossary of the terms used in this 2021 RAMP Report.

[4] *See* D.18-12-014, which adopted the S-MAP Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[5] D.20-09-004 (2019 RAMP Final Decision) closed the Companies' 2019 RAMP proceedings and clarified that the Companies' respective 2019 RAMP Reports would not be integrated into each Company's next GRC Application.

[6] In addition to the RAMP requirements set forth in various risk-related proceeding directives, the Companies' TY 2019 GRC Decision (D.19-09-051) required inclusion of a re-testing implementation plan related to pipelines under the Pipeline Safety Enhancement Plan (PSEP) Phase 2B as part of SoCalGas's 2019 RAMP filing, and provides specific items to be included in this plan. (D.19-09-051, Ordering Paragraph 15 at 779-780.) As discussed in SoCalGas's 2019 RAMP Report (at page RAMP A-3), SoCalGas requested and received approval from the CPUC Executive Director for an extension of time to comply with this requirement. In compliance with the authorized extension (*see* Letter from CPUC Executive Director Alice Stebbins, dated November 14, 2019), SoCalGas will include the required re-testing implementation plan as part of its TY 2024 GRC Application.

[7] D.20-09-004 at 18-19 (Ordering Paragraph 1). This chapter (RAMP-A) includes discussion of intervenor feedback that has been incorporated into the Companies' RAMP Reports. RAMP-E includes discussion of all types of feedback, including feedback that has been considered but has not been incorporated into the Companies' RAMP Reports.

In brief, the Settlement Decision adopted the following required steps:[8]

- Building a Multi-Attribute Value Function (MAVF) (Step 1A);
- Identifying Risks for Investor-Owned Utilities' Enterprise Risk Register (Step 1B);
- Risk Assessment and Risk Ranking in Preparation for RAMP (Step 2A);
- Selecting Enterprise Risks for RAMP (Step 2B); and
- Mitigation Analysis for Risks in RAMP (Step 3).

The Companies' compliance with Steps 1A and 3 of the Settlement Decision are set forth in detail in Chapter SCG/SDG&E RAMP-C. The Companies addressed the requirements in Steps 1B and 2B of the Settlement Decision in Chapters SCG/SDG&E RAMP-B. The workshop requirement in Step 2A of the Settlement Decision is discussed in this Chapter. Addressing the feedback received, as discussed in Step 2A of the Settlement Decision, is addressed in this chapter and also in detail in Chapter SCG/SDG&E RAMP-E.

In addition to the above, the Settlement Decision also required utilities to satisfy the "Ten Major Components of RAMP Filings."[9] A roadmap demonstrating compliance with the ten components of RAMP filings is provided below.

II. SUMMARY OF APPROACH TO MEET RAMP REQUIREMENTS

This section explains how the Companies have complied with the Settlement Decision's "Ten Major Components of RAMP Filings"[10] and the requirement to host a publicly noticed workshop. This section also describes where the Companies have changed and updated their 2021 RAMP Reports, including changes and updates in response to intervenor comments, consistent with the Commission's directive in the 2019 RAMP Final Decision as well as workshop feedback.[11]

A. Approach to Complying with the Settlement Decision's Ten Major Components of RAMP Filings and Roadmap.

The Companies' approach to compliance with the Settlement Decision's enhanced ten major components and a roadmap explaining where these components are addressed in the

---

8 D.18-12-014 at Attachment A, A-4.

9 *See* D.18-12-014 at 33-35 (citing D.16-06-018).

10 D.18-12-014 at 33-35.

11 Intervenor comments and workshop feedback are also addressed in SCG/SDG&E RAMP-E.

Reports is provided below. Together with the enterprise risk management framework presented in Chapters SCG RAMP-B and SDG&E RAMP-B, this approach satisfies the Cycla ten-step evaluation process, as enhanced by the Settlement Decision.[12]

1. **Identify top risks.** The Companies identified their respective top risks as part of developing their respective 2020 Enterprise Risk Registries (ERR), which were used as the starting points for the RAMP Reports. Details of the ERR process are described in each Company's respective RAMP-B chapters.
2. **Describe the controls or mitigations currently in place.** Consistent with the GRC methodology of starting with the last year of recorded information, the Companies generally consider mitigations that were in place as of the end of 2020 to be controls and denotes these existing mitigations with a control ID. The baseline costs represent actual costs incurred for controls in 2020. The controls are identified and discussed in Section III of each risk chapter. Baseline and forecasted costs and units for the controls are identified in Section V of each risk chapter.
3. **Present plan for improving the mitigation of each risk.** Section IV of each risk chapter includes a table identifying the existing and planned new mitigating activities that represent the risk mitigation plan for that risk. Planned new mitigations, *i.e.*, mitigations that are planned to begin after the start of 2021, are denoted with a mitigation ID. Controls that are expected to continue maintain their control ID. The Companies plan to request funding for the risk mitigation plans described in each of the individual risk chapters in their next GRC applications, which will be filed by May 15, 2022.[13]
4. **Present two alternative mitigation plans that were considered.** Section VI within each of the individual risk chapters present at least two considered alternative mitigations with associated costs and Risk Spend Efficiencies (RSEs). The Companies' alternative mitigation plans presented in the RAMP Reports are

[12] D.18-12-014 at 33-35.

[13] The risk mitigation plans are contingent on resource availability, permitting, operational compliance, unanticipated events, and other factors, and therefore the Companies' identified mitigations may be subject to constraints and/or delays.

specific individual activities that were considered in the process of determining the Companies' risk management efforts but are not currently proposed.[14]

5. **Present an early stage "risk mitigated to cost ratio" or related optimization.** The Companies calculated an RSE for each mitigation at the identified tranche, where feasible, and provided a summary of the post-mitigation Likelihood of Risk Event (LoRE), Consequence of Risk Event (CoRE), and risk score analysis within each individual risk chapter. Details of the pre- and post-mitigation analysis are included in the workpapers. As discussed further in Chapter SCG/SDG&E RAMP-C, an explanation is provided in Section V of the applicable risk chapter where an RSE is unavailable for a particular mitigation (consistent with SPD guidance).[15] In addition, Appendix C-1 provides a ranking of each Company's mitigations by RSE, where an RSE analysis is performed, consistent with the Settlement Decision.[16] Mitigations with RSEs are listed in descending order by RSE.

6. **Identify lessons learned in the current round to apply in future rounds.** Consistent with the approach the Companies took when preparing their 2019 RAMP Report under the current S-MAP framework, "lessons learned" from the Companies' 2019 RAMP proceeding, as well as from the RAMP filings of PG&E and SCE are discussed in Chapter SCG/SDG&E RAMP-E. The SCG/SDG&E RAMP-E discussion also meets the RAMP 2019 Final Decision's requirement to "address and consider … the comments and suggestions by intervenors regarding the 2019 RAMP Report and further improvement of the RAMP process."[17]

---

[14] Although an increase/decrease in the scope of activities may be a feasible approach to alternatives, the individual risk chapters (with the exception of the Cybersecurity risk chapter) do not take this approach, based on feedback from the Commission's Safety and Policy Division (SPD).

[15] *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

[16] D.18-12-014 at Attachment A, A-14 (Mitigation Strategy Presentation in the RAMP and GRC).

[17] D.20-09-004 at 18-19 (Ordering Paragraph 1).

7. **Move toward probabilistic calculations, to the maximum extent possible.** The 2021 RAMP Reports apply the probabilistic analysis required by the Settlement Decision, and make strides toward incorporating more probabilistic analysis than in the 2019 Report. The Companies will continue working toward a more probabilistic analysis in future RAMP reports, as further discussed in Chapter SCG/SDG&E RAMP-C.
8. **For those business areas with less data, improve the collection of data and provide a timeframe for improvement**. The Companies continue to position themselves to continually improve data collection efforts and therefore improve the risk assessment process. Further discussion on data collection can be found in Chapters SCG/SDG&E RAMP-C and E.
9. **Describe the company's safety culture, executive engagement, and compensation policies.** Chapters SCG RAMP-D and SDG&E RAMP-D are dedicated to describing the Companies' respective safety cultures, executive engagement, and compensation policies.
10. **Respond to immediate or short-term crises outside of the RAMP and GRC process.** Although the 2021 RAMP Reports identify the Companies' respective key safety risks, the Companies respond to immediate or short-term needs outside of the RAMP efforts and continually manage risk. An example is the unexpected and unprecedented need for the Companies to assess and reprioritize certain resources beginning in early 2020 to address the health and safety issues associated with the COVID-19 Pandemic, as described in SCG-CFF-3 and SDG&E-CFF-3.

B. RAMP Workshop Requirement

The Settlement Decision requires the Companies to host a publicly noticed workshop in preparation for the RAMP filing. Based on interest, the Companies hosted two workshops that were properly noticed and held on October 15, 2020, and January 27, 2021. The Companies also held a pre-filing technical sub-workshop on November 17, 2020. The intent of the workshops was to inform and educate stakeholders and SPD regarding the Companies' upcoming filings and

gather input from stakeholders. As required by the Settlement Decision,[18] the Companies provided the following information to the interested parties on October 1, 2020, in advance of the first workshop:

- their preliminary list of RAMP risks;
- the safety risk score for each risk in the ERRs; and
- the multi-attribute risk score for the top ERR risks.

The Companies appreciate the input received during the workshops, which has been incorporated or otherwise addressed, as described below, in the 2021 RAMP Reports.[19]

C. Changes from the 2019 RAMP

The Companies informed stakeholders during the October 15, 2020 workshop of the following broader changes made from the 2019 RAMP Reports, primarily based on stakeholder feedback up to that point.

1. Change to Risk Spend Efficiency Approach

The Companies informed stakeholders at the workshop of their intention to review all current and newly planned activities to evaluate the usefulness and ability to create an RSE, and that an RSE value would be included when meaningful data or SME judgment is available. The Companies will provide an explanation for each mitigating activity without an RSE value. This approach incorporates feedback on the Companies' 2019 RAMP Reports, in which the Companies generally did not calculate RSE values for mitigations that are performed to maintain compliance with state and federal mandated requirements that were controls.

The Companies also informed workshop participants that a single RSE value would reflect the forecast cost of a mitigation and not a range of RSE values (as the Companies presented in their 2019 RAMP Reports), in response to previous stakeholder feedback.

2. Incorporation of Additional Attributes

The workshops also provided information regarding the Companies' intent to include a fourth attribute to the MAVF that would focus on the impacts to customers, employees, public,

---

[18] D.18-12-014 at Attachment A, A-10.

[19] For example, the Companies considered input received from SPD and other interested parties in determining the modeling of a fourth MAVF attribute (*see* SCG/SDG&E RAMP C). In accordance with the Settlement Agreement (D.18-12-014 at Attachment A, A-10), the Companies also considered input in determining a final list of risks to be addressed in the RAMP Report.

government and/or regulators from a risk event, based in part on previous stakeholder feedback. The idea of incorporating this fourth attribute is to provide a means to capture how risk events affect customers, employees, public, government and/or regulators that are not captured in the other attributes. By adding an attribute to their MAVF, the Companies are the first in the State to apply a fourth attribute beyond the minimum attributes of safety, financial, and reliability in their RAMP Reports. Discussed below (Section II-D-2) are additional details regarding the evolution of that fourth attribute. The Companies also updated lower level attributes of the MAVF. An "acres burned" sub-attribute was added to the safety attribute.

3. Modeling Public Safety Power Shut-off (PSPS) De-Energizations

SDG&E informed stakeholders that within its Wildfire risk chapter (SDG&E-Risk-1), PSPS impacts would be modeled as a risk that impacts the overall total wildfire risk score, as well as a mitigation to the wildfire risk. Although PSPS might be considered by some stakeholders as a separate risk, PSPS events are directly tied to wildfire mitigation and would not otherwise independently exist. Furthermore, without PSPS, the wildfire risk would be significantly higher. SDG&E thus calculates PSPS impacts as an aspect to the wildfire risk and calculates an RSE for PSPS as a mitigation. SDG&E informed stakeholders that, because PSPS as a mitigation has an impact to customers, the overall wildfire risk assessment comprises two components: the risk of a catastrophic wildfire and the PSPS impacts to customers. Thus, the impact of PSPS is incorporated into the mitigation and the risk assessment.

4. Additional Number of Tranches

The Companies informed workshop participants of their intent to subdivide to a greater degree the risk-reducing activities into tranches. As in the previous RAMP, and as described in more detail below in Section D.3 and RAMP-E, this current RAMP filing reflects the subdivision of risk-reduction activities via a multi-tiered methodology. In addition to some of the risks in the 2021 RAMP now having more tranched mitigations than similarly scoped risks in the 2019 RAMP, the Companies have also identified a larger number of mitigations with additional tiers in the 2021 RAMP.

Many of the additional first tier tranched mitigations – mitigations that have their own risk profiles – are the result of an increased understanding of RAMP qualifying criteria by members of the business units and quantitative analysis teams who have been through multiple RAMP and risk spend accountability report cycles. An example of a first-tier tranched

mitigation is in the Electric Infrastructure Integrity (EII) chapter, where underground cable is discussed and quantified separate from electrical switching equipment. In this regard, the mitigation discussed is considered a tranched mitigation.

A second tier occurs among a particular asset class where the risk profiles of that asset can be subdivided further. Using the same example as above, and new for the 2021 RAMP, electrical switching equipment has been tranched into three separate subdivisions, each with its own quantitative analysis, including cost, risk reduction, and RSE. Similarly new for the 2021 RAMP, for some gas instances, pipeline assets have been further tranched into two separate subdivisions, each with its own quantitative analysis, including cost, risk reduction, and RSE.

5. Consolidation of Dig-In Risks Into One Risk Chapter

The Companies informed workshop participants of their intent to consolidate risks associated with dig-ins on the medium pressure pipeline system and dig-ins on the high-pressure pipeline system into one risk chapter, titled Excavation (Dig-In) Damage to the Gas System (SCG-Risk-2 and SDG&E-Risk-7). Consolidating these risks into one chapter is an efficient and effective way to show that the majority of mitigations included in the control and mitigation plan are essentially the same, streamlining the review of the risk activities for stakeholders. As applicable, the mitigations are tranched reflecting the different risk profiles associated with high and medium pressure pipelines.

6. Inclusion of Internal Labor

Internal labor for applicable baseline controls (*e.g.*, internal labor to attend training, adhering to internal protocols or standards, internal time spent at meetings, etc.) is now generally included in the baseline and forecasted cost estimates in the Reports.

7. Creation of Cross-Functional Factors

In response to feedback received, the Companies created cross-functional factor (CFF) volumes to address some of the various topics raised by parties that would not be standalone risk chapters. CFFs, similar to the cross-cutting factors first presented by PG&E in their 2020 RAMP submission, provide additional information regarding foundational, safety-related initiatives that are associated with more than one RAMP risk.

For example, the Companies have included a Safety Management Systems (SMS) CFF, in part based on Commission guidance in the TY 2019 GRC Decision that many of the Office of the Safety Advocate's (OSA) recommendations in that proceeding were "better addressed in

SoCalGas' next RAMP filing."[20] OSA offered several suggestions regarding enhancements to the Companies' respective safety culture and safety management systems, in particular, integration of American Pipeline Institute (API) Recommended Practice (RP) 1173. Accordingly, the Companies are including supplemental information on safety culture and their safety management systems in Chapter RAMP-D of their respective RAMP Reports and Safety Management Systems CFF volumes (SDG&E-CFF-7 and SCG-CFF-6).

D. Changes and Responses Subsequent to the October 15, 2020, Pre-RAMP Filing Workshop

The Companies also incorporated additional changes to their approach in the RAMP Reports following the October 15, 2020, pre-filing workshop, as described below.

1. Fourth Attribute

The Companies presented a preliminary MAVF[21] at the October 15, 2020 workshop, with the understanding that the risk quantification framework may evolve prior to filing the RAMP Report (as permitted by the Settlement Decision). Representatives from the Protect our Community Foundation (PCF) and The Utility Reform Network (TURN) both raised questions during the first workshop regarding the Companies' new fourth attribute, which at the time was called "Trust/Reputation." PCF questioned whether the attribute was – either intentionally or unintentionally – a way to consider the financial impact of a risk event on shareholders. TURN commented that it is not necessarily opposed to inclusion of the attribute but believes that specifications of the attribute are incomplete and that additional clarity is needed to avoid overlap with other attributes.

Based on this feedback, the Companies changed the name of their fourth attribute from Trust/Reputation to Stakeholder Impacts, to better reflect the attribute's intent and function, and provided information regarding this update to stakeholders at the January 27, 2021 workshop. The Companies explained that the elements of the attribute and the anticipated modeling remained the same. Stakeholders again voiced concerns similar to those expressed during the first workshop.

---

[20] D.19-09-051 at 97.

[21] The Company refers to its MAVF herein as the Risk Quantification Framework (*see* discussion in SCG/SDG&E RAMP-C).

Subsequent to the second workshop, the Companies continued to review stakeholder feedback along with the intended use of this fourth attribute and again made modifications – changing the name to "Stakeholder Satisfaction," and also changing the weighting of the attribute to 2% instead of 5%, among other modifications. Additional information regarding this revised fourth attribute is provided in Chapter SCG/SDG&E RAMP-C.

2. MAVF Weights

The Companies changed the final weight of the Reliability MAVF attribute to 23% (from an initial 20% weighting estimate) and the final weight of the fourth attribute to 2% (from an initial 5% weighting estimate), to align with the changes to the fourth attribute described above. The weight of the other two MAVF attributes did not change.

3. Granularity of Tranching

As a follow-up to discussions during the October 15, 2020 workshop, the Companies held a technical sub-workshop on November 17, 2020, regarding tranching. As a result of discussions during this workshop, the Companies agreed to further examine how appropriate tranching could be applied consistently at the risk event level wherein one such result was the appropriateness to tranche mitigations that were occurring in High Consequence Area (HCA) locations separate from non-HCA locations. HCAs are areas along the gas transmission right-of-way where there is increased building density or a proximity to certain types of gathering locations where there is an expected concentration of population. Areas of known greater consequential impact to the public have different risk profiles compared to high pressure pipe not located in an HCA.

While tranches had previously been discussed, it continued to be an area of potential confusion, which warranted a separate working group discussion on November 17, 2020 and further elucidation here. Tranches are subdivisions of a group of assets or systems that align with different risk profiles.[22] As TURN indicated, "all of the assets in each tranche should be grouped so that there are no significant differences in either the LoRE or the CoRE of those assets. If there is a meaningful difference, the asset group needs to be broken out into more granular tranches."[23] The Settlement Decision states "[t]he determination of Tranches will be

[22] *See* Settlement Decision, Appendix A at A-11 ("Definition of Risk Events and Tranches").

[23] TURN Informal Comments (February 12, 2021) at 1.

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."[24] In preparing their 2021 RAMP Reports, the Companies' used a multi-step approach to subdivide assets and systems into groups of different risk profiles that align with how the risks and assets are managed by the Companies. This is discussed further in SCG/SDG&E RAMP-E.

III. GUIDING PRINCIPLES

The Companies strive to provide uniformity and transparency in their risk presentations. The section below outlines the main assumptions and guiding principles that were globally applied throughout their 2021 RAMP Reports.[25] Many of these global assumptions resulted from lessons learned and are therefore also discussed in Chapter SCG/SDG&E RAMP-E.

A. The Risk Quantification Framework Analyzed Direct and Secondary Impacts

As discussed in Chapter SCG/SDG&E RAMP-C, direct and secondary impacts were analyzed for each risk event. An example of an event with a secondary impact is a prolonged power outage which leads to inoperable traffic lights that could result in an automobile accident, the consequences of which may include a serious injury and/or fatality. Each risk has its own impact model, but data regarding impacts that happen after the initial event may be difficult to discover and to utilize.

B. Presentation of Costs to Align with Risk Reduction Benefits

The purpose of RAMP is not to request funding. Any funding requests will be made in the Companies' TY 2024 GRC applications, currently anticipated to be filed in May 2022, with supporting testimony. There, costs associated with activities presented in the 2021 RAMP Reports will be updated to, among other things, put forth specific dollar requests for funding. Accordingly, the Companies present cost information in the 2021 RAMP Reports in ranges of dollars that represent those costs for which the Companies anticipate requesting recovery in the TY 2024 GRC.

Costs are also presented in the 2021 RAMP Reports after accounting for shared service allocations to align the costs with the company that is experiencing the risk reduction benefits,

---

[24] Settlement Decision, Appendix A at A-11 ("Definition of Risk Events and Tranches").

[25] Unless otherwise noted throughout the 2021 RAMP Report, these global assumptions and parameters apply to all risk areas.

consistent with RSE calculations. As explained in the TY 2019 GRC testimony, "Shared services are activities permitted by the Affiliate Transaction Rules Decision (D.) 97-12-088 that are performed by SDG&E and SoCalGas departments that are designated as utility Shared Services departments (*i.e.*, functional area) for the benefit of: (i) SDG&E or SoCalGas, (ii) Sempra Energy Corporate Center (Corporate Center), and/or (iii) any Sempra unregulated subsidiaries. Shared Assets are assets that are on the financial records of one utility, but also benefit other Sempra Energy affiliates."[26] The details providing where the costs are incurred, the shared allocation percentages, and the costs after allocations are shown in the workpapers.

As discussed in more detail in SCG/SDG&E RAMP-C, the baseline costs of controls and mitigations for the 2021 RAMP Reports are the costs incurred in 2020. This is because, at the time of finalizing these RAMP Reports, the last available recorded annual financial data was 2020. Modeled after the GRC presentation, the cost forecasts presented herein include forecasts for anticipated capital expenditures over the forecast years of the next GRC cycle (2022-2024) and estimated O&M cost forecasts for TY 2024. The 2021 RAMP Reports present capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total, whereas O&M costs are presented for TY 2024. All dollars are presented in direct (*i.e.*, does not include company overhead costs such as medical), constant 2020 thousands of dollars. Costs are also, where possible, assigned to one risk chapter. However, in a few cases within the RAMP Reports, a mitigation may help mitigate more than one risk and therefore may be included in multiple chapters.

The Companies provide cost and risk reduction benefit information in a consistent manner in the 2021 RAMP Reports. As such, risk reduction benefits: (1) are estimated for years 2022, 2023, and 2024 for capital programs and TY 2024 for O&M activities; (2) represent the benefiting company (*i.e.*, after company allocations); and (3) are compared for purpose of calculating a RSE to a baseline of 2020, other than the Wildfire risk chapter.[27] Consistently providing cost and benefit information in RAMP and for the same years as the GRC is anticipated to better enable RAMP-to-GRC integration and minimize changes, to the extent

---

[26] A.17-10-007 (cons.). Exhibit SCG-34-2R/SDG&E-32-2R, Testimony of James Vanderhye, Shared Services & Shared Assets Billing, Segmentation & Capital Reassignments (April 6, 2018) at JV-1.

[27] SDG&E's Wildfire risk Chapter (SDG&E-Risk-1) uses 2021 as the baseline for RSE calculations due to the significant risk reduction expected in 2021 compared to 2020.

possible, between RAMP and GRC filings. Section V of each risk chapter presents a summary of the baseline and forecasted costs, units, and RSEs for each control and mitigation by tranche.

The Companies' accounting systems are not configured to capture all costs for the level or type of risk-management activities anticipated by the RAMP process – instead, costs are tracked by cost center (O&M) and budget code (capital). Estimates, assumptions, and available accounting data were provided by SMEs where feasible. Lessons learned associated with the level of detail and specifically for tranches are provided in Chapter SCG/SDG&E RAMP-E.

1. Treatment of Risk Mitigating Activities Presented in Risk Chapters

These RAMP Reports provide analyses of activities within the scope of the risk description (as required by the Settlement Decision) and, in some instances, also provide a qualitative discussion of certain risk mitigation activities that are otherwise out-of-scope due to the risk definition, to aid the Commission and stakeholders in developing a more complete understanding of the breadth and quality of the Companies' mitigation activities. For example, compressor station modifications that are planned to occur during the 2022-2024 period but have an in-service date beyond 2024 are discussed in SoCalGas's Incidents Related to the High-Pressure System (Excluding Dig-in) risk chapter (SCG-Risk-1); electric transmission related activities that have cost recovery through a non-GRC cost recovery mechanism are discussed in SDG&E's Electric Infrastructure Integrity risk chapter (SDG&E-Risk-2). This additional information is provided in the interest of full transparency and understanding of the Companies' activities, consistent with guidance from Commission staff and stakeholder discussions.

2. RSE Analysis

The Settlement Decision directs the Company to provide a Step 3 analysis of mitigations.[28] As further discussed in Chapter SCG/SDG&E RAMP-C, for mitigations where costs are not identified or not available or where data or SME judgment to quantify a benefit is not available or meaningful, such as with communication-based mitigation activities and procurement/utilization of personnel protection equipment, no RSE calculation can be provided. As mentioned above, activities for which no RSE is available are identified with explanations within Section V of the individual risk chapters.

[28] D.18-12-014 at Attachment A, A-11 – A-13.

IV. RAMP RISK CHAPTER ORGANIZATION AND OVERVIEW

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. The Companies present the following sections in each risk chapter:

1. Introduction.
2. Risk Assessment – In accordance with the Settlement Decision,[29] this section describes the risk bow tie, possible drivers/triggers, and potential consequences of each identified risk.
3. 2020 Controls – This section discusses how activities with recorded costs in or prior to 2020 (denoted with a control ID) help mitigate the risk.
4. 2022 – 2024 Controls and Mitigation Plan – This section discusses both planned significant changes to existing mitigations and/or planned new mitigations (denoted with a mitigation ID) that will address the risk, and includes a table informing which existing and new mitigations are planned to occur during the TY 2024 GRC's 2022 – 2024 forecast period.[30]
5. Costs, Unit, and Quantitative Analysis Summary Tables – This section includes tables summarizing the costs, units, and RSEs for mitigations included in the risk control and mitigation plan.
6. Alternative Mitigation Plan Analysis – This section presents at least two alternative mitigation plans considered as part of the risk assessment process, including forecasted costs, units, and RSE values.
7. Appendices
    a. Appendix A provides a summary of which elements of the bow tie are addressed by which mitigations.
    b. Appendix B provides a summary of the source documents used in the quantitative analyses.

[29] D.18-12-014 at 33 and Attachment A, A-11 (Bow Tie).

[30] As discussed in some risk chapters, not all activities with a control ID or a mitigation ID are included in the risk control and mitigation plan for the 2022-2024 period.

In summary, the RAMP Reports provide information regarding how the Companies think about, plan for, and mitigate identified key safety risks. The RAMP Reports will inform the safety-related funding requests that the Companies will include in their respective TY 2024 GRC applications, currently anticipated to be filed in May 2022.

Risk Assessment Mitigation Phase

(SDG&E RAMP-B)

Enterprise Risk Management Framework

May 17, 2021

TABLE OF CONTENTS

RAMP B: ENTERPRISE RISK MANAGEMENT FRAMEWORK

I. INTRODUCTION

This Chapter discusses the enterprise risk management framework for San Diego Gas & Electric Company (SDG&E or Company). For purposes of RAMP, the Company has integrated the directives established in Decision (D.) 18-12-014 and the Settlement Agreement adopted therein (the Settlement Decision) into the Company's enterprise risk management (ERM) framework. This Chapter describes in detail the ERM framework utilized by the Company.

II. ENTERPRISE RISK MANAGEMENT FRAMEWORK

As described in the direct testimony of Risk Management and Policy witness Diana Day in the Test Year (TY) 2019 General Rate Case,[1] the Company's risk framework:

> is modeled after ISO [International Organization for Standardization] 31000, an internationally recognized risk management standard. This framework consists of an enterprise risk management governance structure, which addresses the roles of employees at various levels ranging up to the Companies' Board of Directors, as well as risk processes and tools. One such process is the six-step enterprise risk management process.

Figure 1 below describes the Company's enterprise risk management process, by which the Company identifies, manages, and mitigates enterprise risks and aims to provide consistent, transparent, and repeatable results.

[1] A.17-10-007/-008 (cons.), Exhibit (Ex.) 03 (SCG/SDG&E Day/Flores/York Revised Direct) at DD-8.

Figure 1: Enterprise Risk Management Process

The process illustrated in Figure 1 aligns with Cycla Corporation's 10-step evaluation method, which was 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."[2] While the lexicon used by Cycla differs slightly from that of the Company, the content is largely aligned. Table 1 below provides a side-by-side comparison of the steps in the Company's ERM process to the Cycla method sections.

Table 1: ERM Process Alignment with the Cycla Method

Steps in Cycla[3]	Corresponding Risk Steps in Enterprise Risk Management Process
Step 1: Identify Threats	1. Risk Identification
Step 2: Characterize Sources of Risk; Step 3: Identify Candidate Risk Control Measures (RCMs)	2. Risk Analysis
Step 4: Evaluate the Anticipated Risk Reduction for Identified RCM	3. Risk Evaluation & Prioritization
Step 5: Determine Resource Requirements for Identified RCMs;	4. Risk Mitigation Plan Development & Documentation

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

[3] *Id.* at 17 (Cycla 10-Step Approach [citation omitted]).

Steps in Cycla[3]	Corresponding Risk Steps in Enterprise Risk Management Process
Step 6: Select RCMs Considering Resource Requirements and Anticipated Risk Reduction	
Step 7: Determine Total Resource Requirement for Selected RCMs; Step 8: Adjust the Set of RCMs to be Presented in Rate Case Considering Resource Constraints; Step 9: Adjust RCMs for Implementation following CPUC Decision on Allowed Resources	5. Risk Informed Investment Decisions and Risk Mitigation Implementation
Step 10: Monitor the Effectiveness of RCMs	6. Monitoring and Review

The Company performs its ERM process annually, resulting in an enterprise risk registry (ERR). The ERR contains each of the Company's identified enterprise-level risks. Each risk is assigned to one or more risk owner(s), a member of the senior management team responsible and accountable for the risk, and one or more risk manager(s) responsible for ongoing risk assessments and overseeing the implementation of risk plans. The ERM organization facilitates sessions amongst the Company's risk owners to identify, evaluate, and prioritize risks, and review mitigation plans and consider how investments align with risk priorities.

As Ms. Day explained: "The enterprise risk management process is both a 'bottom-up' and 'top-down' approach, by taking input from the risk managers and the risk owners to ultimately finalize the risk registry. As with any useful risk assessment, the enterprise risk registry is not intended to be static; it must be refreshed on an annual basis. Risks are dynamic; risks that were consolidated together may be separated out, new risks may appear, and the level of the risk may change over time."[4]

Each of the steps in the ERM process is discussed further below.

A. Risk Identification

Risk identification is the process of finding, recognizing, and describing risks. As the first step in the risk management process, the ERM organization works with various business

[4] Ex. 03 (SCG/SDG&E Day/Flores/York Revised Direct) at DD-9.

units to update existing risk information and identify enterprise-level risks that have emerged or accelerated since the prior assessment. This part of the process also includes the identification of risk events, their causes, and potential consequences. Figure 2 below provides a depiction of the risk bow tie, which is a commonly-used tool for risk analysis. The risk bow tie is a way to systematically and consistently evaluate the drivers/triggers, possible outcomes, and potential consequences of a risk event. As the sample risk bow tie (Figure 2 below) illustrates, the left side of the risk bow tie identifies potential drivers and/or triggers that may lead to a risk event (center of the risk bow tie), and the right side shows the potential consequences of a risk event. Drivers/triggers are denoted as "DT" and potential consequences are denoted as "PC."

Figure 2: Example of Risk Bow Tie

Each risk in the RAMP Report includes a risk bow tie similar to that in Figure 2 above. Generally, the drivers/triggers identified in the RAMP risk Chapters are specific to the risk event. However, many of the potential consequences are common across the RAMP risks. Potential consequences that can be in the RAMP risk Chapters are described below:

- **Serious injuries and/or fatalities:** Refers to physical trauma to the body.
- **Property damage:** The potential to cause property damage which typically involves physical damage to tangible property.
- **Operational and reliability impacts:** Effects to utility operations.

- **Penalties and fines:** The risk of a compliance (*e.g.,* regulatory) failure, which results in potential penalties/fines or sanctions.
- **Adverse litigation:** Refers to litigation risk, which is the possibility that legal action will be taken because of an individual's or corporation's actions, inaction, products, services, or other events. Corporations generally employ some type of litigation risk analysis and management to identify key areas where the litigation risk is high and thereby take appropriate measures to limit or eliminate those risks.
- **Erosion of public confidence:** A risk event causing a potential loss to financial capital, social capital, and/or market share resulting from damages to a firm's reputation.

B. Risk Analysis

Risk analysis is the process of understanding the risk and the degree of risk. Risk analysis provides a basis for risk evaluation and decisions about risk mitigation. Risk analysis is undertaken using varying methodologies, depending on the risk and the availability of data and resources. The Company utilizes a combination of qualitative (*e.g*., calibrated subject matter expertise) and quantitative analyses (including external data) to analyze its risks.

C. Risk Evaluation and Prioritization

Using the information from the previous steps, an evaluation and prioritization are performed. The result of this step is pre-mitigation risk scores for each risk in the ERR and a relative ranking reflecting consensus around risk priorities. This step involves a discussion of each ERR risk, including changes in the risk frequency or impact, challenges, and elements of the previous assessment's implementation of mitigants. Arriving at a risk prioritization can be an iterative process; risks that may be very different are compared to one another to determine a relative ranking (for example, evaluating an IT risk in comparison with a customer service risk).

In 2020, the Company completed its ERR before year-end, following the issuance of the Settlement Decision. The evaluation and prioritization process for the 2020 ERR used the Company's risk scoring process, a tool that aids in developing the pre-mitigation risk score for ERR risks. The Settlement Decision that was adopted in December 2018 provides, among other things, a methodology to be used as the basis for this RAMP Report.

In particular, the Settlement Decision established a multi-attribute value function (MAVF).[5] For purposes of this RAMP Report, the Company developed a new MAVF consistent with the Settlement Decision, which resulted in new pre-mitigation risk scores. This process, methodology, and calculations for the pre-mitigation risk scores are further discussed in Chapter RAMP-C.

D. Risk Mitigation Plan Development & Documentation

Based on the analysis and evaluation of risks in the prior steps, risk owners and managers develop and document risk mitigation plans to capture the state of the risk given current control activities and any additional mitigations. On an annual basis, the ERM organization facilitates a risk mitigation planning session where risk owners present their key risk mitigation plans and alternatives considered to the senior management team and discuss the feasibility and prudence of those plans. This risk mitigation planning session helps shape the Company's priorities going into the annual investment planning process and helps identify gaps and/or areas of overlap in risk mitigation plans.

E. Risk-Informed Investment Decisions and Risk Mitigation Implementation

The capital planning process is the Company's annual process for prioritizing funding based on risk-informed priorities and input from operations. The capital allocation planning sessions begin with input from functional capital committees that comprise subject matter experts who perform high-level assessments of the capital requirements based on achieving the highest risk mitigation at the lowest attainable costs. These requirements are presented to a cross-functional team representing each functional area with capital requests. This committee reviews the resource requirement submissions from all functional areas, and projects are evaluated against priority by assessing a variety of metrics, including safety, cost-effectiveness, reliability, security, environmental, strategic, and customer experience. Recommendations for capital spending are then presented to an executive committee for approval. Once the capital allocations are approved, each individual operating organization is chartered to manage their respective capital needs within the capital allotted by the plan. This includes re-prioritization as necessary to address imminent safety concerns as they arise. Similar to the Company's risk

[5] D.18-12-014 at Attachment A, A-8 (Risk Assessment).

evaluation processes, the capital planning process is evolving as the Company endeavors to achieve a more quantitative determination of the risk reduction per dollar invested.

F. Monitoring and Review

Monitoring and reviewing the aspects of risk management supports the Company's efforts to continuously improve its risk management practices. Periodic reviews of the ERR are performed to keep the register current and facilitate discussions on emerging risks that the Company could face. In addition to using risk scores to monitor changes in risks, the Company leverages risk metrics similar to those identified in the Phase Two S-MAP Decision 19-04-020 to hold parties accountable and improve risk oversight.

III. CONTINUOUS IMPROVEMENT OF RISK MANAGEMENT PRACTICES

The Company's risk management practices continue to mature. The TY 2019 GRC Application presented a strategic planning trajectory related to integrating risk, asset, and investment management to be accomplished over future GRC cycles.[6] The Company is moving on that trajectory, further integrating risk, asset, and investment management into the Company's culture.

While the Company's risk practices to date have largely focused on expressing risks in terms of risk events, there is an effort to more closely align risks with asset management practices. There are considerable efforts underway to provide additional granularity of risks and asset health.

One effort demonstrating additional granularity is the development of operating unit risk registries. As explained by Ms. Day, "[t]he operating unit risk registries are intended to provide each operating unit with a tool to capture its specific risks and enable a more structured management of lower consequence risks that occur more frequently and are dealt with at the operating unit levels. As the operating unit risk registries evolve and mature, they will inform the assessment of risks at the enterprise level and provide improved risk quantification and granularity across the Company."[7] The Company continues to work on developing operating unit risk registries in different operating areas of the Company and refining the process. In 2020, SDG&E completed 13 operating unit risk registries, and will complete an additional 5 in 2021.

---

[6] Ex. 03 (SCG/SDG&E Day/Flores/York Revised Direct) at DD-25 (Figure DD-4).

[7] *Id.* at DD-23.

SDG&E's ERR is a comprehensive, rigorous, and iterative program to manage corporate-level risks. The operating unit risk registries support the ERR process by providing a bottom-up approach to identifying risk. This bottom-up risk identification supplements the Company's ERR categories with discrete risk mitigation activities. Mitigations identified within operating unit risk registries may map to multiple ERR risks to provide a cross-enterprise view. For example, if the Electric Distribution Engineering operating unit risk registry includes mitigation to replace a piece of equipment prone to failure, that mitigation may impact several ERR risks such as electric infrastructure integrity, wildfire, employee and contractor safety. Additionally, the Company is leveraging the operating unit risk registries to inform internal asset management strategies to continue the integration of risk and asset management.

In addition, SDG&E has established an enterprise-wide Safety Management System (SMS) that integrates risk management and asset management with SDG&E's gas and electric operations.[8] According to the Office of Safety Advocate (OSA), SMS is "a key tool for achieving safety goals, managing risks and opportunities, and meeting requirements and expectations."[9] SDG&E's SMS further aligns and integrates risk, safety, emergency, operations, and asset management under one framework. SDG&E's SMS is further discussed in Chapter RAMP-D and in the SMS Cross-Functional Factor Chapter, CFF-7.

The Company also continually seeks to implement metrics into its risk-based decision-making processes. Risk metrics span risk, asset, and investment management, in that they help evaluate and monitor asset health and potentially inform and demonstrate progress related to investments. D.19-04-020 approved safety performance metrics, which are reportable on an annual basis beginning in March 2020. The Company's data collection efforts and the metrics themselves will continue to support risk-based decision-making. Further, metrics help to inform investments, and the Company will provide an explanation in its annual Risk Spending Accountability Reports of how the reported safety metric data reflects progress against the safety goals in the Company's RAMP and GRC. In addition to CPUC-reportable metrics, the Company is in the process of identifying ways in which to quantify and track effectiveness related to its mitigations from this 2021 RAMP Report, as discussed in Chapter RAMP-E.

---

[8] Refer to Figure 1 within SDG&E's SMS Cross Functional Factor Chapter (CFF-7).

[9] A.17-10-007/008 (cons.), Ex. 442 (OSA Contreras Prepared Testimony) at 2-20.

Finally, SDG&E and Southern California Gas Company also communicate regularly with risk management representatives at Pacific Gas and Electric Company and Southern California Edison Company to discuss and share best practices, address trends and emerging issues and to improve risk management practices, such as managing the COVID-19 pandemic from a risk perspective.

IV. SELECTION OF RAMP RISKS

As discussed in Section II above, the Company's Enterprise Risk Management Process results in an Enterprise Risk Registry for a given year. For this RAMP Report, the Company began with the risks included in the 2020 ERR. Using the updated Risk Quantification Framework described in Chapter RAMP-C, the Company then scored each of its 2020 ERR risks utilizing the safety attribute only and sorted the risks in descending order by the safety risk score. For the top 40% of ERR risks with a safety risk score greater than zero, the Company then calculated a risk score using all its attributes in the Risk Quantification Framework (*i.e.*, beyond the safety attribute). The Company reviewed the outputs of this process and developed a preliminary list of RAMP risks to present at a pre-filing workshop, consistent with Settlement Decision.[10] The Company selected the preliminary list of RAMP risks based on the initial safety risk scores (*i.e.*, those top 40% of ERR risks with a safety risk score greater than zero) and added additional enterprise risks deemed to be top priority to the Company.

As discussed in Chapter RAMP-A, pre-filing RAMP workshops were held on October 15, 2020 and January 27, 2021. Per the Settlement Decision,[11] the Company must make its determination of the final list of risks to be addressed in the RAMP based on the input received from the Commission's Safety Policy Division and other interested parties. There was no opposition to the risks presented during the pre-filing workshops, therefore, the preliminary list of RAMP risks remained unchanged and became final. In addition to the RAMP risks, SDG&E's RAMP Report includes cross-functional factors. Because the cross-functional factors are not "risks," they are not addressed in this Chapter. (Please refer to Chapter RAMP-A for a discussion of cross-functional factors.)

[10] D.18-12-014 at Attachment A, A-8 (Risk Assessment).

[11] *Id.* at Attachment A, A-10 (Risk Selection Process for RAMP).

V. EVOLUTION OF RISKS IN THE ERR COMPARED TO 2019 RAMP AND 2020 ENTERPRISE RISK REGISTRY

The Settlement Decision requires that the RAMP Report highlight changes to the ERR from previous RAMP or GRC filings.[12] Pursuant to this requirement, Table 2 sets forth a comparison of the risks in this 2021 RAMP Report compared to those that were presented in the Company's 2019 RAMP Report and the 2020 ERR.

As shown in Table 2 below, there were limited changes in the scope of the risks and some slight changes to the risks' naming convention. Additionally, for this 2021 RAMP Report, some risks from the Company's prior RAMP Reports are no longer presented as distinct risk chapters. The following Table 2 compares the 2021 RAMP Risks to the 2020 ERR and the 2019 RAMP risks.

Table 2: Comparison of 2021 RAMP Risks to the 2020 ERR and the 2019 RAMP Risks

2021 RAMP Risks	2020 ERR	2019 RAMP Risks
Excavation Damage (Dig-In) on the Gas System	Dig-in on the Gas Distribution System	Third Party Dig-in Medium Pressure
	Dig-in on the Gas Transmission System	Third Party Dig-in High Pressure
Incident Related to the High Pressure System (Excluding Dig-In)	Incident Related to the Gas Transmission System (Excluding Dig-In)	High Pressure Gas Pipeline Incident
Incident Related to the Medium Pressure System (Excluding Dig-In)	Incident Related to the Gas Distribution System (Excluding Dig-In)	Medium Pressure Gas Pipeline Incident
	Customer & Public Safety – After Meter Gas Incident	Customer and Public Safety*
Wildfires Involving SDG&E Equipment (including Third Party Pole Attachments)	Wildfires involving SDG&E Equipment (including Third Party Pole Attachments)	Wildfires Involving SDG&E Equipment
Incident Involving an Employee	Employee Safety	Employee Safety
Incident Involving a Contractor	Contractor Safety	Contractor Safety
Electric Infrastructure Integrity	Electric Infrastructure Integrity	Electric Infrastructure Integrity
Customer & Public Safety – Contact with Electric Equipment	Customer & Public Safety – Contact with Electric Equipment	Customer and Public Safety*
Cybersecurity	Cybersecurity	Cybersecurity

[12] *Id.* at Attachment A, A-7 (Risk Identification and Definition).

2021 RAMP Risks	2020 ERR	2019 RAMP Risks
	Inability to Recovery Technology and Applications	
	Physical Security of Critical Electric Infrastructure	
	Capacity Restrictions or Disruptions to the Natural Gas Transmission System	
	Electric Grid Failure and Restoration Blackout/Failure to Black Start)	
	Insufficient Supply to the Natural Gas Transmission System	
	Aviation Incident	
	Workplace Violence	
	Customer Privacy	
	Environmental Compliance	
	Negative Customer Impacts Caused by Outdated Customer Information Systems	
	Massive Smart Meter Outage	

* The scope of the Customer and Public Safety risk chapter in the 2019 RAMP included both *After Meter Gas Incident* and *Contact with Electric Equipment*.

The remainder of this Section discusses changes (if any) in scope related to the risks shown in Table 2 above.

Excavation Damage (Dig-In) on the Gas System

Excavation Damage (Dig-In) on the Gas System has evolved from (a) Dig-in on the Gas Distribution System, and (b) Dig-in on the Gas Transmission System in the 2020 ERR. In the 2019 RAMP, Dig-in on the Gas Distribution System was referred to as *Third Party Dig-in Medium Pressure* and Dig-in on the Gas Transmission System was referred to as *Third Party Dig-in High Pressure*.

Incident Related to the High Pressure System (Excluding Dig-In)

Incident Related to the High Pressure System (Excluding Dig-In) has evolved from Incident Related to the Gas Transmission System (Excluding Dig-In) in the 2020 ERR. In the 2019 RAMP, the risk was referred to as *High Pressure Gas Pipeline Incident*.

Incident Related to the Medium Pressure System (Excluding Dig-In)

Incident Related to the Medium Pressure System (Excluding Dig-In) has evolved from two separate risks in the 2020 ERR: (a) Incident Related to the Gas Distribution System (Excluding Dig-In), and (b) Customer & Public Safety – After Meter Gas Incident. In the 2019 RAMP, the Incident Related to the Gas Distribution System (Excluding Dig-In) was referred to as *Medium Pressure Gas Pipeline Incident*, and Customer & Public Safety – After Meter Gas Incident was referred to as *Customer and Public Safety*.

Wildfires Involving SDG&E Equipment (including Third Party Pole Attachments)

There was no change from the 2019 RAMP.

Incident Involving an Employee

Incident Involving an Employee has evolved from Employee Safety in the 2020 ERR. In the 2019 RAMP, the risk was referred to as *Employee Safety.*

Incident Involving a Contractor

Incident Involving a Contractor has evolved from Contractor Safety in the 2020 ERR. In the 2019 RAMP, the risk was referred to as *Contractor Safety*.

Electric Infrastructure Integrity

There was no change from the 2019 RAMP.

Customer & Public Safety – Contact with Electric Equipment

Customer & Public Safety – Contact with Electric Equipment was a new separately identified risk in the 2020 ERR. This risk was not in the 2019 RAMP, though parts of it were addressed in the scope of the *Customer and Public Safety* risk.

Cybersecurity

Cybersecurity remains the same as the 2020 ERR and the 2019 RAMP.

Risk Assessment Mitigation Phase

(RAMP-C)

Risk Quantification Framework and Risk Spend Efficiency

May 17, 2021

TABLE OF CONTENTS

RAMP C: RISK QUANTIFICATION FRAMEWORK AND RISK SPEND EFFICIENCY

I. INTRODUCTION

This joint chapter provides an overview of the quantification methods used by Southern California Gas Company (SoCalGas) and San Diego Gas & Electric Company (SDG&E) (collectively, Companies). Within this chapter, the Companies: (1) provide an overview of the quantitative assessment used for risks and mitigations/controls throughout the RAMP Report, (2) explain the methodology used to create the multi-attribute value function (MAVF) and risk spend efficiencies (RSEs), and (3) demonstrate how RSEs are used in the Reports. The Companies have used the directives established in Decision (D.) 18-12-014 and the Settlement Agreement adopted therein (the Settlement Decision) to inform the quantification methods used in the RAMP Report, as discussed in this chapter.

II. OVERVIEW OF QUANTITATIVE ASSESSMENT

This section provides an overview of how the MAVF is applied to quantitatively assess risks throughout this Report (referred to herein as the Risk Quantification Framework), including illustrating hypothetical examples of risk scores (using the ranges displayed in the examples). The Risk Quantification Framework is used to analyze risk by estimating current risk scores (the Pre-Mitigation Risk Scores) and forecasting future risk scores if new activities are started or current ones are ceased (the Post-Mitigation Risk Scores).

- Section A provides a brief overview of the quantitative analysis used to analyze each risk, according to the Settlement Decision.
- Section B describes the requirements of the MAVF per the Settlement Decision, and how the Companies' Risk Quantification Framework was accordingly constructed.
- Section C describes the steps to apply the Risk Quantification Framework in accordance with the Settlement Decision.
- Section D shows a hypothetical example of a risk score calculation using the Risk Quantification Framework.

A. Overview and Approach

The quantitative analysis applied in the RAMP Reports is derived from the Settlement Decision, and can be outlined as follows:

- Develop an MAVF, which the Companies refer to as the Risk Quantification Framework;[1]
- Consider risks as defined and scoped in the Companies' Enterprise Risk Register (ERR);[2]
- Compute a Safety Risk Score using the Safety Attribute of the MAVF for each risk included in the ERR;[3]
- For each identified risk that is required to be included in the RAMP:
    - Estimate the frequency of a risk event occurring in a given year and use that value for the Likelihood of Risk Event (LoRE);
    - Estimate the average (mean) consequences if the Risk Event were to occur;
    - Apply the average consequences to the Risk Quantification Framework to create a value known as the Consequence of Risk Event (CoRE); and
    - Multiply the values of LoRE and CoRE to determine a risk score for that risk. The result of this calculation constitutes a Pre-Mitigation Risk Score.

As required by the Settlement Decision, for planned mitigations, a resulting Pre-Mitigation Risk Score will be used: (1) to demonstrate a risk score for each risk along with a ranking, and (2) as an input into the calculations to determine the change in risk scores when a risk-reducing activity is started or ceased.

B. Risk Quantification Framework

This section presents the Risk Quantification Framework that will be used throughout the RAMP Reports, as guided by the Settlement Decision. The quantitative aspects shown in this chapter are not meant to reflect precision or a comprehensive view of risk, but rather serve as a starting point on which to build. Further, as explained below, the Risk Quantification Framework is the result of many necessary assumptions. Should those assumptions change, different results would be expected.

---

1 D.18-12-014 at Attachment A, A-5 – A-6 (Step 1A).

2 *Id.* at Attachment A, A-7 (Step 1B).

3 *Id.* at Attachment A, A-8 – A-9 (Step 2A).

Under the Settlement Decision, the Risk Quantification Framework requires certain "attributes," defined as "an observable aspect of a risky situation that has value or reflects a utility objective, such as safety or reliability."[4] The attributes "should cover the reasons that a utility would undertake risk mitigation activities"[5] and must be reflected in "the way the level of an attribute is measured or expressed."[6] The determination of attributes is left to each utility's discretion, with the requirement that the attributes should include safety, reliability, and financial attributes.[7] Attributes are a subset of the many criteria used to assess and manage risk.[8]

The Settlement Decision also requires construction of a scale "that converts the range of natural units … to scaled units to specify the relative value of changes within the range, including capturing aversion to extreme outcomes or indifference over a range of outcomes."[9] Attributes also must be assigned weights reflecting each attribute's relative importance to other identified attributes.[10]

The three tables below show a Risk Quantification Framework utilized in this RAMP Report. Each table shows chosen attributes and assigned weights and scales. A narrative summary of the choices examined and made in assigning values to the variables shown below (*e.g.*, attributes, scales, weights) is described in Section II.E below.

The Risk Quantification Framework (as outlined in the Settlement Decision) is a prescribed methodology that provides a data point to help inform risk-based decision making (amongst other available data points). There are numerous ways to select attributes, scaling, and weights. However, the Settlement Decision contains a prescribed methodology for selecting attributes, scaling, and weights, limiting a utility's choices in certain ways. The choices elected in accordance with the Settlement Decision's prescribed methodology should not be viewed as a precise reflection of real-world circumstances.

---

4 D.18-12-014 at Attachment A, A-2.

5 *Id.*

6 *Id.* at Attachment A, A-3.

7 *Id.* at Attachment A, A-8.

8 *Id.* at Attachment A, A-14 ("Mitigation selection can be influenced by other factors including funding, labor resources, technology, planning and construction lead time, compliance requirements, and operational and execution considerations.").

9 *Id.* at Attachment A, A-5.

10 *Id.* at Attachment A, A-6.

The Settlement Decision requires the Companies to follow six principles to construct its MAVF.[11] The Companies applied these six principles to arrive at the Risk Quantification Framework summarized in Table 1 below. The top-level attributes of safety, reliability, and financial are consistent with the minimum attributes required by the Settlement Decision.[12] The Stakeholder Satisfaction attribute is a new attribute being introduced by the Companies – the first attribute to be used by a utility in the state beyond the three required by the Settlement Decision. Given that "[a]ttributes are combined in a hierarchy,"[13] the top-level attributes are further broken down into sub-attributes.[14] Measurement of each sub-attribute is also required and is based on unique characteristics.[15] These sub-attribute measurements are then rolled up to the top-level attribute. The combined measurement of each top-level attribute is represented in Table 1 below as the Measurement Unit. The scales contained in Table 1 also reflect the Settlement Decision's MAVF principles and were constructed to represent the relative value of changes in a range of the measured units.[16] Similarly, the Companies completed a weighting process in accordance with the Settlement Decision[17] to develop the weights in Table 1 below (as further described in Section III.C, *infra*).

---

[11] *Id.* at Attachment A, A-5 – A-6 ("MAVF").

[12] *Id.* at Attachment A, A-8 ("Risk Assessment").

[13] *Id.* at Attachment A, A-5 ("MAVF Principle 1 – Attribute Hierarchy").

[14] *Id.* at Attachment A, A-5, ("MAVF Principle 1 – Attribute Hierarchy") and ("MAVF Principle 2 – Measured Observations") refer to lower-level attributes in the context of building a MAVF. The term "lower-level attribute" is referred to herein as "sub-attribute."

[15] *Id.* at Attachment A, A-5 ("MAVF Principle 2 – Measured Observations") and ("MAVF Principle 3 – Comparison").

[16] *Id.* at Attachment A, A-5 ("MAVF Principle 5 – Scaled Units").

[17] *Id.*, Ordering Paragraph 2 at 67-68, and at Attachment A, A-6 ("MAVF Principle 6 – Relative Importance").

Table 1: Risk Quantification Framework Top-Level Attributes

Top-Level Attribute	Measurement Unit[18]	Scale	Weight
Safety	Safety Index	0 – 20	60%
Reliability	Reliability Index	0 – 1	23%
Financial	$	$0 - $500M	15%
Stakeholder Satisfaction	Satisfaction Index	0-100	2%

Table 2 below shows the sub-attributes contained in the Safety top-level attribute from Table 1 above. The measured unit for each Safety sub-attribute, when combined, create a single Safety Index value that is used in Table 1 above.[19] The components of the Safety Index are provided in Table 2 below.

Table 2: Risk Quantification Framework Safety Index

Safety Sub-Attributes	Value
Fatality	1
Serious Injury	0.25
Acres Burned[20]	0.00005

Like Table 2 above, Tables 3 and 4 show the sub-attributes that are included in the Reliability top-level attribute from Table 1 for SDG&E and SoCalGas, respectively. Each sub-attribute is measured by its own unit. The Companies' determination of attributes, scales and weights are explained in Section III, *infra*. When all four sub-attributes for reliability are summed together, it creates a single Reliability Index value that is used in Table 1 above.

[18] "Measurement Unit" used herein is the measured attribute, also analogous to "Natural Unit" per the Settlement Decision Lexicon included in D.18-12-014 at Attachment A, A-3.

[19] MAVF Principle 1 - Attributes are combined in a hierarchy. *See* D.18-12-014 at Attachment A, A-5.

[20] Applicable only to Wildfire Involving SDG&E Equipment.

Table 3: Risk Quantification Framework Reliability Index for SDG&E

Reliability Sub-Attribute	Measurement Unit	Scale	Weight
Gas Meters	Number of Gas Meters Experiencing Outage	0 – 50,000 meters	25%
Gas Curtailment	Volume of Curtailments of Natural Gas exceeding 80 million cubic feet/day	0 – 250 MMcf	25%
Electric SAIDI	System Average Interruption Duration Index (SAIDI) minutes	0 – 100 minutes	25%
Electric SAIFI	System Average Interruption Frequency Index (SAIFI) outages	0 – 1 outages	25%

Table 4: Risk Quantification Framework Reliability Index for SoCalGas

Reliability Sub-Attribute	Measurement Unit	Scale	Weight
Gas Meters	Number of Gas Meters Experiencing Outage	0 – 100,000 meters	50%
Gas Curtailment	Volume of Curtailments of Natural Gas exceeding 250 million cubic feet/day	0 – 666 MMcf	50%

Because the Financial attribute is readily measured in dollars, sub-attributes are unnecessary for quantifying it. Similarly, the Stakeholder Satisfaction attribute is composed of only affected stakeholders; thus, sub-attributes are unnecessary.[21]

C. Application of Risk Quantification Framework

The Settlement Decision further requires that the Risk Quantification Framework use specific methods of applying statistical information. The following statistical concepts are key to understanding the Risk Quantification Framework: (a) risks are evaluated at the "risk level," as defined by the Companies' ERR; (b) each risk is evaluated for annual frequency using the risk quantification method; (c) each risk is evaluated by considering possible consequences attributed to a risk event (rather than specific scenarios); and (d) averages, or expected values, are used for LoRE and CoRE.

To calculate a risk score, there are four basic steps. First, estimate the frequency of a risk event occurring in a given year and set the LoRE to this value. If the frequency is estimated to

[21] For further detail regarding the Stakeholder Satisfaction attribute, *see* III.E.4 below.

be less than one per year, the frequency is put into decimal form. Second, estimate the average consequence for each attribute and sub-attribute based on the range of known possible consequences. Third, use the Risk Quantification Framework to obtain a single consequence value known as the CoRE. Finally, multiply the LoRE and the CoRE to calculate the risk score. To ease readability, the risk score is multiplied by 100,000, then rounded to the nearest whole number, or decimal, if less than 1.

D. Hypothetical Example Of Risk Score Calculation Using The Risk Quantification Framework

The following example will follow steps 1 - 4 shown above. All values in this example are illustrative and not representative of a specific risk.

Example: Risk XYZ

Step 1: Estimate LoRE. Internal and external data suggest that Risk XYZ will have an average of 12 risk events per year.

Step 2: Estimate consequences of attributes. Internal and external data suggest that if a risk event were to occur for Risk XYZ, the consequences would average as follows:

a. Fatalities: 0.02 (*i.e.*, 1 fatality for every 50 risk events)

b. Serious Injuries: 0.1 (*i.e.*, 1 serious injury for every 10 risk events)

c. Gas Meters: 0 meters

d. Gas Curtailment: 0 curtailment

e. SAIDI: 0 minutes

f. SAIFI: 0 outages

g. Financial: $1.5 million from damage to property

h. Stakeholder Satisfaction: 5 points from customer

Step 3: Estimate CoRE. Each of the estimates for each attribute/sub-attribute in Step 2 is used to generate top-level attribute scores. Those scores are then used to estimate a CoRE. The values from Step 2 are shown below in boldface type.

a. Safety Index: (Fatalities x 1) + (Serious Injuries x 0.25) = (**0.02** x 1) + (**0.1** x 0.25) = 0.045

b. Reliability Index: 0

c. Financial: **$1.5 million**

d. Stakeholder Satisfaction: **5**

e. CoRE $= \frac{Safety\ Index}{20}\ x\ 60\% + \frac{Reliability\ Index}{1}\ x\ 23\% +$

$\frac{Financial}{\$500M}\ x\ 15\% + \frac{Stakeholder\ Satisfaction}{100}\ x\ 2\% = \frac{0.045}{20}\ x\ 60\% +$

$\frac{0}{1}\ x\ 23\% + \frac{1.5M}{\$500M}\ x\ 15\% + \frac{5}{100}\ x\ 2\% = 0.0028$

Step 4: Calculate Risk Score. Multiply LoRE x CoRE x 100,000 and round to nearest whole number. From step 1, LoRE = 12, from step 3, CoRE = 0.0028. Risk Score = 12 x 0.0028 x 100,000 = 3,360. The Risk Score of Risk XYZ is 3,360.

III. MAVF CONSTRUCTION AND COMPONENTS

Under the Settlement Decision, each utility is required to create a multi-attribute value function that will be used in the RAMP Report for risk scoring.[22] As stated above, the MAVF is a tool for combining potential consequences of the occurrence of a risk event to create a measurement of value. This section provides a detailed description of the construction of SoCalGas and SDG&E's MAVF, including: (1) the determination of attributes, (2) the determination of scales of attributes, (3) the determination of weights of attributes, (4) how attributes were implemented, (5) details on each of the particular attributes (Safety, Reliability, Financial, Stakeholder Satisfaction), and (6) the probabilistic aspects of the MAVF.

The Companies' MAVF construction followed the steps outlined in the Settlement Decision.[23] The process of creating the MAVF is complex and should be considered a non-perfect method to enable the comparison of diverse utility risks. The complex and multilayered process to determine an effective quantitative risk methodology to enable the comparison of a broad range of risks is iterative and continually evolving, and the value functions presented in this RAMP Report should be considered in that vein. It is important to note that the construction of the MAVF discussed herein was a single effort undertaken for both SoCalGas and SDG&E. The attributes, scales, and weighting of attributes in the MAVF were determined collectively for both Companies, given the Companies' shared assets (*e.g.*, the natural gas distribution system and IT infrastructure).

[22] *Id.* at Attachment A, A-5 – A-6 (Step 1A).

[23] *Id.*

A. Determination Of Attributes

An attribute, as defined by the Settlement Decision, is "an observable aspect of a risky situation that has value or reflects a utility objective, such as safety or reliability. Changes in the levels of attributes are used to determine the consequences of a Risk Event."[24] Following this MAVF principle (principle 1), the Companies considered a large number of attributes for the Risk Quantification Framework. The method of attribute inclusion was: (a) create a list of potential attributes (this list was a composite of attributes from various sources such as current attributes, those discussed at CPUC workshops, potential attributes as proposed through the inquiry of internal subject matter experts (SMEs), and researching external entities); and (b) determine the ability to include such attributes by considering availability of data, consistency of data, commonality of the attribute across risks, and complications arising from their inclusion, among others. The attributes included in this RAMP Report are not meant to represent all dimensions of risk management that occur at the Companies but are useful for the purposes of this filing, namely, to create estimated risk quantification that can assist in decision-making.

Like all aspects of the utilities' Risk Quantification Framework, the attributes used, and how they are weighted, will continue to evolve over time. The version of the Risk Quantification Framework that is presented in the RAMP filing is not intended as a final effort, but rather the current version that will undergo improvements through lessons learned and input received from various sources.

Despite thorough consideration, the Companies did not include an environmental attribute in this cycle's Risk Quantification Framework. The Companies are focused on environmental impacts and thoughtfully consider how to reduce those impacts; however, for the purposes of quantification, the Companies were unable to determine how to express an environmental attribute that would enable meaningful comparison of utility risks while meeting the standards of the Settlement Decision. There are several dimensions of impacts related to the environment, including impacts to water, soil, air, species, and cultural. Within those dimensions, there are numerous sub-dimensions. For example, air pollution can take many

[24] *Id.* at Attachment A, A-2.

forms, such as greenhouse gas (GHG) emissions and near-ground pollution, including exhaust from vehicles and sources that have a local impact to air quality.

In addition to the various challenges related to the scope and impacts of the environmental attributes, it is also difficult to define relative weights between each of these environmental impacts. The difficulty becomes exacerbated by the sheer number of dimensions involved. The relative weights between each of them are convoluted and contradictory. The Companies will continue to review academic and governmental research regarding the impact levels of these environmental dimensions and may include updates in future Risk Quantification Frameworks. Although the Companies were unable to include an attribute specifically addressing environmental impacts for this RAMP Report, the Risk Quantification Framework does include "Acres Burned" in the Safety attribute for SDG&E to account for the detrimental impacts from pollution to human health. On a related note, the Companies discuss their dedication to environmental concerns in SoCalGas's Energy Resilience CFF (SCG-CFF-2) and SDG&E's Climate Change Adaptation, Energy System Resilience, and Greenhouse Gas Emission Reductions CFF (SDG&E-CFF-2).

Future versions of the Risk Quantification Framework may be designed with the goal of expanding and refining the number of attributes and sub-attributes in line with other key parameters used in day-to-day decision making.

B. Scales Of Attributes

The Settlement Decision directs the utility to construct a scale that converts the range of natural units to scaled units.[25] While the notion of applying scales for attributes appears to be straightforward, there are many aspects to consider, especially when applying the next step of assigning weights to each scale. The Settlement Decision states that the top of the scale approximates the maximum expected results for a risk. However, the Settlement Decision also requires expected values to be used. Expected values have very different "maximum expected results" depending on each scenario used. For example, a plane crash might lead to a few hundred deaths, but the annual expected value of fatalities for a particular airline in a given year is something far less. The Companies exercised their discretion to make a reasoned decision in choosing the top end of the scales for the attributes because not all risk scenarios involving a

[25] *Id.* at Attachment A, A-5 – A-6 (Step 1A).

particular risk yield the same maximum expected results. As discussed in the "Weights of Attributes" section below, scales and weights are strongly connected.

C. Weights Of Attributes

1. Quantitative Notes on Weights

The weight applied to each attribute is an important step in determining risk scores. Different weights can lead to different rankings of those risks. Below is a simplified, illustrative example of sample risks that show how weights can alter results.

Table 5: Illustrative Example of Weighting

	Safety Score	Financial Score	Risk Score Method 1: Safety: 90% Weight Financial: 10% Weight	Risk Score Method 2: Safety: 50% Weight Financial: 50% Weight
Risk A	0.5	0.2	4700	3500
Risk B	0.2	0.6	2400	4000

In Table 5 above, Risk A has a risk score nearly twice as large as Risk B (4700 compared with 2400) using Method 1 (90% Safety and 10% Financial), but it has a lower risk score using Method 2. This is because Risk A has more Safety risk relative to Risk B, and a weighting that favors Safety would therefore favor Risk A. This example illustrates that choosing weights can have a significant impact on the scoring that follows. The Companies are aware that the choice of weights is not perfect for all situations; therefore, scores should be thought of as estimates, rather than precise values.

2. Methodology for Determining Weights

The Settlement Decision requires that the Safety Attribute of the MAVF have a minimum weight of 40%.[26] Other than that safety minimum weight requirement, the Settlement Decision gives utilities the discretion to select weights through their own internal processes. The Companies' main method for determining weights for the Risk Quantification Framework considered alignment with the Companies' Enterprise Risk Management (ERM) ERR process (described in RAMP B). Using the ERR as a starting point, initial weights were identified and considered for use in the RAMP Report. Although the ERR is more of a qualitative than quantitative view of risk, it can lend itself to numerical comparisons. In addition, an industry-leading reliability study that comments on financial equivalences with reliability was considered

[26] D.18-12-014, Ordering Paragraph 2 at 67-68.

in the creation of the Risk Quantification Framework weights.[27] The Lawrence Berkeley study considers the amount of financial loss to customers due to loss of electric power. As mentioned in more detail below, because every electric outage is unique, the study is used as a guide rather than as a source of precise equivalences. While there is not an equivalent reliability study available that is specific to financial loss to customers due to loss of natural gas, the findings in the study can be extrapolated to generally apply to all utility customers.

The use of the ERR and the reliability study led to a rough approximation of how weights might look across all four attributes. Draft versions of the scales and weights were created and run through a series of real-world events to check the results for reasonableness. Adjustments were made after the reasonableness test runs and results were internally discussed. During the internal testing and discussions, it became clear that no set of scales and weights would lead to expected results for all situations. More refinements were made, and this RAMP Report utilized a set of scales and weights that may reflect an amalgam of SME and external source views.

To summarize how weights were attained for the Risk Quantification Framework, the Companies reconciled different values and data points and considered: a) the current ERR framework, b) an electric reliability study, c) a historical comparison of gas and electric reliability impacts to society, d) scenario testing, e) input from ERM staff and leadership, f) research into other utilities and industries, g) input from personnel of varying levels (including officers) at the Companies, and h) use of rounded numbers for readability.

3. Observations when Determining Weights

This section discusses several issues the Companies encountered when determining the final weights to use for the Risk Quantification Framework.

The Risk Quantification Framework uses four attributes – safety, reliability, financial and stakeholder satisfaction. In an ideal world, the relationship between each of the four pairwise combinations (*i.e.*, reliability vs. safety, safety vs. financial, and financial vs. reliability, stakeholder satisfaction vs. reliability, financial vs. stakeholder satisfaction and safety vs. stakeholder satisfaction) would be consistent. In mathematics, the transitive property is commonly stated as "If a=b and b=c, then a=c." For multi-attribute value functions, however,

---

[27] *See* Ernest Orlando Lawrence Berkeley National Laboratory, *Estimated Value of Service Reliability for Electric Utility Customers in the United States* (June 2009) (Lawrence Berkeley study), *available at https://certs.lbl.gov/sites/default/files/lbnl-2132e.pdf.*

the transitive property is less clear. As noted above, for electric reliability, the Lawrence Berkeley study was used as a starting point to compare reliability to financial. Using that data, a blackout occurring across SDG&E's service territory for eight hours would have a financial impact to SDG&E's customers of over $1 billion. This estimate created one pairwise combination of the attributes (reliability vs. financial). Separately, a hypothetical question was posed to determine another pairwise combination (reliability vs. safety): "Which risk event would you least like to happen, a systemwide blackout for eight hours that harms no one or a safety incident at a substation that results in an employee fatality?" The Companies prioritized the elimination of the safety incident. With the two pairwise comparisons developed, the transitive property could be applied to derive the third and fourth pairwise comparison. When doing so, the third pairwise comparison (safety vs. financial) did not follow the first two pairwise comparisons and, thus, led to unhelpful values for the remaining pairwise comparisons.

In the illustrative example mentioned above, when an eight-hour systemwide outage is considered equal to a $1 billion financial loss, and the utility prefers to have an eight-hour systemwide outage versus the fatality of an employee, it could lead to the conclusion that the utility believes lives to be valued above $1 billion. This example highlights the complexity of creating multi-attribute value functions that have non-transitive pairwise comparisons.

Another issue is that the Companies are not accustomed to quantifying the value (financially or otherwise) of preventing safety incidents. Safety is a priority at the Companies as well as a reflection of our culture and the Companies' core values. Attempting to find pairwise comparisons with safety and other attributes can be difficult – especially at workplaces that hold safety to be non-negotiable.

Another concept observed during the creation of the Risk Quantification Framework relates to comparing the value of preventing an incident versus the value of remediating the impact if the incident were to happen. For example, if an employee becomes injured on the job, it might take some amount of financial effort and Human Resource involvement to make sure the employee is taken care of and that the employee's group has a trained person to temporarily fill the role. The value of trying to prevent the event is not equal to the value of the expected remediation costs.

D. Attribute Units

The Settlement Decision contemplates expression of attributes in "natural units."[28] The natural unit of an attribute is defined as follows:

> [T]he way the level of an attribute is measured or expressed. For example, the natural unit of a financial attribute may be dollars. Natural units are chosen for convenience and ease of communication and are distinct from scaled units.[29]

The top-level attributes of safety and reliability comprise sub-attributes that are used to create Safety and Reliability indices, respectively. The Safety Index has two sub-attributes, while the Reliability Index has four sub-attributes. The measurement units chosen to represent the natural units for the sub-attributes are shown in Table 6 below. The sub-attributes within safety and reliability are used to create an index for the top-level attribute.

Table 6: Attributes

Attribute	Sub-Attribute	Measurement Unit
Safety	Fatality	Number of Fatalities
Safety	Serious Injury	Number of Serious Injuries
Safety	Acres Burned[30]	Numbers of Acres Burned from a Wildfire Involving SDG&E Equipment
Reliability	Gas Meters	Number of Gas Meters Experiencing Outage
Reliability	Gas Curtailment	Volume of Curtailments of Natural Gas exceeding 250 million cubic feet/day
Reliability	Electric SAIDI[31]	System Average Interruption Duration Index (SAIDI)
Reliability	Electric SAIFI[32]	System Average Interruption Frequency Index (SAIFI)
Stakeholder Satisfaction	Stakeholders Satisfaction Index	Five sub-attributes measuring the satisfaction of the five stakeholder groups (customer, public, employee, government, and regulators)

[28] D.18-12-014 at Attachment A, A-3.

[29] *Id.*

[30] Applicable to SDG&E only.

[31] Applicable to SDG&E only.

[32] Applicable to SDG&E only.

E. Details On Particular Attributes

1. Safety Attribute

The Safety attribute consists of a Safety Index, which is calculated by assessing its two sub-attributes for every risk except Wildfire Involving SDG&E Equipment, which takes into account the additional sub-attribute of Acres Burned. SDG&E explored the defensible notion that wildfires, which result in a significant number of acres burned, have a safety impact on the general population.[33] The Company sought to capture this impact; therefore, it included this specific sub-attribute for the Wildfire risk only. The sub-attributes included are related to data that is readily available. The relative value between Fatalities and Serious Injuries is derived from information provided through the Occupational Health & Safety Administration (OSHA) and the Federal Aviation Administration (FAA).[34] Fatalities each receive a score of one, and Serious Injuries receive a score of 0.25 each. A Serious Injury is generally defined as an event that requires hospitalization or a permanent disfigurement of an individual.[35] The sum of these three sub-attributes, where applicable, create the Safety Index, which is then used as a top-level attribute in the Risk Quantification Framework.

Table 7: Safety Attributes

Safety Sub-Attribute	Value
Fatality	1
Serious Injury	0.25
Acres Burned[36]	0.00005

In the RAMP Report, safety impacts are indifferent to: (a) the cause or reason for the event that results in safety impact, (b) the characteristics of those affected, (c) the perceived fault

---

[33] *See* ScienceDirect, *Quantification of pollutants emitted from very large wildland fires in Southern California, USA* (June 2006), *available at* doi:10.1016/j.atmosenv.2006.02.016; *see also Transportation Benefit-Cost Analysis, available at* http://bca.transportationeconomics.org/.

[34] *See* United States Department of Labor, *Severe Injury Reports*, *available at https://www.osha.gov/severeinjury/*; *see also* United States Department of Labor, *Reports of Fatalities and Catastrophes – Archive*, *available at https://www.osha.gov/fatalities/reports/archive*; *see also* Federal Aviation Administration, *Data & Research, available at https://www.faa.gov/data_research*.

[35] Title 8 California Code of Regulations § 330(h).

[36] Applicable to SDG&E only.

of the utilities or others, (d) the mitigating or aggravating circumstances related to any impacted person's situation, and (e) other such concerns.

2. Reliability Attribute

The Reliability attribute comprises a Reliability Index that consists of two equally weighted sub-attributes for SoCalGas and four for SDG&E. The sub-attributes with their Natural Units (Measurement Units) are shown in Table 8 below. The Reliability Index shown below is structured similarly to the overall Risk Quantification Framework and contains attributes, scales, and weights.

Table 8: Reliability Attributes for SDG&E

Reliability Sub-Attribute	Measurement Unit	Scale	Weight
Gas Meters	Number of Gas Meters Experiencing Outage	0 – 50,000 meters	25%
Gas Curtailment	Volume of Curtailments of Natural Gas exceeding 80 million cubic feet/day	0 – 250 MMcf	25%
Electric SAIDI	System Average Interruption Duration Index (SAIDI) minutes	0 – 100 minutes	25%
Electric SAIFI	System Average Interruption Frequency Index (SAIFI) outages	0 – 1 outage	25%

Table 9: Reliability Attributes for SoCalGas

Reliability Sub-Attribute	Measurement Unit	Scale	Weight
Gas Meters	Number of Gas Meters Experiencing Outage	0 – 100,000 meters	50%
Gas Curtailment	Volume of Curtailments of Natural Gas exceeding 250 million cubic feet/day	0 – 666 MMcf	50%

The Settlement Decision requires a utility to identify relative weights between sub-attributes like gas and electric reliability. Relating the gas sub-attributes to electric reliability is difficult, however, there is little industry consensus on how to do so. The rationale for the scales/weights used for the reliability attributes was therefore based on a combination of external information and internal SME judgment. "Worst case" scenarios that have occurred involving gas and electric outages were used to consider the impact from gas and electric reliability. In

1994, the Northridge earthquake affected tens of thousands of gas customers, and the Pacific Southwest blackout of 2011 affected all SDG&E's customers for several hours. As recent as 2018, the Montecito Mudslides affected thousands of gas customers. The Companies' SMEs reasoned that the respective impacts of these events could be used as a baseline to create the sub-attribute scales with the Northridge gas event approximately equaling 200 minutes of a system-wide SDG&E blackout.

The gas reliability sub-attribute of Gas Curtailment is an innovative measurement, one that the Companies believe can be useful in describing the impact to customers and society. For various reasons – such as when there is a disturbance with a major gas transmission pipeline and a coincident high demand for natural gas – there are situations when natural gas service needs to be curtailed to non-core customers. The order in which curtailments are undertaken is systematic, with a goal to prevent severe disruptions to the community. However, when large curtailments are necessary, the impact to the greater community can eventually be felt. The Companies strive to prevent all curtailments, especially those that require curtailing over 250MMcfd at SoCalGas or 80MMcfd at SDG&E. Curtailments at that higher level can impact critical infrastructure such as electric generation, major industries, and hospitals. The use of this sub-attribute helps to value the importance of keeping curtailments limited in size and duration.

In addition to considering previous historical events to estimate the potential impact of a risk event to reliability, SoCalGas and SDG&E utilized subject matter expertise. In particular, SMEs considered the probability and impact of several events occurring at once across multiple operating groups like Distribution and Transmission or Transmission and Storage. Lastly, the Companies examined peak day usages and the occurrence of critical infrastructure impacts to produce a more realistic reliability attribute both in terms of meter outages and gas curtailment.

Valuing electric reliability is a complex endeavor but requires a simplified view for the purposes of the RAMP Report. To the customer, electric reliability is a composite of at least the following items: a) having electricity when the customer wants it, b) having a high quality of electricity without flicker or dimming, c) having power restored quickly if an outage occurs, and d) having access to information about when power will be restored.

The Institute of Electrical and Electronics Engineers (IEEE) has been viewed as a leader on topics related to electric reliability. IEEE publishes a document, known as IEEE 1366-2012, that is considered the industry "best practice" for how to measure electric reliability. The IEEE

1366-2012 has twelve distinct measurements that utilities can use to express reliability, and some of those measurements have sub-measurements providing essentially infinite combinations of measurements. For example, one measurement indicates the number of customers who experience a certain number of outages in a year. That measurement can be used to evaluate customers who experience one outage, or three outages, or seven outages, and so on. The large number of possibilities of measurements is indicative of how complex the subject can be.

Within its electric reliability group, SDG&E has considered at least eight different measurements in the past few years to internally measure its reliability (SAIDI, SAIFI, Worst Circuit SAIDI, Worst Circuit SAIFI, MAIFI, CAIDI, SAIDET, and ERT).[37] For the Risk Quantification Framework, SAIDI and SAIFI were the sole indices used due to their widespread industry usage and their relative ease of use from a forecasting perspective. Future versions of the Risk Quantification Framework may include additional methods of valuing electric and gas reliability.

The electric reliability sub-attribute of Electric SAIDI measures the average duration of service loss for each utility's electric meters over the span of a year. SAIDI is a widely used index in the electric utility industry and is frequently used to compare utilities' performance. This index does not distinguish between the type of customer or the time of day of an electric outage.

The electric reliability sub-attribute of Electric SAIFI measures the average number of outages that each utility's electric meters experiences over the span of a year. This index does not distinguish between the type of customer or the time of day of an electric outage. For example, a SAIFI value of 0.8, means that, on average, 80% of customers served by the utility experienced an outage during a calendar year. But because SAIFI measures averages, using SAIFI alone is not enough to ascertain how many different customers experienced outages. If a utility had 100,000 meters, a SAIFI value of 0.8 could mean that 80,000 meters experienced one outage during one calendar year, or it could mean that 40,000 meters experienced two outages during one calendar year.

There is significant complexity when trying to determine appropriate scales and weights to SAIDI and SAIFI in the Risk Quantification Framework. Different outages have different

[37] MAIFI: Momentary Average Interruption Frequency Index; CAIDI: Customer Average Interruption Duration Index; SAIDET: SAIDI Exceeding Threshold; ERT: Estimated Restoration Time.

impacts depending on who is affected and when the outage occurred. For example, given a choice between three short outages or one long outage, a small retail store may prefer the shorter outages. Shorter outages may only temporarily affect its sales and not significantly affect its infrastructure. In contrast, a large factory may prefer one long outage, because some machinery may be negatively affected by outages, and having its equipment subjected to multiple outages could be detrimental to the factory's operations. Similarly, the impact of a three-hour electric outage at a residence would be dramatically different while cooking a Thanksgiving feast versus one while everyone at the residence is away from the home.

Although gas and electric sub-attributes give information to help understand levels of reliability risk, in the end, they are merely numbers that tell part of a story. Particularly with reliability, limited data exists to determine the equivalency of gas reliability relative to other attributes, resulting in the need to leverage electric reliability data at this time. Accordingly, there is no single combination of reliability attributes that will give the perfect answer on how to measure risk. The values shown throughout the RAMP Report should be thought of as an approximation of risk rather than a precise value.

3. Financial Attribute

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. However, different types of costs are measured in the attribute. The two general types of costs measured include: societal damage (including physical damages, lost wages, relocation costs, etc.) and utility repair costs (labor, materials). As required by D.16-08-018, the Financial attribute does not include any direct impacts related to shareholder financial interests, such as fines to shareholders, stock price changes, changes in credit ratings, or unrecoverable legal fees.

The quantitative approach used by the Companies considered historical events as a guide for possible future impacts. But precision for the financial attribute is difficult to achieve. Risk events are rarely reported with a single summation of all financial impacts. Depending on the risk event, differing approaches were used to estimate the financial impacts. For pipeline risks, Pipeline and Hazardous Materials Safety Administration (PHMSA) data was used in combination with internal data, but the financial values provided by PHMSA do not necessarily include all financial impacts to society. For electrical outages, estimates were made for the amount of labor and cost of repair.

Financial estimates are gathered from various sources including internal estimates based on claims data or work orders, third party sources, news reporting, among others. Because these data sources rarely include all financial impacts from a risk event, estimates are used.

4. Stakeholder Satisfaction Attribute

In this RAMP cycle, SoCalGas and SDG&E are the first California utilities to implement a fourth attribute – Stakeholder Satisfaction. The Stakeholder Satisfaction attribute is a qualitative approach to measuring changes in satisfaction levels to various stakeholders during and after a risk event. SoCalGas and SDG&E recognize that risk events, whether caused by or involving the Companies, have the potential to affect various stakeholders' satisfaction in varying degrees of severity over varying amounts of time. For example, a pipeline rupture involving fatalities would not only have a direct safety, financial and reliability impact for those involved, but it would be expected to result in a decrease in satisfaction to individuals and groups within the rupture's impact zone. This could result from a loss of service downstream of the rupture or potential mental health issues for individuals that were near the risk event when it occurred. Additionally, with respect to non-customer results, the root cause analysis of an event would likely lead to not only operational changes at the Companies but could even spark new regulations to prevent a similar rupture event from occurring again. The Stakeholder Satisfaction attribute is designed to take into account the above effects of a risk event that are not succinctly delineated by safety, financial and reliability impacts alone.

Table 10 below illustrates the elements that comprise the Stakeholder Satisfaction attribute.

Table 10: Stakeholder Satisfaction Attributes

Stakeholder Sub-Attribute	Value
Stakeholders Affected	0-100 (Up to 20 points for each of the stakeholder groups – customer, public, employee, government, and regulators.

Recognizing the difficulty in measuring any particular individual's or group's satisfaction (as noted above), SoCalGas and SDG&E explored various means to quantify the notion of satisfaction during or after a risk event beyond the safety, financial and reliability impacts. One path explored was measuring the satisfaction to stakeholders through public surveys or polling; however, the determination of pre- and post-activity measurements would require consistency of

individuals and/or groups for each survey or polling, and a measurement after each activity, which could be in the thousands. The Companies determined that this would be too challenging and/or imprecise. Measuring this attribute would be further complicated by the fact that satisfaction varies between individuals and groups.

Ultimately, the Stakeholder Satisfaction attribute was determined through a qualitative assessment of risk events by ERM teams and operational SMEs. This qualitative assessment takes into consideration past events both inside and outside the Companies to determine the potential satisfaction of various stakeholders and appropriately apply that to the RAMP filing in the context of the MAVF.

F. Probabilistic Information

This section will discuss the quantitative methodologies, including statistical information and how computer software was used for this RAMP Report. The Settlement Decision requires utilization of specific quantification methods. Among those methods are the creation of LoRE and CoRE values for each current risk. These two values are then multiplied together to obtain a risk score. Additionally, LoRE and CoRE are used to calculate RSEs by estimating new LoRE and CoRE when risk-reducing activities are introduced or ceased.

1. Expected Values

As mentioned above, LoRE and CoRE utilize expected values. The term "Expected Value" is a statistical term meaning the weighted average. For example, suppose there was a casino game that paid $10 to the player 25% of the time and paid $1 to the player the other 75% of the time. The expected value of this game would $3.25 because $10 * 25% + $1 * 75% = $3.25. The term "Expected Value" is not meant to imply that the Company expects a certain outcome. Note that in the example above, the expected value of $3.25 can never occur, because only the values of $10 and $1 can be paid out. The use of expected values has known limitations in the risk management world, and great care must be taken when reviewing data that solely comprises expected values.

2. Likelihood of Risk Event (LoRE)

In the context of the Settlement Decision, the "Likelihood" is not a true likelihood in the typical statistical or probabilistic sense. In standard mathematics, a likelihood is the probability of an event occurring given a set of conditions (*e.g.*, the chance that a red jellybean is drawn from a jar of jellybeans). These standard probabilities can take a value between 0 and 1, where 0

indicates the event will never occur and 1 indicates the event will always occur. For example, in traditional terms, the probability of flipping a coin and obtaining "tails" is 0.5. The term "frequency," on the other hand, is a statistical term denoting the number of times that an event has or will occur, given a specified time frame. For purposes of the RAMP Report, the annual frequency of an event is used to estimate LoRE. An explanation of why frequency was used rather than likelihood is discussed below.

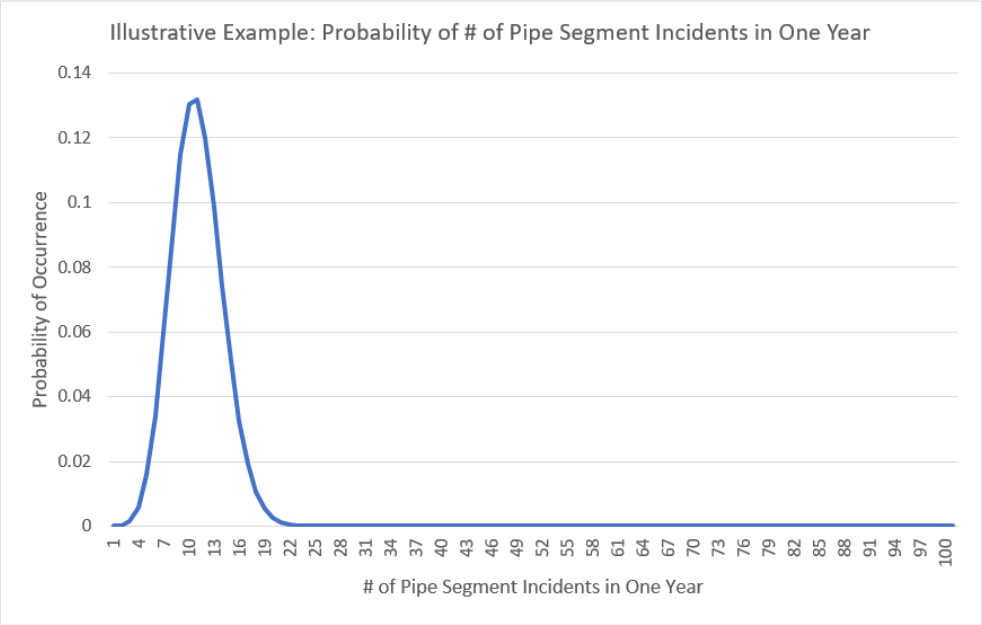
The following is an illustrative example to highlight how frequencies and likelihoods are used in the RAMP Report:

a. Example: Illustrative Gas Risk

The RAMP Report views risks at the "risk-level" over the span of a year. Suppose that a utility has an item in its ERR known as Illustrative Gas Risk. For the RAMP Report, it is necessary to determine the likelihood of that risk occurring each year. In this illustrative example, assume the following:

- The utility uses data to estimate the incident rate.
- The illustrative gas system is composed of 100 pipe segments.
- Each pipe segment has a likelihood of an event of 1/10 over a given year.
- If the pipe segment had an event, the event would cause some amount of safety, reliability, and financial impact to society and to the utility.

From a purely probabilistic point of view, and because LoRE is calculated at the risk-level, the likelihood that at least one pipe segment will have an incident in a given year is quite high (>0.999 or over 99.9%). The graph below shows the probability of the number of incidents, given the assumptions above:



For the RAMP Report, the important concept is not the *likelihood that a pipe segment will have an incident*, but rather, the number of pipe segments that are estimated to have an incident in a year. The likelihood value that is provided is the "Expected Value" of the frequency. In the example above, the expected value of pipe segments that will have an incident in a given year is determined by multiplying the number of pipe segments in the system by the likelihood of a single pipe segment incident occurring: 100 x 1/10 = 10. In this example, the LoRE for this system would be 10, which behaves like an estimated frequency of the number of incidents predicted in a year.

3. Consequence of Risk Event (CoRE)

The CoRE is determined by estimating each of the data points required by the Risk Quantification Framework, as discussed below. Like LoRE, the data points that inform CoRE are also expected values. For example, the number of serious injuries used in the calculations are the expected values of serious injuries if the risk event were to occur. Applying this to one of the RAMP risks, an illustrative example can be found in the SDG&E Employee Safety Risk Chapter (Chapter SDG&E-8), where potential safety consequences can theoretically range from one serious injury to several fatalities. The calculations used in the Risk Quantification Framework for that risk use the expected value of that range. In the case of Employee Safety, the expected value of the safety impact when a risk event occurs is 0.40.

The expected values of each of the nine attributes and sub-attributes are used as inputs into the Risk Quantification Framework to produce a CoRE for each risk. This process was undertaken many times for each risk; once to establish the current risk score, and once for each activity where the estimates of CoRE are performed as if the risk-reducing activity has been implemented, in order to calculate RSEs. As with LoRE, the data used to compute CoRE was a combination of internal data, external data, and/or SME input, depending on the particular risk.

a. Secondary Impacts

The Companies use the term "Secondary Impacts" to distinguish between the impacts that are directly caused by a risk event and the impacts that are "downstream" of the initial risk event. Because each risk has its own definition of a risk event, it is difficult to generalize the difference between the direct impacts and secondary impacts. Table 11 below provides examples, using the Companies' different RAMP risks:

Table 11: Illustrative Examples of Secondary Impacts

	Direct Impact	Secondary Impact
Electric Infrastructure Integrity	Person hurt due to touching fallen electrical wire	Vehicle driver failing to stop at traffic light that is not operating properly during electrical outage
Medium Pressure Gas Incident	Person hurt due to gas explosion	Customer experiencing gas outage decides to cook using a charcoal barbecue and is accidentally injured
Cybersecurity	Intruder uses remote attack to overload transformer, which subsequently explodes and harms individuals	Intruder uses remote attack to steal financial information from utility customer, which leads to additional downstream financial harm to customer

Secondary impacts are generally not used in risk scoring in this RAMP Report because they are difficult to estimate and track and are not always controllable by the Companies. Data sources used for risk assessments do not consistently track secondary impacts, if tracked at all. Secondary impacts will rarely be a large driver of risk scores, even if the data was well collected. One illustrative example mentioned earlier - large electrical outages that span entire cities - could have secondary impacts, but the documented history of such events lacks sufficient data to measure that risk. SDG&E experienced a systemwide blackout in 2011 due to electrical problems outside of its service territory. The blackout caused outages in all of San Diego and

Imperial counties, as well as parts of Orange County and western Arizona. The outage in SDG&E's service territory lasted nearly twelve hours, with the average customer without power for over eight hours. During that time, safety-related incidents were reported. It is clear that undesirable outcomes can occur in large electric or gas outages, but the available data is not conducive to determining expected values of impact. In future years, there may be more opportunities to determine how to effectively incorporate secondary impact information as part of risk assessments.

4. Modeling

Computer software was used for many quantitative aspects of the RAMP Report. The primary software applications used by the Companies were Microsoft Excel, Visual Basic, and @Risk. Additional work was also done with Microsoft Access, R, and Python.

Monte Carlo simulations were performed on risks. Monte Carlo analysis is a technique used to understand the impact of uncertainty related to a particular risk. Although the Settlement Decision does not specify that Monte Carlo simulations are necessary, the modeling assisted in several ways that bolstered the analysis and occasionally informed critical elements. Throughout the individual risk chapters, analytical methods are discussed, including the extent of modeling.

One of the benefits of modeling is that it can be used to demonstrate a range of outcomes that might be observed, given a set of inputs. When trying to identify ranges of outcomes or their certainty, performing Monte Carlo modeling can be easier to implement than precise statistical equations.

Considering consequence ranges is an important part of risk analysis. Consider two risks, both with an expected value of a $10 million loss, but with very different consequence ranges. Suppose Risk A rarely occurs, but when it does, it can require $1 billion of reparations; but, assuming it is a 1/100-year event, its expected value is $10 million ($1 billion x 1/100). Risk B has risk events that occur several times a year and the annual financial impact varies only slightly from $8 million to $12 million, with an expected value of $10 million. Certain stakeholders may be interested to know that, despite having similar expected values, the risks have very different consequences. Creating ranges of outcomes, whether through Monte Carlo modeling or pure statistical approaches, can illuminate differences in risks.

IV. RISK SPEND EFFICIENCIES

This section addresses how RSEs are calculated in this 2021 RAMP Report. RSEs are numerical values that attempt to portray changes in risk scores per dollar spent. The change in a risk score is one data point that can help to inform decision-making and can be due to: (a) the amount of risk reduction when a new activity is completed, or (b) the amount of risk increase if a currently on-going activity is ceased.[38] The overall guiding principle of an RSE is that it presents the difference between the risk score over a certain span of time if the activity is undertaken versus if the activity is not undertaken. However, as discussed further in sections above and below, these data points should be viewed critically. This section: (1) illustrates how RSEs are created, with examples of RSEs for both Controls and Mitigations, (2) explains how benefits over time are treated, and (3) explains the challenges presented by RSEs.

A. Determining Risk Spend Efficiencies

As discussed in the section above, each risk has a risk score, calculated using the Risk Quantification Framework. The risk score that is developed is meant to represent the current risk situation. The current situation for each risk attempts to consider existing activities (known as Controls), current work standards, and all other current characteristics, such as asset conditions, environmental conditions, etc. A risk score is calculated by multiplying the LoRE and CoRE. The risk score that results from using the Risk Quantification Framework is the baseline used when calculating RSEs. Next, a second estimate for LoRE and CoRE that considers a change in a risk-reducing activity is estimated. For Mitigations, the second LoRE and CoRE are estimated assuming the new activity is in place. For Controls, the second LoRE and CoRE reflect the estimated risk if the activity is ceased.

For purposes of this RAMP Report, the terms "pre-mitigation LoRE"[39] and "pre-mitigation CoRE" refer to the estimated risk values given current situations. The terms "post-mitigation LoRE" and "post-mitigation CoRE" refer to the estimated risk values if an activity is

---

[38] It should be noted that, in reality, risk reductions could be the result of other activities that have a positive effect, the improvement of industry-wide data, or other factors not necessarily tied to the mitigation itself.

[39] The terms "pre-mitigation" and "post-mitigation" used herein (and referenced in the Settlement Decision) are not intended to suggest that all activities are Mitigations (*i.e.*, this terminology also applies to Controls).

ceased or a new activity is undertaken. The same terminology applies to the Risk Scores, which are the product of LoRE multiplied by CoRE. In short:

$$pre-mitigation\ risk\ score = (pre-mitigation\ LoRE)\ x\ (pre-mitigation\ CoRE)$$

And

$$post-mitigation\ risk\ score = (post-mitigation\ LoRE)\ x\ (post-mitigation\ CoRE)$$

The RSE is the ratio between the pre-mitigation and post-mitigation risk scores divided by the cost. In its most simplistic form, the equation is:

$$simplified\ RSE = \frac{(pre-mitigation\ risk\ score) - (post-mitigation\ risk\ score)}{\$\ cost\ of\ activity}$$

1. Illustrative Examples

Illustrative Example (One Year Mitigation)

The following is a more thorough example of a one-year mitigation. Suppose there is a risk in one Company's ERR, known as Risk X, which has been assessed using the Risk Quantification Framework. Suppose the assessment generated an assumption that a risk event related to Risk X would occur four times a year. Further, the assessment considered the potential consequences when the risk events occur. Assume, for this example, that when a risk event occurs, the assessment, consistent with methods described above, estimates a 1/10 chance that there will be four serious injuries, no reliability consequence, an average financial consequence of $15 million to repair damage to equipment, and a statewide satisfaction score of 5.

Step 1: The first step is to formulate the pre-mitigation LoRE and CoRE. In this example, LoRE is four, because the LoRE is the average annual frequency. To determine CoRE, the Risk Quantification Framework is applied. Key parameters from the Risk Quantification Framework discussed in the section above are in the following table:

Table 12: Risk Quantification Framework[40]

Attribute	Measurement Unit[41]	Scale	Weight
Safety	Safety Index	0 – 20	60%
Reliability	Reliability Index	0 – 1	23%
Financial	$	$0 - $500M	15%
Stakeholder Satisfaction	Satisfaction Index	0-100	2%

Step 2: Applying the formula explained in the section above, CoRE could be calculated as:

$$CoRE = \left[\frac{0.1}{20}\right] x\ 60\% + \left[\frac{0}{1}\right] x\ 23\% + \left[\frac{\$5}{\$500}\right] x\ 15\% + \left[\frac{5}{100}\right] x\ 2\% = .0055$$

Step 3: The final step is to multiply by 100,000, as discussed above, for readability purposes. Therefore, the pre-mitigation risk score is:

$$Risk\ Score = LoRE\ x\ CoRE\ x\ 100{,}000 = 4\ x\ .0055\ x\ 100{,}000 = 2{,}200$$

Suppose now that there is a proposed activity that will help reduce risk associated to Risk X. Perhaps the activity is replacing older equipment with newer equipment. Assume that, based upon data, it is estimated that undertaking the proposed activity will reduce the likelihood of Risk X occurring by 25%. In this example, the LoRE would therefore change from four to three. This activity, however, is not believed to affect the consequence if the risk event were to occur, so the CoRE stays the same.

Therefore, the post-mitigation risk score would be:

$$\begin{aligned} &post - mitigation\ risk\ score \\ &\quad = (post - mitigation\ LoRE)\ x\ (post - mitigation\ CoRE)\ x\ 100{,}000 \\ &\quad = 3\ x\ .0055\ x\ 100{,}000 = 1{,}650 \end{aligned}$$

[40] As discussed in the section above, because of the wide range of possible choices available to each utility in assigning attributes, weights, scales, and other variables chosen through implementing the Settlement Decision, the Companies provide a range of scoring, based upon two additional alternative Risk Quantification Framework methods.

[41] "Measurement Unit" as used herein is the measured attribute, also analogous to "Natural Unit" per the Settlement Decision Lexicon included in D.18-12-014 at Attachment A, A-3.

Suppose the useful life of this activity is for one year, and that it costs $10 million to perform. The RSE calculation would therefore be:

$$RSE = \frac{(pre-mitigation\ risk\ score) - (post-mitigation\ risk\ score)}{\$10M} = \frac{2200-1650}{\$10M}$$
$$= \frac{550}{\$10M} = 55$$

Illustrative Example (One Year Control)

A similar process is used when Control activities are considered. One important distinction for such situations is that, in the RAMP Reports, when considering the change in risk score if a control were no longer in place, the difference between the pre-mitigation risk score and the post-mitigation risk score will still be shown as a positive number because the cost of the activity in the denominator would be savings. For consistency, in the RAMP Reports, both the numerator and the denominator will be shown as positive numbers.

Suppose there is a risk in a Company's ERR known as Risk ABC and this risk has been assessed using the Risk Quantification Framework. Suppose the assessment led to the estimate that a risk event related to Risk ABC would occur once every five years. Further, the assessment estimated the consequences to be two fatalities, no reliability consequence, an average financial consequence of $50 million to repair and replace equipment damaged by the event, and a stakeholder satisfaction score of 2.

The first step is to formulate the pre-mitigation LoRE and CoRE. In this example, LoRE is 1/5 or 0.2. To determine CoRE, the Risk Quantification Framework is applied as follows:

$$CoRE = \left[\frac{2}{20}\right] x\ 60\% + \left[\frac{0}{1}\right] x\ 23\% + \left[\frac{\$50}{\$500}\right] x\ 15\% + \left[\frac{2}{100}\right] x\ 2\% = .0754$$

For readability purposes, the utilities multiply these small decimal numbers by 100,000. Therefore, the pre-mitigation risk score is:

$$Risk\ Score = LoRE\ x\ CoRE\ x\ 100{,}000 = 0.2\ x\ .0754\ x\ 100{,}000 = 1{,}508$$

Suppose there is an activity that contributes to the risk score as it stands currently. Further, suppose there is a proposal to alter the activity in some way, such as changing the frequency of inspection. An example might be to stop a Quality Assurance program. Lastly, assume that based upon available data and subject matter expertise, it is believed that the

likelihood of the risk event will be increased by 10% and save $25 million. In this example, the LoRE would therefore change from 0.2 to 0.22 (*i.e.*, 10% more than 0.2 is 0.22). Ceasing this activity is not believed to affect the consequence if the risk event were to occur, so the CoRE stays the same.

Therefore, the post-mitigation risk score would be:

$$post - mitigation\ risk\ score = (post - mitigation\ LoRE)\ x\ (post - mitigation\ CoRE)$$
$$= 0.22\ x\ .0754\ x\ 100{,}000 = 1{,}658.8$$

Suppose the useful life of this activity is for one year. The RSE calculation would therefore be:

$$RSE = \frac{(pre - mitigation\ risk\ score) - (post - mitigation\ risk\ score)}{-\$25M}$$
$$= \frac{1508 - 1658.8}{-\$25M} = \frac{-150.8}{-\$25M} = 6.032$$

The Control therefore has an RSE of 6.04.

B. Duration Of Benefits

One of the more nuanced aspects of RSEs is how to address risk-reducing activities that have long-term benefits. The RSE is a comparison between performing an activity versus not performing that activity. In some cases, the implications of an activity have long term effects: pipelines last many years, computer software can be used for several years, etc. To utilize RSEs properly, some consideration needs to be given for the length of time, or duration, of predicted benefits.

A working assumption is that activities involving assets receive benefits for the life of the asset. Other activities, such as training or inspection programs, might have shorter durations of benefits. An illustrative example is a tree trimming program, which will only have a duration of benefits that match the time it takes for a tree to grow back to its former size.

Any activity that has a duration of benefits exceeding one year requires additional data points for the RSE calculation. The Example (One Year Control) above assumes that the activity has a one-year duration of benefits. However, if the assumption increased to three years of benefits, the activity can be considered to affect three years of risk results. The two tables below

illustrate the resulting differences by assuming a duration of benefits for one year versus three years.

Table 13: Example (One Year Control)

	Year				
	2022	**2023**	**2024**	**2025**	**2026**
Risk Score with Activity	980	1078	1078	1078	1078
Risk Score without Activity	1078	1078	1078	1078	1078
Difference	98	0	0	0	0

Table 14: Example (Three Year Control)

	Year				
	2022	**2023**	**2024**	**2025**	**2026**
Risk Score with Activity	980	980	980	1078	1078
Risk Score without Activity	1078	1078	1078	1078	1078
Difference	98	98	98	0	0

As shown in these tables above, the three-year benefit stream provides more value than the one-year benefit stream. The RSE calculation needs to address these differences.

C. Discounting of Benefits

The Settlement Decision allows accounting of long-term benefits of activities but requires an extra step before inclusion into the RSE.[42] The Settlement Decision mandates that future benefits have less value than present benefits. The Companies meet this requirement by applying a "discount" rate to the difference in the risk score. In this RAMP filing, the Companies use a 3% discount rate for purposes of determining the present value of the risk reduction benefits or numerator of the RSE calculation. As shown in the example below, this

[42] D.18-12-014 at Attachment A, A-13 (Risk Spend Efficiency (RSE) Calculation).

discount rate lowers the benefits by 3%, compounded each year. The Companies applied a 3% discount rate based on federal recommendations.[43]

Table 15: Example (Three Year Control)

Year					
	2022	**2023**	**2024**	**2025**	**2026**
Risk Score with Activity	980	980	980	1078	1078
Risk Score without Activity	1078	1078	1078	1078	1078
Difference	98	98	98	0	0
Discounted Difference	98 / (1.03) = 95.1	98 / $(1.03)^2$ = 92.4	98 / $(1.03)^3$ = 89.7	0	0

As shown in the table above, the benefit decreases from 95.1 in the first year to 89.7 in the third year. The term "Present Value" is a financial concept that can also be used when discussing the future benefits of a long-term activity. For the example above, the present value of the benefit in 2022 is 95.1. For activities that have multiple years of benefits, the simplified RSE calculation changes from:

$$RSE = \frac{(pre-mitigation\ risk\ score\ ) - (post-mitigation\ risk\ score\ )}{\$\ of\ activity}$$

to:

$$RSE = \frac{\sum_i^L Present\ Value\ ((pre-mitigation\ risk\ score_i) - (post-mitigation\ risk\ score_i))}{\$\ of\ activity}$$

where *i* is the year of the project, and *L* is the duration of benefits measured in years.

D. Discounting of Costs

Similar to the discounting of benefits mentioned in the section above, the Settlement Decision requires that the cost of activities also be discounted. However, in a GRC, the

[43] *See* Centers for Disease Control and Prevention, *Economic Burden of Occupational Fatal Injuries in the United States Based on the Census of Fatal Occupational Injuries, 2003-2010* (August 2017) (citing 1996 recommendation from U.S. Department of Health and Human Services Panel on Cost-Effectiveness in Health and Medicine), available at *https://www.cdc.gov/niosh/data/datasets/sd-1002-2017-0/pdfs/CFOI-CostTables_Methods_DetailedDescription_Final-508*.

Companies present their forecasts in base year,[44] direct constant dollars. The base year for the Companies Test Year 2024 GRC is 2021. While the Companies will be seeking approval for Test Year 2024 forecasts for O&M and 2022-2024 for capital expenditures, all these forecasts will be presented in 2021 constant dollars. These direct dollar forecasts will be converted into an overall revenue requirement through the Results of Operations (RO) model. In this RAMP Report, the Companies are presenting costs in base year, direct constant dollars, consistent with the GRC framework. As of the date of these RAMP filings, the last available year of recorded data is 2020. Accordingly, the Companies used 2020 direct, constant dollars as the basis for these RAMP Reports.

Therefore, for the purposes of the RSE calculation, the costs are effectively already discounted prior to being used in the RSE calculation. Meaning, the cost for activities with multi-year expenditures does not take into account escalation prior to their usage for RSEs. For example, suppose there was a capital project that sought $10 million a year for all three years of the next GRC forecast period (2022 through 2024). In the RAMP and in the GRC, the Companies would present these costs as $10 million for each year, 2022, 2023, and 2024. No escalation is shown for those years; therefore, there is no need to further discount costs shown for years 2023 and 2024. Additional information is provided in Chapter SCG/SDG&E RAMP-E.

E. Application of Risk Spend Efficiencies

The RAMP Report includes 174 activities for SoCalGas and 275 activities for SDG&E. In the RAMP filing, of the total amount of costs discussed, 90% of the SoCalGas costs have RSEs performed, and 89% of the SDG&E costs have RSEs performed. RSEs were calculated for a wide variety of activities, including all in-scope non-mandated activities, certain mandated Controls, and all Mitigations whether they were mandated or not. RSEs were calculated for all non-mandated activities and all new activities.

Despite best efforts, in the development of particular RSEs for the many Mitigations and Controls in this RAMP Report, the Companies discovered that, in certain situations, RSEs could not be reasonably calculated in certain circumstances or were of minimal value. These situations include the following.

[44] The term "base year" refers to the last recorded year available prior to a GRC filing.

RSEs can be difficult to accurately determine where there is mandated work that is difficult to separate from other work. For example, when a particular regulation has been in place for decades, it is difficult to separate how the Control activity implemented to comply with the regulation would impact the likelihoods and consequences of risk events. It is difficult to unravel the value of that Control to determine quantitatively the benefits it currently gives, especially in any meaningful way.

It can also be difficult to calculate an RSE in circumstances where non-risk-reducing activities enable risk-reducing activities. For example, line inspections do not, by themselves, reduce risk directly, but they do provide information to operators and field personnel, which is then used to find appropriate remediations where necessary. Inspections are bundled together with their remediations, when calculating RSEs.

These above challenges are both present in the case of foundational activities. As described in this RAMP Report, foundational activities include activities prudent to the operation of the gas and electric system, where not performing them would not be an option for the Companies. Some examples of foundational activities are purchasing and employing the computers and vehicles that workers use to perform their job functions. It would be exceedingly difficult to determine how an enterprise risk score would change, along with changes to these types of activities.

The calculation of RSEs in this RAMP Report represents the Companies' best efforts and is in compliance with the Settlement Decision. The methodologies and processes herein have advanced the RSEs. As further discussed in section F below, RSEs should be considered as a single data point, rather than the sole source for risk-based decision-making.

F. RSE Shortcomings

Conceptually, RSEs could be a useful tool to assist in decision-making, and SoCalGas and SDG&E generally support their use and refinement. However, since they were first suggested to the Commission, RSEs have had critical shortcomings – shortcomings that continue with their most recent iteration. Because of these deficiencies (both continuing and those more

recently identified), RSEs remain a data point for utilities to consider, but not the deciding factor for mitigation selection.[45] Below (in no particular order) are several of these shortcomings.[46]

Lack of data: The foundation of the RSE process is the availability of broad, accurate data for every risk and mitigation. Without such data, RSEs become drastically devalued by uncertainty. To properly calculate an RSE, as required by the Settlement Decision, there must be a unique measure of the frequency and consequences of a risk, the effects of a mitigation on both the frequency and consequence of a risk, and the cost required to implement the mitigation. The problem is that for many risks and mitigations, such data is scant or incomplete. For example, the Commission requires the Companies to inspect their systems annually, but there has been little data as to how many incidents were avoided through such annual inspections.

Nevertheless, if an anomaly is observed during an inspection, the Companies would respond as needed. While the Companies may capture additional information during an inspection, the data may not always be useful for risk reduction analysis. Therefore, the Companies cannot accurately determine the risk reduction benefit associated with annual inspections at this time. This issue is further complicated where a particular control has been done for decades. All of the utilities and the Commission's staff have acknowledged the challenge with this dearth of data.[47]

Another challenge commonly experienced with data is determining which data is most appropriate. Although utility-specific data is best, it is not always available. For example, for an asset-based risk, the nationally-relied upon data could be based on a utility that had not invested as much in the safety of its infrastructure. But, at the same time, the utility's infrastructure may

---

[45] California Public Utilities Commission, *Risk and Safety Aspects of Risk Assessment and Mitigation Phase Report of Pacific Gas & Electric Company* [PG&E] *Investigation 17-11-003* (March 30, 2018) at 35 (In their review of PG&E's RSE methodology, Safety and Enforcement Division (SED) agreed that RSEs were not the only factor for consideration in selecting mitigations.).

[46] Although the issues discussed in this section were discussed in the last RAMP Reports, they are included here in somewhat streamlined form because they persist.

[47] *See* Investigation (I.)16-10-015/-016 (cons.), *Order Instituting Investigation Into the November 2016 Submission of San Diego Gas & Electric Company's Risk Assessment and Mitigation Phase* (October 27, 2016), I.17-11-003, *Order Instituting Investigation into the November 2017 Submission of Pacific Gas and Electric Company's Risk Assessment and Mitigation Phase* (November 9, 2017), and I.18-11-006, *Order Instituting Investigation into the November 2018 Submission of Southern California Edison Risk Assessment and Mitigation Phase* (November 8, 2018).

be less likely to experience risk events for other reasons, such as population densities, the environment, or other factors. It is difficult to balance all of these factors with precision.

Frequency of Incidents: Related to the previous point, the lack of the availability of data is difficult to overcome in some instances, because of the infrequency of incidents for many risks. This is particularly the case with "tail" risks. Tail risks are those risks that occur very infrequently, finding themselves on the very extreme end of a probability curve (*i.e.*, the "tail"). Understanding the reduction in risk associated with infrequent catastrophic incidents is difficult to determine because of the frequency of events.

Reliance on Subject Matter Experts (SMEs): The lack of available data and frequency of tail risks leads to a reliance on SMEs to assess how much a risk will be reduced by the implementation of a mitigation and requires SMEs to determine whether the available data is appropriate and applicable to our operations. As the Commission's Safety Division has acknowledged, the RSE is a product of SME input.[48] Although SMEs can be a strong source of input, they can benefit from quantitative calibration. It is frequently beneficial to train SMEs how to think quantitatively and to perform "sanity checks" on their input, by considering scenarios to truth test their inputs. As a result, RSEs are subject to the potential issues that can occur when SME input is used without calibration, or without consistent care in how SME input is scrutinized.

Changes Occur: Conditions change over time. Consequences and frequencies of events, priorities for the Commission and utilities, and other important factors in decision-making can change, even within a rate case cycle. As a result, predictive RSEs can be of limited value and fairly speculative. One of the clearest examples of this is found when calculating RSEs for vegetation management mitigations. In such calculations, one cannot reasonably account for changes in growth rates, costs or even fluctuations in weather. The type and growth rate of vegetation can change in an area; unpredicted weather patterns can change the biological and geographical landscape. RSEs can therefore vary widely from forecast to reality. The Commission appears to recognize this, as evidenced by its acknowledgement that utilities require flexibility to adapt to changing conditions and in addressing risk.

---

[48] California Public Utilities Commission, *Risk and Safety Aspects of Risk Assessment and Mitigation Phase Report of San Diego Gas & Electric Company and Southern California Gas Company Investigation* 16-10-015 and I.16-10-016 (March 8, 2017) at 16.

Changing Methodologies and Tools: Comparing past and future RSEs, even from one cycle to the next, is generally of limited value. Changes will occur in methodologies and tools over time. This is recognized in D.18-12-014, which notes that utilities' MAVFs will evolve over time.[49] This evolution can take many forms. It can result from simply refining data, but wholesale changes to the structure of the Companies' Risk Quantification Framework may also occur. As a basic example, in this RAMP cycle, the Companies have added a fourth attribute and a sub-attribute for SDG&E's reliability MAVF. These and future changes make comparing RSEs across cycles of limited value. These and future changes make comparing RSEs across rate case cycles of limited value.

Non-RSE Factors: Perhaps one of the most critical shortcomings of RSEs is that there is much they do not capture. The methodologies for determining RSEs do not take into consideration all the factors that go into the decision to select a mitigation. For example, if a utility intends to replace a bare wire conductor with insulated conductor, the RSE calculation will consider the risk reduction achieved by installing the new conductor and the cost of the new conductor. While factors such as resource availability, permitting requirements, and changing climate conditions are not considered within the RSE calculation, these factors are certainly taken into consideration for decision-making purposes. Similarly, certain human factor benefits, such as those related to training and communicating with the public, are not easily captured as part of the RSE calculation.

RSEs Cannot Be Compared Across Utilities: RSEs cannot be compared in a meaningful way across utilities. Although the Commission and Intervenors have previously expressed a desire for RSE comparability across utilities on similar risks or mitigations, that is not possible at this time.[50] Each of the utilities use different formulas and methodologies in calculating RSEs. Each utility might use different attributes, different weights and scaling, and even different frequency and consequence valuations.

Lack of Common View of Risk Tolerance: There is no shared viewpoint on risk tolerance. The Commission's Safety Division, individual intervenors, and a utility may have different views regarding the permissible number of incidents on a particular system. Some

[49] D.18-12-014 at 54.

[50] *See* D.16-08-018 at 164.

might say they want zero incidents while others may say there should be no incidents beyond a certain size. These varying tolerances lead to different mitigations and RSEs. In addition, certain outcomes may be a higher priority to avoid because of their cause – but RSEs cannot capture that type of preference. As noted in RAMP-E, the Commission is considering whether to adopt a risk tolerance standard as a statewide issue in the ongoing S-MAP OIR.[51]

Mitigation Synergy not Recognized: As the MAVF for creation of RSEs currently stands, it is incapable of accurately determining the value of RSEs when mitigations are combined or broken up. Some mitigations work best when combined with one or more mitigations. Because RSEs must presented as standalone scores, the value of combining RSEs cannot be captured. Similarly, some mitigations apply across multiple risks. The RSE calculation methodology as it currently stands does not allow for a clear recognition of such benefits. Although combining the benefits across all risks impacted improves accuracy, doing so would significantly add to the complexity of the analysis and presentation of the mitigation benefits. For example, the replacement of live front equipment mitigation impacts both the Electric Infrastructure Integrity (EII) risk and the Employee Safety risk. However, the Companies elected to assess the mitigation benefit as part of the EII risk to minimize double counting of benefits throughout this 2021 RAMP Report. Thus, the risk reduction within the Employee Safety risk is underestimated since the mitigation was assessed against the EII risk. This is another instance of RSEs not being able to capture the entire picture when it comes to the costs and benefits of mitigations or controls.

Non-Asset Mitigations/Controls: Non-Asset mitigations may also not lend themselves well to evaluation by RSEs. Because some Non-Asset mitigations cannot always be broken down into relevant, discrete data points, trying to force them into a quantitative analysis is challenging. For example, consider the benefit of training. It is difficult to ascertain the precise amount of impact a training program has. The simplest way is to attempt to compare results with and without a program. But there are likely other changes occurring within a risk, and knowing which factor contributed to a change in risk outcomes is difficult. Consider driver training for employees. All employees who exceed a certain number of driven miles using company vehicles are required to take driver training. Simultaneously, improvements to vehicles have been made,

[51] *See* Rulemaking (R.) 20-07-013, *Assigned Commissioner Scoping Memo and Ruling* (November 2, 2020) (S-MAP OIR Scoping Ruling) at 7-9.

such as the installation of back-up cameras. It is very difficult analytically to say whether an incident did or did not occur due to the training or the installation of equipment. There are a substantial number of mitigations that utilities pursue and implement that are not asset-based. Determining how to assess them within an RSE-driven framework continues to be problematic.

RSEs Do Not Reflect the Reality of Utility or Commission Priorities: Capturing actual or strategic priorities when valuing mitigations is a challenge. Although there are several shortcomings in the RSEs that are primarily data driven, one of the most challenging to quantify is related to valuing mitigations that are strongly supported by the Commission and IOUs' strategic efforts and priorities. Certain mitigations are recognized by essentially all interested parties to be important – yet their RSEs would suggest they should be treated as lower priority work. For example, in the high-pressure pipeline incident risk, the valve automation mitigation had a relatively low RSE, yet valve automation was required by the Commission in D.14-06-007.[52] The rankings of RSEs shown in Appendix C-1 contain other examples of these types of mitigations.

[52] D.14-06-007 at 21.

APPENDIX C-1

SDG&E RSE RANKING

Appendix C-1: RSE Ranking

SDG&E

Line No.	Risk Chapter	Risk	ID	Control/Mitigation Name	Total Cost ($M)	RSE
1	SDG&E-Risk-7	Digin	C28	Warning Mesh	$ 0.06	2,702
2	SDG&E-Risk-1	Wildfire	C9/M4-T1	PSPS Sectionalizing - Tier 3	$ 0.54	2,112
3	SDG&E-Risk-1	Wildfire	C3-T3	Wireless Fault Indicators - Non-HFTD	$ 0.66	1,516
4	SDG&E-Risk-3	HP	C2-T1	Cathodic Protection – Maintenance (HCA)	$ 0.03	1,075
5	SDG&E-Risk-1	Wildfire	C9/M4-T2	PSPS Sectionalizing - Tier 2	$ 4.09	1,063
6	SDG&E-Risk-2	EII	C11	Tee Modernization Program	$ 11.47	938
7	SDG&E-Risk-3	HP	C11-T1	Measurement & Regulation Station – Maintenance (HCA)	$ 0.59	841
8	SDG&E-Risk-3	HP	M1-T1.1	PSEP: Pipeline Replacement (Phase 2B, HCA)	$ 10.00	731
9	SDG&E-Risk-1	Wildfire	C30-T1	Distribution System Inspection - CMP - Annual Patrol - Tier 3	$ 1.49	684
10	SDG&E-Risk-7	Digin	C3	Locate & Mark Activities	$ 5.25	590
11	SDG&E-Risk-1	Wildfire	C15/M10-T1	Expanded Generator Grant Program - Tier 3	$ 1.45	569
12	SDG&E-Risk-8	EMPL	M1	Purchasing and testing more protective respiratory protection for wildfire smoke particulates.	$ 0.01	516
13	SDG&E-Risk-3	HP	C1-T1	Cathodic Protection – Capital (HCA)	$ 0.20	489
14	SDG&E-Risk-3	HP	M1-T1.2	PSEP: Pipeline Replacement (Phase 2B, non-HCA)	$ 10.00	468
15	SDG&E-Risk-2	EII	C10-T1	Underground cable replacement program - UG Feeder	$ 0.53	465
16	SDG&E-Risk-7	Digin	C14	Locating Equipment	$ 0.14	456
17	SDG&E-Risk-2	EII	C8	Avian Protection Program	$ 1.87	409
18	SDG&E-Risk-3	HP	C9	Compressor Stations - Maintenance	$ 2.33	403
19	SDG&E-Risk-3	HP	C1-T2	Cathodic Protection – Capital (non-HCA)	$ 0.41	388
20	SDG&E-Risk-1	Wildfire	C6/M1-T2	SCADA Capacitors - Tier 2	$ 1.79	381
21	SDG&E-Risk-1	Wildfire	C30-T2	Distribution System Inspection - CMP - Annual Patrol - Tier 2	$ 1.78	373
22	SDG&E-Risk-3	HP	C11-T2	Measurement & Regulation Station – Maintenance (non-HCA)	$ 1.19	369
23	SDG&E-Risk-3	HP	C15-T1	Integrity Assessments & Remediations (HCA)	$ 33.69	355
24	SDG&E-Risk-1	Wildfire	C24-T2	Distribution System Inspection - IR/Corona - Tier 2	$ 0.52	322
25	SDG&E-Risk-7	Digin	C6	Locate and Mark Annual Refresher Training and Competency Program	$ 0.001	317
26	SDG&E-Risk-1	Wildfire	C11/M6-T1	Advanced Protection - Tier 3	$ 30.63	309
27	SDG&E-Risk-3	HP	C15-T2	Integrity Assessments & Remediations (Non-HCA)	$ 7.90	300
28	SDG&E-Risk-8	EMPL	C14	Enhanced Safety in Action Program	$ 0.16	299
29	SDG&E-Risk-7	Digin	C16-T4	Public Awareness Compliance – Excavators	$ 0.01	287
30	SDG&E-Risk-1	Wildfire	C15/M10-T2	Expanded Generator Grant Program - Tier 2	$ 2.18	284
31	SDG&E-Risk-1	Wildfire	C34-T1	Pole Brushing - Tier 3	$ 7.91	261
32	SDG&E-Risk-2	EII	C4-T3	High Risk Switch Replacement program - Hook	$ 1.65	241
33	SDG&E-Risk-3	HP	C6-T1	Pipeline Maintenance (HCA)	$ 0.10	240
34	SDG&E-Risk-2	EII	C10-T3	North Harbor Project	$ 14.91	201
35	SDG&E-Risk-1	Wildfire	C28-T1	Distribution System Inspection - Drone Inspections - Tier 3	$ 4.50	194
36	SDG&E-Risk-1	Wildfire	C31-T1	Tree Trimming - Tier 3	$ 44.85	192
37	SDG&E-Risk-2	EII	C4-T2	High Risk Switch Replacement program - Gang	$ 0.42	190
38	SDG&E-Risk-1	Wildfire	C8/M3-T2	Expulsion Fuse Replacement - Tier 2	$ 3.08	187
39	SDG&E-Risk-7	Digin	C13	Locating Equipment	$ 0.67	179
40	SDG&E-Risk-3	HP	M4	Adobe Falls Relocation Project	$ 2.00	167
41	SDG&E-Risk-2	EII	C10-T2	Underground cable replacement program - UG Branch	$ 15.54	166
42	SDG&E-Risk-3	HP	M1-T1.3	PSEP: Hydrotesting (Phase 2B, HCA)	$ 10.00	161
43	SDG&E-Risk-6	CYBR	C1	Perimeter Defenses	$ 26.74	160
44	SDG&E-Risk-6	CYBR	A1-C1	Perimeter Defenses	$ 19.86	157
45	SDG&E-Risk-1	Wildfire	C16/M11-T1	Strategic Undergrounding - Tier 3	$ 629.68	156

46	SDG&E-Risk-6	CYBR	A2-C1	Perimeter Defenses	$ 31.30	154
47	SDG&E-Risk-1	Wildfire	C34-T2	Pole Brushing - Tier 2	$ 8.96	152
48	SDG&E-Risk-2	EII	C20-T2	Bernardo 12 kV Breakers Replacements	$ 1.00	146
49	SDG&E-Risk-1	Wildfire	C37-T1	Strategy for Minimizing Public Safety Risk During High Wildfire Conditions, PSPS and Re-Energization Protocols - Tier 3	$ 30.75	145
50	SDG&E-Risk-9	MP	C11	Gas Distribution Emergency Department	$ 27.29	144
51	SDG&E-Risk-6	CYBR	C4	OT Cybersecurity	$ 20.84	142
52	SDG&E-Risk-6	CYBR	A2-C4	OT Cybersecurity	$ 21.26	139
53	SDG&E-Risk-4	CONT	C1	Contractor Oversight Program	$ 3.18	139
54	SDG&E-Risk-8	EMPL	C13	Enhanced Mandatory Employee Training (OSHA): Certified Occupational Safety Specialist, Certified Utility Safety Professional; Certified Safety Professional	$ 0.05	138
55	SDG&E-Risk-3	HP	C4-T1	Pipeline Relocation/Replacement (HCA)	$ 1.91	131
56	SDG&E-Risk-7	Digin	C15-T4	Public Awareness Compliance – Excavators	$ 0.02	124
57	SDG&E-Risk-1	Wildfire	C14/M9-T1	Whole House Generator Program - Tier 3	$ 19.60	120
58	SDG&E-Risk-1	Wildfire	C37-T2	Strategy for Minimizing Public Safety Risk During High Wildfire Conditions, PSPS and Re-Energization Protocols - Tier 2	$ 34.80	120
59	SDG&E-Risk-1	Wildfire	C21/M14-T1	Lightning Arrester Removal / Replacement Program - Tier 3	$ 7.83	113
60	SDG&E-Risk-1	Wildfire	C33/M16-T1	Enhanced Vegetation Management - Tier 3	$ 15.01	111
61	SDG&E-Risk-1	Wildfire	C27-T1	Distribution System Inspection - QA/QC Tier 3 Inspections - Tier 3	$ 9.01	111
62	SDG&E-Risk-6	CYBR	A1-C4	OT Cybersecurity	$ 19.51	110
63	SDG&E-Risk-1	Wildfire	C31-T2	Tree Trimming - Tier 2	$ 54.07	104
64	SDG&E-Risk-3	HP	M1-T1.4	PSEP: Hydrotesting (Phase 2B, non-HCA)	$ 10.00	103
65	SDG&E-Risk-6	CYBR	C5	Obsolete IT Infrastructure and Asset Replacement	$ 25.18	102
66	SDG&E-Risk-2	EII	C4-T1	High Risk Switch Replacement program -SCADA	$ 0.62	101
67	SDG&E-Risk-2	EII	C20-T5	Miramar 12kV Replacements	$ 1.42	101
68	SDG&E-Risk-6	CYBR	A1-C5	Obsolete IT Infrastructure and Application Replacement	$ 19.04	98
69	SDG&E-Risk-6	CYBR	A2-C5	Obsolete IT Infrastructure and Application Replacement	$ 27.60	98
70	SDG&E-Risk-6	CYBR	C2	Internal Defenses	$ 36.17	95
71	SDG&E-Risk-1	Wildfire	C12/M7-T1	Hotline Clamps - Tier 3	$ 4.50	93
72	SDG&E-Risk-3	HP	C8	Compressor Stations - Capital	$ 31.72	91
73	SDG&E-Risk-2	EII	C28	RTU Modernization	$ 2.26	91
74	SDG&E-Risk-1	Wildfire	A2	Alternative 2	$ 900.87	88
75	SDG&E-Risk-6	CYBR	A2-C2	Internal Defenses	$ 44.09	88
76	SDG&E-Risk-3	HP	C10-T1	Measurement & Regulation – Capital (HCA)	$ 0.67	86
77	SDG&E-Risk-4	CONT	M2	Enhanced Verification of Class 1 Contractor Employee Specific Training	$ 0.64	86
78	SDG&E-Risk-6	CYBR	A1-C2	Internal Defenses	$ 29.43	85
79	SDG&E-Risk-7	Digin	C23	Excess Flow Valve or Curb Valve Installation	$ 0.33	83
80	SDG&E-Risk-2	EII	C20-T7	Pacific Beach Bus Tie Replacements	$ 2.29	81
81	SDG&E-Risk-1	Wildfire	A1	Alternative 1	$ 1,643.22	79
82	SDG&E-Risk-2	EII	C1	Overhead Public Safety (OPS)	$ 21.73	78
83	SDG&E-Risk-8	EMPL	C3	Strong Safety Culture	$ 0.60	78
84	SDG&E-Risk-1	Wildfire	C13/M8-T1	Backup Power for Resilience - Generator Grant Program, CRCs, HPWREN - Tier 3	$ 7.90	76
85	SDG&E-Risk-9	MP	M2	Cathodic Protection System Enhancements – Real Time Monitoring	$ 3.00	69
86	SDG&E-Risk-3	HP	C2-T2	Cathodic Protection – Maintenance (non-HCA)	$ 0.05	66
87	SDG&E-Risk-1	Wildfire	C22-T1	Distribution System Inspection - CMP - 5 year - Tier 3	$ 11.43	65
88	SDG&E-Risk-1	Wildfire	C36-T1	Wildfire Infrastructure Protection Teams - Tier 3	$ 6.18	63
89	SDG&E-Risk-2	EII	C24	Urban Substation Rebuild	$ 4.12	63
90	SDG&E-Risk-3	HP	C4-T2	Pipeline Relocation/Replacement (non-HCA)	$ 3.88	62
91	SDG&E-Risk-6	CYBR	C3	Sensitive Data Protection	$ 27.64	62
92	SDG&E-Risk-1	Wildfire	C18/M13-T1	(distribution underbuilt) Overhead Transmission Fire Hardening - Tier 3	$ 3.12	63
93	SDG&E-Risk-2	EII	C15	Corrective Maintenance Program- Service Connections and Minor Capital Units	$ 44.63	61
94	SDG&E-Risk-7	Digin	C4	Locate & Mark Activities	$ 1.49	61
95	SDG&E-Risk-1	Wildfire	C33/M16-T2	Enhanced Vegetation Management - Tier 2	$ 17.77	61
96	SDG&E-Risk-9	MP	M3	Replace Curb Valves with EFVs	$ 7.61	61

97	SDG&E-Risk-2	EII	C14	DOE Switch Replacement	$	19.43	60
98	SDG&E-Risk-2	EII	C20-T3	Chicarita 12kV Replacements	$	4.22	60
99	SDG&E-Risk-1	Wildfire	C27-T2	Distribution System Inspection - QA/QC Tier 3 Inspections - Tier 2	$	0.01	57
100	SDG&E-Risk-3	HP	C10-T2	Measurement & Regulation – Capital (non-HCA)	$	1.36	57
101	SDG&E-Risk-8	EMPL	C9	Safe Driving Programs	$	0.27	57
102	SDG&E-Risk-6	CYBR	A2-C3	Sensitive Data Protection	$	31.50	57
103	SDG&E-Risk-9	MP	C4	Regulator Station, Valve, and Large Meter Set Inspection	$	4.46	57
104	SDG&E-Risk-1	Wildfire	C36-T2	Wildfire Infrastructure Protection Teams - Tier 2	$	2.63	56
105	SDG&E-Risk-6	CYBR	A1-C3	Sensitive Data Protection	$	22.21	56
106	SDG&E-Risk-1	Wildfire	C16/M11-T2	Strategic Undergrounding - Tier 2	$	377.81	54
107	SDG&E-Risk-1	Wildfire	C17/M12-T1	Overhead Distribution Fire Hardening - Bare Conductors - Tier 3	$	5.13	53
108	SDG&E-Risk-7	Digin	C16-T2	Public Awareness Compliance - Emergency Officials	$	0.001	51
109	SDG&E-Risk-2	EII	C20-T4	Laguna Niguel 12kV Replacements	$	8.70	45
110	SDG&E-Risk-7	Digin	C11	Damage Prevention Analyst Program	$	0.25	40
111	SDG&E-Risk-7	Digin	C16-T3	Public Awareness Compliance - Local Public Officials	$	0.004	39
112	SDG&E-Risk-7	Digin	C32	Enhance Ticket Management Software	$	0.02	39
113	SDG&E-Risk-1	Wildfire	C13/M8-T2	Backup Power for Resilience - Generator Grant Program, CRCs, HPWREN - Tier 2	$	15.80	38
114	SDG&E-Risk-7	Digin	C16-T1	Public Awareness Compliance - The Affected Public	$	0.06	38
115	SDG&E-Risk-1	Wildfire	C12/M7-T2	Hotline Clamps - Tier 2	$	4.50	36
116	SDG&E-Risk-4	CONT	C2	Field Safety Oversight	$	15.79	35
117	SDG&E-Risk-2	EII	C20-T1	Batiquitos 12kV Replacements	$	7.45	34
118	SDG&E-Risk-1	Wildfire	C22-T2	Distribution System Inspection - CMP - 5 year - Tier 2	$	15.13	33
119	SDG&E-Risk-1	Wildfire	C7/M2-T1	Overhead Distribution Fire Hardening - Covered Conductors - Tier 3	$	340.51	32
120	SDG&E-Risk-1	Wildfire	C18/M13-T2	(distribution underbuilt) Overhead Transmission Fire Hardening - Tier 2	$	41.78	32
121	SDG&E-Risk-7	Digin	M2	Automate Third Party Excavation Incident Reporting	$	0.004	31
122	SDG&E-Risk-2	EII	C29	SCADA Capacitors	$	2.39	31
123	SDG&E-Risk-1	Wildfire	C10/M5-T2	Backup Power for Resilience - Microgrids - Tier 2	$	42.39	30
124	SDG&E-Risk-2	EII	C16	Manhole, Handhole and Vault Restoration Program	$	9.67	27
125	SDG&E-Risk-7	Digin	C27	Warning Mesh	$	0.24	26
126	SDG&E-Risk-8	EMPL	M3	Automate notifications and employee communications when the Air Quality Index PM2.5 reaches specific thresholds during a wildfire in our service territory	$	0.12	26
127	SDG&E-Risk-2	EII	C20-T6	Scripps 12kV Replacements	$	12.32	25
128	SDG&E-Risk-1	Wildfire	C35-T1	Aviation Firefighting Program - Tier 3	$	63.76	24
129	SDG&E-Risk-7	Digin	C5	Locate and Mark Annual Refresher Training and Competency Program	$	5.00	25
130	SDG&E-Risk-9	MP	C2	Cathodic Protection Program - Capital	$	18.73	25
131	SDG&E-Risk-3	HP	C12	Odorization	$	0.01	22
132	SDG&E-Risk-7	Digin	M4	Locate and Mark Photographs	$	0.10	20
133	SDG&E-Risk-7	Digin	C15-T2	Public Awareness Compliance - Emergency Officials	$	0.003	20
134	SDG&E-Risk-7	Digin	C10	Locate and Mark Quality Assurance Program	$	0.08	19
135	SDG&E-Risk-7	Digin	C12	Damage Prevention Analyst Program	$	0.05	19
136	SDG&E-Risk-8	EMPL	C15	Enhanced Employee Safe Driving Training	$	1.65	19
137	SDG&E-Risk-7	Digin	C15-T1	Public Awareness Compliance - The Affected Public	$	0.26	17
138	SDG&E-Risk-7	Digin	C31	Enhance Ticket Management Software	$	0.10	17
139	SDG&E-Risk-7	Digin	M1	Automate Third Party Excavation Incident Reporting	$	0.03	17
140	SDG&E-Risk-2	EII	C6	Tree Trimming	$	121.65	15
141	SDG&E-Risk-2	EII	A3	Avian Protection Program	$	12.17	15
142	SDG&E-Risk-2	EII	C23	San Mateo Substation	$	13.90	15
143	SDG&E-Risk-9	MP	C6/C7	Leak Repair & Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol)	$	41.19	15
144	SDG&E-Risk-2	EII	C18	Distribution Circuit Reliability Construction	$	11.70	15
145	SDG&E-Risk-1	Wildfire	C35-T2	Aviation Firefighting Program - Tier 2	$	37.60	14
146	SDG&E-Risk-3	HP	C6-T2	Pipeline Maintenance (non-HCA)	$	0.21	14
147	SDG&E-Risk-8	EMPL	C8	OSHA Voluntary Protection Program	$	1.50	14

148	SDG&E-Risk-7	Digin	C15-T3	Public Awareness Compliance - Local Public Officials	$ 0.02	14
149	SDG&E-Risk-1	Wildfire	C7/M2-T2	Overhead Distribution Fire Hardening - Covered Conductors - Tier 2	$ 74.75	14
150	SDG&E-Risk-9	MP	C9-T1	Early Vintage Program (Components) - Oil Drip Piping Removal	$ 7.16	14
151	SDG&E-Risk-9	MP	C1	Cathodic Protection Program - O&M	$ 5.85	13
152	SDG&E-Risk-1	Wildfire	C29-T1	Distribution System Inspection - Circuit Ownership - Tier 3	$ 0.13	13
153	SDG&E-Risk-7	Digin	M3	Locate and Mark Photographs	$ 0.44	13
154	SDG&E-Risk-4	CONT	A2	Use internal resources and tools to vet contractors for safety	$ 4.38	13
155	SDG&E-Risk-2	EII	A2-T1	Modernize Manual Switches - OH	$ 33.90	12
156	SDG&E-Risk-8	EMPL	C4	Employee Behavioral Accident Prevention Process Program	$ 2.58	12
157	SDG&E-Risk-2	EII	C20-T8	Coronado 69/12kV Transformer Replacement	$ 1.65	12
158	SDG&E-Risk-2	EII	C3	4kV Modernization Program- Distribution (Overhead, Underground and package Substation removal)	$ 20.58	11
159	SDG&E-Risk-9	MP	C10	Code Compliance Mitigation	$ 6.21	10
160	SDG&E-Risk-8	EMPL	C11	Jobsite Safety Programs	$ 7.34	9.3
161	SDG&E-Risk-1	Wildfire	C28-T2	Distribution System Inspection - Drone Inspections - Tier 2	$ 39.87	8.9
162	SDG&E-Risk-9	MP	C8-T3	Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage).	$ 10.70	8.6
163	SDG&E-Risk-3	HP	C5-T1	Shallow/Exposed Pipe Remediations (HCA)	$ 2.94	8.6
164	SDG&E-Risk-2	EII	C21	Distribution Substation Obsolete Equipment	$ 7.84	8.1
165	SDG&E-Risk-7	Digin	C30	Ticket Risk Assessment and Evaluating City Permit Data	$ 0.01	8.0
166	SDG&E-Risk-1	Wildfire	C29-T2	Distribution System Inspection - Circuit Ownership - Tier 2	$ 0.25	7.3
167	SDG&E-Risk-8	EMPL	M2	Purchasing break/rest trailers with filtered air systems to reduce wildfire smoke exposure	$ 0.45	6.9
168	SDG&E-Risk-3	HP	M2-T1	Gas Transmission Safety Rule - MAOP Reconfirmation (HCA)	$ 37.44	6.9
169	SDG&E-Risk-1	Wildfire	C32/M15-T1	Fuel Management Program - Tier 3	$ 18.62	6.8
170	SDG&E-Risk-9	MP	C3	Piping in Vaults Replacement Program	$ 9.06	6.3
171	SDG&E-Risk-9	MP	C8-T2	Underperforming Steel Replacement Program (1934-1965 vintage).	$ 21.90	6.3
172	SDG&E-Risk-9	MP	C21	CSF Quality Assurance (QA) Program	$ 0.97	6.3
173	SDG&E-Risk-9	MP	C9-T3	Early Vintage Program (Components) - Removal of Closed Valves between High/Medium Pressure Zones	$ 0.77	6.2
174	SDG&E-Risk-3	HP	M3-T2	Gas Transmission Safety Rule – Material Verification (Non-HCA)	$ 0.03	6.2
175	SDG&E-Risk-3	HP	C5-T2	Shallow/Exposed Pipe Remediations (non-HCA)	$ 5.98	5.9
176	SDG&E-Risk-2	EII	C13	Replacement of Live Front Equipment	$ 1.75	5.7
177	SDG&E-Risk-9	MP	C8-T1	Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage	$ 27.65	5.7
178	SDG&E-Risk-3	HP	A1	Proactive Soil Sampling	$ 0.36	5.7
179	SDG&E-Risk-7	Digin	C24	Pipeline Patrol and Pipeline Markers	$ 0.72	5.7
180	SDG&E-Risk-3	HP	C3-T1	Leak Repair (HCA)	$ 2.05	5.6
181	SDG&E-Risk-3	HP	C3-T2	Leak Repair (non-HCA)	$ 4.15	5.3
182	SDG&E-Risk-9	MP	M1	Safety Control Valves	$ 7.61	4.9
183	SDG&E-Risk-9	MP	C12	Cathodic Protection System Enhancements - Base	$ 4.94	4.4
184	SDG&E-Risk-3	HP	M2-T2	Gas Transmission Safety Rule - MAOP Reconfirmation (Non-HCA)	$ 1.56	4.1
185	SDG&E-Risk-9	MP	C16-T1	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIPP)	$ 174.90	3.4
186	SDG&E-Risk-9	MP	C5	Regulator Station Replacement	$ 6.00	2.7
187	SDG&E-Risk-2	EII	A2-T2	Modernize Manual Switches - UG	$ 42.30	2.5
188	SDG&E-Risk-2	EII	A1	Customer Owned E-Structure Reconfigure	$ 0.84	2.1
189	SDG&E-Risk-1	Wildfire	C25-T2	Distribution System Inspection - CMP - 10 year intrusive - Tier 2	$ 3.36	2.0
190	SDG&E-Risk-3	HP	M3-T1	Gas Transmission Safety Rule – Material Verification (HCA)	$ 0.14	1.2
191	SDG&E-Risk-9	MP	A1	Post Training Follow-up Field Evaluations	$ 0.05	1.1
192	SDG&E-Risk-7	Digin	C9	Locate and Mark Quality Assurance Program	$ 0.64	1.0
193	SDG&E-Risk-1	Wildfire	C35-T3	Aviation Firefighting Program - Non-HFTD	$ 2.85	0.9
194	SDG&E-Risk-3	HP	A2	Expanding Geotechnical Analysis	$ 0.18	0.9
195	SDG&E-Risk-3	HP	C13	Security and Auxiliary Equipment	$ 2.21	0.8
196	SDG&E-Risk-7	Digin	C29	Ticket Risk Assessment and Evaluating City Permit Data	$ 0.04	0.7
197	SDG&E-Risk-9	MP	C9-T2	Early Vintage Program (Components) - Dresser Mechanical Coupling Removal	$ 9.29	0.6
198	SDG&E-Risk-9	MP	C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	$ 0.33	0.5

199	SDG&E-Risk-9	MP	C14	Human Factors Mitigations – Operator Qualification Training and Certification	$	12.01	0.4
200	SDG&E-Risk-9	MP	C19	Field and Public Safety	$	30.79	0.2
201	SDG&E-Risk-9	MP	A2	Soil Sampling Program	$	12.30	0.02
202	SDG&E-Risk-7	Digin	A2	Virtual Reality Training	$	0.10	0.02
203	SDG&E-Risk-7	Digin	A1	Virtual Reality Training	$	0.10	0.01
204	SDG&E-Risk-7	Digin	A4	GPS Tracking of Excavation Equipment	$	0.34	0.001
205	SDG&E-Risk-7	Digin	A3	GPS Tracking of Excavation Equipment	$	0.34	0.0002

APPENDIX C-1

SOCALGAS RSE RANKING

Appendix C-1: RSE Ranking

SoCalGas

Line No.	Risk Chapter	Risk	ID	Control/Mitigation Name	Total Cost ($M)	RSE
1	SCG-Risk-1	HP	C7-T1	Pipeline Maintenance (HCA)	$ 0.22	1,336
2	SCG-Risk-1	HP	C4-T1	Leak Survey & Patrol (HCA)	$ 0.14	901
3	SCG-Risk-1	HP	C7-T2	Pipeline Maintenance (non-HCA)	$ 0.45	856
4	SCG-Risk-2	Digin	C3	Locate & Mark Activities	$ 19.49	767
5	SCG-Risk-1	HP	C22-T4.4	PSEP: Valve Enhancement (GRC base, non-HCA)	$ 5.44	743
6	SCG-Risk-1	HP	C4-T2	Leak Survey & Patrol (non-HCA)	$ 0.29	577
7	SCG-Risk-5	EMPL	C10	Workplace Violence Prevention Programs	$ 7.70	498
8	SCG-Risk-2	Digin	C30	Warning Mesh	$ 0.19	484
9	SCG-Risk-1	HP	C23-T2	Ventura Compressor Station Modernization	$ 178.86	345
10	SCG-Risk-1	HP	C22-T4.3	PSEP: Valve Enhancement (GRC base, HCA)	$ 28.69	276
11	SCG-Risk-1	HP	C2-T1	Cathodic Protection – Maintenance (HCA)	$ 0.38	276
12	SCG-Risk-1	HP	C11	Compressor Stations - Maintenance	$ 8.24	261
13	SCG-Risk-3	MP	C22	DIMP: Gas Infrastructure Protection Program (GIPP)	$ 85.02	221
14	SCG-Risk-1	HP	C22-T3.2	PSEP: Pipeline Replacement (Phase 2A, GRC base, non-HCA)	$ 93.71	220
15	SCG-Risk-7	CONT	C3	Contractor Engagement	$ 0.01	202
16	SCG-Risk-7	CONT	C2	Third-Party Administration Tools	$ 0.05	182
17	SCG-Risk-1	HP	C2-T2	Cathodic Protection – Maintenance (non-HCA)	$ 0.77	177
18	SCG-Risk-6	CYBR	C1	Perimeter Defenses	$ 26.74	160
19	SCG-Risk-6	CYBR	A1-C1	Perimeter Defenses	$ 19.86	157
20	SCG-Risk-6	CYBR	A2-C1	Perimeter Defenses	$ 31.30	154
21	SCG-Risk-1	HP	C13-T1	Measurement & Regulation Station – Maintenance (non-HCA)	$ 3.43	129
22	SCG-Risk-2	Digin	C6	Locate and Mark Annual Refresher Training and Competency Program	$ 0.01	121
23	SCG-Risk-2	Digin	C34	Enhance Ticket Management Software	$ 0.13	115
24	SCG-Risk-3	MP	C2	Cathodic Protection- CP10 Activities	$ 3.18	115
25	SCG-Risk-6	CYBR	C4	OT Cybersecurity	$ 19.46	112
26	SCG-Risk-6	CYBR	A2-C4	OT Cybersecurity	$ 20.52	112
27	SCG-Risk-6	CYBR	A1-C4	OT Cybersecurity	$ 14.56	110
28	SCG-Risk-3	MP	C7	Electronic Pressure Monitor (EPM) Replacement & Installs	$ 1.46	107
29	SCG-Risk-2	Digin	C24	Excess Flow Valve or Curb Valve Installation	$ 2.65	105
30	SCG-Risk-6	CYBR	C5	Obsolete IT Infrastructure and Asset Replacement	$ 25.18	102
31	SCG-Risk-6	CYBR	A1-C5	Obsolete IT Infrastructure and Application Replacement	$ 19.04	98
32	SCG-Risk-6	CYBR	A2-C5	Obsolete IT Infrastructure and Application Replacement	$ 27.60	98
33	SCG-Risk-7	CONT	A2	Use a Different Third-Party Administration Tool to Vet Contractors for Safety	$ 0.03	97
34	SCG-Risk-2	Digin	C16-T3	Public Awareness Compliance - Local Public Officials	$ 0.01	97
35	SCG-Risk-6	CYBR	C2	Internal Defenses	$ 36.17	95
36	SCG-Risk-3	MP	C4	Meter & Regulator (M&R) Station and Electronic Pressure Monitors (EPM) Inspection and Maintenance	$ 3.57	93
37	SCG-Risk-3	MP	C11	Pipeline Monitoring (Pipeline Patrol, Bridge & Span Inspections, Unstable Earth Inspection)	$ 0.004	92
38	SCG-Risk-3	MP	C18	Residential Meter Protection Project	$ 27.31	91
39	SCG-Risk-6	CYBR	A2-C2	Internal Defenses	$ 44.09	88
40	SCG-Risk-1	HP	C21-T2	Integrity Assessments & Remediation (Non-HCA)	$ 427.66	86
41	SCG-Risk-2	Digin	C33	Enhance Ticket Management Software	$ 0.54	86
42	SCG-Risk-6	CYBR	A1-C2	Internal Defenses	$ 29.43	85
43	SCG-Risk-1	HP	C13-T2	Measurement & Regulation Station – Maintenance (non-HCA)	$ 6.96	83
44	SCG-Risk-1	HP	C21-T1	Integrity Assessments & Remediation (HCA)	$ 246.87	83
45	SCG-Risk-4	STOR	C6	Compressor Overhauls	$ 15.57	83
46	SCG-Risk-3	MP	C6	Meter Set Assembly (MSA) Inspection and Maintenance	$ 16.18	81
47	SCG-Risk-2	Digin	C16-T4	Public Awareness Compliance – Excavators	$ 0.06	78
48	SCG-Risk-1	HP	C1-T1	Cathodic Protection – Capital (HCA)	$ 15.21	77
49	SCG-Risk-2	Digin	M2	Automate Third Party Excavation Incident Reporting	$ 0.03	70
50	SCG-Risk-1	HP	C10	Compressor Stations - Capital	$ 61.07	67
51	SCG-Risk-3	MP	C12	Valve Inspection & Maintenance	$ 1.25	64
52	SCG-Risk-2	Digin	C15-T3	Public Awareness Compliance - Local Public Officials	$ 0.02	63
53	SCG-Risk-6	CYBR	C3	Sensitive Data Protection	$ 27.64	62
54	SCG-Risk-2	Digin	C25	Pipeline Patrol and Pipeline Markers	$ 0.09	62
55	SCG-Risk-5	EMPL	M6	Industrial Hygiene Program Expansion	$ 0.15	60
56	SCG-Risk-2	Digin	M1	Automate Third Party Excavation Incident Reporting	$ 0.14	58
57	SCG-Risk-6	CYBR	A2-C3	Sensitive Data Protection	$ 31.50	57
58	SCG-Risk-6	CYBR	A1-C3	Sensitive Data Protection	$ 22.21	56
59	SCG-Risk-2	Digin	C4	Locate & Mark Activities	$ 4.44	55
60	SCG-Risk-2	Digin	C15-T4	Public Awareness Compliance – Excavators	$ 0.23	52
61	SCG-Risk-1	HP	C1-T2	Cathodic Protection – Capital (non-HCA)	$ 30.88	51
62	SCG-Risk-3	MP	C3	Cathodic Protection- 100mV Requalification	$ 3.65	51
63	SCG-Risk-2	Digin	C11	Damage Prevention Analyst Program	$ 1.45	48
64	SCG-Risk-5	EMPL	C4	Employee Safety Training and Awareness Programs	$ 0.44	44
65	SCG-Risk-5	EMPL	C7	Near Miss, Stop the Job and jobsite safety programs	$ 0.44	41
66	SCG-Risk-2	Digin	C26	Pipeline Patrol and Pipeline Markers	$ 0.49	39
67	SCG-Risk-1	HP	C5-T1	Pipeline Relocation/Replacement (HCA)	$ 21.88	36
68	SCG-Risk-2	Digin	C12	Damage Prevention Analyst Program	$ 0.29	36
69	SCG-Risk-4	STOR	C5	Storage Field Maintenance	$ 34.35	35
70	SCG-Risk-2	Digin	C16-T1	Public Awareness Compliance - The Affected Public	$ 0.19	34
71	SCG-Risk-3	MP	C1	Cathodic Protection Base Activities	$ 11.94	34
72	SCG-Risk-5	EMPL	M1	OSHA Construction Certification Training	$ 0.05	33
73	SCG-Risk-1	HP	C6-T1	Shallow/Exposed Pipe Remediations (HCA)	$ 4.40	32
74	SCG-Risk-2	Digin	C14	Locating Equipment	$ 4.08	31
75	SCG-Risk-5	EMPL	C2	Drug and Alcohol Testing Programs	$ 0.50	29
76	SCG-Risk-3	MP	C14	Cathodic Protection – Install/Replace Impressed Current Systems	$ 20.35	28
77	SCG-Risk-2	Digin	C15-T1	Public Awareness Compliance - The Affected Public	$ 0.80	25
78	SCG-Risk-1	HP	C22-T3.4	PSEP: Hydrotesting (Phase 2A, GRC base, non-HCA)	$ 269.71	24
79	SCG-Risk-2	Digin	C35	Leverage Data Gathered by Locating Equipment	$ 17.09	24
80	SCG-Risk-1	HP	C5-T2	Pipeline Relocation/Replacement (non-HCA)	$ 44.43	23
81	SCG-Risk-3	MP	C8/C17	Leak Survey and Main & Service Leak Repair	$ 66.51	23

82	SCG-Risk-2	Digin	C5	Locate and Mark Annual Refresher Training and Competency Program	$	0.05	23
83	SCG-Risk-5	EMPL	M4	Creating of a Safety Video Library	$	0.05	22
84	SCG-Risk-2	Digin	C16-T2	Public Awareness Compliance - Emergency Officials	$	0.003	22
85	SCG-Risk-2	Digin	C10	Locate and Mark Quality Assurance	$	0.38	21
86	SCG-Risk-3	MP	C9	Pipeline Monitoring (Pipeline Patrol, Bridge & Span Inspections, Unstable Earth Inspection)	$	0.09	21
87	SCG-Risk-3	MP	C20	Distribution Integrity Management Program - Distribution Riser Inspection Program (DRIP)	$	73.51	21
88	SCG-Risk-1	HP	C6-T2	Shallow/Exposed Pipe Remediations (non-HCA)	$	8.93	20
89	SCG-Risk-2	Digin	M4	Locate and Mark Photographs	$	0.10	20
90	SCG-Risk-5	EMPL	M7	Workplace Violence Prevention Program Enhancements	$	0.73	19
91	SCG-Risk-2	Digin	C29	Warning Mesh	$	0.79	19
92	SCG-Risk-7	CONT	A1	Use Internal Resources and Tools to Vet Contractors for Safety	$	0.53	17
93	SCG-Risk-5	EMPL	M3	Proactive Monitoring	$	0.06	17
94	SCG-Risk-5	EMPL	A3	Workplace Violence Prevention Training Alternative	$	0.05	16
95	SCG-Risk-5	EMPL	A2	OSHA Voluntary Protection Program	$	0.35	15
96	SCG-Risk-2	Digin	C15-T2	Public Awareness Compliance - Emergency Officials	$	0.01	14
97	SCG-Risk-2	Digin	M3	Locate and Mark Photographs	$	0.44	13
98	SCG-Risk-3	MP	C30	Meter Set Assembly (MSA) Inspection Program	$	66.52	12
99	SCG-Risk-7	CONT	C1	Contractor Safety Oversight	$	1.67	11
100	SCG-Risk-5	EMPL	C5	Safe Driving Programs	$	1.18	11
101	SCG-Risk-3	MP	C23	DIMP: Sewer Lateral Inspection Project (SLIP)	$	73.51	11
102	SCG-Risk-1	HP	C3-T1	Leak Repair (HCA)	$	11.52	10
103	SCG-Risk-2	Digin	C21	Prevention & Improvements-Fiber Optics	$	7.98	10
104	SCG-Risk-2	Digin	C32	Ticket Risk Assessment and Evaluating City Permit Data	$	0.05	10
105	SCG-Risk-5	EMPL	M5	Expanded Safety Culture Assessments	$	0.05	8.9
106	SCG-Risk-3	MP	C28	Quality Assurance Program	$	4.06	7.6
107	SCG-Risk-5	EMPL	C8	Safety Culture Programs	$	0.85	7.4
108	SCG-Risk-4	STOR	A2	Alternate technology for methane monitoring	$	3.80	7.1
109	SCG-Risk-1	HP	C3-T2	Leak Repair (non-HCA)	$	23.40	6.8
110	SCG-Risk-1	HP	C22-T2.4	PSEP: Pipeline Replacement (Phase 1B, GRC base, non-HCA)	$	69.25	5.7
111	SCG-Risk-4	STOR	C7	Upgrade to Purification Equipment	$	20.08	5.7
112	SCG-Risk-7	CONT	C4	Construction Contractor Field Oversight	$	0.30	5.2
113	SCG-Risk-3	MP	C10	Pipeline Monitoring (Pipeline Patrol, Bridge & Span Inspections, Unstable Earth Inspection)	$	0.08	5.2
114	SCG-Risk-5	EMPL	C9	Utilizing Industry Best Practices and Benchmarking	$	1.07	4.8
115	SCG-Risk-1	HP	C12-T1	Measurement & Regulation – Capital (HCA)	$	27.81	4.7
116	SCG-Risk-3	MP	C5	Regulator Station Replacements/Installs	$	9.45	4.7
117	SCG-Risk-2	Digin	C13	Locating Equipment	$	0.40	3.5
118	SCG-Risk-3	MP	C13	Valve Installs and Replacements	$	2.71	3.4
119	SCG-Risk-1	HP	C12-T2	Measurement & Regulation – Capital (non-HCA)	$	56.47	3.2
120	SCG-Risk-3	MP	C32	Safety Related Field Orders	$	298.77	3.0
121	SCG-Risk-2	Digin	C9	Locate and Mark Quality Assurance	$	1.94	2.9
122	SCG-Risk-4	STOR	C2	Well Abandonment and Replacement	$	126.97	2.8
123	SCG-Risk-1	HP	M1-T1	Gas Transmission Safety Rule - MAOP Reconfirmation (HCA)	$	170.76	2.7
124	SCG-Risk-1	HP	C14	Odorization	$	0.69	2.6
125	SCG-Risk-2	Digin	C36	Leverage Data Gathered by Locating Equipment	$	0.09	2.1
126	SCG-Risk-3	MP	A2	Post-Training Follow-up Field Evaluation	$	1.08	2.1
127	SCG-Risk-5	EMPL	A1	Develop internal expertise for expanded safety culture assessments	$	0.23	2.0
128	SCG-Risk-5	EMPL	C3	Employee Wellness Programs	$	2.65	1.9
129	SCG-Risk-3	MP	C16	Capital CP 10 Service Replacement	$	40.20	1.9
130	SCG-Risk-1	HP	M1-T2	Gas Transmission Safety Rule - MAOP Reconfirmation (Non-HCA)	$	69.75	1.8
131	SCG-Risk-1	HP	C8-T1	Right of Way (HCA)	$	0.79	1.7
132	SCG-Risk-1	HP	C8-T2	Right of Way (non-HCA)	$	1.60	1.7
133	SCG-Risk-3	MP	A1	Technical Refresher Training	$	1.75	1.3
134	SCG-Risk-3	MP	C21-T1	DIMP – DREAMS: Vintage Integrity Plastic Plan (VIPP)	$	657.34	1.2
135	SCG-Risk-1	HP	C15	Security and Auxiliary Equipment	$	13.57	1.0
136	SCG-Risk-3	MP	C21-T2	DIMP – DREAMS: Bare Steel Replacement Program (BSRP)	$	281.72	0.9
137	SCG-Risk-1	HP	A1	Proactive Soil Sampling	$	5.63	0.8
138	SCG-Risk-4	STOR	A1	Risk-based well casing inspection frequency	$	85.60	0.8
139	SCG-Risk-1	HP	M2-T1	Gas Transmission Safety Rule – Material Verification (HCA)	$	0.54	0.7
140	SCG-Risk-2	Digin	C31	Ticket Risk Assessment and Evaluating City Permit Data	$	0.20	0.5
141	SCG-Risk-5	EMPL	M2	Industrial Hygiene Program Refresh	$	0.97	0.4
142	SCG-Risk-1	HP	M2-T2	Gas Transmission Safety Rule – Material Verification (Non-HCA)	$	1.10	0.4
143	SCG-Risk-3	MP	C25	Field Employee Skills Training	$	30.84	0.4
144	SCG-Risk-1	HP	C9-T1	Class Location – Hydrotest (HCA)	$	7.37	0.3
145	SCG-Risk-1	HP	C9-T2	Class Location – Hydrotest (non-HCA)	$	14.95	0.3
146	SCG-Risk-3	MP	C19	Main Replacements- Leakage, Abnormal Op. Conditions, CP Related	$	72.45	0.3
147	SCG-Risk-4	STOR	C1	Integrity Demonstration, Verification, and Monitoring Practices	$	308.83	0.3
148	SCG-Risk-1	HP	A2	Expanding Geotechnical Analysis	$	1.40	0.2
149	SCG-Risk-2	Digin	A2	Virtual Reality Training	$	0.10	0.1
150	SCG-Risk-2	Digin	A1	Virtual Reality Training	$	0.10	0.1
151	SCG-Risk-2	Digin	A4	GPS Tracking of Excavation Equipment	$	0.34	0.01
152	SCG-Risk-2	Digin	A3	GPS Tracking of Excavation Equipment	$	0.34	0.003

Risk Assessment Mitigation Phase

(SDG&E RAMP-D)

Safety Culture, Organizational Structure, Executive and Utility Board Engagement, and Compensation Policies Related to Safety

May 17, 2021

TABLE OF CONTENTS

RAMP-D: SAFETY CULTURE, ORGANIZATIONAL STRUCTURE, EXECUTIVE AND UTILITY BOARD ENGAGEMENT, AND COMPENSATION POLICIES RELATED TO SAFETY

I. INTRODUCTION

This chapter provides supplemental information regarding San Diego Gas & Electric Company's (SDG&E or Company) organizational structure, programs, culture, and compensation as they relate to safety, as required by Decision (D.) 16-08-018.[1] The California Public Utilities Commission (Commission or CPUC) has stated that "[a]n effective safety culture is a prerequisite to a utility's positive safety performance record,"[2] and defines "safety culture" as follows:

> An organization's culture is the collective set of that organization's values, principles, beliefs, and norms, which are manifested in the planning, behaviors, and actions of all individuals leading and associated with the organization, and where the effectiveness of the culture is judged and measured by the organization's performance and results in the world (reality). Various governmental studies and federal agencies rely on this definition of organizational culture to define 'safety culture.'[3]

The Commission has further stated that, under the above definition, a positive safety culture includes "a clearly articulated set of principles and values with a clear expectation of full compliance" and "effective communication and continuous education and testing."[4] SDG&E agrees and has developed values, goals, and practices for a safety culture throughout its history, advancing its programs, policies, procedures, guidelines, and best practices to improve the safety of its operations.[5]

---

1 Inclusion of Safety Culture and Organizational Structure in RAMP Filings, D.16-08-018 at 140-142. Additionally, the Commission stated "[t]he company's compensation policies related to safety also should be included in the RAMP filing." *Id*. at 141 (citation omitted). *See also*, Investigation (I.)19-06-014, Order Instituting Investigation of Southern California Gas Company's Safety Culture (June 27, 2019) at 3-4.

2 I.15-08-019, Order Instituting Investigation of Pacific Gas and Electric Company's Safety Culture, August 27, 2015) at 4.

3 I.19-06-014, Order Instituting Investigation of Southern California Gas Company's Safety Culture (June 27, 2019) (citation omitted) at 3.

4 *Id.*

5 *See, e.g.,* Application (A.)17-10-007, Direct Testimony of Diana Day (Exh. SDG&E-02-R) at DD-28.

In addition to addressing safety as an integral component of each risk assessment and mitigation activity outlined in each of the individual risk chapters of this RAMP report, the Commission has instructed the utilities to include specific discussion in this filing on the following:[6]

- Safety organizational structure;
- Safety culture;
- Compensation policies related to safety;
- Executive and senior management engagement in the risk assessment, prioritization, mitigation, and budgeting process; and
- Utility board engagement and oversight over safety performance and expenditures.

This chapter addresses each of these topics in the following sections below.

II. BACKGROUND

Following issuance of D.16-08-018, SDG&E has described the elements of its safety culture in various proceedings. For example, various SDG&E witnesses in the test year (TY) 2019 general rate case (GRC) testified regarding safety culture as it related to their respective subject matter areas.[7] Testimony that was sponsored by approximately 50 witnesses, including SDG&E's then President and Chief Operating Officer, Caroline Winn, demonstrated SDG&E's safety culture and safety management practices and based its GRC funding request on key safety and risk-informed RAMP risks and mitigations. SDG&E also provided TY 2019 GRC testimony and information regarding its governance, safety record, and safety culture,[8] pursuant to Commission direction in D.16-06-054.[9]

SDG&E's testimony chapters in the TY 2019 GRC proceeding outlined various safety programs and new and evolving initiatives to develop a safety management system. For example, following the formal release in July 2015 of American National Standards Institute (ANSI)/American Petroleum Institute Recommended Practice 1173 (API 1173), SDG&E

---

6 *See* D.16-08-018 at 140-142.

7 A.17-10-007; witness direct testimony submitted and entered into the proceeding record.

8 A.17-10-007, Exh. SDG&E-02-R, and Direct Testimony of Debbie S. Robinson (Exh. SDG&E-28).

9 D.16-06-054 at 154.

voluntarily adopted and began to implement its foundational principles of safety management systems for its gas operations and encourages its pipeline construction contractors to do the same.[10] To further demonstrate our unwavering commitment to safety, in the fall of 2019, SDG&E began applying API 1173 principles to its electric operations by developing a single, enterprise-wide Safety Management System (SMS).

The SMS is not a new safety initiative; SDG&E's SMS is the framework that ties together each of our existing and future safety programs and initiatives, aligns our core operating units, integrates risk and safety, and allows for risk to be assessed across the entire organization for continued improvement and enhanced safety performance. The SMS leverages SDG&E's already strong safety culture and establishes an enterprise-wide framework and cohesive system to collectively manage and reduce risk and promote continuous improvement in safety performance through systematic, routine, and intentional processes. As further outlined below and separately in the SMS Cross-Functional Factor (CFF) Chapter of this RAMP Report (SDG&E-CFF-7), the SMS encompasses all of SDG&E's safety initiatives, programs, processes, and committees and, in doing so, enhances them by providing additional structure, oversight, awareness, and collaboration by connecting them at the enterprise level.

Additionally, in 2017, SDG&E began implementing asset management developed by the internationally recognized standard ISO 55000, of which safety is a core element of decision-making. SDG&E's SMS Framework integrates ISO standards, including ISO 55000, as illustrated in Figure 1, below.

[10] Southern California Gas Company (SoCalGas) and SDG&E (collectively, the Utilities) own and operate an integrated natural gas system. The Utilities collaborate to develop policies and procedures that pertain to the engineering and operations management of the gas system operated in both the SoCalGas and SDG&E territory to maintain consistency.

Figure 1: Integrated Standards Framework

Using API 1173 as a general standard for operational safety for electric operations requires alignment of risk management (based on ISO 31000), asset management (based on ISO 55000), and emergency management (based on ISO 22320 and the Federal Emergency Management Agency's Incident Command System) with traditional views of safety management (based on OSHA standards) to support development of a comprehensive and proactive safety program that produces ever-improving levels of work forces and public safety.

III. SAFETY ORGANIZATIONAL STRUCTURE

This section provides an overview of how safety is incorporated into SDG&E's organizational structure.[11] Detailed descriptions of SDG&E's safety organization can be found within SDG&E's Incident Involving an Employee and Contractor chapters included in this RAMP Report (SDG&E-Risk-8 and SDG&E-Risk-4).

SDG&E has dedicated teams embedded in the organization whose roles revolve around management of safety and other risks. Such organizational structures include SDG&E's:

- Safety Department,

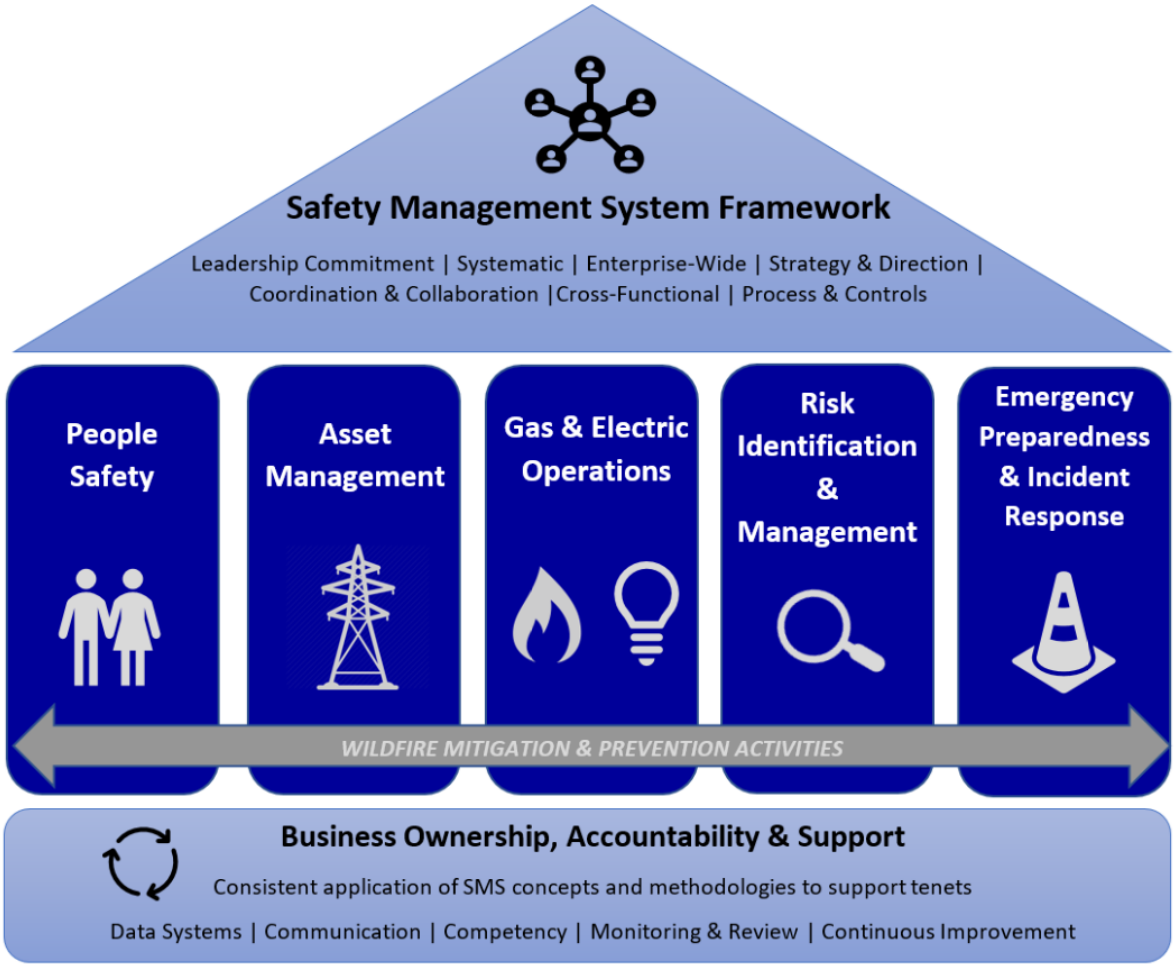
[11] *See* D.16-08-018 at 141, "RAMP filings should also cover the company's organizational structure as it relates to safety."

- Asset Management Organization,
- Enterprise Risk Management Organization, and
- Emergency Management Department.

In addition to these centralized functions that promote safety across the Company, SDG&E embeds safety practices into its operating groups. This is done in the form of safety procedures and policies that are driven across the Company.

SDG&E developed an SMS Framework that aligns and integrates risk and safety across the entire organization. SDG&E established the SMS Framework to focus on both individual safety behaviors and process safety management. The Framework's Five Pillars of Safety (1. People Safety, 2. Asset Management, 3. Gas & Electric Operations, 4. Risk Identification & Management, and 5. Emergency Preparedness & Incident Response) are the core of an integrated, comprehensive, and risk-informed approach to managing safety. An effective SMS requires that all Five Pillars of Safety have a strong interdependence and are supported by business operations enterprise-wide across SDG&E. Business leaders from each of these organizations are members of SDG&E's SMS governance team. Additionally, SDG&E's wildfire mitigation and prevention activities are integrated and highlighted across the SMS framework since such elements are not addressed within API 1173 as a pipeline safety standard. SDG&E's SMS governance structure is based on the SMS Framework in the Figure below.

Figure 2: SDG&E's SMS Framework



A. Safety Department

SDG&E's safety department is organized under SDG&E's Chief Safety Officer.[12] 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 Incident Involving an Employee Chapter (SDG&E-Risk-8) and Incident Involving a Contractor Chapter (SDG&E-Risk-4) of this RAMP Report.

[12] Kevin Geraghty, Senior VP – Electric Operations, currently serves as the Company's Chief Safety Officer.

SDG&E's Executive Safety Council is the governing body for all safety committees. Led by SDG&E's Chief Safety Officer and the Director of Safety and comprising various Company officers, the Executive Safety Council advances the Company's safety culture and addresses enterprise-wide safety strategy. Monthly meetings are held at various Company locations to allow top Company leadership to engage directly with SDG&E's frontline employees. Executive Safety Council meetings integrate employee and supervisor dialogue sessions so that employees have an opportunity to share safety experiences with Company leadership. 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 Executive Safety Council is the governing body for all of SDG&E's safety committees.

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 role of the SMS Governance Team is to communicate with and represent their respective organizations, working together to create and maintain a comprehensive SMS that informs consistent, effective, and appropriately adapted practices across the enterprise.

B. Asset Management Organization

SDG&E's Asset Management organization was created in 2017 to develop a strategic asset management capability for the company that aligns with the international standard of ISO 55000. The group comprises a dedicated team of a director, managers, and staff, who 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 Asset Management organization develops, implements, and enables 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 our customers. This program and others are further described in the Asset Management CFF Chapter of this RAMP Report (SDG&E CFF-1).

C. Enterprise Risk Management Organization

The Enterprise Risk Management Organization comprises a Chief Risk Officer, vice presidents, a director, and risk managers, whose roles are dedicated to implementing the risk management process and the integration of risk-informed 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, as well as supporting operational areas across the Company in the assessment of their risks and development of associated risk mitigations. SDG&E's Enterprise Risk Management Organization oversees the development of the annual risk registry process, as described in the Asset Management CFF Chapter (SDG&E CFF-1). Additionally, other efforts include the responsiveness to regulatory requirements such as risk spend accountability and safety performance metric reporting.

D. Emergency Management Department

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. The Emergency Management Department includes: (1) aviation services, (2) business resumption, (3) emergency preparedness and response operations, (4) information and technical services, and (5) operational field emergency readiness.

SDG&E responds to gas and electric emergencies 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. Elements of SDG&E's UICS program include:

- Certification of 460 Emergency Operations Center (EOC) responders in Standardized Emergency Management System (SEMS),[13] ICS 100 and 200;
- Certification of position-specific EOC responders following California Office of Emergency Services (Cal OES) emergency action planning standards (G626E, G611, ICS 300, Basic PIO, L-954 Safety, G197 AFN Awareness, I-230d Emergency Management, G-191 and G-775);
- Training Operational Leadership in Unified Incident Command System (UICS) roles and responsibilities;
- Annual Unified Command, gas and electric safety and response training with all First Responders in the SDG&E service territory;
- Development and deployment of Tactical Command Vehicles and Communications Trailers to support the UICS and Unified Command System on incidents and emergencies;
- Providing UICS liaisons to Fire and Law Enforcement Unified Command Posts; and
- Measuring the effectiveness of all programs listed through SDG&E's After Action Reviews (AAR) program (Quality Assurance and Improvement).

Each SDG&E operational area has emergency procedures that are specifically written for these types of incidents. These emergency response procedures are thoroughly practiced, and the personnel is well-trained to respond to and resolve routine gas and electric emergencies. When an emergency escalates, there is a need for an organized response with specific procedures and designated personnel. This organized response, through the UICS, provides the required specialized decision-making, the communication capabilities, and the additional resources needed to respond to and recover from an event efficiently.

IV. SAFETY CULTURE

Safety culture requires action and organizational focus by all employees. SDG&E's safety efforts start at the top with appropriate safety governance. Governed by the Executive Safety Counsel and led by SDG&E's Chief Safety Officer, SDG&E has various safety

[13] SEMS is the cornerstone of California's emergency response system and the fundamental structure for the response phase of emergency management. The system unifies all elements of California's emergency management community into a single integrated system and standardizes key elements.

committees to help inform and educate employees about safety issues throughout all levels of the Company and set meaningful and attainable safety goals throughout the organization. The safety committees also provide an opportunity to receive employee feedback on key safety issues. Company employees attend safety meetings, tailgates, and safety congresses, and are surveyed every two years to solicit their candid feedback. The SMS governance structure serves as a conduit to link SDG&E's numerous safety-related committees.

The SMS governance structure's overall objective is to provide cross-functional leadership and the support necessary to build a cohesive system that promotes improved communication, better documentation, and enhanced coordination, to build upon SDG&E's strong safety culture and commitment to safety.

SDG&E's SMS provides a comprehensive framework for its safety culture, to identify and address risk and safety throughout the design, construction, operation, and maintenance of SDG&E's electric and natural gas systems. The SMS builds on SDG&E's well-established and successful safety programs and processes by setting leading standards through the application of ten tenets for safe operation. As stated above, SDG&E's Gas Operations' SMS is guided by the API 1173 guidelines. While there is not currently an electric operations SMS similar to API 1173, SDG&E Electric Operations' culture largely aligns with the expectations of API 1173. Therefore, SDG&E has established an enterprise-wide SMS that aligns with the ten essential elements of API 1173. These include:

1. Leadership and Management Commitment;
2. Stakeholder Engagement;
3. Risk Management;
4. Operational Controls;
5. Incident Investigation, Evaluation, and Lessons Learned;
6. Safety Assurance;
7. Management Review and Continuous Improvement;
8. Emergency Preparedness and Response;
9. Competence, Awareness, and Training; and
10. Documentation and Record Keeping.

SDG&E's efforts as they relate to each of the above ten elements are discussed below.

A. Leadership and Management Commitment

SDG&E is committed to a culture where leadership sets the example and demonstrates safe behaviors expected of employees. SDG&E's leadership team is committed to championing people, doing the right thing, shaping the future, and executing on operational excellence. For example, all executives are Occupational Safety and Health Administration (OSHA) 10-Hour certified and are certified (as necessary) in Incident Command Structure (ICS) 100, 200, and 775 certifications to manage and oversee incidents, if they are assigned as a Utility Commander in the Emergency Operations Center (EOC). Supervisors also engage in four-hour safety leadership training of all new Supervisors as part of Essentials of Supervision.

SDG&E's safety-focused culture and supporting organizational structure enables the Company to be proactive and accountable in the safe delivery of natural gas and electricity, as well as the associated business operations. The Company continuously fosters a work environment where employees and contractors are encouraged to raise gas and electric infrastructure, customer safety, and personal safety concerns and offer suggestions for improvement. SDG&E's leadership and management commitment can best be described by the following Commitment to Safety statement that every member of our Senior Management Team wholeheartedly endorses:

> SDG&E's longstanding commitment to safety focuses on three primary areas – employee/contractor safety, customer/public safety and the safety of our gas and electric delivery systems. This safety focus is embedded in what we do and is the foundation for who we are – from initial employee training, to the installation, operation and maintenance of our utility infrastructure, and to our commitment to provide safe and reliable service to our customers.[14]

In SDG&E's TY 2019 GRC proceeding, several executive witnesses testified to SDG&E's longstanding commitments to operating a safe utility and to aggressively enhancing the implementation of effective safety risk mitigations, including asset health and safety.[15] For example, SDG&E's then Chief Safety Officer, Caroline Winn, testified: "At SDG&E, safety isn't a goal – it is part of the Company's DNA. Nothing is more important than keeping our employees, contractors, and the public safe. We are making strategic investments in culture,

[14] SDG&E's Commitment to Safety, 2021 Gas Safety Plan.

[15] A.17-10-007, Exh. SDG&E-02-R at DD-26.

technology, system upgrades, and community partnerships to enhance the safety of our customers and the communities we serve."[16]

SDG&E has processes, programs, and committees that welcome feedback on safety from employees on the management of risks and unsafe practices or incidents. To promote these principles throughout, and to foster a culture of continuous safety improvement, SDG&E continuously strives for a work environment where employees at all levels can raise pipeline and electric infrastructure, customer safety, and employee safety concerns and offer suggestions for improvement. SDG&E encourages two-way formal and informal communication between the company and the public, employees and management, and contractors and the company, in order to identify and manage safety risks before incidents occur. The vision and emphasis on risk management begin at the top, with strong support for the risk management process. SDG&E has an open-door policy that promotes open communication between employees and their direct supervisors. In addition to these culture-based items, there are formal programs designed to encourage employees to speak up if they see unsafe behaviors, such as "Stop the Job." SDG&E also has a Safety Congress as well as safety meetings for field employees that provide safety training, share best practices and promote leadership and employee engagement. If an employee does not feel comfortable reporting unsafe behaviors and incidents through the above-mentioned avenues, there are anonymous means to do so, including the Ethics & Compliance Hotline, employee engagement surveys, and National Safety Council Culture Survey.

SDG&E's SMS furthers the Company's leadership and management commitment. For example, SDG&E's Chief Safety Officer issues company-wide communications each week, providing an overview of any safety incidents that took place and offering suggestions of lessons learned or corrective action. Another example is SDG&E's Employee Safety Incident Notification Process, developed within the SMS framework, which outlines the steps to communicate safety incidents to a broad e-mail distribution list, spanning all lines of business. Essential elements of an effective SMS include transparency, openness, communication, and broad sharing of lessons learned. Each of these elements is attributable to SDG&E's strong safety culture.

[16] A.17-10-007, Direct Testimony of Caroline A. Winn (Exh. SDG&E-01-R) at CAW-1.

B. Stakeholder Engagement[17]

SDG&E encourages two-way formal and informal communication between the company and the public, employees and management, and contractors and the company. In addition to the Chief Safety Officer communications and Safety Incident Notifications described above in section III.A. and the various safety-related committees described below in section III.F., SDG&E's safety department regularly issues employee safety communications to provide employees with safety-related information in a timely manner regarding standards and safe work practices. These safety communications inform employees about safety hazards and exposures, hazard mitigation, rules, regulations, warnings, goals, and progress reports through an array of media, including safety bulletins, e-mails, electronic bulletin boards (*e.g.*, digiboards), posted signage throughout the workplace, tailgate meetings and reports.

To continuously monitor, measure, and improve the Company's workplace safety culture, SDG&E regularly assesses itself through the National Safety Council's (NSC) Safety Barometer Culture Survey. As described by TY 2019 GRC witnesses Diana Day and Tashonda Taylor, the Safety Barometer Survey assesses overall safety culture and identifies areas of strength and areas of opportunity to eliminate injuries and improve focus and commitment to safety.[18] SDG&E TY 2019 GRC witnesses David Buczkowski and David Geier sponsored joint safety policy testimony that provided the following reasons supporting SDG&E's position that the NSC Safety Barometer Survey is a leading practice to evaluating safety culture:

1. NSC's mission is safety – eliminating preventable deaths through leadership, education, and advocacy;
2. The NSC Safety Barometer Survey is led by third-party experts;
3. The practices included in the survey are the leading practices drawn from survey participants, allowing SDG&E to compare itself and benchmark against 580 other companies; and
4. The survey goes well beyond the utility industry and includes other industries.[19]

---

[17] See Section H, below, for SDG&E's emergency preparedness and response efforts with external stakeholders.

[18] A.17-07-007, Exh. SDG&E-02, and Direct Testimony of Tashonda Taylor (Exh. SDG&E-30).

[19] A.17-10-007, Rebuttal Testimony of David L. Buczkowski and David L. Geier (Exh. SDG&E-252) at DLB/DLG-12.

Through regular participation in the survey, SDG&E shares results, develops targets, implements plans, and measures progress, to increase employee participation in, and contribution to improvements in safety performance.

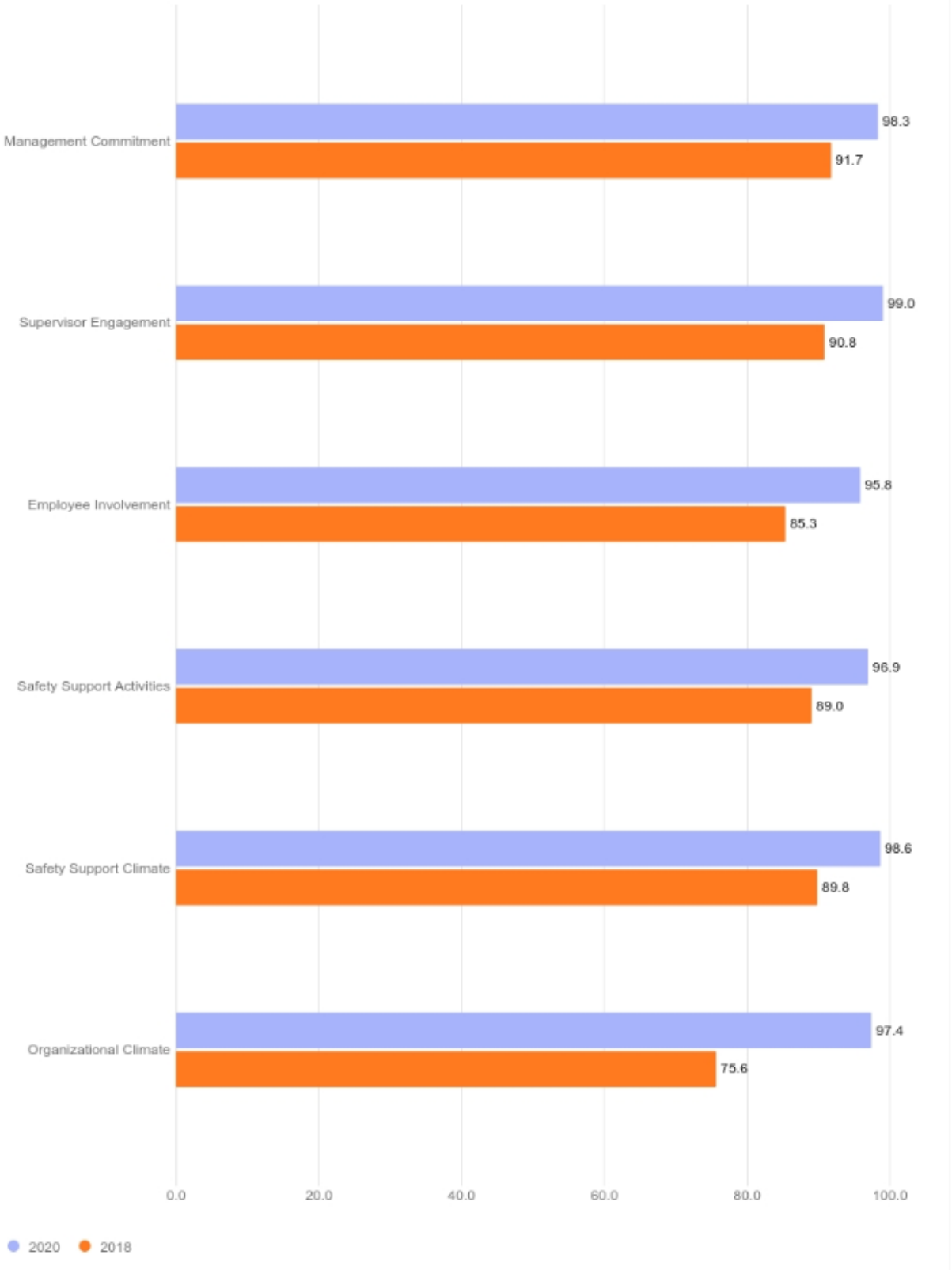
SDG&E began conducting safety culture assessments in 2013, using NSC's Safety Barometer Survey. The NSC Safety Barometer survey is an employee perception survey that engages employees and asks for their anonymous feedback on safety by measuring elements of safety excellence in the following areas:

- Organizational Climate – Items probe general conditions that interact with the safety program to affect its ultimate success, such as teamwork, morale, and employee turnover;
- Management Commitment – Items describe ways in which top and middle management demonstrate their leadership and commitment to safety in the form of words, actions, organizational strategy, and personal engagement with safety;
- Supervisor Engagement – Items consider six primary roles through which supervisors communicate their personal support for safety: leader, manager, controller, trainer, organizational representative, and advocate for workers;
- Safety Support Climate – Items ask employees across an organization for general beliefs, impressions, and observations about management's commitment and underlying values about safety;
- Employee Involvement – Items specify selected actions and reactions that are critical to making a safety program work. Emphasis is given on personal engagement, responsibility, and compliance;
- Safety Support Activities – Items probe the presence or quality of various safety program practices. This focuses on communications, training, inspection, maintenance, and emergency response; and
- Wildfire-specific Safety Culture – For the 2020 survey, SDG&E added four new questions to measure employee's beliefs, impressions, and observations about management's commitment, underlying values, and risk mitigation activities specific to wildfire safety.

NSC Barometer Survey gives the information and insight into the six critical areas of safety culture described above. Furthermore, NSC's rich database provides the ability to benchmark the results with hundreds of other companies who have conducted similar surveys with NSC and gives a comparative analysis of relative strengths and potential opportunities for organizational improvements and for individual work locations and departments.

SDG&E has now completed four cycles of the NSC Safety Barometer Survey (in 2013, 2016, 2018, and 2020), when compared to 580 other companies who have gone through similar surveys, the Company has ranked consistently high. In 2013 and 2018, SDG&E ranked above the 90th percentile. In addition to ranking, the NSC survey tool has helped to identify safety areas of alignment and strength as well as opportunities for potential improvement. The response rate in 2020 was 95.7%, representing 4,293 SDG&E employees completing the NSC survey. Below is an overview of SDG&E's 2020 survey results as compared to 2018.

Figure 3: SDG&E Percentile Scores of NSC Survey Performance Categories



The percentile scores by performance area highlight broad strengths and opportunities. If a specific performance category is underperforming compared with other performance categories, specific components from the lowest-performing category should be considered for action planning.

As shown above in Figure 3, in 2020, all six performance category percentile scores were well above the NSC Database average of 50. Since 2018, all six performance categories show increases in percentile scores. The largest increase in percentile score from 2018 to 2020 is found in the Organizational Climate category, with a considerable increase of +21.8 points.

Figure 4: SDG&E Percentile Score Increases Across Performance Categories

Performance Category	Change
Management Commitment	6.6
Supervisor Engagement	8.2
Employee Involvement	10.5
Safety Support Activities	7.9
Safety Support Climate	8.8
Organizational Climate	21.8

SDG&E has found the NSC survey tool to be very valuable in identifying improvement opportunities in its safety programs and system of safety controls. SDG&E's Safety Department takes the lead in identifying and implementing improvement opportunities with company-wide relevance and benefit. Management at each work location and business function use the survey results to identify potential improvement opportunities and work with their local management, safety committees, and employee base to create action plans and make needed improvements.

Stakeholder engagement is an essential element of an effective SMS. Employees and Contractors, especially operational, field, and frontline workers, are well-positioned to identify safety concerns and/or risks and raise such concerns to be addressed before a safety incident occurs. As part of its SMS, SDG&E developed a process for employees and contractors to proactively raise risk and safety concerns. This process leverages and incorporates existing methods and processes to submit safety or risk concerns and includes additional steps to provide a standardized, consistent means for follow-up and communication when such concerns are reported. When stakeholders see that the information they provide is being utilized and appropriate feedback is provided, the Company's safety culture further improves.

C. Risk Management

Effective risk management practices help to reinforce a strong and positive safety culture. SDG&E has undertaken a thoughtful and measured approach to the adoption of risk management structures and processes at all levels, to further the development of a risk-aware culture. As described in (then-Vice President, Enterprise Risk Management for SDG&E) Diana Day's testimony in the TY 2019 GRC, SDG&E's enterprise risk management organization facilitates the identification, analysis, evaluation, and prioritization of risks, with an emphasis on safety, to ultimately inform the investment decision-making process, and works to integrate risk management with asset and investment management through the creation of governance structures, competencies, and tools.[20] The Enterprise Risk Management practices and processes are used by SDG&E Electric and Gas Operations to identify safety risks, thus providing a critical element of SDG&E's SMS implementation efforts.

SDG&E's risk management framework is consistent with the Cycla Corporation 10-step Evaluation Method adopted in D.16-08-018, as discussed in detail in Chapter RAMP-B. Risk identification, as defined by ISO 31000, is the process of finding, recognizing, and describing risks. It includes the identification of risk sources, events, their causes, and potential consequences. On an annual basis, SDG&E's Enterprise Risk Management organization facilitates the enterprise risk identification process leveraging interviews and meetings with risk owners and managers to review and discuss potential changes to the Enterprise Risk Registry. SDG&E's risk management framework is discussed in detail in Chapter RAMP-B.

As part of its SMS, SDG&E has further integrated risk management practices into its operational processes and developed safety-centric operating unit risk registries (OURRs). Through the development of the OURRs, SDG&E's Enterprise Risk Management engages and solicits input and feedback from the operating business employees who manage risks on a daily basis. SDG&E's positive safety culture encourages and empowers employees to identify risks and to raise safety or risk-related concerns. The OURR development process serves as an additional means for employees to provide input and feedback, helps educate employees on hazard recognition and risk identification, and serves as a clearinghouse for risk mitigation activities identified by operational employees. Identified risk mitigation activities are assessed

[20] A.17-07-007, Exh. SDG&E-02-R at DD-2.

using consistent risk scoring and evaluation methodologies. SDG&E is leveraging the operating unit risk registries to inform the Enterprise Risk Registry and internal asset management strategies to continue integrating risk and asset management.

D. Operational Controls

Operational controls lead to greater certainty that SDG&E's gas, electric, and human systems will perform as expected. SDG&E describes its operational controls for human safety, pipeline infrastructure, and electric infrastructure below. SDG&E's wildfire management efforts are an example of robust operational controls. SDG&E's implementation of Public Safety Power Shutoff (PSPS) events and resiliency efforts are critical operational controls with strong ties to both asset and risk management.

1. Employee and Contractor Safety – OSHA Standards Implementation

Employee safety is a core value at SDG&E. SDG&E's safety-first culture focuses on its employees, customers, and the public, and is embedded in every aspect of the Company's work. SDG&E's Employee Safety risk mitigation programs are founded on proven employee-based programs, safety training, workforce education, and SDG&E's Illness & Injury Prevention Program (IIPP).

SDG&E relies heavily on the use of contractors. As further detailed in the Incident Involving a Contractor Chapter of this RAMP Report (SDG&E-Risk-4), SDG&E standardizes its approach to contractor safety through its contractor oversight program. SDG&E uses both the Contractor Safety Program Standard G8308 for SDG&E and the Class 1 Contractor Safety Manual for contractors to hold all business operations and Class 1 Contractors to the same requirements and/or standards.[21] Business units that use contractors also have field safety oversight of Class 1 construction work performed. This oversight includes instituting safeguards to perform all contracted work in accordance with SDG&E standards, OSHA regulations, applicable laws, and Commission Orders such as G.O. 95 (Rules for Overhead Electric Line Construction), and G.O. 128 (Rules for Construction of Underground Electric Supply and

[21] A Class 1 Contractor, as defined within SDG&E's Contractor Safety Manual at 5, is 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 Serious Safety Incident. Examples of a Class 1 Contractor include contractors performing work involving energized equipment or hazardous chemicals. *Available at* https://www.sdge.com/sites/default/files/SDGE%20-%20Contractor%20Safety%20Manual%20-%20Class%201%20Contractors%2012-21-2020.pdf.

Communications Systems). Further, SDG&E currently utilizes third-party administration tools to ensure contractors comply with SDG&E's established safety and contractual requirements (*see* SDG&E-Risk-4).

2. Gas Operations – API RP 1173 Implementation

In 2017, SDG&E began its Pipeline Safety Management (PSMS) initiative to align the Company's practices with API 1173 and reinforce the Company's safety culture through the alignment of business needs and gas operational risks in a systematic manner. SDG&E's 2020 Gas Safety Plan satisfies Commission directives as outlined in D.12-04-010 and implements "the policy of the state that the commission and each gas corporation place safety of the public and gas corporation employees as the top priority."[22] SDG&E's 2020 Gas Safety Plan also addresses the implementation of an enterprise-wide SMS by conveying the safety performance expectations of SDG&E's Senior Management Team and describing the SMS and all of the gas safety plans, programs, policies, standards, and procedures that are designed to accomplish those expectations.

Safety Policy witnesses David Buczkowski and David Geier testified in SDG&E's TY 2019 GRC proceeding regarding the elements and varying maturity levels of the Safety Management System that has been implemented.[23] More specifically, SDG&E, in its implementation of API 1173 for its gas pipeline operations, has adopted a three-pronged approach based on the following:

a. Employee and Contractor Safety;
b. Customer and Public Safety; and
c. Safety of SDG&E's gas delivery systems.

Each of these categories is addressed in SDG&E's risk management policies, processes, and practices, as well as through day-to-day operations. Moreover, these areas are all reflected in the various risk chapters of this RAMP Report.

As discussed in Omar Rivera's testimony in SDG&E's TY 2019 GRC, API1173 is a structured way to identify hazards and control risks while validating that the risk controls are

[22] Public Utilities Code § 963(b)(3).

[23] A.17-10-007, Exh. SDG&E-252.

effective.[24] This includes increased interdepartmental integration of all pipeline safety-related programs and risk management, development and monitoring of leading and lagging indicators, implementation of reporting and oversight processes, continuous program monitoring and improvement, enhanced incident investigation and lessons learned, safety culture evaluation, improved management of change and recordkeeping, enhanced emergency preparedness, and application of competence training.

3. Electric Operations - API RP 1173 Implementation

SDG&E's Electric Operations has procedures to ensure safe work practices when operating, maintaining, constructing, and responding to the system. While there is not an electric equivalent to the well-vetted API 1173, SDG&E set forth a strategic initiative to align its electric operations to the ten tenets outlined above in the fall of 2019. The SMS provides a comprehensive framework to identify and address safety for the design, construction, operation, and maintenance of SDG&E's electric system.

The safe and effective operation of SDG&E's electric system requires awareness and management of many linked activities within complex processes. While safety efforts may be applied individually to each activity, more effective safety performance is achieved when viewing linked activities as processes that are better managed holistically. The SMS provides a framework to provide for the continual, safe operation of SDG&E's electric system and its improved safety performance.

4. Asset Integrity Management (AIM) – ISO 55000 Implementation

In 2017, SDG&E began the implementation of its Asset Integrity Management (AIM) program, aligning asset management functions and strategies across SDG&E's electric system operations and implementing an integrated and comprehensive (across entire life cycles) asset management program in accordance with ISO 55000. As discussed in Will Speer's testimony in SDG&E's TY 2019 GRC, the benefits of applying ISO 55000 are three-fold:

1. Establishing an internal structure supports SDG&E's optimal balancing of asset cost, asset risk, and asset performance, by making safe and effective management of its physical assets a core business function;

[24] A.17-10-007, Rebuttal Testimony of Omar Rivera (Exh. SDG&E-205).

2. Following ISO 55000 (a proven benchmark) will lead to greater internal consistency across asset groups and repeatable and transparent business and asset management processes; and
3. Implementing the ISO 55000 framework will promote significant alignment across the organization and build "line of sight" to ensure employees at all levels fully understand their role in supporting the goals of the organization, at the top of which is safety.[25]

This asset management initiative is directly aligned with and is a critical extension of SDG&E's enterprise risk management program and is a key component of managing asset safety across the company. In fact, the ISO 55000 standard is structured in a very similar manner to API 1173, regarding the required tenets to achieve conformance, with both standards anchored on the "Plan-Do-Check-Act" process cycle. Since 2017, the Asset Management organization has developed the Asset Integrity Management (AIM) Program to implement an asset management system, with systematic and coordinated activities and practices for electric assets that include an ***integrative approach*** for governance, strategy, analytics and, continuous improvement. Utilizing the ISO 55000 asset management framework and requirements, the AIM Program has developed a policy, an integrated electric strategy, and individual asset management plans, which serve as key foundational documents for reinforcing asset safety practices and implementing reliable management and operations of electric system assets.

Because safety is the company's highest priority, the organization is incorporating a multi-attribute value framework for evaluating investments through a data-driven, quantitative risk- and safety-based lens. This value framework utilizes the Company's strategic values and determines standardized value-based metrics to quantitatively compare projects, thereby enhancing the Company's ability to cross-prioritize across portfolio and optimize investment decisions. Initial implantation of this value framework will occur with electric transmission and substation assets, and a phased approach will be employed to implement to other assets supporting the electric system infrastructure. SDG&E is also developing an information system platform to enable data integration and perform asset risk analytics to manage risk-informed asset life-cycle planning, strategy development, and prioritization. This system platform

[25] A.17-10-007, Direct Testimony of William H. Speer (Exh. SDG&E-15-2R) at WHS-63.

includes three components – an asset data integration platform, an asset performance management analytics tool, and an asset investment prioritization tool, including the value framework. Consistent with the value framework, the initial implementation of this platform will occur with electric distribution assets and then phased to other electric system assets. Additional information on SDG&E's Asset Integrity Management Programs is contained in the Asset Management CFF Chapter (SDG&E CFF-1).

E. Incident Investigation, Evaluation, and Lessons Learned

The SDG&E Injury and Illness Prevention Programs (IIPP) describe procedures and responsibilities for incident and injury reporting and the steps involved to conduct an incident evaluation. Employees are required to report all work-related incidents and injuries promptly to their supervisor. The incident evaluation process includes proper notification, visiting the incident scene, interviewing employee(s) and witnesses involved, examining the factors associated with the incident, determining the contributing factors of the incident, developing and implementing corrective actions to prevent reoccurrence and documenting findings and corrective actions using the incident evaluation form (or safety information management system). Through the incident evaluation process, SDG&E develops and communicates lessons learned from both internal and external incidents and investigations and makes recommendations for safety performance improvement, including changes to training, processes and procedures.

Every employee at SDG&E has the authority to "Stop the Job" or stop a task that they believe is unsafe or requires a pause for clarification regardless of level. This action is supported by management, the union, and employees throughout the Company. SDG&E's "Near Miss" reporting program is a means to help raise awareness and provides the opportunity to help prevent future incidents by communicating the facts around events that had the potential to result in injury, illness or damage, but did not. This program allows potential hazards to be investigated, mitigated, and communicated. Reporting near misses also reduces risk by promoting a safety culture that establishes opportunities to review safety systems and hazard control and to share lessons learned. SDG&E has a Near Miss Reporting portal where employees can report an incident online or via a mobile application. Additionally, this portal allows employees to print the form and anonymously submit it to their supervisor or the Safety Department. Further discussion on these programs can be found in the Incident Involving an Employee Chapter of this RAMP Report (SDG&E-Risk-8).

SDG&E established a team to create a more comprehensive and robust investigation standard and reporting process.[26] Further, as part of the SMS framework, SDG&E has developed processes for the broader sharing and use of lessons learned. Applying this process uniformly across the Company will result in more consistent investigations and will allow lessons learned to be shared broadly. In addition, regular training is available for those conducting incident investigations to confirm consistency and thorough investigations.

F. Safety Assurance

SDG&E has numerous programs and committees in place to provide safety assurance, which, as described above, are collectively managed within the SMS framework. Additionally, the SMS includes Quality Control and Quality Assurance to validate adherence to the system, reasonable progress toward full compliance with all expected standards of performance, and the resulting safe operation of the electric and gas systems. Quality Assurance provides confidence that the SMS and its processes are measured, analyzed, and used to identify continuous safety improvements.

1. Audits & Evaluations – Regularly scheduled internal audits are performed by Sempra Energy Audit Services. These audits assist management in assessing risks and evaluating whether business controls are in place and effective. Management is responsible for taking ownership of, and being accountable for, understanding, establishing, and maintaining effective business controls. Audit Services has full access to all levels of management, and to all organizational activities, records, property, and personnel relevant to the matters under review. Audit Services is authorized to select activities for audit, allocate resources, determine audit scope, and apply techniques required to accomplish audit objectives.
2. Executive Safety Council Team Meeting Dialogs – The Executive Safety Council is the governing body for all safety committees. Led by SDG&E's Chief Safety Officer and Director - Safety, this is a roundtable with company officers to advance the Company's safety culture, address enterprise-wide safety strategy, and give employees an opportunity to share their safety experiences with

[26] See SDG&E's Serious Injury and Fatality (SIF) initiative described in SDG&E's Incident Involving an Employee Chapter, SDG&E-Risk-8, Control 14.

company leadership. SDG&E's labor and represented workforce participate in the Executive Safety Council.

3. Electric Safety Subcommittee – This committee brings management and frontline electric system personnel together as a forum to discuss safety concerns from the perspective of those closest to the risks. The objectives are to make a lasting difference in reducing unnecessary risk, resolve division-wide safety issues/concerns and have front-line employees bring information back to their respective workgroups.
4. Gas Safety Subcommittee – This committee brings represented employee representatives from each district and management together monthly to discuss concerns and address potential gas operations safety hazards. The objective is to reduce unnecessary risk, resolve gas safety issues/concerns, and communicate information back to front-line employees.
5. Field and Office Safety Committees (site-specific) – These committees (approx. 40) are actively engaged in safety awareness through education, promoting a healthy lifestyle, encouraging work-life balance, and maintaining a safe work environment. To keep the committees connected, quarterly meetings are held with committee chairpersons and co-chairpersons. During these meetings, safety updates are shared, training is provided, and action planning steps are identified. Like SDG&E's other safety committees, site committees roll up to the Executive Safety Council as the governing body.
6. Field and Office Behavioral Accident Prevention Process – SDG&E's Behavioral Accident Prevention Process (BAPP®), formerly referred to as the Behavior Based Safety (BBS) Program, is a proactive approach to safety and health management, which recognizes at-risk behaviors as a frequent cause of both minor and serious injuries. BAPP is the "application of science of behavior change to real world safety problems." This process is a safety partnership between management and employees that continually focuses people's attentions and actions on their, and others, daily safety behavior to identify safe and at-risk behaviors. Through a peer observation program, employees observe employees working using a behavior inventory checklist to track safety behaviors and have a

dialog on safe and at-risk behaviors, with recommended behavioral safety changes.

7. Management Field Observations – Field supervisors conduct documented observations with their employees to address at-risk behaviors and to attempt to modify an individual's actions and/or behaviors through these interactions. Supervisors provide quality feedback during these positive interventions aimed at developing safe work habits and improving safety culture.
8. Grassroots Safety Culture Change Teams – SDG&E's grassroots safety culture change initiative involves a safety culture journey that goes beyond the "3 E's" of engineering, enforcement, and education. The emphasis is on building relationships, partnerships and trusts, which impact strategic focus areas of the Company, including safety. This approach uses an "iceberg analysis" to identify cultural norms and assumptions that cannot be seen (below the waterline) that may undermine established policies and procedures, uses Behavior Based Safety observations, and develops a culture action team to address at-risk behaviors.
9. Safety Congress and Leadership Awards – Held annually, the Safety Congress provides a forum for safety committee members, safety leaders, and others to share and exchange information and ideas through networking and workshops. At this event, safety leaders are recognized for living by the Company's safety vision, turning that vision into action, embracing the SDG&E safety culture, and demonstrating safety leadership.
10. The National Safety Council (NSC) Barometer Survey – As noted above, the NSC Barometer Survey is used to assess the overall health of the Company's safety climate and helps to identify areas of opportunity to eliminate injuries and improve focus and commitment to safety. The survey is administered to employees every other year. All organizations interpret their results using a three-step process to investigate, discuss, and understand where the improvement opportunities are. Organizational leaders work with their employees to identify and implement specific action-oriented strategies within their organization and carry out action plans to completion.

11. Environmental & Safety Compliance Management Program (ESCMP) – SDG&E's comprehensive health and safety risk management organization and framework establishes and implements SDG&E's health and safety risk management policies, including SDG&E's ESCMP. ESCMP is an environmental, health and safety management program to plan, set priorities, 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 also has an annual ESCMP Certification process to collect and record employee and facility compliance.

As demonstrated above, SDG&E has numerous longstanding initiatives, programs, and committees with a common objective of reducing safety risk and improving safety performance. SDG&E's SMS integrates and aligns each of these efforts into a systematic framework for continuous review and improvement.

G. Management Review and Continuous Improvement

SDG&E's SMS is based upon a continuous improvement framework. SDG&E's management review and continuous improvement efforts begin with the continuous assessment of risks identified through the ERM and Asset Management processes. The observations and information captured through those processes are used to develop strategic risk mitigations. Implementation of mitigation by business operations, results, and any lessons learned are reviewed by management, the Executive Safety Council and SDG&E's leadership on a regular basis.

Management Review of Performance – Safety metrics provide a baseline for how well SDG&E's organization is performing. Tracking both leading and lagging indicators and comparing historical results provides a baseline for continuous improvement and offers the ability to identify improvement opportunities. Common metrics (*e.g.*, OSHA reportable and Near Miss incidents) are tracked and analyzed, and recommendations for safety performance improvement are made, including training, tools, equipment, processes, and procedures.

Continuous Improvement – Results from a variety of safety metrics, including injuries, motor vehicle accidents, near-miss incidents, safety observations, are carefully reviewed by management, with a view toward evaluating risk and developing any necessary mitigation plans. Management sets safety goals with continuous improvement in mind, focusing on increasing current goals and developing new leading indicators.[27]

H. Emergency Preparedness and Response

SDG&E conducts public awareness efforts through education and outreach to enhance the safety of its customers and the general public. These efforts are designed to engage with our customers and the public to inform them about our shared safety responsibilities. For example, SDG&E's Public Safety campaigns focus on informing and educating the public about the danger of downed power lines, pole contact from vehicles and the hazards associated with digging near gas lines. These campaigns include videos, TV and radio spots, newspaper ads, billboards and collateral geared toward a variety of scenarios used for different audiences. Of equal importance are outreach activities with local first responder agencies, county coordinators (emergency management), and other public officials that occur on a yearly basis, focusing on how SDG&E partners through planning, training, and exercises prior to emergency incident response. This includes alignment of Utility ICS and Unified Command goals and objectives, understanding protocols and procedures, establishing effective Liaisons and Gas and Electric Safety Zones and processes, and reviewing infrastructure location information, hazard awareness and prevention, leak recognition and response, emergency preparedness and communications, damage prevention and integrity management. In addition, SDG&E also partners with these stakeholders throughout the year on joint drills, exercises, tabletops, and preparedness fairs in order to enhance our coordination and response during emergencies. Target audiences include but are not limited to:

- The County Office of Emergency Services;
- All Fire Departments and personnel (firefighters to Chief Officers);
- All Local Agency Emergency Dispatch Centers/personnel; and
- All Law Enforcement Agencies.

[27] Refer to SDG&E's SIF initiative described in SDG&E's Incident Involving an Employee Chapter, SDG&E-Risk-8, Control 14.

Emergency Preparedness – SDG&E's PSPS program is an element of utility wildfire mitigation plans authorized by the CPUC to address the threat of wildfire and customer/public safety, as discussed in the Wildfires Involving SDG&E Equipment (Including Third-Party Pole Attachments) Chapter (SDG&E-Risk-1). SDG&E's PSPS Communication plan consists of a public outreach and education campaign, implemented June through November. Communications will also include notifications for Public Safety Power Shutoff events. These communications target customers, first responders, public officials and government, public safety partners, as well as the Access and Functional Needs community.

The SDG&E First Responder Outreach Program is beginning its 8th year of service to all First Responder agencies in San Diego County. This Outreach Program has expanded significantly since its inception, as described above, by increasing target audiences, establishing an Operational Field & Emergency Readiness (OFER) program, and strengthening relationships with key stakeholders internally and externally. The OFER program objective is to provide targeted training and contingency planning activities for the local first responder agencies, as well as improved scene management and the use of the UICS for SDG&E responders. Strategic partnerships with agency leadership allow for increased communication, awareness of gas and electric safety protocols, and collaboration on mutual emergency preparedness to ensure employee and public safety. These objectives are accomplished through annual First Responder training and exercise programs, including the following meetings and collaborative outreach programs:

- Monthly briefings and input meetings with the San Diego County Fire Chief's Association on SDG&E response, planning, training, and exercise programs;
- Quarterly briefings with the County Fire Training Officers' committee;
- Annual briefings with the San Diego Police and Sheriff's Association; and
- Regular meetings and collaborative efforts with the County Office of Emergency Services.

Response Plans – SDG&E developed and continues to maintain an Emergency Operations Center (EOC) for use during significant emergencies to allow Company employees to efficiently collaborate and take appropriate action to respond to and mitigate that emergency. During an EOC activation, over 50 subject matter experts may be brought into the EOC, from across the Company, to provide strategic direction, coordination and to facilitate all emergency

response aspects through event duration. When activated, some basic responsibilities of the EOC include:

- Acquire and allocate critical resources;
- Consistent and aligned internal and external communications;
- Manage crisis information;
- Strategic and policy-level decision-making; and
- Provide centralized coordination of all aspects of the emergency.

The EOC is the hub from which all incident management, response, and communication are coordinated and/or directed. As such, the EOC serves a critical support function to ensure that SDG&E can respond effectively and efficiently to any hazard it may encounter, thereby protecting the safety of its employees, stakeholders, customers, the public, contractors, and any other resources or individuals in its service territory. After Action Reviews (AAR) are core to our Continuous Quality Assurance and Improvement process in Emergency Management. Following an incident or an emergency, AAR's are developed and facilitated to identify the following:

- What went well;
- What needs improvement; and
- Specific Action Items toward improvement (these are entered into a data base and tracked to completion).

I. Competence, Awareness, and Training

SDG&E's employees and contractors receive extensive training because we believe safety starts with proactive upstream measures to prevent a safety incident from occurring. Front-line employees are trained in behavior-based safety programs, such as Stop the Job, which empowers anyone to stop the job at any time, without fear of retaliation, if they identify a safety hazard. Further details about SDG&E's extensive training programs can be found in the Incident Involving an Employee Chapter (SDG&E-Risk-8).

J. Documentation and Record-Keeping

For safety and compliance purposes, SDG&E has implemented various recordkeeping controls for its system in accordance with, for example, the following CPUC regulations:

- G.O. 95 – Rules For Overhead Electric Line Construction

- Rule 80.1 defines the record-keeping requirement for the required inspection of joint-use poles.

- G.O. 128 – Rules For Construction of Underground Electric Supply and Communication Systems
  - Rule 17.7 provides requirements and responsibility for records pertaining to the location of underground facilities.
- G.O. 165 – Inspection Requirements For Electric Distribution and Transmission Facilities
  - Section III and Section IV provide the records management requirements for the inspection and maintenance of electrical assets for distribution and transmission facilities, respectively. Additionally, Section III.D requires submittal of an annual report identifying the asset inspection work completed.
- G.O. 166 – Standards for Operation, Reliability, and Safety During Emergencies and Disasters
  - Standard 11 requires annual reporting reflecting compliance with the G.O. and any modifications to the emergency plan.
- G.O. 174 – Rules for Electric Utility Substations
  - Section III provides requirements for substation inspection program records and reporting requirements.

There are also many CPUC decisions (*e.g.*, D.16-01-008) and additional requirements for data and records management resulting from various CPUC directives and laws (*e.g.*, AB 1650). In addition to existing rules, SDG&E must also comply with new or developing records management rules.

SDG&E's records management policies provide guidelines for defining records and non-records, applying legal holds, and utilizing the company-approved retention and disposition schedules. The goal of records management policies and practices is to provide consistent responsibility and accountability for records management as well as oversight and administration of records management.

SDG&E also has assigned records coordinators across the company. These record coordinators manage records and related issues and are based within each of their respective business areas. The purpose is to give each operational area day-to-day control over records for which it has responsibility and knowledge. Sempra Energy's Audit Services group performs periodic audits to verify compliance with policies related to records management and retention.

Further details about SDG&E's documentation and record-keeping can be found in the Records Management CFF Chapter (SDG&E-CFF-6).

V. SAFETY CULTURE ASSESSMENTS

As described above, in Section IV.B., SDG&E continually seeks to assess, measure, and enhance its safety culture by soliciting feedback in the form of biannual safety culture surveys. SDG&E's internal and external assessments of its safety culture both contribute to continuous improvement. For example, in its most recent employee survey (2020), SDG&E included questions specifically targeted to wildfire safety culture (*See* SDG&E-Risk-1). In addition to internal assessments, the Commission provides oversight and assessment of SDG&E's safety culture. Public Utilities Code Section 8389(d)(4) requires the Commission to adopt and approve a process for the Wildfire Safety Division (WSD) to conduct annual safety culture assessments for each electrical corporation. The CPUC approved the WSD's annual safety culture assessment process in Resolution WSD-011 on November 19, 2020.

On January 22, 2021, the WSD issued its requirements and guidelines for the utilities' first annual safety culture assessments. Through the assessments, the WSD seeks to develop a broad view of safety culture across the utilities to identify best practices and relative gaps, along with an understanding of each utility's strengths, weaknesses, and approaches. The WSD's annual safety culture assessment is specific to wildfire safety and is distinct from the CPUC's broader safety culture investigations, which are performed every five years. The WSD will evaluate the utilities primarily through a workforce survey and a utility self-assessment. The workforce survey will solicit feedback from relevant utility employees engaged in wildfire mitigation activities on their assessment of the utility's safety culture. Regarding the utility self-assessment, the WSD intends to track each utilities' organizational culture over time and will assess the current and future state of various safety culture elements. Specifically, the utilities must respond to questions that assess the organization's sustaining systems, structure and governance, and safety enabling systems. After reviewing the utility's submissions, WSD may require the utilities to provide supporting documentation to further justify and validate their self-assessments or submit to interviews. The WSD also has the discretion to conduct observational visits.

VI. COMPENSATION POLICIES RELATED TO SAFETY

SDG&E's strong safety culture is demonstrated through use of compensation metrics and key performance indicators to drive improved safety performance. As the Commission stated in D.16-06-054:

> One 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.[28]

Benefit programs that promote employee health and welfare also contribute to SDG&E's safety performance and culture. SDG&E has taken a number of actions to support employee safety during the pandemic, including providing COVID-related leaves, engaging specialists to advise on workplace safety issues, and providing a technology reimbursement that employees working remotely may use to purchase ergonomic equipment.

In her TY 2019 GRC testimony, Compensation and Benefits witness Debbie Robinson explained how SDG&E's compensation and benefits programs are designed to focus employees on safety, and that SDG&E has increased emphasis on employee and operational safety measures in their variable pay plans, commonly referred to as the Incentive Compensation Plans (ICP), thus bolstering their already strong safety culture and safety performance.[29] Ms. Robinson testified that SDG&E has increased the weighting of the employee and operational safety measures in their variable pay plans since the TY 2016 GRC.[30] These safety-related performance measures comprise a mixture of leading and lagging measures and span all lines of business – fire and public safety, gas safety, and electric safety – in order to prevent bias. Providing even stronger alignment between SDG&E's safety programs and the ICP helps to strengthen the Company's safety culture and signal to employees that safety is the number one priority.

VII. EXECUTIVE AND SENIOR MANAGEMENT ENGAGEMENT IN THE RISK ASSESSMENT, PRIORITIZATION, MITIGATION AND BUDGETING PROCESS

SDG&E Executive and senior management are engaged and play a direct role in managing risk at the Company. They are involved at many levels to review and understand the

---

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

[29] A.17-10-007, Exh. SDG&E-28 at DSR-10.

[30] A.17-10-007, Exh. SDG&E-28 at DSR-11.

risks of the business, prioritization of those risks, mitigation strategies and determining appropriate funding for the management and mitigation of risk. In her TY 2019 GRC testimony, SDG&E's risk management policy witness Diana Day testified that SDG&E's executive management, and specifically the Company's Executive Safety Council, are committed to and accountable for the development and maintenance of safety culture.[31] Ms. Day further testified that SDG&E's leadership holds regular safety meetings at many levels, including Executive Safety Council meetings, which have been in place for over a decade, annual Safety Summits, and annual Contractor Safety Summits, which have included hundreds of participants, representatives from other California utilities and the Safety Policy Division of the CPUC.[32] As detailed above and in the Incident Involving an Employee Chapter (SDG&E-Risk-8), SDG&E's Executive Safety Council, comprised of top company leadership, meets monthly to engage directly with front-line employees and supervisors, including especially SDG&E's labor and represented workforce, to listen and reinforce key safety tenets and have an open dialogue on safety issues, performance and culture.

Appendix E to Diana Day's direct TY 2019 GRC testimony describes how SDG&E's risk management framework and the annual development and updating of the enterprise risk registry provides a structured way for the organization to reflect on different types of risk and the strategies to control or mitigate those risks, as both a "bottom up" and a "top down" process.[33] Subject matter experts and risk managers from throughout the organization provide insight on risk drivers, impacts, and mitigants for risks that are being assessed. Risk owners and the senior management team then discuss enterprise level risks and mitigants for those risks. Risk owners and risk managers then have the opportunity to ensure that mitigations for top risks are transparent in the business process and are prioritized in decision making.

The Enterprise Risk Registry (ERR) is a communication tool that is shared amongst the management team and with employees. On an annual basis, the Vice President of Enterprise Risk Management & Compliance provides the SDG&E Board with a risk update that focuses on key enterprise-level risks and associated mitigants. The Sempra Energy Board of Directors also

---

31 A.17-10-007, SDG&E-02-R at DD-28.

32 *Id.*

33 *Id.* at DD-E-5.

receives periodic risk updates based on the written reports and management presentations from its operating subsidiaries, including SDG&E. Training and education regarding the management of risks is an ongoing endeavor. SDG&E senior executives continue to be involved in at least three executive risk sessions each year to review top risks identified for the utilities, ranking and prioritization of the risks, and funding for the mitigations.

With respect to assuring that risk mitigation is prioritized and appropriately funded, senior management also takes an active role. The involvement of SDG&E's leadership in the financial planning, budgeting, and investment prioritization process was described in the TY 2019 GRC testimony of SDG&E's rate base witness Craig Gentes, as follows:

> For non-balanced base capital, the SDG&E Executive Finance Committee (EFC) establishes a total annual capital expenditure target consistent with our authorized GRC funding for that period. From this total allocation, funding is prioritized based on risk-informed priorities and continuous input from operations.

- Step 1 – Initial capital allocations begin with input from Functional Capital Committees (FCCs), which are organized by the nature and type of capital investment or function. These teams of managers and subject matter experts perform a high-level assessment of the capital requirements for serving customers to ensure that infrastructure is maintained and developed to provide safe, reliable service with the highest risk mitigation at the lowest attainable cost. Each FCC elicits broad input for developing each function's capital plan and formulates a prioritized grouping of annual spending requirements.

- Step 2 – The capital requirements identified by the FCCs are provided to the Capital Planning Committee (CPC), a cross-functional team of directors representing each operational area with capital requests. The CPC reviews the FCC submissions, cross-prioritizes projects among the FCCs, and establishes a final ranking for proposed capital work. Projects determined to have the highest ratings on key priority metrics will receive the highest priority for funding. These key priority metrics include safety, cost-effectiveness, reliability, security, environmental, and customer experience.

- Step 3 – The CPC presents its recommendations for capital spending consistent within each functional area and consistent with the overall funding target to the EFC, which reviews the recommendations and either approves the proposed capital funding allocations or requests changes.

  Once the capital allocations are approved, the individual operating organization is chartered to manage its respective capital needs within the allotted capital. The real-time prioritization of work within the context of the budget allocations is completed by the front-line and project managers on an ongoing and continuous basis. Regulatory compliance deadlines, customer scheduling requirements, and

overall infrastructure condition are all factors taken into consideration as work elements are prioritized. Progress on existing capital projects is monitored and reviewed on a monthly basis by the CPC and EFC, and any new projects stemming from incremental Commission directives or changing business needs are evaluated and assessed throughout the year to determine whether current capital allocation should be reprioritized. Before starting a project or making any commitments, the project manager must secure specific project approval signatures in accordance with the Company's Internal Order process and approval and commitment policies.[34]

VIII. UTILITY BOARD ENGAGEMENT AND OVERSIGHT OVER SAFETY PERFORMANCE EXPENDITURES

SDG&E's Board of Directors determines safety performance measures and targets to be included in each year's ICP and reviews and approves the results. The Board meets on at least a quarterly basis; 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. As a part of its oversight roles, the Board may exercise discretion to reduce or eliminate any payout for employee and/or contractor safety measures in the event safety performance targets are not met.

A. SDG&E's Board of Directors Safety Committee and the Community Wildfire Safety Advisory Council

Governor Newsom signed Assembly Bill (AB) 1054 into law on July 12, 2019. AB 1054 contains numerous statutory provisions and amendments designed to enhance the mitigation and prevention of catastrophic wildfires – including wildfires linked to utility equipment – in California. AB 1054 added Section 8389 to the Public Utilities Code. Section 8389(e) establishes the requirements for annual safety certifications and, *inter alia,* requires electrical corporations to establish a safety committee of their board of directors. SDG&E established its Safety Committee in July 2019 and received its initial safety certification from the Commission via a letter from the Executive Director dated July 26, 2019.

SDG&E's Safety Committee advises and assists SDG&E's Board of Directors in the oversight of safely providing electric and natural gas services to SDG&E's customers.[35] The Safety Committee meets on a quarterly basis; meetings begin with a report by the Chief Safety

---

[34] A.17-10-007, Exh. SDG&E-33-2R at RCG-3 – RCG-4.

[35] *See*, SDG&E Safety Committee Charter, adopted on July 17, 2019, as revised and adopted on November 4, 2019, included as Attachment B to Advice Letter 3461-E, approved January 6, 2020 and effective November 5, 2019.

Officer, including a review of current safety and risk-related topics and conclude with the Safety Committee's recommendations to SDG&E. Per the Safety Committee Charter, the duties and responsibilities of the Safety Committee include, but are not limited to:

> (a) review and monitor (i) the Company's [SDG&E] safety culture, goals, and risks; (ii) significant safety-related incidents involving employees, contractors, or members of the public; (iii) the measures to prevent, mitigate or respond to safety-related incidents; (iv) periodic reports on safety audits;
>
> (b) … safety performance metrics.[36]

In addition, shortly after establishing its Safety Committee in 2019, SDG&E established a Wildfire Safety Community Advisory Council (WSCAC), comprising independent community members who possess extensive public safety, community and emergency services, and wildfire prevention and mitigation experience, to advise the Safety Committee. The WSCAC, which meets on a quarterly basis, held its first meeting on September 10, 2019. SDG&E convened on February 26, 2021, which took place virtually in light of the COVID-19 pandemic, and the next meeting of the Council is scheduled for March 25, 2021. The Safety Committee and the Community Wildfire Safety Advisory Council are intended to provide additional safety oversight for SDG&E with respect to safely providing electric and natural gas services. Further details about SDG&E's wildfire programs can be found in the Wildfires Involving SDG&E Equipment (Including Third-Party Pole Attachments) Chapter (SDG&E-Risk-1).

IX. CONCLUSION

SDG&E's safety-focused culture and supporting organizational structure allow the company to be proactive and accountable in the safe delivery of natural gas, electricity, and supporting services. The company continuously strives for a work environment where employees of all levels and its contractors can raise pipeline and electric infrastructure, customer safety, and employee safety concerns and offer suggestions for improvement through multiple platforms such as "Stop the Job," local Safety Committees, the Executive Safety Committee and the implementation of a reporting app for near misses and close calls. SDG&E's safety performance is regularly monitored and evaluated not only in accordance with all state and federal regulations, but beyond.

---

[36] *Id.,* Attachment B at 3.

As demonstrated throughout the chapters of this RAMP Report, SDG&E has made and continues to make strategic investments in its culture, technology, systems, and community partnerships to enhance the safety of our employees, contractors, customers, and the communities we serve. As part of its continuous improvement, SDG&E will propose new projects and programs in its TY 2024 GRC. SDG&E is focused on developing practices and initiatives that improve safety and strengthen its culture and public awareness that nothing is more important than keeping our employees, contractors, and the public safe.

Risk Assessment Mitigation Phase

(Chapter SCG/SDG&E-RAMP-E)

Lessons Learned

May 17, 2021

TABLE OF CONTENTS

RAMP-E: LESSONS LEARNED

I. INTRODUCTION

This chapter identifies lessons learned that could apply to future Risk Assessment Mitigation Phase (RAMP) filings made by other California investor-owned utilities (IOUs), pursuant to Decision (D.) 18-12-014 and D.16-08-018.[1] This chapter discusses lessons that SoCalGas and SDG&E (the Companies) have learned from feedback and experience in the 2019 RAMP Proceeding[2] and have incorporated into these 2021 RAMP Reports, as well as from the RAMP submissions of Pacific Gas and Electric Company (PG&E) and Southern California Edison Company (SCE). This chapter also addresses feedback and comments considered from the 2019 RAMP Proceeding and feedback received in connection with pre-filing activities held in advance of the Companies' 2021 RAMP Reports. RAMP-A addresses intervenor feedback that was incorporated into the Companies' RAMP Reports; this chapter summarizes feedback received and discusses how it was carefully considered in the preparation of this RAMP.

The Companies appreciate the feedback received and are committed to continuously improving by incorporating best practices and lessons learned, and collaborating and sharing knowledge with the Commission, IOUs, and other stakeholders. These lessons learned have helped make these RAMP Reports substantially more detailed, quantitative, and robust than the Companies' last RAMP filing. Incorporating feedback from stakeholders, these RAMP Reports include a new major attribute (Stakeholder Satisfaction) beyond the three required attributes for the first time in the state, add a new sub-attribute (acres burned), increase the number and percent of activities that have risk spend efficiencies, add descriptions in instances an RSE could not be calculated, and make a number of other positive changes. The Companies commit to continuing on the trajectory of improving and maturing their RAMP processes and presentations in future Reports.

---

1 D.18-12-014 at 34; D.16-08-018 at 151 ("Lessons learned by one company will also inform the RAMP filings of the other companies.").

2 Investigation (I.) 19-11-010/-011 (cons.), Order Instituting Investigation into Southern California Gas Company's and San Diego Gas & Electric Company's Risk Assessment and Mitigation Phase (2019 RAMP Proceeding).

II. LESSONS LEARNED CONSIDERING THIRD PARTY INPUT

In the Companies' 2019 RAMP Proceeding, parties submitted comments providing feedback and recommendations for SoCalGas's and SDG&E's next RAMP filings. In closing the 2019 RAMP Proceedings, the 2019 RAMP Decision ordered the Companies to "address and consider in their next Risk Assessment Mitigation Phase (RAMP) applications, the comments and suggestions by intervenors regarding the 2019 RAMP Report and further improvement of the RAMP process. The utilities' next RAMP filing shall fully comply with the guidelines set forth in Decision 16-08-018 and the Safety Model Assessment Proceeding Settlement Agreement."[3]

In addition to comments on the 2019 RAMP submissions, the Companies received oral and written feedback[4] on their preliminary position explanations during pre-filing RAMP events (public workshops and working group meetings).

As demonstrated in Chapters SCG/SDG&E RAMP-A, SCG and SDG&E RAMP-B, and SCG/SDG&E RAMP-C, these 2021 RAMP Reports fully comply with Commission decisions governing the RAMP process, specifically D.18-12-014 (Settlement Decision) and D.20-09-004 (2019 RAMP Decision). The Commission decisions allow for some flexibility in how certain requirements are met, and the Companies strive for continuous improvement. Accordingly, the Companies carefully evaluated and considered the valuable comments received from parties, which in turn influenced these 2021 RAMP Reports. Some intervenor feedback was incorporated into these RAMP Reports, as discussed in Chapter SCG/SDG&E RAMP-A; other feedback was carefully reviewed and considered but may not have been incorporated. Many of the comments made during the public forums mirrored comments received on the 2019 SoCalGas and SDG&E RAMP submissions[5] or were recently made in PG&E's 2020 RAMP proceeding.[6]

A. Summary of Intervenor Feedback

Table 1 below captures and addresses feedback received from parties, including the Public Advocates Office (CalPA), The Utility Reform Network (TURN), Mussey Grade Road

---

3 D.20-09-004 (the 2019 RAMP Decision) at 18-19 (Ordering Paragraph [OP] 1).

4 Written feedback was provided in "informal comments" served on February 12, 2021.

5 I.19-11-010 (cons.).

6 Application (A.) 20-06-012.

Alliance (MGRA), Utility Workers Union of America (UWUA), Protect Our Communities Foundation (PCF), and FEITA Bureau of Excellence (FEITA). For practical reasons, the table does not cover each minute issue raised in parties' comments, especially where such issues were not understandable.[7] The Companies appreciate and have carefully considered all feedback in accordance with the 2019 RAMP Decision. Table 1 covers the majority of topics raised.

Table 1 demonstrates that the Companies incorporated a majority of the feedback received into their 2019 RAMP Reports. This, as well as going through the RAMP process in general, helped the Companies to continue to evolve in their risk practices. Input that was considered but not incorporated into the 2021 RAMP Reports was generally not included because either: (1) there was a disagreement of interpretation amongst the parties, or (2) the recommendation was beyond the requirements for RAMP. Should the Commission want to consider those issues, they could be resolved in a statewide proceeding such as the ongoing Safety Model Assessment Proceeding Order Instituting Rulemaking (S-MAP OIR).[8]

Table 1

Topic	Party Comment	SoCalGas and SDG&E Response
Number of Attributes	Included only three attributes in the 2019 RAMP Report (Safety, Reliability, and Financial) even though when making investment decisions for risk mitigations, the Companies acknowledge a variety of other factors are considered.[9]	The Companies appreciate this feedback and have revised the MAVF in this RAMP report. As described in Chapters SCG/SDG&E RAMP-A and C, SoCalGas's and SDG&E's 2021 RAMP Reports include additional attributes (a top and sub-attribute). Note, feasibly incorporating additional attributes is bound by practical limitations.

[7] As an example, PCF's informal comments (at Section IV) expressed opposition to including a mitigation in the 2021 RAMP Reports to place markers on real property. SoCalGas and SDG&E are unaware of the program PCF references.

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

[9] I.19-11-010 (cons.), *Comments of The Utility Reform Network on Southern California Gas Company and San Diego Gas & Electric Company's Risk Assessment and Mitigation Phase Submissions* (April 6, 2020) at 3; *See also* I.19-11-010, *FEITA Bureau of Excellence Comments on SoCalGas and SDG&E 2019 RAMP Filing* (April 6, 2020) (FEITA Comments) at 17.

Topic	Party Comment	SoCalGas and SDG&E Response
New Fourth Attribute	The Companies' newly proposed attribute is incomplete, has the potential to overlap with other attributes,[10] and may result in inflated risk analyses.[11]	The Companies appreciate this feedback and have further clarified their fourth attribute proposal in their 2021 RAMP Reports to address the comments received, as discussed in Chapters SCG/SDG&E RAMP-A and C.
Equivalencies Between Attributes	Equivalencies implied by the Companies' Risk Quantification Framework are questionable, because in comparing between the financial and safety attribute, the result in terms of the statistical value of life are beyond that of the federal agencies.[12]	In both the 2019 and 2021 RAMP Reports, the Companies constructed their Risk Quantification Framework in accordance with the six principles outlined in the Settlement Decision, which do not require equivalencies to be based on a statistical value of life.[13] This is further discussed in Section III below (and in SCG/SDG&E RAMP-C). Moreover, the Commission is considering whether to adopt a risk tolerance standard as a statewide issue in the ongoing S-MAP OIR.[14]
Removal of Shareholder Financial Interest	The 2019 RAMP Report did not demonstrate that shareholders' financial interests have been removed from their risk assessment decision-making.[15]	The Companies disagree with PCF's assessment with respect to their 2019 RAMP Report. In their 2021 RAMP Reports, Chapter SCG/SDG&E RAMP-C discusses

[10] *Informal Comments of TURN In Response to the Sempra Pre-RAMP Workshops* (February 12, 2021) (TURN Informal Comments) at 6-7.

[11] *The Protect Our Communities Foundation's Comments on January 27, 2021 Pre-Filing 2021 RAMP Workshop #2 of SDG&E and SoCalGas* (February 12, 2021) (PCF Informal Comments) at Section III.

[12] TURN Informal Comments (February 12, 2021) at 5-6.

[13] *See* Settlement Decision, Appendix A at A-5 – A-6.

[14] *See* Rulemaking (R.) 20-07-013, *Assigned Commissioner Scoping Memo and Ruling* (November 2, 2020) (S-MAP OIR Scoping Ruling) at 7-9.

[15] I.19-11-010 (cons.). *The Protect Our Communities Foundation Reply in Support of its Proposal Regarding How This Proceeding Should Move Forward in Light of the Directives in D.20-01-002; and Comments on the Joint 2019 Risk Assessment and Mitigation Phase Report of Southern California Gas Company and San Diego Gas & Electric Company* (April 6, 2020) (POC Comments) at 38 (Section IX).

Topic	Party Comment	SoCalGas and SDG&E Response
		how SoCalGas's and SDG&E's financial attribute is calculated. Shareholder financial interests are not included.
Secondary Impacts	An analysis of secondary impacts was arbitrarily eliminated in the 2019 RAMP Report.[16]	The Companies explained the challenges of secondary impact analysis in their 2019 RAMP Report.[17] As explained in the 2021 RAMP Report's Chapters SCG/SDG&E RAMP-A and C, SoCalGas and SDG&E attempted to analyze certain secondary impacts from the risk events. Secondary impacts were incorporated into the Cybersecurity risk chapters. Secondary impacts remain difficult to discover, meaningfully quantify, and incorporate.
Use of Frequency versus Likelihood	Frequency effectively represents risk reduction, since it effectively handles the case of multiple risk events per year.[18] Likelihood, not frequency, should be used to calculate the likelihood of a risk event.[19]	The Companies have appropriately provided and quantified frequency and likelihood in their 2019 and 2021 RAMP Reports. The use of frequency in calculating pre-mitigation risk scores is appropriate due to the Enterprise Risk grouping used for risk quantification, as discussed in SCG/SDG&E RAMP-C, and is permitted in the Settlement Decision.[20] A more detailed discussion is included in Section III below.

[16] POC Comments (April 6, 2020) at 21.

[17] I.19-11-010 (cons.), *Joint 2019 Risk Assessment and Mitigation Phase Report* (December 2, 2019) (2019 RAMP Report), Chapters RAMP-A at A-11 – A-12 and RAMP-C at C-33 – C-34.

[18] I.19-11-010 (cons.), *Mussey Grade Road Alliance Comments on SDG&E's 2019 RAMP Filing* (April 6, 2020) (MGRA Comments) at 7.

[19] I.19-11-010 (cons.), *Comments of The Utility Reform Network on Southern California Gas Company and San Diego Gas & Electric Company's Risk Assessment and Mitigation Phase Submissions* (April 6, 2020) (TURN Comments) at 7.

[20] Settlement Decision, Appendix A, at A-8 ("Identification of the Frequency of the Risk Event").

Topic	Party Comment	SoCalGas and SDG&E Response
Risk Spend Efficiency (RSE) Calculations	In the 2019 RAMP Report, RSEs were "not calculated for mandated activities without providing a justification."[21] RSEs must be calculated for all mitigations in the 2021 RAMP filing[22] and a ranking of all mitigations by RSE must be provided.[23]	Although the Companies adopted a different approach in their 2019 RAMP Reports, the Companies have improved their process and reviewed all activities in their 2021 RAMP Reports and performed an RSE and/or evaluated the feasibility of doing so. Where performing an RSE is infeasible (*e.g.*, no meaningful data or SME judgment is available), the Companies have provided an explanation. Further details are provided in Chapters SCG/SDG&E RAMP-A and C and the risk chapters.
Use of RSE High/Low Ranges	Not clear what added value the alternative ranges for RSEs bring; additional justification should be provided if this is kept in the 2021 RAMP filing.[24]	Alternative calculations for RSEs are not included in the 2021 RAMP Reports, as discussed in Chapter SCG/SDG&E RAMP-A.
Tranches	Sufficiently granular tranches were not provided in the 2019 RAMP Report.[25] Location specific risks were not adequately considered in the 2019 RAMP Report.[26]	As explained in Chapter SCG/SDG&E RAMP-A and shown in the risk chapters, the Companies have improved their process and incorporated more tranches, where appropriate, including location-specific tranches, in the 2021 RAMP Reports. Further details are provided in Section III below.
Alternatives	Part of the alternative mitigation analysis should be to demonstrate an	The Companies have improved their process in the 2021 RAMP

[21] TURN Comments (April 6, 2020) at 4-5; POC Comments (April 6, 2020) at 24 and 26-30; *see also* PCF Informal Comments (February 12, 2021) at 2-3, TURN Informal Comments (February 12, 2021) at 3-4.

[22] TURN Comments (April 6, 2020) at 4-5.

[23] POC Comments (April 6, 2020) at 30.

[24] MGRA Comments (April 6, 2020) at 4.

[25] TURN Comments (April 6, 2020) at 5; TURN Informal Comments (February 12, 2021) at 1-3.

[26] FEITA Comments (April 6, 2020) at 28-29.

Topic	Party Comment	SoCalGas and SDG&E Response
	effort to choose a project size that maximizes the RSE.[27] Meaningful mitigation alternatives were not provided in the 2019 RAMP Report; alternatives should be analyzed in the planning process so that the most safety results are achieved.[28]	Reports, as follows: Each RAMP risk chapter presents two alternative mitigation plans that it considered, consistent with the Commission requirements in the Settlement Decision. RSE values were calculated and reviewed for alternatives. Although the alternatives were dismissed, an explanation is provided regarding why.
Discounting Costs	Costs should be discounted at the weighted average cost of capital (WACC); adjusting costs for inflation is not the same as discounting.[29]	In the 2019 and 2021 RAMP Reports, the Companies presented costs in base year (2020), constant dollars. This means that all costs are expressed in the most recent year's recorded dollars. No discounting is needed to get costs back to today's dollars, consistent with the GRC presentation. As discussed in Section III below, the Companies continue to evaluate applying a formal discount rate, such as the WACC, to all costs in the RSE calculation (including operations and maintenance costs that do not earn a rate of return at the WACC). The Companies will provide an update in the Test Year (TY) 2024 GRC.
Baseline	The baseline for risk reduction calculations in the 2021 RAMP Reports should be the risk levels at the end of 2023. [30]	As discussed in detail in Section III below, the baseline for costs and benefits should be consistent with the GRC framework, which requires the comparison point to be the last year of available recorded data.

[27] MGRA Comments (April 6, 2020) at 10.

[28] POC Comments (April 6, 2020) at 35.

[29] TURN Comments (April 6, 2020) at 6-7.

[30] TURN Informal Comments (February 12, 2021) at 4-5.

Topic	Party Comment	SoCalGas and SDG&E Response
Exclusion of Certain Internal Labor Costs	In order to accurately calculate RSEs, all benefits and costs must be incorporated, including internal labor costs.[31]	The Companies have improved their process for the 2021 RAMP Reports. As discussed in Chapter SCG/SDG&E RAMP-A, the RAMP Reports include estimates for internal labor costs, where applicable.
Data	In the 2019 RAMP Report, no explanation was provided for why there is scant or incomplete data and the criteria used to scale national data.[32] Utility-specific data was not included.[33]	The Companies perform a broad review of available data and seek ways to utilize that data – whether it be internal, state, or nationwide. The Companies have improved their process for 2021 RAMP Reports' risk chapters and their workpapers with additional discussion of data sources and how those sources are used. Data is addressed in more detail in Section III below.
Transparency	RAMP calculations are to be obtained from real, measurable data where possible.[34] Sources should be provided for estimates of LoRE and CoRE, and a justification for each estimate used should be included in workpapers.[35] Transparency requirements were not met in the 2019 RAMP Report.[36]	The Companies have improved their process in the 2021 RAMP Reports by providing in each risk chapter the type of data that was used (utility-specific, industry) and the estimates for LoRE and CoRE (both on a pre-mitigation and post-mitigation basis). Additional information, such as sources, are included in the workpapers.

[31] TURN Comments (April 6, 2020) at 7-8.

[32] POC Comments (April 6, 2020) at 24.

[33] POC Comments (April 6, 2020) at 31-34; PCF Informal Comments (February 12, 2021) at 1-2. SoCalGas and SDG&E acknowledge that utility-specific data reflects the particular circumstances of the utility; however, PCF is incorrect that utility-specific data is required. The Settlement Decision states: "Data can include company-specific data or industry data. Whether use of a type of data is appropriate depends on the issue under consideration. If a utility relies on industry data, the utility will provide justification for applying those data to the specific circumstances of the utility." *See* Settlement Decision, Appendix A at A-18 ("Data Support and Data Sources").

[34] MGRA Comments (April 6, 2020) at 2.

[35] MGRA Comments (April 6, 2020) at 8.

[36] POC Comments (April 6, 2020) at 16.

Topic	Party Comment	SoCalGas and SDG&E Response
Sensitivity Analysis for Wildfire	Use of expected value of the safety attribute may lead to underestimation of wildfire risks and underinvestment in wildfire prevention measures; 99th percentile values should be used for safety indices.[37]	SDG&E has improved its analysis for use in the 2021 RAMP Report with the development and implementation of its Wildfire Next Generation System (WiNGS) model. Additional information is discussed in Chapter SDG&E-Risk-1.
Treatment of Public Safety Power Shutoff (PSPS)	PSPS was treated only as a solution and not as a safety risk in the 2019 RAMP Report.[38]	SDG&E has improved its methodology and treatment of PSPS issues for the 2021 RAMP Report. As further discussed in SCG/SDG&E RAMP-A, SDG&E's Wildfire RAMP Chapter (SDG&E-Risk-1) consists of two components, the risk of wildfire and PSPS impacts.
Electric Grid Cybersecurity	Attempted attacks on the electric grid should be analyzed as an independent risk.[39]	The Companies have improved their process in the 2021 RAMP Reports by performing separate scenario analyses on the gas and electric systems related to cybersecurity.
Climate Change	Climate change posed by SDG&E's and SoCalGas's operations was not addressed as an individual risk chapter in the 2019 RAMP Report.[40]	The Companies have improved their presentation for the 2021 RAMP Reports. SoCalGas and SDG&E have incorporated additional information regarding climate change-related issues as a cross-functional factor (CFF) in these RAMP Reports (*see* SCG-CFF-2; SDG&E-CFF-2).
Adequate Staffing and	Understaffing is not included as a driver/trigger in the risk bow-tie for	The Companies have improved their presentation for the 2021

[37] MGRA Comments (April 6, 2020) at 4-6.

[38] MGRA Comments (April 6, 2020) at 11; *Post Workshop Comments of the Public Advocates Office on the Southern California Gas Company and San Diego Gas & Electric Company January 27, 2021 Pre-filing RAMP Workshop* (February 12, 2021) (CalPA Informal Comments) (February 12, 2021) at 1.

[39] MGRA Comments (April 6, 2020) at 12.

[40] POC Comments (April 6, 2020) at 20-21; *See* PCF Informal Comments (February 12, 2021) at 4, FEITA Comments (April 6, 2020) at 18, CalPA Informal Comments (February 12, 2021) at 1.

Topic	Party Comment	SoCalGas and SDG&E Response
Human Performance	any of the RAMP risks in the 2019 RAMP Report.[41] Human error and a discussion about personnel competency are missing from the 2019 RAMP Report.[42]	RAMP Reports by addressing Workforce Planning / Qualified Workforce issues as a CFF in these RAMP Reports (*see* SCG-CFF-7; SDG&E-CFF-8). Training to minimize human error is discussed in the Incident Involving an Employee risk chapters (*see* SCG-Risk-5, SDG&E-Risk-8).
Safety Management Systems (SMS) and Process Safety	SMS, process safety, management of change (MOC), and incident investigations should be discussed in the RAMP.[43]	SMS, including process safety, MOC, and incident investigations, is addressed as a CFF in these RAMP Reports (*see* SCG-CFF-6; SDG&E-CFF-7) and is also discussed as integral to SoCalGas's and SDG&E's safety culture in SCG RAMP-D and SDG&E-RAMP-D.
Overpressure Events, the Low Pressure System, and Gas Quality	Overpressure events and the low pressure system appear to be missing from the 2019 RAMP Report. Gas quality and contamination should be more thoroughly discussed.[44]	Activities to mitigate overpressure events are included in these RAMP Reports in SoCalGas's and SDG&E's RAMP risk chapters of Incident Related to the High Pressure System and Incident Related to the Medium Pressure System (*see* SCG-Risk-1, 3; SDG&E-Risk-3, 9). Overpressure issues are not always called out in mitigations, but apply to several activities in those chapters.
Reliability Items	Reliability of supplies (*i.e.,* availability of spare parts) and compressor stations should be discussed.[45]	The Companies have improved their presentation for the 2021 RAMP Reports. For certain RAMP risks, an execution constraint driver was added to the

[41] I.19-11-010 (cons.), *Comments of Utility Workers Local Units No. 132, 483 and 522 ("Utility Workers" or "UWUA") on 2019 RAMP Report of Southern California Gas Company* (April 6, 2020) at 12.

[42] FEITA Comments (April 6, 2020) at 11-12 and 17.

[43] FEITA Comments (April 6, 2020) at Sections 7-8, 8-9, 20-21.

[44] FEITA Comments (April 6, 2020) at Sections 10-11, 12-16.

[45] FEITA Comments (April 6, 2020) at 18-19.

Topic	Party Comment	SoCalGas and SDG&E Response
		risk bow tie to address reliability of supplies. Compressor station reliability is discussed in SoCalGas's and SDG&E's Incident Related to the High Pressure System risk chapters (see SCG-Risk-1; SDG&E-Risk-3) and SoCalGas's Incident Related to the Storage System risk chapter (*see* SoCalGas-Risk-4).
System Visibility	Gas and electric system visibility through the supervisory control and data acquisition (SCADA) network should be discussed.[46]	The Companies have improved their presentation for the 2021 RAMP Reports. Foundational Technology Systems, including SCADA, are addressed as a CFF in these RAMP Reports (*see* SCG/SDG&E-CFF-4).

The feedback received by parties influenced SoCalGas's and SDG&E's approach on these 2021 RAMP Reports, as noted above and discussed in Chapter SCG/SDG&E RAMP-A. Lessons learned from the input received is also addressed in Section III, *infra*.

B. Other Utility RAMP Filings

SoCalGas and SDG&E also reviewed the RAMP proceedings of PG&E and SCE to prepare their respective RAMP Reports. Consistent with the Commission's goal of increasing efficiency by moving toward standardizing the organization and format of RAMP submissions,[47] the Companies evaluated each IOU's organization of its RAMP risk chapters and adopted a similar structure for purposes of consistency.

In addition to striving for unity in the structure of their RAMP Reports, the Companies also considered the unique elements contained in the other IOU RAMP reports and adopted similar approaches, where appropriate. For example, PG&E introduced in its 2020 RAMP Report the concept of cross-cutting factors. SoCalGas and SDG&E further built upon this concept to create their volumes of Cross-Functional Factors, or CFFs. As stated in Chapter

[46] FEITA Comments (April 6, 2020) at 28.

[47] *See, e.g.*, D.20-01-002 (the Rate Case Plan Decision) at 3 (establishing workshops to further explore "[s]tandardizing the organization and format of GRC and RAMP filings").

SCG/SDG&E RAMP-A, CFFs are safety-related initiatives that impact several of SoCalGas's and SDG&E's RAMP risks.

PG&E used non-linear scaling functions in its multi-attribute value function (MAVF),[48] and received comments criticizing this approach.[49] SCE used a combination of linear and non-linear scaling functions.[50] SoCalGas and SDG&E monitored the RAMP proceedings of the other utilities and elected to use linear scaling functions in their Risk Quantification Framework. The Companies' lessons learned from other aspects of PG&E's and SCE's RAMP proceedings, such as additional granularity of tranches, RSE calculation, and accounting for the risk of PSPS impacts (as well as intervenor feedback), are noted in Table 1.

III. RAMP MATURITY AND ENHANCED RAMP TO GRC INTEGRATION CONSIDERATIONS

SoCalGas and SDG&E continue to improve their risk quantification methods. The 2021 RAMP Reports demonstrate improvement through the introduction of new attributes in the Risk Quantification Framework (for the first time in the State), additional granularity, the calculation of more RSEs (including for many mandated programs), and the introduction of CFFs. However, the Companies strive for continuous improvement. Accordingly, the Companies identify additional lessons learned for consideration in future RAMP submissions below. Although many of these must be addressed as longer-term goals, SoCalGas and SDG&E are beginning to plan for such efforts. The Companies also address any remaining parties' comments that were not incorporated into the 2021 RAMP Reports below, in accordance with the 2019 RAMP Decision.

Many of the lessons learned discussed in this Section stem from the Companies' belief that RAMP and GRC filings should be consistently presented to better align with and connect the information presented in the RAMP, GRC, and accountability reporting processes. The RAMP and GRC processes are not distinct; rather, they are part of the GRC process. This is evident as

---

[48] A.20-06-012, *Application of Pacific Gas and Electric Company (U39M) to Submit Its 2020 Risk Assessment and Mitigation Phase Report* (June 30, 2020) at 4 and Attachment A, Chapter 3.

[49] A.20-06-012, *Safety Policy Division Safety Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application* (November 25, 2020) at 15-17.

[50] I.18-11-006, *Southern California Edison Company's 2018 Risk Assessment and Mitigation Phase Report* (November 15, 2018) at 1-36 (Selection of Scaling Functions).

the final step in the RAMP process is for a utility to integrate RAMP results into its GRC application.[51]

It is also consistent with the Commission Staff proposal put forth in the S-MAP OIR to "[m]atch RAMP information to the subsequent GRC."[52] This means that the years presented in GRCs should be the basis for the RAMP filings and the GRC ratemaking principles should likewise apply. For example, a utility should begin with the years that will be forecasted in the subsequent GRC and provide estimates for the same years in the RAMP filing. In addition, the comparison points (for costs and benefits) should be consistent with the requirements set forth in the Rate Case Plan for GRCs; mainly to begin with the last year of recorded information and develop estimates from that "baseline." Similarly, with respect to RSE calculations, costs should be expressed in a consistent manner with how such costs will be presented in GRCs, and risk reduction benefit assumptions should be those the utility is comfortable defending with supporting testimony in the GRC. Rather than taking one approach for RAMP and a different approach for the GRC, consistency should be pursued. This principle of consistency between RAMP and GRC filings runs through many of the items discussed below.

A. Use of Frequency

The Settlement Decision defines frequency as "the number of events generally defined per unit of time," and notes that "[f]requency is not synonymous with probability or likelihood."[53] As explained by MGRA, "frequency can represent multiple events per year."[54] Likelihood, however, is "quantified as a number between 0% and 100% (where 0% indicates impossibility and 100% indicates certainty). The higher the probability of an event, the more certain we are that the event will occur."[55] MGRA explains when commenting on the difference between frequency and likelihood:

---

51 D.14-12-025 at 42.

52 R.20-07-013 and D.20-01-002, *CPUC Consolidated Workshop Presentation* Slide 9 (Workshop held on February 9, 2021) (*available at* https://www.cpuc.ca.gov/uploadedFiles/CPUC_Website/Content/Safety/Risk_Assessment/SMAP/SMAP_Tr_3_RCP_Wrkshp_4_Presentation%20--%20FINAL.pdf).

53 D.18-12-014, Appendix A at A-2.

54 MGRA Comments at 6 (April 6, 2020) (citation omitted).

55 D.18-12-014, Appendix A at A-2.

> The probability and the frequency are the same for small values but begin to deviate as the frequency approaches 1 event per year. The probability becomes effectively equal to 1.0 (100%) for larger expected values per year. For example, if we expect 100 dig-ins per year then it is virtually certain that at least some dig-ins (the risk event) will occur during the course of the year.[56]

TURN opposed the Companies' use of frequency, stating that it is not compliant with the Settlement Decision because likelihood is needed to calculate the Likelihood of a Risk Event or LoRE.[57] The Companies disagree. The Settlement Decision specifically permits the use of frequency in calculating pre-mitigation risk scores at the risk level, and therefore, use of likelihood also creates a disconnect in the approach with respect to pre-mitigation LoRE.[58] And, as MGRA comments, "SDG&E's method does effectively represent risk reduction, since it effectively handles the case of multiple risk events per year."[59] The Companies suggest the parties further explore the use of frequency and likelihood in the S-MAP OIR.

B. Baseline for Risk Reduction Activities

There have been discussions on what the "baseline," or comparison point, should be when calculating risk reduction benefits and RSEs. TURN's informal comments on the Companies' pre-filing 2021 RAMP workshop initially suggested that the baseline for risk reduction calculations in the 2021 RAMP Reports should be the level at the end of 2023. This is because the revenue requirement from the last General Rate Case is authorized through 2023, and the Test Year 2024 General Rate Case will establish the revenue requirement for years 2024 through 2027.[60] TURN claimed that risk reduction benefits would be double counted with those supposed to be achieved by the last GRC cycle, if this were not done. TURN further comments that "Rows 10 and 11 of the Settlement… require that data reflecting past results '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.'"[61]

---

[56] MGRA Comments (April 6, 2020) at 7.

[57] TURN Comments (April 6, 2020) at 7.

[58] D.18-12-014, Appendix A at A-8 – A-9 ("Identification of the Frequency of the Risk Event").

[59] MGRA Comments (April 6, 2020) at 7.

[60] TURN Informal Comments (February 12, 2021) at 4-5.

[61] TURN Informal Comments (February 12, 2021) at 5.

The Companies initiated follow-up discussions on this topic with SPD and jointly with SPD and TURN. Through these discussions, the Companies believe that TURN is conflating the GRC cycles (*i.e.*, the years for which revenue requirement is authorized in a previous GRC) with the required framework for proposing forecasted costs (which are then used to establish the authorized revenue requirement in the next GRC). The Companies understood TURN's initial suggestion to be that the baseline for these 2021 RAMP Reports should be the end of 2023 and the Companies should forecast the years 2024-2027. This suggestion would have the Companies forecast the years of the TY 2024 GRC cycle in which revenue requirement will be authorized. In further informal discussions, the Companies came to understand that TURN is most interested in incorporating baseline RAMP benefits for the year 2023, compared to TY 2024 forecasts. The Companies disagree with TURN's position, as discussed below, because: (1) using a forecasted baseline to analyze other forecasts is illogical; (2) the Settlement Agreement must be read within the context of the Commission's GRC Rate Case Plan; (3) there is no double counting of costs or risk reduction benefits under existing Commission-adopted processes; and (4) selecting a "correct" baseline is not defined or prescribed by the Settlement Agreement, as TURN suggests.

Generating a Forecast on Top of a Forecast is Illogical.

To incorporate risk reduction benefits through 2023, as TURN suggests, the Companies would first need to take its current risk scores and somehow determine a methodology to reflect risk scores at the end of 2023. One way to do this would be to utilize the Companies' estimates in these RAMP Reports through 2023 and assume the risk reduction benefits associated with these forecasted activities are realized. The result would be lower risk scores as the starting point. However, this is illogical for several reasons.

First, 2023 has not yet occurred. Designating a future year as the baseline would unnecessarily insert uncertainty and assumptions into the analysis by basing a forecast on a forecast, with little to no value. On top of this, future forecasts would be compared against this future baseline. *Second*, as the Commission has recognized, issues arise during GRC cycles that may require a utility to re-prioritize funding to address immediate needs.[62] Reflecting reductions in risk scores before the years have occurred runs the risk of not accurately crediting (or benefiting) the correct risks based on actual events. *Third*, risks generally increase over time if

[62] *See, e.g.*, D.20-01-002 at 38 ("The Commission has always acknowledged that utilities may need to reprioritize spending between GRCs.").

mitigations are not performed. Each year, for example, assets and systems age, vegetation grows, and there are increased threats (for example, emerging cybersecurity threats) on our systems. Accordingly, risk reduction benefits cannot be realized without also recognizing the increased risk that may occur due to the passage of time.

In addition to the foregoing, performing RSEs in the manner dictated by TURN would create no apparent benefit, because changing the baseline would not likely change the relative rankings of RSEs. Simply, risk reduction compares a new risk score (LoRE x CoRE) with a mitigation to the prior risk score without the mitigation. The RSE then divides this change in risk score by the cost of the mitigation. To determine this new risk score (*i.e.*, the post-mitigation risk score), SoCalGas and SDG&E calculate a new LoRE and CoRE for the given program. This new LoRE and CoRE isolate the risk reduction benefit for that program. Therefore, the comparison point or baseline is irrelevant so long as it is consistently applied (*i.e.*, a new LoRE and CoRE compared to the same baseline LoRE and CoRE).

Contrary to TURN's suggestion of starting the analysis for risk reduction with a forecasted, future baseline, the Rate Case Plan *requires* the use of recorded data as the starting point for baseline comparisons.[63] In these RAMP Reports, the Companies use 2020 as the "baseline," which is the last year of recorded data available at the time of the instant Applications,[64] as further discussed below.

The Settlement Agreement Must Be Read within the Context of the Commission's GRC Rate Case Plan.

The Settlement Agreement's language referencing the "GRC period under review in the RAMP submission" must be interpreted within the context of the Commission's Rate Case Plan. It does not exist in a vacuum. The RAMP is the first phase of the GRC; and therefore, the RAMP Reports must be developed in such a way that they may be integrated into the GRC. From the Companies' perspective, the GRC period that is reviewed in the RAMP must align with the period reviewed in the GRC – *i.e.*, the years that the Companies will forecast in their GRC applications, which will be used to evaluate the test year revenue requirement. In this case, the

---

[63] *See* D.07-07-004, Attachment A, at A-31.

[64] The Companies' risk score calculations were performed throughout August 2020 to February 2021, using the most recent set of historic data available up to that time frame. The Companies used the most recent available data, but not all data for each risk was available to the same time frame, therefore risks were scored using data up through a time period between 2019 and 2020.

GRC forecast years are 2022-2024.[65] The Companies will file their TY 2024 GRC Applications by May 15, 2022, pursuant to D.20-01-002. Accordingly, the Companies will use 2021 as a base year in the GRC (their last historical year of data prior to filing), upon which forecasts will be developed for the years leading up to the test year, 2024. Because the RAMP is filed one year before the GRC, the last year of recorded data is 2020, making that the base year or baseline for RAMP.

Using the same forecast years in both the RAMP and the GRC is also consistent with another example from the Settlement Agreement, Row 28, which requires a Step 3 supplemental analysis in the GRC based on threshold amounts for a three-year cumulative total for capital programs and a test year amount for expense programs, for the "CPUC jurisdictional *forecast cost of the program in the GRC*."[66]

From the Companies' perspective, the years 2022-2024 is the only possible "GRC period under review in the RAMP submission" for this proceeding.[67] This is because a smooth integration of RAMP into GRC requires that the comparison used for cost and benefit information should match between both proceedings. It would be illogical to compare risk reduction benefits shown in a forecasted baseline of 2023 in the RAMP filing to a 2021 GRC baseline. The result would be, among others, that the risk reduction benefits being reviewed and considered in the GRC would be compared to a different year than those included in the RAMP.

---

[65] The Companies' use of a 2021 base year and 2022-2024 forecast years for their GRC presentation follows the Commission's established standard requirements for GRC presentations in the Rate Case Plan. The standard requirements include providing the last year of historical data at the time a GRC application is submitted, called the "base year" and forecasting "with evaluation of changes up to and including the test year." *Id*. For the Test Year 2024 GRC, SoCalGas and SDG&E will provide a historical base year of 2021 (because the GRC application will be filed by May 15, 2022) and forecast the years are 2022-2024.

[66] D.18-12-014, Appendix A, at A-14 – A-15 ("Step 3 Supplemental Analysis in the GRC") (emphasis added).

[67] The Companies understand that the topic of baseline and whether it should be a defined term in the lexicon is currently in scope for the open S-MAP OIR. *See* R.20-07-013, S-MAP OIR Scoping Ruling at 4-5 and 6 (Tracks 1 and 3). Any adjustments to the Companies' approach, if necessary, should be made in future filings.

There is No Double Counting of Risk Reduction Benefits.

As shown above, TURN's argument that because the Companies have been authorized a revenue requirement through 2023, the RAMP analysis should begin with 2024[68] is not supported by the GRC framework. TURN, however, claims that its proposed baseline is necessary to avoid double counting of risk reduction benefits.[69] On the contrary, the Rate Case Plan requires each GRC cycle to start with recorded information regardless of the amounts previously authorized, which does not create double counting in GRC forecasting. Any realized efficiencies or new ways of doing business are included in the history and rolled into the next GRC.

For example, the Commission generally examined costs as well as gained efficiencies for the Companies' programs shown in the TY 2019 GRC presentation only through the test year, 2019 (*i.e.*, the Commission evaluated programs for years 2017-2019).[70] The RAMP programs were similarly evaluated for the same years, 2017-2019. And in the next TY 2024 GRC, cost levels (including realized efficiencies) for the 2022-2024 programs will be evaluated, for the first time, to set future funding.[71] Thus, neither the GRC framework nor the Companies' RAMP presentation results in an overlap of program year evaluation nor a double-counting of costs.[72] And the same is true for risk reduction benefits; no double counting of realized risk reduction benefits is created by using a historic RAMP base year.

---

68 TURN Informal Comments (February 12, 2021) at 5.

69 TURN Informal Comments (February 12, 2021) at 5.

70 D.20-01-002 at 8. The Rate Case Plan's requirement to use the last recorded year of data as a GRC baseline allows for the extensive review of programs by the Commission and parties for the years that are forecasted in GRCs (to set test year revenue requirement levels), while post-test year funding is established through a mechanism based on escalation factors.

71 The purpose of the evaluation of programs in a GRC, in accordance with the Rate Case Plan, is to provide levels for future funding. *See Id.*

72 Any concern of double-counting benefits is also alleviated by the additional oversight created by the Commission's reporting requirements. In D.14-12-025, the Commission created two accountability reports, the Risk Spending Accountability Report and Risk Mitigation Accountability Report to provide the opportunity to review spending and benefits after work is completed. Currently, only the Risk Spending Accountability Report has been implemented. However, the Risk Mitigation Accountability Report implementation is an open item in scope of the open S-MAP OIR (*see* Section III.D below).

Selection of a "Correct" Baseline Is Not Prescribed by the Settlement Agreement, as TURN Suggests.

Finally, selecting a baseline is not defined or mentioned in the Settlement Agreement, nor is the selection of a "correct" baseline prescribed by the Settlement Agreement, as TURN suggests. The first mention of "baseline" in the context of RAMP proceedings is in D.14-12-025, which requires RAMP filings to include, among other things, "A description of the controls *currently in place*, as well as the 'baseline' costs associated with the current controls."[73] The Commission's "currently in place" language is consistent with the Companies' understanding that the term "baseline" relates to programs that currently exist, for which there are known data, rather than a forecasted "baseline" year in the future. The Companies are unaware of any Settlement Agreement requirement or Commission decision that is inconsistent with their understanding of D.14-12-025's language.

C. Validation of Data and Assumptions

Quantitative risk analysis relies heavily on data. Therefore, the ability to locate and use meaningful data will always be a factor in risk analysis. Although many data sources are available for a wide array of uses, it is uncommon to find data that is precisely what is needed at a particular point or for a particular use. The Companies are proactive in their efforts to learn and obtain relevant data and to pivot to adapt to future needs for new and advanced data.

SoCalGas and SDG&E believe granular and robust data sets are needed to evaluate a program's effectiveness as well as to meet evolving Commission reporting requirements. In the wildfire space, extensive reporting requirements already exist and are becoming more rigorous. The Companies expect that with the implementation of the Risk Mitigation Accountability Report, which is a topic in scope of the pending S-MAP OIR,[74] additional data and validation will be required.

In an effort to improve data collection,[75] SoCalGas and SDG&E are developing processes to confirm that risk reduction metrics are understood, tracked, repeatable, and producing results. The intent is to validate, upon look-back, if risk reduction was achieved.

---

[73] D.14-12-025 at 32 (emphasis added).

[74] *See* S-MAP OIR Scoping Ruling at 8 (Phase II, Track 1, x, "Risk Mitigation and Accountability Reports (RMAR)").

[75] D.16-08-018 at 146 and 193 (Conclusions of Law [COL] 38).

D. Equivalences Between Attributes in Risk Quantification Framework

The Settlement Decision requires that when building an MAVF, each attribute should reflect its relative importance to other attributes in the value framework. This is done "based on the relative value of moving each attribute from its least desirable to its more desirable level,"[76] creating equivalencies between attributes. As shown in Table 1, TURN disagrees with the Companies' preliminary equivalencies based on TURN imputing the statistical value of life and finding the values were beyond those utilized by federal agencies.[77]

SoCalGas and SDG&E did not develop their Risk Quantification Framework to imply a statistical value of life, nor should it be utilized for that purpose. Rather, the Companies constructed their Risk Quantification Framework in accordance with the six principles outlined in the Settlement Decision, which do not require equivalencies to be based on a statistical value of life.[78] Moreover, the Commission is considering whether to adopt a risk tolerance standard as a statewide issue in the ongoing S-MAP OIR.[79] SoCalGas and SDG&E agree that this issue has RAMP implications for all IOUs and should be considered and determined uniformly for all IOUs. We look forward to discussing this issue in the S-MAP OIR.

E. Granularity and Tranches

SoCalGas and SDG&E continue to advance their risk modeling and have provided risk analysis at granular levels, in accordance with the Settlement Decision, to the extent it is currently feasible. The Settlement Decision requires a utility to "subdivide the group of assets or the system associated with the risk into Tranches…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."[80] The Companies complied with this requirement by subdividing their assets and systems to align with how the assets and systems are managed, as discussed below.

---

[76] Settlement Decision, Appendix A at A-6 (MAVF Principle 6 – Relative Importance).

[77] TURN Informal Comments (February 12, 2021) at 5-6.

[78] *See* Settlement Decision, Appendix A at A-5 – A-6.

[79] *See* Rulemaking (R.) 20-07-013, *Assigned Commissioner Scoping Memo and Ruling* (November 2, 2020) (S-MAP OIR Scoping Ruling) at 7-9.

[80] D.18-12-014, Appendix A at A-11 ("Definition of Risk Events and Tranches").

In the 2021 RAMP Reports, the Companies subdivided assets and systems in four ways. *First*, risk events themselves are already subdivided. For example, SoCalGas and SDG&E consider high pressure (HP) gas assets to have different risks than medium pressure (MP) gas assets. One way to demonstrate the difference in these risk profile (but not the approach used by the Companies) would be to first identify a mitigation to a risk that involves the entire gas system and to then create a tranche for the high pressure assets and a different tranche for the medium pressure assets. The result would be: Control 1; Control 1-T1 (HP), Control 1-T2 (MP). Alternatively, the Companies could first create the subdivision by risk profile and then identify a mitigation (which is the approach used by the Companies). The result would be Control 1 in the HP risk and Control 1 in the MP risk. Both approaches result in the exact same level of analysis but the mitigation with the "T" in its ID Name appears to be tranched, and the one without a "T" in its ID Name does not appear to be tranched. The Companies consider the results of both methods to be tranches.

Second, SoCalGas and SDG&E identify tranches for the risk event that are applicable to the entire risk. Expanding on the previous example, the Companies' respective high pressure pipelines traverse locations that are classified as either High Consequence Area (HCA) locations or non-HCA locations. In many cases, a mitigation on high pressure pipeline is the same regardless of its location (HCA versus non-HCA), but the risk profile of that mitigation is different because of the pipeline's location (HCA versus non-HCA). Continuing the first approach (not used by the Companies) in the previous example, the mitigation Control 1-T1 (HP) would now be tranched again, with the result being Control 1-T1-T1 (Gas pipeline-HP-HCA) and Control 1-T1-T2 (gas pipeline-HP-non-HCA). Continuing the approach used by the Companies, the results are Control 1-T1 (HP pipeline-HCA) and Control 1-T2 (HP pipeline - non-HCA). The mitigations in SDG&E's Wildfire risk for High Fire Threat District tiers could be used as another example.

Third, another way to achieve tranches is to identify separate programs for different assets. In the Companies' respective risks for Excavation Damage (Dig-In) on the Gas System, programs are presented in a manner that separates the difference in risk profiles for dig-ins on the high pressure system compared with the medium pressure system. In this example, programs are given the nomenclature Control 1 (HP) and Control 2 (MP). They could have equivalently been called Control 1-T1 (Dig-in – HP) and Control 1-T2 (Dig-in – MP). As another example, the

Companies typically develop programs associated with a specific asset, such as a distinct program for hotline clamps and lightning arresters in SDG&E's Wildfire risk or piping in vaults in SDG&E's Incident Related to the Medium Pressure System. Moreover, for circumstances where various inspections have differing cycles, such inspections are represented as separate programs, as seen in SoCalGas's Incident Related to the Medium Pressure System for its pipeline monitoring activities.

Fourth, in addition to subdividing assets or systems through separate risks, locations applicable to the risk, and program development, the Companies further subdivide assets and systems when different risk profiles exist for an activity. For example, as seen in SoCalGas's RAMP risk chapter of Incident(s) Related to the Medium Pressure System, SoCalGas subdivided its Distribution Integrity Management Program into a vintage integrity plastic plan and a bare steel replacement program to capture the different risk profile of the different types of material. Similarly, in SDG&E's Electric Infrastructure Integrity risk chapter, SDG&E subdivided its distribution overhead switch replacement program into the following types of switches: SCADA, gang, and hook to capture the different risk profiles of each type of switch.

These four ways of tranching within the Companies' respective 2021 RAMP Reports align with how the assets and systems are managed, consistent with the Settlement Decision. SoCalGas and SDG&E strive for additional granularity of tranches when feasible and when doing so reflects how SoCalGas and SDG&E manage their assets or systems; however, a number of challenges persist. Practically speaking, providing risk analysis at granular levels presents challenges. Locational differences, for example, may result in different risk profiles, or tranches, for certain risks as discussed above. However, the Companies generally do not track costs by location. Accordingly, to perform this or a similar breakdown, assumptions must be made. To accommodate the granularity of tranches for future GRCs and accountability reports, SoCalGas and SDG&E are looking into potential changes to their accounting practices to track cost information in this manner, so that the data and assumptions associated with tranches are repeatable. The Companies will continue to strive for greater granularity in their tranching as appropriate in future RAMP Reports.

F. Risk Reduction and RSEs

As explained in Chapter SCG/SDG&E RAMP-A, in these 2021 RAMP Reports, the Companies reviewed all current and newly planned activities in the RAMP risk chapters to

evaluate the usefulness of performing an RSE, and included an RSE value when meaningful data or SME opinions are available. Activities without an RSE value include an explanation. This approach addresses feedback received on the Companies' 2019 RAMP Reports that the Companies should provide RSE values for mitigations performed to maintain compliance with state and federal mandated requirements, as shown above in Table 1.

The Companies are gaining more practice in quantifying risk reduction, building on the development of these Reports. Nonetheless, estimating risk reduction can be a thought-provoking, theoretical practice. Subject matter experts are often perplexed with how exactly to quantify the benefits of a given program that, in many instances, is a longstanding best practice. For example, how much risk is reduced by performing pipeline patrols, or administering locate and mark training, or continuing a contractor oversight program?

Further, estimating risk reduction requires data to yield sound results. When data is available, less subjectivity is applied. Absent data, however, SMEs are asked to use their judgment, as required by the Settlement Agreement. The Settlement Agreement states:

> All estimates should be based on data whenever practical and appropriate. However, the available data should not restrict the application of the risk assessment methodologies. SME judgment should be used if the methodologies require use of data that is not available. Over time, SME judgment should be increasingly supplemented by data analysis as the methodologies mature.[81]

However, the Settlement Agreement does not require the Companies to guess or make things up when no SME judgment is available. Many times, particularly when no utility-specific or industry data exists, SMEs may not have a basis for knowing the amount of risk reduction provided by a mitigation or control, and providing a data point would require guesswork, rather than judgment. Despite these facts, parties have argued that if needed, utilities are absolutely required to guess as part of creating an RSE, and to state in their RAMP filings that they have little to no confidence in the "guesses."[82] The Companies disagree that providing an RSE based on guesswork is required by the Settlement Decision or would be useful to the Commission. Moreover, Rule 1.1 of the Commission's Rules of Practice and Procedure requires parties before the Commission to never "mislead the Commission or its staff by an artifice or false statement of

---

[81] D.18-12-014, Appendix A at A-18 ("Data Support and Data Sources").

[82] *See* TURN Informal Comments (February 12, 2021) at 3-4.

fact or law." The Companies believe that presenting RSEs without any basis in fact or judgment has the potential to mislead.

Where RSEs are unavailable for a particular activity in the 2021 RAMP Reports, SoCalGas and SDG&E provide an explanation for why the RSE is unavailable, consistent with the Safety Policy Division's guidance in PG&E's 2020 RAMP proceeding[83] and discussions at SoCalGas's and SDG&E's pre-filing workshops. The Settlement Decision does not require forced production of an RSE where only guesswork, and no data or SME judgment, exists.

How to express a "risk score" also presents philosophical questions. Quantitative risk analyses use many methods to evaluate the seriousness of a risk, and those methods can vary depending on circumstances. At times, one might want to know the likelihood of a large event occurring or the worst expected impact over a 20-year span of time. Both of those questions require other methodologies than those used in the current RAMP to create a risk score. Those other methodologies could also be useful to communicate the reasons why the utilities chose the risk-reducing activities that they did. RSEs are just one piece of information that could help explain the efficacy of a risk-reducing activity.

G. Discounting of Costs

The Settlement Decision requires calculation of an RSE as follows:

> RSE should be calculated by dividing the mitigation risk reduction benefit by the mitigation cost estimate. The values in the numerator and denominator *should be present values* to ensure the use of *comparable measurements* of benefits and costs.[84]

The GRC Rate Case Plan also requires the use of comparable values in an IOU's GRC request, as follows: "All data for expenses shall be stated in recorded dollars and dollars inflation adjusted to a constant base year."[85] In other words, all costs in the GRC are presented in base year dollars to reflect a single year's dollars, without adjustment for escalation. The Companies believe that the "comparable measurements" and "present values" language in the Settlement Decision is consistent with the Rate Case Plan's requirement to present all costs in base year,

---

[83] A.20-06-012, *Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application* (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

[84] D.18-12-014, Appendix A at A-13 ("Risk Spend Efficiency (RSE) Calculation") (emphasis added).

[85] D.89-01-040, Appendix A at A-31.

constant dollars.[86] Thus, the Companies' 2019 RAMP Report stated all costs in today's (base year) dollars, consistent with GRC filings, in compliance with the Settlement Decision's requirement to ensure comparable measurements. No further discounting is needed.

TURN, however, provided its view that all costs should be discounted at the weighted average cost of capital (WACC), on the grounds that escalation and discounting are different.[87] The Companies revisited this topic in preparing their 2021 RAMP Reports and agree with TURN that escalation and discounting are different concepts. While the Companies are not opposed to the concept of discounting, TURN's suggestion to discount all costs at the WACC does not represent differences in utility costs. For example, O&M costs are different from capital costs. One such difference is that O&M expenditures do not earn a rate of return. Therefore, it may be inaccurate to discount O&M costs at the WACC. Prior to the implementation in a RAMP or GRC filing, questions should be addressed as to the types of costs subject to discounting. The Companies maintain that their use of base year, constant dollars is appropriate and consistent with the Settlement Decision and the Rate Case Plan; however, additional discussion of discounting costs could be further discussed with interested stakeholders in the S-MAP OIR.

H. Pre-filing Workshops

As mentioned above, SoCalGas and SDG&E held three workshops/working group sessions prior to filing their 2021 RAMP Reports. PG&E similarly held several workshops/working group sessions prior to their 2020 RAMP Report submittal. SoCalGas and SDG&E found these public forums valuable and appreciate parties' investment of time and feedback. During the Companies' final public workshop, some participants expressed the view that the workshops were perfunctory and held only because they were procedurally mandated, and that the utilities had not expressly committed to incorporate recommendations from the parties into their final RAMP submissions.

As summarized in this Chapter and demonstrated throughout their Reports, SoCalGas and SDG&E have carefully evaluated and considered the oral and written feedback provided by parties. At the time of the pre-filing workshops, however, the Companies could not commit to which recommendations would be incorporated because the 2021 RAMP Reports were still

[86] Generally, present value is a financial calculation that discounts a future stream of cash flows to today's dollars to account for the time value of money.

[87] TURN Comments (April 6, 2020) at 6.

being developed or doing so would require undoing substantial work on fundamental issues that were already foundational components of the Reports. The utilities need time to develop large, complex filings such as the RAMP Reports. The Settlement Decision requires utilities to host one pre-filing RAMP workshop to gather input from stakeholders "to inform the determination of the final list of risks to be included in the RAMP."[88] More than one pre-filing workshop should not be required if it results in misaligned expectations and does not benefit the process.

IV. CONCLUSION

The lessons learned offered by SoCalGas and SDG&E are intended to be a constructive representation of the RAMP process and how to improve future filings. SoCalGas and SDG&E welcome lessons learned by others to improve the process.

[88] Settlement Decision, Appendix A at A-10 ("Risk Selection Process for RAMP").

Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-1)
Wildfire Involving SDG&E Equipment

May 17, 2021

TABLE OF CONTENTS

RISK: WILDFIRE INVOLVING SDG&E EQUIPMENT

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 risk of wildfire involving SDG&E equipment, including third party pole attachments (Wildfire). Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter SDG&E-RAMP-B of this RAMP Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter SCG/SDG&E RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs, and cost estimates are provided for years 2022-2024, as further discussed in Chapter SCG/SDG&E RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are

---

[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and General Rate Case.

[2] *See* D.18-12-014 at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

provided where those costs are available and within the scope of the analysis required in this RAMP Report.

Throughout this 2021 RAMP Report, activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's Wildfire risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters SCG/SDG&E RAMP-A and SDG&E RAMP-C, SDG&E has endeavored to calculate a Risk Spend Efficiency (RSE) for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or Subject Matter Expert (SME) opinion exists to calculate the RSE, SDG&E has included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

SDG&E has also included a qualitative narrative discussion of certain risk mitigation activities that would otherwise fall outside of the RAMP Report's requirements, to aid the CPUC and stakeholders in developing a more complete understanding of the breadth and quality of the Company's mitigation activities. These distinctions are discussed in the applicable control and mitigation narratives in Section III and/or IV.

A. Risk Overview

SDG&E's service territory experiences Santa Ana winds, which have been directly linked to some of the largest and most destructive wildfires in Southern California. These Santa Ana winds, coupled with other weather conditions, dry fuels, and the impacts of climate change, have resulted in an increased risk of catastrophic wildfires. The California Legislature found that

---

3 *Id.* at 16.

4 *Id.* at 17.

5 *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

"[t]he increased risk of catastrophic wildfires poses an immediate threat to communities and properties throughout the state,"[6] "[w]ith increased risk of catastrophic wildfires, the electrical corporations' exposure to financial liability resulting from wildfires that were caused by utility equipment has created increased costs to ratepayers,"[7] and "[t]he state has dramatically increased investment in wildfire prevention and response, which must be matched by increased efforts of the electrical corporations."[8]

In 2020, the scale and scope of California wildfires occurred at an unprecedented level. The California Department of Forestry and Fire Protection's (CAL FIRE) website reports that the 2020 August Complex Fire burned over one million acres, making it the largest wildfire in California history. Indeed, five of the six largest fires in California history occurred in 2020. Unfortunately, these wildfires caused deaths and the destruction of property and natural resources.

In SDG&E's service territory, the most significant fire of 2020 was the Valley Fire, burning 16,390 acres and causing significant property damage, as well as the interruption of electric service after burning 119 wood poles. While the ignition of the Valley Fire, and many of the other major fires of 2020, were not linked to utility equipment, these fires and their consequences nevertheless reinforce the continued importance of taking dramatic action to mitigate the risk of climate change-driven catastrophic wildfires in California, including potential utility-caused wildfires.

The Valley Fire occurred in SDG&E's High Fire-Threat District (HFTD). The HFTD, as established by D.17-12-024, is an area within SDG&E's service territory that has a greater potential for wildfires. The HFTD represents approximately 64% of SDG&E's service territory. 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."[9] Although wildfire risk is not limited to the HFTD, the majority of the risk is primarily within Tier 2 and Tier 3 areas. Roughly 61% of the ignition consequences are estimated to be in Tier 3, 36% in Tier 2, and 3% in non-HFTD. This is why the majority of

---

6 Assembly Bill (AB) 1054 (2019-2020), Section 1(a)(1).

7 AB 1054, Section 1(a)(2).

8 AB 1054, Section 2(a).

9 D.17-12-024 at 2.

SDG&E's wildfire mitigation initiatives are targeted and prioritized in the HFTD, and thus, this Wildfire RAMP Chapter is focused on the HFTD.

Safety is SDG&E's top value, and virtually no activity implicates safety more than wildfire prevention. SDG&E has focused on wildfire prevention and mitigation activities for more than a decade, and it strives to be the industry leader in this area. In the aftermath of the catastrophic October 2007 wildfires in SDG&E's service territory and across Southern California, SDG&E dedicated itself to revamping and enhancing its wildfire prevention and mitigation measures across a wide spectrum of disciplines and activities.

A prime example is SDG&E's ability to forecast fire danger and to use such information to adapt the Company's behavior. SDG&E developed an in-house meteorology team to forecast fire danger throughout its service territory and enable the Company to undertake advanced preparations for severe weather events. SDG&E built the first of its kind network of dense, utility-owned weather stations to provide detailed weather data across the service territory, which informs day-to-day operational decision-making at all levels of the Company. Additionally – and as a last resort when conditions warrant – SDG&E pioneered the use of de-energization (*i.e.*, Public Safety Power Shutoffs or PSPS) for public safety from major wildfires. While SDG&E uses PSPS as a last resort tool, it also recognizes that PSPS itself can impact customers and communities. Accordingly, the risk presented herein is comprised of two components: the risk of wildfire and PSPS impacts.

SDG&E continues to innovate and improve its wildfire mitigation initiatives to keep its communities safe through situational awareness, prevention, communication, and collaboration. SDG&E openly shares its experience, lessons learned, and technological advancements in weather and wildfire mitigation with other investor-owned utilities (IOUs), state agencies, and stakeholders in the fire community, with the objective of improving wildfire prevention across California and the West. Despite an unusually challenging year, SDG&E advanced its wildfire mitigation initiatives in 2020 and will continue to do so in 2021.

B. Risk Definition

For purposes of this RAMP Report, SDG&E's Wildfire risk is defined as the risk of catastrophic wildfire, especially those initiated by SDG&E equipment, resulting in fatalities, widespread property destruction, and multi-billion-dollar liability. Because PSPS as a mitigation

has an impact on customers, the overall risk assessment is comprised of two components: the risk of a catastrophic wildfire and the PSPS impacts to customers.

C. Scope

This Wildfire RAMP Chapter is focused on the HFTD; programs outside of the HFTD are addressed in the RAMP risk of Electric Infrastructure Integrity (SDG&E-Risk-2). Table 1 below provides what is considered in scope for the Wildfire risk in this RAMP Report.

Table 1: Risk Scope

In-Scope:	Wildfires that meet the CPUC Fire Incident Data Collection requirements for reporting.[10] In accordance with D.14-02-015, 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 to customers are also included in the scope of the overall risk assessment.
Data Quantification Sources:	SDG&E ignition-related historical data that was adjusted by Subject Matter Experts for operational and environmental changes. *See* Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision,[11] this section describes the risk bow tie, possible Drivers, potential Consequences, and the risk score for the Wildfire risk.

SDG&E considers risk-related differences in its analysis of the Wildfire risk. The Settlement Decision requires "[f]or each Risk Event, the utility will subdivide the group of assets or the system associated with the risk into Tranches…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."[12] As discussed in Section I above, pursuant to D.17-12-024, SDG&E's HFTD consists of Tiers 3 and

[10] D.14-02-015 at Appendix C, C-3.

[11] D.18-12-014 at 33 and Attachment A, A-11 ("Bow Tie").

[12] D.18-12-014 at Attachment A, A-11 ("Definition of Risk Events and Tranches").

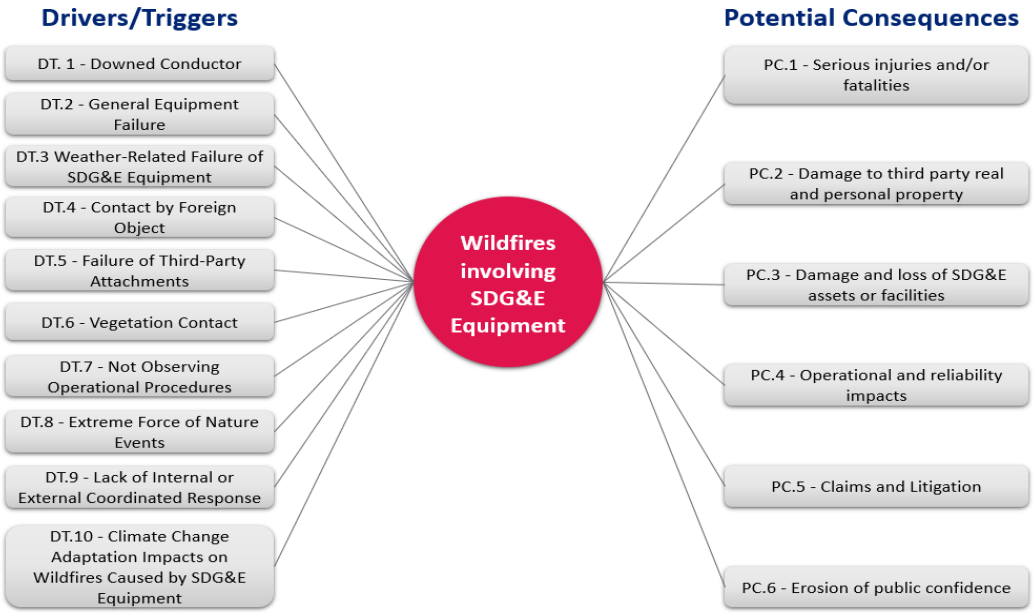
2 consistent with the Commission's Fire-Threat Map. In defining HFTD Tiers 3 and 2, the Commission recognized the difference in risk profiles between HFTD Tiers 3 and 2 with Tier 3 being deemed as "extreme risk" and Tier 2 as "elevated risk." SDG&E also recognizes the different risk profiles in HFTD Tiers 3 and 2 and therefore plans, manages, and prioritizes most its wildfire mitigation work based on the location (HFTD, non-HFTD) and the associated risk within (Tiers 3 and 2). Given this, SDG&E tranched a majority of the controls and mitigations herein into HFTD Tiers 3 and 2. In addition to assessing Wildfire risk by location (HFTD) and Tier (Tier 3 vs. Tier 2), SDG&E further distinguishes its asset-specific differences through the creation and scoping of its programs. This is provided in more detail in Section III below.

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision[13] instructs the utility to include a risk bow tie illustration for each risk included in RAMP. As illustrated in the risk bow tie shown below in Figure 1, the risk event (center of the bow tie) is a wildfire involving SDG&E equipment, the left side of the bow tie illustrates drivers/triggers that could lead to the risk event occurring, and the right side shows the potential consequences of the risk event occurring. SDG&E applied 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 addressed is provided in Appendix A.

[13] *Id.* at Attachment A, A-11 ("Bow Tie").

Figure 1: Risk Bow Tie



B. Cross-Functional Factors

SDG&E identified the following cross-functional factors (CFF) that are associated with wildfire risk. These include:

- **Asset Management (SDG&E-CFF-1):** To prevent wildfires and safely operate its grid, SDG&E conducts various asset management and inspection programs to enable identification and repair of equipment conditions. These programs include detailed cyclical inspections, infrared inspections, intrusive wood pole inspections, light detection and ranging (LiDAR) surveys, additional HFTD Tier 3 focused inspections, drone inspections, annual aerial and ground patrols, and quality assurance of inspections. Asset Management is also discussed below in Section III as C39.
- **Climate Change Adaptation, Energy System Resilience, and GHG Emissions (SDG&E-CFF-2):** In the years prior to 2018, there was growing evidence that changing climate conditions were contributing to an increase in wildfire potential throughout California. As a result, and to prepare the Company to adapt to climate change, SDG&E established a Fire Science and Climate Adaption (FS&CA) department in 2018, which

continues to expand and grow to meet the needs of increasing wildfire and climate-related risks. Climate change adaptation is listed as one of the drivers/triggers (DT.10) that impacts wildfire risk and is discussed in Section II.C. Details regarding the FS&CA department are provided in Section III below as C4.

- **Emergency Preparedness and Response (SDG&E-CFF-3):** A major focus of SDG&E's emergency preparedness and response activities is to reduce the likelihood of a wildfire occurring and to mitigate the impacts associated with PSPS. This is demonstrated by the number of Emergency Operations Center (EOC) activations associated with wildfire risk, which is further demonstrated below in Section III below as C41. In addition to the EOC activations, SDG&E's Emergency Management department conducts a facilitated de-brief of all major fire and PSPS-related incidents and activations as an essential part of the after-action review program, where opportunities for improved safety, scene management, communications, and/or training are identified.
- **Foundational Technology Systems (SDG&E-CFF-4):** Many of SDG&E's wildfire mitigation activities rely on foundational technology systems. For example, advanced technologies are used to monitor weather conditions to evaluate the fire potential in SDG&E's service territory, track vegetation growth, review outage and fault information, and more. The health of SDG&E's foundational technology systems, therefore, impacts wildfire mitigation.
- **Records Management (SDG&E-CFF-6):** SDG&E implemented various recordkeeping controls for its system in accordance with CPUC regulations, decisions and directives. For wildfire, this includes compliance with the D.14-02-015, Wildfire Safety Division resolutions, and the General Orders (*e.g.*, G.O. 95 Rules For Overhead Electric Line Construction).
- **Safety Management Systems (SDG&E-CFF-7):** SDG&E's Safety Management System (SMS) provides a systematic, cohesive framework

which builds upon SDG&E's strong safety culture and integrates new and existing processes. By taking an integrated, systematic approach to safety, SDG&E is better able to assess and manage risk across the entire organization. Enhancing our communication, collaboration, feedback and documentation and using data and analytics to regularly measure our effectiveness and make continuous improvements will help make each of our current and future safety programs more effective. SDG&E's SMS framework, as referenced in the SMS Cross Functional Factor Chapter, includes the Five Pillars of Safety, to focus on both individual safety behaviors and process safety management. Activities to effectively manage the risks SDG&E faces, including wildfire mitigation and prevention activities, are integrated throughout the Five Pillars of Safety and the SMS Framework.

- **Workforce Planning / Qualified Workforce (SDG&E-CFF-8):** A highly qualified workforce positions a utility to efficiently and effectively manage operations to ensure safety, compliance, and reliability, and fosters confidence in those who regulate these activities. SDG&E requires workers in the below roles to meet minimum qualifications of degree, experience, and/or time-in-service. Additionally, workers are provided training to gain knowledge to perform their roles safely, effectively, and efficiently. In its 2021 Wildfire Mitigation Plan (Wildfire Mitigation Plan or WMP) update, SDG&E reported on worker qualifications and training practices regarding wildfire and PSPS mitigation for workers in the following target roles:
    - Vegetation inspections and projects
    - Asset inspections
    - Grid hardening
    - Event-related inspections

C. Potential Drivers/Triggers

The Settlement Decision[14] instructs the utility to identify which element(s) of the associated risk bow tie each mitigation addresses. When performing the risk assessment for Wildfire, SDG&E identified potential leading indicators, referred to as drivers or triggers.[15] These include, but are not limited to:

DT.1 – 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 an energized mode. A wire down can result from a variety of factors, many of which are outside of SDG&E's control.

DT.2 – General Equipment Failure: Electric equipment failure 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 the energized mode. Other equipment failures can also spark ignitions regardless of whether they lead to wire down situations.

DT.3 – Weather-Related Failure of SDG&E Equipment: 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.4 – Contact by Foreign Object: 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. In the worst case this can cause the conductor to fail and land in an energized mode, causing arcing and sparking in dry conditions. In addition, vehicular contact can bring down conductors and

[14] D.18-12-014 at Attachment A, A-11 ("Bow Tie").

[15] Potential Drivers/Triggers serve as an indication that a risk could occur. They do not reflect actual or threatened conditions.

sometimes the entire pole, resulting in conductors laying on the ground in an energized mode.

DT.5 – 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. This has led to contact of these attachments with the electrical facilities, leading to fire-related incidents.

DT.6 – 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, phase-to-phase contact and a cascade of sparks. In addition, trees that are many feet away from an energized conductor sometimes uproot and fall on the conductor, causing pole and equipment damage, line failure, or sparking.

DT.7 – Not Observing Operational Procedures: SDG&E revises its protocols and procedures based on certain conditions. For example, during fire weather watch or red flag warnings, SDG&E and its contractors may not perform welding or other activities that may generate potential ignition sources. If an employee or contractor does not adhere to the operational procedure, it may cause an adverse consequence.

DT.8 – 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, conditions that may not be found until the following scheduled inspection and repair cycle.

DT.9 – Lack of Internal or External Coordinated Response: A well-coordinated response to a downed conductor aids in the suppression of a fire as well as the de-energization of the conductor in a safe manner. Lack of coordination could lead to uncontrolled fire, electrical exposure to first responders, and possibly injury or death.

DT.10 – Climate Change Adaptation Impacts on Wildfires Caused By SDG&E Equipment: Despite SDG&E's proactive approach to mitigating fire risk, increases in temperature and prolonged periods of drought 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 interfaces that were previously considered at lower risk for fire ignition and propagation. Prolonged periods of drought will also likely result in a longer wildfire season, potentially extending the focus of our threat monitoring and potential response from the fall months to year-round – with the greatest increased threat in the spring and summer months. These 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 upon the most recent climate science, these trends are likely to continue and worsen into the future.

D. Potential Consequences of Risk Event

Potential consequences[16] are listed to the right side of the risk bow tie illustration provided above. If one or more of the drivers/triggers listed above were to result in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

PC.1 – Serious injuries and/or fatalities;

PC.2 – Damage to third party real and personal property;

PC.3 – Damage and loss of SDG&E assets or facilities;

PC.4 – Operational and reliability impacts;

PC.5 – Claims and litigation; and

PC.6 – Erosion of public confidence.

These potential consequences were used in the scoring of Wildfire that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

[16] D.18-12-014 at 16 and Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

E. Risk Score

The Settlement Decision requires a pre and post-mitigation risk calculation.[17] Chapter SCG/SDG&E RAMP-C of this RAMP Report explains the Risk Quantitative Framework, which underlies this Chapter, including how the pre-mitigation risk score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.[18]

SDG&E continually evaluates its wildfire risk assessments regarding the probability of ignitions and the consequences of wildfires. This wildfire risk assessment is an ongoing effort that is updated as new data is collected and when new studies are undertaken. In accordance with the Settlement Decision,[19] Table 2 below provides risk scores that take into account the benefits of any mitigations that have been implemented as of the end of 2020. Table 2 also provides the risk score for the wildfire risk, PSPS impact and Total Wildfire Risk Score (TWRS).

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[20]

	Wildfire Risk	**PSPS Impact**	**Total Wildfire Risk Score (TWRS)**
Pre-Mitigation Risk Score	11,768	4,691	16,459
LoRE	21.2	4	N/A
CoRE	556	1,173	N/A

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, available and appropriate data.[21] The general approach to quantifying Wildfire risk is a hybrid approach – "top down," coupled with "bottoms up." The "top down" approach refers to the assessment across the entire risk, namely the total wildfire risk across SDG&E's entire

---

17 D.18-12-014 at Attachment A, A-11 ("Calculation of Risk").

18 *See infra,* n. 20.

19 D.18-12-014 at Attachment A, A-8 – A-9 ("Identification of Potential Consequences of Risk Event" and "Identification of the Frequency of the Risk Event").

20 The term "pre-mitigation analysis," in the language of the Settlement Decision refers to required pre-activity analysis conducted prior to implementing control or mitigation activity. (D.18-12-014 at Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score")).

21 *Id.* at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

service territory, using global concepts of ignitions, relevant outages, potential damage, and so forth. The "bottoms up" approach is undertaken by analyzing granular aspects of Wildfire risk, such as the amount of risk (likelihood of ignition and consequence if an ignition occurs) from specific assets or locations. Together these two methods help calibrate each other to provide a more robust risk picture than only reviewing one method (global or granular).

The global "top down" assessment is based on a model that was built using stochastic methods (*e.g.*, Monte Carlo), which allows for uncertainty to be incorporated into the modeling. The inputs related to the likelihood of ignition involve information related to historical large fires, annual ignitions, accommodations to climate change, accommodations to system hardening, and accommodations from operational changes such as system protection settings and PSPS. The inputs related to the consequence of ignitions involve information related to SDG&E's wildfire behavior modeling, accommodations due to climate change, and applying financial treatments to consequences to adjust to the current year's financial considerations (*e.g.*, real estate prices). The output of the model is two probability distributions, one for ignition likelihoods and another financial consequence. Currently, the financial consequence is used as a proxy for human safety, due to the strong connection between safety and homes destroyed and because large fires are rare, giving a small sample size to find correlations between location and safety implications.

The granular "bottoms up" approach attempts to find failure and ignition rates for specific scenarios, starting with equipment types and sub-types, but also by location and environmentally focused conditions such as vegetation and wind. Bear in mind that the sample size of ignitions is relatively small from a statistical standpoint when considering all of the situational characteristics. For example, there are fewer than 10 ignitions recorded for certain equipment types, over the past five years, and those ignitions occurred under various conditions with varying weather, vegetation, and asset-specific characteristics such as age or manufacturer. Although it is a positive situation to have small sampling of ignitions, it leads to the need to generalize much of the information. As an example, there have been a total of four ignitions due to distribution fuses in the past five years. There are thousands of distribution fuses in SDG&E's distribution system, and each of these ignitions occurred under their own unique circumstances when one considers the weather, vegetation, fuse type, and so forth. Therefore, one should not

expect SDG&E to have extremely granular ignition rates for all fuse-related situations, but rather it will be generalized to a few fuse categories and broken out by Tier 2 and Tier 3 of the HFTD.

Finally, an important notion regarding wildfire risk is the connection between ignitions and risk. Over the past 10 years, there have been approximately 300 CPUC reportable ignitions[22] associated with SDG&E equipment. Of those 300, only one of them is associated with the destruction of property – which was a single structure. For the most part, each of these 300 ignitions did not require significant fire suppression activity and burned less than one acre. In other words, preventing any one of those 300 ignitions would not have provided significant risk reduction. However, one large fire at the wrong time and place could have a larger impact than those 300 ignitions combined. Because wildfire risk is very situationally dependent, and many of SDG&E's mitigations involve long-term improvements such as equipment change-outs, it is very difficult to confidently attribute risk reduction for each equipment change-out. Because of this, SDG&E has chosen to largely use all reportable ignitions as the measure to quantify risk reduction, while understanding that an ignition that was prevented was not necessarily going to be a catastrophic wildfire. Put another way, SDG&E's global modeling suggests that approximately one in 500 ignitions will be catastrophic (*e.g.*, damage resulting in over $100 million; significant damage and potential safety consequences), and therefore, if a mitigation prevents one ignition in the High Fire Threat District, it is preventing 1/500th of a catastrophic fire.

Additionally, when evaluating the current level of wildfire risk, SDG&E incorporated PSPS impacts. While PSPS could be considered a separate risk, it is directly tied to wildfire mitigation and would not exist otherwise. Without PSPS, the wildfire risk would be significantly higher.

Therefore, as shown in Table 2, there are two separate risk scores that SDG&E measures for this Wildfire risk: (1) wildfire risk, and (2) PSPS impacts. The overall risk evaluation, referred to as the TWRS, is the sum of the risk scores for wildfire risk and PSPS impact. All RSE scores presented in this RAMP chapter use the TWRS as their basis. Some mitigations in SDG&E's RAMP Wildfire chapter reduce the wildfire risk, while other mitigations reduce the PSPS impacts, and some mitigations lower the risk for both wildfire risk and PSPS impacts.

[22] As defined by D.14-02-015.

The evaluation of PSPS impacts is still in the early stages of development, and SDG&E's framework will continue to evolve in quantifying and understanding the impacts of PSPS to inform strategies for wildfire mitigation.

III. 2020 CONTROLS

This section "[d]escribe[s] the controls or mitigations currently in place" as required by the Settlement Decision.[23] The activities in this section were in place as of December 31, 2020. Controls that will continue as part of the control and mitigation plan are addressed in Section IV.

To mitigate, minimize, and manage the Wildfire risk, SDG&E uses a multi-layered approach designed to defend against single points of failure. SDG&E strategically performs a variety of activities to prevent wildfires and reduce PSPS impacts. For example, SDG&E inspects and remediates vulnerabilities on its system while at the same time performing vegetation management activities, hardening infrastructure, and as a last resort, a PSPS when deemed necessary.

As described in Section II above, SDG&E tranched a majority of the controls and mitigations into HFTD Tiers 3 and 2. Moreover, SDG&E recognizes asset-specific characteristics through the creation and scoping of its programs. For example, bare conductor and covered conductor could be considered different tranches of conductor. Rather than treating these as separate tranches, SDG&E developed unique programs to identify and evaluate these assets. Other examples of assets being further broken down into distinct programs include:

- Multiple resiliency programs (*i.e.*, Microgrids, Resiliency Grant Programs, Standby Power Programs, and Resiliency Assistance Programs) that have different goals and targeted customers
- Separate asset-specific programs (*e.g.*, SCADA Capacitors, Hotline Clamps, Lightning Arresters)
- Multiple inspection programs, which are separated by the duration of inspection cycles (*e.g.*, annual, 5-years, 10-years) and the inspection method (*e.g*., patrols, drones, IR/Corona)

These identified tranches and program designations represent how SDG&E currently manages its wildfire mitigation portfolio. As described in Section III.A below, SDG&E's wildfire modeling

[23] Settlement Decision at 33.

continues to mature and develop. SDG&E is working toward evaluating programs at a more granular level beyond HFTD Tiers 3 and 2 and is beginning to do so in certain programs, including the Strategic Undergrounding and Covered Conductor Grid Hardening programs.

SDG&E notes that for the majority of the controls and mitigations subject to the HFTD Tiers 3 and 2 tranching, the activity performed in Tier 3 is the same as in Tier 2. Accordingly, in the presentation below, there is a single description of the control and mitigation. After the control name, SDG&E has identified the tranche in the following sections by the nomenclature C#-T1: HFTD Tier 3; C#-T2: HFTD Tier 2. The same nomenclature is used for mitigations with an "M" instead of a "C" in the identifier. Costs, units, and RSEs are provided at the tranche level (*i.e.*, Tiers 3 and 2) using these identifiers. Because SDG&E does not track costs by HFTD Tiers 3 and 2, an approximation was applied per program based on the forecasted units per tranche.

Consistent with its Wildfire Mitigation Plan 2021 Update, SDG&E presents this RAMP Chapter in the following categories, each of which is further described below:

- Risk Assessment and Mapping
- Situational Awareness and Forecasting
- Grid Design and System Hardening
- Asset Management and Inspections
- Vegetation Management and Inspections
- Grid Operations and Protocols
- Data Governance
- Resource Allocation Methodology
- Emergency Planning and Preparedness
- Stakeholder Cooperation and Community Engagement

A. Risk Assessment and Mapping

SDG&E has remained committed to the ongoing development and implementation of its wildfire modeling and continues to refine a primarily automated risk assessment and mapping methodology. At the same time, SDG&E's engineers and emergency operations personnel continue to analytically evaluate and prioritize proposed grid hardening projects and emergency actions from the standpoint of reducing or eliminating fire risk potential from overhead electric facilities.

SDG&E continues to work to implement innovative approaches to enhance and leverage this modeling and learn from efforts undertaken across the state. The Wildfire Risk Reduction Model (WRRM) and WRRM-Operational System (WRRM-Ops) have and will continue to serve the need to understand the wildfire risk from electric grid assets and fire propagation. These models represent SDG&E's continued commitment to the ongoing development and further refinement of risk-related models for the evaluation of hardening projects and the safe operation of the SDG&E system. To date, SDG&E subject matter experts, including fire coordinators and fire scientists, analyze the model's performance for all wildfires on the landscape, identifying deviations from the risk and propagation modeling. These findings help drive the future development of the model, and refining the model will result in improved and more specific quantifiable outcomes allowing for better decision making in the overall hardening effort.

While WRRM and WRRM-Ops continue to play a critical role in understanding the fire risk, SDG&E recognized a need for a model with the capability to analyze circuit segments for risk of wildfire and PSPS impacts, as well as calculate RSE scores for mitigation initiatives. To meet that need, SDG&E developed a new model in 2020 named Wildfire Next Generation System (WiNGS). While it is in the first year of development, WiNGS is expected to help prioritize SDG&E's grid hardening mitigations in the coming years.

1. C1: Wildfire Risk Reduction Model – Operational System

SDG&E's WRRM prioritizes long-term system hardening efforts to target the areas of greatest wildfire risk. This model was developed in collaboration with fire behavior experts and leverages 30 years of high-resolution weather data to establish a climate scenario and failure rates of SDG&E's assets, establishing risk maps showing the overall ignition probability and estimated wildfire consequence along electric lines and equipment. SDG&E has further enhanced this model into an operational system (WRRM-Ops) by developing a fully automated process to ingest daily weather and fuel moisture data from its supercomputers, and to re-calculate risk levels to support emergency operations. This information is now leveraged by SDG&E's subject matter experts to gather intelligence and communicate potential impacts and risk for every potential fire of consequence that occurs in SDG&E's service territory.

This initiative enhances SDG&E's awareness of wildfire risk by deploying science-based technologies and implementing solutions to inform SDG&E's operations. Lessons learned from

this process inform the ongoing development of the modeling system, which supports short, mid, and long term operational and system hardening decisions.

Enhancements and progress that have been made in 2020 include:

- ALERTWildfire viewer cameras,[24] mountain top camera network used to spot fires, are located on the map with a camera icon and improved integration with Application Programming Interfaces (APIs)
- Weather stations integration using observed weather data
- Delta Wind field inclusion – the difference between Forecasted and Observed wind
- Simulations are automatically run for all incidents in the Integrated Reporting of Wildland-Fire Information (IRWIN) database

Additionally, improved performance for fire behavior calculations were updated and included:

- herbaceous content
- urban density (isolated, scattered, dense)
- vegetation type (high and low intensity fire behavior fuels)
- A surface spotting model has been implemented
- Rate of Spread (ROS) adjustments have been made
- Complex ignitions: the API allows ignitions from hexagons

Enhancements to the tool planned for 2021 include upgrading fuel moisture inputs into the fire behavior modeling, upgrading the forecaster interface, and incorporating the data into a PSPS decision support tool. Fuel moisture improvements are ongoing with leading post-doctoral experts from San Jose State University Wildfire Interdisciplinary Research Center (WIRC) working in conjunction with SDG&E Meteorology and WRRM-Ops software vendor Technosylva.

B. Situational Awareness and Forecasting

Weather continues to have a significant impact on utility operations. SDG&E is an industry leader in the development and implementation of utility-specific meteorological technology to anticipate, prepare for, respond to, and recover from severe weather and wildfire

[24] *http://www.alertwildfire.org/sdge/*.

events. Utilization of situational awareness tools, further described in this Section, has proven successful historically and continues to be beneficial to system planning, emergency operations, and the safe implementation of PSPS. Based on these successes, SDG&E situational awareness networks will be expanded into areas where they can be used to minimize the impacts of PSPS and make communities safer.

1. C2: Advanced Weather Station Integration

This initiative provides more specific information regarding the location and severity of weather events that may impact SDG&E's system. Weather events have the potential to cause damage to the electric system, which may lead to an ignition. Advanced weather stations provide important information that enables safer and more informed operation of SDG&E's electric system during extreme weather events. SDG&E will continue the strategic rebuild of the weather station network through 2021 as the original equipment is reaching the end of its usable life. This is critical because the information from this weather network provides the foundational data for mission-critical activities such as the Fire Potential Index (FPI) and PSPS activities.

SDG&E will focus this activity on regions that have old weather monitoring equipment that has reached the end of life. This activity will also be engaged in areas where additional sensors can be installed to acquire data on fuel moisture conditions as an enhancement to the weather station capability. Region prioritization can also be influenced by an assessment of PSPS impacts and identification of areas where additional weather stations can support enhanced isolation strategies during PSPS events. There are multiple methods that are used to prioritize regions. These methods include the integration of high-resolution modeling to determine where unmeasured strong winds may be occurring, subject matter expert input from weather and fire experts, and input from community partners sharing local knowledge.

In 2020, SDG&E had the largest expansion to its weather station network since 2011 with the addition of over 30 new stations and a rebuild of about 50 additional weather stations that were at the end of their usable lives.

Regarding regions covered, these stations were selected in locations where it was determined that when coupled with additional sectionalizing, this weather information could help mitigate the impact of PSPS by better representing localized neighborhoods and increasingly isolating PSPS when possible. Additionally, SDG&E rebuilt some stations that were some of the

oldest on SDG&E's network (originally installed in 2010 and 2011) and covered the highest risk regions across HFTD Tier 3 locations.

In 2021, SDG&E plans to rebuild approximately 30% of the existing network, which is at end-of-life and install new sensor technology to measure fuel moisture where available. As technological advancements permit, SDG&E plans to install sensors to better measure and validate fuel moisture conditions across the region to better understand the effects on the wildfire ignition and spread.

2. C3: Wireless Fault Indicators

- **C3-T1: Tier 3; C3-T2: Tier 2; C3-T3: Non-HFTD**

SDG&E initiates operational measures during times of elevated or extreme wildfire risk to improve public safety, such as the disabling of automatic reclosing and the use of sensitive and fast protection settings that limit the heat energy produced by a fault reducing the chance of ignition. These operational practices increase the duration of outages for SDG&E's customers as a lack of circuit coordination caused by these mitigations makes faults and damaged assets more difficult to locate. 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 decrease wildfire ignition risk.

During times of heightened wildfire risk, SDG&E patrols all infrastructure for damage prior to restoring power. In instances where large areas are de-energized due to sensitive protective relay settings, wireless fault indicators are used to concentrate focus to a much smaller portion of the electric circuit, which allows for: a faster response to the site if an ignition exists; a greater chance of determining and correcting a fault cause (when damage on the overhead electric system is not immediately obvious); and, potentially, faster customer restoration (which could offset customer reliability impacts caused by wildfire mitigation measures).

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 will provide complete information on the status of all conductors downstream. Other applications of wireless fault indicators are at locations where facilities enter areas of high fuel concentrations, areas that are difficult to patrol, or transitions between HFTD tiers. Overhead to underground and underground to overhead unfused transitions and downstream of non-SCADA substations are also valuable applications.

In 2020, SDG&E installed 502 wireless fault indicators in the HFTD. In 2021, SDG&E plans to maintain the current rate of installations of wireless fault indicators finishing the Tier 2 and expanding into the wildland urban interface, another fire heightened area in SDG&E's service territory.

3. C4: Fire Science and Climate Adaptation Department

This initiative addresses understanding of wildfire risk and impacts of climate change on the risk. In the years prior to 2018, there was growing evidence that changing climate conditions were contributing to an increase in wildfire potential throughout California. As a result, SDG&E established a Fire Science and Climate Adaption (FS&CA) department in 2018, which continues to expand and grow to meet the needs of increasing wildfire and climate-related risks. The department is comprised of meteorologists, community resiliency experts, fire coordinators, and project management personnel. This department's purpose is responding to and strategizing for SDG&E's fire preparedness activities and programs.

One of the programs managed by the FS&CA department is the Ignition Management program. The purpose of the Ignition Management program is to track and perform root cause analyses on ignitions and potential ignitions to detect patterns or correlations. When patterns or correlations are identified, the outcomes are communicated and assigned to mitigation owners from the business unit most logically positioned to eliminate or reduce future events of a similar nature. The value of this program is in understanding and preventing ignitions. The ignition management program has enabled SDG&E to gather focused data on near ignition events and analysis of this data has helped educate fire prevention decisions.

In addition to providing SDG&E with subject matter expertise in meteorology, wildland fire coordination and response, and community resiliency, this department is building and leading the creation of a Fire Science and Innovation Lab (FSI Lab). The FSI Lab brings together leading thinkers and problem solvers in academia, government, and the community to create forward-looking solutions to help prevent ignitions, mitigate the impacts of fires, and

ultimately help build a more resilient region. Due to the COVID-19 pandemic in 2020, SDG&E established a virtual FSI Lab to move forward in a remote environment, engaging expanded partnerships with San Jose State University, the San Diego Supercomputer Center, University of Wisconsin, and Scripps Institution of Oceanography. With this FSI Lab, SDG&E aims to lead the development of the next generation of fire science and wildfire innovation; this data would then feed into SDG&E's risk models to prioritize work. Additionally, numerous community resilience events were targeted to SDG&E's service territory and conducted both online and in socially distant outreach events. Three new academic partnerships were established in 2020 for the purpose of advancing wildfire science. Below are additional details regarding these partnerships:

- SDG&E has established a 3-year strategic partnership with leading experts in climate at Scripps Institute of Oceanography to study the onset of wildfire suppressing precipitation in San Diego County, with attention paid to impacts on wildfire and subsequent later autumn and winter season hydrological measures. Scripps will examine the variability from year to year, documenting the types of storms that produce the precipitation, quantifying the current lead time in predicting these events, and identifying potential approaches to display and to predict these important storms. These late season storms and the impact on the wildfire environment could have an impact on PSPS frequency in the future.
- The San Jose State University project will develop new Live Fuel Moisture Content (LFMC) tools to better assess fire danger in the SDG&E service territory using state-of-the-science remote sensing data sets. These tools will be developed using the new high-resolution data from various satellite products eventually leading to a dataset and methodology to incorporate these tools into the Technosylva FireCast fire behavior modeling platform. Additional output from the project will include two peer-reviewed publications and one M.S. thesis which have yet to be finalized.
- SDG&E is also working with the San Diego Supercomputer Center (SDSC) to ingest and store SDG&E datasets for weather forecast, fire

potential index and fuels to enable publicly available findability and accessibility of these datasets for various stakeholders and all researchers through web services and visual maps. Application Programming Interfaces will enable time range or geolocation and tagged metadata-based querying as well as grouping and sub-setting of datasets for context-driven use. The map services will enable layering of these datasets for use in fire modeling. The project will maintain a server at SDSC for data access along with data storage capabilities stored at SDSC and back up storage on Amazon Cloud.

The FS&CA department will continue to focus on collaborations with stakeholders in the community and will continue to evolve the FSI Lab. Specific enhancements and improvements in 2021 will be further enhancing academic partnerships through broader data sharing and sponsoring specific utility focused projects through the FSI Lab. The FS&CA department envisions establishing long-lasting partnerships with academia to create opportunities to educate the next generation of utility wildfire subject matter expertise.

4. C5: High-Performance Computing Infrastructure

This initiative provides tools to process big data that is key to understanding the fire risk. Wildfire risk mitigation requires the development of high-quality weather information to support daily decision-making. To that end, SDG&E utilizes three high-performance computing clusters to generate high quality weather data that is incorporated directly into operations. Collectively, nearly 2,000 compute core hours of high-performance computing are used per day to generate operational products, including WRRM-Ops.

The weather-related forecast data generated by these supercomputers is shared with several partners, including the U.S. Forest Service, which disseminates the data through their public website, and the National Weather Service.

SDG&E plans to continue the production and sharing of forecast products as well as prioritize data analytics and modeling for the foreseeable future.

SDG&E intends to maintain and update this program to stay aligned with the latest computing technology and intends to share all the data that is generated with the wildfire community. This will include acquiring a new high-performance computing platform in 2022, at which point SDG&E's existing computing infrastructure will be at the end of its useful life. The

new high-performance computing infrastructure is essential to the ongoing development of fire science and big data analytics. SDG&E intends to work closely with the San Diego Supercomputer Center to closely monitor data science advancements to ensure that this program remains highly capable of providing the advanced analytics required to operate the utility of today and of the future.

C. Grid Design and System Hardening

SDG&E's grid hardening programs are a set of controls and mitigations that directly address the goal of reducing wildfires caused by utility equipment and minimizing the societal impacts to customers from mitigations such as PSPS. SDG&E has a number of controls and mitigations including overhead hardening and strategic undergrounding that have demonstrated a measured reduction in risk events on utility equipment, reducing the opportunities for ignition. SDG&E has a number of protection and equipment programs such as advanced protection, expulsion fuse replacement program, and the lightning arrestor program. These programs reduce the chance that a risk event results in an ignition by utilizing protection settings and/or equipment that address a specific failure mode known to lead to the ignition. These result in measured reductions in ignition percentage from risk events. Finally, SDG&E has a number of programs with the purpose of reducing PSPS impacts to customers including the PSPS sectionalizing program, microgrid and generator programs, as well as strategic undergrounding. The impacts of these programs are measured in the number of customers who will no longer be impacted by a PSPS event assuming weather conditions similar to previous events.

1. C6: SCADA Capacitors

- **C6-T1: Tier 3; C6-T2: Tier 2**

This initiative mitigates the risk of a capacitor being an ignition source. The supervisory control and data acquisition (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 corregction 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. This rupture of molted metal has the potential to be an ignition source. These capacitor faults are currently protected through fusing, which is not always effective at preventing the high-risk failure mode described.

The SCADA capacitors program will replace existing non-SCADA capacitors with a more modern SCADA switchable capacitor. The modernization of these capacitors will introduce a monitoring system to check for imbalances and internal faults and 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 will first prioritize 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. The new protection equipment built within these capacitors is designed to detect and isolate issues on capacitors before the capacitor rupture occurs, reducing or eliminating the failure mode most likely to lead to an ignition, and providing improvement over the current protection which utilizes analog fuses.

SDG&E plans to replace all capacitors within the HFTD, prioritizing Tier 3 and then proceeding to Tier 2. SDG&E is modernizing approximately 100 capacitors in the HFTD. In 2020, SDG&E completed 30 and plans to complete 32 in 2021, and approximately 40 in 2022, completing the program.

SDG&E plans to monitor the SCADA capacitors to ensure effectiveness of reducing ignition risk and improve equipment as necessary if there are any issues. As more work is done to understand the risk in the wildland urban interface, the program could potentially expand to those areas as well.

2. C7: Overhead Distribution Fire Hardening – Covered Conductor

- **C7-T1: Tier 3; C7-T2: Tier 2**

Covered conductor was studied by SDG&E beginning in 2019 to determine where it should be applied in SDG&E's service territory, with the first installation of covered conductor in the service territory occurring in 2020.

While SDG&E has not conducted studies to measure the effectiveness of covered conductor, it estimates it to be 70% effective, assuming it will be equally effective as bare conductor hardening at preventing equipment failures and better than bare conductor hardening at preventing foreign object in line contacts. In addition to its wildfire mitigation benefits, covered conductor has some PSPS benefits as well, raising the threshold for PSPS to higher wind speeds than bare conductor hardening.

SDG&E intends to install covered conductor in the HFTD, however, given the significant unhardened mileage that exists, risk-based prioritization of the deployment of these hardening initiatives remains very important. SDG&E utilized an early version of WiNGS to identify some circuit segments to pivot from bare conductor hardening to covered conductor hardening based on the risk analysis conducted in the model. As it continues to scope specific covered conductor projects, SDG&E plans to utilize its WiNGS model to both evaluate mitigation alternatives and prioritize the deployment of mitigations at the circuit segment level. The scope of covered conductor work identified in 2023-2024 was informed by the segment-level analysis conducted in WiNGS.

In 2020, SDG&E completed its first covered conductor installation, hardening approximately 1.9 miles of line. Given the success of the pilot installation, SDG&E is moving forward with the program and has plans to significantly increase the amount of covered conductor installed over the next several years ramping up to approximately 100 miles per year.

As covered conductor becomes a larger part of SDG&E's system, SDG&E will continue to monitor and measure all performance indicators that impact the efficiency of this mitigation, including a study of the measured effectiveness, and the cost per mile.

3. C8: Expulsion Fuse Replacement

- **C8-T1: Tier 3; C8-T2: Tier 2**

SDG&E's distribution system is dynamic and can experience events that result in a fault, which may serve as an ignition source. When the distribution system experiences a fault or overcurrent, there are fuses connected to the system to protect its integrity and isolate the fault. These expulsion fuses are designed to operate by creating a significant expulsion within the fuse, resulting in the fuse opening and isolating the fault, and in turn limiting further damage to other equipment. Because of this internal expulsion, the fuses are equipped with a venting system that sends a discharge of energy out of the fuse and into the atmosphere. This external discharge has the potential to ignite flammable vegetation.

SDG&E's fuse replacement program replaces existing expulsion fuses that operate as described above with new more fire safe expulsion fuses that are approved by CAL FIRE and reduce the discharge expelled into the atmosphere, reducing the chance of a fuse operation leading to an ignition. Since the program began in 2019, SDG&E has measured the fuse operations of the new CAL FIRE approved fuses. SDG&E's research has shown 139 fuse

operations with zero ignitions. While there are currently not enough samples relative to historical fuse operations to demonstrate statistical significance, the early effectiveness results are promising and in alignment with SDG&E expectations for this program.

It is SDG&E's intention to replace a total of 11,000 fuses throughout the HFTD. Prioritization started with Tier 3 and moved to Tier 2. Due the high volume of replacements, projects are bundled based on geographic proximity for construction efficiency and to reduce outages when required.

In 2020, SDG&E has replaced 5,669 fuses out of the 11,000 expulsion fuses in the HFTD. The target for 2021 is 4,000 fuses, which will be primarily in Tier 2 of the HFTD with minor work remaining in Tier 3. While Tier 3 remains the priority, the remaining work in Tier 3 are jobs that are more difficult to execute due to access or permitting issues. SDG&E continues to work through these jobs to see them to completion, however, work on the Tier 2 jobs will continue in parallel to maximize productivity and make progress to the final goal of replacing all expulsion fuses within the HFTD.

4. C9: PSPS Sectionalizing

- **C9-T1: Tier 3; C9-T2: Tier 2; C9-T3: Non-HFTD**

SDG&E utilizes Public Safety Power Shutoffs as a last resort mitigation during extreme weather conditions where the probability of ignition is much higher than normal and the consequences of ignitions due to high winds and dry conditions can and have been catastrophic. While SDG&E believes the last resort utilization of this activity is necessary and the right thing to do for the safety of SDG&E's customers and communities, SDG&E also understands that power outages can have negative economic and societal impacts and should be limited as much as feasible to the specific areas that are experiencing the extreme risk.

To that end, SDG&E's PSPS sectionalizing enhancement program strategically installs switches in locations that allow for more customers to remain energized during PSPS by improving the ability to isolate high-risk locations. Examples of this include installing switches on circuits that have significant portions of the circuit undergrounded, allowing the customers with the lower risk underground infrastructure to remain energized while the switch isolates the high-risk overhead portion of the circuit. In other cases, certain portion of circuits are more susceptible to experiencing extreme wind than other parts of the circuit, thus combining weather stations with sectionalizing devices enables SDG&E to de-energize only the sections of circuits

that are actually experiencing the extreme wind, rather than the entire circuit. The effectiveness of these mitigations is measured in customers who will no longer experience a PSPS event assuming weather conditions similar to prior PSPS events. By adding in remote sectionalizing devices within the HFTD, SDG&E is able to reduce the number of impacted customers based on past weather events, and improve the restoration times for the smaller circuit segments that will still be impacted.

SDG&E utilizes lessons learned from historical PSPS events to identify and prioritize locations for switches. This typically means installing switches in the HFTD, and SDG&E has made significant progress in this area. But as recent weather patterns have become more extreme and widespread as experienced in October 2019 and December 2020, SDG&E is utilizing the lessons learned from those events to place switches with the goal of limiting PSPS exposure in future years, which includes locations in the HFTD and wildland urban interface.

SDG&E has installed approximately 303 remote sectionalizing devices combined with over 214 weather stations, which typically allows SDG&E to execute PSPS events at a circuit segment level rather than utilizing whole circuits or substations. In 2019, SDG&E installed 7 switches and in 2020, 23 were installed. SDG&E was able to exceed its target in 2020 by aggressively replacing the highest impact switches before the 2020 fire season. The target for the next several years will be 10 PSPS sectionalizing devices per year.

Through the PSPS events which have occurred in SDG&E's service territory since 2013, SDG&E demonstrated how remote sectionalizing devices combined with a dense weather station network can limit the impacts of PSPS only towards those customers with the highest risk. SDG&E has over 183,000 customers located within its HFTD, but because of SDG&E's hardened transmission system, weather station network, and remote sectionalizing devices, only a small percentage of those customers are exposed to PSPS events during the highest risk system conditions, and only if they are the customers exposed to the risk on a particular high wildfire threat day. Going forward, SDG&E will continue this program as a last resort with the goal of reducing PSPS impacts using the most relevant data, including the recent PSPS events of December 2020.

5. C10: Microgrids

- **C10-T1: Tier 3; C10-T2: Tier 2**

Microgrids provide power continuity to customers during both planned and unplanned outages. Specifically, during PSPS events, this results in reduced duration and severity of disruption to customers' electric service. The reduction of PSPS impacts is key to increasing resiliency and reliability to customers. This is especially important for critical facilities, as they may provide firefighting resources and life-saving services among other things. Another segment of customers who benefit greatly from reduced PSPS duration are the Access and Functional Needs (AFN) community. AFN customers are deemed by the CPUC to be the most vulnerable during PSPS outages and are defined in D.19-05-042 to include individuals who have developmental or intellectual disabilities, physical disabilities, chronic conditions, injuries, limited English proficiency or who are non-English speaking, and transportation disadvantaged, among others.

Historical analysis of areas impacted by PSPS events highlight specific communities which are compared against the grid hardening strategy. SDG&E evaluates these communities against recent or future grid hardening strategies to determine if additional mitigations should be considered to reduce PSPS impacts to customers. Specific customer information, such as classification as a critical facility, is used to appropriately determine the need to install additional resiliency tools to reduce PSPS impacts to customers.

Microgrids are designed to meet the identified customers' load needs for the duration of a PSPS event. While other solutions may be the preferred approach from a wildfire risk reduction perspective (*e.g.*, undergrounding), those options may not be technically feasible or the most cost-effective solution. For instance, customers who are located far away from a substation or central source of generation would require additional mileage of undergrounding that can be cost-prohibitive.

Additionally, customers may be located in a geographical area that makes digging for undergrounding infeasible, whether from hard rock or from an environmental or cultural perspective. When these situations arise, SDG&E evaluates other solutions to reducing the PSPS impacts to customers, which can include designing and building a microgrid that can be electrically isolated during a PSPS event and offer reliable electric service to customers and allow SDG&E to use de-energization of power lines as a wildfire risk mitigation solution.

By 2022, microgrids are expected to reduce PSPS impacts to a total of 662 customers. This number is calculated based on the locations of microgrids and the customers they serve and is used to estimate the reduction in PSPS impact to calculate the RSE. Sites for 2023 and 2024 are still being scoped and actual customer counts are not yet available. Because microgrids are designed to keep those customers energized throughout the duration of a PSPS event, the effectiveness of the mitigation is estimated to be 100%.

SDG&E uses a combination of data including, but not limited to, the risk of wildfire from overhead infrastructure, feasibility of alternative solutions such as undergrounding distribution infrastructure, and historical PSPS impact data to guide the targeted customers. This analysis is performed in concert with determining if a traditional overhead hardening or undergrounding solution could mitigate both the wildfire and PSPS impact risks. Additional information such as identification of critical facilities or AFN customers is incorporated into prioritizing targeted locations for a potential microgrid project.

In 2020, four microgrids sites were deployed at the following locations: Ramona Air Attack Base, Cameron Corners, Shelter Valley, and Butterfield Ranch. SDG&E has completed the temporary configuration (conventional generators) for these microgrids and plans to have the permanent renewable solution in service as soon as 2022. For 2021, SDG&E has identified an additional location for further evaluation in coordination with the other grid hardening efforts discussed herein. The community of Sherilton Valley is a low-income community, including medical baseline customers, located in Tier 3 of the HFTD, and was consistently impacted by PSPS events due to overhead distribution line exposure to extreme weather conditions. While SDG&E's 2021 WMP indicated Campo as a second location for a future microgrid, upon further evaluation, this location has been identified as suitable for traditional grid hardening solution instead of a microgrid. SDG&E will deploy temporary generation to the Feeding America location to provide power continuity during PSPS events. SDG&E continues to evaluate additional locations for microgrid solutions such as Warner Springs. Dependent upon final engineering and design of the microgrids, additional locations would include either a single battery energy storage solution or combination of solar plus battery energy storage to provide power continuity to customers during the PSPS events.

6. C11: Advanced Protection

- **C11-T1: Tier 3; C11-T2: Tier 2**

SDG&E's Advanced Protection (AP) program develops and implements advanced protection technologies within electric substations and on the electric distribution system. AP aims to prevent and mitigate the risks of fire incidents, create higher visibility and situational awareness in fire-prone areas, and allow for the implementation of new relay standards in locations where protection coordination is difficult due to lower fault currents attributed to high impedance faults. SDG&E's advanced protection program is designed to reduce the risk of transmission or distribution risk events leading to an ignition.

More 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, and wireless communication radios comprise the portfolio of devices that SDG&E installs in substations and on distribution circuits to allow for a more comprehensive protection system along with greater situational awareness via SCADA in the fire-prone areas of the HFTD. This portfolio of advanced technology allows SDG&E to implement new protection systems, such as:

- **Falling Conductor Protection (FCP)** designed to trip distribution overhead circuits before broken conductors can reach the ground energized;
- **Sensitive Ground Fault Protection** for detecting high impedance faults resulting from downed overhead conductors that result in very low fault currents;
- **Sensitive Profile Relay Settings** enabled remotely on distribution equipment during red flag events to reduce fault energy and fire risk;
- **High Accuracy Fault Location** for improved response time to any incident on the system;
- **Remote Event Retrieval and Reporting** for real-time and post-event analysis of system disturbances or outages;
- **SCADA Communication** to all field devices being installed for added situational awareness; and

- **Increased Sensitivity and Speed of Transmission Protection Systems** to reduce fault energies and provide swifter isolation of transmission system faults.

Specifically, AP aims to replace aging substation infrastructure such as obsolete 12 kV substation circuit breakers, electro-mechanical relays, and Remote Terminal Units (RTUs). New circuit breakers incorporating microprocessor-based relays, RTUs, and the latest in communication equipment facilitating the requirements of SDG&E's advanced protection systems will be installed in SDG&E substations within the HFTD. On distribution circuits within the HFTD, AP coordinates with the overhead system hardening programs to strategically install or replace sectionalizing devices, line monitors, direct fiber lines, and communication radios to facilitate the requirements of SDG&E's advanced protection systems.

In 2020, the AP program focused on hardening projects in HFTD Tier 3 and 2 areas. Accomplishments in 2020 include design initiation of 7 substations and 6 circuits, with 8 substations and 6 circuits energized. Equipment replaced totaled 13 circuit breakers, 13 electro-mechanical or incompatible relays, and 2 RTUs. 7 new distribution reclosers were installed to increase sectionalizing in support of falling conduction protection and PSPS.

Over the next several years, the program is targeting enabling AP on 8 circuits per year with a goal of completing all 76 HFTD Tier 3 circuits by 2026.

Improvements to AP technology include expanding FCP to include two-phase and single-phase distribution circuits, further extending branch circuit protection. The program will also begin migrating new FCP communication designs to leverage the Company's private LTE communication initiative to improve wireless network coverage, increase path resiliency and optimize deployment cost.

7. C12: Hotline Clamps

- **C12-T1: Tier 3; C12-T2: Tier 2**

Through equipment failure analysis related to wire down outages, SDG&E has identified high risk connectors known as "hotline clamps" that SDG&E intends to replace as part of this program. These hotline clamps have been identified because they have been associated with creating a weak connection that can fail during a fault on the system, resulting in a wire down event. This wire down event can lead to an energized wire on the ground or coming into contact with a foreign object, thus becoming an ignition source.

This initiative replaces these hotline clamp connections with compression connections to eliminate the risk of the wire down failure associated with hotline clamps, which in turn will reduce wire down events and ignitions associated with connection failures.

SDG&E is focusing this initiative on the HFTD portion of its service territory. Tier 3 of the HFTD is prioritized over Tier 2 areas. Due to the high volume of replacements, projects are bundled based on geographic proximity for construction efficiency and to reduce outages when required.

To date, SDG&E has replaced 2,758 hotline clamps of the 8,500 identified in the HFTD, approximately 32%. SDG&E plans to replace 1,650 clamps in 2021. At the current pace, SDG&E will complete this program by the year 2024.

8. C13: Resiliency Grant Programs

- **C13-T1: Tier 3; C13-T2: Tier 2**

SDG&E's Resiliency Grant Programs focus on enhancing resiliency among vulnerable customer segments in the SDG&E territory. This program consists of several projects that all aim to provide customers renewable backup power options during PSPS events. The primary initiative in this category is the Generator Grant Program (GGP), which was launched in 2019 and continued in 2020. To optimize available program resources to vulnerable customers, the GGP targeted Medical Baseline (MBL) customers who have experienced a previous PSPS outage. Medical Baseline customers are those have a qualifying medical condition or have certain medical devices such as a dialysis machine, electric wheelchair, or pacemaker. Because these customers have experienced at least one PSPS event, it is considered one of the best indicators of propensity of future outage, thus contributing efficiently to improving overall customer resilience. The objective of the GGP is to provide backup power sources that can both mitigate safety and health risks, as well as overall impacts experienced during de-energization incidents.

In both 2019 and 2020, MBL customers were offered a portable battery unit with a solar charging capability under the GGP, to achieve additional resiliency during PSPS events. Portable battery units delivered to customers through GGP demonstrate SDG&E's desire to leverage cleaner, renewable generator options that enable vulnerable customers to enhance their personal emergency plans with a means to keep small devices and appliances charged and powered during PSPS events.

In 2020, approximately 1,864 MBL customers with a previous 2019 PSPS outage were invited to participate in the program, and 1,409 portable battery units were delivered to customers between May and October 2020 under the GGP. This high customer response rate of roughly 76% for the 2020 program was borne out in post-program surveys for the program that validated the high customer satisfaction with this program.

For customers who accepted participation in the 2020 GGP program, 81% were able to use the battery during a PSPS event, and 96% of customers state that they now feel "very" or "extremely" prepared for a future PSPS event. This population included every customer who experienced a PSPS while being enrolled as an MBL customer in 2019. Of the delivered units, 75 units were provided specifically to master-metered MBL customers who lived in Mobile Home Parks, which were impacted by PSPS in 2019. Additionally, 20 battery units were made available for "emergency" delivery during larger PSPS events in November and December 2020, for customers experiencing severe medical challenges due to power outages.

Through 2024, the Resiliency Grant Program is expected to reduce PSPS impacts to over 8,000 customers. This number is calculated based on the count of customers that would receive the generator and is used to estimate the reduction in PSPS impact to calculate the RSE. Because the generators provided to customers as a part of this program are not whole-facility solutions but rather smaller units that keep specific equipment energized, the effectiveness of the mitigation is estimated to be 40%. Of the more than 66,000 currently active participants in SDG&E's MBL program at this time, over 11,000 of these households are in the HFTD. While the 2020 program was able to target all MBL customers impacted by a 2019 PSPS event, large scale PSPS events occurring late in 2020 have expanded the number of MBL customers with a previous PSPS outage. A majority of this newly identified vulnerable population will still be within the HFTD, however, additional eligibility criteria are likely to come into play for the 2021 season, such as HFTD level, as well as the number and length of outages in specific communities. Additionally, SDG&E will explore offering this program to certain eligible utility-identified AFN customers outside of just the MBL program.

The GGP for 2020 concluded with a total of 1,420 battery deliveries made, including the additional emergency units delivered during the November and December 2020 PSPS events. The GGP program served over 30 communities with eligible customers concentrated primarily in HFTD Tier 3 and Tier 2. The three largest communities served (Alpine, Ramona, and Valley

Center) comprised about 55% of all customers in 2020 benefitting from GGP. Based on the large PSPS events in late 2020, the program is scheduled to target roughly 3,200 customers for battery units in 2021. Invitations for the 2021 GGP are on track to begin reaching eligible customers by May 2021.

For 2021, SDG&E is looking to expand Resiliency Grant Programs to accommodate both the increased number of MBL customers impacted by 2020 PSPS outages, and to include other customers with access and functional needs who may not be currently enrolled in the MBL program. This includes those that have "self- reported" disabilities or vulnerabilities to SDG&E. Another potential expansion for the AFN population is the development of emergency or "real-time" response programs that can address needs for customers in the short time leading up to and during PSPS events. In late 2020, during PSPS outages, two new enhancements to this program were tested: (1) emergency delivery, and (2) resiliency item delivery. While the core GGP program focuses on proactive empowerment of known vulnerable customers, there is also an opportunity to develop some reactive services that are triggered around actual PSPS events. The newly tested enhancements involved delivery of charged GGP batteries to customers who called into the SDG&E Customer Care Centers or 2-1-1 in need of emergency power backup needs that could not be met through other AFN services such as hotel stays and accessible transportation. In two late 2020 PSPS outages, the SDG&E Emergency Operations Center was able to leverage a real-time delivery of a portable battery backup to eight customers in need. There is potential to expand this program further through a partnership with 2-1-1 to identify and support severely at-risk customers with these deliveries.

9. C14: Standby Power Programs

- **C14-T1: Tier 3; C14-T2: Tier 2**

SDG&E's Standby Power Programs provide alternative energy solutions aimed at providing the participating customer a comprehensive source of power to energize their entire home or business. Targeted customers – residential, small commercial, critical facilities, and mobile home park clubhouses – will see their risk of PSPS events mitigated through Standby Power Programs.

The first of its Standby Power Programs, SDG&E introduced what is now known as the Fixed Backup Power (FBP) Program. Customers who will not directly benefit from SDG&E's grid hardening programs in the near future, and who reside in the HFTD, are considered for

participation in the Fixed Backup Power Program. Specifically, this program assists backcountry residences, businesses, and local communities in the HFTD that may not benefit from a near or long-term traditional hardening initiatives. Since these customers reside in the backcountry and are so widely distanced from one another, SDG&E's grid hardening initiatives will not reduce the PSPS impacts to this subset of customers. The intention is to help certain customers who have experienced a PSPS event in the past and reside in the HFTD in becoming more resilient to PSPS events, while also reducing wildfire risk.

The Fixed Backup Power Program is designed to offer a fixed installation backup generator, while community businesses and organizations may receive a critical facility generator on a temporary basis during an active PSPS,[25] and clubhouse or central community building at mobile home parks may receive a solar panel and battery backup system.

Analyzing RSE and cost-effectiveness, installing fixed standby generators is the most efficient option for these customers. Undergrounding and hardening overhead power-line installations could potentially prove to be ineffective, considering there is no guarantee that these powerlines would stay energized during a PSPS event. Providing standby generators is the most efficient remedy for customers likely to experience PSPS events, as identified by this program.

Through 2024, the Standby Power Program is expected to reduce PSPS impacts to approximately 1,200 customers. This number is calculated based on the count of customers that would receive the generator and is used to estimate the reduction in PSPS impact to calculate the RSE. Because the generators provided to customers as a part of this program are whole-facility solutions that are expected to keep the customers energized throughout a PSPS event, the effectiveness of the mitigation is estimated to be 100%.

In assessing which communities would benefit most from these programs, SDG&E reviewed areas in the HFTD that have been highly impacted by frequent PSPS events in the past. Based on this review, SDG&E found that Julian, Santa Ysabel, Descanso, Potrero, and Ramona communities were the highest impacted, and therefore, could benefit most from this resiliency program.

The intention is to target customers within these high-risk communities where there is a historical risk of PSPS events. SDG&E intends to complete installations in one community

[25] This program was previously known as the Critical Facility Generator Program in SDG&E's 2020 WMP.

before moving to the next, hoping this will build resilience across the most vulnerable populations and customer segments.

The Standby Power Programs are relatively new initiatives, and as such, SDG&E is tracking all aspects of the program to effectively document lessons learned, which will be incorporated in subsequent program years. Currently, 75 residences are confirmed to have installed generators as of the end of 2020, including one commercial site. The targeted residences, communities, and commercial buildings reside in Julian, Santa Ysabel, Descanso, Potrero, and Ramona.

For 2021, SDG&E plans on increasing the goal of 2020 from 300 generator installations to 413. SDG&E anticipates the 2021 program year to incorporate a portion of the remaining 2020 sites that will not complete construction by end of year 2020 and the full target of approximately 300 additional sites in 2021.

SDG&E plans to extend its Standby Power Programs at least through 2024. SDG&E has established a streamlined process and plans to maintain and improve it going forward. Specifically, SDG&E has collaborated with the County of San Diego (and the third-party contracting company involved with these programs) to streamline residential permitting—a process that used to take anywhere from four to eight weeks, reducing it down to a two- to three-week process. Also, in discovering the extended permitting and installation processes involved with specific commercial/community buildings (like schools and mobile home parks), SDG&E intends to start these projects earlier in the year in preparation for the timelier site assessments, permitting, and installations. SDG&E will continue to explore enhancements to this category of customer initiatives through evaluation of customer feedback and lessons learned.

10. C15: Resiliency Assistance Programs

- **C15-T1: Tier 3; C15-T2: Tier 2**

The final area in which SDG&E is minimizing risk by increasing customer resilience is through its Resiliency Assistance Programs, aimed at providing eligible customers point-of-sale rebates for generators purchased through traditional retailers. The Generator Assistance Program (GAP) is SDG&E's most prominent program under the Resiliency Assistance umbrella. The objective of these customer offerings is to expand the focus to the greater market of SDG&E customers who have recently been impacted or may be impacted by PSPS outages in years to come. While the Resiliency Grant Programs, outlined above, address the needs of the most

medically vulnerable, and Standby Power Programs focus on customers that are not yet planned to benefit from SDG&E grid hardening initiatives to mitigate impact of PSPS outages, the GAP expands resilience opportunities to the general market in SDG&E's HFTD boundaries and beyond.

In July 2020, SDG&E launched the GAP, marketing to customers in the HFTD who had experienced a 2019 PSPS outage with an offer to download a rebate on a portable generator. The intent was to engage, educate and offer customers new options to enhance their own personal emergency preparedness plans for PSPS events through a dedicated rebate program. Using a similar model to Energy Efficiency rebates offered on customer programs promoting products like programmable thermostats, GAP was launched to offer rebates for a wide array of dual-fuel (gas-propane) portable generators that are available in local "big box" stores. To streamline the process for customers during a year where COVID-19 protection measures were critical, a customer who was invited to the program could download a coupon online, choose a retailer, then choose between the delivery channel of their choice: direct delivery to their home, order with store pickup, or in standard in-store shop and purchase.

Through 2024, Resiliency Assistance Programs are expected to reduce PSPS impacts to approximately 5,000 customers. This number is calculated based on the count of customers that are expected to purchase generators through the rebate program and is used to estimate the reduction in PSPS impact to calculate the RSE. Because the generators purchased through this program vary depending on the customer's preferences, the effectiveness of the mitigation is estimated to be 75%.

The 2020 GAP program focused on a broad market of residential and small business customers impacted by recent PSPS events across the HFTD. This being SDG&E's first generator rebate program, the objective was to cast a wide net to those with the highest propensity for a future outage while offering a generous rebate as an incentive for customers to prepare themselves with backup power sources. The program offered a $300 rebate to customers who met the basic eligibility criteria of residing in the HFTD and having experienced a recent outage. In addition, for California Alternative Rates for Energy (CARE) customers meeting these criteria, a larger rebate of $450 was made available. For lower income customers, this enhanced rebate provided roughly a 70-90% discount on an average portable generator. The 2021 GAP program will continue to target low-income customers with enhanced rebates.

Final 2020 program participation included 2,661 coupons downloaded, including 483 by CARE customers. Of the coupons downloaded, 1,305 total customers redeemed the rebate and purchased a portable generator, 271 of which were CARE customers. The program was designed to offer a customer resiliency power backup option to the highest PSPS event propensity customers across the HFTD. Customers in 34 communities across the HFTD have participated so far in this program, with about 60% of customers concentrated in larger communities of Valley Center, Ramona, Alpine and Campo. Based on the large PSPS events in late 2020, the program will expand eligibility in 2021 to roughly 59,000 customers, well beyond the 28,256 customers targeted in 2020. The 2021 Generator Assistance Program is expected to begin offering eligible customers invitations to participate in the expanded rebate program by May of 2021.

The Resiliency Assistance Programs in 2021 are expected to be enhanced in several ways. First, based on limited availability of certain generator models in local retailers during 2020 due to nationwide shortages from major weather events, SDG&E will pursue expansion of the type of rebates offered to include additional downstream rebate options to customers. This will allow customers more choice and will also open supply chain options to additional local and national retailers by allowing customers to purchase at their favorite stores and then redeem coupons post purchase. In an effort to provide new options for customers, SDG&E also plans to add new portable batteries and power station options to the rebate program, following demonstrated demand for these products at other utilities in California and beyond. Finally, GAP will also include an expanded focus on well pump customers in SDG&E's territory with need for backup power capability during PSPS outages. A partnership with the County of San Diego to identify these customers has been completed and will target these homes and small businesses. Finally, SDG&E is pursuing new ways to educate and inform customers about smart customer resiliency tips and recommendations. An approach to offering "Resiliency Audits" to customers to self-evaluate PSPS preparedness is also underway and could be offered to both residential and critical facilities customers in 2021. These audit/surveys will inform customers about programs available to solve their unique resiliency gaps while also gathering critical information from customers on new ways to help prepare them even better in future years.

11. C16: Strategic Undergrounding

- **C16-T1: Tier 3; C16-T2: Tier 2**

Strategic undergrounding provides the dual benefits of nearly eliminating wildfire risk for the areas where overhead system is converted to underground and eliminating the need and impacts of PSPS for customers fed by underground systems. Undergrounding is, however, often the most expensive major hardening alternative on a per-mile basis, and is thus being deployed strategically. SDG&E seeks to deploy undergrounding in areas where wildfire risk is very high as well as in areas where substantial PSPS reductions can be gained through a minimal installation of underground electric system. The scope of undergrounding work identified in 2023 - 2024 is informed by the WiNGS model.

In 2020, SDG&E installed 29.1 miles of underground cable (including 13.3 miles from the Cleveland National Forest (CNF) project) and intends to install approximately 25 miles of underground within the HFTD in 2021. Over the next several years, SDG&E plans to significantly increase its strategic undergrounding scope to over 100 miles per year to reduce wildfire risk and PSPS event impacts. Another benefit of undergrounding that is yet to be quantified is the reduced scope of vegetation management required in areas that are undergrounded. The strategic underground initiative will continue to evolve as SDG&E gains a better understanding of the costs and constraints involved. Although SDG&E has extensive experience in installation of underground cable, performing undergrounding within the HFTD makes this initiative challenging to implement. Some challenges include difficult terrain, environmental constraints, permitting timelines, and acquisition of easements. Lessons learned from each year's undergrounding accomplishments will help to alleviate some of these constraints through process improvements and stakeholder engagement.

12. C17: Overhead Distribution Fire Hardening – Bare Conductors

- **C17-T1: Tier 3; C17-T2: Tier 2; C17-T3: Non-HFTD**

SDG&E's Distribution Overhead System Hardening program combines SDG&E's overhead hardening programs, formerly known as Fire Risk Mitigation (FiRM), Pole Risk Mitigation Engineering (PRiME), and Wire Safety Enhancement (WiSE) into one program. The one exception to the consolidation of work under this initiative is the distribution hardening component of the CNF project. CNF will continue to be managed separately from the work formerly known as FiRM, PRiME, and WiSE as all distribution CNF work is expected to be

completed in 2021. The consolidation of these hardening programs involves the strategy evolution described in SDG&E's 2020 WMP and will result in the execution of projects based on a circuit-by-circuit approach that weighs risk inputs alongside the need to reduce PSPS impacts, rather than scoping projects based on specific wire or at-risk poles. Ultimately combining overhead distribution hardening programs into one program has made the engineering, design, construction, and management of the projects more efficient and has minimized impacts to customers during job walks, construction and post-construction close-out activities. The overhead scope includes the replacement of wood with steel poles and replacement of conductor with high strength conductor.

In 2020, SDG&E conducted a research study that measured the effectiveness of bare conductor hardening and found that it reduced risk events by 47%. Given this is the lowest cost of its major hardening mitigation programs, SDG&E continues to leverage this program as an efficient method to reduce risk for the near future. This will allow for additional time to gain more experience with covered conductor and to transition from bare conductor scope of work to covered conductor or strategic undergrounding.

One of the biggest challenges with SDG&E's projects and execution schedules is the various land and environmental constraints imposed on projects. A single distribution circuit can traverse over multiple landowners, including federal, state, and local agencies (*i.e.*, Cleveland National Forest, Camp Pendleton, Bureau of Land Management (BLM)), California State Park, County of San Diego, Caltrans, Indian Tribal Lands, irrigation districts), private properties, and conservation easements. SDG&E often faces environmental constraints that require detailed review and approval processes that can limit the time of year it can operate, dictate the means and methods for construction, or cause re-routing of a section of circuit due to cultural or other environmental concerns. The federal, state, and local agencies often have specific and unique permitting requirements and environmental review and mitigation requirements and often require near final designs before the permitting process can start. In many cases, SDG&E must acquire new land rights or amend existing land rights. These land and environmental activities can impose long durations and uncertainty in our project schedules, but SDG&E leverages previous experience to build accurate schedules and thus forecasts. Efforts will be made to try to complete the highest risk reduction projects first, but this may not always be possible given the land and environmental constraints noted above.

SDG&E completed nearly 100 miles of bare conductor overhead system hardening in 2020, with 42 miles in Tier 3 of the HFTD, 54 miles in Tier 2 of the HFTD, and 4 miles in the wildland urban interface. SDG&E plans to execute an additional 100 miles of bare conductor in 2021 and will begin ramping down bare conductor mileage in 2022. SDG&E is transitioning to the other hardening alternatives beginning in 2022 to mitigate both wildfire risk reduction and PSPS impact reduction.

13. C18: Overhead Transmission Fire Hardening – Distribution Underbuilt

- **C18-T1: Tier 3; C18-T2: Tier 2**

SDG&E has been hardening its transmission system within the HFTD since the wildfires that impacted Southern California in 2007. SDG&E has nearly 1,000 circuit miles of overhead transmission that traverse the HFTD. SDG&E has generally prioritized this overhead transmission hardening by focusing on the areas with the highest risk, starting with Tier 3 and moving then into Tier 2. Approximately 800 miles, or 80% of the transmission system within the HFTD, currently meets SDG&E's hardened design and construction standards. There are still 200 miles of transmission infrastructure that remains to be fully hardened

To address the remaining infrastructure, SDG&E's overhead transmission hardening program utilizes enhanced design criteria, steel poles over wood poles, high strength conductor, and increased conductor spacing in the HFTD to reduce the chance of risk events and ignitions. In 2020, SDG&E performed a study on 17 transmission lines totaling 190 miles in the HFTD. SDG&E reviewed 20 years of reliability performance from 2000 to 2019. SDG&E compared overhead risk events per operating year per 100 miles before and after overhead transmission hardening and found an 83% reduction in risk events on hardened infrastructure.

Now that the transmission portion of the Cleveland National Forest project is completed, SDG&E has at least one hardened transmission line into every substation within the HFTD. This not only reduces the risk of ignitions caused by SDG&E's transmission system in the areas of greatest consequence, but it also significantly reduces the risk of transmission-related PSPS events impacting customers at the substation level. SDG&E's hardened transmission system allows SDG&E to take a targeted approach to PSPS decisions utilizing remote sectionalizing on the distribution system, thereby significantly reducing the number of customers impacted by further limiting the need to de-energize transmission lines or entire substations for public safety.

In 2020, SDG&E completed construction on approximately 21.6 miles of transmission and 9.4 miles of distribution underbuilt on transmission lines (in addition to the transmission hardening performed by the CNF project) in 2020. These projects were completed in the communities of Kearny Mesa, Otay Mesa, and portions of lines located on Camp Pendleton.

In 2021 and 2022, SDG&E plans to harden additional transmission mileage within the HFTD, including its last remaining miles in Tier 3 of the HFTD. SDG&E notes that the tie lines hardened in accordance with this strategy are driven by Federal Energy Regulatory Commission (FERC)-jurisdictional projects, given that hardening efforts address the 69 kV transmission system and the associated 12 kV distribution system located in the HFTD. The costs associated with this initiative include only the CPUC-jurisdictional elements related to this strategy.

By the end of 2022, SDG&E plans to have hardened 100% of transmission lines traversing the Tier 3 HFTD, and approximately 85% of the HFTD overall. SDG&E intends to complete this long-term strategy of grid hardening its transmission system within the HFTD by 2026. Projects for the remaining unhardened lines have been identified and have started the process of being scoped and approved.

14. C19: Cleveland National Forest Fire Hardening

- **C19-T1: Tier 3; C19-T2: Tier 2**

The CNF project design was based on various recommendations addressing fire prevention and the U.S. Forest Service's environmental requests. Using an analytical matrix reflecting elements of fire risks and environmental concerns, SDG&E and the U.S. Forest Service collaborated to determine which sections of the electric system should be upgraded. Each segment required a custom solution based on many factors, including the location of the customer being served by the distribution system, the topography of the land, and various biological, cultural, and environmental factors. Similar to overhead transmission hardening, because of the known local wind conditions, the grid hardening activities were designed to handle the higher wind speeds and utilize increased wire spacing to decrease the likelihood of wire-to-wire contact or arcing as the result of contact by flying debris.

The CNF projects include the hardening of facilities and select undergrounding of several existing 12 kV and 69 kV electric facilities spread throughout an approximately 880 square-mile area in the eastern portion of San Diego County located in the HFTD. The existing electric lines located within CNF also extend outside of CNF boundaries. Generally, the CNF program will

increase the safety and reliability of SDG&E's system by 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 with the CNF and surrounding areas.

Construction commenced on the CNF program in late 2016 and is planned to be completed in 2021. At the end of 2020, SDG&E has hardened a total of 98 miles of transmission, 107 miles of overhead distribution and has installed 16.6 miles of distribution underground. In 2020 specifically, the CNF project converted 12.5 miles of existing overhead distribution to 14.3 miles of underground cable, hardened 29 miles of electric transmission, and 45.5 miles of overhead distribution. All of the transmission lines that were identified on this project have been completed and can withstand winds of either 85 mph or 111 mph based upon the known local wind conditions. Less than 10 miles of overhead distribution remains to be fire-hardened within CNF and is expected to be completed in 2021. All construction and close-out activities, such as QA/QC reviews, are planned to occur within 2021.

SDG&E notes that the tie lines hardened in accordance with this strategy are driven by FERC-jurisdictional projects, given that hardening efforts address the 69 kV transmission system and the associated 12 kV distribution system located in the HFTD. The costs presented include only the CPUC-jurisdictional elements related to this strategy.

15. C20: LTE Communication Network

This initiative enables SDG&E's other mitigation activities, such as the Advanced Protection program, and contributes to addressing the risk of equipment failures or foreign objects in lines that could lead to ignitions. SDG&E's existing communication system within the HFTD does not have the bandwidth to support some of the technologies SDG&E is currently deploying as wildfire mitigations including its Advanced Protection program and specifically the Falling Conductor Protection initiative. In addition, there are gaps in coverage of third-party communication providers in the rural areas of eastern San Diego County that limit SDG&E's ability to communicate with field personnel during Red Flag Crew deployments and Emergency Operations Center activations.

SDG&E is deploying a privately-owned LTE network using licensed radio frequency (RF) spectrum by means of the Distribution Communications Reliability Improvements (DCRI) program. This will enhance the overall reliability of SDG&E's communication network, which

is critical for enabling fire prevention and public safety programs. SDG&E's communication network is foundational to many initiatives that demand reliable communication. The ability to reliably enable and disable sensitive settings, enable or disable reclosing, or even remotely operating a switch during a high-risk weather event demands reliable communication that the LTE network will provide. SDG&E's Falling Conductor Protection, in particular, relies on a robust communications network to operate successfully and falling conductor circuits will continue to be enabled as SDG&E's communication network comes online.

SDG&E is prioritizing installations in the HFTD and is working closely with the Advanced Protection team to coordinate the installation of protection and communications equipment.

In 2020, the DCRI program completed a large number of accomplishments foundational to advancing communications coverage and reliability in the HFTD. Accomplishments include: acquisition of spectrum licensing; single spectrum RF design for 50% of service territory; site design standards for attachment to distribution assets; integrated LTE/Distribution build process; siting surveys, land rights and environmental analysis; community outreach and communications planning; 15 base stations completed; georedundant production core; QA/test core; use case testing lab environment built; and further use case testing and validation.

The active development of distribution standards and as well as the associated integrated LTE/Distribution build process has delayed the installation of additional base stations this year. The integrated LTE/Distribution build process is a new unique process that integrates numerous departments and various safety and regulatory requirements into new distribution standards that drive design. Site-specific designs must be fully completed prior to initiating procurement of the engineered steel poles used in the designs. Over the next several years, SDG&E plans to ramp up installations of base stations to create the required communication network necessary to implement the AP initiatives.

The program is continually progressing and there are many facets to define success with a program of this nature. Efforts are being taken to increase efficiency of the buildout, such as potential acquisition of a second spectrum type, as well as analyzing initial build sites and adjusting deployment strategies to meet build-out timelines.

16. C21: Lightning Arrester Removal / Replacement Program

- **C21-T1: Tier 3; C21-T2: Tier 2**

Lightning arrestors are a piece of electrical equipment designed to mitigate the impact of transient overvoltages on the electric system. Overvoltage can cause damage to more expensive distribution equipment such as transformers and underground cables, so lightning arrestors are used as protection devices. Overvoltage can be caused by switching surges, faults, or lightning strikes. When the arrestor senses an overvoltage on the system, the device activates, stabilizing the voltage on the system while passing excess current to ground. If the overvoltage duration is too long, or the overvoltage too high, the arrestor can become thermally overloaded, causing these units to fail in a way where they can become an ignition source.

Through SDG&E's effort to improve and explore alternate solutions and evaluate new technology, a new product was introduced that received CAL FIRE approval. Utilizing this new product, SDG&E plans to replace these arrestors in strategic locations within the HFTD with a CAL FIRE approved lightning arrestor. The CAL FIRE approved device comes with an external device that operates prior to the arrestor overloading, dramatically reducing the potential of becoming an ignition source.

SDG&E will be installing the first of these units in 2021, so no studies have been completed on the effectiveness of this mitigation. SDG&E estimates the program will have an 80% reduction in ignitions, based on the technology and what the product is designed to accomplish. Like all of its equipment programs, SDG&E will be installing these new assets in a way where they can be queried for later reporting, so SDG&E can evaluate the effectiveness of these mitigations as new lightning arrestors begin to protect the electric system under overvoltage conditions.

In 2020, SDG&E's plan for this program was to finalize its construction standards and constructing at test sites for successful installation of these lightning arrestors in 2021. Thus, no major installations occurred in 2020. Construction standards were finalized, and major construction will begin in 2021 with a target of installing 924 lightning arrestors. Over the next several years, the program will ramp up to begin replacing approximately 1,800 arrestors per year. This pace would replace all at-risk arrestors within a ten-year period.

D. Asset Management and Inspections

The purpose of SDG&E's asset management and inspection programs are to promote safety for the general public, SDG&E personnel, and contractors by providing a safe operating and construction environment while maintaining system reliability. SDG&E's established inspection and maintenance programs enable SDG&E to identify and repair conditions and components to reduce potentially defective equipment on SDG&E's electric system to minimize hazards and maintain system reliability. To accomplish this, SDG&E meets or exceeds the requirements of the inspections mandated by Public Resource Code Sections 4292 and 4293 as well as G.O. 95, G.O. 128, G.O. 165, and G.O. 174.

As discussed in the sections below, SDG&E is continually working to find ways to improve the safety of its system through its asset management and inspection programs. This includes development of new programs such as the distribution and transmission drone programs with a continued focus on existing programs such as the routine and detailed inspections performed for substation, distribution and transmission assets.

1. C22: Distribution System Inspection – CMP – 5 Year Detailed Inspections

- **C22-T1: Tier 3; C22-T2: Tier 2**

Commission G.O. 165 requires SDG&E to perform a service territory-wide inspection of its electric distribution system, which is referred to as the Corrective Maintenance Program (CMP). This inspection program mitigates the risk of equipment failure by identifying equipment deterioration and making the repair and/or replacement before failures occur. Equipment failure can lead to electrical faults, which can lead to ignitions. G.O. 165 establishes inspection cycles and record-keeping requirements for utility distribution equipment. Utilities must conduct detailed inspections at a minimum every three to five years, depending on the type of equipment. For detailed inspections, the utilities' records must specify the condition of inspected equipment, any problems found, and a scheduled date for corrective action. Utilities are also required to perform intrusive inspections of distribution wood poles depending on the age and condition of the pole and prior inspection history.

The CMP helps to mitigate wildfire risk by providing SDG&E additional information about its electric distribution system, including in the HFTD. With this information, SDG&E's corrective actions address infractions before a potential issue can occur.

The five-year detailed inspections are mandated by G.O. 165. These inspections are performed throughout SDG&E's entire service territory, including the HFTD. SDG&E conducts an audit to ascertain the effectiveness of the inspections. This audit is managed by SDG&E's operational and engineering managers, who are responsible for certain districts. They typically select about 1.5% of the combined (overhead and underground) territories and assess their conditions to see if the appropriate improvements have been properly carried out. SDG&E tracks the issues identified through this inspection method. These records can be evaluated to identify the quantity and types of issues found that demonstrate the effectiveness of the program.

In 2020 and future years, SDG&E will continue to comply with G.O. 165. SDG&E plans to review the results and high-definition imagery from its drone inspections to provide feedback and enhance its ground G.O. 165 detailed overhead visual inspections and patrols. The following table summarizes the top five conditions found on overhead detailed inspections within the HFTD in 2020 from the CMP.

Table 3: Top Five Conditions During Overhead Detailed Inspections in 2020

OHVI Conditions - HFTD	Count
Damaged/Missing High Volt Signs - 2	333
SDGE/Cust Pole or Stub Pole Dmged/B	280
Damaged Ground Molding	252
CIP Not Transferred- Non-Immediate	198
Overhead connectors Directly on Lin	182

2. C23: Transmission System Inspection

SDG&E utilizes a comprehensive, multi-faceted inspection and patrol program for its electric transmission system which consists of visual patrols, infrared patrols, detailed patrols, as well as other various specialty patrols, inspections, and assessments. Inspections and patrols of all structures, attachments, and conductor spans are performed to identify facilities and equipment that may not meet Public Resources Code §§ 4292 and 4293 or G.O. 95 and G.O. 128 rules.

When non-conformances are identified through these inspections, secondary assessments are performed based on severity levels assigned. These assessments inform what mitigation measures are needed and the timelines for corrective action. This inspection program mitigates the risk of equipment failure by identifying equipment deterioration and making the repair and/or

replacement before failures occur. Equipment failure can lead to electrical faults, which can lead to ignitions.

For detailed inspections, experienced, internal lineman (patrollers) physically visit every structure scheduled for the year to perform the inspections, looking at all components of the structure and conductor. By physically visiting the structures, patrollers are able to look the structure and also access to the structure for current and future maintenance requirements. Detailed inspections result in the largest number of G.O. 95 findings for corrections showing the benefit of this specific activity.

Detailed inspections are currently completed on a three-year cycle for all structures in the HFTD. As conditions are identified during these detailed patrols, internal severity codes are established to properly prioritize corrections. This also is so that conditions are corrected in timeframes which meet or exceed G.O. 95 requirements.

In addition, prior to the first event of the current year's wildfire season as conditions allow, SDG&E plans to complete an additional set of visual transmission inspections on tie lines located within Tier 3 of the HFTD which are likely to be impacted by high winds. This additional patrol is looking for potential fire conditions within the high-risk Tier 3 HFTD environment which take immediate prioritization.

SDG&E currently plans on continuing its historical practice in the subsequent years. With the continuation of this program and interval, SDG&E plans to complete inspections of approximately 2,700 structures in 2021. SDG&E notes that the transmission line inspection programs are driven by FERC-jurisdictional projects. This filing provides only the CPUC-jurisdictional elements related to this strategy.

SDG&E annually evaluates its maintenance practice to confirm inspection and repair intervals meet or exceed regulatory requirements. SDG&E regularly monitors all its inspection programs and ensures all inspection goals are met. Yearly inspections and patrols are performed simultaneously with multiple inspectors and inspection types, validating the quality of the patrols performed. In addition, every quarter, transmission supervisors randomly select 1% of the structures with conditions identified and mitigation measures completed, to field verify the reported conditions have been appropriately addressed. The table below summarizes the top five corrective transmission maintenance orders for 2020.

Table 4: Top Five Corrective Transmission Maintenance Orders for 2020[1]

Maintenance Order	Qty
Ceramic Insulators - Rust	77
Cotter Key(s) – Missing	23
Foundations – Covered/Washed Out	15
Conductor Strands – Broken	14
Complete Wood Pole – Replacement Required	10

[1] Represents only maintenance orders created based on findings from 2020 transmission detailed inspections.

3. C24: Distribution System Inspection – IR/Corona

- **C24-T1: Tier 3; C24-T2: Tier 2**

Infrared distribution inspections mitigate the risk of issues with electrical connections and equipment that cannot be seen during SDG&E's traditional visual inspections. Left undetected, these issues could cause an equipment failure that could lead to an ignition. Connections are difficult to fully assess from the ground or air as it is not possible to visually see the electrical flow. If connections look secure but are not truly tight, the electrical flow may all follow one path resulting in potential premature failure of a connection. Thermographers utilize infrared technology which looks at the radiation emitted by the connections to determine if there are potential issues with a connection prior to failure.

Issues identified through the infrared program are often issues that would not have been identified through current visual or detailed inspections. SDG&E plans to track the infrared inspection findings to evaluate the risk reduction potential. At this time, only a few inspection findings have been discovered utilizing the infrared technology that would not have been seen through traditional visual inspections. The issues identified to date are conditions that could pose a fire or public safety risk.

SDG&E began this program on a pilot basis. The initial focus of the pilot program was on distribution circuits located within Tier 3 of the HFTD. Circuits were initially selected within Tier 3 based on the historical fault counts. Based on the results from the initial pilot program and a comparison to visual findings for a similar region, the prioritization of the pilot program has been changed. Due to the low current running through the lines in the more rural areas, it is thought this may have an impact on the effectiveness of the technology in determining potential connection issues. Based on the risk avoided and cost, the program did return value in the Tier 3

HFTD, but SDG&E plans to continue the pilot program on more urban circuits within Tier 2 of the HFTD and assess the effectiveness.

In 2020, SDG&E completed infrared inspections on the structures and adjacent conductors on approximately 13,000 distribution structures within Tier 3 of the HFTD. As noted above, moving into 2021, the scope of this program will change in order to determine the effectiveness of the program within the higher loaded circuits within Tier 2 of the HFTD.

SDG&E plans to continue the pilot program in 2021 to analyze the effectiveness on higher loaded circuits. As data is collected through these infrared inspections, the results can be analyzed as they were with the Tier 3 study. Depending on the results, the program with be re-evaluated to analyze potential modification or improvements such as frequency, quantity per year, or new features to increase the effectiveness of the program.

4. C25: Distribution System Inspection – CMP – 10 Year Intrusive

- **C25-T1: Tier 3; C25-T2: Tier 2**

SDG&E performs wood pole intrusive inspections on a 10-year (average) cycle on all wood poles throughout SDG&E's service territory. This program mitigates the risk of a pole failing due to internal degradation prior to SDG&E identifying the issue and replacing the pole. A pole failure can lead to a fault on the system and a potential ignition. Each pole is inspected visually and if conditions warrant, intrusively. G.O. 165 requires that 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 of the pole at ground-line. Treatment is applied at this time in the form of ground-line pastes and/or internal pastes. The 10-year cycle fulfills the requirements of G.O. 165: (1) all wood poles over 15 years of age are intrusively inspected within 10 years, and (2) all poles which previously passed intrusive inspection are to be inspected intrusively again on a 20-year cycle.

Depending on the cavities found, or the amount of rot found, an estimate of the remaining pole strength is determined utilizing industry-wide standards. Depending on the severity of the deterioration, the pole either passes, must be reinforced with a steel truss to provide it another five to ten years of useful life or replaced.

In 2020, SDG&E performed approximately 14,000 wood pole intrusive inspections in the HFTD. The number of poles inspected in the HFTD will slightly vary year-to-year, as the inspection cycle begins to move in other areas of the service territory.

SDG&E does not currently plan on modifying or enhancing this program. Consistent with the Commission's requirements, all wood poles will continue to be intrusively inspected on a 10-year cycle. The following table summarizes the top conditions found during intrusive inspections on distribution poles within the HFTD in 2020.

Table 5: Top Conditions Found on Intrusive Inspections on Distribution Poles in 2020

Wood Pole Intrusive Conditions - HFTD	Count
Climbing Inspection Recommended	548
Restoration Recommended, Steel Rein	50
Restoration Rejected, Replace	43
Restoration Recommended, C-Truss	19
Pole Leaning Badly	10

5. C26: LiDAR Flights

Accurate surveys of the electric distribution right of ways, including existing distribution lines, telecommunication lines, structures, crossings, vegetation, and other potential hazards, are critical to effective and accurate electric line design. While previous design methods relied upon standard structure heights, span lengths, and sag and tension charts, enhanced design tools and survey methods are required to mitigate the risk of wildfires.

LiDAR surveys have evolved into a foundational component for SDG&E's overhead transmission and distribution line engineering analysis and design. The transmission department was the early adopter of utilizing LiDAR into their designs. In 2013 with the start of the FiRM program, SDG&E began utilizing LiDAR for the distribution system for clearance and structural adequacy prior to implementation of the grid hardening program. LiDAR surveys provide the most cost-effective, scalable, and accurate solution for overhead power line analysis increasing both system reliability and safety.

Ideally, a transmission or distribution line can be modeled with a single deployment of LiDAR and subsequent modeling. But transmission and distribution systems are often changing with joint use additions, customer relocations, compliance, reliability and maintenance modifications, conductor creep and pole settling, and external development. Rural transmission lines, particularly in HFTD, require attentive vegetation analysis. As such, it is important that LiDAR is field verified. Priority for LiDAR spend follows post-construction survey, pre-construction design, and vegetation analysis.

LiDAR is and has been essential for SDG&E's design projects, vegetation analysis, and post-construction assessment. In 2020, SDG&E captured LiDAR for approximately 5,700 distribution structures. As SDG&E's system hardening projects continue to roll out, additional pre-LiDAR and post-LiDAR design and analysis will follow.

LiDAR acquisition and inspections will continue to support the transmission and distribution fire hardening efforts. SDG&E plans to assess transmission lines for vegetation and clearance compliance with a targeted completion of all HFTD Tier 3 projects by the end of 2021. Section and structural usage analysis based on the same LiDAR set will follow in 2022 and beyond.

LiDAR inspections will continue to supplement the grid hardening efforts and post-construction analysis. Vegetation and clearance checks will be fully implemented within the HFTD and potentially expand into non-HFTD projects. Results of these analyses will also be used for emergency operations during red flag and other extreme events.

6. C27: Distribution System Inspection – HFTD Tier 3 Inspections

- **C27-T1: Tier 3; C27-T2: Tier 2**

SDG&E has implemented an HFTD Tier 3 Inspection program to perform Quality Assurance/Quality Control (QA/QC) inspections within the HFTD Tier 3 prior to fire season. These additional proactive inspections are scheduled on a three-year cycle, in addition to the G.O. 165 five-year detailed inspections, exceeding the requirements of G.O. 165. These additional inspections are designed to identify potential structural and mechanical problems before they fail. SDG&E has performed HFTD Tier 3 Inspections of its overhead electric distribution poles in high-risk fire areas with a focus on identifying areas where maintenance would improve fire safety and reliability, with a goal of mitigating the probability that SDG&E's overhead electric system, facilities, and equipment would be the source of ignition for a fire.

These inspections were conducted from 2010 through 2016 as a result of a settlement agreement adopted in D.10-04-047. In 2017, SDG&E decided to proactively continue the HFTD Tier 3 Inspections as part of its normal program. In 2018, when the CPUC adopted the current statewide fire threat map, SDG&E began applying the QA/QC three-year inspection cycle to the newly defined HFTD Tier 3. From 2016 to 2018, SDG&E performed HFTD Tier 3 Inspections on an average of 15,000 poles annually (approximately one-third of the distribution poles in the HFTD Tier 3) in its then-existing "extreme" and "very high" fire threat areas. In addition to the

inspections, SDG&E performs a system maintenance patrol (as specified by G.O. 165) for the entire overhead electric distribution system in the HFTD on an annual basis. Safety-related issues identified on those patrols are scheduled for follow-up repair.

For HFTD Tier 3 Inspections, the main purpose is to identify fire safety conditions in the HFTD Tier 3. SDG&E performed 11,864 inspections in the HFTD Tier 3 in 2020. All of these inspections were completed by March 2020. In 2021, SDG&E plans to complete 10,815 HFTD Tier 3 inspections.

In addition, SDG&E intends to accelerate repairs of these types of conditions found in Tier 2 and 3 of the HFTD (including the design, engineering, and construction of the new structures) faster than the six-month or twelve-month time frame required by the Commission's General Orders. This will reduce the risk of wildfire on an accelerated schedule within the highest risk areas. The table below shows the top five conditions found on HFTD Tier 3 inspections for 2020.

Table 6: Top Five Conditions Found on HFTD Tier 3 Inspections for 2020

HFTD Tier 3 Conditions	Count
SDGE/Cust Pole or Stub Pole Dmged/B	99
Damaged Cross-Arm	52
Other - Infraction - No Applicable	47
Damaged Ground Molding	40
Damaged/Missing High Volt Signs - 2	39

7. C28: Distribution System Inspection – Drone Inspections

- **C28-T1: Tier 3; C28-T2: Tier 2**

SDG&E began a pilot program at the end of 2019 to determine whether the use of drone technology could help improve or enhance its existing inspection efforts in the HFTD. Specifically, SDG&E was interested in determining whether drones and the high-resolution imagery captured by the drones could be used to identify issues that could not be or were difficult to identify from the ground using traditional inspection methods. Improved identification methods for potential fire hazards on distribution facilities would minimize the risk of wildfire ignition and faults that cause outages.

Further, the number of images (over 1 million) being captured during the pilot drone program put a spotlight on how SDG&E could review the data from the drones more efficiently in the future and address a situation where SDG&E would be consuming image data from other

sources, such as cameras mounted on fleet vehicles or photos submitted by customers. As the amount of data coming into SDG&E's system increases, the ability for humans to review all the data would become impossible, costly, and burdensome. Therefore, SDG&E began using intelligent image processing (*i.e.*, machine learning or artificial intelligence) technology to process large amounts of data and focus human resources on potential issues.

In 2020, SDG&E concluded assessments for 37,310 distribution poles in the Tier 3 HFTD. An analysis of the data collected by the drone program concluded that the program found a higher percentage of total issues than current inspection programs; however, the timing of the inspections or other efforts, such as vegetation management schedules, can influence a straight comparison between programs. Accordingly, SDG&E focused its analysis on the 8,149 poles that were reviewed using ground-based inspectors and the drone teams. For poles with overlapping inspection dates within 0-180 days, the drone program found, on average, 51% more issues. The top issues that were found significantly more by the drone program included: 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 conductor, damaged transformer and CIP connection issues. With that said, the types of issues identified between the two programs with vegetation issues, grounding problems, and other damage were identified more by the ground-based inspectors.

While further analysis would help determine the exact reasons for the discrepancy in findings between the different types of assessments, it is apparent that the imagery collected by the drones does allow for improved identification of potential fire hazards for certain types of issues or where conditions such as terrain and vegetation density present difficulties in completing full detailed inspections. The drone program also provided SDG&E with an opportunity to leverage the influx of images captured by the drones as well as build intelligent image processing models to identify assets and detect potential damage to its electric facilities. Once the models are developed and tested, SDG&E would potentially be able to process thousands of images in real-time or in a fraction of what it would take for a qualified electrical worker to review.

SDG&E targeted its initial efforts in Tier 3 of the HFTD, as this is the area with the highest risk for wildfire. Next, SDG&E plans to expand the program into Tier 2 of the HFTD and complete assessments on its distribution facilities in that area over the next two years.

Prioritization will be completed by reviewing circuit risk indexes that are built considering pole age, pole material type, local weather conditions, and vegetation communities. SDG&E will also review its efforts on other programs and remove facilities that are being upgraded or otherwise affected by its other Wildfire initiatives from the scope of its drone assessments.

SDG&E did encounter constraints in performing drone assessments for all its distribution facilities primarily related to government agency authorizations from California State Parks and U.S. Forest Service, as well as coordination with certain customers. Additional efforts will be made to gain approvals from these agencies and perform drone inspections on those distribution facilities beginning in 2021.

For the intelligent image processing effort, SDG&E prioritized the types of models it developed to focus on the highest risk items and highest frequency issues. As SDG&E gained experience through the pilot program, efficiencies in flight planning, customer outreach, and image collection and review were gained over the approximate 15-month schedule for completion of flights. These efficiencies were able to reduce costs by 50% from an average of $1,000/pole to $500/pole. With further modifications to the program, SDG&E is working to decrease cost impacts as it expands the program to Tier 2 of the HFTD. There are approximately 44,000 distribution facilities in Tier 2 of the HFTD and SDG&E plans to perform flights and assessments on half of those facilities in 2021 and the remainder in 2022 based on the prioritization discussed above. The program will then transition to completing inspections within the HFTD on a five-year cycle.

SDG&E's intelligent image processing models now in development include 25 models detecting 15 asset variations and 12 damage conditions within a range of 65-97% accuracy. These models are generally associated with the pole, crossarm, insulator, and transformer. SDG&E has invested approximately $2 million in the development of these models and intends to continue refining the current models and building additional models in 2021 to eventually allow for a full evaluation of the pole, depending on the images provided. For example, a certain number of different types of conditions are necessary in order to build an effective model, and if those conditions do not exist, then the model's accuracy will be affected.

To help decrease the costs for flight and assessments while maintaining quality and effectiveness of the drone program, SDG&E plans on implementing two significant changes in

the next phase: (1) reducing the number of images taken by the drone, and (2) deploying a qualified electric worker (QEW) to act as the visual observer with the drone pilot.

Reducing the number of images taken will allow the field teams to complete flights on more poles per day and decrease the time it takes the QEW to review all images and perform the assessment. This will ultimately reduce the cost to perform the flights and assessments on a per pole basis. SDG&E based this change on an analysis of which images were used by the assessment team to identify most issues. The results indicated that more than 65% of the issues were identified using the level 2 image, which is taken from an angle above the pole and at a close distance from the pole. While only approximately 13% of issues were identified using the level 1 image, this photograph was useful in executing the repair and providing context to the assessment team when performing their reviews. Thus, SDG&E will be eliminating the level 3 image capture, which is taken below the crossarm and presents the highest risk of collision when flying the drone and, while it offers additional angles and views of hardware and connections, it represents what can generally be seen from the ground.

Next, the drone teams consisted of a two-person crew with a drone pilot and the visual observer, both of which are not QEWs. By pairing the drone pilot with a QEW, SDG&E would get the cost savings of reducing manpower and the benefit of having a trained and qualified individual to observe the pole in the field. This change will help better determine the advantages and disadvantages between ground-based and drone-based inspections and make a more informed decisions about how to incorporate drone technology into its inspection programs in the future.

Finally, the intelligent image processing models will continue to be enhanced and expanded to reduce future costs associated with inspections and provide the means necessary to address the increasing need to consume and process data.

8. C29: Distribution System Inspection – Circuit Ownership

- **C29-T1: Tier 3; C29-T2: Tier 2**

The Circuit Ownership platform relies upon field personnel expertise to identify potential hazards that could lead to a wildfire. This initiative helps to reduce the risk of potential fire hazards turning into ignitions by identifying concerns and mitigating them before they fail. This platform gives SDG&E's field personnel another avenue to submit these concerns via a Mobile Data Terminal (MDT) program or mobile application (both iOS and Android). Specifically, this

program facilitates supplemental submission of circuit vulnerabilities (in addition to the existing inspection programs) so that they can be timely repaired, to prevent a potential ignition and minimize the risk of wildfire. In essence, this program provides field personnel a platform for "if you see something, say something." This program focuses on regions where there could potentially be a wildfire concern. This includes Tier 2 and Tier 3 of the HFTD and coastal canyons where simulations have indicated a wildfire risk exists.

SDG&E's mobile application enables all employees to submit supplemental inspections if they see an issue with SDG&E assets that needs to be addressed. When issues are identified through the mobile application, they are categorized within two days (unless identified as an imminent danger or hazard) as either a priority, emergency, or non-emergency. This prioritizes the prompt follow-up of those priority and emergency submissions. For example, a submission through this program identified a long stretch of overhead wire (sized #6 bare stranded copper) that runs through a dry brush canyon near an urban development. This branch line feeds a small transformer that is used for monitoring. Once the issue was identified, the Circuit Ownership program developed a plan to isolate the transformer "off grid" with solar and batteries, and then remove the 22-span section of overhead small conductor that has a higher risk of failure.

SDG&E deployed this program in 2020, and there are have been four submissions to date. Plans for 2021 include providing refresher training to field personnel that could use this tool to identify potential hazards. This initiative has the potential to expand to all users in SDG&E's Electric Regional Operations department or even outside departments to submit concerns. Other discretionary inspection of transmission electric lines and equipment, beyond inspections mandated by rules and regulations.

9. C30: Distribution System Inspection – CMP – Annual Patrol

- **C30-T1: Tier 3; C30-T2: Tier 2**

In general, utilities must patrol their systems once a year in urban areas and in Tier 2 and Tier 3 of the HFTD. Patrols in rural areas outside of the HFTD are required to be performed once every two years. As a long-standing practice, however, SDG&E performs patrols in all areas on an annual basis as part of the CMP. In addition to the patrols, utilities must conduct detailed inspections at a minimum every three to five years, depending on the type of equipment. SDG&E's inspection and repair programs mitigate wildfire risk by identifying and repairing or

replacing deteriorated equipment before the failures occur, including in the HFTD. This program reduces faults due to equipment failure, which reduces the probability of ignitions.

The patrol inspections are mandated by G.O. 165. Upon completion of prescribed actions necessitated by the detailed CMP inspections, SDG&E conducts an audit to ascertain the effectiveness of the inspections. This audit is managed by SDG&E's operational and engineering managers, who are responsible for certain districts. The managers typically select about 1.5% of the combined (overhead and underground) territories and assess their conditions to see if the appropriate improvements have been properly carried out.

SDG&E performs inspections throughout its service territory. SDG&E tracks the issues identified through this inspection method. These records can be evaluated to identify the quantity and types of issues found that demonstrate the effectiveness of the program.

In 2020, all patrols on the electric distribution system have been completed in SDG&E's service territory. In 2021 and future years, SDG&E will continue to comply with G.O. 165 and conduct the required inspections.

SDG&E tracks the issues identified through this inspection method. These records can be evaluated to identify the quantity and types of issues found that demonstrate the effectiveness of the program. The table below summarizes the top five conditions found on patrols of distribution poles within the HFTD in 2020.

Table 7: Top Five Conditions Found on Patrols in 2020

Patrol Conditions - HFTD	Count
Damaged/Missing High Volt Signs - 2	333
SDGE Leaning Pole or Potential Over	64
SDGE/Cust Pole or Stub Pole Dmged/B	46
Damaged Cross-Arm	32
Damaged / Missing Pole Hardware	17

E. Vegetation Management and Inspections

Vegetation around electric distribution lines and equipment poses potential risks for safety, wildfire, compliance, and reliability. To address these risks, SDG&E developed and executes a robust and detailed schedule and scope for its vegetation inspection activities. While tree trimming is a mandated activity pursuant to CPUC G.O. 95, Rule 35, Public Resources Code 4293, and NERC FAC003-4, SDG&E's program goes beyond these minimum requirements to further enhance safety, especially in the HFTD.

SDG&E's vegetation management program involves several components including: tracking and maintaining a database of inventory trees and poles, routine and enhanced patrolling, pruning and removing hazardous trees, replacing unsafe trees with more situationally compatible species, pole brushing, and training first responders in electrical and fire awareness. These program components are discussed in detail in the Sections below.

SDG&E divides its service territory into 133 distinct zones known as Vegetation Management Areas (VMA). SDG&E's activities in each VMA are driven by a master schedule that identifies specific activities that are calendared to take place in each VMA every year. The activities include: pre- inspection, audit of pre-inspection work, tree pruning and removal, pole brushing, post-trim, and brushing audits. Patrol activities are generally termed to include routine inspections and off-cycle, incremental/enhanced inspections throughout the service territory. During the pre-inspection activity, trees in proximity to SDG&E's power lines are inspected and evaluated and the tree condition in the database is updated accordingly. Each tree is visited and inspected annually. The annual inspections include routine maintenance and hazard tree assessments to verify that trees will remain compliant for the duration of the cycle and/or pruned according to standards and clearances. Trees that will not maintain compliance, or that have the potential to impact power lines within the annual pruning cycle, are identified and assigned to the tree contractor to work. If a tree requires urgent work, the inspector has the discretion to issue the job to the tree contractor for priority completion. Emergency pruning may occur where a tree requires immediate attention to clear an infraction, or if it poses an imminent threat to the electrical facilities.

The aim of SDG&E's enhanced vegetation management strategy is to minimize or eliminate the likelihood of vegetation encroachment near power lines or tree-line contact as a result of by wind sway, branch breakout, or tree/root failure. SDG&E follows the industry standard of directional pruning to achieve this goal. If a tree cannot be mitigated by pruning, SDG&E may determine that complete removal is necessary. This course may be followed in situations where continued pruning is detrimental to the tree, the remaining tree poses a threat, or its growth potential cannot be managed for the duration of the annual cycle.

1. C31: Tree Trimming

- **C31-T1: Tier 3; C31-T2: Tier 2**

SDG&E maintains an electronic tree database that tracks the inspection, trimming, and auditing activity of its nearly 457,000 inventory trees. SDG&E defines an inventory tree as one that could encroach the minimum required clearance or otherwise impact the electrical facilities within three -years of the inspection date. The database includes tree information including species, height, diameter, growth rate, clearance, and other characteristics. This history provides tree inspectors with relevant information to determine which trees require work for the annual cycle. The tree inventory database is updated daily, reflecting trees that are added to or removed from the system. SDG&E employs a contracted workforce of ISA-Certified Arborists trained in species identification, characteristics, and hazard assessment.

SDG&E's vegetation management program strategy and schedule are centered around annual routine and enhanced inspections. Routine operations are driven by regulatory requirements by following an annual master schedule that includes pre-inspection activities, trimming, auditing, and pole brushing. Within the HFTD, SDG&E performs separately scheduled routine and non-routine hazard tree inspections annually. These off-cycle inspections provide a second assessment of all trees during the annual cycle. The inspections are performed by International Society of Arboriculture (ISA) Certified Arborists and include a 360-degree assessment of every tree within the "strike zone" of the conductors. The strike zone includes the area adjacent to power lines both inside and outside the rights-of-way for trees that are tall enough to potentially strike the overhead facilities. SDG&E completes work identified during the non-routine inspections prior to the start of the peak fire season (September 1).

During routine and off-cycle inspections in the HFTD, SDG&E also pursues enhanced clearances on its targeted species, including eucalyptus, palm, oak, pine, and sycamore. When determining targeted species, SDG&E considered factors such as growth rate and characteristics, failure potential, outage frequency history, and other environmental factors. Species alone does not necessarily trigger the need for enhanced trimming. As with any living organism in a changing environment, risk assessments are based on multiple site-specific conditions. Many of these trees, such as eucalyptus and sycamore, are fast-growing and have the propensity to shed branches during windy conditions.

SDG&E schedules its enhanced tree inspections within the HFTD to coincide with the post-trim QA/QC activity. The enhanced inspection activity occurs approximately six months after the routine inspection activity. This inspection frequency enables a second look at trees within the annual cycle to ensure conditions have not changed that may result in a tree/line conflict. In areas of the HFTD where the annual, routine pre-inspection activity occurs in the Fall (September-December), SDG&E performs the enhanced tree inspection activity in the Spring and Summer, in advance of seasonal Santa Ana wind conditions. The protocol and scope for both routine and enhanced inspections within the HFTD includes a visual inspection of all trees that have the potential to strike the electrical facilities if the tree were to fail at ground level. The visual inspection includes a 360-degree hazard assessment of trees from ground level to canopy height to determine tree health, structural integrity, and environmental conditions. Where appropriate, sounding techniques or root examination may also be conducted.

In 2021, SDG&E created four new internal SDG&E Forester Patroller positions to perform the off-cycle, enhanced tree inspections within the HFTD. These patrollers are ISA-Certified Arborists and highly qualified to perform hazard tree risk assessments. This team will also be engaged to perform customer refusal resolution within the HFTD.

Also, in 2021 SDG&E is implementing its next-generation database and work management system. Vegetation management and inspection activities were previously managed within a work management system currently called PowerWorkz. An enhancement to this system called EPOCH is scheduled to roll out in early 2021. This new system will include upgraded computer field hardware and software which will create improvements in data entry, accuracy, and reporting and should increase efficiencies in tree-trimming activities.

SDG&E tree contractors follow American National Standards Institute (ANSI) A300 industry tree standards and “directional pruning” techniques which foster the health of a tree while maximizing clearance and extending the pruning cycle. Tree branches that overhang electrical conductors may be considered a risk. SDG&E removes all overhanging branches on its distribution and transmission lines. Once the work is completed, the tree crew updates the tree information and records the work performed in a MDT, then uploads this information into the Vegetation Work Management System. Where achievable, SDG&E prunes trees to a clearance of 12 feet (or greater) from power lines. The post-pruning clearances obtained by the tree contractor are determined by factors such as species, tree growth, wind sway, and proper

pruning practices. On average, SDG&E prunes approximately 175,000 trees each year and removes approximately 8,500 non-compatible trees. In 2020 SDG&E pruned 221,500 trees and removed 12,985 trees. By comparison, in 2019, SDG&E pruned 167,588 trees and 9,936 removed trees.

In 2020, SDG&E experienced a significant cost increase in the tree trim and removal contract rates due to Senate Bill (SB) 247. This legislation resulted in an average contract rate increase of 48% for Davey Tree rates and 63% for Utility Tree Service rates. These cost increases, coupled with a higher overall volume of tree trimming and removals, resulted in a substantial portion of the increased Tree Trimming Balancing Account (TTBA) spending in 2020.

Tree removal includes the chipping of all material and removal of debris. Large wood (> 6-8-inch diameter) generated from tree removal work is generally left onsite with the property owner's acknowledgment on the signed tree removal authorization document. Any large debris left on slopes is positioned to prevent movement of the material by gravity. All debris associated with pruning and removal operations is removed from watercourses to prevent flooding or degradation of water quality. Tree removal operations that may occur in sensitive environmental areas are reviewed to determine protocols that must be followed to protect species and habitat.

As part of its sustainability measures, SDG&E supports and follows its "Right Tree-Right Place" initiative to replace incompatible trees with trees that are safe to grow near power lines. This program supports tree health, prevents outages and ignitions, and minimizes customer impact as a result of frequent tree trimming. SDG&E's sustainability initiative also includes the effort to divert a greater volume of the green waste associated with vegetation activities from landfills to recycling in an effort to reduce the carbon footprint. In late 2020, SDG&E initiated a new service agreement with a second recycling vendor to increase the amount of green waste debris diverted from landfills.

Documented QA/QC activities are a critical component of a utility's vegetation management program to measure contractor performance and further safety, compliance, and reliability.

SDG&E utilizes a third-party contractor to perform quality assurance audits of all its vegetation management activities to measure work quality, contractual adherence, compliance, and to determine the effectiveness of each component of the program. These audits include a

statistical analysis of a representative sample of all completed work. Auditing is performed by Certified Arborists. A minimum random sampling of 15% of completed work is audited to determine compliance with scoping requirements. Safety, regulatory requirements, and service reliability dictate the vegetation management methodology of spend and resource allocation. SDG&E works with the audit contractor to determine the scope, frequency, and number of resources needed to complete all audit activities. During the post-trim audit, the Certified Arborist also performs an inspection of all the power lines within the VMA for any trees that will not remain compliant with applicable regulatory requirements for the duration of the annual cycle. SDG&E and the contractor review the results to determine if any additional work is required.

In 2020, SDG&E expanded its audit program by integrating "level 2" hazard tree assessments during the post-trim audit. These assessments are performed by the same Certified Arborists performing the audit. In 2020, SDG&E also began auditing 100% of all completed reliability trimming and removals performed within the HFTD. Lastly, Vegetation Management increased the audit sampling for all other activities from 10-15%. Within the next two years, SDG&E hopes to expand and integrate the use of LiDAR as an additional tool for QA/QC.

SDG&E plans to explore the use of WiNGS to evaluate vegetation management prioritization in the near future. This will determine future refinements for risk models to support future prioritization and implementation of tree trimming. Over the next 5 years, SDG&E will work to develop a comprehensive audit program to continue to assess and quantify the state of compliance of the Vegetation Management program with regulatory requirements. These audits will inform on the overall success of the program, state of compliance, and procedural integrity.

2. C32: Fuel Management Program

- **C32-T1: Tier 3; C32-T2: Tier 2**

The Fuel Management Program aims to mitigate the following:

- Accumulation of wildland fuels in proximity to electrical infrastructure (wires, poles, equipment) poses a risk of damage to these facilities during wildland fires.
- Firefighting activities, firefighter safety, and faults resulting from smoke columns in proximity to electric facilities can cause power interruption.

- Wildland fuels pose a risk of ignition resulting from electric equipment failure if left unabated.

Wildland fuel reduction involves the thinning, pruning, and in some cases, removal of vegetation for the purpose of minimizing source material that could ignite and propagate a wildfire. The program consists of three activities:

- **Fuels Treatment activity** - Increased clearances around select structures (*e.g.*, poles). The Fuels Treatment activity was developed in 2019 to reduce the risk of ignition that could occur from equipment or pole failure or a wire-down event and propagate fire. This activity is also intended to protect Company infrastructure in the event of a wildfire that originates beyond SDG&E facilities.

  The Fuels Treatment activity has been implemented primarily within the Tier 3 High Fire Threat District on select poles which carry hardware that could possibly spark and ignite a fire. The scope of this activity entailed the removal of dead or dying fine fuels at ground level within a 50-foot radius of the poles. Some of these poles are those that are already subject to clearing requirements of Public Resources Code Section 4292. However, that requirement only requires a radius clearing of 10 feet.

  For this activity, SDG&E also included the use of a chemical fire retardant as an alternative to mechanical brush clearing. The fire retardant was applied around poles, and in some areas, in a linear application between structures within an easement. Landowner approval was secured for all work associated with the Fuels Modification activities.
  In 2020, SDG&E implemented the Fuels Treatment activity for pole brushing and fire-retardant activities where the total treatment of pole brushing in 2020 was 304 acres, and the total treatment using fire retardant was 25 acres, including 38 poles and roadside application.
- **Vegetation Abatement activity** - Vegetation clearing within transmission rights-of-way. This activity primarily consists of the removal of ground level, non-native flashy fuels, and the thinning of tree branches (to 6-8

feet) above ground. Brush abatement activities are planned and scheduled in late February/early March each year near the end of the normal rain season and before the flush spring growth occurs so that activities are efficiently managed in the appropriate regions.

In 2020 a total of 1,352 acres were abated on fee-owned power line corridors, and 300 acres of fee-owned properties were abated. SDG&E will continue these abatement activities following the same scheduled frequency.

- **Fuels Reduction Grant activity** - SDG&E-sponsored funding grants to third parties for the creation of fuel breaks. The Fuels Reduction Grant Activity was implemented to provide funds to third parties (*e.g.*, community organizations) targeted at reducing the risk of a fire of consequence igniting in a project area and strengthening the resiliency of the project areas.

  Fire Coordination fuels treatment projects will be identified using GIS analysis of Tier 2 and 3 areas of the service territory that meet certain criteria. The analysis will focus on areas impacted by significant wind events (PSPS). The analysis will then overlay areas where electric facilities, fuels, and topography have a direct association to fire ignition potential and growth and community protection.

  SDG&E awarded a $500,000 fuels treatment grant to Fire Safe Council of San Diego County for 2020-2021. This grant will be used to treat wildland fuels in proximity to electric facilities with potential to impact communities during a wildland fire.

SDG&E developed the Fuels Treatment activity as a proactive program intended to reduce wildfire fuel loads in high fire risk areas outside the areas already addressed by traditional pole brushing and other Company wildfire mitigation-related activities. The goal is to implement and assess new fire reduction practices so the Company can minimize the chances of an ignition event in high fire threat areas. SDG&E is gathering data on this program to determine the best methods to reduce fire threat.

SDG&E will continue to monitor the success of the program and adjust funding accordingly. Where appropriate, SDG&E will also continue to engage fire agencies, local/state/federal governments, and community groups to coordinate and maximize all stakeholder efforts. For the Vegetation Abatement activity specifically, anticipated improvements and innovations include enhanced reporting methods, pictorial documentation of brushing activities, successional training opportunities, efficient/improved sustainable brush abatement machinery technology (lower emissions & finely ground deck mulching spoils), and the possible utilization of prescribed grazing using goats.

3. C33: Enhanced Vegetation Management

- **C33-T1: Tier 3; C33-T2: Tier 2**

SDG&E's Vegetation Management program strives to be best-in-class through innovative approaches to further reduce risks associated with vegetation and power lines. In the HFTD, vegetation-related risks include the potential for vegetation contacts, vegetation-related ignitions, and catastrophic wildfire. Increased activity frequency and enhanced post-trim clearances are two elements of SDG&E's effort to mitigate these risks.

Trees are dynamic, living organisms. As such, the vegetation/powerline environment is in continual flux as clearances change due tree growth, tree health, and external forces. Additional and discretionary inspections and trimming beyond currently mandated requirements reduce the risk of non-compliant or high-risk conditions that may lead to wildfire. To that end, in 2020, SDG&E continued broader application of its vegetation management activities in the HFTD related to routine inspection, enhanced patrols, and trimming. SDG&E also continued its enhanced vegetation management activities, including trimming identified high-risk species in the HFTD to an approximately 25-foot clearance from electrical facilities, where achievable.

Enhanced vegetation management activities are targeted in the HFTD. During the annually scheduled routine inspection and enhanced patrol activities, all trees within the strike zone of the transmission and distribution lines receive a "level 2" hazard evaluation. These inspections are performed by ISA-Certified Arborists. Trees tall enough to strike overhead electric lines are assessed for trimming or removal. These efforts would include identification of dead, dying, and diseased trees, live trees with a structural defect, and conditions such as wind sway and line sag. Where required, trees are trimmed or removed to prevent line strike from either whole tree failure or limb break out. The enhanced patrols are timed to occur mid-cycle

with the routine scheduled inspection resulting in inspections occurring within the HFTD twice annually. Approximately 240,000 of SDG&E's 455,000 inventory trees are located within the HFTD.

SDG&E's tree trimming operations follow the concept of directional pruning, where all branches growing towards the lines are rolled back to direct the growth away from the lines and to increase the post-trim clearance. This practice decreases the risk of tree branches contacting electric facilities, whether by growth encroachment, limb failure, or complete tree failure.

SDG&E continues to focus on applying expanded post-trim clearances on targeted species identified as a higher risk due to growth potential, failure characteristics, and relative outage frequency. These species include eucalyptus, sycamore, oak, pine, and palm.

During elevated or extreme weather events, SDG&E's vegetation management contractors are kept informed of conditions in advance, allowing them time to relocate crews into safe work areas or to cease operations if required. In instances of emergency tree trimming during elevated fire conditions, additional fire equipment or support from contracted, professional fire resources may be utilized. In advance of a forecasted Red Flag Warning or Santa Ana conditions, SDG&E will determine if vegetation management patrols are warranted to assess tree conditions. SDG&E's internal Meteorology department confers with our Fire Coordination and Vegetation Management organizations to determine where this activity should occur.

SDG&E provides electrical equipment training to CAL FIRE representatives in conjunction with joint utility inspections. This training is intended to provide CAL FIRE awareness of electrical equipment, and to build a collaborative and positive working relationship between utility and regulator. CAL FIRE can then use this training to perform regularly scheduled inspections. CAL FIRE was unavailable to participate in joint inspections with SDG&E in 2020 due to fire response throughout the state. However, they have committed to resuming these activities in 2021 and future years.

In 2020, SDG&E continued to apply its enhanced vegetation management program, including achieving an approximate 25-foot clearance, where feasible, between trees and electric distribution facilities within the HFTD. This is a significant increase over the average 12-foot post-trim clearance SDG&E typically achieves and goes beyond the legal and regulatory requirements that apply throughout SDG&E's service territory. In 2020, SDG&E trimmed

approximately 13,000 targeted trees to the expanded 20 to 30-foot clearance range. As stated in section 4.4.2.9 of the 2021 WMP Update SDG&E can reduce vegetation contacts by 6.3 per year, and the associated ignitions by 0.19 per year by completing these clearances throughout the HFTD.

As SDG&E has implemented enhanced inspections, patrols, and trimming, it has identified that additional tools, fleet, and crews are needed to support this program. SDG&E also hired four internal SDG&E inspectors to augment its contractor workforce to perform the off-cycle HFTD and additional patrol activities for target species, such as Century plant and bamboo. Tree contractors are adding to their workforce to meet the demand of the increased workload associated with enhanced scoping.

Over the next 3 years, SDG&E will continue to refine and expand the use of its Vegetation Risk Index over the next three years to identify where to target additional trimming and removal activities. SDG&E will work with CAL FIRE to schedule annual training and joint inspection activities. SDG&E will continue to partner and collaborate with fire agencies and stakeholders on fire avoidance and fuel reduction initiatives.

4. C34: Pole Brushing

- **C34-T1: Tier 3; C34-T2: Tier 2**

Pole brushing is a fire prevention measure involving the removal of vegetation at the base of poles that carry specific types of electrical hardware that could cause sparking or molten material to fall to the ground. The clearance requirements in Public Resources Code Section 4292 require the removal of all vegetation down to bare mineral soil within a 10-foot radius from the outer circumference of subject poles located within the boundary of the State Responsibility Area (SRA). The requirement also includes the removal of live vegetation up to eight vertical feet, and the removal of dead vegetation up to conductor level within the clearance cylinder.

Pole brushing follows a specific multi-activity, annual schedule in order to remain compliant year-round. The number of subject-poles fluctuates minimally year-to-year, so scheduling, spend, and resource allocation remain fairly constant. SDG&E performs an environmental review in advance of all new pole brushing activities to assess impacts to protected species and habitat. Like all other vegetation management activities, a QA/QC audit is performed on a random, representative sample of all completed pole-brush work. Additionally, SDG&E conducts internal compliance audits for vegetation management on an annual basis.

In 2020, SDG&E replaced approximately 3,176 fuses and 1,857 hot line clamps attached to poles within the HFTD. This will reduce the risk of equipment-related ignitions and will potentially reduce the number of poles that are subject to pole brushing requirements in Public Resources Code Section 4292. In 2021 SDG&E plans to continue the effort of replacing fuses and hot line clamps attached to poles within the HFTD. This will continue to reduce the risk of equipment-related ignitions and will potentially reduce the number of poles that are subject to pole brushing requirements in Public Resources Code Section.

Pole brush inspection occurs in conjunction with the tree inspection activity. There are opportunities for redundancy and data discrepancy between this and the pole brushing activity which is performed on a different schedule. Within the next two years, SDG&E is planning to revise its procedure to integrate pole brush inspection within the pole brush activity. This will help reduce property visits and customer contacts and improve contractor work efficiency and data integrity. Over the next 10 years, SDG&E will develop the use of LiDAR to help with equipment change detection and auditing of pole brushing. SDG&E is also investigating inter-departmental processes that could automate notification when equipment is changed out that makes a pole subject to brushing.

SDG&E performs required pole brushing activities on subject poles located within the State Responsibility Area (SRA) per Public Resources Code Section 4292. The State Responsibility Area where Public Resources Code Section 4292 applies does not align completely with the HFTD boundary. As an extra precautionary measure, SDG&E brushes about 2,000 additional poles located outside SRA where Public Resources Code Section 4292 does not apply. These poles exist in areas of potentially flammable vegetation, on steep slopes, and/or adjacent to areas where a fire may propagate.

SDG&E's Vegetation Management department works with internal Meteorology and Fire Coordination departments to determine where it may be prudent to expand vegetation clearances around subject poles within high fire areas to mitigate the risk of ignitions that could occur outside the required clearances of Public Resources Code Section 4293.

SDG&E utilizes the same work management system to manage and track the inventory of all subject poles that require clearing. SDG&E brushes approximately 34,000 distribution poles that have non-exempt subject hardware attached. Inspectors determine which poles required

work and update the records in the database. SDG&E performs three separately scheduled pole brush activities annually including mechanical brushing, chemical application, and re-clearing.

Mechanical pole brushing includes clearing all vegetation around the base of the pole down to bare mineral soil for a radius of ten feet from the outer circumference of the pole; removing all live vegetation within the cylinder up to a height of eight feet above ground; removing all dead vegetation up to the height of the conductors. Mechanical brushing is typically performed in the spring months.

On poles where environmentally safe and with customer consent, contractors will apply an Environmental Protection Agency (EPA) approved herbicide, the chemical application. SDG&E treats approximately 10,000 poles with the pre-emergent herbicide to minimize vegetative re-growth and reduce overall maintenance costs. The chemical application is typically done just before the rain season (during the fall and winter months) so the chemical is activated and effective. Not all subject poles can be treated with herbicide due to environmental constraints which include species/habitat protection, site slope, proximity to water, proximity to trees, etc.

Reclearing, a second mechanical activity, is performed on poles that do not allow chemical application to remove vegetation that has grown into, or blown into, the required clearance area since the last maintenance activity. The need to revisit a subject pole multiple times is not uncommon due to leaf litter cast or blown into the cleared area and vegetation regrowth that cannot controlled by mechanical or herbicide treatments.

F. Grid Operations and Protocols

SDG&E's grid operations and protocols consist of mitigations that reduce risk through changing the way SDG&E operates during periods of elevated and extreme wildfire risk. This includes the disabling of reclosing in the HFTD, the enabling of fast recloser settings, restricting work in the HFTD during extreme fire potential and Red Flag Warnings, and sending contract fire resources into the field during elevated days in the HFTD. These operational decisions strive to reduce ignitions on the electric system. It is important to note that these protocols are now part of how SDG&E operates and is embedded into what we do. Accordingly, no costs are identified as costs are not separated for operating in such a manner.

In the research study detailed in the 2021 Wildfire Mitigation Plan, SDG&E shows that the chance of an ignition is highest during extreme FPI days for circuits located within the

HFTD. A risk event occurring during those weather conditions within the HFTD is more likely than normal and elevated FPI days. Sensitive and fast protection settings help reduce fault energy from causing an ignition.

To mitigate the high ignition percentages that may occur on extreme FPI days within the HFTD, SDG&E has developed a protective relay setting focused on detecting and isolating faults as quickly as possible. This protection settings profile is designed to operate as fast as possible, ignoring traditional protective coordination. SDG&E enables this setting profile on dynamic protective devices such as reclosers and circuit breakers when the FPI indicates an extreme risk. By reducing the resultant energy of a fault, the probability of causing significant damage to the surrounding area is reduced by limiting additional sparks resulting from less sensitive relay settings. These sensitive relay settings improve both the sensitivity of fault detection and the speed at which faults are cleared.

Sensitive and fast protection settings are part of SDG&E's operating standards to enable these setting on remote sectionalizing devices located within the HFTD on days where the fire potential is extreme. SDG&E developed the settings and the operating standard around these settings in 2015 and have been utilizing them since. Specifically, SDG&E operated these settings in 2020 and will use them again in the future.

SDG&E previously completed a large deployment of overhead distribution reclosers, focusing heavily on the HFTD. A recloser is a switching device that is designed to detect and interrupt momentary faults. The device can reclose automatically and open back up if a fault is still detected. The automated reclosing feature can be disabled, so if a device detects a fault it will trip open and remain open and minimize the potential for an ignition.

These overhead distribution reclosers allow SDG&E to operate its system in a variety of configurations depending on input from its meteorologists, known localized conditions, and its declared Operating Condition. They also provide SDG&E the ability to sectionalize various elements of its distribution system to efficiently manage system operations and reliability, which results in quicker restoration times for customers. Additionally, SDG&E has associated these remote SCADA-controlled sectionalizing devices with specific wind anemometer locations, allowing for targeted applications of PSPS to the areas that pose the most significant real-time system condition risk of wildfire.

Under Normal Conditions, overhead distribution reclosers operate to clear faults by isolating the fewest number of customers while reducing overall exposure to the electric system. Under Elevated Conditions or higher and now most of the year, all distribution reclosing functions are disabled on circuits located within the HFTD but may include other circuits if the burn environment is conducive to large wildfires. This is done so that if a fault occurs on the system, the recloser automatically opens and stays open so the fault only occurs once and is not closed, creating another opportunity for a potential ignition. Disabling reclosing functions is not optimal for reliability, but is performed for public safety and wildfire risk reduction when weather conditions are elevated or higher.

SDG&E's internal operating procedure for reclosing protocols is validated annually prior to fire season. SCADA-controlled sectionalizing devices with specific anemometer locations are validated yearly to ensure all newly installed devices are updated on the procedure, along with the SCADA summary screen. SDG&E's recloser protocols are intended to reduce the chance of a fault leading to an ignition. This includes disabling reclosing and the enabling sensitive settings described in the narrative above. SDG&E would expect the ratio of ignitions/faults to rise over time if SDG&E were to stop following these procedures.

The disabling of reclosing and the enabling of sensitive settings were among the first mitigations SDG&E initiated after the lessons learned from the 2007 fires. These innovative mitigations represented a shift in priority from electric reliability in favor of public safety and wildfire risk reduction. Today, these procedures represent a standard best practice for California utilities.

SDG&E has designated the type of work activity that can be performed for each of the Operating Conditions. As conditions increase in severity, activities that present an increased risk of ignition have additional mitigation requirements. Where risk cannot be mitigated, work activity might cease. The following summarizes the work activity guidelines for each Operating Condition:

- **Normal Condition:** normal operating procedures are followed with baseline tools and equipment.
- **Elevated Condition:** certain at-risk work activities may require additional mitigation measures in order to proceed with work. The additional mitigation measures will be documented.

- **Extreme or RFW Condition:** most overhead work activities will cease, except where not performing the work would create a greater risk than doing so. In those cases where at-risk work needs to be performed, an SDG&E Fire Coordinator is consulted, and additional mitigation steps are implemented. Status of work, ceased or continued, will be documented.

These guidelines suffice for most routine types of activities performed in the wildland areas, which consist of undeveloped areas with vegetation. For non-routine, or especially hazardous work, SDG&E's Fire Coordination group is consulted to determine whether additional mitigation requirements are needed.

SDG&E intends to continue to prioritize the integration of the Fire Potential Index into operational practices to promote safety. The FPI classifies the fire potential based on weather and fuel conditions and historical fire occurrences within SDG&E's service territory. SDG&E conducts annual reviews of these procedures and makes updates as necessary. Other special work procedures restrict work activities on elevated and extreme FPI days. Because of these procedures, SDG&E would expect crew related ignitions to decrease on elevated or higher FPI days.

In addition to operating procedures, SDG&E has protocols for maintaining public safety during high wildfire conditions, PSPS and re-energization events. SDG&E has experienced that while power lines are de-energized, they are still exposed to extreme winds and weather, and the potential for damage. Once the wind has passed, the conditions are typically still extremely dry and dangerous. Before re-energizing a line at the conclusion of a weather event, to confirm no damage has occurred to the line and ignitions will not occur upon re-energization, post-event patrols must be completed. SDG&E patrols 100% of lines that were proactively de-energized as part of a PSPS event. To perform these post-event patrols of de-energized lines, SDG&E utilizes both ground and aerial resources once a weather event concludes. While aerial resources are much faster at completing patrols, they cannot fly in elevated wind conditions, which often still exist when extreme wind events are determined to be over. SDG&E strives to complete post-event patrols and restoring service within 24 hours from when the Utility Incident Commander gives the okay to patrol, which signals the end of the weather event for that circuit. While SDG&E has been generally successful in restoring service within 24 hours, challenges such as

damage found on lines, a lack of daylight hours, or high winds impacting deployment of aerial resources may cause delays.

1. C35: Aviation Firefighting Program

- **C35-T1: Tier 3; C35-T2: Tier 2; C35-T3: Non-HFTD**

Under certain conditions, a wildfire that is not suppressed may grow rapidly and uncontrollably, endangering public safety. SDG&E's Aviation Firefighting Program mitigates this risk by serving as a wildfire suppression resource. If fire agencies divert aerial resources to fight wildfires outside of SDG&E's service territory, this program allows aerial firefighting resources to remain available in the region.

SDG&E has two firefighting helicopters available. SDG&E leases an Erickson S-64 helitanker (Air Crane) and a Sikorsky UH-60 Blackhawk helitanker (Blackhawk). Both firefighting assets are Type 1 firefighting helicopters, which are defined as carrying over 700 gallons of water to fight fires. The Air Crane has the capability of dropping up to 2,650 gallons of water, and the Blackhawk has the capability of dropping up to 850 gallons of water. Additionally, the Blackhawk is configured for night vision device flight and is capable of night firefighting with the appropriate crew and training.

SDG&E based its decision for these two resources on two missions. First, both resources provide very good fire suppression capability to SDG&E's service territory. They have both been successfully utilized in many instances, preventing fires from burning out of control in San Diego County. Second, SDG&E performs capital work in the more rural areas with accessibility issues. In areas of difficult access, aerial resources are a necessary construction tool to be able to set structures. Both assets currently under lease fit the requirements for SDG&E.

SDG&E's Aviation Firefighting Program provides risk reduction not only to fires associated with SDG&E equipment but also to the entire community for all causes of wildfire. However, the risk reduction discussed in this Chapter, and the RSE for the program, only focuses on Wildfire risk associated with the utility. Similar to other risk-reducing programs, quantifying aviation risk reduction is complex. The goal is to understand how the Aviation Firefighting program reduces wildfire likelihoods and consequences.

From a likelihood standpoint, the Aviation Firefighting Program is not focused on preventing CPUC reportable ignitions. As defined by D.14-02-015, a reportable ignition is one that starts at utility equipment and travels a meter in vegetation. The helicopters are not

dispatched to an ignition site before the fire spreads one meter. As such, the ignition count will not be decreased.

The Aviation Firefighting Program focuses on reducing the consequences of wildfires through suppression of fire spread and protection of assets. Thus, the risk reduction can be found in the CoRE portion of the risk score assessment.

The risk assessment asks the question of "how much less impact do wildfires have with its Aviation Firefighting Program versus without one." This is a complex question to solve. Each fire is different, and there is no known general rule to apply to SDG&E's specific program. Fire behavior modeling is not accurate enough to compare what would have happened without suppression activities. There is, however, anecdotal evidence that recent non-utility wildfires benefitted from aviation resources. Strong evidence of the benefit is reflected in the regularity that local fire agencies use the resource.

What follows is a brief discussion on how the Aviation Firefighting Program is effective against wildfires in different types of weather. It is known that on low wind days, aviation resources are excellent tools to prevent prolonged spread; and SDG&E's aviation resources are regularly dispatched in these situations. The effectiveness of aviation resources to assist general fire suppression activities is significant in these situations. However, most wildfire risk that exists to the community is not due to these types of calmer low wind weather days. On the other end of the weather perspective, *i.e.*, high wind weather conditions, the benefit of aviation resources is likely to have more constraints. On extremely windy days, wildfires can grow in size even in the first 10 minutes, and although aerial firefighting resources can arrive very quickly, the spread can become too great to overcome. Additionally, on extremely windy days, there are situations and locations when helicopters are not safe to operate. Generally, helicopters that drop water need to be relatively close to their target, and the stronger the wind, the more dangerous it becomes to fly close to the ground. Importantly, strong winds can help dissipate the water from the aircraft and lead to ineffective water drops.

SDG&E will continue to analyze the most effective way to run its Aviation Firefighting Program, and to determine the effectiveness of that program, using internal and external data to assist in the analysis. For the time being, subject matter experts believe that the program reduces overall wildfire consequence, and therefore wildfire risk, by approximately 4% based solely on the knowledge of the equipment and operations, coupled with anecdotal evidence of recent

history. Notably, this 4% is only the measure of utility-associated wildfires and the overall benefit of the program is much larger than what that 4% represents.

SDG&E has agreements with the County of San Diego, CAL FIRE, and the Orange County Fire Authority for aerial firefighting within SDG&E's service territory. Dispatch of SDG&E's aviation firefighting assets is performed through CAL FIRE and these assets support their initial attack strategy to contain wildfires to less than 10 acres. SDG&E employs flight operations staff to assist in dispatching SDG&E aerial assets 365 days per year. This allows the assets to be launched rapidly once dispatched by CAL FIRE.

When wildfires occur outside of SDG&E's service territory, CAL FIRE may divert aerial firefighting resources to those emerging wildfires, which reduces the aerial firefighting capability in the San Diego region. Accordingly, SDG&E has developed and implemented an effective, year-round aerial firefighting program to support the fire agencies in its service territory.

SDG&E is pursuing a partnership with CAL FIRE for night firefighting. While the demands of this mission and requirements are determined by CAL FIRE, SDG&E has started night currency and proficiency flights for pilots to gain confidence and familiarity with night operations. SDG&E is also increasing the hangar space for maintenance and security of these aerial firefighting assets. Expanding the current hangar space will allow robust maintenance of the helicopters to be performed indoors, as well as provide secure indoor storage for when the helicopters are not in use.

SDG&E will maintain its leases for the Air Crane and the Blackhawk. In 2021, SDG&E will take ownership of a Sikorsky S-70M (Firehawk), which will serve as one of SDG&E's lead aerial firefighting resources once it is outfitted with firefighting capability. Once the Firehawk is in service, which is expected to be in 2022, the Blackhawk will be available as a backup if needed. Operations with the Firehawk will be more capable and safer for firefighting than the current Blackhawk due to the platform's advanced safety systems and enhanced performance characteristics. The Firehawk will be maintained and operated by Helistream. Over the next three to ten years, SDG&E will continue to assess the effectiveness of its Aviation Firefighting Program and will work with CAL FIRE on any changes for improved firefighting effectiveness.

2. C36: Wildfire Infrastructure Protection Teams

- **C36-T1: Tier 3; C36-T2: Tier 2**

Contract Fire Resources are utilized to mitigate the fire risks associated with at-risk work activities performed in areas that are adjacent to wildland fuels. The primary objective is preventing ignitions from utility activities. In addition, the Contract Fire Resources are trained and equipped to notify the agency having jurisdiction of an ignition and are able to safely mitigate the impact of an ignition through suppressive action until first responders arrive.

SDG&E's service territory has a large percentage of its infrastructure in the HFTD. While all SDG&E field personnel attend annual fire prevention training, the use of Contract Fire Resources during times of increased fire risk (*e.g.*, during Extreme or Red Flag Warning FPI days) enables SDG&E to perform necessary activities while reducing the risk of an ignition or of a fire growing into a fire of consequence.

In 2020, SDG&E utilized these Contract Fire Resources to prevent fires and reduce the consequence of ignitions associated with utility activities during Extreme or higher FPI days. SDG&E will continue to use them in the future. The utilization of Contract Fire Resources may increase/decrease with the severity of the fire conditions in the region. Factors such as fuel moisture, weather, work activities, and fire activities in the region all play a role in determining the need for these prevention resources. This program is regularly refined with the training qualifications of personnel serving on Contract Fire Resources and utility activities are being reviewed annually.

3. C37: PSPS Events and Mitigation of PSPS Impacts

- **C37-T1: Tier 3; C37-T2: Tier 2**

SDG&E has a statutory obligation to operate its system safely, and as part of that obligation, SDG&E may de-energize circuits (*i.e.*, turn off power) when necessary to protect public safety (Public Safety Power Shutoff or PSPS). Any decision to de-energize circuits for public safety is made in consultation with SDG&E's Emergency Operations Center (EOC), Meteorology, and SDG&E leadership. Typically, it is expected, but not required, that the FPI would be "extreme" or that there would be a Red Flag Warning in effect when a PSPS decision is made.

A PSPS is a last resort measure to reduce wildfire risk. SDG&E leverages a multitude of situational awareness data and input from its subject matter experts when considering the need

for a PSPS event. In determining whether to employ a PSPS in any area of its service territory, SDG&E considers a variety of factors such as:

- Weather conditions
- Vegetation conditions
- Field observations
- Information from first responders
- Flying debris
- Meteorology
- Expected duration of conditions
- Location of any existing fires
- Wildfire activity in other parts of the state affecting resource availability.

Utility operating experience is required to analyze all the various inputs and decide how to manage risk to the communities affected.

If SDG&E determines it is necessary to employ a PSPS for portions of its system, re-energization will take place after the SDG&E weather network shows that wind speeds have decreased and SDG&E weather forecasts indicate that winds will not re-accelerate at or above dangerous levels. All lines that have been de-energized are inspected for damage before re-energization may occur. Once a line is patrolled and any needed repairs are made, the area will be patrolled again and then re-energized.

G. Data Governance

In 2020, SDG&E began centralizing its measures and metrics put forth in Wildfire Mitigation Plans in a central repository to gain insights and assess progress on programs and initiatives.

During the establishment of the centralized measures and metrics reporting process, SDG&E inventoried required data metrics and identified data owners and data sources. Through subsequent interviews of data owners, SDG&E determined that each specific data metric would need to be clearly defined and a repeatable and verifiable process established to accumulate and track the data to ensure its integrity and auditability.

Initially, SDG&E almost exclusively collected data metrics and measures manually. In addition, data definitions were inconsistent, some data was untimely, and preliminary and final data metrics could vary. To enhance data quality and improve the efficiency of the data

gathering process, SDG&E began developing a WMP Data Governance Framework (DGF) and an automated Central Data Repository (CDR) for wildfire-related data, which can be used by multiple internal and external stakeholders in the future. These changes will improve data collection by moving away from manual collection to a more uniform, electronic format that will provide data metrics in a searchable format, similar to a GIS data structure.

The DGF will define a set of repeatable standards, policies, processes and controls for wildfire- related data. Similar to the Wildfire Safety Division's GIS Data Standards, the vision of SDG&E's DGF is to make its wildfire-related data actionable, accessible, aligned, and auditable.

1. C38: Centralized Repository for Data

Development of an Enterprise Asset Management Platform (EAMP) will build a central data repository to house all required metrics specific to SDG&E's wildfire mitigation efforts and establish an asset data foundation integrating key asset-related attributes to enable predictive asset health analyses and risk modeling and improve inspection/assessment strategies and prioritization. Integrating this asset risk information with other inputs, such as Circuit Risk Index for situational awareness, will inform the appropriate asset-related operational decision-making and strategy for enhanced reliability and safe operation of assets. SDG&E believes this will provide a means to optimize the risk, performance, and investments while meeting or exceeding safety and regulatory objectives.

SDG&E envisions that the CDR will eventually provide a "single source of truth" for SDG&E's wildfire-related data for use by multiple internal and external stakeholders in the future. This program will work to pull data from over ten business units and data sources into the CDR. This data will be leveraged to automate the population of the required metrics in the schema required by the WSD. The costs included are primarily related to services required to connect up to a dozen different company systems into the CDR. The data, including both spatial and non-spatial data, will need to be placed into the data schema required by the WSD to meet the standardized reporting requirements given to all electric utilities. This includes licenses and hardware to support the increased capacity required to house the additional data and automation of the data gathering. This will allow for consistent, accurate reporting of all required WMP data.

In 2021 and beyond, the EAMP program will continue to integrate disparate asset data across SDG&E's Electric Distribution, Transmission, and Substation into the centralized repository. Further asset health indexes, asset risk calculations, and advanced analytics will be developed as well. Assets to be integrated as part of EAMP will be prioritized through analysis of ignition and reliability data. SDG&E has completed approximately 25% of the effort needed to implement the DGF and CDR and anticipates the completion of data related to the all the metrics tables contained in the WMP by the end of 2021. SDG&E expects that the development of the centralized repository along with the supporting documentation will continue through 2024**.**

H. Resource Allocation Methodology

SDG&E's enterprise risk management process, discussed in Chapter RAMP-B, includes a focus on risk-informed investment decision-making. The programs provided in this Section are tools to help prioritize Wildfire-related investments.

1. C39: Asset Management

Asset Management provides a consistent framework that is based on risk to evaluate various projects and allocate resources to different areas. SDG&E's Asset Management organization, under the Investment Prioritization workstream, has been working on building the governance process, resource allocation methodology and enabling tool to support the creation of long-term and short-term plans for capital investment, operation & maintenance and asset retirement. Asset Management is discussed in more detail in RAMP Chapter CFF-1.

While the Asset Management initiative focuses on enterprise-wide resource allocation, there was a need to develop a more granular application of the same type of modeling to tackle specific wildfire-related issues such as targeted grid hardening to reduce PSPS. To do that, SDG&E's wildfire mitigation team developed the WiNGS model to specifically tackle the issue of quantifying the impacts of PSPS and identifying more optimal solutions to target both wildfire risk reduction as well as PSPS reduction. The WiNGS model, further described above, was developed internally with the support of third-party consultants to validate the methodology and provide external proxies to improve data used in the model.

2. C40: Wildfire Mitigation Personnel

In July 2019, SDG&E established the Wildfire Mitigation and Vegetation Management department with existing management personnel already deeply familiar with SDG&E's wildfire

mitigation portfolio. This new department is overseen by the Director of the Wildfire Mitigation and Vegetation Management and contains four groups to address aspects of the overall wildfire mitigation effort:

- The Wildfire Mitigation Programs group is involved with the various regulatory proceedings that address wildfire and de-energization as well as legislative and media inquiries.
- The Vegetation Management group manages the current tree and vegetation management inspection and trim program and will begin to address SDG&E's newly formed fuels management program.
- The Wildfire Mitigation Plan Strategic group develops metrics, leads vision projects, promotes new ways to enhance fire safety, and explores advancements to further drive improvement and change including risk modeling capabilities.
- The Wildfire Mitigation Plan Accountability group is responsible for monitoring fire-related metrics, tracking WMP activities, complying with reporting requirements, provide for governance specifications and procedures, and act in a lead capacity on audits of the WMP programs.

The department structure is integrated across the entire SDG&E organization as well as through its reporting hierarchy. With regular monthly meetings of each group, this structure allows for wide collaboration and information gathering, as well as the ability to inform, plan, act, and improve within a compressed timeline, when needed. This structure also allows any operational or strategic changes to be communicated and captured within SDG&E's approach to wildfire mitigation and response.

The Wildfire Mitigation and Vegetation Management department will continue to play a critical role in monitoring and reporting on the Company's overall wildfire mitigation efforts and continuing to advance and mature SDG&E's wildfire mitigation capabilities.

I. Emergency Planning and Preparedness

As discussed in RAMP Chapter CFF-3, the mission of the SDG&E Emergency Management department is to coordinate safe and effective emergency preparedness for the Company, SDG&E's customers, and emergency response personnel. That mission extends to safely and efficiently preparing for, responding to, and recovering from all threats and hazards

through strategic planning, training and exercising, and a sustained Quality Assurance and Improvement process.

1. C41: Emergency Management Operations

SDG&E manages emergencies in alignment with the state Standardized Emergency Management System (SEMS) and federal National Incident Management System (NIMS), to coordinate across all levels of utility, government, and agency activity. The Company utilizes a utility-compatible Incident Command System (ICS) structure as an all-hazards framework to manage emergency incidents and events. ICS is the combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure and serves as the mechanism to direct those functions during an emergency response.

The SDG&E Emergency Management department is responsible for coordinating emergency management activities and activation of the EOC. SDG&E's EOC serves as the location from which centralized emergency management is coordinated. To respond and recover effectively from all hazards and threats, like wildfires, SDG&E established an EOC with cross-functional teams representing every major business line within the Company and functioning within a utility-compatible ICS.

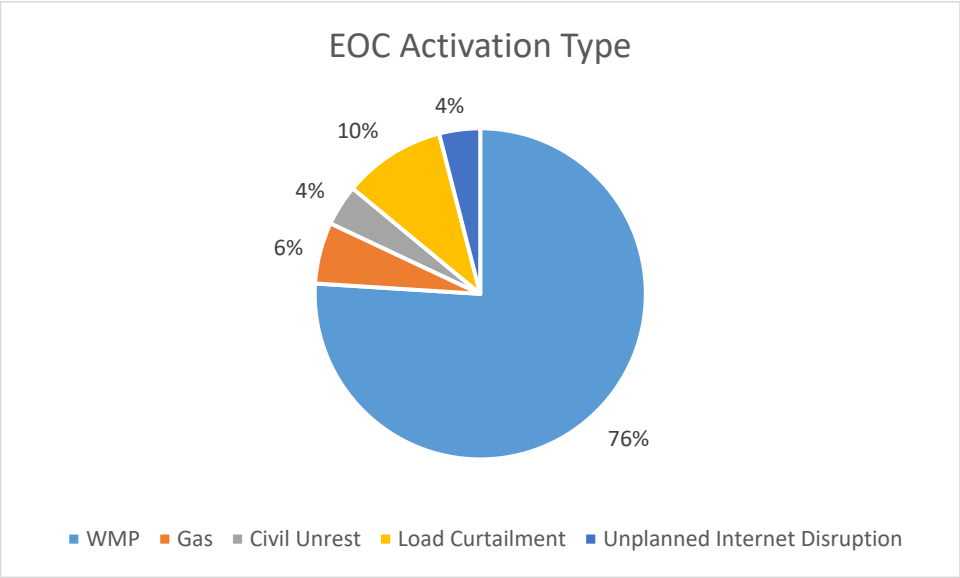
SDG&E's EOC was activated numerous times in 2020. The following table summarizes SDG&E's 2020 EOC activations with numbers of days activated.

Table 8: Summary of 2020 EOC Activations

Event / Incident Name	# of Days Activated	Start Date
COVID-19 Pandemic	299	March 7, 2020
Civil Unrest	2	May 30, 2020
Orange Ave Gas Incident	3	July 16, 2020
Electric Load Curtailment	5	August 14, 2020
Extreme Weather (Load Curtailment, Valley Fire, PSPS)	6	September 3, 2020
PSPS	5	September 25, 2020
PSPS	6	October 23, 2020
Unplanned Internet Disruption	2	November 16, 2020
PSPS	16	November 24, 2020
PSPS, Creek Fire	5	December 20, 2020
2020 Total	**353**	

Not including the activation for the COVID-19 pandemic, 76% of SDG&E's EOC activations were Wildfire related (as shown in the figure below).

Figure 2: 2020 EOC Activation Types



While additional details regarding SDG&E's Emergency Preparedness and Response activities are provided in RAMP Chapter CFF-3, the costs for such activities are included in this RAMP chapter, consistent with WMP presentations, and are duplicated in CFF-3. SDG&E took this approach because many of these emergency preparedness and response activities were initiated and developed to respond to wildfire and PSPS events. Furthermore: (1) the majority of EOC activations are typically wildfire or PSPS related, (2) SDG&E's Aviation Services program (another Wildfire mitigation) is part of the Emergency Management organization, and (3) other wildfire supportive departments (*e.g.*, FS&CA) are physically located in the EOC.

J. Stakeholder Cooperation and Community Engagement

Engagement and cooperation among all wildfire stakeholders are extremely important to SDG&E, as it endeavors to fulfill its commitment to mitigating the risk of wildfires and adverse impacts of PSPS events. SDG&E remains dedicated to partnering with utility customers, elected officials, nonprofit support organizations, first responders and all other public safety and community partners, understanding they all play a unique and important role in achieving wildfire prevention and mitigation in SDG&E's service territory. SDG&E provides an essential service, and it takes its role within the communities it serves very seriously. This is especially true during times of PSPS events, when communities – neighborhoods in which SDG&E's

employees, families and friends live – depend on complete, accurate, and timely information for their well-being.

SDG&E will continue to strive to provide all stakeholders with awareness and information, doing everything in its power to educate the public on wildfire preparedness, including PSPS events. It is SDG&E's goal to equip those it serves with information and resources to navigate the adversity of an emergency, wildfire or PSPS event. Through thoughtful education campaigns and strategic partnerships, SDG&E has implemented a robust, external communication strategy, which is continuously analyzed to identify areas of improvement. SDG&E also leverages its broadened and increased relationships with community-based organizations (CBOs) and stakeholders to amplify and disseminate critical, sometimes life-saving information. These year-round efforts and partnerships are further explained below.

SDG&E remains committed to fostering productive collaboration and engaging the communities it serves. Endeavoring to collaboratively identify fresh ways to better serve our communities will remain a top priority in 2021 and beyond. As outlined below, SDG&E will continue to leverage its partner network, agency relationships and strive for clear, concise education and messaging.

1. C42: Communication Practices

The nearly year-round threat of wildfire risk in California and changing conditions illustrates the need for SDG&E to continually educate customers and the general public about wildfire safety, resiliency and emergency preparedness. Thus, a comprehensive wildfire safety communications and outreach plan has been developed with the intent of increasing community resiliency to wildfires and PSPS impacts.

The importance of providing accurate, timely information to increase public awareness cannot be understated. By educating communities before an emergency, wildfire, or PSPS event occurs, customers can take the necessary steps to prepare for and navigate the inherent difficulties these events bring. Additionally, SDG&E leverages channels outside of its internal outreach campaigns, in the form of partnerships and external events. These provide additional avenues for SDG&E to interact with the public. Providing myriad outreach and engagement channels increases public touchpoints and leads to increased awareness.

SDG&E has a team of outreach advisors that work with community organizations to provide education, programs and services beneficial to customers, with a key focus on wildfire

preparedness, PSPS notifications and support services. A key channel and support network utilized by outreach advisors to promote wildfire preparedness information, PSPS notifications, and available support services during PSPS events is SDG&E's Energy Solutions Partner network. This network is comprised of nearly 200 CBOs who serve a critical role in connecting SDG&E with their constituencies. Through this Partner Network, SDG&E is able to reach diverse, multicultural, multilingual, senior, special needs, disadvantaged and AFN communities. In many cases they are considered trusted partners and experts by the communities they serve, and are able to provide valuable feedback to SDG&E on the needs of their constituents, as well as amplify SDG&E's wildfire preparedness and notification messaging to hard-to-reach customers.

As part of its ongoing efforts to support wildfire mitigation and community fire safety, the SDG&E Wildfire Safety Community Advisory Council (WSCAC) is a forum allowing community leaders to provide direct and constructive input, feedback, recommendations, and support to SDG&E senior management and the Safety Committee of SDG&E's Board of Directors. SDG&E takes the information discussed during these meetings very seriously, as the council members provide useful insight into how SDG&E can continue to help protect the region from wildfires.

Wildfire Safety Fairs will also continue to serve the communities with information, education, resiliency and opportunities to help before, during and after a PSPS activation and/or any other emergency situation. The Company will also review and assess the prevalent languages identified. The expanded CBO collaboration will help with this effort.

SDG&E plans to continue strategically enhancing collaboration with community partners, including Fire Safe Councils, local Fire Departments, CERT, local town organizations and other CBOs to educate on PSPS, emergency response and programs available to all communities.

Additionally, SDG&E will continue to partner with CBOs, and will be focusing on building new partnerships with organizations that represent the needs of customers with AFN in the future.

In addition to and in coordination with its wildfire safety communications discussed above, SDG&E conducts PSPS-specific communications in three phases: prior to, during, and following a PSPS event. Efforts before a PSPS focus on educating customers and the public about what a PSPS is and tactics they can employ to remain safe, resilient, and updated during a

PSPS occurrence. In 2020, SDG&E expanded its public education and outreach efforts associated with its PSPS Communications Plan. In light of COVID-19 considerations, special emphasis was placed on reaching and educating customers and the public in new and novel manners. For example, in September 2020, the Company launched its novel PSPS Mobile App (Alerts by SDG&E). This new tool enables customers to receive information including, but not limited to, notifications, Community Resource Center information with GPS directions, and other real-time updates and safety information related to PSPS activities. During a PSPS, the company focuses on providing real-time awareness and updates about the event and how to remain safe. For instance, SDG&E assigns a dedicated 2-1-1 organization liaison who is responsible for conveying real-time updates and talking points. The Company will also employ standard communication channels to promote 2-1-1 service resources including, but not limited to social media channels, broadcast and print media, and the SDG&E NewsCenter and website. Lastly, following a PSPS, the Company examines communications and solicits customer feedback with the intent of refining and improving communication efforts for the following year. Specifically, SDG&E reaches out to customers, through formal surveys, to establish a baseline awareness of PSPS-related messaging and communications at the beginning of wildfire season. At the end of wildfire season, customers will again be surveyed to measure the effectiveness of public education efforts and communications.

SDG&E assigns a dedicated 2-1-1 organization liaison who is responsible for conveying real-time updates and talking points. SDG&E will be investing in improvements that enhance both the wildfire safety and PSPS communications. The public education campaign will start sooner in the year and will work to expand the reach of communications within the service territory. Also, the formal CBO contract established in 2020 will continue, and the lessons learned during the 2020 wildfire season will be applied to future campaigns. The Company will also review and assess the prevalent languages identified. The expanded CBO collaboration will help with this effort. Additionally, the Company is considering and evaluating additional efforts including, but not limited to, working with local school districts to enhance public education efforts. Considerations include school newsletters, communications to parents as well as leveraging established school communication platforms (emails, text messages, and collateral materials). SDG&E is also examining new opportunities within its established partnerships with local Tribal Councils and other resources that serve Native American communities. Along with

the expanded communication efforts, SDG&E is working to develop new communications in a culturally appropriate and relevant manner.

2. C43: Non-Conductive Balloon Alternatives

Metallic foil balloons continue to disrupt the reliability of the electric grid and are a source of reportable ignitions. In 2020, SDG&E attributed two CPUC reportable ignitions to balloons, and according to SDG&E's 2020 Wildfire Mitigation Plan (Table 11a), SDG&E reported an average of 3.6 ignitions per year caused by balloons from 2015 to 2019.

As a potential solution, SDG&E is pursuing the development of a non-conductive balloon with a major manufacturer in the balloon industry. SDG&E brings expertise in electrical engineering and the distribution power grid, and the balloon manufacturer brings expertise in manufacturing processes and retail commercialization. Both companies are working collaboratively to develop a prototype non-conductive balloon, which will not cause an electrical fault when it comes in contact with overhead distribution power lines. Both companies are also involved in drafting an industry standard to test balloons in distribution power lines to identify whether a balloon will cause a fault to overhead distribution power lines. Such a test standard might be adopted by local authorities to limit the sale of balloons that do not pass the test.

The non-conductive balloons are being tested according to distribution power voltages, rather than geographic areas. The balloons so far have passed tests at 12 kV and 21 kV, in conditions that represent the highest distribution voltages in SDG&E's territory and PG&E's territory. Currently, tests are underway to test higher distribution voltages in use within SCE's territory and some municipal electric utilities in the State.

The next high-voltage tests will address 33 kV to model distribution voltages used across other Californian electric utilities. The work will also clarify what standard test conditions should apply to an industry-wide standard test.

The test standard is being developed within the Institute of Electrical and Electronic Engineers (IEEE, ieee.org). The trial-use standard is in the drafting stage, and is being developed by a task force within the Distribution Reliability Working Group of IEEE. The task force is made up of representatives from electric utilities across the U.S., a high voltage test lab, a balloon manufacturer, and other consultants and experts. The draft standard is titled "Trial Use Standard for Testing and Evaluating the Dielectric Performance of Celebratory Balloons in Contact with Overhead Power Distribution Lines Rated up to 38 kV System Voltage." The goal

is to have a standard test that could be performed by any high-voltage lab to determine if a celebratory foil balloon will cause a fault in overhead distribution lines or not. According to the IEEE process for developing draft standards, the expected date of submitting the draft for initial sponsor ballot is December 2022.

If the prototypes continue to have success in the high voltage tests, the balloon manufacturer may seek improvements to lower the production costs and apply the technology to complex balloon designs. SDG&E does not anticipate it will fund any of those product improvements but may participate in ensuring the industry-standard test applies to any new product developments.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[26] As described in Section II above, SDG&E tranched a majority of the activities by Tiers 3 and 2 of the HFTD given that each Tier has a different risk profile. Accordingly, the costs, units and RSEs are provided for each program by Tiers 3 and 2 of the HFTD.

All of the activities discussed in Section III above, with the exception of C19: Cleveland National Forest Fire Hardening, are expected to continue during the 2022 through 2024 time period. SDG&E's control and mitigation plan herein differs from SDG&E's 2021 WMP because the years covered in each filing are different. For clarity, a current activity that is included in the control and mitigation plan may be referred to as either a control and/or a mitigation. For purposes of this RAMP, a control that will continue as a Mitigation will retains its control ID unless that the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. The table below shows which activities are expected to continue.

[26] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Table 9: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	WRRM-Ops	X	X
2	C2	Advanced Weather Station Integration	X	X
3	C3	Wireless Fault Indicators	X	X
4	C4	Fire Science and Climate Adaptation Department	X	X
5	C5	High Performance Computing Infrastructure	X	X
6	C6 / M1	SCADA Capacitors	X	X
7	C7 / M2	Overhead Distribution Fire Hardening – Covered Conductor	X	X
8	C8 / M3	Expulsion Fuse Replacement	X	X
9	C9 / M4	PSPS Sectionalizing	X	X
10	C10 / M5	Microgrids	X	X
11	C11 / M6	Advanced Protection	X	X
12	C12 / M7	Hotline Clamps	X	X
13	C13 / M8	Resiliency Grant Programs	X	X
14	C14 / M9	Standby Power Programs	X	X
15	C15 / M10	Resiliency Assistance Programs	X	X
16	C16 / M11	Strategic Undergrounding	X	X
17	C17 / M12	Overhead Distribution Fire Hardening – Bare Conductor	X	X
18	C18 / M13	Overhead Transmission Fire Hardening – Distribution Underbuilt	X	X
19	C19	Cleveland National Forest Fire Hardening	X	-
20	C20	LTE Communication Network	X	X
21	C21 / M14	Lightning Arrestor Removal/Replacement Program	X	X
22	C22	Distribution System Inspection – CMP – 5 Year Detailed Inspections	X	X
23	C23	Transmission System Inspection	X	X

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
24	C24	Distribution System Inspection – IR/Corona	X	X
25	C25	Distribution System Inspection – CMP – 10 Year Intrusive	X	X
26	C26	LiDAR Flights	X	X
27	C27	Distribution System Inspection – HFTD Tier 3 Inspections	X	X
28	C28	Distribution System Inspection – Drone Inspections	X	X
29	C29	Distribution System Inspection – Circuit Ownership	X	X
30	C30	Distribution System Inspection – CMP – Annual Patrol	X	X
31	C31	Tree Trimming	X	X
32	C32 / M15	Fuels Management Program	X	X
33	C33 / M16	Enhanced Vegetation Management	X	X
34	C34	Pole Brushing	X	X
35	C35	Aviation Firefighting Program	X	X
36	C36	Wildfire Infrastructure Protection Teams	X	X
37	C37	PSPS Events and Mitigation of PSPS Impacts	X	X
38	C38	Centralized Repository for Data	X	X
39	C39	Asset Management	X	X
40	C40	Wildfire Mitigation Personnel	X	X
41	C41	Emergency Management Operations	X	X
42	C42	Communication Practices	X	X
43	C43	Non-Conductive Balloon Alternatives	X	X

As shown in Table 9 above, almost all of the Wildfire mitigation activities are expected to continue, and no completely new programs are included in SDG&E's control and mitigation

plan. For activities that SDG&E plans to perform that remain unchanged, please refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in this section below. Some of the programs in Table 9 above, such as C8: Expulsion Fuse Replacement, include a Mitigation ID that are not addressed in Section IV.A below. SDG&E considers these mitigations to be fundamentally unchanged but addresses assets in additional portions of the service territory in the future years. These differ from programs such as inspections where SDG&E is visiting the same assets on a given cycle.

A. Changes to 2020 Controls

The following describes planned changes to the existing activities discussed above in Section III. Given the objectives to minimize the Wildfire risk (wildfire and PSPS impacts), SDG&E's control and mitigation plan differs from the activities performed in 2020 by significantly increasing grid hardening investments in both Covered Conductor and Strategic Undergrounding and decreasing the traditional, bare conductor programs including FiRM, PRiME, and WiSE. These substantial grid hardening changes as well as other changes from the 2020 controls are described below.

1. C1: WRRM-Ops

SDG&E's Wildfire Risk Reduction Modeling Program will see improvements and cost increases through 2024. SDG&E's continued investment will enable the development of new fire science technologies and will increase the effectiveness of existing tools such as the Fire Potential Index. SDG&E has partnered with the San Diego Super Computing Center to re-evaluate the inputs into the FPI by incorporating higher fidelity data sets and examining the influence of additional data to obtain a more representative fire potential prediction. Modernizing existing tools is critical to daily operations to greatly enhance efficiencies and increase reliability by reducing the number of required patrols following outages. In addition, WRRM-Ops will be further enhanced the development of the physical Fire Science and Innovation lab pending a return to the Emergency Operations Center.

2. Grid Hardening Changes

SDG&E's WiNGS tool, used for risk-based prioritization, now takes into account both Wildfire risk reduction and PSPS impact reduction when analyzing projects. Prior to the development of this tool, only the risk reduction related to wildfire was considered, so the programs of Covered Conductor and Strategic Undergrounding, which are costly and have

limited wildfire risk reduction, had lower RSEs than the traditional hardening. With the inclusion of PSPS impact reductions factored into the RSE, the RSEs for these programs can now compete with traditional hardening due to the additional benefits they bring with respect to PSPS impacts.

a. C7 / M2: Overhead Distribution Fire Hardening – Covered Conductor

- **M2-T1: Tier 3; M2-T2: Tier 2**

SDG&E now has the personnel and standards in place to ramp up these programs significantly over the next several years while phasing out traditional hardening. SDG&E completed 1.9 miles of covered conductor in 2020 and plans to increase that amount to 20 miles in 2021, 60 miles in 2022, and 100 miles in 2023 and 2024. The associated costs increase from approximately $1.7 million in 2020 to $160 million per year in 2023 and 2024.

b. C16 / M11: Strategic Undergrounding

- **M11-T1: Tier 3; M11-T2: Tier 2**

SDG&E completed 16 miles of strategic undergrounding in 2020 and plans to increase that amount to 25 miles in 2021, 80 miles in 2022, 125 miles in 2023, and 150 miles in 2024. The associated costs increase from approximately $39 million in 2020 to $420 million in 2024.

c. C17 / M12: Overhead Distribution Fire Hardening – Bare Conductor

- **M12-T1: Tier 3; M12-T2: Tier 2; M12-T3: Non-HFTD**

SDG&E completed 100 miles of bare conductor hardening in 2020 at a cost of approximately $140 million. SDG&E plans for another 100 miles of bare conductor hardening in 2021, but only 5 miles in 2022 at a cost of approximately $5 million and no future work in 2023 or 2024.

3. C22: Distribution System Inspection – CMP – 5 Year Detailed Inspections

- **C22-T1: Tier 3; C22-T2: Tier 2**

SDG&E's CMP detailed inspections are expected to increase O&M costs in 2021 and 2022 as the program adds a crossarm remediation component in these years. The crossarm remediation initiative will investigate and remediate crossarms that do not meet the required loading criteria. This initiative involves fielding and performing pole loading calculations for each location to verify that the crossarm needs to be remediated. This program will add

approximately two million dollars per year in order to investigate roughly 4,000 crossarms. Current estimates show that the failure rate is expected to be ten percent. SDG&E will first target high-risk crossarms in Tier 3, then proceed to medium-risk crossarms in Tier 3 and high-risk crossarms in Tier 2. All remediations are expected to be completed in 2024.

4. C28: Distribution System Inspection – Drone Inspections

- **C28-T1: Tier 3; C28-T2: Tier 2**

The Drone Inspection program will begin to ramp down and level out its inspections and costs after 2022. The Drone Inspection program started with the goal of inspecting every structure within the HFTD in a three-year period. This program was successful in identifying items that were not able to be discovered with traditional ground inspections. This led to extra work in order to remedy the items found during the inspections. Once the initial inspections and repairs have been completed in 2022, the program will transition to a five-year inspection cycle. SDG&E expects that during this future five-year cycle, fewer concerns requiring follow-up construction will be identified, stabilizing the future costs.

5. C35: Aviation Firefighting Program

- **C35-T1: Tier 3; C35-T2: Tier 2; C35-T3: Non-HFTD**

SDG&E's Aviation Firefighting Program sees increases in costs during the period of 2022-2024. These increases are related to the ownership of a new Sikorsky S-70M (Firehawk). The Firehawk will serve as one of SDG&E's lead aerial firefighting resources once it is outfitted with firefighting capability. The Firehawk is expected to be ready for service in 2022, leaving the Blackhawk available as a backup if needed. Operations with the Firehawk will be more capable and safer for firefighting compared to the current Blackhawk due to the platform's advanced safety systems and enhanced performance characteristics.

6. C38: Centralized Repository for Data

Data Governance will involve a substantial increase to address the Centralized Data Repository and automation of new reporting required by the WSD. These costs are primarily related to the services required to automate the data gathering across up to a dozen different company systems into the CDR and develop further automation to calculate required metrics and report on these items in the schema required by the WSD. This also includes licenses and hardware to support the increased capacity required to house the additional data and automation

of the data gathering. This will allow for consistent, accurate reporting of all required WMP data.

7. C40: Wildfire Mitigation Personnel

SDG&E's Wildfire Mitigation department is hiring four new FTEs in Data Analyst roles to assist with the expanded data requirements from the Wildfire Safety Division (WSD). Additional reporting around the Quarterly Initiative Updates and Quarterly Data Reports has driven the need for these additional FTEs. The WSD also began compliance inspections related to SDG&E's WMP Programs in 2020 that necessitate additional reporting. This led to the creation of a dashboard that allows the WSD to view and download information on the various WMP Programs required to perform inspections. The additional costs in this group are also attributed to IT projects to modify and improve existing tools to support streamlined data gathering to support several new reporting requirements.

V. COSTS, UNITS, AND QUANTITATIVE SUMMARY TABLES

SDG&E's risk control and mitigation plan takes into account recent data and trends related to Wildfire, affordability impacts, possible labor constraints and the feasibility of mitigations. SDG&E has performed RSEs, in compliance with the Settlement Decision, but ultimate mitigation selection can be influenced by other factors, including funding, labor resources, technology, planning, compliance requirements, and operational and execution considerations.

The following tables in this section provide a summary of the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided.

SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data. Certain programs, as shown in Table 10 below, include both O&M and capital cost components. In those instances, SDG&E provided units for the programs in its control and mitigation plan in either the O&M or capital columns in Table 11 consistent with the program's primary activity. For example, as illustrated in Table 10, Strategic Undergrounding (C16/M11) is largely a capital program that also has an O&M component. The associated units are, therefore, shown in Table 11 in the capital column.

Table 10: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[27]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	WRRM - Ops	$1,385	-	$6,456	$7,890	-	-
C2	Advanced Weather Station Integration	$1,032	-	$1,625	$1,986	-	-
C3-T1	Wireless Fault Indicators (HFTD Tier 3)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C3-T2	Wireless Fault Indicators (HFTD Tier 2)	$838	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C3-T3	Wireless Fault Indicators (Non-HFTD)	-	-	$590	$722	-	-
C4	Fire Science and Climate Adaptation Department	$424	$3,363	$272	$333	$3,700	$4,523
C5	High Performance Computing Infrastructure	-	-	$6,579	$8,041	-	-
C6/M1-T1	SCADA Capacitors (HFTD Tier 3)	$406	-	$0	$0	-	-
C6/M1-T2	SCADA Capacitors (HFTD Tier 2)	$625	-	$1,612	$1,970	-	-
C7/M2-T1	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 3)	$1,101	-	$298,691	$365,066	$2,962	$3,620
C7/M2-T2	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 2)	$593	-	$65,566	$80,137	$650	$795
C8/M3-T1	Expulsion Fuse Replacement (HFTD Tier 3)	$2,081	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			

[27] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar amounts and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[28] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with Controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C8/M3-T2	Expulsion Fuse Replacement (HFTD Tier 2)	$4,210	-	$2,771	$3,387	-	-
C9/M4-T1	PSPS Sectionalizing (HFTD Tier 3)	$588	-	$482	$589	-	-
C9/M4-T2	PSPS Sectionalizing (HFTD Tier 2)	$3,203	-	$2,628	$3,213	-	-
C9/M4-T3	PSPS Sectionalizing (Non-HFTD)	$1,282	-	$1,052	$1,285	-	-
C10/M5-T1	Microgrids (HFTD Tier 3)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C10/M5-T2	Microgrids (HFTD Tier 2)	$3,608	$371	$34,301	$41,924	$1,284	$1,570
C11/M6-T1	Advanced Protection (HFTD Tier 3)	$9,164	-	$27,564	$33,689	-	-
C11/M6-T2	Advanced Protection (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C12/M7-T1	Hotline Clamps (HFTD Tier 3)	-	$956	-	-	$164	$201
C12/M7-T2	Hotline Clamps (HFTD Tier 2)	-	$2,343	-	-	$164	$201
C13/M8-T1	Resiliency Grant Programs (HFTD Tier 3)	-	$1,692	-	-	$2,370	$2,897
C13/M8-T2	Resiliency Grant Programs (HFTD Tier 2)	-	$3,384	-	-	$4,740	$5,793
C14/M9-T1	Standby Power Programs (HFTD Tier 3)	-	$1,754	-	-	$4,163	$5,088
C14/M9-T2	Standby Power Programs (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C15/M10-T1	Resiliency Assistance Programs (HFTD Tier 3)	-	$304	-	-	$324	$396
C15/M10-T2	Resiliency Assistance Programs (HFTD Tier 2)	-	$456	-	-	$486	$594
C16/M11-T1	Strategic Undergrounding (HFTD Tier 3)	$27,512	-	$552,350	$675,095	$5,993	$7,324
C16/M11-T2	Strategic Undergrounding (HFTD Tier 2)	$11,384	-	$331,410	$405,057	$3,596	$4,395
C17/M12-T1	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 3)	$57,969	$1,447	$4,500	$5,500	-	-
C17/M12-T2	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 2)	$74,531	$1,861	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C17/M12-T3	Overhead Distribution Fire Hardening – Bare Conductor (Non-HFTD)	$5,521	$138	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C18/M13-T1	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 3)	-	-	$2,809	$3,433	-	-
C18/M13-T2	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 2)	$5,038	-	$37,604	$45,960	-	-
C19-T1	Cleveland National Forest Fire Hardening (HFTD Tier 3)	$84,044	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C19-T2	Cleveland National Forest Fire Hardening (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C20	LTE Communication Network	$40,647	-	$181,103	$221,348	-	-
C21/M14-T1	Lightning Arrestor Removal/Replacement Program (HFTD Tier 3)	$20	-	$7,051	$8,618	-	-
C21/M14-T2	Lightning Arrestor Removal/Replacement Program (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C22-T1	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 3)	$3,866	$90	$9,325	$11,398	$185	$226
C22-T2	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 2)	$3,790	$89	$12,093	$14,780	$109	$133
C23	Transmission System Inspection	$838	-	$ 1,957	$ 2,392	-	-
C24-T1	Distribution System Inspection – IR/Corona (HFTD Tier 3)	-	$175	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C24-T2	Distribution System Inspection – IR/Corona (HFTD Tier 2)	-	-	-	-	$157	$192
C25-T1	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 3)	$344	$584	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C25-T2	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 2)	$177	$300	$2,266	$2,770	-	-
C26	LiDAR Flights	-	-	-	-	$1,620	$1,980
C27-T1	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 3)	$1,147	$399	$7,191	$8,789	$282	$344
C27-T2	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 2)	$2	$1	$8	$10	-	-

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C28-T1	Distribution System Inspection – Drone Inspections (HFTD Tier 3)	$15,899	$51,953	-	-	$2,025	$2,475
C28-T2	Distribution System Inspection – Drone Inspections (HFTD Tier 2)	-	-	$10,085	$12,326	-	-
C29-T1	Distribution System Inspection – Circuit Ownership (HFTD Tier 3)	-	-	-	-	$38	$46
C29-T2	Distribution System Inspection – Circuit Ownership (HFTD Tier 2)	$48	-	-	-	$75	$92
C30-T1	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 3)	$332	$135	$1,210	$1,479	$10	$13
C30-T2	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 2)	$394	$160	$1,437	$1,756	$12	$15
C31-T1	Tree Trimming (HFTD Tier 3)	-	$15,721	-	-	$14,521	$17,748
C31-T2	Tree Trimming (HFTD Tier 2)	-	$18,954	-	-	$17,508	$21,398
C32/M15-T1	Fuels Management Program (HFTD Tier 3)	-	$5,805	-	-	$5,586	$6,827
C32/M15-T2	Fuels Management Program (HFTD Tier 2)	There are no recorded or planned activities for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C33/M16-T1	Enhanced Vegetation Management (HFTD Tier 3)	-	$4,687	-	-	$4,637	$5,668
C33/M16-T2	Enhanced Vegetation Management (HFTD Tier 2)	-	$5,548	-	-	$5,489	$6,708
C34-T1	Pole Brushing (HFTD Tier 3)	-	$2,549	-	-	$2,450	$2,995
C34-T2	Pole Brushing (HFTD Tier 2)	-	$2,885	-	-	$2,773	$3,390
C35-T1	Aviation Firefighting Program (HFTD Tier 3)	$5,054	$4,146	$1,358	$1,660	$5,691	$6,956
C35-T2	Aviation Firefighting Program (HFTD Tier 2)	$2,980	$2,445	$801	$979	$3,356	$4,101
C35-T3	Aviation Firefighting Program (Non-HFTD)	$214	$176	$58	$70	$241	$295

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[28]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C36-T1	Wildfire Infrastructure Protection Teams (HFTD Tier 3)	-	$1,816	-	-	$1,855	$2,267
C36-T2	Wildfire Infrastructure Protection Teams (HFTD Tier 2)	-	$771	-	-	$788	$963
C37-T1	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 3)	There are no recorded or forecasted cost estimates for these tranches during the TY 2024 GRC's 2022 – 2024 forecast period					
C37-T2	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 2)						
C38	Centralized Repository for Data	$10,214	-	$56,578	$69,150	-	-
C39	Asset Management	$444	$329	-	-	$349	$426
C40	Wildfire Mitigation Personnel	-	$3,389	-	-	$5,224	$6,385
C41	Emergency Management Operations	$2,846	$12,214	$10,101	$12,346	$10,938	$13,369
C42	Communication Practices	$5,224	$8,675	$2,781	$3,399	$5,996	$7,328
C43	Non-Conductive Balloon Alternatives	-	$86	-	-	$68	$83

Table 11: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	WRRM - Ops	A risk model that estimates wildfire consequence along electric lines and equipment. One unit of measure would not accurately represent the program.							
C2	Advanced Weather Station Integration	# weather stations rebuilt		30	-	135	165	-	-
C3-T1	Wireless Fault Indicators (HFTD Tier 3)	# wireless fault indicators installed		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C3-T2	Wireless Fault Indicators (HFTD Tier 2)	# wireless fault indicators installed		502	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C3-T3	Wireless Fault Indicators (Non-HFTD)	# wireless fault indicators installed		-	-	450	550	-	-
C4	Fire Science and Climate Adaptation Department	A department that creates weather forecasts, including FPI forecasts. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C5	High Performance Computing Infrastructure	Infrastructure that allows SDG&E to run simulations foundational to understanding wildfire risk. One unit of measure would not accurately represent the program.							
C6/M1-T1	SCADA Capacitors (HFTD Tier 3)	# of capacitors replaced		10	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C6/M1-T2	SCADA Capacitors (HFTD Tier 2)	# of capacitors replaced		20	-	36	44	-	-
C7/M2-T1	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 3)	# of miles hardened		1	-	192	235	-	-
C7/M2-T2	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 2)	# of miles hardened		1	-	42	51	-	-
C8/M3-T1	Expulsion Fuse Replacement (HFTD Tier 3)	# of fuses replaced		1,052	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C8/M3-T2	Expulsion Fuse Replacement (HFTD Tier 2)	# of fuses replaced		2,128	-	815	997	-	-
C9/M4-T1	PSPS Sectionalizing (HFTD Tier 3)	# of switches installed		6	-	3	3	-	-

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C9/M4-T2	PSPS Sectionalizing (HFTD Tier 2)	# of switches installed		13	-	18	21	-	-
C9/M4-T3	PSPS Sectionalizing (Non-HFTD)	# of switches installed		4	-	6	9	-	-
C10/M5-T1	Microgrids (HFTD Tier 3)	# of microgrids		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C10/M5-T2	Microgrids (HFTD Tier 2)	# of microgrids		4	-	3	3	-	-
C11/M6-T1	Advanced Protection (HFTD Tier 3)	# of circuits enabled		6	-	22	26	-	-
C11/M6-T2	Advanced Protection (HFTD Tier 2)	# of circuits enabled		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C12/M7-T1	Hotline Clamps (HFTD Tier 3)	# of hotline clamps removed		-	598	-	-	86	106
C12/M7-T2	Hotline Clamps (HFTD Tier 2)	# of hotline clamps removed		-	1,466	-	-	86	106
C13/M8-T1	Resiliency Grant Programs (HFTD Tier 3)	# of generators		-	473	-	-	600	733
C13/M8-T2	Resiliency Grant Programs (HFTD Tier 2)	# of generators		-	947	-	-	1,200	1,467
C14/M9-T1	Standby Power Programs (HFTD Tier 3)	# of generators		-	74	-	-	166	202
C14/M9-T2	Standby Power Programs (HFTD Tier 2)	# of generators		-	1	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C15/M10-T1	Resiliency Assistance Programs (HFTD Tier 3)	# of generators		-	510	-	-	221	271
C15/M10-T2	Resiliency Assistance Programs (HFTD Tier 2)	# of generators		-	764	-	-	332	406
C16/M11-T1	Strategic Undergrounding (HFTD Tier 3)	# of miles UG		11	-	200	244	-	-
C16/M11-T2	Strategic Undergrounding (HFTD Tier 2)	# of miles UG		5	-	120	146	-	-
C17/M12-T1	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 3)	# of miles hardened		42	-	5	6	-	-
C17/M12-T2	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 2)	# of miles hardened		54	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C17/M12-T3	Overhead Distribution Fire Hardening – Bare Conductor (Non-HFTD)	# of miles hardened		4	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C18/M13-T1	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 3)	# of miles hardened		-	-	3	4	-	-
C18/M13-T2	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 2)	# of miles hardened		9	-	41	50	-	-

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C19-T1	Cleveland National Forest Fire Hardening (HFTD Tier 3)	# of miles hardened		61	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C19-T2	Cleveland National Forest Fire Hardening (HFTD Tier 2)	# of miles hardened		-	-	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C20	LTE Communication Network	# of base stations		15	-	128	156	-	-
C21/M14-T1	Lightning Arrestor Removal/Replacement Program (HFTD Tier 3)	# of lightning arrestors replaced		30	-	4,990	6,098	-	-
C21/M14-T2	Lightning Arrestor Removal/Replacement Program (HFTD Tier 2)	# of lightning arrestors replaced		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C22-T1	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 3)	# of HFTD inspections		-	9,055	-	-	9,266	11,326
C22-T2	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 2)	# of HFTD inspections		-	8,877	-	-	5,450	6,662
C23	Transmission System Inspection	# of HFTD inspections		2,679	-	7,331	8,661	-	-
C24-T1	Distribution System Inspection – IR/Corona (HFTD Tier 3)	# of HFTD inspections		-	13,077	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C24-T2	Distribution System Inspection – IR/Corona (HFTD Tier 2)	# of HFTD inspections		-	-	-	-	16,200	19,800
C25-T1	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 3)	# of HFTD inspections		-	10,368	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C25-T2	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 2)	# of HFTD inspections		-	5,330	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period			
C26	LiDAR Flights	Program to create accurate surveys of electric distribution lines, structures, vegetation, and other potential hazards critical to design. One unit of measure would not accurately represent the program.							
C27-T1	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 3)	# of HFTD inspections		-	10,993	-	-	9,734	11,897
C27-T2	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 2)	# of HFTD inspections		-	19	-	-	3	3
C28-T1	Distribution System Inspection – Drone Inspections (HFTD Tier 3)	# of HFTD inspections		-	37,310	-	-	13,320	16,280
C28-T2	Distribution System Inspection – Drone Inspections (HFTD Tier 2)	# of HFTD inspections		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C29-T1	Distribution System Inspection – Circuit	Submissions made to the Circuit Ownership program		-	-	-	-	5	6

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
	Ownership (HFTD Tier 3)								
C29-T2	Distribution System Inspection – Circuit Ownership (HFTD Tier 2)	Submissions made to the Circuit Ownership program		-	2	-	-	9	11
C30-T1	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 3)	# of HFTD patrols		-	39,371	-	-	35,434	43,308
C30-T2	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 2)	# of HFTD patrols		-	46,751	-	-	42,076	51,426
C31-T1	Tree Trimming (HFTD Tier 3)	# of trees inspected		-	122,740	-	-	41,294	50,470
C31-T2	Tree Trimming (HFTD Tier 2)	# of trees inspected		-	147,984	-	-	49,787	60,850
C32/M15-T1	Fuels Management Program (HFTD Tier 3)	# of structures cleared		-	324	-	-	450	550
C32/M15-T2	Fuels Management Program (HFTD Tier 2)	# of structures cleared		No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C33/M16-T1	Enhanced Vegetation Management (HFTD Tier 3)	# of trees trimmed		-	7,829	-	-	7,007	8,564
C33/M16-T2	Enhanced Vegetation Management (HFTD Tier 2)	# of trees trimmed		-	9,266	-	-	8,293	10,136
C34-T1	Pole Brushing (HFTD Tier 3)	# of poles brushed		-	17,151	-	-	14,101	17,234

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C34-T2	Pole Brushing (HFTD Tier 2)	# of poles brushed		-	19,412	-	-	15,959	19,506
C35-T1	Aviation Firefighting Program (HFTD Tier 3)	Helicopters available for use by CalFire to respond to active fires. One unit of measure would not accurately represent the program.							
C35-T2	Aviation Firefighting Program (HFTD Tier 2)								
C35-T3	Aviation Firefighting Program (Non-HFTD)								
C36-T1	Wildfire Infrastructure Protection Teams (HFTD Tier 3)	Qualified firefighters join electric crews to serve in a prevention and ignition mitigation role. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C36-T2	Wildfire Infrastructure Protection Teams (HFTD Tier 2)								
C37-T1	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 3)	De-energizing power lines for public safety. One unit of measure would not accurately represent the program.							
C37-T2	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 2)								
C38	Centralized Repository for Data	Centralized repository to integrate asset data across distribution, transmission, and substation. One unit of measure would not accurately represent the program.							
C39	Asset Management	Initiative that develops proactive asset replacement, inspection, and repair programs based on risk. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C40	Wildfire Mitigation Personnel	A department that tracks and reports on wildfire mitigation programs through quarterly reports and annual WMP. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C41	Emergency Management Operations	A department that reduces risk by effectively responding to fires or extreme fire potential events. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C42	Communication Practices	Program that improves coordination and customer awareness during fires or PSPS events. Because there are multiple different types of units of measure in this program, it would not be accurate or consistent to identify one unit of measure.							
C43	Non-Conductive Balloon Alternatives	Program to develop a non-conductive balloon that will not cause an electrical fault when it comes in contact with overhead distribution power lines. One unit of measure would not accurately represent the program.							

Table 12: Risk Control & Mitigation Plan - Quantitative Analysis Summary[29]

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C1	WRRM - Ops	*See* Table 13 below					
C2	Advanced Weather Station Integration	*See* Table 13 below					
C3-T1	Wireless Fault Indicators (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C3-T2	Wireless Fault Indicators (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C3-T3	Wireless Fault Indicators (Non-HFTD)	-	-	9.20	24.01	220.87	1,516.03
C4	Fire Science and Climate Adaptation Department	*See* Table 13 below					
C5	High Performance Computing Infrastructure	*See* Table 13 below					
C6/M1-T1	SCADA Capacitors (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C6/M1-T2	SCADA Capacitors (HFTD Tier 2)	4	351.80	6.78	622.91	5,628.63	381.49
C7/M2-T1	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 3)	4	820.76	4.79	1,409.28	10,034.69	32.47
C7/M2-T2	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 2)	4	351.80	6.77	622.91	5,623.76	13.64
C8/M3-T1	Expulsion Fuse Replacement (HFTD Tier 3)	-	-	-	-	-	-

[29] It should be noted that the RSE provided in Table 12 represents the combination of C37: PSPS Events and Mitigation of PSPS Impacts, C42: Emergency Management Operations, and C43: Communication Practices. This is because PSPS events (C37) cannot be performed without Emergency Management Operations (*i.e.*, EOC activations) and Communication Practices (*i.e.*, communicated with our customers).

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C8/M3-T2	Expulsion Fuse Replacement (HFTD Tier 2)	4	351.80	6.79	622.91	5,634.86	186.71
C9/M4-T1	PSPS Sectionalizing (HFTD Tier 3)	4	801.85	5.13	1,409.28	10,436.99	2,112.33
C9/M4-T2	PSPS Sectionalizing (HFTD Tier 2)	4	278.78	6.84	622.91	5,375.80	1,062.66
C9/M4-T3	PSPS Sectionalizing (Non-HFTD)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C10/M5-T1	Microgrids (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C10/M5-T2	Microgrids (HFTD Tier 2)	4	330.32	6.84	622.91	5,581.97	30.15
C11/M6-T1	Advanced Protection (HFTD Tier 3)	4	820.87	4.74	1,409.28	9,968.82	309.45
C11/M6-T2	Advanced Protection (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C12/M7-T1	Hotline Clamps (HFTD Tier 3)	4	820.87	5.11	1,409.28	10,489.12	92.64
C12/M7-T2	Hotline Clamps (HFTD Tier 2)	4	351.80	6.83	622.91	5,658.53	36.13
C13/M8-T1	Resiliency Grant Programs (HFTD Tier 3)	4	803.20	5.13	1,409.28	10,442.42	76.30
C13/M8-T2	Resiliency Grant Programs (HFTD Tier 2)	4	334.13	6.84	622.91	5,597.21	38.15
C14/M9-T1	Standby Power Programs (HFTD Tier 3)	4	771.64	5.13	1,409.28	10,316.19	119.92
C14/M9-T2	Standby Power Programs (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C15/M10-T1	Resiliency Assistance Programs (HFTD Tier 3)	4	796.67	5.13	1,409.28	10,416.30	568.86
C15/M10-T2	Resiliency Assistance Programs (HFTD Tier 2)	4	333.65	6.84	622.91	5,595.29	284.43

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C16/M11-T1	Strategic Undergrounding (HFTD Tier 3)	4	800.44	2.17	1,409.28	6,266.93	155.87
C16/M11-T2	Strategic Undergrounding (HFTD Tier 2)	4	333.20	5.55	622.91	4,789.38	53.75
C17/M12-T1	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 3)	4	820.87	5.12	1,409.28	10,501.38	52.70
C17/M12-T2	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C17/M12-T3	Overhead Distribution Fire Hardening – Bare Conductor (Non-HFTD)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C18/M13-T1	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 3)	4	820.87	5.12	1,409.28	10,504.62	62.62
C18/M13-T2	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 2)	4	351.80	6.75	622.91	5,610.50	31.74
C19-T1	Cleveland National Forest Fire Hardening (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C19-T2	Cleveland National Forest Fire Hardening (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C20	LTE Communication Network	*See* Table 13 below					
C21/M14-T1	Lightning Arrestor Removal/Replacement Program (HFTD Tier 3)	4	820.87	5.09	1,409.28	10,462.35	112.77
C21/M14-T2	Lightning Arrestor Removal/Replacement Program (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C22-T1	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 3)	4	820.87	5.67	1,409.28	11,278.32	65.03
C22-T2	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 2)	4	351.80	7.66	622.91	6,181.14	32.95
C23	Transmission System Inspection	*See* Table 13 below					
C24-T1	Distribution System Inspection – IR/Corona (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C24-T2	Distribution System Inspection – IR/Corona (HFTD Tier 2)	4	351.80	7.12	622.91	5,841.66	322.17
C25-T1	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 3)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C25-T2	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 2)	4	351.80	6.85	622.91	5,674.72	1.98
C26	LiDAR Flights	*See* Table 13 below					
C27-T1	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 3)	4	820.87	5.86	1,409.28	11,543.27	111.05
C27-T2	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 2)	4	351.80	6.84	622.91	5,668.49	57.46
C28-T1	Distribution System Inspection – Drone Inspections (HFTD Tier 3)	4	820.87	5.77	1,409.28	11,412.20	193.99
C28-T2	Distribution System Inspection – Drone Inspections (HFTD Tier 2)	4	351.80	7.42	622.91	6,031.65	8.86

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C29-T1	Distribution System Inspection – Circuit Ownership (HFTD Tier 3)	4	820.87	5.13	1,409.28	10,511.39	13.14
C29-T2	Distribution System Inspection – Circuit Ownership (HFTD Tier 2)	4	351.80	6.84	622.91	5,666.00	7.26
C30-T1	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 3)	4	820.87	5.88	1,409.28	11,565.81	683.68
C30-T2	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 2)	4	351.80	7.94	622.91	6,349.95	373.04
C31-T1	Tree Trimming (HFTD Tier 3)	4	820.87	11.41	1,409.28	19,364.02	191.61
C31-T2	Tree Trimming (HFTD Tier 2)	4	351.80	16.18	622.91	11,485.31	104.45
C32/M15-T1	Fuels Management Program (HFTD Tier 3)	4	820.87	5.10	1,391.02	10,382.39	6.83
C32/M15-T2	Fuels Management Program (HFTD Tier 2)	No activities are planned for this tranche during the TY 2024 GRC's 2022 – 2024 forecast period					
C33/M16-T1	Enhanced Vegetation Management (HFTD Tier 3)	4	820.87	5.08	1,409.28	10,440.78	111.32
C33/M16-T2	Enhanced Vegetation Management (HFTD Tier 2)	4	351.80	6.77	622.91	5,621.15	60.78
C34-T1	Pole Brushing (HFTD Tier 3)	4	820.87	6.64	1,409.28	12,641.14	261.05
C34-T2	Pole Brushing (HFTD Tier 2)	4	351.80	9.09	622.91	7,071.77	152.16
C35-T1	Aviation Firefighting Program (HFTD Tier 3)	4	820.87	5.13	1,443.91	10,690.74	23.79
C35-T2	Aviation Firefighting Program (HFTD Tier 2)	4	351.80	6.84	631.93	5,729.57	14.02
C35-T3	Aviation Firefighting Program (Non-HFTD)	-	-	9.20	30.25	278.29	0.91

ID	Control/Mitigation Name	PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	Risk Score	RSE
C36-T1	Wildfire Infrastructure Protection Teams (HFTD Tier 3)	4	820.87	5.41	1,409.28	10,913.88	62.94
C36-T2	Wildfire Infrastructure Protection Teams (HFTD Tier 2)	4	351.80	7.08	622.91	5,819.42	56.03
C37-T1	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 3)	4	820.87	8.39	1,409.28	15,107.453	145.06
C37-T2	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 2)	4	351.80	13.73	622.91	9,959.09	119.71
C38	Centralized Repository for Data	*See* Table 13 below					
C39	Asset Management	*See* Table 13 below					
C40	Wildfire Mitigation Personnel	*See* Table 13 below					
C41	Emergency Management Operations	*See* information for control C37-T1 and C37-T2					
C42	Communication Practices	*See* information for control C37-T1 and C37-T2					
C43	Non-Conductive Balloon Alternatives	*See* Table 13 below					

It should be noted that the RSE provided in Table 12 above represents the combination of C37: PSPS Events and Mitigation of PSPS Impacts, C42: Emergency Management Operations, and C43: Communication Practices. This is because PSPS events (C37) cannot be performed without Emergency Management Operations (*i.e.*, EOC activations) and Communication Practices (*i.e.*, communicated with our customers).

Table 13: Risk Control & Mitigation Plan - Quantitative Analysis Summary for RSE Unavailability

ID	Control/Mitigation Name	RSE Unavailability Rationale
C1	WRRM-Ops	This initiative does not have an RSE because it is considered foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a 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. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C2	Advanced Weather Station Integration	This does not have an RSE because it is considered foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a 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. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C4	Fire Science and Climate Adaptation Department	This is considered foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a 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. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C5	High Performing Computing Infrastructure	This does not have an RSE because it is considered foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a 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. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C20	LTE Communication Network	This does not have its own RSE because it is foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a 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.

ID	Control/Mitigation Name	RSE Unavailability Rationale
C23	Transmission System Inspection	This does not have an RSE because a majority of the costs for this program are FERC related. Only a portion of these costs are related to distribution equipment on the transmission structures.
C26	LiDAR Flights	This does not have an RSE because it does not directly reduce wildfire risk. As described above, LiDAR inspections on distribution and transmission lines are primarily used for grid hardening design efforts rather than for identifying issues like the other inspection programs. As such, quantifying a reduction in ignition risk for these inspections is not applicable. LiDAR is utilized for distribution hardening programs, which are primarily being designed and constructed in the HFTD.
C38	Centralized Repository for Data	This initiative is foundational to supporting wildfire mitigation efforts. Centralizing data does not by itself reduce Wildfire risk, but provides tools to allow SDG&E to further reduce Wildfire risk. Quantifying an RSE for such a mitigation would be impractical because it cannot be directly tied to reducing a risk driver and measuring the effectiveness of that reduction. It supports various initiatives by providing better information to make risk informed mitigation decisions.
C39	Asset Management	SDG&E has categorized this workgroup and activity as foundational, in which this activity alone does not mitigate the risk of wildfire but is critical in understanding the wildfire risk in general in relation to SDG&E equipment assets. This activity, in conjunction with the other foundational activities, allows for mitigation prioritization; the calculation of RSEs; and aids to effectively select and implement the right mitigations and controls to reduce the risk of wildfires. Initiatives included in this category cover both an enterprise-wide initiative (Investment Prioritization) lead by the Asset Management organization as well as a more focused initiative (WiNGS) lead by the wildfire mitigation team to apply more granular analytics to grid hardening projects.
C40	Wildfire Mitigation Personnel	This initiative does not have an RSE because it is foundational to supporting wildfire mitigation efforts. Quantifying an RSE for such a 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. It supports various initiatives by providing better information to make risk-informed mitigation decisions.
C43	Non-Conductive Balloon Alternatives	This does not have an RSE because the current scope of this initiative is focused on outreach efforts to drive adoption of the alternative technology for metallic foil balloons. No current deployment of this

ID	Control/Mitigation Name	RSE Unavailability Rationale
		technology is in place to allow for a calculation of RSEs based on measurable indicators of effectiveness.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the risk control and mitigation plan for the Wildfire risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this control and mitigation plan also took into account modifications to the plan and constraints, such as budget and resources.

In considering alternatives to the control and mitigation plan, SDG&E utilized a segment-level analysis to examine different grid hardening strategies evaluating the combined effect of the hardening options in a small portfolio-level analysis.[30] With a long-term objective of significantly reducing the risk of wildfires over a multi-year timeframe that extends beyond this RAMP, SDG&E selected the portfolio of grid hardening strategies set forth in the control and mitigation plan that includes a mix of undergrounding and covered conductor implementation. The proposed scope included in this RAMP is part of a long-term effort that is aimed at reducing the Wildfire risk by approximately 80% and reducing impacts of PSPS to approximately 18K customers. The total risk[31] reduction estimated from this strategy is ~70% over a period of ~10 years.

Identifying the long-term objectives for grid hardening is critical to selecting the mitigation strategies. For instance, if SDG&E had selected an objective of reducing Wildfire risk by 60%, the mitigations selected for the segments in scope of this strategy will differ from those that would be selected under a different objective of reducing 80%. This is because each segment has a certain level of risk and depending on which mitigation is selected, the risk reduction achieved will vary. For example, if a segment is selected for the implementation of

[30] A portfolio-level analysis refers to the analysis done when combining multiple mitigations to assess combined effect of the mitigations. In this context, a 'small' portfolio refers to the combination of a couple of mitigations that are complementary in nature.

[31] Total risk combines both wildfire and PSPS impacts.

covered conductor, the risk reduction that could be achieved on that segment will be roughly around 60%. On the other hand, if the same segment is selected for undergrounding, the risk reduction that could be achieved on that segment would be closer to 100%. As such, the selection of hardening strategies for each segment in the near term affects the long-term potential for risk reduction.

The alternatives analysis conducted for grid hardening includes the scope of work planned for 2023 and 2024. 2022 is held constant for a couple of reasons; first, hardening projects planned for 2022 are already underway making it infeasible and overly burdensome to switch to other types of mitigations and second, the segment-level analysis that SDG&E recently developed (using the WiNGS model) is influencing the scope of hardening work starting in 2023 making it more comparable from a segment alternatives analysis standpoint.

The analysis of annual targets took into consideration constraints, including affordability as well as resources. This analysis is considered preliminary and may change as a result of updating our models. Additionally, the mitigations that ultimately get implemented may differ from the mitigations that the model proposes as SDG&E's engineering teams begin to scope the proposed solutions and evaluate additional constraints such as environmental and land permitting as well as other feasibility factors.

The grid hardening strategies analyzed as a part of this alternative analysis are summarized in the table below. Underground is referred to as 'UG' and Covered Conductor is referred to as 'CC'.

Table 14: Grid Hardening Alternative Analysis

	2023 - 2024			2023 - 2030		
Alternatives	**2023 -2024 Scope**	**2023 - 2024 Total Risk Reduction**	**2023 - 2024 RSE**	**Long-term Scope**	**Long-term Total Risk Reduction**	**Long-term RSE**
Proposed	275 miles of UG 200 miles of CC	32.8%	100.35	584 miles of UG 865 miles of CC	62.7%	69.35
Alternative 1	475 miles of UG	34.1%	85.11	1,449 miles of UG	70.9%	58.04
Alternative 2	475 miles of CC	21.1%	93.36	1,449 miles of CC	46.0%	66.58

A. Alternative 1

As shown in the summary table above, the SDG&E's control and mitigation plan includes a total of ~475 miles over 2023 – 2024. While the control and mitigation plan includes a mix of undergrounding as well as implementation of covered conductor, Alternative 1

considers the scenario of undergrounding the ~475 miles instead of implementing the proposed mix of mitigations. While Alternative 1 offers greater risk reduction, it comes with higher costs that result in a lower RSE. SDG&E's control and mitigation plan offers a tangible risk reduction at a much lower cost. Additionally, taking an all-underground approach may not be feasible due to permitting, terrain constraints as well as resource availability.

B. Alternative 2

Alternative 2 considers the scenario of implementing covered conductor across the ~475 miles and eliminates the option of undergrounding. While it has a comparatively close RSE due its lower costs, its risk reduction potential, particularly in the long run, is capped at ~50%. Because of SDG&E's desire to go beyond the 50% reduction while considering cost impacts, deploying a mixed strategy as proposed meets those objectives.

Table 15: Alternate Mitigation Plan - Recorded and Forecast Dollars Summary[32] (Direct After Allocations, In 2020 $000)

ID	Alternative Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Alterative 1	$ 1,436,587	$ 1,755,828	$ 19,575	$ 23,925
A2	Alterative 2	$ 787,500	$ 962,500	$ 11,070	$ 13,530

Table 16: Alternate Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Alterative 1	# of UG miles		500	611	225	275
A2	Alterative 2	# of CC miles		482	589	225	275

[32] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar amounts and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

Table 17: Alternate Mitigation Plan - Quantitative Analysis Summary

ID	Control/Mitigation Name	Forecast (2022 – 2024)					
		PSPS LoRE	PSPS CoRE	Wildfire LoRE	Wildfire CoRE	TWRS	RSE
A1	Alterative 1	4.00	1,133.53	11.29	556	10,812	79
A2	Alterative 2	4.00	1,172	15.00	556	13,026	88

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

ID	Control/Mitigation Name	Drivers/Triggers/Potential Consequences Addressed
C1	WRRM-Ops	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C2	Advanced Weather Station Integration	DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
C3	Wireless Fault Indicators	DT.9, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C4	Fire Science and Climate Adaptation Department	DT.7, DT.8, DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
C5	High Performance Computing Infrastructure	DT.9, DT.10, PC.1, PC.2, PC.3, PC.5, PC.6
C6 / M1	SCADA Capacitors	DT.2, PC.1, PC.2, PC.3, PC.5, PC.6
C7 / M2	Overhead Distribution Fire Hardening – Covered Conductor	DT.1, DT.2 DT.3, DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C8 / M3	Expulsion Fuse Replacement	PC.1, PC.2, PC.3, PC.5, PC.6
C9 / M4	PSPS Sectionalizing	PC.4, PC.6
C10 / M5	Microgrids	PC.4, PC.6
C11 / M6	Advanced Protection	PC.1, PC.2, PC.3, PC.5, PC.6
C12 / M7	Hotline Clamps	DT.1, DT.2, PC.1, PC.2, PC.3, PC.5, PC.6
C13 / M8	Resiliency Grant Programs	PC.4, PC.6
C14 / M9	Standby Power Programs	PC.4, PC.6
C15 / M10	Resiliency Assistance Programs	PC.4, PC.6
C16 / M11	Strategic Undergrounding	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C17 / M12	Overhead Distribution Fire Hardening – Bare Conductor	DT.1, DT.2, DT.3, DT.5, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C18 / M13	Overhead Transmission Fire Hardening – Distribution Underbuilt	DT.1, DT.2, DT.3, DT.5, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C19	Cleveland National Forest Fire Hardening	DT.1, DT.2, DT.3, DT.5, DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C20	LTE Communication Network	PC.1, PC.2, PC.3, PC.5, PC.6
C21 / M14	Lightning Arrestor Removal/Replacement Program	DT.2, PC.1, PC.2, PC.3, PC.5, PC.6
C22	Distribution System Inspection – CMP – 5 Year Detailed Inspections	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10

ID	Control/Mitigation Name	Drivers/Triggers/Potential Consequences Addressed
C23	Transmission System Inspection	DT.1, DT.2, DT.3, DT.4, DT.6, DT.8, DT.10
C24	Distribution System Inspection – IR/Corona	DT.1, DT.2, DT.3
C25	Distribution System Inspection – CMP – 10 Year Intrusive	DT.1, DT.2, DT.3, DT.8, DT.10
C26	LiDAR Flights	DT.2, DT.3, DT.4, DT.6
C27	Distribution System Inspection – HFTD Tier 3 Inspections	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
C28	Distribution System Inspection – Drone Inspections	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
C29	Distribution System Inspection – Circuit Ownership	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
C30	Distribution System Inspection – CMP – Annual Patrol	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.8, DT.10
C31	Tree Trimming	DT.1, DT.2, DT.3, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C32 / M15	Fuels Management Program	DT.6, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C33 / M16	Enhanced Vegetation Management	DT.1, DT.2, DT.3, DT.6, DT.8, PC.1, PC.2, PC.3, PC.5, PC.6
C34	Pole Brushing	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C35	Aviation Firefighting Program	DT.9, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C36	Wildfire Infrastructure Protection Teams	DT.9, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C37	PSPS Events and Mitigation of PSPS Impacts	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C38	Centralized Repository for Data	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C39	Asset Management	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C40	Wildfire Mitigation Personnel	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 DT.8, DT.10, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C41	Emergency Management Operations	DT.9, PC.1, PC.2, PC.3, PC.5, PC.6
C42	Communication Practices	DT.7, DT.9, PC.5, PC.6
C43	Non-Conductive Balloon Alternatives	DT.4

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

Appendix B: Quantitative Analysis Source Data References

The Settlement Decision directs the utility to identify potential consequences of a risk event using available and appropriate data.[33] The list below provides the inputs used as part of this assessment.

San Diego Gas & Electric, CPUC Reportable Fire Database

- 2014 –2020 ignition reporting (pursuant to D14-02-015, Ordering Paragraph 9 and Appendix C)

San Diego Gas & Electric, Electric Reliability Database

- 2010 –2020 internal reliability data

San Diego Gas & Electric, Asset Management data

- Various asset information, such as the count and type of assets, by HFTD tier

CALFIRE, Wildfire Activity Statistics (also known as Redbooks)

https://www.fire.ca.gov/stats-events

- Annual record of wildfire statistics such as location, size, and damage

Technosylva (internal consultant who performs wildfire modeling)

WRRM consequence data

[33] D.18-12-024, Attachment A at A-8 (Identification of Potential Consequences of Risk Event).

Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-2)

Electric Infrastructure Integrity

May 17, 2021

TABLE OF CONTENTS

RISK: ELECTRIC INFRASTRUCTURE INTEGRITY

I. INTRODUCTION

The purpose of this chapter is to present SDG&E's risk control and mitigation plan for the Electric Infrastructure Integrity (EII) risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter RAMP-B of this RAMP Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs and cost estimates are provided for years 2022-2024, as further discussed in Chapter RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are provided where those costs are available and within the scope of the analysis required in this RAMP Report.

---

[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[2] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Throughout this 2021 RAMP Report activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's EII risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters RAMP-A and RAMP-C, SDG&E has endeavored to calculate an RSE for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or SME opinion exists to calculate the RSE, SDG&E has included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

A. Risk Overview

Safety is a core value at SDG&E. SDG&E's safety-first culture focuses on its employees, customers, and the public, and is embedded in every aspect of our work. One of the known safety risks for employees, customers and the public pertain to the electric infrastructure. SDG&E continually aims to improve its electric infrastructure and educate employees, customers and the public about safety measures related to energized lines, both overhead and 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 15th consecutive ReliabilityOne "Best in the West" award.[6] SDGE has developed strong controls through programs such as the Corrective Maintenance Program (CMP) and its

---

3 *Id.* at 16.

4 *Id.* at 17.

5 *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

6 *See article available at* https://sdgenews.com/article/sdge-receives-awards-outstanding-electric-reliability-innovation-and-system-resiliency.

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 substantial growth in residual risks.

The EII risk can be characterized by several possible scenarios. One example of these scenarios is the occurrence of an energized wire-down event which was used for risk impact and frequency scoring that involves asset failures. The 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 intended approved 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 is continuing to take proactive measures to determine the cause of any such wire-down events and has a dedicated team reviewing all wire-down events to determine the root cause and to identify any trends to potentially trigger the development of a new program. SDG&E's Electric Engineering department is dedicated to the development and implementation of strategies that support all the unique operations practices, field construction, and microclimate conditions throughout the area served by SDG&E, while assuring electric distribution efficiency, access, control, cost-effectiveness, and safety are being considered in all final decisions. Data analysis suggests 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 potential consequences.

Asset age and equipment characteristics (*e.g.*, wire type) can be predictable and impactful attributes leading to the natural 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 technology 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 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: Incident Involving an Employee, Incident Involving a Contractor, and Customer and Public Safety-Contact with Electric Equipment. These other risk chapters focus on mitigations that address public outreach, 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 Customer and Public Safety-Contact with Electric Equipment chapters.

This EII Chapter primarily focuses 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 "Wildfires Involving SDG&E Equipment" risk Chapter (SDG&E-Risk-1). 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-1 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.

B. Risk Definition

SDG&E's Electric Infrastructure Integrity 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 safety or reliability incident." A potential Risk Scenario assessed as part of this risk is an energized wire-down event caused by a foreign object or failure of an electric component (*e.g.*, a connector). If a member of the public comes into contact with the

energized wire or in close proximity to the energized wire on the ground, the results could be loss of power to customers and injury and/or possibly death.

C. Scope

This EII RAMP Risk Chapter is focused on the programs outside of the HFTD; programs addressing issues inside the HFTD are addressed in the RAMP risk of the Wildfire RAMP Risk Chapter (SDG&E-Risk-1). Table 1 below provides what is considered in and out of scope for the Electric Infrastructure Integrity risk in this RAMP Application.

Table 1: Risk Scope

In-Scope:	The risk of an electric asset failure due to internal or external factors, which results in serious injuries, fatalities, or reliability impacts.
Data Quantification Sources:	Company data was used, reviewed, and adjusted by SMEs as appropriate. See Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision,[7] this section describes the risk bow tie, possible drivers, potential consequences, and the risk score for the EII risk. SDG&E meets the Settlement Decision requirements for the EII risk by presenting controls and mitigations that have been subdivided by asset groupings and by specific activities related to the electric system, consistent with how SDG&E manages its risks and assets.[8] Certain asset groupings were further divided by characteristics of the asset. For many controls and mitigations, the amount of activity presented is a subset of the entire system. For example, the amount of work discussed in the activity with ID "C1" (Overhead Public Safety) focuses on 30 miles of overhead system. These 30 miles are considered to be their own tranche because they have a similar risk profile in both likelihood and consequence. Other controls, such as those that are part of compliance programs, have a large portion of the electric system as their scope. For example, the activity with ID "C7" (Restoration of Service) is applicable to the entire distribution system, and SDG&E's activities to restore service when outages occur.

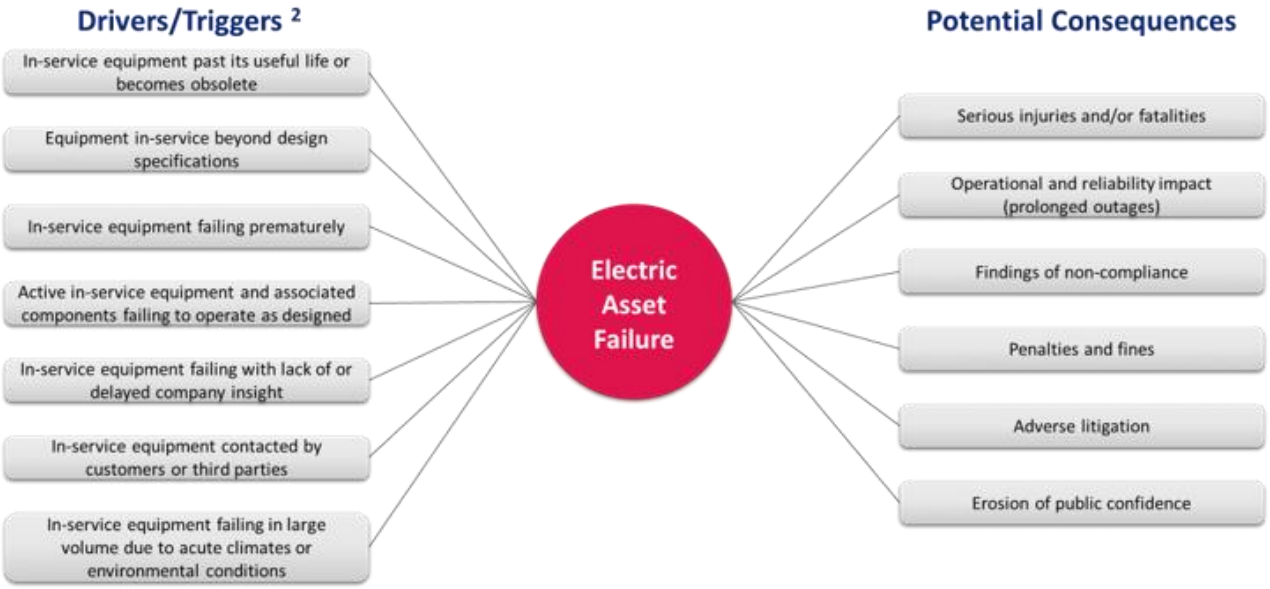
[7] D.18-12-014 at 33 and Attachment A at A-11 (Bow Tie).

[8] *See Id.*, Attachment A at A-11 (Definition of Risk Events and Tranches).

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision[9] instructs the utility to include a risk bow tie illustration for each risk included in RAMP. As illustrated in the risk bow tie shown below in Figure 1, the risk event (center of the bow tie) is Electric Asset Failure, the left side of the bow tie illustrates drivers/triggers that lead to the Electric Asset Failure, and the right side shows the potential consequences of the Electric Asset Failure. SDG&E applied 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 addressed is provided in Appendix A.

Figure 1: Risk Bow Tie



B. Cross-Functional Factors

This RAMP filing includes separate Cross-Functional Factor Chapters that impact SDG&E's EII and help to further mitigate SDG&E's EII risk. - SDG&E identified the following cross-functional factors that are associated with EII risk. These include:

- **Asset Management (SDG&E-CFF-1):** To safely operate its grid, SDG&E conducts various asset management activities. Asset Management is an enterprise-wide framework that provides a standardized approach for managing risk and safety across assets and activities. Asset

[9] *Id.*, Attachment A at A-11 (Bow Tie).

Management also focuses on data analytics to integrate critical asset data attributes and support alternative replacement strategy analyses and asset health indices for certain critical assets.

- **Climate Change Adaptation, Energy System Resilience and GHG Emissions (SDG&E-CFF-2):** SDG&E recognizes the need to ensure safety and reliability of its services to customers and to adapt to weather- and climate-related threats to its system. Climate hazards are expected to increase the severity and frequency of adverse weather and other natural events and create or enhance risks to SDG&E's system as a result. For example, the threat of a rising sea level poses safety risks to coastal regions, and SDG&E's safety risks can come in the form of damaged assets in its coastal regions as well as extended outages due to damaged assets. To build comprehensive mitigations to wildfire and other climate hazards, SDG&E has combined the best available science (and has spearheaded scientific development where it is lacking), cutting-edge situational awareness technology, integration of sustainability principles, and subject matter expertise dedicated to solving complex climate change-related issues.
- **Emergency Preparedness and Response and Pandemic (SDG&E-CFF-3):** SDG&E's Emergency Preparedness and Response (EP&R) programs provide a standardized approach for managing risk and safety across assets and activities. The Emergency Management Department's programs and processes include planning, training, exercising, and supporting responses and recovery efforts related to incidents, emergencies, disasters, and catastrophes. EP&R is a factor in protecting operational reliability, ensuring the safety of employees and the public, and maintaining compliance with government regulations or guidelines.
- **Foundational Technology Systems (SDG&E-CFF-4):** The safe operation of electric infrastructure depends on many technological tools and applications for asset monitoring and awareness in the field. For example, SDG&E's outage and distribution management systems are

systems used by distribution operators to support safe operations related to outage restoration. Supervisory Control and Data Acquisition (SCADA) provides operational data from electric assets in order to proactively monitor for and remediate asset failure. SCADA reduces the need for field personnel to perform manual operations, thus minimizing the safety risks to employees and/or contractors. The health of SDG&E's foundational technology systems, therefore, impacts EII-related activities.

- **Records Management (SDG&E-CFF-6):** SDG&E implemented various recordkeeping controls for its system in accordance with CPUC regulations, decisions and directives. For EII-related activities, this includes compliance with the General Orders (GO) (*e.g.*, GO 95).
- **Safety Management Systems (SMS) (SDG&E-CFF-7):** SDG&E's SMS provides a systematic, cohesive framework which builds upon SDG&E's strong safety culture and integrates new and existing processes. By taking an integrated, systematic approach to safety, SDG&E is better able to assess and manage risk across the entire organization. Enhancing our communication, collaboration, feedback and documentation and using data and analytics to regularly measure our effectiveness and make continuous improvements will help make each of our current and future safety programs more effective. SDG&E's SMS framework, as referenced in the SMS Cross Functional Factor Chapter, includes the Five Pillars of Safety, to focus on both individual safety behaviors and process safety management. Activities to effectively manage the risks SDG&E faces, including mitigation and prevention activities for EII-related risks, are integrated throughout the SMS Framework and its Five Pillars of Safety.
- **Workforce Planning / Qualified Workforce (SDG&E-CFF-8):** A highly qualified workforce positions a utility to efficiently and effectively manage operations to ensure safety, compliance, and reliability, and fosters confidence in those who regulate these activities. Additionally, workers are provided training to gain knowledge to perform their role safely, effectively, and efficiently.

C. Potential Drivers/Triggers[10]

The Settlement Decision instructs the utility to identify which element(s) of the associated risk bow tie each mitigation addresses.[11] When performing the risk assessment for Electric Infrastructure Integrity, SDG&E identified potential leading indicators, referred to as drivers or triggers. These include, but are not limited to:

- **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 sudden 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 – Equipment in-service beyond design 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.

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

[11] *See* D.18-12-014, Attachment A at A-11 (Bow Tie).

- **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.*, 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 in large volume (*i.e.*, simultaneous failure of numerous assets) due to acute climates 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 may lead to large volumes of failures that 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

- Potential consequences[12] are listed to the right side of the risk bow tie illustration provided above. If one or more of the drivers/triggers listed above were to result

[12] D.18-12-014 at 16 and Attachment A at A-8 ("Identification of Potential Consequences of Risk Event").

in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

- PC.1 - Serious injuries and/or fatalities
- PC.2 - Operational and reliability impacts
- PC.3 - Findings of non-compliance
- PC.4 - Penalties and fines
- PC.5 - Adverse litigation
- PC.6 - Erosion of public confidence

These potential consequences were used in the scoring of Electric Infrastructure Integrity that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[13] Chapter RAMP-C of this RAMP Application explains the Risk Quantitative Framework which underlies this Chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[14]

	LoRE	CoRE	Risk Score
Electric Infrastructure Integrity	1,632	6	9,177

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, available and appropriate data.[15] The primary source of data used for this risk is based on internal data, please see Appendix B.

[13] D.18-12-014, Attachment A at A-11 ("Calculation of Risk").

[14] The term "pre-mitigation analysis," in the language of the Settlement Decision refers to required pre-activity analysis conducted prior to implementing control or mitigation activity. *See* D.18-12-014, Attachment A at A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," and "Measurement of Pre-Mitigation Risk Score").

[15] *Id.,* Attachment A at A-8 ("Identification of Potential Consequences of Risk Event").

III. 2020 CONTROLS

This section describes the controls currently in place as required by the Settlement Decision.[16] The Settlement Decision's lexicon defines a "control" as a "[c]urrently established measure that is modifying risk."[17] The activities in this section were in place as of December 31, 2020. Controls that will continue as part of the Plan are addressed in Section IV.

A. C1: Overhead Public Safety (OPS) Program

The OPS program[18] effectively replaces the overhead assets most prone to failure. The OPS program uses historical data collected from actual wire-down events to estimate failure rates of overhead infrastructure. Applying these failure rates to all non-HFTD areas and outside of the scope of the Distribution Overhead System Hardening program provides SDG&E's subject matter experts with an estimate of an individual circuit's expected likelihood of experiencing a wire-down event over a given period of time. SDG&E ranks these individual circuits by the total expected number of wire-down events, to identify the top quartile circuits where risk reductions may be concentrated. The top quartile of circuits have the most exposure of high-risk assets, primarily small wire (*e.g.*, #6 Cu and #4 Cu). Other environmental factors are considered when estimating failure rates and potential for risk reduction, including high winds, accelerated corrosion in coastal areas, likelihood of public contact, and areas where wire-down events have occurred more than usual.

SDG&E's OPS program is 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 to achieve the greatest risk reduction for energized wire-down events

---

16 Settlement Decision at 33.

17 Settlement Decision at 16.

18 As previously stated in Section I of this Chapter, SDG&E's OPS program was identified in SDG&E's previous RAMP and GRC filings as the WiSE Central program. With the Commission's recent rulemaking on Wildfire Mitigation Plan (R.18-10-007), SDG&E reduced the scope of the WiSE program to align with wildfire mitigation activities outside of SDG&E's HFTD. Therefore, the OPS program is separate and distinct form the WiSE program.

by reconductoring and deploying advanced protection and/or detection schemes. This program replaces existing assets with assets that have been designed to current and updated construction standards. The assets targeted in this scope (typically small wire copper spans) 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.

This program also evaluates overhead distribution lines that cross major or high-traffic freeways. Overhead distribution crossings that have poor structural integrity or high-risk conductors will be hardened to avoid a wire-down event in the roadway that could put motorists at risk.

The main scope of the program is to replace remaining small wire with conductor that is known to be statistically less prone to failure. In other areas, where small 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. In addition to the OPS infrastructure replacement program, SDG&E also has an enhanced public safety communication campaign (SDG&E-5-C1), as further described in SDG&E's Customer and Public Safety – Contact with Electric Equipment Chapter of this RAMP Report (SDG&E-Risk-5). This robust public safety awareness campaign aims to educate and provide a deeper level of understanding to the public with respect to safe practices around electric infrastructure. Associated costs for SDG&E-5-C1 are included in the Customer and Public Safety–Contact with Electric Equipment RAMP Chapter.

B. C2: GO165 Pole Replacement Reinforcement

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, 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, 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.

C. C3: 4 kV Modernization Program – Distribution

The purpose of SDG&E's 4 kV modernization program is to systematically remove the 4 kV distribution system from service and replace it or upgrade to modern 12 kV standards. 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. Half of the 4 kV substations are more than 50 years old, an age for which replacement components are no longer available. The operation of 4 kV substations presents safety concerns, for example, because the company is facing a shortage of qualified crews and electricians who are familiar with and knowledgeable about design and operation of those aging and obsolete substations. The maintenance cost for the 4 kV substations is unusually high and continues to increase. The 4 kV substations also present reliability and safety risks for customers due to higher failure rates, lack of replacement parts, and limited options to transfer load to adjacent circuits. All of these factors create the potential for more frequent and extended duration outages. In addition, 4 kV overhead circuits are more likely to experience a wire-down event compared to 12 kV circuits, due to a higher percentage of small wire (*e.g.*, #6 Cu and #4 Cu) aging conductors and smaller conductor clearances. SDG&E's 4 kV modernization plan addresses all areas of 4 kV substation and distribution infrastructure removals and upgrades.

The scope of the program includes removing 4 kV packages or "unit" substations, modernizing other aging substation infrastructure as needed; cutting over existing 4 kV assets to 12 kV assets, replacing small and aging wire, and completely rebuilding, if deemed necessary, based on the asset.

D. C4: Distribution Overhead Switch Replacement Program

- **C4-T1: SCADA; C4-T2: Gang; C4-T3: Hook**

SDG&E's 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. 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, such as hooksticks, 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.

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 forced outage when crews are required to install additional jumpers or other workarounds. Switches that are not consistently exercised are at increased risk of being inoperable when needed. The inoperable state of the switch poses safety risks to field operating personnel, due to potential flash or overexertion by the employee. Antiquated single phase disconnect switches are targeted to be replaced with newer model disconnects with superior material specifications, three-phase gang-operated switches (mitigating ferroresonance over-voltages and flashovers, both SCADA and Non-SCADA), as well as remote operable SCADA tie switches, for improved reliability. Switch replacements may also require simultaneous or subsequent upgrades to relevant equipment such as poles, crossarms, wires, guys, and other hardware.

E. C5: 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; and
- Install a barrier around the pole to prevent reoccurrence.

F. C6: Vegetation Management (non-HFTD)

SDG&E's Vegetation Management Program is responsible for inspecting and maintaining an inventory of approximately 450,000 trees that have the potential to encroach within the minimum required compliance distance between vegetation and overhead power lines. This work includes pruning healthy trees growing into overhead power lines as well as the pruning or removal of dead, dying, diseased, or structurally unsound trees that have the potential to fall into overhead lines. SDG&E is responsible for compliance with CPUC GO 95, Rule 35; Public Resources Code, sections 4292 and 4293; and NERC FAC-003-4. Compliance with these rules and regulations mandate a minimum clearance between vegetation and SDG&E facilities and are the primary cost drivers of the program.

SDG&E's vegetation activities are coordinated through a centralized Vegetation Management Program within the Wildfire Mitigation and Vegetation Management department, under the Electric Operations organization. The Vegetation Program Manager and staff set the standards, guidelines, and processes for the overall program to see that the company is in compliance with all rules, laws, and regulations governing SDG&E practices. There are two types of work that drive the tree program costs: (1) routine work and (2) field memos and hazard tree work. Routine work includes annual-cycle pruning and removal of trees. Pre-inspection contractors perform the overhead power line patrols, which identify trees to be pruned and removed. Routine tree pruning and removal is typically done by a contractor and is compensated on a unit price basis. Field memos and/or unscheduled tree pruning are reactive work, and include customer refusals, hazard tree pruning and removal, environmentally or culturally sensitive pruning activities, trees which require priority pruning, district requests, and customer safety checks, and may require time and equipment compensation instead of a per-unit price, due to the nature of the work activity.

To confirm the above activities are completed in accordance with the company's contracted scopes of work, SDG&E has a quality control program to verify the completion and certification of each work activity. An automated random sampling method is used to create audit work packages, and then the auditor field reviews records for adherence to contract specifications, quality, and compliance. In conjunction with the post-prune audit, auditing activity includes a patrol of all spans of overhead power lines for any trees that may have

encroached the minimum clearance zones since the last pre-inspection activity. This activity provides a higher level of compliance for the duration of the annual cycle.

G. C7: 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 the 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); or
- Emergency repairs of facilities that are required for service restoration (cable or equipment failures, for example).

H. C8: 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 of birds 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.[19] The plan will primarily address known bird contacts, in which case we will identify and resolve potential avian risk.

I. C9: 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 program provides funding for

[19] *See* APLIC guidelines, *available at* https://www.aplic.org/.

the replacement of underground cable involved in a forced outage. 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.

J. C10: Underground Cable Replacement Program – Proactive

- **C10-T1: UG Feeder; C10-T2: UG Branch; C10-T3: North Harbor Project**

SDG&E currently performs reactive replacement of underground unjacketed cable. There are currently approximately 65 circuit miles of unjacketed feeder cable and roughly 1,308 circuit miles of unjacketed lateral cable remaining on the SDG&E electric distribution system. The reactive program (C9, above) identifies and replaces failed equipment. This program takes a proactive approach by replacing underground cable that has been identified to have a high probability of failure based on electric reliability circuit analysis and cable failure data. It also provides quality customer service and reliability to existing customers by proactively replacing cable in the underground system before it fails and an outage occurs. In addition, this proactive control will assist in mitigating future outages caused by the failure of unjacketed cable to major customers (*e.g.*, San Diego International Airport).

K. C11: Tee Modernization Program – Underground

SDG&E's Tee Modernization Program involves the proactive at-risk identification and replacement of 600-amp tee connectors. 600-amp tees are used as underground connections in handholes, manholes, and at-switch terminations. Tee failures often occur along feeder cables, causing forced outages to large customer counts that require extensive reconstruction to permanently restore the outage. Tee connector failures have become one of the largest contributors to increasing the duration of customer outages in the last few years. The modernization of tees through this program provides a more reliable system that has more sectionalizing capability. Additionally, tees can fail violently (*e.g.*, tee failure could lead to an arc flash), which poses a serious safety risk to our field personnel and the public.

L. C12: Replacement of Live Front Equipment – Reactive

"Live front" equipment is equipment that has primary connections exposed, with no insulation covering. Live front equipment contains electric components enclosed in a protective (usually steel) cabinet that does not have additional protective barriers. Thus, when the cabinet

is opened, energized (or live) electric connections are exposed. This has been and still is a safety concern for employees required to work around these energized exposed parts within the confined space. Live front equipment was primarily installed on SDG&E's electric distribution system during the 1960's and 1970's and has since become obsolete and is no longer approved for installations with new construction. It is now being replaced by "dead front" equipment with additional safety barriers, such as removable fiberglass, composite plates, protective covers or additional compartmentalization. The dead front also provides additional locations to safely sectionalize equipment, assisting with troubleshooting and restoring partial load during outage events. SDG&E's Live Front Equipment Replacement Project replaces live front pad-mounted distribution equipment with dead front pad-mounted distribution equipment, when it is encountered during normal SDG&E work and not the main driver.

M. C13: Replacement of Live Front Equipment – Proactive

As described above in C12, "live front" equipment has the primary connections exposed with no insulative covering. Thus, when the equipment is opened, there are energized (or live) conductors present. SDG&E has a current live front terminator replacement program that is reactive; *i.e*., when there is a job on the SDG&E distribution system that involves working with live front equipment, the equipment that is involved will be replaced with dead front equipment at that time. The specific program described in this section aims to proactively identify and replace live front equipment before employees are deployed to the job, thereby further reducing the potential for employee injury and/or outage.

Continued use of live front terminators causes risks to workers who rely on limited tools to operate the live equipment. As an alternative to operating live front equipment, switching plans are used to operate 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 unnecessary outages. And, if the limited switching tools are insufficient, workers may be dangerously exposed to live primary voltage, potentially resulting in serious risk of injury or death.

N. C14: 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 appropriately superior or equivalent asset, depending on field conditions and reliability impact. This program improves worker safety while operating these switches and prevents premature failures of these assets, avoiding potential for injuries and damages to adjacent facilities. In addition, replacement of these switches allows for a reduced customer impact when isolation devices are needed during planned and unplanned outages.

O. C15: GO165 Corrective Maintenance Program - Underground

Short- and long-term 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. Degraded equipment would also increase volume and frequency of forced distribution outages, 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.

This 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.

SDG&E performs this type of inspection on approximately 25,000 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
- Weeds/Grass/Dirt Inside Unit.

P. C16: GO 165 Manhole, Vault Restoration Program

Short- and long-term structural deterioration of manholes, handholes, and vaults cause potential risks, including the risk of injury or death, to the public and workers. As this program is mandated per GO 165 (Inspection Requirements for Electric Distribution and Transmission Facilities), non-compliance poses risk of regulatory action, including fines.

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.

On average, SDG&E performs this type of detailed inspection on approximately 400 structures per year. The top five conditions found on this type of inspection are as follows:

- Weeds/Trees/Bushes/Dirt or Obstacle;
- EXT/INT High Voltage Sign Missing;
- Weeds/Grass/Dirt Inside Unit;
- ID/Circuit/Switch Number Missing or Incorrect; and
- External Working Space Sign Missing.

Q. C17: 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; and

- Install fault indicators, fusing, or switching equipment as necessary to maintain service reliability.

R. C18: Distribution Circuit Reliability

This program helps mitigate the Electric Infrastructure Integrity 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 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.

S. C19: Minor Distribution Substation Reliability Projects

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.

T. C20: Substation Reliability for Distribution Components

The following projects focuses 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:

- C20-T1: Chicarita 12 kV Breaker and Capacitor Replacements;
- C20-T2: Laguna Niguel 12 kV Breaker and Capacitor Replacements;
- C20-T3: Scripps 12 kV Breaker and Capacitor Replacements;
- C20-T4: Coronado 69/12 kV Transformer Replacement;
- C20-T5: Batiquitos 12 kV Breaker and Capacitor Replacements;
- C20-T6: Bernardo 12 kV Breaker Replacements;
- C20-T7: Miramar 12 kV Breaker Replacements; and
- C20-T8: Pacific Beach 12 kV Bus Tie Replacements.

U. C21: Distribution Substation Obsolete Equipment

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 $1M. Similar to C20, this program covers individual equipment with limited spare parts and introduces significant risk to the system.

V. C22: Emergency Transformer and Switchgear

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.

W. C23: San Mateo Substation Rebuild

The purpose of this project is to enhance reliability and reduce the number of transmission and distribution outages impacting the San Clemente Area. The scope of this project includes replacing all aging infrastructure inside the substation past its useful life and functioning beyond design specifications. The San Mateo Substation rebuild project involves replacing capacitor banks, transformer banks and circuit breakers. San Mateo Substation will

approach or exceed its normal operating life in several years, and SDG&E has determined that replacing this aging equipment will be needed to address reliability concerns. The need to obtain optimum operating conditions to maintain substation reliability and to reduce outage times is a key driver for this project.

X. C24: Urban Substation

The purpose of this project is to enhance reliability and to reduce the number of transmission and distribution outages impacting the area. The scope of this project is significant as it includes replacing an impactful amount of equipment within the substation including replacing all aging infrastructure inside the substation as equipment is past its useful life and functioning beyond design specifications. The scope involves replacing capacitor banks, transformer banks and circuit breakers.

SDG&E's existing Urban Substation will approach or exceed its normal operating life in several years, and SDG&E has determined that replacing this aging equipment will be needed to address reliability concerns. The need to obtain optimum operating conditions to maintain substation reliability and to reduce outage times is a key driver for this project.

Y. C25: Substation Inspection & Repair GO-174

SDG&E's Substation System Inspection and Maintenance Program promotes safety for SDG&E personnel and contractors by providing a safe operating and construction environment, within the substation fence. Additional goals include: meeting all of the requirements of GO 174, achieving a level of station availability satisfactory to SDG&E's health and safety programs and maintenance standards, and assuring compliance with all sections of the California Independent System Operator (CAISO) Transmission Control Agreement (TCA). This is accomplished through routine inspections at reoccurring cycles. A security check is planned once per week, and a more detailed inspection is planned monthly or bimonthly, which takes a visual look at equipment and attempts to identify any problems, like oil leaks.

Z. C26: 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 distribution and substation asset management, operations, and power quality investigations. These devices are foundational to SDG&E's ability to monitor the system and develop root cause analysis to investigate issues on the system. 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 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.

AA. C27: Distribution Substation SCADA Expansion

This budget provides funding for the installation, upgrades, and expansion of the SCADA system at SDG&E's distribution substations, which is foundational to how SDG&E monitors the system and enhances SDG&E's situational awareness. Benefits of installing SCADA within the substation includes faster faulted circuit identifications, faster isolation of faulted electric distribution circuits, and improved system performance. This program replaces aging 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.

BB. C28: Field SCADA RTU Replacement

Older SCADA RTUs that support communication to distribution field devices such as switches, regulators and capacitors have poor reliability, often complicating outages or requiring field crews to manually switch devices that normally could be remotely switched. SDG&E's Field SCADA RTU Replacement Project replaces distribution field-deployed RTUs (outside substations) that are past their useful life and no longer supported by the vendor.

This project resolves issues with the current SCADA system, thereby allowing SDG&E to move away from legacy communication protocols that are no longer supported and to improve communication reliability. This project also allows for a more transparent view to the grid, which will enhance SDG&E's reliability. Proactively modernizing SDG&E's SCADA RTUs by replacing old legacy equipment better enables operability of the distribution network, including faster circuit outage restorations.

CC. C29: SCADA Capacitors

The supervisory control and data acquisition (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 and ignitions associated with capacitor failures would decrease over time as a result of this program.

DD. Transmission-related Projects

SDG&E notes that there are non-CPUC jurisdictional mitigation activities performed that further mitigate the EII risk, but the costs and narrative associated with these activities will not be presented, as funding authorization of such projects fall under the jurisdiction of a non-CPUC authority (*e.g.*, CAISO and FERC). Such non-CPUC jurisdictional activities include, but are not limited to:

- Transmission OH Reliability projects;

- Transmission UG Reliability projects;
- Transmission Substation projects;
- Transmission Compliance projects; and
- Transmission Safety projects.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[20] The activities listed below have been tranched as described in section II above. Certain activities that have been subdivided further within their asset class are identified by adding a "T" to their control/mitigation ID, such as C4-T1.

All of the activities discussed in Section III above are expected to continue during the TY 2024 GRC. A current activity that is included in the risk control and mitigation plan may be referred to as either a control or a mitigation. For purposes of this RAMP, a control that will continue as a mitigation retains its control ID unless that the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. The table below shows which activities are expected to continue.

Table 3: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	Overhead Public Safety (OPS) Program	X	X
2	C2	GO165 Pole Replacement Reinforcement	X	X
3	C3	4 kV Modernization Program – Distribution	X	X
4	C4-T1	Distribution Overhead Switch Replacement Program - SCADA	X	X
5	C4-T2	Distribution Overhead Switch Replacement Program - Gang	X	X
6	C4-T3	Distribution Overhead Switch Replacement Program - Hook	X	X
7	C5	Management of Overhead Distribution Service (Non-CMP)	X	X
8	C6	Vegetation Management (non-HFTD)	X	X
9	C7	Restoration of OH Service	X	X
10	C8	Avian Protection Program	X	X

[20] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
11	C9	Underground Cable Replacement Program - Reactive	X	X
12	C10-T1	Underground Cable Replacement Program (Proactive) – UG Feeder	X	X
13	C10-T2	Underground Cable Replacement Program (Proactive) – UG Branch	X	X
14	C10-T3	Underground Cable Replacement Program (Proactive) – UG North Harbor	X	X
15	C11	Tee Modernization Program - Underground	X	X
16	C12	Replacement of Live Front Equipment – Reactive	X	X
17	C13	Replacement of Live Front Equipment – Proactive	X	X
18	C14	DOE Switch Replacement	X	X
19	C15	GO165 Corrective Maintenance Program - Underground	X	X
20	C16	GO165 Manhole, Vault Restoration Program	X	X
21	C17	Management of Underground Distribution Service (Non-CMP)	X	X
22	C18	Distribution Circuit Reliability	X	X
23	C19	Minor Distribution Substation Reliability Projects	X	X
24	C20-T1	Substation Reliability for Distribution Components – Batiquitos 12kV Replacements	X	X
25	C20-T2	Substation Reliability for Distribution Components – Bernardo 12kV Replacements	X	X
26	C20-T3	Substation Reliability for Distribution Components – Chicarita 12kV Replacements	X	X
27	C20-T4	Substation Reliability for Distribution Components – Laguna Niguel 12kV Replacements	X	X
28	C20-T5	Substation Reliability for Distribution Components – Miramar 12kV Replacements	X	X
29	C20-T6	Substation Reliability for Distribution Components – Scripps 12kV Replacements	X	X
30	C20-T7	Substation Reliability for Distribution Components – Pacific Beach Bus Tie Replacements	X	X
31	C20-T8	Substation Reliability for Distribution Components – Coronado 69/12kV Replacements	X	X
32	C21	Distribution Substation Obsolete Equipment	X	X

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
33	C22	Emergency Transformer and Switchgear	X	X
34	C23	San Mateo Substation Rebuild	X	X
35	C24	Urban Substation	X	X
36	C25	Substation Inspection GO-174	X	X
37	C26	Power Quality Monitor Deployment and Replacement	X	X
38	C27	Distribution Substation SCADA Expansion	X	X
39	C28	Field SCADA RTU Replacement	X	X
40	C29	SCADA Capacitors	X	X
41	M1	Non-HFTD Wireless Fault Indicator	-	X
42	M2	UG Fault Detection	-	X

For activities SDG&E plans to perform that remain unchanged, please refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in this section, below.

A. Changes to 2020 Controls

SDG&E does not anticipate any significant changes to the scope of the existing controls that are anticipated to continue into years 2022-2024.

B. 2022 – 2024 Mitigations

1. M1: Non-HFTD Wireless Fault Indicator

This program installs wireless fault indicators and necessary network devices and software to strengthen and modernize the Low Power Communication Network (LPCN) coverage and reliability on SDG&E's electric distribution system outside of the HFTD. This sensing capability is foundational to SDG&E's ability to monitor and sense faults and normal loading on our system, providing enhanced situational awareness. These installations may also require simultaneous or subsequent upgrades to relevant equipment such as poles and other hardware to conform to existing construction standards. Wireless fault indicators are a proven technology that help 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.

In instances where large areas are de-energized due to protective relay settings, wireless fault indicators are used to concentrate focus on a much smaller portion of the electric circuit, which allows for:

- a faster response to the site; and
- a greater chance of determining and correcting a fault cause (when damage on the overhead electric system is not immediately obvious).

2. M2: UG Fault Detection

A significant number of outages are caused by failing underground conductors and terminations. These facilities are in conduits or handhole/manholes where damage is not readily apparent. Early fault detection systems will monitor the electric discharge from the system and identify specific segments of cable or terminations that have failed. Similar to M1, this detection system will assist in concentrating focus on a small portion of the electric circuit allowing for strategic troubleshooting. This sensing capability is foundational to SDG&E's ability to monitor and sense faults and normal loading on our system, providing enhanced situational awareness.

V. COSTS, UNITS, AND QUANTITATIVE SUMMARY TABLES

The tables in this section summarize the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided. SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data.

Table 4: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[21]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars[22]		Forecast Dollars			
		2020 Capital[23]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)[24]	TY 2024 O&M (High)
C1	Overhead Public Safety (OPS) Program	53	0	18,470	22,817	0	0
C2	GO165 Pole Replacement Reinforcement	7,222	0	22,103	27,304	0	0
C3	4kV Modernization Program – Distribution	2,951	0	17,492	21,606	0	0
C4-T1	Distribution Overhead Switch Replacement Program – SCADA	154	0	525	649	0	0
C4-T2	Distribution Overhead Switch Replacement Program - Gang	77	0	358	442	0	0
C4-T3	Distribution Overhead Switch Replacement Program - Hook	579	0	1,403	1,734	0	0
C5	Management of Overhead Distribution Service (Non-CMP)	6,487	0	23,656	29,222	0	0

[21] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[22] SDG&E does not currently track all Capital and O&M costs at the RAMP activity level and is unable to provide Capital and O&M historical costs for all activities.

[23] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with Controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

[24] SDG&E is not currently proposing associated O&M cost forecasts for activities where costs are not currently tracked at the level of detail presented in this 2021 RAMP Report. SDG&E will address this issue in its TY 2024 GRC Application.

ID	Control/Mitigation Name	Recorded Dollars[22]		Forecast Dollars			
		2020 Capital[23]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)[24]	TY 2024 O&M (High)
C6	Vegetation Management (non-HFTD)	0	31,900	0	0	37,201	45,954
C7	Restoration of Service	7,401	0	30,078	37,154	0	0
C8	Avian Protection Program	209	0	1,591	1,967	0	0
C9	Underground Cable Replacement Program – Reactive	5,407	0	17,250	21,309	0	0
C10-T1	Underground Cable Replacement Program (Proactive) - UG Feeder	213	0	450	555	0	0
C10-T2	Underground Cable Replacement Program (Proactive) - UG Branch	4,047	0	13,205	16,314	0	0
C10-T3	Underground Cable Replacement Program (Proactive) - North Harbor Project	0	0	12,674	15,657	0	0
C11	Tee Modernization Program	1,750	0	9,750	12,042	0	0
C12	Replacement of Live Front Equipment - Reactive	522	0	1,131	1,399	0	0
C13	Replacement of Live Front Equipment - Proactive	442	0	1,490	1,839	0	0
C14	DOE Switch Replacement	5,731	0	16,516	20,402	0	0
C15	GO165 Corrective Maintenance Program – Underground	16,365	0	37,937	46,865	0	0
C16	GO 165 Manhole, Vault Restoration Program	4,794	0	8,220	10,153	0	0
C17	Management of Underground Distribution Service (Non-CMP)	3,750	0	9,639	11,908	0	0
C18	Distribution Circuit Reliability	4,337	0	9,947	12,288	0	0
C19	Minor Distribution Substation Reliability Projects	1,218	0	4,503	5,565	0	0

ID	Control/Mitigation Name	Recorded Dollars[22]		Forecast Dollars			
		2020 Capital[23]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)[24]	TY 2024 O&M (High)
C20-T1	Substation Reliability for Distribution Components – Batiquitos 12kV Replacements	0	0	6,334	7,825	0	0
C20-T2	Substation Reliability for Distribution Components – Bernardo 12kV Breakers Replacements	0	0	846	1,045	0	0
C20-T3	Substation Reliability for Distribution Components – Chicarita 12kV Replacements	0	0	3,588	4,432	0	0
C20-T4	Substation Reliability for Distribution Components – Laguna Niguel 12kV Replacements	0	0	7,397	9,137	0	0
C20-T5	Substation Reliability for Distribution Components – Miramar 12kV Replacements	0	0	1,112	1,374	0	0
C20-T6	Substation Reliability for Distribution Components – Scripps 12kV Replacements	0	0	10,476	12,940	0	0
C20-T7	Substation Reliability for Distribution Components – Pacific Beach Bus Tie Replacements	0	0	1,950	2,409	0	0
C20-T8	Substation Reliability for Distribution Components – Coronado 69/12kV Transformer Replacements	0	0	1,402	1,731	0	0
C21	Distribution Substation Obsolete Equipment	4,126	0	6,663	8,232	0	0
C22	Emergency Transformer and Switchgear	739	0	658	812	0	0
C23	San Mateo Substation Rebuild	6	0	11,813	14,592	0	0
C24	Urban Substation Rebuild	916	0	3,498	4,322	0	0

ID	Control/Mitigation Name	Recorded Dollars[22]		Forecast Dollars			
		2020 Capital[23]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)[24]	TY 2024 O&M (High)
C25	Substation Inspection GO-174	0	1,580	0	0	1,500	1,853
C26	Power Quality Monitor Deployment and Replacement	889	0	1,332	1,647	0	0
C27	Distribution Substation SCADA Expansion	226	0	4,787	5,914	0	0
C28	Field SCADA RTU Replacement	1,729	0	1,924	2,378	0	0
C29	SCADA Capacitors	61	0	2,028	2,504	0	0
M1	Non-HFTD Wireless Fault Indicator	0	0	2,805	3,465	0	0
M2	UG Fault Detection	0	0	1,500	1,851	0	0

Table 5: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units[25]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	Overhead Public Safety (OPS) Program	Number of reconductor miles		0	0	27	34	0	0
C2	GO165 Pole Replacement Reinforcement	Number of poles		0	0	1,350	1,665	0	0
C3	4kV Modernization Program – Distribution	Number of reconductor miles		0	0	20	25	0	0
C4-T1	Distribution Overhead Switch Replacement Program – SCADA	Number of OH SCADA switch		4	0	9	11	0	0

[25] SDG&E does not currently track units at the RAMP activity level and is unable to provide units for all activities.

ID	Control/Mitigation Name	Units Description		Recorded Units[25]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C4-T2	Distribution Overhead Switch Replacement Program - Gang	Number of OH gang switch		2	0	11	14	0	0
C4-T3	Distribution Overhead Switch Replacement Program - Hook	Number of OH hookstick		15	0	59	73	0	0
C5	Management of Overhead Distribution Service (Non-CMP)	Number of OH distribution equipment		768	0	1,665	2,058	0	0
C6	Vegetation Management (non-HFTD)	Number of trims and removals		0	123,042	0	0	127,124	157,036
C7	Restoration of Service	Number of distribution equipment		2,814	0	6,759	8,349	0	0
C8	Avian Protection Program	Number of avian covers		22	0	255	315	0	0
C9	Underground Cable Replacement Program – Reactive	Number of cable circuit miles		243	0	96	120	0	0
C10-T1	Underground Cable Replacement Program (Proactive) – UG Feeder	Number of feeder cable circuit miles		0	0	3	3	0	0
C10-T2	Underground Cable Replacement Program (Proactive) - UG Branch	Number of branch cable circuit miles		0	0	90	112	0	0
C10-T3	Underground Cable Replacement Program (Proactive) – North Harbor Project	Number of cable feet		0	0	38,446	47,492	0	0
C11	Tee Modernization Program	Number of tee sets		75	0	384	474	0	0
C12	Replacement of Live Front Equipment - Reactive	Number of live front terminators		0	0	30	39	0	0
C13	Replacement of Live Front Equipment - Proactive	Number of live front terminators		7	0	39	48	0	0
C14	DOE Switch Replacement	Number of DOE switch		26	0	80	99	0	0
C15	GO165 Corrective Maintenance Program – Underground	N/A		2,184	0	5,448	6,729	0	0

ID	Control/Mitigation Name	Units Description		Recorded Units[25]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C16	GO 165 Manhole, Vault Restoration Program	N/A		763	0	1,386	1,710	0	0
C17	Management of Underground Distribution Service (Non-CMP)	Number of underground equipment		472	0	3	3	0	0

ID	Control/Mitigation Name	Units Description		Recorded Units[26]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C18	Distribution Circuit Reliability	Number of switches		22	0	57	71	0	0
C19	Minor Distribution Substation Reliability Projects	Number of substation equipment		0	0	6	9	0	0
C20-T1	Substation Reliability for Distribution Components – Batiquitos 12kV Replacements	Number of substation equipment		0	0	26	33	0	0
C20-T2	Substation Reliability for Distribution Components – Bernardo 12kV Breakers Replacements	Number of substation equipment		0	0	13	16	0	0
C20-T3	Substation Reliability for Distribution Components – Chicarita 12kV Replacements	Number of substation equipment		0	0	19	23	0	0

[26] SDG&E does not currently track units at the RAMP activity level and is unable to provide units for all activities.

ID	Control/Mitigation Name	Units Description		Recorded Units[26]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C20-T4	Substation Reliability for Distribution Components – Laguna Niguel 12kV Replacements	Number of substation equipment		0	0	29	36	0	0
C20-T5	Substation Reliability for Distribution Components – Miramar 12kV Replacements	Number of substation equipment		0	0	14	17	0	0
C20-T6	Substation Reliability for Distribution Components – Scripps 12kV Replacements	Number of substation equipment		0	0	23	30	0	0
C20-T7	Substation Reliability for Distribution Components – Pacific Beach Bus Tie Replacements	Number of substation equipment		0	0	6	7	0	0
C20-T8	Substation Reliability for Distribution Components – Coronado 69/12kV Transformer Replacements	Number of substation equipment		0	0	2	2	0	0
C21	Distribution Substation Obsolete Equipment	Number of substation equipment		0	0	9	10	0	0
C22	Emergency Transformer and Switchgear	Number of transformer and switchgear		0	0	2	2	0	0
C23	San Mateo Substation Rebuild	Number of substation equipment		0	0	2	2	0	0
C24	Urban Substation Rebuild	Number of substation equipment		0	0	4	4	0	0
C25	Substation Inspection GO-174	Number of inspection and repairs		0	0	0	0	1,458	1,801
C26	Power Quality Monitor Deployment and Replacement	Number of PQ meters		0	0	27	34	0	0

ID	Control/Mitigation Name	Units Description		Recorded Units[26]		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C27	Distribution Substation SCADA Expansion	Number of relays		0	0	10	12	0	0
C28	Field SCADA RTU Replacement	Number of RTUs		25	0	69	86	0	0
C29	SCADA Capacitors	Number of SCADA capacitors		0	0	45	57	0	0
M1	Non-HFTD Wireless Fault Indicator	Number of wireless faults installed		0	0	4,080	5,040	0	0
M2	UG Fault Detection	Number of fault indicators		0	0	9	12	0	0

Table 6: Risk Control & Mitigation Plan - Quantitative Analysis Summary

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	Overhead Public Safety (OPS) Program	1,620.93	6	9,114	78
C2	GO 165 Pole Replacement Reinforcement	See Table 7			
C3	4 kV Modernization Program – Distribution	1,630.73	6	9,169	11
C4-T1	Distribution Overhead Switch Replacement Program - SCADA	1,631.78	6	9,175	101
C4-T2	Distribution Overhead Switch Replacement Program - Gang	1,631.67	6	9,174	190
C4-T3	Distribution Overhead Switch Replacement Program - Hook	1,629.56	6	9,163	241
C5	Management of Overhead Distribution Service (Non-CMP)	See Table 7			
C6	Vegetation Management (non-HFTD)	1,972.52	6	11,091	15
C7	Restoration of Service	See Table 7			
C8	Avian Protection Program	1,637.29	6	9,206	409
C9	Underground Cable Replacement Program – Reactive	See Table 7			
C10-T1	Underground Cable Replacement Program (Proactive) – UG Feeder	1,630.42	6	9,167	465
C10-T2	Underground Cable Replacement Program (Proactive) - UG Branch	1,613.53	6	9,072	166
C10-T3	Underground Cable Replacement Program (Proactive) – North Harbor Project	1,610.46	6	9,055	201
C11	Tee Modernization Program	1,561.76	6	8,781	938
C12	Replacement of Live Front Equipment - Reactive	See Table 7			

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C13	Replacement of Live Front Equipment - Proactive	1,632.13	6	9,177	6
C14	DOE Switch Replacement	1,632.20	6	9,130	60
C15	GO165 Corrective Maintenance Program – Underground	1,651.98	6	9,289	61
C16	GO 165 Manhole, Vault Restoration Program	1,634.10	6	9,188	27
C17	Management of Underground Distribution Service (Non-CMP)	See Table 7			
C18	Distribution Circuit Reliability	1,632.20	6	9,170	15
C19	Minor Distribution Substation Reliability Projects	See Table 7			
C20-T1	Substation Reliability for Distribution Components – Batiquitos 12 kV Replacements	1,630.47	6	9,168	34
C20-T2	Substation Reliability for Distribution Components – Bernardo 12kV Breakers Replacements	1,631.20	6	9,172	146
C20-T3	Substation Reliability for Distribution Components – Chicarita 12 kV Replacements	1,630.48	6	9,168	60
C20-T4	Substation Reliability for Distribution Components – Laguna Niguel 12 kV Replacements	1,629.52	6	9,162	45
C20-T5	Substation Reliability for Distribution Components – Miramar 12kV Replacements	1,631.22	6	9,172	101

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C20-T6	Substation Reliability for Distribution Components – Scripps 12kV Replacements	1,630.08	6	9,165	25
C20-T7	Substation Reliability for Distribution Components – Pacific Beach Bus Tie Replacements	1,630.93	6	9,170	81
C20-T8	Substation Reliability for Distribution Components – Coronado 69/12kV Transformer Replacements	1,632.07	6	9,177	12
C21	Distribution Substation Obsolete Equipment	1,631.77	6	9,175	8
C22	Emergency Transformer and Switchgear	-	-	-	-
C23	San Mateo Substation Rebuild	1,630.78	6	9,169	15
C24	Urban Substation Rebuild	1,630.42	6	9,167	63
C25	Substation Inspection GO-174	See Table 7			
C26	Power Quality Monitor Deployment and Replacement	See Table 7			
C27	Distribution Substation SCADA Expansion	See Table 7			
C28	Field SCADA RTU Replacement	1,632.20	6	9,169	91
C29	SCADA Capacitors	1,630.88	6	9,170	31
M1	Non-HFTD Wireless Fault Indicator	See Table 7			
M2	UG Fault Detection	See Table 7			

Table 7-SDG&E MP: Risk Control & Mitigation Plan - Quantitative Analysis Summary for RSE Unavailability

ID	Control/Mitigation Name	RSE Unavailability Rationale
C2	GO165 Pole Replacement Reinforcement	SDG&E performs these activities in accordance with CPUC General Order 165 and has been doing so for many years. Therefore, SDG&E does not have reliable data that can be used to estimate the increase in risk if the GO165 program were ceased. There is no comparable data that could be used to provide such an estimate, because each utility runs their compliance programs differently. SME judgment is also unavailable, as any estimate solely would be built upon pure assumptions (*i.e.*, not on data or subject matter expertise and judgment) with no confidence to those estimates.
C5	Management of Overhead Distribution Service (Non-CMP)	SDG&E has not conducted an RSE analysis on this baseline control. This program represents mandated compliance and safety per CPUC General Order 95; Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). Therefore, it is not feasible for SDG&E to stop performing these activities. Similarly, SDG&E cannot reasonably estimate the rise in risk from not adhering to these programs, because there has never been a time when SDG&E has not remedied known imminent threats to its equipment. For similar reasons, there is also no comparable data. SME judgment is also unavailable, because any estimates solely would

ID	Control/Mitigation Name	RSE Unavailability Rationale
		be built upon assumptions and not on data or subject matter expertise and judgment.
C7	Restoration of Service	SDG&E, as a public utility, has an obligation to serve as a provider of last resort. This program represents mandated activity per Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). SDG&E therefore has not performed an RSE analysis because it is not feasible for SDG&E to stop performing this activity or to calculate the risk reduction benefits received from performing this activity. For similar reasons, there is also no comparable data to use in calculating an RSE. SME judgment would also be unavailable for performing an RSE, because any estimates solely would be built upon assumptions and not on data or subject matter expertise and judgment.
C9	Underground Cable Replacement Program – Reactive	SDG&E has an obligation to serve and this program replaces underground cable necessary to restore service to customers. This program represents mandated activity per; Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). SDG&E does not know the impacts of discontinuing this activity or to calculate the risk reduction benefits received from performing this activity, because it is not feasible for SDG&E to stop performing it. Similarly, there are also no comparable data or SME judgment to use in calculating an RSE, because any estimates solely would be built

ID	Control/Mitigation Name	RSE Unavailability Rationale
		upon assumptions and not on data or subject matter expertise and judgment.
C12	Replacement of Live Front Equipment - Reactive	SDG&E has not performed an RSE analysis on this activity. This control occurs when new business activities provide the opportunity to replace non-standard equipment. It is included in this RAMP chapter due to its distribution engineering nature and as information to the CPUC.
C17	Management of Underground Distribution Service (Non-CMP)	SDG&E has not conducted an RSE analysis on this baseline control. This program is a mandated compliance activity per CPUC General Order 128; Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). SDG&E cannot reasonably know the rise in risk from not adhering to these programs, because there has never been a time when SDGE did not remedy known imminent threats to its equipment. For similar reasons, there is also no comparable data. Therefore, it is not feasible for SDG&E to stop performing this activity.
C22	Emergency Transformer and Switchgear	SDG&E, as a public utility, has an obligation to serve as a provider of last resort. This program represents mandated activity per Cal. Pub. Util. Code §§ 451, 761, 762, 768, and 770 (Obligation to Serve). SDG&E therefore has not performed an RSE analysis because it is not feasible for SDG&E to stop performing this activity or to calculate the risk reduction benefits received from performing this activity.

ID	Control/Mitigation Name	RSE Unavailability Rationale
		For similar reasons, there is also no comparable data.
C25	Substation Inspection GO-174	SDG&E has not conducted an RSE analysis on this baseline control, because substation inspections are not a risk-reducing activity by themselves. This program is a mandated compliance activity per CPUC General Order 174; NERC Reliability Standards. The inspections determine if follow up work is needed; and if it is needed, SDG&E typically creates a program to address the need, as described above in C20.
C26	Power Quality Monitor Deployment and Replacement	SDG&E has not performed an RSE analysis, as the function of the control is to perform a routine operation that is foundational to monitor the system. This activity does not directly reduce risk but gives information to engineering and operations teams for real-time and planning purposes.
C27	Distribution Substation SCADA Expansion	This activity does not have an RSE because it is considered foundational to supporting daily mitigation efforts. Quantifying an RSE for such a 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. The activity supports various initiatives by providing better information to make risk-informed mitigation decisions. This activity does not directly reduce risk but gives information to engineering and operations.

ID	Control/Mitigation Name	RSE Unavailability Rationale
M1	Non-HFTD Wireless Fault Indicator	This mitigation does not have an RSE because it is considered foundational to supporting daily mitigation efforts. Quantifying an RSE for such a 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. It supports various initiatives by providing better information to make risk-informed mitigation decisions. This activity does not directly reduce risk but gives information to engineering and operations.
M2	UG Fault Detection	This mitigation does not have an RSE because it is considered foundational to supporting daily mitigation efforts. Quantifying an RSE for such a 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. It supports various initiatives by providing better information to make risk-informed mitigation decisions. This activity does not directly reduce risk but gives information to engineering and operations.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the risk control and mitigation plan for the Electric Infrastructure Integrity risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for SDG&E's risk control and mitigation plan also considered possible modifications and constraints, such as budget and resources.

A. A1 – Customer Owned E-Structure Reconfigure

"Enclosed" structures are electric facilities that contain a non-pad mount transformer located at ground level on customer property enclosed by a customer fence. They vary in state of repair but generally have exposed or aged components. Moving these transformers to pad mount or overhead facilities will mitigate the risk of exposed components. This project is not currently included in SDG&E's risk control and mitigation plan, given the minimal history of issues, challenges with requiring modifications by customers, obtaining property easements, and minimal reliability benefit.

B. A2 – Modernize Manual Switches

To increase reliability on the distribution system and enhance optimal reliability, SDG&E considered a program that would replace every overhead and underground manual distribution switch within its system with a SCADA switch. These enhancements would provide further visibility of the distribution system and improve situational awareness. The program would consist of prioritizing work by starting with circuits that have the highest customer count and replacing every single manual switch to a SCADA switch. This project is not currently included in SDG&E's risk control and mitigation plan for this risk, given it does not directly impact public safety, and the associated cost to perform such a replacement on every switch would provide diminishing returns for reliability and in many situations be redundant. Rather than proposing a program to replace all manual distribution switches at this time, SDG&E instead put forth a plan for strategic, prioritization-targeted replacement. SDG&E's Enterprise Asset Management – Distribution program, as presented in the risk control and mitigation plan will allow SDG&E to identify which assets have a higher likelihood of failure. Based on this information, asset replacement strategies would be evaluated, prioritized and implemented to manage the asset in a manner that aligns with SDG&E's overall risk management strategy,

supports risk-informed platform for managing assets, and reinforces safe operations, maintenance and proactive replacement strategies.

C. A3 – Avian Protection Program

Bird and other wildlife contact on overhead distribution facilities must closely be managed to protect wildlife from accidental death, prevent electric outages and utility facility damage, and to prevent regulatory impacts (*e.g.*, fines). Expand avian protection equipment installation and related procedures to install mitigations on all overhead equipment. This project is not currently included in SDG&E's risk control and mitigation plan for this risk, given it does not impact public safety, and SDG&E already requires installing covers in specific locations (*e.g.*, the Avian Protection Zone), in compliance with federal and state law.

Table 8: Alternative Mitigation Plan - Recorded and Forecast Dollars Summary[27]
(Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Customer Owned E-Structure Reconfigure	714	882	0	0
A2	Modernize Manual Switches	64,767	80,004	0	0
A3	Avian Protection Program	10,347	12,783	0	0

Table 9: Alternative Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
A1	Customer Owned E-Structure Reconfigure	Number of E-Structures		11	14	0	0
A2	Modernize Manual Switches	Number of switches		399	492	0	0
A3	Avian Protection Program	Number of poles		8,463	10,455	0	0

[27] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

Table 10: Alternative Mitigation Plan - Quantitative Analysis Summary
(Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast				
		Total Dollars[28]	LoRE	CoRE	Risk Score	RSE
A1	Customer Owned E-Structure Reconfigure	840	1,632.18	6	9,177	2
A2-T1	Modernize Manual Switches - OH	33,896	1,629.48	6	9,162	12
A2-T2	Modernize Manual Switches - UG	42,300	1,631.44	6	9,173	2
A3	Avian Protection Program	12,173	1,631.01	6	9,171	15

[28] The total dollars used to calculate RSE values equal the sum of forecasted O&M and Capital.

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Appendix A: Summary of Elements of the Risk Bow Tie

Electric Infrastructure Integrity: Summary of Elements of the Risk Bow Tie

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
SDG&E-2-C1	Overhead Public Safety (OPS) Program	DT.1, DT.2, DT.3, DT.6 PC.1, PC.2
SDG&E-2-C2	GO165 Pole Replacement Reinforcement	DT.1, DT.2, DT., DT.5, DT.6, DT.7 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
SDG&E-2-C3	4kV Modernization Program – Distribution	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7 PC.1, PC.2
SDG&E-2-C4	Distribution Overhead Switch Replacement Program	DT.1, DT.2, DT.3, DT.4 PC.1, PC.2
SDG&E-2-C5	Management of Overhead Distribution Service (Non-CMP)	DT1, DT.2, DT.3, DT.6, DT.7 PC.1, PC.2
SDG&E-2-C6	Vegetation Management (non-HFTD)	DT.3, DT.7 PC.1, PC.2, PC.3, PC.4
SDG&E-2-C7	Restoration of Service	DT.1, DT.2, DT.3, DT.5, DT.6, DT.7 PC.2, PC.3, PC.6
SDG&E-2-C8	Avian Protection Program	DT.6 PC.2, PC.3, PC.4, PC.6
SDG&E-2-C9	Underground Cable Replacement Program – Reactive	DT.1, DT.2, DT.3, DT.7 PC.2, PC.6
SDG&E-2-C10	Underground Cable Replacement Program – Proactive	DT.1, DT.2, DT.3, DT.5, DT.7 PC.2, PC.6
SDG&E-2-C11	Tee Modernization Program	DT.1, DT.2, DT.3, DT.5, DT.7 PC.2, PC.6
SDG&E-2-C12	Replacement of Live Front Equipment - Reactive	DT.1, DT.6 PC.1, PC.2
SDG&E-2-C13	Replacement of Live Front Equipment - Proactive	DT.1, DT.6 PC.1, PC.2
SDG&E-2-C14	DOE Switch Replacement	DT.1, DT.2, DT.3 PC.1, PC.2
SDG&E-2-C15	GO165 Corrective Maintenance Program – Underground	DT.1, DT.2, DT.3, DT.5, DT.7 PC.1, PC.2

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
SDG&E-2-C16	GO165 Manhole, Vault Restoration Program	DT.1, DT.1, DT.3, DT.5, DT.7 PC.1, PC.2, PC.3, PC.4
SDG&E-2-C17	Management of Underground Distribution Service (Non-CMP)	DT.1, DT.2, DT.3, DT.5, DT.7 PC.1, PC.2
SDG&E-2-C18	Distribution Circuit Reliability	DT.1, DT.2 PC.2
SDG&E-2-C19	Minor Distribution Substation Reliability Projects	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2,
SDG&E-2-C20	Substation Reliability for Distribution Components	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2
SDG&E-2-C21	Distribution Substation Obsolete Equipment	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2
SDG&E-2-C22	Emergency Transformer and Switchgear	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2, PC.6
SDG&E-2-C23	San Mateo Substation Rebuild	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2,
SDG&E-2-C24	Urban Substation Rebuild	DT.1, DT.2, DT.3, DT.4, DT.5 PC.2
SDG&E-2-C25	Substation Inspection GO-174	DT.1, DT.2, DT.3, DT.4, DT.5, PC.1, PC.2
SDG&E-2-C26	Power Quality Monitor Deployment and Replacement	DT.5, PC.3, PC.6
SDG&E-2-C27	Distribution Substation SCADA Expansion	DT.5 PC.3, PC.6
SDG&E-2-C28	Field SCADA RTU Replacement	DT.1, DT.2, DT.5 PC.2, PC.6
SDG&E-2-C29	SCADA Capacitors	DT.4, DT.3, DT.5, PC.1, PC.2
SDG&E-2-M1	Non-HFTD Wireless Fault Indicator	DT.5, PC.3, PC.6
SDG&E-2-M2	UG Fault Detection	DT.5, PC.3, PC.6

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

Appendix B: Quantitative Analysis Source Data References

The Settlement Decision directs the utility to identify potential consequences of a risk event using available and appropriate data.[29] The list below provides the inputs used as part of this assessment.

San Diego Gas & Electric, Annual Serious Injuries and Fatalities (SIFs) Incidents

- 2015 –2020 internal SIF data

San Diego Gas & Electric, Electric Reliability Database

- 2016 –2020 internal reliability data

[29] D.18-12-014, Attachment A at A-8 (Identification of Potential Consequences of Risk Event).

Risk Assessment and Mitigation Phase

(Chapter SDG&E Risk-3)

Incident Related to the High Pressure System (Excluding Dig-in)

May 17, 2021

TABLE OF CONTENTS

RISK: INCIDENT RELATED TO THE HIGH PRESSURE SYSTEM (EXCLUDING DIG-IN)

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 Incident Related to the High Pressure System (Excluding Dig-In) (High Pressure Incident) risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter SDG&E-RAMP-B of this RAMP Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter SCG/SDGE RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs and cost estimates are provided for years 2022-2024, as further discussed in Chapter SCG/SDG&E RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are

---

[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[2] *See* D.18-12-014 at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

provided where those costs are available and within the scope of the analysis required in this RAMP Report.

Throughout this 2021 RAMP Report activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's High Pressure Incident risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters SCG/SDG&E RAMP-A and SCG/SDG&E RAMP-C, SDG&E has endeavored to calculate a Risk Spend Efficiencies (RSE) for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or SME opinion exists to calculate the RSE, SDG&E has included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

SDG&E has also included a qualitative narrative discussion of certain risk mitigation activities that would otherwise fall outside of the RAMP Report's requirements, to aid the Commission and stakeholders in developing a more complete understanding of the breadth and quality of the Company's mitigation activities. These distinctions are discussed in the applicable control and mitigation narratives in Section III and/or IV.

A. Risk Overview

The SDG&E transmission and distribution 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 524 miles of high-pressure pipelines in its service territory, which includes the 218 miles of transmission defined pipelines.

---

[3] *Id*. at 16.

[4] *Id.* at 17.

[5] *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

The U.S. Department of Transportation Pipeline and Hazardous Materials and Safety Administration (PHMSA) and American Society of Mechanical Engineers (ASME) pipeline integrity standard B31.8S,[6] "Managing System Integrity of Gas Pipelines" categorizes nine types of threats that could lead to a high-pressure pipeline incident. The Third Party Damage threat is addressed in the Excavation Damage (Dig-In) on the Gas System chapter. The eight types of threats covered in this chapter include:

1) External Corrosion
2) Internal Corrosion
3) Stress Corrosion Cracking
4) Manufacturing Defect
5) Construction & Fabrication
6) Outside Forces
7) Incorrect Operation
8) Equipment Threat

These factors, also known as potential risk drivers, can work independently and/or interactively together. When a gas pipeline has a loss of product, PHMSA categorizes it as a non-hazardous release of gas or a leak. Specifically, 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 into a confined space. The safety concern of the leak is addressed by SDGE's leak indication prioritization and repair schedule procedures. In most cases, a pipe with a leak will continue to transport gas, and therefore is not considered a pipeline "failure" using the definition in ASME B31.8S.

However, in some instances a pipeline may be weakened to the extent that the pipe can overload and "break open" or burst apart. This is referred to as a pipeline rupture and considered a failure of the pipeline, as it can no longer function as intended. This type of failure could

[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.

release a high level of energy, and sometimes ignite, resulting in damage to the surrounding area, injury, and/or loss of life.

The leak versus rupture failure mode is generally dependent on the stress to the pipe, the pipe material properties, and the geometry of the latent weak point on a pipeline. As a general rule, the rupture failure mode does not occur on a pipeline operating under 30% of Specified Minimum Yield Strength (SMYS), unless there is an egregious pipe anomaly acting as an initiation growth point and there are interacting threats involved.

Due to the nature of a potential rupture failure mode, this risk category discusses the potential consequences of a rupture event occurring on the Company's high-pressure gas system. The extent of damage of an incident can be modeled through the use of a potential impact radius (PIR) around a pipe. PHMSA has incorporated the PIR into its methods for determining a high consequence area (HCA) along a pipeline right-of-way. In addition, the presence of HCA miles in a high-pressure system can indicate certain consequences of an incident to the public because HCAs consist of highly populated areas and identified sites where people regularly gather or live.

Applying mitigative measures as outlined in Title 49 of the Code of Federal Regulations (CFR) Section (§) 192.935, such as increased inspections and assessments, additional maintenance, participation in a one-call system, community education and consideration of the installation of additional remote-controlled valves, can help reduce the likelihood or consequence of a rupture event in both high consequence and lesser populated areas.

The SDG&E High Pressure Incident risk is similar to the SoCalGas High Pressure Incident risk because the threats are the same and the system is managed in an integrated manner. Since the high-pressure pipeline system is managed by two operating departments (Transmission and Distribution), it is difficult to identify costs solely dedicated to high pressure pipelines managed by Distribution Operations. Therefore, the costs in this risk chapter are primarily related to the Transmission Operations department.

B. Risk Definition

For purposes of this RAMP Report, SDG&E's High Pressure Incident risk is defined as the risk of failure of a high-pressure pipeline,[7] which results in serious injuries, or fatalities,

[7] Maximum Allowable Operating Pressure (MAOP) at higher than 60 psig.

and/or damages to the infrastructure. For purposes of this chapter, the failure event would be the result of eight threats identified by the Department of Transportation Pipeline and Hazardous Materials and Safety Administration. The medium pressure assets operating at a pressure of 60 pounds per square inch gauge (psig) and less are included in the Risk Assessment Mitigation Phase (RAMP) chapter for incidents involving medium pressure pipelines. Similarly, events caused by third party dig-in damage are included in the Excavation Damage (Dig-in) on the Gas System risk chapter.

C. Scope

Table 1 below provides what is considered in and out of scope for the High Pressure Incident risk in this RAMP Report.

Table 1: Risk Scope

In-Scope:	The risk of damage, caused by a high-pressure system (maximum allowable operating pressure (MAOP) greater than 60 psig) failure event, which results in consequences such as injuries, fatalities or outages.
Data Quantification Sources:	SDG&E engaged internal data sources for the calculation surrounding risk reduction; if data was insufficient, however, Industry or National data was supplemented and adjusted to fit the risk profile associated with the operating locations and parameters of the utilities. For example, certain types of incident events have not occurred within the SDG&E service territory; therefore, expanding the quantitative needs to encompass industry data where said incident(s) have been recorded to provide a proximate is justified in establishing a baseline of risk and risk addressed by activities. See Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision,[8] this section describes the risk bow tie, possible Drivers, potential Consequences, and the risk score for the High Pressure Incident risk.

A. Risk Bow Tie and Risk Event Associated with the Risk

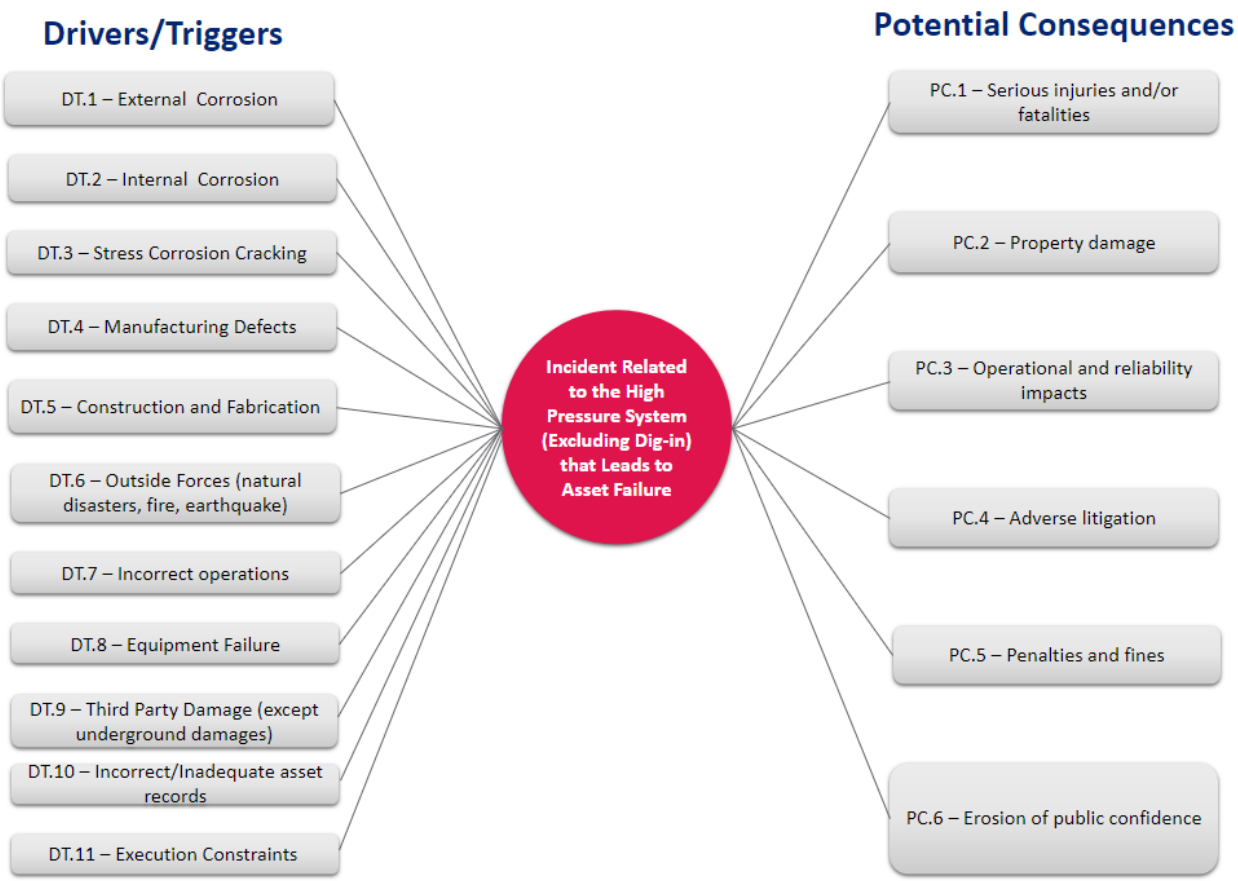
The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision[9] instructs the utility to include a risk bow tie illustration for each risk included in RAMP. As

[8] D.18-12-014 at 33 and Attachment A, A-11 ("Bow Tie").

[9] *Id.* at Attachment A, A-11 ("Bow Tie").

illustrated in the risk bow tie shown below in Figure 1, the risk event (center of the bow tie) is a High Pressure Incident that Leads to Asset Failure, the left side of the bow tie illustrates drivers/triggers that lead to the High Pressure Incident that Leads to Asset Failure, and the right side shows the potential consequences of the High Pressure Incident that Leads to Asset Failure, SDG&E applied 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 addressed is provided in Appendix A.

Figure 1: Risk Bow Tie



B. Cross-Functional Factors

The following cross-functional factors have programs and/or projects that affect one or more of the drivers and/or consequences of this risk: Climate Change Adaptation, Energy Systems Resilience, and GHG Emissions; Emergency Preparedness and Response and Pandemic; Foundational Technology Systems; Physical Security; Records Management; Safety Management Systems; and Workforce Planning / Quality Workforce.

C. Potential Drivers/Triggers[10]

The Settlement Decision[11] instructs the utility to identify which element(s) of the associated risk Bow Tie each mitigation addresses. When performing the risk assessment for the HP Incident risk, SDG&E identified potential leading indicators, referred to as drivers or triggers. These include, but are not limited to:

- **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. [12]
- **DT.2 – Internal Corrosion:** Deterioration of the interior of an asset as a result of the environmental conditions on the inside of the pipeline. [13]
- **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 pipeline that together reduces the pressure-carrying capability of the pipe. [14]
- **DT.4 – Manufacturing Defect:** Attributable to a material defect 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:** Attributable to the construction methodology applied during the installation of pipeline components specifically based on the vintage of the construction standards, fabrication techniques (welding, bending, etc.) and overall guiding regulations.
- **DT.6 – Outside 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, and high winds.

---

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

[11] D.18-12-014 at Attachment A, A-11 ("Bow Tie").

[12] *See* AMSE B31.8S.

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

[14] *See* AMSE B31.8S.

- **DT.7 – Incorrect Operations:** May include a pipeline incident attributed to insufficient or incorrect operating procedures or the failure to follow a procedure.
- **DT.8 – Equipment Failure:** Attributable to malfunction of a component, including but not limited to regulators, valves, meters, flanges, gaskets, collars, couples, etc.
- **DT.9 – Third-Party Damage (except for underground damages[9]):** Attributable to outside force damage other than excavation damage or natural forces such as damage by car, truck or motorized equipment not engaged in excavation, etc.
- **DT.10 – Incorrect/Inadequate Asset Records:** The use of inaccurate or incomplete information that could result in the failure to (1) construct, operate, and maintain SDG&E's pipeline system safely and prudently; or (2) to satisfy regulatory compliance requirements.
- **DT.11 – Execution Constraints:** Events (excluding those covered by outside force damages) that impact the Company's ability to perform as anticipated. Examples include but are not limited to: materials and 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

Potential consequences[15] are listed to the right side of the risk Bow Tie illustration provided above. If one or more of the drivers/triggers listed above were to result in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

- PC.1 – Serious Injuries and/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

[15] D.18-12-014 at 16 and Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

These potential consequences were used in the scoring of the High Pressure Incident risk that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[16] Chapter SCG/SDG&E RAMP-C of this RAMP Report explains the Risk Quantitative Framework which underlies this Chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[17]

	LoRE	CoRE	Risk Score
Incident Related to the High Pressure System	0.88	2,301	2,029

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, where available, as well as available and appropriate data (*e.g.*, Pipeline and Hazardous Materials Safety Administration data).[18] Historical PHMSA data and internal SME input was used to estimate the frequency of incidents. For additional sources refer to Appendix B.

III. 2020 CONTROLS

This section "[d]escribe[s] the controls or mitigations currently in place" as required by the Settlement Decision.[19] The activities in this section were in place as of December 31, 2020. Controls that will continue as part of the control and mitigation plan (Plan) are identified in Section IV.

Pursuant to 49 CFR Part 192 Subpart O, HCAs must be identified by the Company and are areas along the gas transmission right-of-way where there is increased building density or a proximity to certain types of gathering locations where there is an expected concentration of population. The establishment of areas of known greater consequential impact to the public

---

16 D.18-12-014 at Attachment A, A-11 ("Calculation of Risk").

17 The term "pre-mitigation analysis," in the language of the Settlement Decision (Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score")), refers to required pre-activity analysis conducted prior to implementing control or mitigation activity.

18 D.18-12-014 at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

19 Settlement Decision at 33.

institutes a different risk profile associated with HCA pipe as compared to high pressure pipe not located in an HCA. Therefore, SDG&E set out to appropriately tranche controls and mitigations, where feasible, for the determination of costs and activity scope. For the majority of the controls and mitigations subject to the HCA and non-HCA tranching, the work performed in the HCA is the same as in a non-HCA and as such, there is only a single description of the control and mitigation. These are identified by C#-T1: HCA; C#-T2: non-HCA nomenclature after the control name. Because SDG&E does not track costs or scope for high pressure activities by HCA and non-HCA, a fixed 33% multiplier for HCA and a 67% multiplier for non-HCA (representing to ratio of total miles of pipe located in HCAs versus in non-HCAs) was applied to costs and scope for activities within these two tranches, unless otherwise noted. SDG&E recognizes that this mileage methodology is only an approximation and where this assumption was deemed too gross (*i.e.,* unreliable), the tranche was not applied to an activity.

A. C1: Cathodic Protection (CP) – Capital

- **C1-T1: HCA; C1-T2: non-HCA**

Cathodic protection activities consist of the planning, installation, construction, and closeout of rectifiers/deep well anode beds, remote power, and pipeline coating replacements on transmission pipelines. Rectifiers/deep well anode beds are utilized to 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 lower the amount of CP current needed to protect the newly recoated portion of pipeline. These activities are necessary to maintain or improve the pipelines CP system, extend the life of the pipeline, and maintain CP compliance prescribed by 49 CFR Subpart I – Requirements for Corrosion Control Section 192.463:

- Each cathodic protection system required by this subpart must provide a level of cathodic protection that complies with one or more of the applicable criteria contained in appendix D of this part. If none of these criteria is applicable, the cathodic protection system must provide a level of cathodic protection at least equal to that provided by compliance with one or more of these criteria.

- Each segment of metallic pipe that replaces pipe removed from a buried or submerged pipeline because of external corrosion must have a properly prepared surface and must be provided with an external protective coating that meets the requirements of § 192.461.
- Each segment of metallic pipe that replaces pipe removed from a buried or submerged pipeline because of external corrosion must be cathodically protected in accordance with this subpart.
- Except for cast iron or ductile iron pipe, each segment of buried or submerged pipe that is required to be repaired because of external corrosion must be cathodically protected in accordance with this subpart.

B. C2: Cathodic Protection – Maintenance

- **C2-T1: HCA; C2-T2: non-HCA**

Cathodic protection maintenance activities consist of annual electrical test station (ETS) reads, bi-monthly current source inspections and annual rectifier maintenance on transmission pipelines. The mentioned activities involve the following: read/record voltage and verify compliance, inspect ETS for signs of damage, verifying ID tags & test leads for correct information and good condition, verify rectifier proper operation, read/record voltage and amperage across rectifier, clean and tighten all current carrying connections on rectifier, clean all ventilating screens on rectifier units, calibrate voltage and amperage meters on rectifier, repair any damaged wires, check all fuses/circuit breakers, clean off rectifier unit, replace rectifier ID tags, and diagnose and troubleshoot substandard conditions or out of tolerance reads. These activities are necessary to maintain or improve the pipelines CP system, extend the life of the pipeline, and maintain CP compliance prescribed by 49 CFR Subpart I – Requirements for Corrosion Control – External Corrosion Control: Monitoring Section 192.465:

- Each pipeline that is under cathodic protection must be tested at least once each calendar year, but with intervals not exceeding 15 months, to determine whether the cathodic protection meets the requirements of § 192.463.
- Each cathodic protection rectifier or other impressed current power source must be inspected six times each calendar year, but with intervals not exceeding 2 ½ months, to ensure that it is operating.

C. C3: Leak Repair

- **C3-T1: HCA; C3-T2: non-HCA**

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 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 uphold public safety, maintain system reliability and meet regulatory requirements prescribed by 49 CFR Part 192 Subpart M – Maintenance Section 192.717:

- Each permanent field repair of a leak on a transmission line must be made by:
  - Removing the leak by cutting out and replacing a cylindrical piece of pipe; or
  - Repairing the leak by one of the following methods:
    - Install a full encirclement welded split sleeve of appropriate design unless the transmission line is joined by mechanical couplings and operates at less than 40 percent of SMYS.
    - If the leak is due to a corrosion pit, install a properly designed bolt-on-leak clamp.
    - If the leak is due to a corrosion pit and on pipe of not more than 40,000 psi (267 Megapascals) SMYS, fillet weld over the pitted area a steel plate patch with rounded corners, of the same or greater thickness than the pipe, and not more than one-half of the diameter of the pipe in size.
    - Apply a method that reliable engineering tests and analyses show can permanently restore the serviceability of the pipe.

D. C4: Pipeline Relocation/Replacement

- **C4-T1: HCA; C4-T2: non-HCA**

Pipeline relocation and replacement activities consist of planning, installation, construction, and closeout of pipeline reroutes triggered by either weather-related external forces, municipality requests, right-of-way agreements, or class location changes. Pipeline replacements due to change in operating class are time sensitive and must be remediated within 24 months of the class location change. These relocation and replacement activities are

necessary to reduce the potential for pipeline damage, uphold public safety and maintain pipeline access.

E. C5: Shallow/Exposed Pipe Remediations

- **C5-T1: HCA; C5-T2: non-HCA**

Shallow or exposed pipe 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） and/or additional earth coverage are installed to prevent damage to exposed/shallow pipe caused by corrosion, third party damages, erosion, or other external forces. These activities are necessary to uphold public safety, reduce the potential for pipeline damage and extend the life of the pipeline.

F. C6: Pipeline Maintenance

- **C6-T1: HCA; C6-T2: non-HCA**

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 any changes in population density, verifying ID tags for correct information and good condition, partially operating valves, inspecting & servicing actuators, lubricating valves, checking for atmospheric corrosion, testing for combustible gas, inspecting covers, ventilation systems, structural condition of vaults, vault ladders, steps, and handrails. These activities are necessary to maintain or improve the pipeline system, extend the life of the pipeline, maintain pipeline compliance prescribed by 49 CFR Part 192 Subpart M – Maintenance Sections 192.745 and 192.749:

- Each transmission line valve that might be required during any emergency must be inspected and partially operated at intervals not exceeding 15 months, but at least once each calendar year.
- Each operator must take prompt remedial action to correct any valve found inoperable unless the operator designates an alternative valve.
- Each vault housing pressure regulating and pressure limiting equipment and having a volumetric internal content of 200 cubic feet (5.66 cubic meters) or more, must be inspected at intervals not exceeding 15 months, but at least once

each calendar year, to determine that it is in good physical condition and adequately ventilated.

- If gas is found in the vault, the equipment in the vault must be inspected for leaks, and any leaks found must be repaired.
- The ventilating equipment must also be inspected to determine that it is functioning properly.
- Each vault cover must be inspected to assure that it does not present a hazard to public safety.

G. C7: Compressor Station Physical Security

Compressor Station Physical Security activity consists of a security guard shack located at the Moreno Compressor Station. This activity is necessary to harden the security at the Moreno Compressor Station, resulting in increased personnel safety and reduction of potential system damage.

H. C8: Compressor Stations - Capital

Compressor station activities consist of the planning, installation, construction and closeout of compressor upgrades, pipe replacements, valve replacements, equipment upgrades including water, oil, and air on transmission pipeline systems. These activities are necessary to maintain or improve system reliability, extend equipment and system life, and uphold public safety.

I. C9: Compressor Station - Maintenance

Compressor Station Maintenance activities consist of compressor unit inspections, primary and backup power generators 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 Stations equipment and pipeline systems. The above mentioned activities involves the following; complete periodic performance analysis and time-based overhauls on main compressor units and generators, function testing of 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 and gas quality systems, verifying ID tags for correct information and good condition, operating valves,

inspecting & servicing actuators, lubricating 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 the pipeline, maintain pipeline and station compliance prescribed by 49 CFR Part 192 Subpart M – Maintenance Sections 192.731:

- Except for rupture discs, each pressure relieving device in a compressor station must be inspected and tested in accordance with §§ 192.739 and 192.743 and must be operated periodically to determine that it opens at the correct set pressure.
- Any defective or inadequate equipment found must be promptly repaired or replaced.
- Each remote-control shutdown device must be inspected and tested at intervals not exceeding 15 months, but at least once each calendar year, to determine that it functions properly.

J. C10: Measurement & Regulation – Capital

- **C10-T1: HCA; C10-T2: non-HCA**

Measurement & Regulation activities consist of the planning, installation, construction, and closeout of redesigns/upgrades for producer vessels, meters, stations, company owned facilities at customer meter set assembly's and control valve stations on transmission pipeline systems. These activities are necessary to maintain or improve system reliability, extend equipment and system life, and uphold public safety.

K. C11: Measurement & Regulation – Maintenance

- **C11-T1: HCA; C11-T2: non-HCA**

Measurement & Regulation Stations activities consist of valve inspections, vault inspections, producer station inspection, pressure limiting station inspections, relief valve inspections and actuator/controller and regulator inspections on transmission pipelines. The mentioned activity involves the following; verifying ID tags for correct information and good condition, partially operating valves, inspecting & servicing actuators, lubricating valves, check for atmospheric corrosion, test for combustible gas, inspect covers, ventilation systems, structural condition of vaults, vault ladders, steps, handrails, 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, inspect mummy cage, 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 the pipeline, maintain pipeline compliance prescribed by 49 CFR Part 192 Subpart M – Maintenance Section 192.739:

- Each pressure limiting station, relief device (except rupture discs), and pressure regulating station and its equipment must be subjected at intervals not exceeding 15 months, but at least once each calendar year, to inspections and tests to determine that it is:
  - In good mechanical condition;
  - Adequate from the standpoint of capacity and reliability of operation for the service in which it is employed;
  - Except as provided in paragraph (b) of this section, set to control or relieve at the correct pressure consistent with the pressure limits of § 192.201(a); and
  - Properly installed and protected from dirt, liquids, or other conditions that might prevent proper operation.
- For steel pipelines whose MAOP is determined under § 192.619(c), if the MAOP is 60 psi (414 kPa) gage or more, the control or relief pressure limit is as follows:

If the MAOP produces a hoop stress that is:	**Then the pressure limit is:**
Greater than 72 percent of SMYS	MAOP plus 4 percent.
Unknown as a percentage of SMYS	A pressure that will prevent unsafe operation of the pipeline considering its operating and maintenance history and MAOP.

L. C12: Odorization

Odorization activities consist of monthly odor intensity testing on transmission pipelines. The mentioned activity involves the following: testing gas to verify a recognizable amount of gas odor is detectable, test for any harmful components and calibrate appropriate equipment intervals. These activities are necessary to uphold public safety, maintain system reliability, meet regulatory requirements prescribed by 49 CFR Part 192 Subpart L – Operations Section 192.625:

- A combustible gas in a distribution line must contain a natural odorant or be odorized so that at a concentration in air of one-fifth of the lower explosive limit, the gas is readily detectable by a person with a normal sense of smell.
- To assure the proper concentration of odorant in accordance with this section, each operator must conduct periodic sampling of combustible gases using an instrument capable of determining the percentage of gas in air at which the odor becomes readily detectable. Operators of master meter systems may comply with this requirement by:
    - Receiving written verification from their gas source that the gas has the proper concentration of odorant; and
    - Conducting periodic "sniff" tests at the extremities of the system to confirm that the gas contains odorant.

M. C13: Security & Auxiliary Equipment

Security & auxiliary equipment activities consist of the planning, installation, construction and closeout of security cameras, lighting, gates, locks, and equipment upgrades such as pipe supports, analyzers and SCADAs on transmission pipeline facilities. These activities are necessary to harden the security at pressure limiting stations, valve stations, compressor stations, increase personnel safety and reduce the potential of system damage.

N. C14: Engineering, Oversight and Compliance Review

Engineering, Oversight and Compliance Review activities consist of utility plan checks and review of all completed compliance orders on transmission pipeline systems. These activities are necessary to avoid third party damage, uphold the structural integrity of the pipeline, maintain feasible access to the pipeline system, verify we are meeting all regulatory standards prescribed by 49 CFR Part 192, complying to company issued standards, extend the life of the pipeline, uphold public safety, and maintain system reliability.

O. C15: Integrity Assessments & Remediation

- **C15-T1: Transmission Integrity Management Program (TIMP)**

Through the TIMP, per 49 CFR Part 192 Subpart O, SDG&E is federally mandated to identify threats to transmission pipelines in HCAs, determine the risk posed by these threats, schedule prescribed assessments to evaluate these threats, collect information about the condition of the pipelines, and take actions to minimize applicable threat and integrity concerns to reduce

the risk of a pipeline failure. At a minimum of every seven years, transmission pipelines located within HCAs are assessed using methods such as In-Line-Inspection (ILI), Direct Assessment, or Pressure Test, and remediated as needed.

Detected anomalies are classified and addressed based on severity with the most severe requiring immediate action. Remediations reduce risk by addressing areas where corrosion, weld or joint failure, or other forces are occurring or have occurred. Post-assessment pipeline repairs, when appropriate, and replacements are intended to increase public and employee safety by reducing or eliminating conditions that might lead to an incident.

ILI is the primary assessment method used to identify potential pipeline integrity threats. When a threat is identified, SDG&E acts in accordance with 49 CFR § 192.933 to reduce risk. These actions involve removing a pipeline from service or reducing operating pressure. In cases where the assessment involves a pressure test that has failed, immediate remediation is also required as the pressure test cannot be completed until the pipeline is repaired.

TIMP reduces the risk of failure to the transmission system and on a continual basis evaluates the effectiveness of the program and scheduled assessments. TIMP Risk Assessment evaluates the Likelihood of Failure (LOF) using the nine threat categories (External Corrosion, Internal Corrosion, Stress Corrosion Cracking, Manufacturing, Construction, Equipment, Third Party Damage, Incorrect Operations, and Weather Related and Outside Force) for transmission pipelines located within an HCA. Pipeline operational parameters and the area near the pipeline are considered to evaluate Consequence of Failure (COF). The LOF multiplied by the COF produces the pipelines Relative Risk Score. Further information is collected about the physical condition of transmission pipelines through integrity assessments. Action is taken to address applicable threats and integrity concerns to increase the safety and preclude pipeline failures.

The number and types of TIMP activities vary from year to year and are based on the timing of previous assessments done on the same locations. Approximately 185 miles out of 218 miles of SDG&E's transmission pipelines are located in HCA areas.

- **C15-T2: Outside of High Consequence Area Assessments**

Because a pipeline may consist of segments located inside and outside of HCAs, SDG&E also assesses incidental non-HCA pipeline segments. Since SDG&E does not plan assessments by consequence area, the overall assessment and remediation activities and costs have been tranched by applying a seven-year average of historical HCA versus non-HCA miles assessed.

Additionally, in October of 2019, PHMSA issued final rule of Pipeline Safety: Safety of Gas Transmission Pipelines: MAOP Reconfirmation, Expansion of Assessment Requirements, and Other Related Amendments. Published as the first of three parts, this final rule updates sections of 49 CFR §§ 191 and 192 and federally mandates gas operators to update or implement procedures accordingly.

Pursuant to 49 CFR § 192.710, SDG&E is newly required to assess transmission pipelines in medium consequence areas (MCAs) and non-HCA Class 3 and 4 locations. At a minimum of every ten years, these transmission lines must be assessed using methods such as ILI, External Corrosion Direct Assessment (ECDA), and pressure testing. As with TIMP assessment, detected anomalies will be classified and addressed based on severity. Remediations reduce risk by addressing areas where corrosion, weld or joint failure, or other forces are occurring or has occurred. Post-assessment pipeline repairs, when appropriate, and replacement are intended to increase public and employee safety by reducing or eliminating conditions that might lead to an incident. When a threat is identified, SDG&E will act in accordance with 49 CFR §§ 192.485, 192.711, and 192.713 to reduce risk. These actions involve removing a pipeline from service or reducing operating pressure. In cases where the assessment involves a pressure test that has failed, immediate remediation is also required as the pressure test cannot be completed until the pipeline is repaired.

These assessments are incremental to TIMP and serve to further minimize the risk of failure to the transmission system. Taking into consideration the difference in the risk profiles of HCAs and non-HCAs, the evaluation of these segments is modeled after the TIMP risk assessment and prompts similar actions to address applicable threats and integrity concerns to increase safety and preclude pipeline failures.

The numbers and types of activities will vary from year to year and approximately 6 miles out of 218 miles of SDG&E's transmission pipelines are located in MCAs or non-HCA Class 3 and 4 locations.

P. C16: Pipeline Safety Enhancement Plan

The Pipeline Safety Enhancement Plan (PSEP) is an ongoing systematic effort to replace or pressure test all of the natural gas transmission pipelines that have not been tested or for which reliable records are not available as directed by the Commission in D.11-06-017 and later codified in California Public Utilities Code Sections 957 and 958. Separate from the testing or

replacing of pipeline, PSEP also includes a valve enhancement plan, as required by the Commission in D.11-06-017.[20]

The primary objectives of PSEP are to enhance public safety, comply with Commission directives, maximize cost effectiveness, and minimize customer and community impacts from these safety investments. As directed by the Commission, the program includes a risk-based prioritization methodology that prioritizes pipelines located in more populated areas ahead of pipelines located in less populated areas and further prioritizes pipelines operated at higher stress levels above those operated at lower stress levels. The PSEP is divided into two phases and each phase is further subdivided into two parts resulting in four separate phases, Phase 1A, Phase 1B, Phase 2A, and Phase 2B.

PSEP Phase 1A and Phase 1B both include projects that had recorded costs in 2020 and these phases are discussed below in this Section and denoted with a control ID. SDG&E's PSEP does not include any mileage for Phase 2A projects – those for pipelines that do not have sufficient documentation of a pressure test to achieve at least 125% of MAOP and are located in Class 1 and 2 of non-HCAs, and therefore Phase 2A is not discussed in this RAMP Report. SDG&E plans to initiate the implementation of Phase 2B projects during the TY 2024 GRC forecast period, and as such that phase is discussed below in Section IV and denoted with a mitigation ID (M1).

SDG&E's PSEP is comprised of projects with spending that is classified in this RAMP Report as either "refundable" or "GRC based." Cost recovery for refundable projects occurs outside of the TY 2024 GRC but SDG&E is including a discussion of these classes of projects in this RAMP Report to inform the Commission and stakeholders of these safety risk mitigating activities and to help eliminate potential confusion with projects for which SDG&E will be requesting cost recovery in the TY 2024 GRC. The refundable PSEP projects are not included in the Plan and the GRC based projects are included in the Plan.

1. C-16-T1: Phase 1A

Phase 1A encompasses replacing or pressure testing pipelines located in Class 3 and 4 locations and Class 1 and 2 locations in HCAs that do not have sufficient documentation of a pressure test to achieve at least 125% of the MAOP of the pipeline. For reference, determination

[20] D.11-06-017, Conclusion of Law 9 at 30, and Ordering Paragraph 8 at 32.

of the class of a pipeline is dependent on the type and density of dwellings and human activity within 220 yards of the pipeline. The majority of the pipeline mileage that has thus far been addressed falls within the Phase 1A category. Phase 1A projects are classified as refundable and are tranched to reflect pipeline replacement and hydrotesting projects.

- C-16-T1.1: Pipeline Replacement (Phase 1A, refundable, HCA)
- C-16-T1.2: Hydrotesting (Phase 1A, refundable, HCA)

2. C-16-T2: Phase 1B

The scope of Phase 1B is to replace pipelines installed prior to 1946 that are incapable of being assessed via inline smart inspection tools (non-piggable pipelines) with new pipe constructed using state-of-the-art methods and to modern standards, including current pressure test standards. For SDG&E, this control also addresses Phase 1B pipe through hydrotesting and replacement pursuant to the Line 1600 Test and Replace Plan. SDG&E began construction in 2020 pursuant to D.20-02-024 on replacement of certain sections of pipe and anticipates that substantial investments will be made in both the replacement and pressure testing of existing Line 1600 mileage during the 2022-2024 forecast period. The Line 1600 project is classified as refundable and is tranched to reflect pipeline replacement and hydrotesting projects and that projects may occur in both HCA and non-HCA areas.

- C-16-T2.1: L1600 Pipeline Replacement (Phase 1B, refundable, HCA)
- C-16-T2.2: L1600 Pipeline Replacement (Phase 1B, refundable, non-HCA)
- C-16-T2.3: L1600 Hydrotesting (Phase 1B, refundable, non-HCAs)

3. C-16-T3: Valve Enhancement Plan

The valve enhancement plan focuses on the modification or addition of valve infrastructure to identify, isolate, and contain escaping gas from transmission pipelines in the event of a pipeline rupture. The modifications include installing automated shut-off capability of the valves to enable a faster response time should a failure occur due to natural forces (such as natural disasters, fires, earthquakes, landslides), third party damage, vandalism, or other causes. Valve enhancement projects are classified as refundable and are tranched to reflect that projects may occur in both HCA and non-HCA areas.

- C-16-T3.1: Valve enhancement (refundable, HCA)

- C-16-T3.2: Valve enhancement (refundable, non-HCA)

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[21]

All of the activities discussed above in Section III, except for the PSEP related activities with cost recovery via a mechanism outside of the GRC, are expected to continue during the TY 2024 GRC. For clarity, a current activity that is included in the plan may be referred to as either a control and/or a mitigation. For purposes of this RAMP, a control that will continue as a mitigation will retain its control ID unless the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. The table below shows which activities are expected to continue.

Table 3: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	Cathodic Protection – Capital	X	X
2	C2	Cathodic Protection – Maintenance	X	X
3	C3	Leak Repair	X	X
4	C4	Pipeline Relocation/Replacement	X	X
5	C5	Shallow/Exposed Pipe Remediation	X	X
6	C6	Pipeline Maintenance	X	X
7	C7	Compressor Station Physical Security	X	X
8	C8	Compressor Stations – Capital	X	X
9	C9	Compressor Stations – Maintenance	X	X
10	C10	Measurement & Regulation - Capital	X	X
11	C11	Measurement & Regulation – Maintenance	X	X
12	C12	Odorization	X	X
13	C13	Security and Auxiliary Equipment	X	X
14	C14	Engineering, Oversight and Compliance Review	X	X
15	C15	Integrity Assessments & Remediation	X	X
16	C16-T1.1 C16-T1.2	PSEP, Phase 1A - Refundable	X	No
17	C16-T2.1 C16-T2.2 C16-T.2.3	PSEP, Phase 1B – Refundable	X	No
18	C16-T3.1	PSEP, Valve Enhancements - Refundable	X	No

[21] *See* D.18-12-014 at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
	C16-T3.1			
19	M1-T1.1 M1-T1.2	PSEP, Phase 2B – Pipeline Replacement	X	X
20	M1-T1.3 M1-T1.4	PSEP, Phase 2B – Hydrotesting	X	X
21	M2	Gas Transmission Safety Rule – MAOP Reconfirmation	No	X
22	M3	Gas Transmission Safety Rule – Material Verification	No	X
23	M4	Adobe Falls Relocation Project	No	X
24	M5	Moreno Compressor Station Modernization	No	No

For activities SDG&E plans to perform that remain unchanged, refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in the section below.

A. Changes to 2020 Controls

- **C15-T2: Integrity Assessments & Remediation**

As described above in Section III, the Integrity Assessments & Remediation mitigation has been expanded beyond the Transmission Integrity Management Program to include the Outside of HCA assessments required by PHMSA's Pipeline Safety: Safety of Gas Transmission Pipelines: MAOP Reconfirmation, Expansion of Assessment Requirements, and Other Related Amendments final rule. Specifically, 49 CFR § 192.710 requires operators to assess transmission pipelines in MCAs and non-HCA Class 3 and 4 locations. At a minimum of every ten years, these transmission lines must be assessed using methods such as ILI, ECDA, and pressure testing. Accordingly, SDG&E has incorporated approximately 6 miles of non-HCA pipelines into the Company's assessment plan. In order to account for the difference in risk profiles between pipelines located in HCAs versus non-HCAs, SDG&E has tranched the Integrity Assessments & Remediation control accordingly.

B. 2022 – 2024 Mitigations

- **M1: PSEP Phase 2B**

Phase 2B pipelines are pipelines that have documentation of a pressure test that predates the adoption of federal testing regulations in 1970, specifically, Part 192 Subpart J of Title 49 of the CFR. Because SDG&E's PSEP does not include any Phase 2A scoped work that must

precede Phase 2B work, SDG&E is planning to begin implementing standalone Phase 2B projects during the TY 2024 GRC forecast period. In its TY 2019 GRC proceeding (A.17-10-007), SoCalGas had sought clarification from the Commission for both utilities as to whether work to test or replace Phase 2B qualifying pipelines was required to be undertaken and completed as a part of PSEP. The Commission concluded in D.19-09-051 that Phase 2B was within the scope of PSEP, stating "D.11-06-017 requires that all in-service natural gas transmission pipeline be tested in accordance with 49 CFR 192.619"[22] and "pipeline projects under Phase 2B of SoCalGas' Implementation Plan must comply with D.11-06-017…."[23] The Decision also required that SoCalGas file a proposed implementation plan for the pipelines that may be re-tested as part of Phase 2B. [24,25] Consistent with the D.19-09-051, SoCalGas and SDG&E are currently performing an evaluation of Phase 2B pipeline mileage and plans to include certain components of its Phase 2 implementation plan, such as identified Phase 2B pipeline segments, a Phase 2B decision tree, and the results of an independent engineering review of the Phase 2B decision tree, as part of its TY 2024 GRC Application.[26] Phase 2B projects are classified as GRC based and are tranched to reflect both pipeline replacement and hydrotesting projects and projects may occur in both HCA and non-HCA areas.

- M1-T1.1: Pipeline Replacement (Phase 2B, GRC base, HCA)
- M1-T1.2: Pipeline Replacement (Phase 2B, GRC base, non-HCA)
- M1-T1.3: Hydrotesting (Phase 2B, GRC base, HCA)
- M1-T1.4: Hydrotesting (Phase 2B, GRC base, non-HCA)

1. Gas Transmission Safety Rule Implementation

In October of 2019, PHMSA issued the final rule of Pipeline Safety: Safety of Gas Transmission Pipelines: MAOP Reconfirmation, Expansion of Assessment Requirements, and Other Related Amendments. Published as the first of three parts, the final rule updates sections

---

22 D.19-09-051 at 220.

23 D.19.09-051, Conclusion of Law 47 at 767.

24 SDG&E's Phase 2B projects will be coordinated with the Phase 2B implementation plan prepared by SoCalGas.

25 D19.09-051, Ordering Paragraph 15 at 779-780.

26 SoCalGas requested and received an extension to file the Phase 2B implementation plan as part of its next GRC Application. *See* Letter from Alice Stebbins, Executive Director, CPUC to Chuck Manzuk, Director, GRC Revenue Requirements, Sempra Energy Utilities (November 14, 2019).

of 49 CFR 191 and 192 and federally mandates gas operators to update or implement procedures accordingly.

There are three new sections with which SDG&E must comply that require new risk mitigating programs: Outside-of-HCA Assessments (49 CFR § 192.710) – which has been addressed under C20, MAOP Reconfirmation (49 CFR § 192.624), and Material Properties and Attributes Verification (49 CFR § 192.607).

a. M2: Gas Transmission Safety Rule - MAOP Reconfirmation

- **M2-T1: HCA; M2-T2: non-HCA**

Pursuant to 49 CFR § 192.624, SDG&E is required to reconfirm – by July 2035 – the MAOP of transmission lines that either: (1) do not have traceable, verifiable, or complete pressure test records in accordance with 49 CFR § 192.517(a) and are located in HCAs or Class 3 or 4 locations, or (2) have an MAOP established in accordance with 49 CFR § 192.619(c), have an MAOP greater than 30% SMYS, and are located in HCAs, Class 3 or 4 locations, or – where the segment can accommodate an in-line inspection tool – MCAs.

PHMSA has required operators to document MAOP Reconfirmation procedures by July 1, 2021, and SDG&E is in the process of developing its MAOP Reconfirmation program in accordance with the final rule. Separate from the state mandated PSEP, SDG&E has preliminarily identified approximately 130 miles out of 218 miles of SDG&E's transmission pipelines that fall within the scope of MAOP Reconfirmation per 49 CFR § 192.624. For these transmission lines, reconfirmation would be performed using one of six allowable methods: pressure testing, replacement, pressure reduction, engineering critical assessment (ECA), pressure reduction for lines with a small PIR, and alternative technology approved by PHMSA.

The MAOP Reconfirmation program will include a risk-based prioritization methodology that considers, amongst other elements, pipeline location and stress level and will reduce risk of failure to the transmission system through re-evaluation of the pipeline's MAOP and, when necessary, repair/remediation of each transmission line that is within the scope.

b. M3: Gas Transmission Safety Rule – Material Properties and Attributes Verification

- **M3-T1: HCA; M3-T2: non-HCA**

Pursuant to 49 CFR § 192.607, SDG&E is required to develop and implement procedures to opportunistically verify the material properties and attributes of transmission pipelines and

associated components that do not have "traceable, verifiable, and complete"[27] records. Procedures will address nondestructive or destructive tests, examinations, and assessments, as well as sampling requirements established by 49 CFR § 192.607. If SDG&E should find materials that are not consistent with existing information or expectations, SDG&E will address these findings in accordance with 49 CFR § 192.607 and may re-evaluate a pipeline's MAOP to reduce the risk of failure of a transmission pipeline.

The material verification plan and program are currently in development and SDG&E's preliminary forecast of activities and costs are an estimate. Because the program is based on opportunistic verification, actual costs will be influenced by SDG&E's ongoing portfolio of projects.

2. M4: Adobe Falls Pipeline Relocation Project

The current Adobe Falls pipeline is a 6-inch, 400 psig steel line, 2000 feet in length, that runs from north of the San Diego State University (SDSU), across a deep valley, to serve 3 Meter Set Assemblies including a cogeneration facility on the SDSU campus. On the north side of the valley, the pipeline drops 260 feet, nearly vertical, and then southward under Interstate 8 to serve the SDSU facilities. This northside valley route, due to its steep drop, presents a dangerous path for mandated periodic leak surveys by Company personnel as well as nearly impossible access should the pipeline require other maintenance or response for emergency repairs.

This RAMP project relocates this pipeline to a new route, thus eliminating the risk to personnel involved in periodic surveys and other pipeline maintenance while still serving the SDSU campus. In addition, the new route eliminates the current route's position under Interstate 8 freeway, and environmentally it eliminates ground disturbance caused when periodic mandated surveys are completed in the natural area portion of the current pipeline route.

The relocated pipeline is 6000 feet of 400 psig 6-inch steel line, running from a position east of the campus to serve the same SDSU services and cogeneration facility.

---

[27] Pipeline Safety: Safety of Gas Transmission Pipelines: MAOP Reconfirmation, Expansion of Assessment Requirements, and Other Related Amendments (October 1, 2019) at 52218-52219, available at *https://www.govinfo.gov/content/pkg/FR-2019-10-01/pdf/2019-20306.pdf*.

3. M5: Moreno Compressor Station Modernization Project

The primary objective of the Moreno Compressor Modernization project is to replace and modernize existing compressors and associated infrastructure to comply with air quality regulations while prioritizing reliability, capacity, and system resilience. In D.19-09-051[28] the Commission recognized the importance of facility modernization projects and the role of compressor stations in maintaining operational reliability and safety of the gas transmission system. The Commission encouraged SDG&E to place a high priority on critical projects with aging compressors because of key risks that need to be mitigated.

The Moreno Compressor Station is an SDG&E-owned facility located in Moreno Valley, approximately 35 miles north of the San Diego County line, and is operated and maintained by SDG&E (and managed by shared SoCalGas employees). The station is currently comprised of three compressor plants with supporting auxiliary equipment and buildings which are used to flow and compress gas into San Diego County.

The existing configuration of the Moreno Compressor Station includes:

- Clark Plant: Three Clark HSRA-8LEC reciprocating compressors
- Solar Plant: Four Solar Saturn turbine-driven centrifugal compressors
- Cooper Plant: Two Cooper "Quad" reciprocating compressors and one Cooper 8V-275 reciprocating compressor

The Moreno Compressor Modernization Project's scope includes the retirement of the existing Clark, Solar, and two Cooper units and replacing with new compression equipment. The compression plant will be known as Plant 4 and will include two modern gas turbine driven centrifugal compressors including post combustion NOx and CO reduction systems, two

[28] D. 19-09-051 at 116-117 ("With respect to the requested amounts for this GRC, we note that other large-scale projects are being planned specifically for the Ventura Compressor Station and the Honor Rancho Compressor Station (and the Moreno Compressor station for SDG&E). Because we recognize the importance of the proposed projects and the role of compressor stations in maintaining operational reliability and safety of the gas transmission system, we find that it is prudent and reasonable to authorize the proposed projects and for SoCalGas to have the necessary funding to conduct these projects (and Moreno Compressor station for SDG&E). At this point, we do not find it necessary to deviate from current GRC practice and authorize funding only for specific projects because of the large scope covered in the GRC and because of the many challenges associated with planning and executing multiple and large projects within a specified timeframe. We do however encourage SoCalGas to place a high priority on critical projects under this category as most of its compressors are over 50 years old and because of key risks that need to be mitigated in this area. Therefore, we find that the requested amounts for Compressor Stations should be authorized.").

emission-free electric motor driven reciprocating compressors, a new compressor building, and additional infrastructure and appurtenances to support Plant 4 operations.

This project has a planned in-service date after the 2024 test year of the upcoming GRC and as such it is not part of the risk control and mitigation plan. It is included in this RAMP Report for the Commission's and stakeholders' awareness of safety risk activities being pursued by SDG&E.

V. COSTS, UNITS, AND QUANTITATIVE SUMMARY TABLES

The tables in this section provide a summary of the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided. SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by Subject Matter Experts (SMEs) and available accounting data.

Table 4: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[29]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital [30]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1-T1	Cathodic Protection – Capital (HCA)	$64	-	$192	$234	-	-
C1-T2	Cathodic Protection – Capital (non-HCA)	$130	-	$391	$475	-	-
C2-T1	Cathodic Protection – Maintenance (HCA)	-	$30	-	-	$23	$29
C2-T2	Cathodic Protection – Maintenance (non-HCA)	-	$60	-	-	$47	$60
C3-T1	Leak Repair (HCA)	$0	-	$1,943	$2,353	-	-
C3-T2	Leak Repair (non-HCA)	$0	-	$3,946	$4,777	-	-

[29] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[30] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital [30]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C4-T1	Pipeline Relocation/Replacement (HCA)	$148	-	$1,815	$2,195	-	-
C4-T2	Pipeline Relocation/Replacement (non-HCA)	$301	-	$3,683	$4,459	-	-
C5-T1	Shallow/Exposed Pipe Remediations (HCA)	$81	-	$2,797	$3,385	-	-
C5-T2	Shallow/Exposed Pipe Remediations (non-HCA)	$165	-	$5,678	$6,874	-	-
C6-T1	Pipeline Maintenance (HCA)	-	$194	-	-	$182	$232
C6-T2	Pipeline Maintenance (non-HCA)	-	$393	-	-	$369	$472
C7	Compressor Station Physical Security	-	$248	-	-	$202	$258
C8	Compressor Station – Capital	$7,779	-	$30,131	$36,474	-	-
C9	Compressor Station - Maintenance	-	$2,501	-	-	$2,099	$2,683
C10-T1	Measurement & Regulation – Capital (HCA)	$186	-	$634	$768	-	-
C10-T2	Measurement & Regulation – Capital (non-HCA)	$378	-	$1,288	$1,560	-	-
C11-T1	Measurement & Regulation Station – Maintenance (non-HCA)	-	$140	-	-	$105	$134
C11-T2	Measurement & Regulation Station – Maintenance (non-HCA)	-	$285	-	-	$213	$272
C12	Odorization	-	$9	-	-	$8	$10
C13	Security and Auxiliary Equipment	$730	-	$2,095	$2,536	-	-
C14	Engineering, Oversight and Compliance Review	-	$229	-	-	$195	$249
C15-T1	Integrity Assessments & Remediations (HCA)	$3,302	$7,955	$15,228	$19,458	$5,030	$6,427
C15-T2	Integrity Assessments & Remediations (Non-HCA)	$516	$1,243	$3,572	$4,564	$1,180	$1,508

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital [30]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
M1-T1.1	PSEP: Pipeline Replacement (Phase 2B, HCA)	-	-	9,500	$11,500	-	-
M1-T1.2	PSEP: Pipeline Replacement (Phase 2B, non-HCA)	-	-	$9,500	$11,500	-	-
M1-T1.3	PSEP: Hydrotesting (Phase 2B, HCA)	-	-	$2,850	$3,450	$6,650	$8,050
M1-T1.4	PSEP: Hydrotesting (Phase 2B, non-HCA)	-	-	$2,850	$3,450	$6,650	$8,050
M2-T1	Gas Transmission Safety Rule - MAOP Reconfirmation (HCA)	-	-	$9,360	$29,952	$6,480	$20,736
M2-T2	Gas Transmission Safety Rule - MAOP Reconfirmation (Non-HCA)	-	-	$390	$1,248	$270	$864
M3-T1	Gas Transmission Safety Rule – Material Verification (HCA)	-	-	$23	$74	$18	$56
M3-T2	Gas Transmission Safety Rule – Material Verification (Non-HCA)	-	-	$6	$15	$4	$11
M4	Adobe Falls Relocation Project	-	-	$1,900	$2,300	-	-

Table 5: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1-T1	Cathodic Protection – Capital (HCA)	# of Projects		3	-	4	9	-	-
C1-T2	Cathodic Protection – Capital (non-HCA)	# of Projects		3	-	12	15	-	-
C2-T1	Cathodic Protection – Maintenance (HCA)	# of CP and follow up reads		-	51	-	-	61	78
C2-T2	Cathodic Protection – Maintenance (non-HCA)	# of CP and follow up reads		-	105	-	-	125	160
C3-T1	Leak Repair (HCA)	# of Projects		0	-	2	2	-	-
C3-T2	Leak Repair (non-HCA)	# of Projects		0	-	4	5	-	-
C4-T1	Pipeline Relocation/Replacement (HCA)	# of Projects		1	-	4	8	-	-
C4-T2	Pipeline Relocation/Replacement (non-HCA)	# of Projects		3	-	7	12	-	-
C5-T1	Shallow/Exposed Pipe Remediations (HCA)	# of Projects		1	-	6	6	-	-
C5-T2	Shallow/Exposed Pipe Remediations (non-HCA)	# of Projects		4	-	12	15	-	-
C6-T1	Pipeline Maintenance (HCA)	# of Miles Patrolled & Maintained		-	146	-	-	131	168
C6-T2	Pipeline Maintenance (non-HCA)	# of Miles Patrolled & Maintained		-	296	-	-	266	340
C7	Compressor Station Physical Security	# of Labor Hours		-	8,760	-	-	7,884	10,074
C8	Compressor Stations - Capital	# of Projects		23	-	73	88	-	-

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C9	Compressor Stations - Maintenance	# of Compressor Station Maintenance orders		-	414	-	-	440	562
C10-T1	Measurement & Regulation – Capital (HCA)	# of Projects		2	-	8	13	-	-
C10-T2	Measurement & Regulation – Capital (non-HCA)	# of Projects		6	-	19	24	-	-
C11-T1	Measurement & Regulation Station – Maintenance (non-HCA)	# of Measurement and Regulation (M&R) repairs and upgrades		-	127	-	-	119	152
C11-T2	Measurement & Regulation Station – Maintenance (non-HCA)	# of Measurement and Regulation (M&R) repairs and upgrades		-	258	-	-	240	307
C12	Odorization	# of Gallons of Odorant used		-	185	-	-	167	213
C13	Security and Auxiliary Equipment	# of Projects		5	-	12	15	-	-
C14	Engineering, Oversight and Compliance Review	# of Labor Hours		-	4,540	-	-	4,111	5,253
C15-T1	Integrity Assessments & Remediations (HCA)	# of miles		N/A	32	N/A	N/A	24	30
C15-T2	Integrity Assessments & Remediations (Non-HCA)	# of miles		N/A	5	N/A	N/A	6	7
M1-T1.1	PSEP: Pipeline Replacement (Phase 2B, HCA)	# of miles		N/A	N/A	1	1	N/A	N/A

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
M1-T1.2	PSEP: Pipeline Replacement (Phase 2B, non-HCA)	# of miles		N/A	N/A	1	1	N/A	N/A
M1-T1.3	PSEP: Hydrotesting (Phase 2B, HCA)	# of miles		N/A	N/A	N/A	N/A	2	3
M1-T1.4	PSEP: Hydrotesting (Phase 2B, non-HCA)	# of miles		N/A	N/A	N/A	N/A	2	3
M2-T1	Gas Transmission Safety Rule - MAOP Reconfirmation (HCA)	# of Miles		N/A	N/A	1	2	2	8
M2-T2	Gas Transmission Safety Rule - MAOP Reconfirmation (Non-HCA)	# of Miles		N/A	N/A	0.02	0.07	0.1	0.34
M3-T1	Gas Transmission Safety Rule – Material Verification (HCA)	The material verification program is being developed and the number and types of samples are unclear.							
M3-T2	Gas Transmission Safety Rule – Material Verification (Non-HCA)								
M4	Adobe Falls Relocation Project	# of projects		N/A	N/A	1	1	N/A	N/A

Table 6: Risk Control & Mitigation Plan - Quantitative Analysis Summary
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1-T1	Cathodic Protection – Capital (HCA)	0.88	2301	2029	489.2
C1-T2	Cathodic Protection – Capital (non-HCA)	0.88	2301	2027	387.6
C2-T1	Cathodic Protection – Maintenance (HCA)	0.88	2301	2026	1074.6
C2-T2	Cathodic Protection – Maintenance (non-HCA)	0.88	2301	2024	65.5
C3-T1	Leak Repair (HCA)	0.87	2301	2001	5.6

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C3-T2	Leak Repair (non-HCA)	0.88	2301	2026	5.3
C4-T1	Pipeline Relocation/Replacement (HCA)	0.88	2301	2029	131.3
C4-T2	Pipeline Relocation/Replacement (non-HCA)	0.88	2301	2029	62
C5-T1	Shallow/Exposed Pipe Remediations (HCA)	0.88	2301	2020	8.6
C5-T2	Shallow/Exposed Pipe Remediations (non-HCA)	0.88	2301	2021	5.9
C6-T1	Pipeline Maintenance (HCA)	0.88	2301	2028	1037.9
C6-T2	Pipeline Maintenance (non-HCA)	0.88	2301	2028	62.3
C7	Compressor Station Physical Security	N/A	N/A	N/A	N/A
C8	Compressor Stations - Capital	0.83	2301	1917	91.2
C9	Compressor Stations - Maintenance	0.46	2301	1060	403.4
C10-T1	Measurement & Regulation – Capital (HCA)	0.88	2301	2027	86.0
C10-T2	Measurement & Regulation – Capital (non-HCA)	0.88	2301	2026	57.0
C11-T1	Measurement & Regulation Station – Maintenance (HCA)	0.87	2301	2009	841.4
C11-T2	Measurement & Regulation Station – Maintenance (non-HCA)	0.88	2301	2027	50.6
C12	Odorization	0.88	2301	2029	22.4
C13	Security and Auxiliary Equipment	0.88	2301	2029	0.8
C14	Engineering, Oversight and Compliance Review	N/A	N/A	N/A	N/A
C15-T1	Integrity Assessments & Remediations (HCA)	0.05	2301	108	355.3
C15-T2	Integrity Assessments & Remediations (Non-HCA)	0.76	2301	1751	300.0
M1-T1.1	PSEP: Pipeline Replacement (Phase 2B, HCA)	0.77	2301	1,771	730.5
M1-T1.2	PSEP: Pipeline Replacement (Phase 2B, non-HCA)	0.81	2301	1,864	467.5
M1-T1.3	PSEP: Hydrotesting (Phase 2B, HCA)	0.77	2301	1,771	160.8
M1-T1.4	PSEP: Hydrotesting (Phase 2B, non-HCA)	0.81	2301	1,864	102.9
M2-T1	Gas Transmission Safety Rule - MAOP Reconfirmation (HCA)	0.88	2301	2,014	6.9
M2-T2	Gas Transmission Safety Rule - MAOP Reconfirmation (Non-HCA)	0.88	2301	2029	4.1
M3-T1	Gas Transmission Safety Rule – Material Verification (HCA)	0.88	2301	2029	1.2

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
M3-T2	Gas Transmission Safety Rule – Material Verification (Non-HCA)	0.88	2301	2029	6.2
M4	Adobe Falls Relocation Project	0.88	2301	2018	167.1

Table 7: Risk Control & Mitigation Plan - Quantitative Analysis Summary for RSE Exclusions

ID	Control/Mitigation Name	RSE Exclusion Rationale
C7	Compressor Station Security – O&M	Compressor stations are key facilities in the gas system marked as cornerstones to the reliability of the gas system. Ensuring the facilities remain in operation and incapable of interacting with the public is a prudent safety and reliability measure by the utility. However, no internal or external data exist that can tie a compressor incident to a lack of security at the stations. Likewise, no SME input could be used to construct a viable measure of the changes to likelihood or consequence of a high-pressure system incident due to station security; therefore, an RSE was not calculated.
C14	Engineering, Oversight and Compliance Review - O&M	Engineering, Oversight and Compliance review is a prudent safety and reliability activity conducted by the utility. Although SoCalGas tracks data surrounding engineering approvals, compliance goals and overall establishment of overall health to the pipeline design process, no data exists internally or externally to directly relate this activity to a reduction in incident rate or the consequences thereof. Additionally, no SME input could establish a quantifiable value for risk addressed by possessing proper engineering, oversight, and compliance protocol.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the risk mitigation plan for the High Pressure Incident 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 also took into account modifications to the plan and constraints, such as budget and resources.

A. A1: Soil Sampling

SDG&E collects soil samples during TIMP-related excavations along its pipelines. These soil samples are analyzed for chemical composition and characteristics that determine the corrosivity of the soil in the vicinity of the pipeline. Expanding this soil sampling program to include collecting soil samples at regular intervals, such as every mile, along pipelines with a history of corrosive activity may allow SDG&E to anticipate areas of their pipelines that may be

susceptible to accelerated corrosion between inspection events. The results of the soil sampling would be integrated into the SDG&E pipeline GIS system and be used in a comprehensive evaluation of the SDG&E pipeline system. Soil sample data (i.e., resistivity and pipe-to-soil reads) would be used to determine corrosion rates, which is critical information in developing a mature risk assessment of corrosion threat. SDG&E has not initiated an expanded soil sampling program since the potential benefit is related to the maturing of the risk assessment. As the risk assessment continues to mature from a relative risk model to a deterministic risk model for the corrosion threat, the benefit of additional information can be better understood. In the interim SDG&E will be researching available data sets and determining the benefit of additional soil property information.

B. A2: Geotechnical Analysis Expansion

SDG&E considered expanding its geotechnical analysis of pipelines potentially exposed to landslide and debris flow hazards. This analysis includes slope stability of terrain surrounding the pipelines and evaluating the likelihood and consequence of landslides and the resulting debris flow on the pipeline. SDG&E has performed extensive analysis and evaluation of the slope stability, landslide, and debris flow conditions of pipelines that have been impacted by severe weather events. The results of this analysis and evaluation have been used to mitigate the potential impact of future severe weather events on these pipelines. SDG&E has considered identifying additional pipelines with potential exposure to severe weather events to perform analysis regarding slope stability, landslide, and debris flow. SDG&E has not initiated an expanded geotechnical analysis program since the potential benefit is related to the maturing of the risk assessment. As the risk assessment continues to mature from a relative risk model to a deterministic risk model the benefit of additional information can be better understood.

Table 8: Alternative Mitigation Plan - Forecast Dollars Summary[31]
(Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Proactive Soil Sampling	-	-	$108	$138
A2	Expanding Geotechnical Analysis	-	-	$54	$69

Table 9: Alternative Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
A1	Proactive Soil Sampling	Miles		-	-	137	175
A2	Expanding Geotechnical Analysis	Miles		-	-	14	17

Table 10: Alternative Mitigation Plan - Quantitative Analysis Summary
(Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
A1	Proactive Soil Sampling	0.88	2,301	2,027	5.7
A2	Expanding Geotechnical Analysis	0.88	2,301	2,029	0.9

[31] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Summary of Elements of the Risk Bow Tie

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
C1	Cathodic Protection – Capital	DT.1, DT.2, DT.8, DT.4, DT.6, PC.3, PC.1
C2	Cathodic Protection - Maintenance	DT.1, DT.2, DT.4, DT.8, PC.1, PC.3
C3	Leak Repair	DT.6, DT.9, PC.3
C4	Pipeline Relocation/Replacement	DT.5, DT.4, DT.6, DT.9, DT.10, PC.3, PC.4, PC.5
C5	Shallow/Exposed Pipe Remediations	DT.6, DT.5, PC.3, PC.4, PC.5
C6	Pipeline Maintenance	DT.7, DT.8, PC.3
C7	Compressor Station Physical Security	DT.8, PC.2, PC.3
C8	Compressor Stations - Capital	DT.8, DT.4, DT.5, DT.3, PC.3, PC.1, PC.5
C9	Compressor Stations - Maintenance	DT.3, DT.4, DT.5, DT.10, PC.1, PC.3, PC.5
C10	Measurement & Regulation – Capital	DT.8, DT.4, DT.7, PC.3, PC.1, PC.5
C11	Measurement & Regulation Station – Maintenance	DT.4, DT.7, DT.8, DT.10, PC.3, PC.5, PC.1
C12	Odorization	DT.7, DT.8, PC.4, PC.6, PC.5
C13	Security and Auxiliary Equipment	DT.5, DT.8, PC.3, PC.2
C14	Engineering, Oversight and Compliance Review	DT.4, DT.7, DT.6, DT.8, DT.9; DT.11 PC.2, PC.3, PC.4
C15	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
M1	PSEP: Phase 1A, 1B, 2B (Replacement and Hydrotesting)	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
M2	Gas Transmission Safety Rule – MAOP Reconfirmation	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
M3	Gas Transmission Safety Rule – Material Verification	DT.10 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M4	Adobe Fall Relocation Project	DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENECES

Appendix B: Quantitative Analysis Source Data References

The SA Decision directs the utility to identify potential consequences of a risk event using available and appropriate data. The below provides a listing of the inputs utilized as part of this assessment.

Annual Report Mileage for Natural Gas Transmission & Gathering Systems

- Agency: Pipeline and Hazardous Materials Safety Administration
- Link: *https://www.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-natural-gas-transmission-gathering-systems*

Link: Annual Report mileage for Gas Distribution Systems

- Agency: Pipeline and Hazardous Materials Safety Administration
- Link: *https://www.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-gas-distribution-systems*

Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data

- Agency: Pipeline and Hazardous Materials Safety Administration
- Link: *https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data*

San Diego Gas & Electric high-pressure pipeline miles

- 2020 internal pipeline integrity data

San Diego Gas & Electric Probability of Exceedance (PoE) Data

- 5 years of anomaly data from in-line-inspections (ILI)

Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-4)

Incident Involving a Contractor

May 17, 2021

TABLE OF CONTENTS

RISK: INCIDENT INVOLVING A CONTRACTOR

I. INTRODUCTION

The purpose of this chapter is to present SDG&E's risk control and mitigation plan for the Incident Involving a Contractor (Contractor Incident) risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter RAMP-B of this RAMP Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs and cost estimates are provided for years 2022-2024, as further discussed in Chapter RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are provided where those costs are available and within the scope of the analysis required in this RAMP Report.

---

[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[2] *See* D.18-12-014 at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Throughout this 2021 RAMP Report activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's Contractor Incident risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters RAMP-A and RAMP-C, SDG&E has endeavored to calculate an RSE for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or Subject Matter Expert (SME) opinion exists to calculate the RSE, SDG&E has included why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

A. Risk Overview

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 Shutoff's (PSPS), Red Flag Warnings (RFW) and other emergency events.

SDG&E has many safety-related policies and procedures for contractors to follow. There are myriad instances that could implicate this risk, including:

---

3 *Id*. at 16.

4 *Id.* at 17.

5 *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.") (November 25, 2020).

- Failure of a contractor to adhere to an OSHA Regulation or Company safety policy or procedure could result in a safety-related event involving serious injuries and/or fatalities while conducting work on behalf of the Company.
- Contractors failing to report safety incidents, including serious near misses, and sharing lessons learned from such incidents with SDG&E, can result in a reoccurrence of the incident with potentially more adverse results.
- Driving distractions due to increased vehicles on the road and/or use of mobile technology may result in more vehicle related incidents.
- Personnel turnover and movement within the contracting industry impacting availability of experienced workers and resulting impact on safety.

To address the potential risk drivers and consequences, SDG&E has implemented strong oversight and controls as part of its contractor safety program, such as by developing and implementing a Contractor Safety Manual, establishing a third-party vetting process requiring membership in ISNetworld (a vendor platform for contractor management services), to pre-qualifying contractors on safety practices, and engaging with contractors to strengthen the sharing of best safety practices. The purpose of implementing strong controls and mitigations to oversee contractors is to enhance the safety of SDG&E construction projects from inception to completion.

B. Risk Definition

For purposes of this RAMP Application, SDG&E's Contractor Incident risk is defined as the risk of a safety event, caused by a contractor or subcontractor not following safety standards and/or procedures, which results in serious injuries and/or fatalities while conducting work on behalf of the Company.

C. Scope

Table 1 below provides what is considered in scope for the Contractor Incident risk in this RAMP Application.

Table 1: Risk Scope

In-Scope:	The risk of a work-related – as defined by Occupational Safety and Health Administration (OSHA) – safety incident involving a Class 1 Contractor(s) that causes serious injuries or fatalities while conducting work on behalf of SDG&E. SDG&E is focusing its enhanced Contractor Safety Program on Class 1 Contractors. Class 1 Contractors are:

	"A Class 1 Contractor is 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 Serious Safety Incident. Examples of a Class 1 Contractor include contractors performing work involving energized equipment or hazardous chemicals."
Data Quantification Sources:	Company data and SME judgement See Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision,[6] this section describes the risk bow tie, possible drivers/triggers, potential consequences, and the risk score for the Contractor Incident risk.

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision[7] instructs the utility to include a risk bow tie illustration for each risk included in RAMP. As illustrated in the risk bow tie shown below in Figure 1, the risk event (center of the bow tie) is an incident involving a contractor, the left side of the bow tie illustrates drivers/triggers that lead to the risk of a Contractor Incident, and the right side shows the potential consequences of the risk of Contractor Incident. SDG&E applied 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 addressed is provided in Appendix A.

[6] D.18-12-014 at 33 and Attachment A, A-11 ("Bow Tie").

[7] *Id.* at Attachment A, A-11 ("Bow Tie").

Figure 1: Risk Bow Tie

B. Cross-Functional Factors

There are two cross-functional factors that may influence this risk: Safety Management System, and Emergency Preparedness and Response and Pandemic cross-functional factors. In addition, Company Safety Culture can also play a role with this risk. The activities that are described in those chapters play a role in helping reduce the risk of a Contractor Incident. For example, a strong safety culture could reinforce and further emphasize the need for compliance with many of the controls and mitigations presented within this risk chapter.

C. Potential Drivers/Triggers[8]

The Settlement Decision[9] instructs the utility to identify which element(s) of the associated risk bow tie each mitigation addresses. When performing the risk assessment for the

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

[9] D.18-12-014 at Attachment A, A-11 ("Bow Tie").

Contractor Incident risk, SDG&E identified potential leading indicators, referred to as drivers or triggers. These include, but are not limited to:

- **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 may lead to a safety-related event.
- **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 can 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 provide training to and to supervise their employees to reduce the likelihood of an incident. Inadequate training or the lack of sufficient supervision can 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 contractors sustaining 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 can lead to safety-related events to contractor employees.
- **DT.7 – Unsafe operation of equipment or motor vehicle:** Contractors may utilize their own company vehicles and equipment, or vehicles and equipment owned by SDG&E. The unsafe operation of such may lead to a safety-related event.

- **DT.8 – Inadequate employee training/supervision:** Contractors working without appropriate training or adequate supervision.
- **DT.9 – Contractor crew fatigue/complacency:** Contractors working excessive hours can create unsafe work environments. Also, complacency may reduce the level of awareness to hazards which can lead to a safety-related event.
- **DT.10 – Contractor impairment due to environmental factors:** Factors such as heat, night work, high-risk work locations (e.g. busy roadways), etc., may lead a contractor to become impaired, and as a result increase the likelihood of a safety-related event.
- **DT.11 – Hazards in the work environment:** Unsafe work environments, including work locations, roadways and parking places, customer premises, gas equipment condition, Polychlorinated Biphenyls (PCB), lead from paint, asbestos, and fumigation chemicals, for example, could lead to a safety-related event.
- **DT.12 – Non or improper use of personal protective equipment:** Contractors working without personal protective equipment (PPE) or performing work with the incorrect PPE may lead to a safety-related event.
- **DT.13 – Damaged SDG&E equipment and/or infrastructure:** Damage to gas and electric infrastructure and facilities could cause an unpredictable environment and, thus, can lead to a safety-related incident.

D. Potential Consequences of Risk Event

Potential consequences[10] are listed to the right side of the risk bow tie illustration provided above. If one or more of the drivers/triggers listed above were to result in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

- PC.1 - Serious injuries or fatalities
- PC.2 - Property damage
- PC.3 - Additional compliance safety inspections
- PC.4 - Operational and reliability impacts
- PC.5 - Adverse litigation

[10] D.18-12-014 at 16 and Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

- PC.6 - Penalties and fines
- PC.7 - Erosion of public confidence

These potential consequences were used in the scoring of the Contractor Incident risk that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[11] Chapter RAMP-C of this RAMP Application explains the Risk Quantitative Framework which underlies this Chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[12]

	LoRE	CoRE	Risk Score
Contractor Incident	1.83	1,033	1,894

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, as well as available and appropriate data.[13]

SDG&E used company data to model the uncertainty of safety frequency and consequences and used SME judgment to model financial and stakeholder satisfaction. SDG&E used a Monte Carlo methodology to yield a probability distribution of safety and stakeholder satisfaction results per year. Specific data sources and other supporting material will be provided in workpapers.

III. 2020 CONTROLS

This section "[d]escribe[s] the controls or mitigations currently in place" as required by the Settlement Decision.[14] The activities in this section were in place as of December 31, 2020. Controls that will continue as part of the plan are addressed in Section IV.

---

[11] D.18-12-014 at Attachment A, A-11 ("Calculation of Risk").

[12] The term "pre-mitigation analysis," in the language of the S-MAP Settlement Agreement Decision (Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score")), refers to required pre-activity analysis conducted prior to implementing control or mitigation activity.

[13] *Id*. at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

[14] S-MAP Settlement Agreement Decision at 33.

A. Control 1 - Contractor Oversight Program

The Contractor Oversight Program is the overall program used by SDG&E to assess and educate contractors with respect to safety protocols. This program is primarily run by the Contractor Safety Services (CSS) Department. CSS's main objective is to ensure the Class 1 Contractors engaged with SDG&E are working safely and risk is being managed effectively. The CSS team is made up of both internal and contracted resources to support the various activities to ensure contractors are working safely. SDG&E business units also have field safety oversight responsibilities for all construction work being performed by Class 1 Contractors working for their respective groups (*see* Control 2).

With respect to internal resources, SDG&E institutes a number of safeguards that all contracted work is performed in accordance with SDG&E standards, 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). The safeguards can include:

- Adherence to the Contractor Safety Program Standard for SDG&E, and the Class 1 Contractor's Safety manual for contractors to ensure each group is adhering to the same requirements and/or standards.
- Administrative activities associated with Class 1 work such as education on the program requirements to our contractors and internal resources, assisting in obtaining program compliance, and following up with contractors that fall out of compliance.
- Pre-qualification of all Class 1 Contractors according to SDG&E's Contractor Safety program.
    - Contractors that meet the criteria targets in the table below are granted points toward an overall compliance grade from SDG&E's third-party administrator.
    - Contractors that fall below the criteria targets do not receive points toward an overall compliance grade from SDG&E's third-party administrator.

Criteria	Target	Below Target
3-Year TRIR (Total Recordable Incident Rate)	Equal to or less than BLS industry average for applicable NAICS code	Greater than BLS industry average for applicable NAICS code
3-Year DART (Days Away Restricted/Transfer Rate)	Equal to or less than BLS industry average for applicable NAICS code	Greater than BLS industry average for applicable NAICS code
EMR (Experience Modification Rate)*	Equal to or less than 1.1	Greater than 1.1
5 -Year Fatality Data	Zero (0) fatalities within the last five (5) years	One (1) or more fatalities within the last five (5) years
5-Year Non-Fatal, Serious Safety Incident Data (e.g., life altering/life threatening, including incidents affecting the public)	Zero (0) non-fatal, serious safety incidents within the last five (5) years	One (1) or more non-fatal, serious safety incidents within the last five (5) years
3-Year OSHA Serious, Willful, or Repeat Citations	Zero (0) serious, willful, or repeat OSHA citations within the last three (3) years	One (1) or more serious, willful, or repeat citations within the last three (3) years
3-Year OSHA Non-Serious Citations	Zero (0) non-serious OSHA citations within the last three (3) years	One (1) or more non-serious citations within the last three (3) years
Written Safety Programs	Company has comprehensive written safety programs that are in compliance with environmental, health, and safety laws and regulations and are specific to the hazards associated with the work to be performed	Company does not have comprehensive written safety programs that are in compliance with environmental, health, and safety laws and regulations and are specific to the hazards associated with the work to be performed
Drug and Alcohol Plan	Company has a comprehensive written drug and alcohol plan that is in compliance with applicable laws and regulations	Company does not have a comprehensive written drug and alcohol plan that is in compliance with applicable laws and regulations
Subcontractor Management Plan	Company has a written plan to monitor subcontractors and hold them accountable for the same requirements as themselves	Company does not have a written plan to monitor subcontractors and hold them accountable for the same requirements as themselves
Employee Disciplinary Action Plan	Company has a written employee disciplinary action plan	Company does not have a written employee disciplinary action plan
Safety Culture Evaluation	Company has a positive safety culture that it is working to advance	Company does not have a positive safety culture that it is working to advance

* **Experience modification rate** (EMR) is a number insurance companies use to represent a business' prior workers' comp claims and potential for future injuries.

- Requiring Pre-Work Safety Meeting Notices and Acknowledgement Forms. Notifications to contractors of known hazards, followed by meetings with contractors to discuss hazards and mitigations that are jointly acknowledged before performing work.
- All new and existing contracts and Master Service Agreements (MSAs) between SDG&E and a primary contractor includes a reference to SDG&E's Class 1 Contractor Safety Manual and states it is a requirement to follow as part 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 contractual requirements. SDG&E currently uses Predictive Solutions for safety observations and Veriforce for gas operator qualifications as third-party software administration tools to monitor risk in a more cost-effective manner than has been found utilizing an internal workforce.

Veriforce is a third-party vendor that offers comprehensive solutions for Operator Qualifications (OQ), Drug & Alcohol (D&A), Training, Auditing, and Consulting programs to Operators and contractors nationwide. In 2012, SDG&E partnered with Veriforce to manage all gas contractors' OQ and D&A programs. The Veriforce partnership allows SDG&E to improve the overall OQ program for gas contractors by requiring them to abide by a common OQ program and tracks their D&A status to maintain compliance. Some key features of using the Veriforce system are: the ability for contractors to have proof of qualifications on the job site, the ability to track qualification failures, and visibility to the D&A status of each contractor company and its employees.

SDG&E partnered with Veriforce in response to increased scrutiny and auditing by internal and/or external parties of the OQ and D&A programs which revealed inconsistencies among contractors. Veriforce provided SDG&E with solutions to address these audit findings and improved the OQ and D&A programs by implementing an electronic platform for testing and an electronic database for tracking this data. The Veriforce platform also allows for portability of qualifications between SDG&E and Southern California Gas Company.

SDG&E uses a third-party administrator, ISNetworld, to house and verify the established SDG&E pre-qualification requirements for our 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 our contractors, including:

- Communication of new rules, regulations and requirements;
- Reports from contractors on SDG&E specific incidents and hours in order for SDG&E to track and trend performance;
- A bulletin board that houses documents communicated to all connected contractors; and
- An action item tool for targeted communications to specific contractors.

ISNetworld monitors new and changing OSHA requirements and verifies SDG&E's Class 1 Contractors meet minimum 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 main elements in the scoring criteria of pre-qualification collected by ISNetworld are:

- The nationwide review of the three previous years of Total Recordable Incident Rate (TRIR);
- The nationwide review of the three previous years of Days Away Restricted or Transfer Rate (DART);
- Previous year Experience Modification Rate (EMR);
- Previous 5-year fatalities review;
- Previous 5-year Serious Safety Incidents (SSI) review;
- Written safety program reviews according to the work type(s) performed; and
- Safety Culture questionnaire review.

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.

B. Control 2 - Field Safety Oversight

SDG&E's CSS oversees safety for all business units that use Class 1 Contractors. CSS's contracted safety professionals perform field level safety assessments on Class 1 Contractors who perform work on behalf of SDG&E.

Duties of CSS with respect to field safety oversight include but are not limited to:

- Safety inspections/observations: This is a proactive measure to observe 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 ensure accuracy.
- Pre-work safety meetings: Contracted safety professionals perform jobsite reviews with all parties involved to identify and agree with potential hazards and mitigations prior to work starting and also review site specific safety plans when SDG&E requires contractors to submit them.
- Post-Job evaluations: SDG&E construction team conducts post major project or annual jobsite performance reviews of contractors. This review has the ability to affect a contractor's qualification status and ability to continue working with SDG&E.

Additionally, SDG&E has a variety of administration tools and programs to support the safety oversight of Class 1 Contractors as described below.

1. Administration and Tools

Predictive Solutions is used by SDG&E as the primary software application for safety observations of Class 1 Contractors. This customizable tool can house a specifically designed safety observation form for each business unit in order to capture all relevant data. There is also a core group of questions that is used to track and trend safety contractor observations enterprise wide. Predictive Solutions allows SDG&E to easily collect safety observations, track and trend, then communicate the results of observations in a clear format so SDG&E can potentially mitigate at-risk behaviors or incidents.

2. Stop the Job

The Stop the Job (STJ) Process is a protocol SDG&E has established for all contractors. It gives authority to everyone onsite to stop a job or task if an unsafe work condition or activity is identified. All work must immediately cease in the area of concern once the STJ is declared until site supervision and the involved contractor(s) have done an investigation, the identified

situation is abated, controlled, or otherwise determined to be safe, and the situation and outcome are explained to effected personnel.

3. Near Miss/Close Call Reporting Program

SDG&E requires its contractors to report all incidents per the Class 1 Contractor Safety Manual including Near Miss/Close Call incidents immediately, then monthly in a report. This information is then tracked and used during SDG&E's Class 1 Contractor safety observations and also communicated out to contractors, if applicable.

SDG&E defines a Near Miss/Close Call as follows:

- Non-Serious Near Miss: A work-connected incident in which property damage less than $50,000 or an injury or illness (other than a Serious Safety Incident) could have occurred but did not.
- Serious Near Miss: A work-connected incident in which property damage, a spill/release resulting in damages of $50,000 or more, or a Serious Safety Incident could have occurred but did not.

C. Control 3 - Safety Culture

SDG&E strives to ensure a positive safety culture with our contractors through outreach, education, and leading the way. Our drive to improve starts with our company culture and the way we do business. SDG&E not only has established touchpoints throughout the year with our contractors but identifies items during the year where collaboration or improvement should be reviewed and implements mitigation measures for any identified potential gaps.

The Annual Contractor Safety Summit and Contractor Safety Quarterly Meetings are particular events that create a forum to share industry leading best practices with our contractors, communicate new requirements, give our 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 Executives and Management. The quarterly safety meeting are attended by SDG&E and Class 1 Contractor Executives and Management, but field-level personnel are also encouraged to attend.

SDG&E engages our internal workforce and Class 1 Contractors with periodic safety culture assessments to better gauge where we are with our culture and maturity of the SDG&E

Contractor Safety Program. The results of these assessments are used for action planning and upcoming initiatives targeted to improve safety and cultural gaps.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[15] Controls and mitigations in the Contractor Incident risk have the same risk profile; thus, they are not further tranched.

Many of the activities discussed in Section III above are expected to continue during the TY 2024 GRC. A current activity that is included in the plan may be referred to as either a control and/or a mitigation. For purposes of this RAMP, a control that will continue as a mitigation retains its control ID unless that the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. The table below shows which activities are expected to continue, and which activities are new.

Table 3: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	Contractor Oversight Program	X	X
2	C2	Field Safety Oversight	X	X
3	C3	Safety Culture	X	X
4	M1	Enterprise-Wide Contractor Incident and Schedule Management	No	X
5	M2	Enhanced Verification of Class 1 Contractor Employee Specific Training	No	X

For activities SDG&E plans to perform that remain unchanged, please refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in this section below.

A. Changes to 2020 Controls

The Contractor Oversight Program (C1) and the Field Safety Oversight (C2) controls discussed above have been expanded in 2021 to reflect implementation on an enterprise-wide

[15] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

basis into all business units that use Class 1 Contractors. Additional contracted resources have been added to the Contractor Oversight Program (C1) to support the additional data received by new Class 1 Contractors and business units in order to pre-qualify, process, track, trend, and communicate safety data. Additional safety professionals have been contracted to support Field Safety Oversight (C2) to support the additional business units that are using Class 1 Contractors.

B. 2022 – 2024 Mitigations

1. Mitigation 1- Enterprise-Wide Contractor Incident and Schedule Management

During the expansion of the SDG&E Contractor Safety Program it was determined that certain business units that used Class 1 Contractors did not have enough work to support having a dedicated resource to manage contractor incidents or schedules. Because of the number of business units with this same gap, SDG&E decided to have that function brought into the Contractor Safety Services Department where this work scope could be performed for multiple business units. Incident reporting would be moved to a single contact in Contractor Safety Services then communicated out to the Enterprise, Business Units, and other parties as appropriate.

Requiring all Class 1 Contractors to submit a schedule to a single source in Contractor Safety Services would be a benefit to the enterprise. The tool would provide a view of all Class 1 Contractors that are working for SDG&E that Contractor Safety Services and the business units using the contractors could access. This would improve tracking of incidents, hours worked, and scheduling safety observations.

2. Mitigation 2 – Enhanced Verification of Class 1 Contractor Employee Specific Training

This activity encompasses developing a process to verify contractors are trained on specific safety programs according to their company specific requirements (*i.e*. OSHA, SDG&E). SDG&E will perform field visits to identify contractor employees' specific work scope in order to follow up with contractors to verify specific training requirements. Documentation will be reviewed specific to each contractor employee and training programs will be reviewed. Once this program framework is developed, additional third-party support will be required to support this effort.

V. COSTS, UNITS, AND QUANTITATVE SUMMARY TABLES

The tables in this section provide a summary of the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided. SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data.

Table 4: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[16]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[17]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	Contractor Oversight Program	-	1,148	-	-	1,008	1,220
C2	Field Safety Oversight	3,894	433	13,500	16,342	500	605
C3	Safety Culture	-	-	-	-	11	14
M1	Enterprise-Wide Contractor Incident and Schedule Management	-	-	285	345	19	23
M2	Enhanced Verification of Class 1 Contractor Employee Specific Training	-	-	570	690	38	46

[16] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[17] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with Controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

Table 5: Risk Control and Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	Contractor Oversight Program	FTEs		-	9	-	-	10	11
C2	Field Safety Oversight	3rd party contractors		21	2	24	29	3	4
C3	Safety Culture	# of Joint Meetings		-	-	-	-	4	6
M1	Enterprise-Wide Contractor Incident and Schedule Management	Contractor		-	-	1	1	-	-
M2	Enhanced Verification of Class 1 Contractor Employee Specific Training	Contractor		-	-	1	2	-	-

Table 6: Risk Control and Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	Contractor Oversight Program	2.27	1,033	2348	139
C2	Field Safety Oversight	2.38	1,033	2461	35
C3	Safety Culture	See Table 7			
M1	Enterprise-Wide Contractor Incident and Schedule Management	See Table 7			
M2	Enhanced Verification of Class 1 Contractor Employee Specific Training	1.78	1,033	1837	86

Table 7: Risk Control and Mitigation Plan - Quantitative Analysis Summary for RSE Exclusions

ID	Control/Mitigation Name	RSE Exclusion Rationale
C3	Safety Culture	As mentioned in the description for this control, SDG&E strives for a positive safety culture with its contractors. SME judgement for this control is highly subjective given the nature of this control, and the data to determine the level of risk reduction associated with the activities noted in that section does not exist in order to calculate a meaningful RSE.
M1	Enterprise-Wide Contractor Incident and Schedule Management	Incident reporting and schedule management is an activity which provides a tool to improve reporting and monitoring of SDG&E's contractors. These tools are foundational, in that they are used as the underlying basis for the risk reduction that the Field Oversight control provides. As such, meaningful data or SME inputto determine the level of risk reduction associated with this tool does not exist in order to calculate an RSE.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the Risk Control and Mitigation Plan for the Contractor Incident 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 also took into account modifications to the plan and constraints, such as budget and resources.

A. Alternative 1 - SAP Contractor Incident Portal

This alternative would involve developing a portal for contractors to self-report their incidents which would trigger SDG&E Contractor Safety's incident reporting process. Internalizing this process would give Contractor Safety Services more control over the incident information collected and allow for additional analysis and trending of incidents. SDG&E currently uses a tool within our third-party administrator, ISNetworld, for this process. Due to its complexity, the development of a portal that is more effective than what is currently in place has proven difficult to accomplish.

B. Alternative 2 - Use Internal Resources and Tools to Vet Contractors for Safety

This alternative would involve developing an in-house electronic platform using internal Information Technology (IT) resources at a cost exceedingly greater than the subscription fees incurred for outside third-party platforms, like ISNetworld. It would also result in time delays to develop such a platform. Furthermore, this alternative would require hiring several safety professionals at a much greater cost than the subscription fees incurred for third-party services, like ISNetworld, to review contractor compliance programs on an on-going basis for accuracy and completeness. Based on our experience over two years with using ISNetworld, this alternative was judged to be not a cost-effective option.

Table 8: Alternative Mitigation Plan - Forecast Dollars Summary[18]
(Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	SAP Contractor Incident Portal	-	-	95	115
A2	Use internal resources and tools to vet contractors for safety	-	-	1,390	1,530

[18] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

Table 9: Alternative Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
A1	SAP Contractor Incident Portal	Internal IT Resources		-	-	1	1
A2	Use internal resources and tools to vet contractors for safety	FTEs		-	-	10	11

Table 10: Alternative Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
A1	SAP Contractor Incident Portal	See Table 11			
A2	Use internal resources and tools to vet contractors for safety	1.78	1,033	1,837	13

Table 11: Alternative Mitigation Plan - Quantitative Analysis Summary for RSE Exclusions

ID	Control/Mitigation Name	RSE Exclusion Rationale
A1	SAP Contractor Incident Portal	The Contractor Incident Portal alternative is currently being developed for review. Until we understand the new system, we will not know the potential benefits. As such, meaningful data to determine the level of risk reduction associated with this tool does not exist in order to calculate an RSE, and SME judgment does not fill the gaps.

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Appendix A: Summary of Elements of the Risk Bow Tie

Contractor Incident: Summary of Elements of the Risk Bow Tie

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
C1	Contractor Oversight Program	DT.1 - DT.13 PC.1 - PC.7
C2	Field Safety Oversight	DT.1 - DT.13 PC.1 - PC.7
C3	Safety Culture	DT.1, DT.2, D.T. 3, D.T. 4, D.T. 11 PC.1 - PC.7
M1	Enterprise-Wide Contractor Incident and Schedule Management	D.T. 3 PC.1 - PC.7
M2	Enhanced Verification of Class 1 Contractor Employee Specific Training	DT.1, DT.2, D.T. 3, D.T. 4, D.T. 7, D.T. 8, D.T. 12 PC.1 - PC.7

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

Appendix B: Quantitative Analysis Source Data References

The SA Decision directs the utility to identify potential consequences of a risk event using available and appropriate data.[19] The below provides a listing of the inputs utilized as part of this assessment.

San Diego Gas & Electric Annual Serious Injuries and Fatalities (SIFs)

- 2015 –2020 internal SIF data

[19] D.18-12-014, Attachment A at A-8 (Identification of Potential Consequences of Risk Event).

Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-5)

Customer and Public Safety – Contact with Electric Equipment

May 17, 2021

TABLE OF CONTENTS

RISK: CUSTOMER AND PUBLIC SAFETY – CONTACT WITH ELECTRIC EQUIPMENT

I. INTRODUCTION

The purpose of this chapter is to present SDG&E's risk control and mitigation plan for the Customer and Public Safety – Contact With Electric Equipment (Electric Contact) risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter RAMP-B of this RAMP Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs, and cost estimates are provided for years 2022-2024, as further discussed in Chapter RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are provided where those costs are available and within the scope of the analysis required in this RAMP Report.

---

[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[2] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Throughout this 2021 RAMP Report, activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's Electric Contact risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters RAMP-A and RAMP-C, SDG&E has endeavored to calculate an RSE for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or subject matter expert (SME) opinion exists to calculate the RSE, SDG&E has included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

A. Risk Overview

The Electric Contact risk is the threat of harm due to contact with SDG&E's electric equipment that is operating in a normal, electrified configuration, including serious injury, fatality, and property damage. For example, the Electric Contact risk includes the threat of harm from a customer contacting an energized electric overhead service drop to their residence with an aluminum ladder. To mitigate this risk, SDG&E strives to continually educate its customers and the public about the dangers and risks associated with working and being around electricity. Bill inserts, public service announcements, postings to social media platforms, paid media tactics such as television, print and digital advertising, and warning signage near electric facilities all serve to warn and communicate to the public about the care that needs to be taken in the vicinity of SDG&E's electric equipment. The Electric Contact risk was not presented in the Company's previous Risk Assessment Mitigation Phase (RAMP) Reports.

---

3 D.18-12-014 at 16.

4 *Id.* at 17.

5 *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

SDG&E's safety-related communications costs are not tracked in a manner that is specific to any particular risk, including the Electric Contact risk. For example, SDG&E's budget codes for safety communications include costs that address the risks of contacting any electric equipment (whether it is operating in a normal or non-normal operating configuration) as well as the safety risks to the public or customers associated with the company's gas operations. When preparing the data referenced in the Electric Contact risk chapter, SDG&E used best efforts to separate costs for communications specific to the Electric Contact risk from those that discuss electric and gas safety, only gas safety, or other types of electric safety risk. Therefore, the cost information provided in this chapter reflect SDG&E's best estimate of costs related to Electric Contact risk mitigation, with the understanding that such costs may, in some cases, address other safety risks.

B. Risk Definition

For purposes of this RAMP Chapter, SDG&E's Electric Contact risk is defined as the threat of harm to a customer, third-party, or member of the public from making contact with in-service electrical equipment that is operating in a normal configuration.

C. Scope

Table 1 below provides what is considered in scope for the Electric Contact risk in this RAMP Report.

Table 1: Risk Scope

In-Scope:	The threat of harm associated with contact with energized electrical equipment that is operating in a normal configuration.
Data Quantification Sources:	Company data and Subject Matter Expert (SME) judgment See Appendix B for additional information.

II. RISK ASSESSMENT

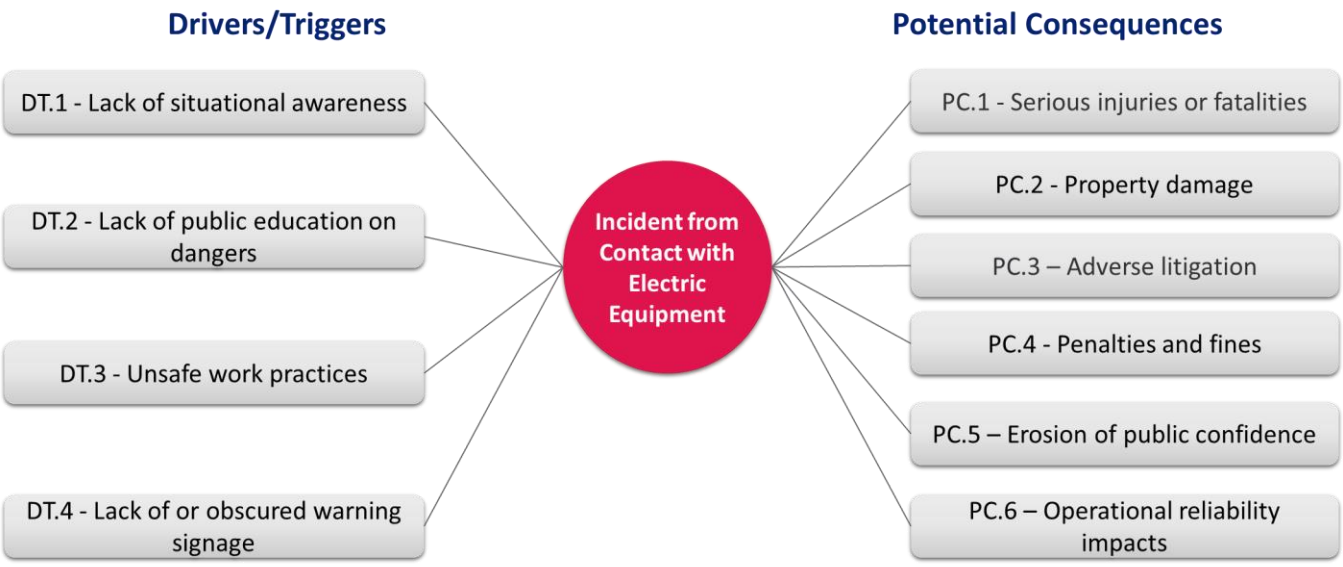
In accordance with the Settlement Decision,[6] this section describes the risk bow tie, possible drivers, potential consequences, and the risk score for the Electric Contact risk.

[6] D.18-12-014 at 33 and Attachment A at A-11 ("Bow Tie").

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision[7] instructs the utility to include a risk bow tie illustration for each risk included in RAMP. As illustrated in the risk bow tie shown below in Figure 1, the risk event (center of the bow tie) is Electric Contact, the left side of the bow tie illustrates drivers/triggers that lead to Electric Contact, and the right side shows the potential consequences of Electric Contact. SDG&E applied this framework to identify and summarize the information provided in Figure 1. A mapping of each control and mitigation to the element(s) of the risk bow tie addressed is provided in Appendix A.

Figure 1: Risk Bow Tie



B. Cross-Functional Factors

Aspects of SDG&E's Emergency Preparedness and Response and Pandemic Cross-Functional Factor are applicable to the Electric Contact risk. For example, the Emergency Operating Center may be activated in response to an Electric Contact incident.

[7] *Id.*, Attachment A at A-11 ("Bow Tie").

C. Potential Drivers/Triggers[8]

The Settlement Decision[9] instructs the utility to identify which element(s) of the associated risk bow tie each mitigation addresses. When performing the risk assessment for Electric Contact, SDG&E identified potential leading indicators, referred to as drivers or triggers. These include, but are not limited to:

- **DT.1 – Lack of situational awareness:** The inability of an individual to identify and understand the dangers associated with contacting energized electrical equipment located within their present environment.
- **DT.2 – Lack of public education on dangers:** Insufficient and/or inadequate outreach to inform the public of the potential dangers associated with coming in contact with energized electrical equipment.
- **DT.3 – Unsafe work practices:** Performing work in a manner and/or location that compromises the safety of the individual as well as others.
- **DT.4 – Lack of or obscure warning signage:** Insufficient and/or inadequate use of visible signage to inform the public of potential dangers associated with coming in contact with energized electrical equipment.

D. Potential Consequences of Risk Event

Potential consequences[10] are listed to the right side of the risk bow tie illustration provided above. If one or more of the drivers/triggers listed above were to result in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

- PC.1 – Serious injuries and/or fatalities
- PC.2 – Property Damage
- PC.3 – Adverse litigation
- PC.4 – Penalties and fines
- PC.5 – Erosion of public confidence
- PC.6 - Operational reliability impacts

---

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

9 D.18-12-014, Attachment A at A-11 ("Bow Tie").

10 D.18-12-014 at 16 and Attachment A at A-8 ("Identification of Potential Consequences of Risk Event").

These potential consequences were used in the scoring of Electric Contact risk that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[11] Chapter RAMP-C of this RAMP Application explains the Risk Quantitative Framework which underlies this chapter, including how the pre-mitigation risk score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[12]

	LoRE	CoRE	Risk Score
Contact with Electric Equipment	1.17	1,197	1,396

SDG&E used company data to model the uncertainty of safety frequency and consequences and used SME judgment to model financial and stakeholder satisfaction. SDG&E used a Monte Carlo methodology to yield a probability distribution of safety and stakeholder satisfaction results per year. Specific data sources, underlying curves, and other supporting material will be provided in workpapers.

III. 2020 CONTROLS

This section "[d]escribe[s] the controls or mitigations currently in place" as required by the Settlement Decision.[13] The activities in this section were in place as of December 31, 2020. Controls that will continue as part of the control and mitigation plan are identified in Section IV.

In addition to the controls discussed below, SDG&E performed various inspections of its electrical equipment, in accordance with programs such as the Company's Corrective Maintenance Program (CMP), conducted pursuant to General Order 165. SDG&E has conducted field observations as part of its inspection programs, to confirm that assets are constructed and maintained per applicable Company standards. CMP and other inspections

---

[11] D.18-12-014, Attachment A at A-11 ("Calculation of Risk").

[12] The term "pre-mitigation analysis," in the language of the Settlement Decision, refers to required pre-activity analysis conducted prior to implementing control or mitigation activity (*See* D.18-12-014, Attachment A at A-12, "Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score").

[13] Settlement Decision at 33.

performed by SDG&E are further discussed in the RAMP Chapters of Wildfire Involving SDG&E Equipment (SDG&E-Risk-1) and Electric Infrastructure Integrity (SDG&E-Risk-2).

A. C1: General Safety Communications

SDG&E's electric safety communications strive to inform customers and the public about safety around electricity and electric equipment. Every year paid marketing efforts and direct communications are employed to try to reach people across the service territory in a variety of manners. Though the tactics listed below are the primary methods the company uses to educate the public about overall electric safety and contact with electric facilities, similar information may be embedded in safety messaging associated with other public education campaigns (*e.g.*, gas safety communications).

1. Social Media Posts

SDG&E uses organic (non-paid) social media to help educate customers with electric safety messaging and provide website links to additional content that customers can use to educate themselves about electric safety. Organic social media also refers to customers who follow the company on their social media channels (paid social media is another form of social media with a broader audience that gets served paid social-media advertisements across social media channels). The primary social media channels that are employed for organic posting include Facebook, Twitter, and Instagram.

2. Paid Media

SDG&E utilizes paid media on an annual basis to implement electric safety campaigns. Paid media refers to communication channels directly paid for by SDG&E to disseminate or advertise information to a wide audience. Examples of typical paid media tactics are listed in the table below. SDG&E uses paid media to promote electric safety information to customers and the public who are in the company's service territory. The company also evaluates the effectiveness of its paid media campaigns, including the number of impressions associated with these public education campaigns. The term "impressions" is a common industry measure and represents the number of times that paid content (ads) is displayed .

Below is an overview of impressions associated with the company's broader electric safety paid media that was marketed during 2019 and 2020. 2019 performance measures include tactics, *i.e.*, types of advertising media used from other campaigns that had messaging related to electric safety. 2020 performance measures apply to messaging related to electric safety.

Table 3: Performance Measures

TACTIC	2019 PERFORMANCE (Impressions)	2020 PERFORMANCE (Impressions)
Digital advertising	26,193,027	49,365,163
Paid Search	65,000	81,406
Paid Social Media	0	12,091,403
TV	35,432,921	15,405,500
OTT (Connected TV/Streaming)	2,400,361	1,589,258
Radio	35,282,460	2,750,700
Print/Newspaper	6,745,616	7,189,005
Outdoor Advertising	18,013,780	9,798,133
Cinema Advertising	1,450,408	0
Magazine	410,700	0

3. Press Releases/NewsCenter Stories

Press releases and NewsCenter stories are other tools that SDG&E uses to help disseminate safety-related messaging and information to the public. Press releases are drafted and provided to print and broadcast media outlets. NewsCenter stories are posted to SDG&E's NewsCenter (at sdgenews.com), provide additional information to customers and the public about various topics, including safety, and are in a news story format. NewsCenter stories are drafted and posted by SDG&E's media team and provide additional situational awareness information about emergency events or general safety information.

4. Safety Messaging On SDG&E's Company Website

SDG&E manages and updates the electric safety content on the company's website found at sdge.com/safety. This section of the website is updated throughout the year and is often referenced in safety-campaign messaging.

5. Bill Inserts/Ads

Safety content is also added to customer billing each year. Associated messaging includes tips and information related to electric safety and dangers associated with potential contact with electric infrastructure.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[14]

All the activities discussed in Section III above are expected to continue during the TY 2024 GRC. A current activity that is included in the control and mitigation plan may be referred to as either a control or a mitigation. A control that will continue as a mitigation retains its control ID, unless the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. Table 4 below shows which activities are expected to continue.

Table 4: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	General Safety Communications	Yes	Yes
2	M1	Kids Website Expansion	No	Yes
3	M2	Direct Communications to At-risk Businesses	No	Yes

For activities SDG&E plans to perform that remain unchanged, please refer to the description in section III. If changes to the various activities are anticipated, such modifications are further described in this section below.

A. Changes to 2020 Controls

The above-described 2020 control reflects the same scope of activities planned for 2022-24; there are no planned changes.

B. 2022 – 2024 Mitigations

The mitigations below aim to further address the Electric Contact risk.

1. M1: Kids Website Expansion

The SDG&E website (sdge.com) is a major information resource that many public education efforts refer to for additional information. SDG&E plans to expand the content on the website to create a section for children (Kids Website) that can both help further educate the community and reach younger audiences. Efforts in 2021 and after will seek to establish this new resource and promote it to local school districts and communities. Those efforts would

[14] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

include, among other topics, safety education related to the hazards of being around live electric facilities.

2. M2: Direct Communications to At-risk Businesses

There are various businesses and industries within SDG&E's service territory that have employees who regularly encounter electric equipment and power lines. Examples of these businesses include, but are not limited to, tree trimmers, pool cleaners, sign installers, and other types of industries that risk touching electrical equipment. SDG&E plans to expand direct communications with these types of businesses to promote electric safety and identify electric hazards of which their employees should be aware. Efforts in 2021 and after will work to develop and produce print collateral to be mailed to these businesses on an annual basis.

V. COST, UNIT, AND QUANTITATIVE ANALYSIS SUMMARY TABLES

The tables in this section provide a summary of the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided. SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data.

Table 5: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[15]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[16]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	General Safety Communications	-	1,670	-	-	1,500	2,170
M1	Kids Website Expansion	-	-	-	-	Included in C1	Included in C1
M2	Direct Communications to at Risk Businesses	-	-	-	-	Included in C1	Included in C1

[15] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[16] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with Controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

Table 6: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	General Safety Communications	A measurable unit is not practical given the multiple means of communications used to address this risk.							
M1	Kids Website Enhancement								
M2	Direct Communications to at Risk Businesses								

Table 7: Risk Control & Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	General Safety Communications	See Table 8			
M1	Kids Website Expansion	See Table 8			
M2	Direct Communications to at Risk Businesses	See Table 8			

Table 8: Risk Control & Mitigation Plan -
Quantitative Analysis Summary for RSE Exclusions

ID	Control/Mitigation Name	RSE Exclusion Rationale
C1	General Safety Communications	SDG&E strongly believes that safety related communications are beneficial towards the prevention of contacts with electrical equipment operating in a normal configuration; however, SDG&E is unable to quantify the risk reduction benefits for the General Safety Communications, Kids Website Expansion, and Direct Communications to at Risk Business controls and mitigations, for several reasons: 1) It is difficult to determine a direct correlation between the communications campaigns mitigating electric contact and risk events (or non-events). 2) The messaging usually addresses a combination of gas- and electric-related safety risks and therefore does not specifically call out contacting equipment operating in a normal configuration. Safety messages typically are more general in nature, focusing on the inherent dangers of electrical equipment, storm and outage preparedness and importance of treating every downed power line as energized. More simply stated, we inform customers of the importance of staying safe around electricity and electrical equipment no matter its configuration. This is a more efficient use of safety education and outreach funding and results in more effective and simple messaging for our customers. For example, communication campaigns often combine more than one safety message for both gas and electric risks to customers. The difficulty, therefore, arises in the ability to parse out the levels of effectiveness of the multiple messages across the two commodities.
M1	Kids Website Expansion	See rationale for C1
M2	Direct Communications to at Risk Businesses	See rationale for C1

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the control and mitigation plan for the Electric Contact risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for the Electric Contact risk also took into account modifications to the plan and constraints, such as budget and resources.

A. A1: K-12 School Curriculum Development

Local school districts can play a pivotal role in assisting with community education. Today's youth will eventually become tomorrow's utility customers, and educating them early about electric safety can have far-reaching benefits. SDG&E considered working with local school districts to develop a curriculum that can be taught in local classrooms about electric safety. This was not pursued due to challenges presented by different school districts within the service territory, distance learning issues, as well as political barriers for quick execution.

B. A2: Dedicated Safety Outreach Position

This new employee position would be responsible for traveling across the service territory for drop-in visits to various industrial and commercial job sites. This person would be responsible for assessing and educating site personnel on electric contact hazards and issues. This position was not pursued due to several identified risks and inefficiencies, including labor and overhead costs, safety risk, vehicle miles and hours traveled relative to volume of customer impact, etc.

Table 9: Alternatives - Forecast Dollars Summary[17]
(In 2020 $000)

ID	Control/Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	K-12 School Curriculum	-	-	90	115
A2	Dedicated Safety Outreach Position	-	-	90	115

Table 10: Alternate Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
A1	K-12 School Curriculum	Number of curriculum		-	-	1	1
A2	Dedicated Safety Outreach Position	FTE		-	-	1	1

Table 11: Alternate Mitigation Plan - Quantitative Analysis Summary
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
A1	K-12 School Curriculum	See Table 12			
A2	Dedicated Safety Outreach Position	See Table 12			

[17] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

Table 12: Alternative Mitigation Plan - Quantitative Analysis Summary for RSE Exclusions

ID	Alternative Mitigation Name	RSE Exclusion Rationale
A1	K-12 School Curriculum	See rational in Table 8 for C1
A2	Dedicated Safety Outreach Position	See rational in Table 8 for C1

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Customer & Public Safety – Contact With Electric Equipment: Summary of Elements of the Risk Bow Tie

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
C1	General Safety Communications	DT.1, DT.2, DT.3 DT.4 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M1	Kids Website Expansion	DT.1, DT.2, DT.3 DT.4 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M2	School Curriculum	DT.1, DT.2, DT.3 DT.4 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

The Settlement Decision directs the utility to identify potential consequences of a risk event using available and appropriate data.[18] The list below provides the inputs used as part of this assessment.

San Diego Gas & Electric Annual Serious Injuries and Fatalities (SIFs) Incidents

- 2015 –2020 internal SIF data

[18] D.18-12-014, Attachment A at A-8 (Identification of Potential Consequences of Risk Event).

Risk Assessment and Mitigation Phase

(Chapter SCG/SDG&E-Risk-6)

Cybersecurity

May 17, 2021

TABLE OF CONTENTS

RISK: CYBERSECURITY

I. INTRODUCTION

The purpose of this chapter is to present Southern California Gas Company's (SoCalGas) and San Diego Gas & Electric Company's (SDG&E) (collectively, the Companies) risk mitigation plan for the Cybersecurity risk. This risk chapter is identical for both Companies given that Cybersecurity risk is currently managed centrally for both Companies. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein at Attachment A (the Settlement Decision).[1]

SoCalGas and SDG&E have identified and defined RAMP risks in accordance with the process described in further detail in Chapter RAMP-B of this RAMP Report. On an annual basis, SoCalGas' and SDG&E's Enterprise Risk Management (ERM) organizations facilitate the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SoCalGas' and SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SoCalGas and SDG&E anticipate requesting recovery in its Test Year (TY) 2024 GRC. SoCalGas' and SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SoCalGas' and SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs and cost estimates are provided for years 2022-

---

[1] D.16-08-018 adopted the requirements previously set forth in D.14-12-025. D.18-12-014, the Phase Two Decision Adopting Safety Model Assessment Proceeding (S-MAP) Settlement Agreement With Modifications, adopted the Settlement Agreement Among Pacific Gas and Electric Company, Southern California Edison Company, Southern California Gas Company, San Diego Gas & Electric Company, The Utility Reform Network, Energy Producers and Users Coalition, Indicated Shippers, and the Office of Ratepayer Advocates, which contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and General Rate Case.

[2] *See* D.18-12-014 at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

2024, as further discussed in Chapter RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are provided where those costs are available and within the scope of the analysis required in this RAMP Report.

Throughout this 2021 RAMP Report, activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SoCalGas' and SDG&E's Cybersecurity risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters RAMP-A and RAMP-C, SoCalGas and SDG&E have endeavored to calculate a Risk Spend Efficiency (RSE) for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or Subject Matter Expert (SME) opinion exists to calculate the RSE, SoCalGas and SDG&E have included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report (if any) are identified in Section V below.

A. Risk Overview

At the Companies, 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

---

3 *Id*. at 16.

4 *Id.* at 17.

5 *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

territories include millions of people, one of the nation's busiest ports, some of country's largest cities, most critical military bases, countless 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 – and not only directly harm the Companies, but also indirectly harm the Companies' stakeholders. 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 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 believe their investment and spend in cybersecurity is prudent and reasonable to address the 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. A current example of increased threat complexity and impact is the recent SolarWinds breach.[6] This breach was so significant in breadth and depth that the effect and impact, as of this writing, are still being investigated and understood. The United States (US) Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) were two of many entities affected by this breach. In fact, a directive by the Cybersecurity and

---

6 *See* E&E News, Cybersecurity, *'This is bad.' Hacking chaos engulfs FERC, DOE, Microsoft* (December 18, 2020), *available at https://www.eenews.net/stories/1063721065.*

Infrastructure Security Agency (CISA) and a "North American Electric Reliability Corporation (NERC) Alert- Essential Action" have been issued for this breach.[7]

Most recently, another significant cybersecurity incident occurred on May 8, 2021 at Colonial Pipeline. Colonial is the operator of the largest fuels pipeline in the US. This cybersecurity ransomware attack affected its information technology (IT) and operations technology (OT) systems, requiring Colonial Pipeline to shut down operations. The Colonial cybersecurity incident further illustrates the growing emerging threat to the Companies' critical infrastructure, given the trends cited below:

- Cyberattacks targeting critical infrastructure or key companies, some by suspected foreign actors, have become a growing area of concern for the US national security officials.[8]
- "Cybersecurity analysts say companies have been targeted with ransomware for several years, and that the attacks are becoming more brazen and costly, particularly since the start of the pandemic."[9]
- "As companies shifted to remote work, fewer employees worked exclusively within protected networks, creating more opportunities for hackers to break into their systems, cybersecurity analysts say."[10]
- According to Homeland Security Secretary Alejandro Mayorkas, "The rate of ransomware attacks increased 300% in 2020."[11]

Energy regulators have also recognized the threat cyberattacks pose to the energy sector. In a recent Notice of Proposed Rulemaking (NOPR), FERC notes that the energy sector "faces numerous and complex cybersecurity challenges at a time of both great change in the operation of the transmission system and an increase in the number and nature of attack methods." The NOPR also recognizes that "[t]hese ever-expanding risks create challenges in defending the

---

[7] NERC has responsibility for oversight of the Bulk Power System and to provide guidance and insight such as via alerts like this. *See* Cybersecurity & Infrastructure Security Agency, Alert (AA20-352A), *Advanced Persistent Threat Compromise of Government Agencies, Critical Infrastructure, and Private Sector Organizations* (revised April 15, 2021), *available at https://us-cert.cisa.gov/ncas/alerts/aa20-352a.*

[8] *See, e.g.*, Collin Eaton and Dustin Volz, *U.S Pipeline Cyberattack Forces Closure*, The Wall St. Journal (WSJ), May 8, 2021; James Rundle and David Uberti, *How Can Companies Cope with Ransomware*, WSJ, May 9, 2021. *See also*, Collin Eaton, *Pipeline's Shutdown Exposes Cyber Threat to Power Sector*, WSJ, May 10, 2021.

[9] James Rundle and David Uberti, *How Can Companies Cope with Ransomware*, WSJ, May 9, 2021.

[10] *Id.*

[11] *Id.*

digitally interconnected components of the grid from cyber exploitation."[12] This acknowledgment has been underscored by the realization of various threats. For example, in 2016, a Ukrainian utility experienced an OT attack on utility infrastructure that resulted in the loss of electric load to approximately 200,000 customers.[13] Cybersecurity-related attacks were also experienced in 2019 and 2020 on other gas and electric operators that caused unforeseen disruptions to business operations.[14]

Given that the Companies' cybersecurity threats continue to evolve rapidly, the Companies' strategy to counter cybersecurity threats must be flexible and enable adaption to these evolving threats over time. 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) cybersecurity threat intelligence. The Companies also obtain cybersecurity threat intelligence from a variety of entities and sources, including Information Sharing and Analysis Centers (ISACs), the Federal Bureau of Investigations (FBI), FERC, the DOE, the Department of Homeland Security (DHS), CISA, Transportation Security Administration (TSA) and a variety of US intelligence community agencies. Information from threat intelligence sources in the utility industry continues to reveal adversaries that are using advanced tradecraft in their attempts to access our nation's utility systems.

---

[12] Federal Energy Regulatory Commission, *FERC Proposes Incentives for Cybersecurity Investments by Public Utilities* (December 17, 2020), *available at https://www.ferc.gov/news-events/news/ferc-proposes-incentives-cybersecurity-investments-public-utilities*.

[13] *See* Cybersecurity & Infrastructure Security Agency, ICS Alert (IR-ALERT-H-16-056-01) *Cyber-Attack Against Ukrainian Critical Infrastructure* (revised August 23, 2018), *available at https://www.us-cert.gov/ics/alerts/IR-ALERT-H-16-056-01*.

[14] *See* Kate O'Flaherty, *U.S. Government Issues Powerful Cyberattack Warning As Gas Pipeline Forced Into Two Day Shut Down*, Forbes, February 19, 2020, *available at https://www.forbes.com/sites/kateoflahertyuk/2020/02/19/us-government-issues-powerful-cyberattack-warning-as-gas-pipeline-forced-into-two-day-shut-down/?sh=3dcb3d8d5a95*.

A representative sample of recent threats facing the energy industry is provided below:

OT Attacks on Utility Infrastructure

Title: Ransomware Attack Shuts Down Biggest U.S. Gasoline Pipeline

Link: *https://www.bloomberg.com/news/articles/2021-05-08/u-s-s-biggest-gasoline-and-pipeline-halted-after-cyberattack*

Summary: 05/08/21: The operator of the biggest gasoline pipeline in the US shut down operations late Friday following a cybersecurity attack that has threatened to roil energy markets and upend the supply of gas and diesel to the East Coast. Colonial is a key artery for the eastern half of the US. It is the main source of gasoline, diesel, and jet fuel for the East Coast, with a capacity of about 2.5 million barrels a day on its system from Houston to as far as North Carolina and another 900,000 barrels a day to New York.

Title: Hackers try to contaminate Florida town's water supply through computer breach

Link: *https://www.reuters.com/article/us-usa-cyber-florida/hackers-try-to-contaminate-florida-towns-water-supply-through-computer-breach-idUSKBN2A82FV*

Summary: 02/08/21: Hackers remotely accessed the computer system of a facility that treats water for about 15,000 people near Tampa, Florida, and sought to add a dangerous level of additive to the water supply. This breach illustrates the connection between cybersecurity and the potential consequence of serious injury/harm.

Title: Energy company EDP confirms cyberattack, Ragnar Locker ransomware blamed

Link: *https://www.zdnet.com/article/edp-energy-confirms-cyberattack-ragnar-locker-ransomware-blamed/*

Summary: 07/07/2020: EDP Renewables North America (EDPR NA) disclosed a cyberattack in which ransomware infected parent company Energias de Portugal's (EDP) systems, potentially leading to information exposure. The energy firm denied the loss of customer data. Attackers claim to have stolen ten terabytes of business records.

Title: U.S. Government Issues Powerful Cyberattack Warning as Gas Pipeline Forced into Two Day Shut Down

Link: *https://www.forbes.com/sites/kateoflahertyuk/2020/02/19/us-government-issues-powerful-cyberattack-warning-as-gas-pipeline-forced-into-two-day-shut-down/?sh=3dcb3d8d5a95*

Summary: 02/19/20: A major cyberattack targeted a gas compression facility, forcing it to shut it down for two days as it struggled to recover, according to an alert from the US government.

Title: 'Denial of service' attack caused grid cyber disruption: DOE

Link: *https://www.eenews.net/stories/1060254751*

Summary: 03/05/2019: A recent cyber disruption to the US grid involved a "denial of service condition" at a Western utility.

Title: Attack on Ukrainian Electric Operator

Link: *https://www.us-cert.gov/ics/alerts/IR-ALERT-H-16-056-01*

Summary: 02/25/2016: This was a well-publicized and understood attack by a nation-state on the electrical transmission system in Ukraine. This was an advanced attack that migrated from the IT to OT system and resulted in the loss of electric load to approximately 200,000 customers.

Insider Attacks

Title: Arizona Utility Worker Charged

Link: *https://www.officer.com/home/news/10251659/ariz-waste-water-worker-charged-with-terrorism*

Summary: 04/02/2011: A City of Mesa Water Resources employee was charged with terrorism and making terrorist threats after he turned off numerous wastewater treatment operating systems at a facility overnight.

Title: Capital One former insider

Link: *https://www.bloomberg.com/news/articles/2019-07-29/capital-one-data-systems-breached-by-seattle-woman-u-s-says*

Summary: 07/29/2019: An insider, formerly employed by Amazon Web Services (AWS), illicitly penetrated vulnerabilities in the AWS configurations to enable access to the Capital One customer data.

Supply Chain

Title: SolarWinds Breach

Link: *https://www.businessinsider.com/solarwinds-hack-explained-governmentagencies-cyber-security-2020-12*

Summary: 12/24/2020: SolarWinds, a major US information technology firm, was the subject of a cyberattack that spread to its clients and went undetected for months. Foreign hackers, who some top US officials believe are from Russia, were able to use the hack to spy on private companies like the elite cybersecurity firm FireEye and the upper echelons of the US Government, including the Department of Homeland Security and Treasury Department.

Title: Major hack of US agencies may have started with software company SolarWinds

Link: *https://www.cnet.com/news/major-hack-of-us-agencies-may-have-started-with-software-company-solarwinds/*

Summary: 12/15/2020. In a filing with the Securities and Exchange Commission, SolarWinds said the vulnerable Orion updates were delivered to customers between March and June, and as many as 18,000 customers may have downloaded the software.

Title: Russian attack on electric utility suppliers

Link: *https://www.wsj.com/articles/americas-electric-grid-has-a-vulnerable-back-doorand-russia-walked-through-it-11547137112)*

Summary: 01/10/2019: Reports that a Russian group accessed an electric utility via one of the utility's smaller vendors. The Companies are monitoring a growing concern in cyber with respect to harmful vulnerabilities introduced in the supply chain.

IT Cybersecurity

Title: Hackers are using DDoS attacks to squeeze victims for ransom

Link: *https://www.techradar.com/news/hackers-are-using-ddos-attacks-to-squeeze-victims-for-ransom*

Summary: 01/09/21: A major Fortune Global 500 company was targeted by a Ransom DDoS (RDDoS) attack in late 2020. This extortion attempt was part of a wider trend of ransom campaigns that unfolded throughout last year. Cybercriminals will likely continue to use similar methods as they have been quite successful.

Title: An Old Bot's Nasty New Tricks: Exploring Qbot's Latest Attack Methods

Link: *https://research.checkpoint.com/2020/exploring-qbots-latest-attack-methods/*

Summary: 08/27/20. An Electricity Information Sharing and Analysis Center (E-ISAC) partner shared a report of Qakbot malware and Cobalt Strike tools beaconing in their environment. The E-ISAC has tracked similar activity that use Qakbot and Cobalt Strike for installation of malicious payloads, including ProLock ransomware, against multiple organizations in the United States. Open-source investigation of the indicators convey a fixed association with either Qakbot phishing email or command and control activity using Cobalt Strike.

Title: ThreatConnect Research Roundup: Spoofing SharePoint

Link: *https://threatconnect.com/blog/threatconnect-research-roundup-spoofing-sharepoint/*

Summary: In April 2020, a government partner report identified the registration of a lookalike domain of a US-based energy engineering company by unknown threat actors. The company being imitated, HPI Energy Services Ltd., specializes in turbine and utility

plant control systems integration. According to the report, the threat actors created a primary and two sub-domains that host fake Microsoft SharePoint-themed login pages for a probable credential harvesting campaign. These fake sites are likely aimed at collecting credentials of HPI Energy Services employees.

B. Risk Definition

For purposes of this RAMP Application, the Companies' Cybersecurity risk is defined as the risk of a major cybersecurity incident, which results in disruptions to electric or gas operations (*e.g.*, Industrial Control Systems, supply, transmission, distribution, storage) and/or damage or disruption to the Companies' operations, reputation, or disclosure of sensitive customer or Company data.

C. Scope

Table 1 below provides what is considered in scope for the Cybersecurity risk in this RAMP Application.

Table 1: Risk Scope

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.
Data Quantification Sources:	SoCalGas & SDG&E engaged internal data sources for the calculation surrounding risk reduction; however, if data was insufficient, industry or national data was supplemented and adjusted to fit the risk profile associated with the operating locations and perimeter of the utilities. For example, certain types of incident events have not occurred within the SoCalGas & SDG&E service territories; therefore, expanding the quantitative needs to encompass industry data where said incident(s) have been recorded provides a proxy and is justified in establishing a baseline of risk and risk addressed by activities.

Additional information on data quantification sources for the Cybersecurity risk, the potential gas system impacts, and electric system impacts is provided in Appendix B.

II. RISK ASSESSMENT

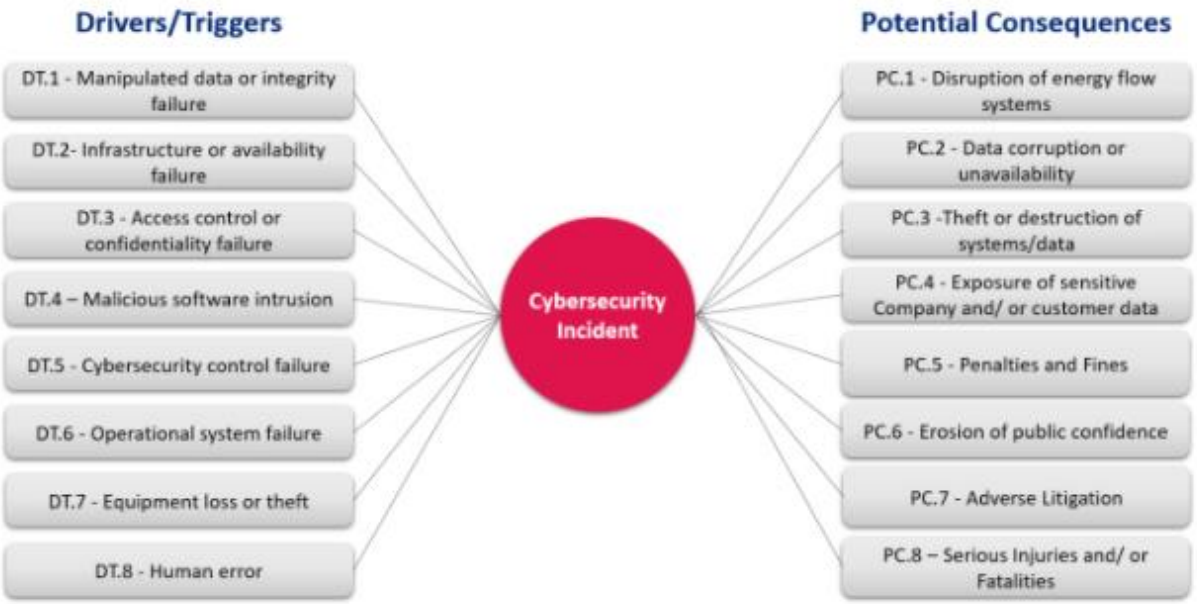
In accordance with the S-MAP Settlement Decision,[15] this section describes the risk Bow Tie, possible Drivers, potential Consequences, and the risk score for the Cybersecurity risk.

[15] D.18-12-014.

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision[16] instructs the utility to include a risk bow tie illustration for each risk included in RAMP. 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 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 element(s) of the risk bow tie addressed is provided in Appendix A.

Figure 1: Risk Bow Tie



B. Overarching & Cross-Functional Factors

Cross-functional factors (CFF) refer to initiatives (drivers, consequences, and/or mitigations) that are associated with, but are not specific to, any specific RAMP risk. Cybersecurity does not operate in a vacuum. It touches upon, and its focus is, to protect every technology system in the Companies.

[16] *Id.* at Attachment A, A-11 ("Bow Tie").

An important cross-functional factor that impacts the Cybersecurity risk is the safe and reliable operation of Foundational Technology Systems. As explained in RAMP Chapters SCG-CFF-4/SDG&E-CFF-4, these systems are used in every aspect of operations, customer engagement, and emergency response. These systems encompass the Companies' critical software application systems, communication networks, monitoring systems, end-user systems, and hardware and software platforms hosted in the Companies' data centers and on internal and external Cloud Platforms. The security and reliability of operations depend on Foundational Technology Systems; thus, it is critical for these systems to be secure, resilient, and recoverable to mitigate risks.

Cybersecurity threats, if successful, can impact the Companies' Foundational Technology Systems. Impacts to Foundational Technology Systems can negatively affect critical business operations and processes that rely on these systems. The following four factors relate to Foundational Technology Systems:

(1) Technology systems have become the foundation for operational, business, and customer engagement needs across the enterprise, where even the most routine tasks rely on an interdependent network of systems and services. The interdependencies of such systems can create an increased Cybersecurity risk.

(2) Technology can quickly become obsolete and require lifecycle management activities such as maintenance, upgrades, and replacements. Neglecting these activities may result in downstream impacts, performance issues, and/or cybersecurity vulnerabilities.

(3) The industry is faced with constantly evolving threats from both domestic and foreign adversaries, as well as supply chain risks, third-party and insider threats, and natural hazards. Collectively, the dependency on technology systems and the dynamic nature of technology threats, hazards, and risks requires that the Companies' controls and mitigations leverage the latest security solutions on the market and constantly adapt to securely, safely, and reliably provide services to the workforce and customers.

(4) Cloud technology is the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—to offer faster innovation, flexible resources, and economies of scale. Implementing and operating in a secure cloud enables the use of a broad set of policies, technologies, applications, and controls provided by the Cloud

Platforms to assist in protecting sensitive Company data, applications, services, and the associated infrastructure.

Cloud technology provides a shared responsibility model between Cloud Platforms and the Company. Although the Company is ultimately accountable for ensuring cybersecurity protections are in place and effective, the Companies' Cloud Platform partners are responsible for protecting the infrastructure that runs the services offered in the cloud. Specifically, the cloud provider manages the security of the cloud, while security in the cloud is the responsibility of the Companies.

By prioritizing Cloud Platform as a service, the Companies are decreasing the Cybersecurity risk raised by traditional Information Technology (IT) systems and manual techniques. Cloud providers manage security, patching, and updates at the platform level, allowing the Companies to focus on driving business value and increasing enterprise resiliency.

C. Potential Drivers/Triggers[17]

The Settlement Decision[18] instructs the utility to identify which element(s) of the associated risk Bow Tie each mitigation addresses. When performing the risk assessment for Cybersecurity, SoCalGas and SDG&E identified potential leading indicators, referred to as Drivers or Triggers. These include, but are not limited to:

- **DT.1 - 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.
- **DT.2 - Infrastructure or availability failure**: An unplanned, severe, extensive and/or large-scale system outage caused by a cybersecurity-related event or incident.
- **DT.3 - 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.

---

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

[18] D.18-12-014 at Attachment A, A-11 ("Bow Tie").

- **DT.4 - 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 - 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.6 - 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 - 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.8 - Human error (*e.g.*, clicking on a phishing email):** An accidental cybersecurity event/incident conducted by a human.

D. Potential Consequences of Risk Event

Potential Consequences[19] are listed to the right side of the risk Bow Tie illustration provided above. If one or more of the Drivers/Triggers listed above were to result in an incident, the potential Consequences, in a reasonable 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

[19] D.18-12-014 at 16 and Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

These potential Consequences were used in the scoring of Cybersecurity that occurred during the development of SoCalGas' and SDG&E's respective 2020 Enterprise Risk Registries.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[20] Chapter RAMP-C of this RAMP Application explains the Risk Quantitative Framework that underlies this Chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[21]

SoCalGas	LoRE	CoRE	Risk Score
Cybersecurity	0.09	10,829	975
SDG&E	**LoRE**	**CoRE**	**Risk Score**
Cybersecurity	0.08	16,446	1,316

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, and available and appropriate data.[22] Given the emerging and evolving nature of Cybersecurity risk, particularly in the Operational Technology (OT) domain, there is limited information to assess the risk using historical information. Therefore, the Companies used multiple indicators in predicting the likelihood and consequence of such an event, such as SME and industry data to inform the likelihood and consequence values. The risk of a Cybersecurity incident was evaluated with consideration for the different risk profiles of the OT infrastructure of the gas and electric systems. Additional information and the evaluation of Cybersecurity risk and the potential gas system impacts and electric system impacts is provided in Appendix B.

III. 2020 CONTROLS

This section "[d]escribe[s] the controls or mitigations currently in place" as required by the Settlement Decision.[23] The activities in this section were in place as of December 31, 2020. Controls that will continue in 2022-2024 are addressed below in Section IV.

---

[20] *Id.* at Attachment A, A-11 ("Calculation of Risk").

[21] The term "pre-mitigation analysis," in the language of the S-MAP Settlement Decision (Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score")), refers to required pre-activity analysis conducted prior to implementing control or mitigation activity.

[22] *Id.* at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

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

The controls discussed in this chapter focus on activities performed or supported directly by the Cybersecurity department as a shared service for SoCalGas, SDG&E, and Sempra Energy. The Cybersecurity department manages cybersecurity risks across the enterprise.

The Cybersecurity program utilizes risk management frameworks, including but not limited to the National Institute of Standards and Technology (NIST) Cybersecurity Framework, Center for Internet Security (CIS-20), NIST 800-53, and MITRE ATT&CK framework. Additionally, the Companies comply with applicable laws and regulations both at the State and Federal level.

The Companies have considered the evolving threat and regulatory landscape of cybersecurity risk in the design of their planned controls. The Companies have adopted a comprehensive and enhanced control portfolio that balances risk mitigation and cost effectiveness while also establishing foundational security capabilities that will serve to mitigate risks from evolving threats. The planned controls are designed to provide adequate risk reduction to offset the projected Cybersecurity risk increase to maintain this risk at a manageable level.

A. Control 1: 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. 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 our 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 as outlined above in Figure 1 and in Appendix A including: Manipulated data or integrity failure (DT.1), Infrastructure or availability failure (DT.2), Access control or confidentiality failure (DT.3), Malicious software intrusions (DT.4), Cybersecurity control failures (DT.5), Operational system failures (DT.6), Equipment Loss or Theft (DT.7), Human error (DT.8). In addition, the Perimeter Defenses control helps to reduce the Potential Consequences of: Data corruption or unavailability (PC.2), Theft or destruction of systems/data (PC.3), Exposure of internal data (PC.4), Erosion of public confidence (PC.6).

Perimeter Defenses projects presented in this control include:

- Firewall upgrades and process automation,
- Web Application Firewall Protection,
- Distributed Denial of Service Protection,
- System security assessment efforts,
- Browser isolation/sandboxing,
- IoT (Internet of Things) Sensors, and
- Perimeter Defense mechanisms.

B. Control 2: 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. The enhancements to the Companies' IT and OT systems' Access Management system reduces the risk to internal assets, Foundational Technology 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, which improves 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.

Use of "browser based" and Virtual desktop infrastructure (VDI) further helps improve the effectiveness of Internal Defense mitigations. VDI is defined as the hosting of desktop environments on a central server. It is a form of desktop virtualization, as the specific desktop images run within virtual machines (VMs) and are delivered to end clients over a network. This IT strategy reduces the attackers' threat surface by limiting their ability to compromise and establish a foothold on any one device or endpoint and then pivot to other resources on the network.

Based on the foregoing, Internal Defenses address several Drivers/Triggers and Potential Consequences including: Manipulated data or integrity failure (DT.1), Infrastructure or availability failure (DT.2), Access control or confidentiality failure (DT.3), Malicious software intrusions (DT.4), Cybersecurity control failures (DT.5), Operational system failures (DT.6), Equipment Loss or Theft (DT.7), Human error (DT.8), Data corruption or unavailability (PC.2), Theft or destruction of systems/data (PC.3), Exposure of internal data (PC.4), Erosion of public confidence (PC.6).

Internal Defenses projects presented in this control include:

- Endpoint Security Monitoring,
- Threat and Vulnerability Management,
- Insider Threat Detection and User Behavior Analytics,
- Incident Management,
- Third Party External Privileged Access Management,
- Data Loss Prevention (DLP)
- Supply Chain Risk Management, and
- Cloud Access Security

C. Control 3: Sensitive Data Protection

Sensitive Data Protection is a core component of the Companies' defense-in-depth strategy for cybersecurity. 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 will help the Companies continue the prudent management of sensitive data.

Sensitive Data Protection addresses several Drivers/Triggers and Potential Consequences including: Manipulated data or integrity failure (DT.1), Access control or confidentiality failure (DT.3), Cybersecurity control failures (DT.5), Human error (DT.8), Data corruption or unavailability (PC.2), Theft or destruction of systems/data (PC.3), Exposure of internal data (PC.4), Penalties and fines (PC.5), Erosion of public confidence (PC.6), Adverse litigation (PC.7).

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.

D. Control 4: 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. Network anomaly detection, endpoint detection, and security event monitoring improves visibility into the OT environment, which allows for faster response and remediation. Enhanced secure access technologies help reduce risk of unauthorized access. These risk mitigation activities strengthen our capabilities by securing the foundation of OT security. These enhancements are necessary to maintain a secure OT system and mitigate the increasing potential threat on that critical system.

OT Cybersecurity requires a specialized approach in order 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 improves visibility into the OT environment, which allows for faster response and remediation. Enhanced secure access technologies help reduce risk of unauthorized access. These risk mitigation activities strengthen the Companies' capabilities by securing the foundation of OT security. These enhancements are necessary to maintain a secure OT system and mitigate the increasing potential threat on that critical system.

This specialized OT Cybersecurity addresses several Drivers/Triggers and Potential Consequences including: Infrastructure or availability failure (DT.2), Access control or confidentiality failure (DT.3), Malicious software intrusions (DT.4), Cybersecurity control failures (DT.5), Operational system failures (DT.6), Human error (DT.8), Disruption of energy flow systems (PC.1), Data corruption or unavailability (PC.2), Penalties and fines (PC.5), Erosion of public confidence (PC.6), Adverse litigation (PC.7), Serious Injuries and Fatalities (PC.8).

The Companies' cybersecurity program prioritizes operational technology 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 Cybersecurity Tools Hosting Environment Enhancements
- OT Network Anomaly Detection
- OT Application Whitelisting
- OT Advanced Security Incident Management (SIEM) and Analytics
- OT Asset Inventory Control
- OT Environment Network Access Control
- OT Environment Endpoint Detection Response
- OT Network Anomaly Detection Critical Facilities
- OT Malware Defense
- OT Secure Remote Connection

E. Control 5: Obsolete Information Technology (IT) Infrastructure and Application Replacement

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 baseline activities referenced in the O&M (Operations & Maintenance) budget outlook (see Tables 4 and 5 below) support the capital investments. Some examples of these baseline controls include, but are not limited to:

- A security policy framework
- Risk management and assessments
- Cybersecurity awareness and training
- Security assessment
- Asset management
- Protective technologies (Network, User, Application)
- System authentication – public key infrastructure (PKI)
- Security Operations Center
    - Monitors security-related activities in systems and applications
    - Anomaly detection
    - Security event detection and escalation
    - Monitors detection infrastructure systems to investigate security events

- Incident response
- Exercises/drills

Obsolete IT Infrastructure and Application Replacement addresses several Drivers/Triggers and Potential Consequences as outlined above in Figure 1 and in Appendix A. These include: Manipulated data or integrity failure (DT.1), Infrastructure or availability failure (DT.2), Access control or confidentiality failure (DT.3), Malicious software intrusions (DT.4), Cybersecurity control failures (DT.5), Operational system failures (DT.6), Disruption of energy flow systems (PC.1), Data corruption or unavailability (PC.2), Theft or destruction of systems/data (PC.3), Exposure of sensitive Company and customer data (PC.4), Erosion of public confidence (PC.6).

The projects presented in this control include:

- Technology refreshes, including, but not limited to:
  - Infrastructure
  - Operating systems
  - Middleware
  - 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.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[24] All of the activities discussed in Section III above are expected to continue during the TY 2024 GRC. For clarity, a current activity that is included in the 2022-2024 plan may be referred to as either a control and/or a mitigation. For purposes of this RAMP, a control that will continue as a mitigation will retain its control ID unless the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. The table below shows which activities are expected to continue.

[24] *See id.* at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Table 3 Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	Perimeter Defenses	X	X
2	C2	Internal Defenses	X	X
3	C3	Sensitive Data Protection	X	X
4	C4	OT Cybersecurity	X	X
5	C5	Obsolete IT Infrastructure and Asset Replacement	X	X

A single tranche is appropriate for a Cybersecurity risk event, as there is no logical disaggregation of assets or systems related to the controls presented in the mitigation plan. The controls for this risk 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 RSE (Risk Spend Efficiency) is currently at the operational program level (*i.e.*, Perimeter Defenses, Internal Defenses, Sensitive Data Protection, OT Cybersecurity and Obsolete IT Infrastructure and Asset Replacement) rather than each individual risk mitigation activity for the Cybersecurity risk.

A. Changes to 2020 Controls

The Companies plan to continue each of the existing controls discussed above in Section III through the 2022 – 2024 period without any significant changes.

B. 2022 – 2024 Mitigations

The Companies are currently not planning any new mitigations during the 2022 – 2024 period.

V. COSTS, UNITS, AND QUANTITATIVE SUMMARY TABLES

The tables in this section provide a summary of the risk mitigation plan, including the associated costs, units, and the RSEs, by tranche. SoCalGas and SDG&E do not account for and track costs by activity or tranche; rather, SoCalGas and SDG&E account for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data.

Table 4: SoCalGas Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[25]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	Perimeter Defenses	$8,037	$1,032	$10,445	$13,347	$1,251	$1,599
C2	Internal Defenses	$4,658	$3,124	$10,816	$13,821	$3,158	$4,035
C3	Sensitive Data Protection	$0	$2,377	$7,054	$9,014	$2,351	$3,004
C4	OT Cybersecurity	$127	$896	$14,790	$18,898	$1,066	$1,362
C5	Obsolete IT Infrastructure and Asset Replacement	$206	$1,083	$8,928	$11,408	$1,297	$1,657

[25] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for the Company's Test Year 2024 GRC Application.

Table 5: SDG&E Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[26]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	Perimeter Defenses	$10,231	$811	$10,013	$12,795	$984	$1,257
C2	Internal Defenses	$4,312	$2,457	$9,405	$12,018	$2,483	$3,173
C3	Sensitive Data Protection	$0	$1,869	$6,807	$8,698	$1,849	$2,362
C4	OT Cybersecurity	$458	$704	$16,245	$20,758	$838	1,071
C5	Obsolete IT Infrastructure and Asset Replacement	$1,326	$852	$7,921	$10,121	$1,020	$1,303

[26] *See*, *supra*, n. 25.

Table 6: SoCalGas Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	Perimeter Defenses	The cybersecurity mitigations have multiple different types of units of measure. For example, in the Perimeter Security mitigation area there are devices involved, network users, data consumed, service contracts, etc. It would not be accurate or consistent to identify a single unit of measure.							
C2	Internal Defenses								
C3	Sensitive Data Protection								
C4	OT Cybersecurity								
C5	Obsolete IT Infrastructure and Asset Replacement								

Table 7: SDG&E Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	Perimeter Defenses	The cybersecurity mitigations have multiple different types of units of measure. For example, in the Perimeter Security mitigation area there are devices involved, network users, data consumed, service contracts, etc. It would not be accurate or consistent to identify a single unit of measure.							
C2	Internal Defenses								
C3	Sensitive Data Protection								
C4	OT Cybersecurity								
C5	Obsolete IT Infrastructure and Asset Replacement								

Table 8: SoCalGas Risk Control & Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	Perimeter Defenses	0.10	13,482	1,356	160
C2	Internal Defenses	0.11	13,482	1,544	95
C3	Sensitive Data Protection	0.14	13,482	1,918	62
C4	OT Cybersecurity	0.05	10,829	497	112
C5	Obsolete IT Infrastructure and Asset Replacement	0.13	13,482	1,731	102

Table 9: SDG&E Risk Control & Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	Perimeter Defenses	0.10	13,482	1,356	160
C2	Internal Defenses	0.11	13,482	1,544	95
C3	Sensitive Data Protection	0.14	13,482	1,918	62
C4	OT Cybersecurity	0.04	16,466	672	142
C5	Obsolete IT Infrastructure and Asset Replacement	0.13	13,482	1,731	102

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, the Companies considered alternatives to the risk mitigation plan for the 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 considered modifications to the risk mitigation 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 risk-spend efficiency, 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,
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 based on several criteria:

- The project implementation's impact on the maturity of cybersecurity at the Companies;

- The extent to which each project addresses recommendations from CSC 20,[27] ICS-CERT,[28] and other frameworks;
- The extent to which each project addresses threats to cybersecurity of high impact and likelihood; and
- The effectiveness in mitigating a credible attack impacting safety.

After each project was tagged as High/Medium/Low, 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:

1. Perimeter Defenses,
2. Internal Defenses,
3. Sensitive Data Protection,
4. Operational Technology Cybersecurity, and
5. Obsolete IT Infrastructure and Application Replacement.

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 high RSE compared to other alternative portfolios.

---

[27] CSC-20: The Twenty (20) Critical Security Controls (CSC) for Cyber Defense are a culmination of exhaustive research and development of information security initiatives that advocate a "offense must inform defense approach," as noted by the SANS institute, available at *https://www.sans.org/critical-security-controls*.

[28] ICS-CERT: The Industrial Control Systems Cyber Emergency Response Team (ICS-CERT) provides a control system security focus in collaboration with US-CERT (*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.

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. The quantitative analysis conducted by the Companies shows that the Companies' Alternative Portfolio 1, comprising only high-impact projects, is estimated to have a lower RSE than the Plan when considering the RSE of the individual categories, as shown below. In addition, 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 growth rate of the risk. If Alternative Portfolio 1 is executed, the Cybersecurity risk will increase compared to the Companies' risk mitigation plan.

The quantitative analyses for each of the five utility-focused operational cybersecurity categories are presented below. As stated above, these projects, when combined into an alternative portfolio, is lower than the Companies' Plan.

1. Alternative Portfolio 1 – C1 (High-impact Perimeter Defenses)
2. Alternative Portfolio 1 – C2 (High-impact Internal Defenses)
3. Alternative Portfolio 1 – C3 (High-impact Sensitive Data Protection)
4. Alternative Portfolio 1 – C4 (High-impact OT Cybersecurity)
5. Alternative Portfolio 1 – C5 (High-impact Obsolete IT Infrastructure and Application Replacement)

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 an RSE 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.

1. Alternative Portfolio 2 – C1 (High-, Medium-, and Low-impact Perimeter Defenses)
2. Alternative Portfolio 2 – C2 (High-, Medium-, and Low-impact Internal Defenses)
3. Alternative Portfolio 2 – C3 (High-, Medium-, and Low-impact Sensitive Data Protection)
4. Alternative Portfolio 2 – C4 (High-, Medium-, and Low-impact OT Cybersecurity)
5. Alternative Portfolio 2 – C5 (High-, Medium-, and Low-impact Obsolete IT Infrastructure and Application Replacement)

The costs and RSEs for Alternative Portfolio 1 and Alternative Portfolio 2 are presented in the tables that follow.

Table 10: SoCalGas Alternate Mitigation Plan - Recorded and Forecast Dollars Summary[29] (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Alternative Portfolio 1	$47,984	$61,312	$9,122	$11,656
A2	Alternative Portfolio 2	$81,319	$103,907	$9,122	$11,656

Table 11: SDG&E Alternate Mitigation Plan - Recorded and Forecast Dollars Summary[30] (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Alternative Portfolio 1	$20,159	$25,759	$7,173	$9,166
A2	Alternative Portfolio 2	$21,104	$26,966	$7.173	$9,166

[29] *See, supra*, n. 25.

[30] *Id.*

Table 12: SoCalGas Alternate Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
A1	Alternative Portfolio 1	The cybersecurity mitigations have multiple different types of units of measure. For example, in the Perimeter Security mitigation area there are devices involved, network users, data consumed, service contracts, etc. It would not be accurate or consistent to identify a single unit of measure.					
A2	Alternative Portfolio 2						

Table 13: SDG&E Alternate Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
A1	Alternative Portfolio 1	The cybersecurity mitigations have multiple different types of units of measure. For example, in the Perimeter Security mitigation area there are devices involved, network users, data consumed, service contracts, etc. It would not be accurate or consistent to identify a single unit of measure.					
A2	Alternative Portfolio 2						

Table 14: SoCalGas Alternate Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
A1-C1	Perimeter Defenses	0.12	13,482	1610	157
A1-C2	Internal Defenses	0.13	13,482	1746	85
A1-C3	Sensitive Data Protection	0.15	13,482	2019	56
A1-C4	OT Cybersecurity	0.06	10,829	627	110
A1-C5	Obsolete IT Infrastructure and Application Replacement	0.14	13,482	1883	98
A2-C1	Perimeter Defenses	0.09	13,482	1238	154
A2-C2	Internal Defenses	0.11	13,482	1449	88
A2-C3	Sensitive Data Protection	0.14	13,482	1899	57
A2-C4	OT Cybersecurity	0.04	10,829	474	112
A2-C5	Obsolete IT Infrastructure and Application Replacement	0.13	13,482	1703	98

Table 15: SDG&E Alternate Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
A1-C1	Perimeter Defenses	0.12	13,482	1610	157
A1-C2	Internal Defenses	0.13	13,482	1746	85
A1-C3	Sensitive Data Protection	0.15	13,482	2019	56
A1-C4	OT Cybersecurity	0.05	16,465	847	110
A1-C5	Obsolete IT Infrastructure and Application Replacement	0.14	13,482	1883	98
A2-C1	Perimeter Defenses	0.09	13,482	1238	154
A2-C2	Internal Defenses	0.11	13,482	1449	88
A2-C3	Sensitive Data Protection	0.14	13,482	1889	57
A2-C4	OT Cybersecurity	0.04	16,466	672	139
A2-C5	Obsolete IT Infrastructure and Application Replacement	0.13	13,482	1703	98

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Appendix A: Summary of Elements of the Risk Bow Tie
Cybersecurity: Summary of Elements of the Risk Bow Tie

Control ID	Control Name	Elements of the Risk Bow Tie Addressed
C1	Perimeter Defenses	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7, DT.8 PC.2, PC.3, PC.4, PC.6
C2	Internal Defenses	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7, DT.8 PC.2, PC.3, PC.4, PC.6
C3	Sensitive Data Protection	DT.1, DT.3, DT.5, DT.8, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C4	Operational Technology (OT) Cybersecurity	DT.2, DT.3, DT.4, DT.5, DT.6, DT.8 PC.1, PC.2, PC.5, PC.6, PC.7, PC.8
C5	Obsolete Information Technology (IT) Infrastructure and Application Replacement	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.6

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

Appendix B: Quantitative Analysis Source Data References

Cybersecurity: Quantitative Analysis Source Data References

The Settlement Decision directs the utility to identify potential consequences of a risk event using available and appropriate data.[31] The list below provides the inputs used as part of this assessment.

Gas Systems Impacts

The scoring for a cybersecurity attack's impact on the gas system was conducted using SME input and industry data as a proxy for historical cybersecurity attacks on the gas system. A number of potential cybersecurity attacks on the gas system were evaluated to determine safety, financial, and reliability consequences of an event. A cybersecurity attack with high safety consequences could involve the inundation of the Companies' Contact Centers (call center) by attackers, rendering the call centers inoperable. This might prevent customers and employees from being able to alert the Companies about time-sensitive gas operations emergencies in the field. Which, in turn, could result in a delayed Company response to the gas emergency, exacerbating the safety and reliability consequences of the event. For example, a gas leak, if left unreported and unremedied, under some circumstances might lead to an explosion or ignition. To determine the safety impacts of a cybersecurity attack on a call center, the Companies relied on historical Company evacuations data to estimate the number of customers who may not be evacuated during a gas leak if unable to contact the Company due to a cybersecurity attack on the call center. The financial consequences of a cybersecurity attack on the call center include the cost of stolen customer records, as informed by Ponemon Institute's 2020 "Cost of a Data Breach Report."[32] In addition to financial consequences, the theft of customer records can lead to reputational consequences for the Company.

A cybersecurity attack on the gas system may result in the attacker gaining access to the gas control or Supervisory Control And Data Acquisition (SCADA) systems and manipulating, or disarming alarms to cause operational and safety consequences. The 2008 Turkey Oil Pipeline explosion is a historical example of this type of cybersecurity attack. During this attack,

---

[31] D.18-12-014, Attachment A at A-8 (Identification of Potential Consequences of Risk Event).

[32] *See*, DigitalGuardian, *What Does a Data Breach Cost in 2020?* (August 18, 2020), available at *https://digitalguardian.com/blog/what-does-data-breach-cost-2020.*

attackers gained access to the pipeline's surveillance systems and valve stations and over-pressured the pipeline without triggering alarms.[33] The overpressure resulted in an explosion that cost over a million dollars and resulted in thousands of barrels of oil spilled near a water aquifer. To determine the safety impacts of a cybersecurity attack impacting gas control at the Companies, SMEs analyzed the safety consequences of national Pipeline and Hazardous Materials Safety Administration (PHMSA) transmission incident events without SCADA in place. The average value of safety impacts for these events was used as a proxy for a cybersecurity attack on the gas control system at the Companies. Financial consequences for an attack on the gas control/SCADA systems were informed by industry research, including a Center for Strategic and International Studies report, which calculated the cost of a cybersecurity attack on oil and gas SCADA systems at an estimated $8.4 million per day.[34] SME input estimates the time to rebuild the SCADA system as one month in a worst-case scenario. A cybersecurity attack on the gas control center can also have major reliability consequences. To determine the operational consequences of this type of event, SMEs used the average reliability impacts of incidents on the transmission system at the Companies (*see* Incident Related to the High Pressure System (Excluding Dig-in) RAMP chapters SCG-Risk-1/SDG&E-Risk-3). A cybersecurity attack may result in outages and lead to a gas curtailment.

Several data points and sources were used by the Companies' SMEs to estimate the likelihood of events on the electric and gas systems. According to the 2015 Lloyd's Emerging Risk Report, "there have been 15 suspected cyber attacks or events on the US electricity grid since 2000"[35] to 2015. The estimate of the likelihood of this event occurring based on that report is in the order of 2% (1 in 50 years). In addition, a 2017 industry research report by Accenture,

---

[33] Bloomberg, *Mysterious '08 Turkey Pipeline Blast Opened New Cyberwar* (December 10, 2014), available at *https://www.bloomberg.com/news/articles/2014-12-10/mysterious-08-turkey-pipeline-blast-opened-new-cyberwar*.

[34] McAfee, Inc. *In The Crossfire: Critical Infrastructure In The Age of Cyber War* (2010), available at *https://img.en25.com/Web/McAfee/NA_CIP_RPT_REG_2840.pdf*.

[35] Lloyd's Emerging Risk Report – 2015, *Business Blackout: The Insurance Implications of a Cyber Attack on the US Power Grid* (2015) at 53, available at *https://www.lloyds.com/~/media/files/news%20and%20insight/risk%20insight/2015/business%20blackout/business%20blackout20150708.pdf*.

"Cost of Cyber Crime Study,"[36] indicates a rapidly evolving risk increasing at an annual rate of 27%. The 2019 study reflected a similar rate of increase at 11%. Given this information, the Companies' SMEs provide a likelihood of 2% for the cyber risk or 1:50 years. This frequency was also used as a proxy for cybersecurity attacks on the gas system with low safety consequences, such as attacks on the gas control center. An attack with high safety consequences on the gas system, such as an attack on a Company Contact Center, was given a frequency of 1 incident in 25 years based on SME input.

Electric System Impacts

To determine the potential consequences for the electric system, SMEs evaluated relevant industry event scenarios to determine a credible worst-case scenario of a cybersecurity attack at SDG&E. Historical examples used to inform estimates of potential consequences of a cybersecurity attack on the electric system include:

- Ukraine (2015 and 2016) – In 2015, remote cyber intrusions caused outages at three regional electric power distribution companies, impacting approximately 225,000 customers for 6 hours in Ukraine. In 2016, hackers used a more sophisticated malware ("Crash Override") in an attempt to disable protective relay devices through a denial of service (DoS) attack. Although the 2016 attack only caused a one-hour outage, recent research suggests that hackers intended to inflict lasting damage that could have led to outages for weeks or even months.
- Southwest US Outage (2011) – In 2011, a maintenance procedure in Yuma, Arizona caused a cascade of power failures across the Southwest resulting in widespread outages in SDG&E's service territory. As the failure spread, grid operators were unaware of many rapid-fire events outside their territories. Electrical service was restored to most of SDG&E's customers within 12 hours.
- Northeast US Outage (2003) – The biggest blackout in North America occurred in 2003. High voltage power lines came into contact with vegetation, and a

[36] Ponemon Institute, LLC and Accenture, *2017 Cost of Cyber Crime Study: Insights on the Security Investments that Make a Difference* (2017) at 2, ("*... there are over 130 large-scale, targeted breaches in the U.S. per year, and that number is growing by 27 percent per year."*), available at *https://www.accenture.com/_acnmedia/pdf-62/accenture-2017costcybercrime-us-final.pdf#zoom=50.*

combination of human error and equipment failures resulted in outages for 50 million people.

- Lloyds Scenarios (Scenario 1) – A report produced by Lloyd's of London and the University of Cambridge considered the impact of a hypothetical cybersecurity attack. In the scenario, malware infects generation control rooms in the Northeast US. The malware goes undetected until triggered and tries to take control of generators. While power is restored to some areas within 24 hours, others remain without electricity for weeks.

Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-7)

Excavation Damage (Dig-In) on the Gas System

May 17, 2021

TABLE OF CONTENTS

RISK: EXCAVATION DAMAGE (DIG-IN) ON THE GAS SYSTEM

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 Excavation Damage (Dig-in) on the Gas System risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter SDG&E RAMP-B of this RAMP Report. SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process annually. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter SCG/SDG&E RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs and cost estimates are provided for years 2022-2024, as further discussed in Chapter SCG/SDG&E RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are

---

[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[2] *See* D.18-12-014 at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

provided where those costs are available and within the scope of the analysis required in this RAMP Report.

Throughout this 2021 RAMP Report, activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's Dig-in risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters SCG/SDG&E RAMP-A and C, SDG&E has endeavored to calculate an RSE for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or SME opinion exists to calculate the RSE, SDG&E has included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

SDG&E has also included a qualitative narrative discussion of certain risk mitigation activities that would otherwise fall outside of the RAMP Report's requirements, to aid the California Public Utilities Commission (CPUC or Commission) and stakeholders in developing a more complete understanding of the breadth and quality of the Company's mitigation activities. These distinctions are discussed in the applicable control and mitigation narratives in Section III and/or IV.

A. Risk Overviews

SDG&E operates and manages a natural gas system of over 14,500 miles of Distribution pipe and 232 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

---

3 *Id*. at 16.

4 *Id.* at 17.

5 *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

(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.

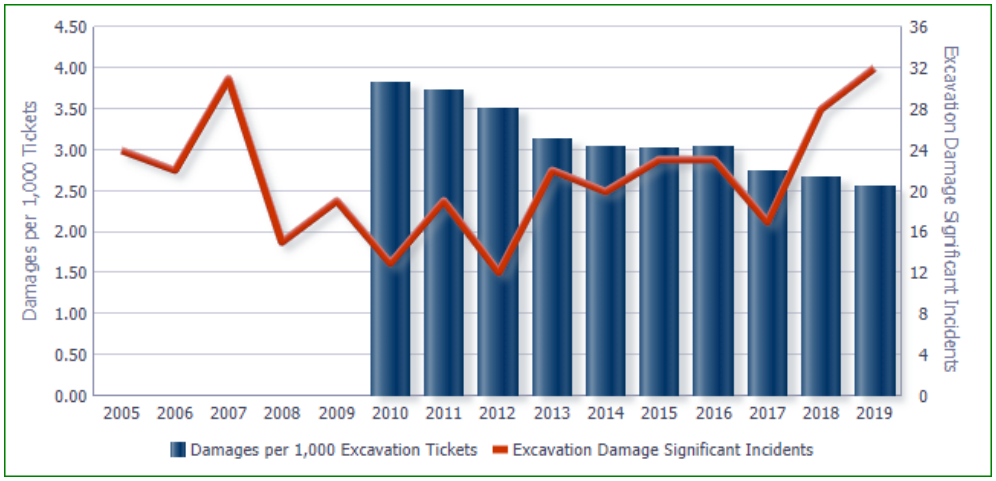
SDG&E has been mitigating dig-in risk to its underground gas infrastructure for decades. Dig-ins are a common national problem for all industries and utilities with buried infrastructure and are not unique to SDG&E. Excavation activities can vary widely based on project scope and size. Some examples are: a homeowner doing landscaping work, a plumber repairing a sewer line, or a city upgrading its aging municipal water or sewer systems. Excavation damage can range from minor scratches or dents 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 minor damage accumulated over time. Minor damage that does not result in a release of gas is often not 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 1,700 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 has been trending down (Figure 1), incidents still occur. Excavation tickets are a common metric used throughout the industry to gauge the status of a damage prevention program. Figure 1 represents trends for dig-ins on distribution lines. Excavation data for

transmission incidents are less frequent and harder to trend. Thus, the Pipeline and Hazardous Materials Safety Administration (PHMSA) collects ticket totals in annual reports for distribution facilities but does not collect ticket information for transmission facilities.

Figure 1: Excavation Tickets & Incidents



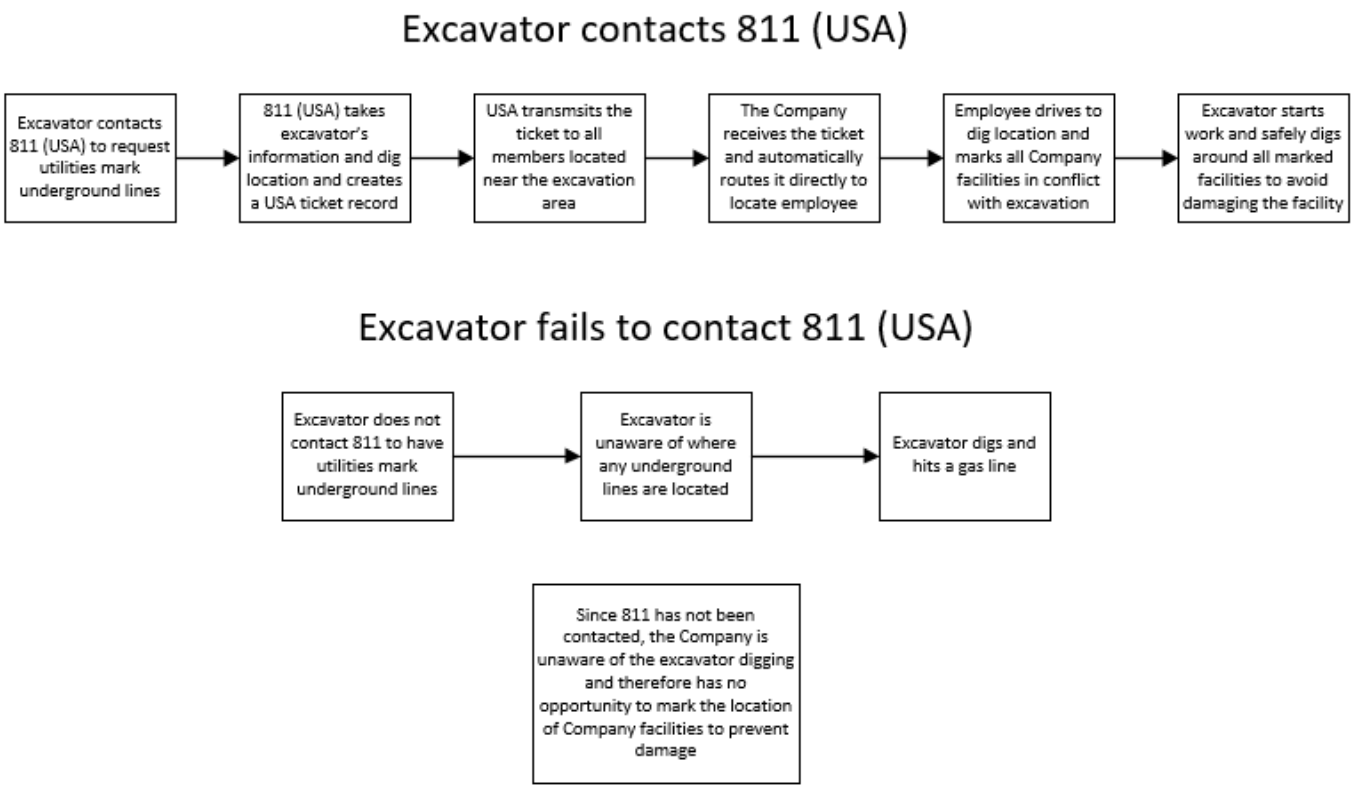
Under California State Law, an excavator planning excavation work is required to contact the Regional Notification Center for their area, also known as Eight-One-One (811) or Underground Service Alert (USA), at least two (2) full working days prior to commencing construction excavation activities, not including the day of the notification.[6] 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 a 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 positioned, thus

[6] Cal. Gov. Code § 4216.2(b).

enabling excavators, like contractors and homeowners, to know where substructures are located. The law also requires excavators to use careful, manual (hand digging) methods to expose substructures prior to using mechanical excavation tools.[7]

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.

Figure 2: Excavation Contact Process Flow



As can be seen in the figure above, 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 significantly reduced.

SDG&E managed over 180,000 811 USA tickets and reported over 300 dig-in excavation damage incidents in 2020. Analysis of the data collected during routine damage investigations indicate that further analysis of the reported damage incidents shows that about approximately

[7] Cal. Gov. Code § 4216.4(a)(1).

58% were due to a lack of notification to 811 USA for a locate and mark ticket, and another 30% were due to 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 Definition

For purposes of this RAMP Application, SDG&E's Dig-in risk is defined as excavation damage on the gas system, regardless of the party (1st, 2nd, 3rd), which results in significant consequences, including serious injuries and/or fatalities.

Excavation Damage (Dig-In) on the Gas System has evolved from Dig-in on the Distribution System and Dig-in on the Transmission System in the 2020 ERR. In the 2019 RAMP the risk was referred to as Third Party Dig-in Medium Pressure and Third Party Dig-in High Pressure.

In the 2019 RAMP Report, SDG&E presented two stand-alone risk chapters associated with Third Party Dig-in risks. They were separated by operating pressure: one for Medium Pressure and the other for High pressure piping facilities. For this RAMP application, the definition of Excavation Damage (Dig-In) On the Gas System has been expanded to include all aspects and parties involved with excavation damage. The gas system is considered gas pipelines upstream of the gas meter for both medium and high-pressure systems.

C. Scope

Table 1 below provides what is considered in and out of scope for the Dig-in risk in this RAMP Application.

Table 1: Risk Scope

In-Scope:	Excavation damage on the gas system, which includes both medium & high-pressure pipelines upstream of the gas meter, regardless of the party (1^{st}, $2^{nd,}$ 3^{rd}) which results in significant consequences, including serious injuries and/or fatalities.
Data Quantification Sources:	SDG&E engaged internal data sources for the calculation surrounding risk reduction; however, if data was insufficient, Industry or National data was supplemented and adjusted to fit the risk profile associated with the operating locations and perimeter of the utilities. For example, when certain types of incident events have not occurred within the SDG&E and

	SoCalGas territory; therefore, expanding the quantitative needs to encompass industry data where said incident(s) have been recorded provide a proximate and is justified in establishing a baseline of risk and risk addressed by activities. See Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision,[8] this section describes the risk bow tie, possible drivers, potential consequences, and the risk score for the Dig-in risk.

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision instructs the utility to include a risk bow tie illustration for each risk included in RAMP.[9] As illustrated below in Figure 3, the risk event (center of the bow tie) is Excavation Damage (Dig-In) On The Gas System, the left side of the risk bow tie illustrates drivers/triggers that lead to the Excavation Damage, and the right side shows the potential consequences of the Excavation Damage. SDG&E applied this framework to identify and summarize the information provided in Figure 3. A mapping of each Mitigation to the element(s) of the risk bow tie addressed is provided in Appendix A.

[8] D.18-12-014 at 33 and Attachment A, A-11 ("Bow Tie").

[9] *Id.*

Figure 3: Risk Bow Tie -
Excavation Damage (Dig-In) Medium Pressure

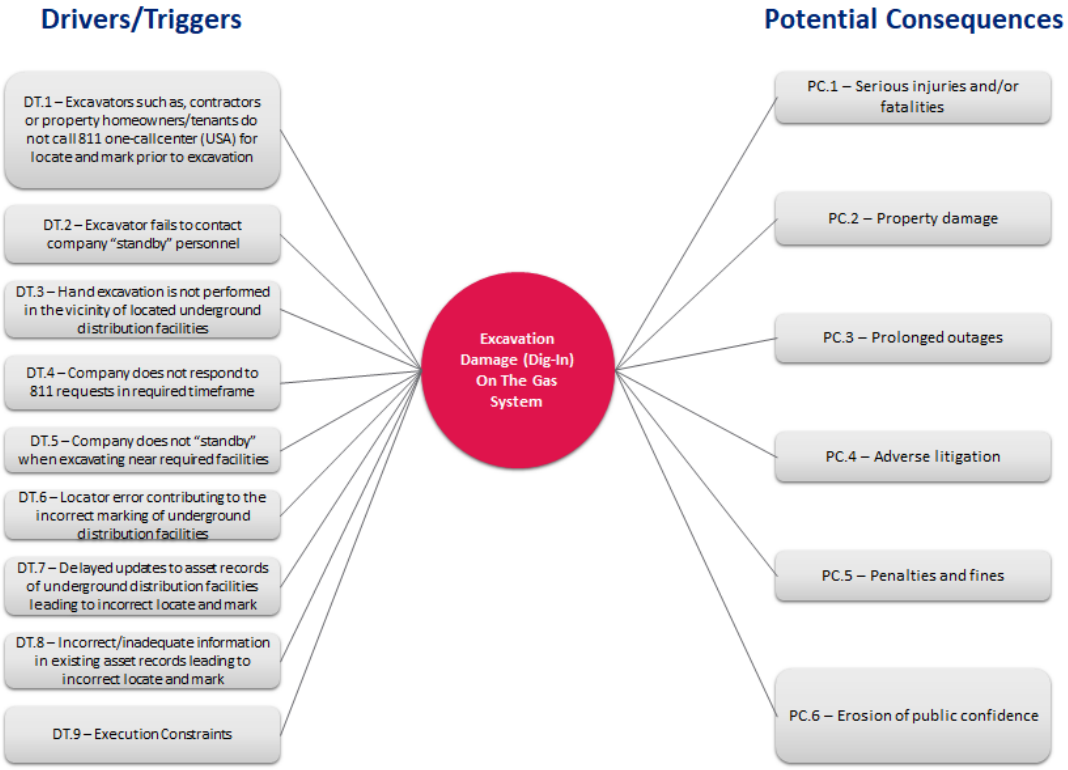
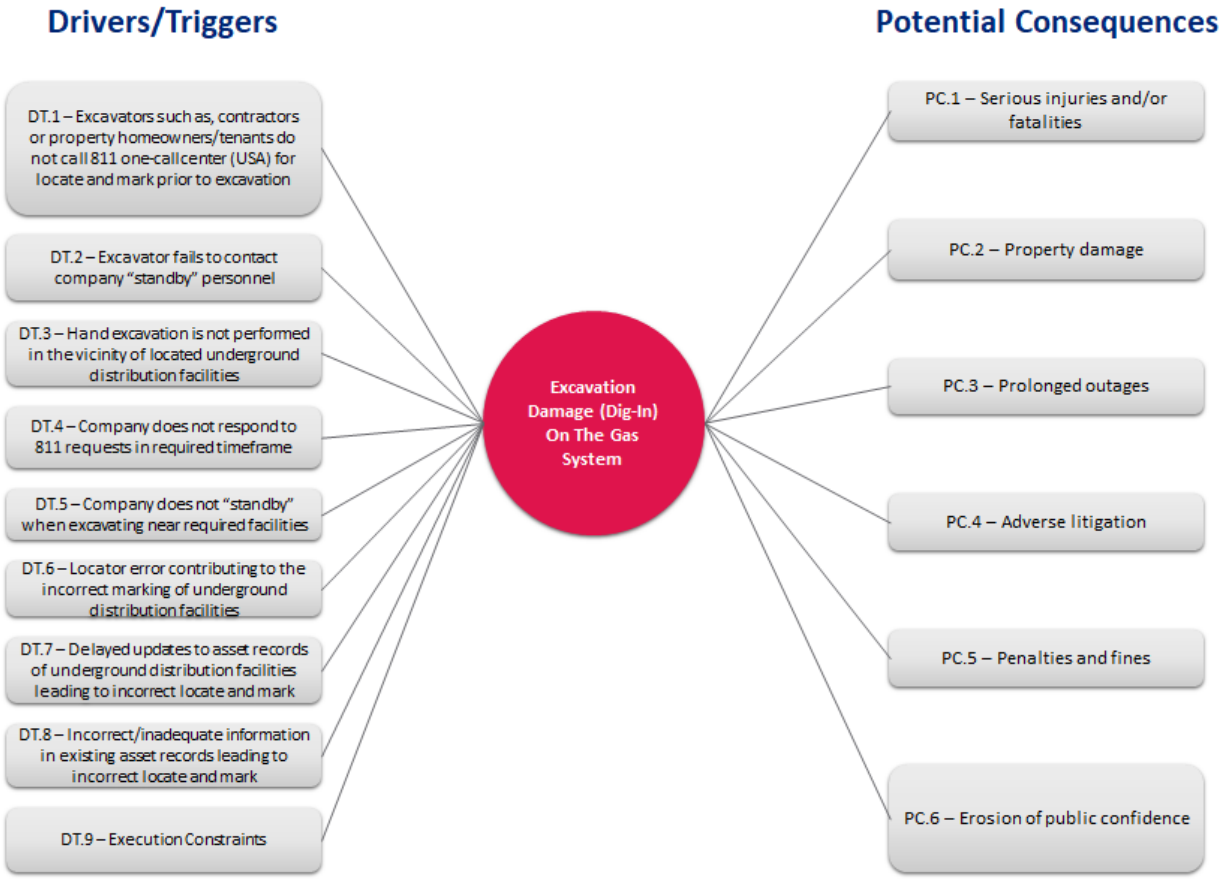


Figure 4: Risk Bow Tie -
Excavation Damage (Dig-In) High Pressure



B. Cross-Functional Factors (CFF)

The following cross-functional factors have programs and/or projects that affect one or more of the drivers and/or consequences of this risk: Emergency Preparedness and Response and Pandemic; Foundational Technology Systems; Safety Management Systems; and Workforce Planning / Quality Workforce. As an example, the training of SDG&E emergency response personnel and activation of SDG&E's emergency operations control center, as discussed in the Emergency Preparedness and Response, and Pandemic CFF address some of the potential consequences of this risk. Please review the narratives for the referenced CFF for additional information.

C. Potential Drivers/Triggers[10]

The Settlement Decision[11] instructs the utility to identify which element(s) of the associated risk bow tie each mitigation addresses. When performing the risk assessment for Dig-in on the System, SDG&E identified potential leading indicators, referred to as drivers or triggers. These include, but are not limited to:

- **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:** Despite the creation of Regional Notification Centers to inform and allow excavators to have underground infrastructure located and marked, and advertising campaigns alerting the excavator of the need to do so, incidents still occur where excavations are conducted without notifying 811 USA. In fact, third-party failure to contact the Regional Notification Center prior to excavating is the leading contributor of damages to Company pipelines. Third parties can damage or rupture underground pipelines and potentially cause property damage, injuries, or even death if gas lines are not properly marked before excavation activities begin. Without receiving an 811 USA ticket, the Company has no opportunity to mark its facility within the area of excavation. Furthermore, even when an 811 USA ticket is requested, excavators who are not knowledgeable with the details of the Dig Safe law may still damage underground facilities by performing some of the following practices:
  - Excavating prior to the valid start date/time;
  - Excavating after a valid ticket has expired;
  - Excavating under another excavator's USA ticket;
  - Improper job delineation and/or excavating beyond delineation marks
- **DT.2 – Excavator fails to contact company "standby" personnel:** An excavator may fail to contact the Utility's "standby" personnel to prevent damage to high pressure gas pipelines and other facilities when required, prior to

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

[11] D.18-12-014 at Attachment A, A-11 ("Bow Tie").

excavating within 24 inches of a high-pressure gas pipeline. This would increase the risk and likelihood that the excavator damages a high-pressure pipeline.

- **DT.3 – Hand excavation and other required excavation practices are not performed in the vicinity of located underground facilities:** Before using any power operated excavation equipment or boring equipment, the excavator is required to hand expose, using "Hand Tools,"[12] to verify the exact location and no conflict exist within 24 inches on either side of the gas pipeline. Excavators put themselves and others at risk for injuries when they do not exercise caution when digging near natural gas pipelines. However, even when proper hand excavation is performed, damages can still occur if an excavator fails to continue with unsafe excavation practices such as:
  - Maintaining proper clearance from the underground facilities;
  - Allowing the above ground locating marks to become faded or lost, rendering them ineffective;
  - Failure to provide adequate shoring, protection or support facilities; and
  - Utilizing improper backfill procedures.

  Excavators put themselves and others at risk when they do not exercise caution when digging near natural gas pipelines.
- **DT. 4 – Company does not respond to 811 requests in required timeframe:** The Company may fail to respond to 811 USA requests within the "legal excavation start date and time" [13] (within two working days of notification, excluding weekends and state holidays, not including the date of notification, or before the start of the excavation work, whichever is later, or at a time mutually agreeable to the operator and the excavator). This may happen because of human error, poor communication, or system failures. In these cases, the third party may not know that the locate and mark activity was not performed and may wrongly assume that not seeing any marking at their excavation site indicates there is no gas infrastructure nearby. Without the marked gas infrastructure, third parties

[12] "Hand Tools" is defined in Cal. Govt. Code § 4216(i).

[13] "Legal Excavation Start Date and Time" is defined in Cal. Govt. Code § 4216(l).

may damage or rupture the infrastructure if they are performing excavation activities near pipelines.

- **DT.5 - Company does not "standby" when requested near required facilities:** High Pressure pipelines (those that operate over 60 psig) and pipelines near required facilities pose a higher risk of hazard to life and property when damaged or ruptured, and additional precautions are not taken by the Company to observe excavation activities in the vicinity of these facilities. Qualified Company personnel are required to be present during excavation activities within 10 feet of any high-pressure gas line (commonly referred to as "stand-by"). The stand-by employee is onsite to monitor and communicate with the excavator, so safe excavation activities are followed (*e.g.*, not hand excavating near the pipeline).
- **DT.6 – Locator error contributing to the incorrect marking of underground facilities:** The Company, in some cases, inaccurately marks facilities due to incorrect operations, such as mapping/data inaccuracies, equipment signal interference, and human error. When this happens, third parties are not provided with accurate knowledge of underground pipelines in the vicinity of excavations, and the risk of damaging or rupturing gas pipelines increases.
- **DT. 7 – Delayed updates to asset records of underground facilities leading to incorrect locate and mark:** The Company may fail to update permanent mapping records necessary to meet federal, state, and local regulations, as well as corporate needs. This could result in underground infrastructure being incorrectly marked, which could lead to third-party damage if the excavator does not have the correct information on infrastructure location. In addition, inaccurate mapping data could delay repairs if a pipeline is damaged.
- **DT. 8 – Incorrect/inadequate information in existing asset records leading to incorrect locate and mark:** The use of inaccurate or incomplete information in asset records could result in the failure to meet federal, state, and local regulations, as well as corporate needs. This could result in underground infrastructure being incorrectly marked, which could lead to third-party damage if the excavator does not have the correct information on infrastructure location. In

addition, in the event in which a pipeline is damaged, inaccurate mapping data could delay repairs.

- **DT.9 - Execution Constraints:** Events (excluding those covered by outside force damages) that impact the Company's ability to perform as anticipated. Examples include but are not limited to materials and 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

Potential Consequences[14] are listed to the right side of the risk bow tie illustration provided above. If one or more of the drivers/triggers listed above were to result in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

- PC. 1 - Serious injuries and/or fatalities;
- PC. 2 - Property damage;
- PC. 3 - Prolonged outages;
- PC. 4 - Adverse litigation;
- PC. 5 - Penalties and fines; and
- PC. 6 - Erosion of public confidence.

These potential consequences were used in the scoring of Dig-in on the System that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[15] Chapter SCG/SDG&E RAMP-C of this RAMP Application explains the Risk Quantitative Framework which underlies this chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

[14] D.18-12-014 at 16 and Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

[15] D.18-12-014 at Attachment A, A-11 ("Calculation of Risk").

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[16]

	LoRE	CoRE	Risk Score
Dig-In on the High-Pressure System	0.19	4,235	815

	LoRE	CoRE	Risk Score
Dig-In on the Medium Pressure System	300.20	1	316

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, available and appropriate data (*e.g.*, Pipeline and Hazardous Materials Safety Administration data).[17]

Historical PHMSA data, internal damage database and emergency incident reporting were used to estimate the frequency of incidents.

III. 2020 CONTROLS

This section "[d]escribe[s] the controls or mitigations currently in place" as required by the Settlement Decision.[18] The activities in this section were in place as of December 31, 2020. Controls that will continue as part of the plan are addressed in Section IV.

As stated above, the excavation damage on the gas system is the risk of damage caused by an excavation event, which could result in serious injuries and/or fatalities. The risk mitigation plan includes both controls that are expected to continue and projected mitigations for the period of SDG&E's Test Year 2024 GRC cycle. The controls are those activities that were in place as of 2021, most of which are compliance driven and have been implemented over decades. These activities focus mainly on the essentials of damage prevention, including excavator's knowledge and use of the 811 one-call services and safe excavation practices, and the operator's responsibility to communicate the location of underground facilities through activities such as 811 one-call ticket responses and locate and mark activities.

---

16 The term "pre-mitigation analysis," in the language of the S-MAP Settlement Agreement Decision refers to required pre-activity analysis conducted prior to implementing control or mitigation activity. *See* D.18-12-014 at Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score").

17 D.18-12-014 at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

18 D.18-12-014 at 33.

A. Locate and Mark Training

C1: MP; C2: HP

Locate and mark training provides employees who perform locating tasks with the necessary knowledge and operator qualification to locate and mark underground gas facilities. At SDG&E, in response to an 811-excavation request, the Distribution Locators are responsible for locating and marking Distribution Operations gas facilities, and the Transmission Locators are responsible for performing the L&M duties for Transmission Operations facilities. Gas Operations Training and Development provides each trainee with the initial locate and mark training upon being newly assigned to a position. Overall, training is approximately an eight-week course with hands-on locate and mark training comprising approximately one week. The employees are not certified to locate or mark gas facilities until they have successfully completed initial training and passed locate and mark operator qualification tasks. SDG&E's Gas Operations Training and Development includes training approximately 48 new locators. It is necessary to have a trained workforce to accurately locate and mark gas infrastructure and provide the necessary information to third-party excavators for safe excavation.

Marked facilities provide the excavator with approximate pipeline locations within the delineated work area. Awareness of underground gas facilities allows the excavator to either avoid the areas or carefully dig with hand tools to prevent damage while excavating. Since a vast majority of SDG&E's assets are buried below ground, it is imperative that proper action is taken to reduce the risk of accidental damage to these facilities by accurately communicating the locations to the excavators. Without a highly skilled and trained locate and mark workforce, excavators would have little knowledge and confidence of pipeline locations which could lead to third-party excavation damage. By improving knowledge and competency through training, locate and mark accuracy will increase, and the number of mismarks and third-party damages should reduce. Additionally, this training reinforces the requirements to accurately locate our pipelines, the importance of two-way communication with an excavator, the completeness and thoroughness of documentation, and the timeliness of locate and mark ticket completion.

B. Locate and Mark Activities

C3: MP; C4: HP

The purpose of the Locate and Mark Activities 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, locating and marking, 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 2020, SDG&E responded to over l80,000 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 locate and mark 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 reduction in damages. This collection of Locate and Mark Activities ultimately provides the excavator with the necessary information to avoid hitting or damaging gas facilities.

C. Locate and Mark Annual Refresher Training and Competency Program C5: MP; C6: HP

All company personnel performing locate and mark activities must complete an annual re-training and refresh program. This program consists of local supervisors reviewing SDG&E Gas Standards with the locate and mark workforce. Employees are required to pass the refresher training in order to continue locate and mark activities. This refresher training involves all aspects of the Locate and Mark procedures to allow personnel to be able to successfully receive an 811 USA ticket and provide a proper positive response. Similar to the Locate and Mark training mentioned above, interactive electronic learning course modules are being developed for this refresher training with the addition of other training methods such as on-the-job training and

mentoring. This is a mandated activity in order to comply with regulations and code requirements and to provide employees with the basic knowledge to satisfactorily perform this critical task.

D. Locate and Mark Operator Qualification

C7: MP; C8: HP

Locate and Mark Operator Qualification (OQ) training requires employees to field-demonstrate their knowledge and competency to perform locate and mark tasks. This includes activities such as obtaining proper locating signals, interpreting the signals by placing accurate and proper markings on the ground to indicate the location of the pipe. This OQ training is in addition to Locate and Mark Training (C1), is required for employees every five years, and is administered by the Gas System Integrity - Operator Qualification department at SDG&E. In 2020, there were approximately 48 employees at SDG&E who participate in OQ training. OQ training is mandated by PHMSA.[19]

Maintaining resources that are trained and Operator Qualified to perform Locate and Mark functions promotes procedural knowledge and competency to perform the tasks. A prepared and qualified workforce allows SDG&E to meet its regulatory requirements, the demands of the excavator community, and helps provide for a safe excavation environment.

E. Locate and Mark Quality Assurance

C9: MP; C10: HP

The purpose of the Locate and Mark Quality Assurance (QA) Program is to validate that locators are following processes and procedures when performing locating tasks. The QA evaluators document each ticket assessment and identify opportunities for improvement. SDG&E's Safety Assurance, Quality, and Risk department administers the QA 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, proper documentation, and proper

[19] The Operator Qualification rule was adopted into the Code of Federal Regulations under Subpart N in 49 CFR Part 192 and Subpart G in 49 CFR Part 195.

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 Locate and Mark QA Program provides a variety of benefits to reduce the number of and potential for damage to gas infrastructure by a third party. By evaluating locate and mark activities that have been completed or are being performed, SDG&E can address gaps in performance with additional training or updating company documentation or recording company assets. Locator errors can result in a mismark or a ticket not completed within the required timeframe. Additionally, the QA review can highlight errors in the timely and/or accurate documentation of utility assets. Adherence to proper company policy and procedures reduces the percentage of locate and mark mismarks, increases the overall awareness of unsafe activity, and expedites response times.

F. Damage Prevention Analysts

C11: MP; C12: HP

The Damage Prevention Analyst Program works to reduce the number of third-party damages to gas facilities by identifying at-risk excavating contractors and educating them on proper one-call and safe digging techniques. The Damage Prevention Analyst Program strives to reduce the number of third-party damages to gas facilities by identifying at-risk excavating contractors through data analysis. The benefit of the damage prevention analyst is threefold. First, it enables SDG&E to stop a job before an incident occurs if no underground markings are present or the excavator is not practicing safe digging techniques. 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.

The damage prevention analysts 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 other construction projects to investigate if the excavator notified USA 811 and if safe excavating techniques are followed. At times, the analysts will stop the job

and educate the contractor about safe excavating practices and procedures. SDG&E expects to expand this program with additional analysts and broader system-wide coverage. SDG&E's damage prevention analysts have stopped many jobs since the program's inception in 2019 and have conducted over 684 contractor outreach and educational opportunities.

G. Locating Equipment

C13: MP; C14: HP

Providing hardware that is appropriate for the rugged outdoor environment and updated with the latest software to run efficiently and provide correct information to locate underground pipelines accurately. SDG&E utilizes Locate and Mark laptops and software to comply with the requirements of state and federal regulations. SDG&E provides locate and mark technicians rugged laptops called Mobile Data Terminals (MDTs) containing KorMobile© Ticket Management Software to respond to 811 USA tickets in real-time. Using obsolete technology increases wait times, contributes to data communication failure, and increases likelihood of not responding to an 811 USA request in the required timeframe.

SDG&E has a service territory that covers about 4,100 square miles, from San Diego to southern Orange counties. The service territory covers two counties and 25 communities. Providing durable refreshed laptops increases efficiency and the ability to work in a rugged outdoor setting. Increasing the processor speed and extending the battery life also allows for prolonged working hours. The refreshed laptops contain a detachable screen with a built-in camera allowing the on-site technician to photograph their surroundings and the excavating equipment associated with an 811 USA ticket. A 4G LTE Advanced multi-carrier mobile broadband facilitates the response to 811 USA tickets real-time.

Employees who perform locate and mark activities rely on laptops, 811 USA tickets, asset mapping, records data, software, and locating equipment. Using laptops in an outdoor setting, and often in construction areas, can reduce life expectancy due to the harsh environment. Therefore, employees have laptops designed to withstand a harsh environment. Additionally, as software and data are updated and become more sophisticated with new and more powerful features, new laptops with advanced capabilities are required to process the information. Approximately 70 laptops are replaced every five years.

Updated and ruggedized laptops provide longer battery life and can process software faster and more efficiently. Updated hardware and software increase the effectiveness of

performing locate and mark activities. The ruggedized laptops can also take pictures of the area near the excavation site to update and improve asset mapping information. New laptops provide enhanced features to reduce locator errors and reduce pipeline damage.

The purpose of the Locating Equipment Program is to utilize technology to standardize locating tools to locate and mark underground gas infrastructure accurately. The Locating Equipment program will provide employees with standardized locating devices. Employee locating equipment will be replaced as new technology becomes available. Reducing the potential for damage to underground facilities that is caused by excavation activities requires correct facility markings. Excavators use these markings to know when hand-digging and other safe digging practices should be followed. Finally, providing employees standardized equipment allows for consistent training and use of the equipment to improve locate accuracy.

H. Public Awareness Compliance

C15: MP; C16: HP

For the purpose of an RSE analysis, SDG&E separated Public Awareness into four tranches. Each of the four tranches reduces the likelihood of third-party damage differently according to the RSEs.

It is important for contractors and excavators to be informed of the potential safety issues that might arise when working around natural gas pipelines. Underground pipelines can be located anywhere, including under streets, sidewalks, and private property – sometimes just inches below the surface. Hitting one of these pipelines while digging, planting, or performing demolition work can cause serious injury, property damage, and loss of utility service.

Title 49 Code of Federal Regulation section 192.616 requires utilities/natural gas providers to include efforts to educate the public, appropriate government organizations, and persons engaged in excavation-related activities. The four types of groups identified in section 192.616[20] are the affected public, emergency officials, local public officials, and excavators. The SDG&E-6-C8 – Public Awareness mitigation has been tranched to match the four groups identified in section 192.616.

Periodically SDG&E participates in Distribution Public Awareness Council (DPAC) Benchmark studies to collect and compare membership data related to the effectiveness of public

[20] 49 CFR § 192.616.

awareness and community safety outreach programs managed by gas utilities. There is a clear distinction between the general level of awareness between the affected public, emergency officials, local public officials, and excavators. In order to address this gap and reduce third-party damage, targeted messaging campaigns are performed for each subgroup to increase overall awareness and education. Emergency officials and local public officials are often met with in person to discuss municipal third-party damage trends. The public and excavators are informed of 811 USA notification and safe digging practices using bill inserts, media campaigns, SDG&E damage prevention analysts, radio advertising, internet advertising, billboard advertising, and safety meetings. A summary of SDG&E's 2019 public awareness activities is shown in the table below.

Table 3: Summary of SDG&E' 2019 Public Awareness Activities

	Mailers	**Email messages**	**Campaigns/ Presentations**	**811 Unique Page views (2019 data)**
Excavators	26k	5k	0	16,863
Local Public Officials	212	220	0	
Affected Public	753k customers; 175k live/work near HP	877k	4	
Emergency Officials	338	4	33	

A comprehensive public awareness program works to reduce the number of gas incidents by educating the general public on identifying and recognizing a gas leak and whom to notify if a leak is suspected. This allows first responders and SDG&E to respond in a timely manner to avoid a gas incident or minimize the impact. More specifically, the Public Awareness Program works to reduce the number of potential gas incidents due to third-party excavation activities. Third parties refer to a broader group than just excavators; it can also include "do it yourself" home and business owners. By providing information about the 811 USA process and safe digging practices to these audiences, SDG&E can increase the number of locates performed by the gas utility and potentially reduce the number of incidents and damage to gas infrastructure.

1. Public Awareness - Affected Public

C15-T1: MP; C16-T1: HP

SDG&E continues to promote awareness of the Underground Service Alert (811, "call-before-you dig") system to the affected public by reaching out to contractors and the general public through meetings, mailers, bill inserts, hosting events, the Company website, marketing, and banners at locally broadcasted events and other methods, so pipelines are properly marked and located before excavation activities. Excavation activity includes excavating, blasting, boring, tunneling, backfilling, removing aboveground structures by explosive or mechanical means, and other earth-moving operations.

When residents or contractors dial 811 USA before any project that involves digging, SDG&E marks the locations of underground lines to prevent damage, which could cause injury or service outages. This outreach is performed in compliance compliant with Title 49 Code of Federal Regulations, section 192.616 (d) subsections 1-5.

2. Public Awareness - Emergency Officials

C15-T2: MP; C16-T2: HP

SDG&E has the responsibility to train its employees on emergency procedures and establish a liaison with first responders in accordance with Title 49 Code of Federal Regulations, section 192.615.[21] According to General Order (GO) 112-F, SDG&E, as an "Operator," must comply with the requirements of sections 192, 192.615, and 192.616(e). There are significant benefits to creating strategic partnerships and promoting awareness with emergency officials. Communication and coordination are improved when it matters most. SDG&E works to implement this requirement by establishing lines of communication between SDG&E and first responders, by learning about the responsibility and resources available to each party in the event of a gas pipeline emergency, and by educating each other on how to best respond to a gas system emergency.

Additionally, section 192.616, which governs GO 112-F, states that SDG&E is required to coordinate emergency exercises or drills with first responders. To commemorate "811" 8/11 Day SDG&E, The California Regional Common Ground Alliance (CARCGA), and Orange County Fire Authority (OCFA) hold a mock utility line strike to raise awareness about the

[21] 49 CFR § 192.615.

importance of contacting 811 USA at least two working days (not counting the day of notification) prior to the start of any project that involves digging. The event program includes the 811 USA process, emergency response demonstration, investigation by the Dig Safe Board, Speakers from Dig Safe Board, Orange County Fire Authority, plus exhibitor booths. Building relationships with emergency officials is imperative in creating awareness of safe digging practices and potential consequences if excavators are not safe.

3. Public Awareness - Local Public Officials

C15-T3: MP; C16-T3: HP

Working directly with city officials involved in construction activities within their jurisdictions helps to educate external personnel to support unsafe excavation practices that could result in damage to underground facilities. This interaction can involve several efforts. First, educating city personnel on the specific requirements of the California safe excavation laws. Second, helping officials understand their role in enforcing the laws by promoting the use of 811 USA for excavation tickets through their project review and permitting activities and through field inspections their employees perform. Third, to explain the city's potential cost savings from avoiding their emergency personnel from having to respond to a blowing gas emergency due to non-compliant excavation damage. City officials can avoid unnecessary emergency response if they promote safe excavation practices during their routine daily planning and permitting work. This outreach is performed to be compliant with Title 49 Code of Federal Regulations, section 192.616 (d) subsections 1-5.

4. Public Awareness – Excavators

C15-T4: MP; C16-T4: HP

Excavator awareness of 811 USA is essential. Nationwide statistics from the Common Ground Alliance indicate that when a locate request is made prior to an underground excavation, no damage will occur 99% of the time.[22] It is important for contractors and excavators to be informed of the potential safety issues that might arise when working around natural gas pipelines. Underground pipelines are in various locations, including under streets, sidewalks,

[22] Common Ground Alliance, *Common Ground Alliance's 2014 DIRT Report Confirms Importance of Calling 811 Before Digging for Fifth Consecutive Year* (August 11, 2015) (*available at* https://commongroundalliance.com/sites/default/files/press_release_pdfs/2014%20DIRT%20Report%20Press%20Release%20FINAL.pdf).

and private property – sometimes just inches below the surface. Hitting one of these pipelines while conducting routine work such as digging, planting, or demolition work can cause serious injury, property damage, and loss of utility service. The benefits of calling 811 USA are communicated through awareness campaigns, such as in person excavator outreach events, targeted mailings, and the Big Shovel display. Excavator outreach is performed to be compliant with Title 49 Code of Federal Regulations, section 192.616(d) subsections 1-5.

I. Increase Reporting of Unsafe Excavation

C17: MP; C18: HP

The purpose of Increased Reporting of Unsafe Excavation is to identify and report excavators who frequently utilize unsafe excavation practices and to report those contractors to the Dig Safe Board and/or State Licensing Board (CSLB). Reporting of unsafe excavation is applicable to the entire SDG&E territory.

SDG&E's purpose for Increased Reporting of Unsafe Excavation is to consolidate and formalize internal procedures for identifying excavators who frequently utilize unsafe excavation practices and reporting those contractors to the Dig Safe Board and/or (CSLB). This includes consolidating the efforts of the Damage Prevention Strategies Team with the Claims Recovery Team. Both internal groups engage in various degrees of excavator education and outreach efforts on safe digging practices. The consolidation of efforts includes a consistent methodology for identifying targeted excavators. Education and outreach efforts provide the excavators understanding of the implications of unsafe excavation practices. In 2020, SDG&E stopped several jobs for unsafe excavation and conducted over 442 outreach and educational opportunities.

By combining the outreach information, this program provides a more comprehensive and holistic effort to achieve the benefits of reducing third-party damage. First, it provides the names of unsafe excavators to the appropriate state boards to support the state's objectives. Second, it offers an opportunity for excavators to be educated and informed on their obligations, such as the contractor's requirement to call prior to any excavation activity and to perform hand excavation in the vicinity of gas pipelines. The outreach to the excavator and contractor community should reduce the number of excavation activities without location marks and reduce the number of incidents on our pipelines.

The costs for this activity are not planned to be incorporated into the next GRC, and therefore, these activities are not part of the risk mitigation plan.

J. Damage Prevention Policy Activities

C19: MP; C20: HP

SDG&E aims to secure greater education, compliance, and enforcement of safe excavation practices through legislation and work with other organizations. SDG&E actively participates in the California Underground Safe Excavation Board (Dig Safe Board) to provide input and education from the natural gas utility perspective. Similarly, the purpose of remaining active members of the California Regional Common Ground Alliance (CARGA) is to work with all members of the excavation community in achieving the Dig Safe Board's objectives of providing education and outreach, developing safe excavation practices, investigating violations, and supporting the Board's authority. Securing greater enforcement through legislation and working with the California State Digging Board applies to all third-party excavations. Therefore, no further tranching is required.

The purpose of this participation is to work with all members of the excavation community in achieving the Dig Safe Board's objectives of providing education and outreach, developing safe excavation practices, investigating violations, and supporting the Board's authority.

Through involvement in board meetings and workshops and collaborating to achieve common objectives related to damage prevention, SDG&E fosters a positive and more robust working relationship with all stakeholders. By playing an active role in developing, educating, and enforcing utility and contractor requirements, a collaborative and holistic environment can be achieved among all stakeholders. The Dig Safe Board provides a forum so that effective, safe excavation requirements can be cooperatively developed and disseminated to reduce third-party damage.

SDG&E is an active member of Dig Alert. Dig Alert's territory includes nine Southern California Counties: Imperial, Inyo, Los Angeles, Orange, San Bernardino, San Diego, Santa Barbara, Riverside, and Ventura. SDG&E is mandated by Title 49 Code of Federal Regulation, section 192.614 and California Government Code, section 4216 to remain an active member of the California One-Call Centers.

The California 811 USA One-Call Centers serve as the communication conduit between SDG&E and excavators to support safe digging practices. Excavators contact the 811 USA one-call centers with their intent to excavate in a specific location. This information is made available to the owners and operators of underground infrastructure to provide pipeline location information before excavation occurs. SDG&E is an active member of local one-call centers. In calendar year 2020, SDG&E responded to over 180,000 locate and mark requests on the system through the local one-call centers.

As a member of the 811 USA one-call centers, SDG&E actively works with other industry stakeholders to simplify the process, improve its accessibility, and educate on safe digging practices. The California one-call centers play a critical role in safe excavation practices and reducing the number of third-party damages. The call centers provide a single source for all excavators to contact as well as a source for utilities, simplifying the communication process between contractors and the various utilities, many of which are not known by the contractors. The one-call process also allows this communication process to take place before digging occurs so that utilities can correctly locate and mark their facilities in the required timeframe. Excavating after pipeline marks are provided allows the contractors to practice safe digging techniques, minimizing the potential of hitting or damaging gas pipelines.

K. The Gold Shovel Standard Program

C21: MP; C22: HP

The Gold Shovel Standard (GSS) Program utilizes an external organization that certifies contractor's policies and procedures to protect underground facilities against an established Gold Shovel Standard. This program applies to all third-party contractors working for SDG&E. All third-party damage caused by contractors working for SDG&E poses the same safety risk. Therefore, no further tranching is required.

The Gold Shovel Standard (GSS) Program is an external organization that certifies contractor's policies and procedures to protect underground facilities against an established Gold Shovel Standard. The GSS provides positive reinforcement and reviews contractor's excavation performance. SDG&E requires all pipeline contractors to participate in the Gold Shovel Program.

The GSS provides positive guidance to underground contractors, aligning their excavation practices against established safe digging practices and procedures. It helps to

educate contractors about industry excavation standards and identify and address gaps in their processes. SDG&E requires contractors who perform excavation on behalf of SDG&E to be GSS certified. GSS serves as an additional quality check for its contractors. Actively supporting the Gold Shovel Standard Program helps to improve the use of 811 USA one-call requirement and improves safe digging techniques, such as hand-digging when near gas pipelines.

L. Excess Flow Valve or Curb Valve Installation

C23: MP

Excess Flow Valves (EFV) are designed to prevent gas escape by automatically stopping the gas flow when a medium pressure service is damaged. Curb valves are used to quickly shut down damaged medium pressure service lines.

A medium pressure service line can be damaged by several driver/triggers such as the failure to follow the 811-notification process, a mismark by the locator, or the lack of caution during excavation. When a gas service line is severely damaged, the EFV immediately stops the flow of gas, eliminating the risk of prolonged gas release and migration. EFV and curb valves mitigate the consequences associated with a damaged medium pressure gas service line.

M. Pipeline Patrol and Pipeline Markers

C24: HP

Qualified employees patrol high-pressure pipelines, assessing the area over and around the pipeline for signs of excavation or potential excavation. Part of this patrol includes establishing and maintaining pipeline markers where required. Pipeline markers provide a visual warning to outside parties that a high-pressure gas pipeline is in the vicinity and contact must be made to 811 or SDG&E before any excavation occurs. Pipeline patrol and pipeline markers are important for preventing damage to the pipeline. During patrol, potential excavators without a USA ticket could be identified. The patrols help prevent excavators from digging without a USA ticket or without a SDG&E standby employee onsite when required. This mitigation is a proactive measure to alert excavators who are unaware of 811 laws and rules or standby requirements.

N. Company Excavator Training

C25: MP; C26: HP

A formal training program provides excavation training to employees who are required to excavate as part of their job duties. The training reinforces safe excavating procedures, so employees know how to avoid damaging company pipelines as well as other utilities' buried facilities. The training includes the use of a pneumatic clay spade around buried facilities and backhoe training. The training content is comprehensive, covering all operational aspects for the safe use of a particular piece of equipment, including the required personal protective equipment, manufacturers recommendations and instructions, as well as additional procedures, guidelines and limitations developed internally by SDG&E. Excavation equipment training is typically performed when an employee begins a new job position, as part of the job requirements. Once trained and qualified, employees continue to develop their safe operating skills in the field under direction of senior employees and supervision. Refresher training is available to employees on an as-needed basis.

Training employees to understand the applicable excavation regulations and safe excavating techniques around pipelines will mitigate the risk of employees damaging pipelines.

O. Warning Mesh

C27 MP; C28: HP

Warning mesh is a practice to help prevent excavators from not adhering to the 811 USA excavation safety notification requirement. Approximately 60% of Company damages are caused by excavators not contacting 811 USA before excavating. Warning mesh is installed over pipelines in open trench before backfilling. This program applies to all SDG&E open trench new pipeline installations or replacements.

The purpose of installing warning mesh over pipelines is to provide a visual warning to excavators to prevent damage. Warning mesh is installed over pipelines when an open-trench installation opportunity is available for new construction, repair, and replacements projects before backfilling. The warning mesh is a visual indicator that can be exposed before the excavator damages pipelines and can mitigate locate errors or unsafe excavation techniques. It reminds the excavator to exercise safe excavation techniques, corrects inaccurate surface locate markings, and warns the excavator that a pipeline is nearby.

P. Ticket Risk Assessment and Evaluating City Permit Data

C29: MP; C30: HP

Ticket Risk Assessment (TRA) technology uses complex modeling software to assign risk scores to every USA ticket received by the Company. The technology also provides additional identifiers on each USA ticket to quickly identify other facility properties, such as flags for high-pressure pipes or regulator stations intersecting the ticket's work scope. The tool also provides integration with public information such as city and county permit data, where available. This permit data is used to help determine areas with construction or building permits that may not have a USA ticket.

The TRA provides a new way to mitigate notification issues, location issues, and excavation issues that could lead to significant consequences. The higher risk tickets are visited by field employees who communicate with the excavator to assess if excavation rules are understood to prevent damage to pipelines. Field employees review and assess the USA ticket to verify it has been adequately addressed by locators and take appropriate follow-up action if required.

Q. Enhance Ticket Management Software

C31: MP; C32: HP

The primary focus of system improvements to the 811 USA ticket routing and monitoring is to upgrade the ticket management system to automatically provide periodic reports on the status of ticket requests, send notifications as a ticket is approaching its deadline, and capture and report data that will be used to monitor and evaluate performance per Title 49 Code of Federal Regulation, section 192.614.

As part of continuous improvement, an assessment of the current state of the 811 USA one-call ticket routing and monitoring is underway. The primary focus of system improvements to the USA ticket routing and monitoring is to upgrade the ticket management system to provide increased abilities to monitor and manage locate and mark ticket requests and to evaluate and measure performance for meeting time commitments. In calendar year 2019, SDG&E fulfilled over 164,000 USA ticket requests from excavators.

SDG&E has a time requirement to fulfill locate and mark ticket requests. If time requirements are not met, contractors might excavate and assume no visible marks means no underground facilities conflict with their project. If this occurs, contractors could hit and damage

underground gas infrastructure due to the lack of surface markings. By providing enhanced capabilities to monitor and manage ticket request workload, SDG&E will have the ability to prioritize ticket requests, assign crews, and balance workload among the locate and mark crews. Additionally, the data capture and reporting enhancements can improve SDG&E's ability to monitor its processes and identify process improvements. These enhancements work toward improving SDG&E's performance in meeting the locate and mark timeframe, thereby reducing the potential of contractors digging without knowledge of underground gas infrastructure.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[23]

As reflected in the Table below, all of the activities discussed in Section III above are expected to continue during the TY 2024 GRC. For clarity, a current activity that is included in the Plan may be referred to as either a control and/or a mitigation. For purposes of this RAMP, a control that will continue as a mitigation will retain its Control ID unless the size and/or scope of that activity will be modified, in which case that activity's Control ID will be replaced with a Mitigation ID. The table below shows which activities are expected to continue.

Table 4: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	Locate & Mark Training (MP)	X	X
2	C2	Locate & Mark Training (HP)	X	X
3	C3	Locate & Mark Activities (MP)	X	X
4	C4	Locate & Mark Activities (HP)	X	X
5	C5	Locate and Mark Annual Refresher Training and Competency Program (MP)	X	X
6	C6	Locate and Mark Annual Refresher Training and Competency Program (HP)	X	X
7	C7	Locate and Mark Operator Qualification (MP)	X	X
8	C8	Locate and Mark Operator Qualification (HP)	X	X
9	C9	Locate and Mark Quality Assurance (MP)	X	X
10	C10	Locate and Mark Quality Assurance (HP)	X	X
11	C11	Damage Prevention Analyst Program (MP)	X	X

[23] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
12	C12	Damage Prevention Analyst Program (HP)	X	X
13	C13	Locating Equipment (MP)	X	X
14	C14	Locating Equipment (HP)	X	X
15	C15 – T1	Public Awareness Compliance - The Affected Public (MP)	X	X
16	C15 – T2	Public Awareness Compliance - Emergency Officials (MP)	X	X
17	C15 – T3	Public Awareness Compliance - Local Public Officials (MP)	X	X
18	C15– T4	Public Awareness Compliance – Excavators (MP)	X	X
19	C16 – T1	Public Awareness Compliance - The Affected Public (HP)	X	X
20	C16 – T2	Public Awareness Compliance - Emergency Officials (MP)	X	X
21	C16 – T3	Public Awareness Compliance - Local Public Officials (HP)	X	X
22	C16 – T4	Public Awareness Compliance – Excavators (HP)	X	X
23	C17	Increase Reporting of Unsafe Excavation (MP)	X	No
24	C18	Increase Reporting of Unsafe Excavation (HP)	X	No
25	C19	Damage Prevention Policy Activities (MP)	X	X
26	C20	Damage Prevention Policy Activities (HP)	X	X
27	C21	Gold Shovel Standard Program (MP)	X	X
28	C22	Gold Shovel Standard Program (HP)	X	X
29	C23	Excess Flow Valve or Curb Valve Installation (MP)	X	X
30	C24	Pipeline Patrol and Pipeline Markers (HP)	X	X
31	C25	Company Excavator Training (MP)	X	X
32	C26	Company Excavator Training (HP)	X	X
33	C27	Warning Mesh (MP)	X	X
34	C28	Warning Mesh (HP)	X	X
35	C29	Ticket Risk Assessment and Evaluating City Permit Data (MP)	X	X
36	C30	Ticket Risk Assessment and Evaluating City Permit Data (HP)	X	X
37	C31	Enhance Ticket Management Software (MP)	X	X
38	C32	Enhance Ticket Management Software (HP)	X	X
37	M1	Automate Third Party Excavation Incident Reporting (MP)	-	X
38	M2	Automate Third Party Excavation Incident Reporting (HP)	-	X

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
39	M3	Locate and Mark Photographs (MP)	-	X
40	M4	Locate and Mark Photographs (HP)	-	X
41	M5	Electronic Positive Response (MP)	-	X
42	M6	Electronic Positive Response (HP)	-	X
43	M7	Leverage Technology for Difficult Locates (MP)	-	No
44	M8	Leverage Technology for Difficult Locates (HP)	-	No
45	M9	Outreach for Latent 3rd Party Damages (MP)	-	X
46	M10	Outreach for Latent 3rd Party Damages (HP)	-	X
47	M11	Leverage Data Gathered by Locating Equipment (MP)	-	No
48	M12	Leverage Data Gathered by Locating Equipment (HP)	-	No
49	M13	Pipeline Monitoring Technologies (HP)	-	X

For activities SDG&E plans to perform that remain unchanged, please refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in this section below.

A. Changes to 2020 Controls

SDG&E plans to continue each of the existing mitigations discussed above in Section III through the 2022 – 2024 period without any significant changes.

B. 2022 – 2024 Mitigations

1. Automate Third Party Excavation Incident Reporting

M1: MP; M2: HP

Automating Third Party Excavation incident reporting into one system will centralize the reporting and data analysis. This will assist with meeting compliance reporting obligations, develop a better understanding of the data collected in an investigation, simplify reporting, and enhance data analysis processes. Title 49 Code of Federal Regulation, section 192.614 and California Government Code, section 4216 require SDG&E to collect data on third-party excavation incidents.

Automating third-party excavation incident reporting is an effort to consolidate and simplify the data collection process involved in investigating a gas incident. Field supervisors complete the investigations of gas incidents. Currently, there are multiple systems and processes used to capture and report data, internally and externally, for a gas incident. All systems and

processes might not be updated simultaneously, thereby creating additional manual steps when using the data for internal analysis for process improvements or generate reports for internal or external stakeholders. SDG&E is undertaking an initiative to centralize these processes and systems into one record system to minimize data quality issues, simplify reporting, and standardize data collection with field supervisors.

Standardizing data collection into one system will centralize reporting and data analysis, assist with meeting compliance reporting obligations, develop a better understanding of data collected in an investigation, simplify reporting, and enhance data analysis processes. This will facilitate improvements in SDG&E's accuracy and timeliness in locating and marking its infrastructure.

2. Locate and Mark Photographs

M3: MP; M4: HP

Recording photographs for each locate and mark ticket visited by locators is planned for all SDG&E's above and belowground facilities in the service territory. These pictures will help audit the quality of locates and provide an opportunity to improve future locate and mark ticket request for previous locations.

The purpose of recording photographs of each locate and mark ticket is to improve the accuracy of the locating activity and to inform process improvements based on investigations of gas incidents and quality assurance audits. By having a record of the locate marks, SDG&E can perform root cause analyses of QA activities and investigations of gas incidents. Photographs could show incorrect markings or GIS mapping, which could be used to improve employee training and update GIS data. The benefits of this mitigation are to improve locate and mark accuracy and mitigate gas infrastructure damage.

3. Electronic Positive Response

M5: MP; M6: HP

Electronic positive response is an electronic response provided to the regional notification center (DigAlert and USA North) that informs the excavator, prior to the excavation date, that the facility has been marked or there is no conflict with the proposed excavation area. Electronic positive response is utilized throughout SDG&E's territory. All excavations utilizing electronic positive response poses the same safety risk, and a single tranche is appropriate.

SDG&E is required to locate and mark its underground infrastructure within two business days after receiving an 811 USA locate and mark ticket request. Implementing a positive response feature with the regional notification centers improves communication between SDG&E and excavating contractors. The system will inform the contractor that the utility has completed its task or inform the excavator there is no conflict with gas infrastructure in the excavation area. The system also provides a way to communicate stand-by requirements and notification if the locate task was incomplete due to weather or accessibility issues.

This program requires participation from contractors and SDG&E. It will mitigate potential damage to gas infrastructure due to miscommunication between the contractors and SDG&E. This is especially important in situations where the utility could not provide markings within the required timeframe and the contractor assumes no conflict with gas infrastructure because no marks are present. Without pipeline markings, the contractor may not exercise safe excavation techniques and damage gas infrastructure.

4. Leverage Technology for Difficult Locates

M7: MP; M8: HP

Vacuum excavation technology is an example of a hydro excavation tool that can be deployed to find the location of pipelines when it is difficult to locate the pipeline because of interference or other reasons. The technology is a safe alternative to hand tools to locate and prevent damage to unknown pipeline locations. Vacuum excavation is utilized on an as-needed, case-by-case basis during Locate and Mark activities or in a proactive way in areas that are historically known to be hard to locate. Vacuum excavation is applicable to areas in SDG&E's territory. All excavations utilizing vacuum excavation technology pose the same safety risk, and a single tranche is appropriate.

At times, employees cannot accurately locate pipelines using the standard tools available. In these instances, SDG&E will work with the requesting contractor to help fulfill the request without creating an unsafe situation. SDG&E will establish a process to work with the excavator to utilize various alternatives to locate gas facilities or enhance safe-digging technologies. These alternatives include stand-by and observe the contractor as they perform their excavation or use other tools such as a Jameson locator or vacuum technology that can expose the pipe for visual verification.

Using locating tools that can provide the actual location of gas infrastructure by safely exposing the pipe provides the most accurate location of the gas infrastructure. With this knowledge, the contractor is aware of when to exercise safe excavation techniques and company records can be updated with the exact location of the pipeline. Both benefits will work toward reducing the potential for damage to underground pipelines for current and future projects.

5. Outreach for Latent 3rd Party Damages

M9: MP; M10: HP

This mitigation encompasses the efforts to identify and communicate with excavators who may have damaged an SDG&E underground facility without complying with safe excavation laws and best practices.

Occasionally, during routine activities, SDG&E will expose a section of underground piping and, upon visual inspection, determine that previously unknown damage has occurred. SDG&E was likely unaware of the excavation activity and thus was not onsite to perform the required standby activities. To identify excavators who may have conducted the excavation, further investigation would be required to determine if any USA tickets or excavation/construction permits had been valid in the area over a given time period. This would include communication and information requests with the Regional Notification Center and any local jurisdiction that may have issued a permit. Follow-up communications would then be made to these excavators to remind them of the safe excavation law requirements and best practices, along with an offer to conduct a safe excavation training event at their facilities for their employees and management to attend. Additionally, information would be provided regarding the potential enforcement actions that can be taken by the Dig Safe Board Investigation department and the Contractor State Licensing Board.

The benefits of this activity would be to continue to educate the excavator community on the importance of following the laws and best practices in order to prevent unintended consequences that can be attributed to unsafe excavations.

6. Leverage Data Gathered by Locating Equipment

M11: MP; M12: HP

The current locating equipment has the capability of recording information from a locate site. This information could be used to assess the quality of each locate and the relative accuracy of pipe location in the GIS system. By having a quality measurement for each locate the company can further determine areas for improvement. The data gathered by leveraging locating equipment will be used to evaluate performance per Title 49 Code of Federal Regulation, section 192.614.

The purpose of the Leveraging Data Gathered by Locating Equipment Program is to utilize technology to improve how SDG&E mapping and asset records are updated and improve the accuracy of locate and mark activities. It provides locate and mark employees with tools and technology to update Company records by capturing location coordinates found in the field, which is used to validate existing company records and identify GIS or locating errors.

Correct and accurate pipeline locations will reduce the potential for damage to underground facilities caused by excavation. Excavators use markings to inform when to hand expose a pipeline or utilize other safe excavation techniques. Equipment with the latest technology provides an opportunity for more accurate pipeline location and the ability to provide latitude and longitude coordinates to update GIS records. Maintaining an accurate GIS database and records is essential to improve locate and mark quality and mitigate pipeline damage.

7. Pipeline Monitoring Technologies

M13: HP

The Control Center Modernization (CCM) organization will deploy new field pipeline monitoring technologies along existing high consequence areas, evacuation challenged areas, and new or replaced transmission pipelines. These field monitoring assets (*i.e.*, fiber, methane) will allow Gas Control to better monitor pipelines to more quickly identify and respond to abnormal operating or emergency conditions resulting from a dig-in incident.

These new field pipeline technologies will 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.

- A centralized and modernized technology will increase operational efficiency and improve the speed and ability to manage incidents, directly translating to improvement in public and employee safety.

V. COST, UNITS, AND QUANTITATIVE SUMMARY TABLES

The tables in this section summarize the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided. SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data.

Table 7: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[24] (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[25]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	Locate & Mark Training (MP)	-	105	-	-	103	124
C2	Locate & Mark Training (HP)	-	14	-	-	15	18
C3	Locate & Mark Activities (MP)	-	4,946	-	-	5,135	6,215
C4	Locate & Mark Activities (HP)	-	1,435	-	-	1,458	1,765
C5	Locate and Mark Annual Refresher Training and Competency Program (MP)	-	8	-	-	4	5
C6	Locate and Mark Annual Refresher Training and Competency Program (HP)	-	1	-	-	1	1

[24] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar amounts and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[25] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[25]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C7	Locate and Mark Operator Qualification (MP)	-	-	-	-	11	14
C8	Locate and Mark Operator Qualification (HP)	-	-	-	-	1	1
C9	Locate and Mark Quality Assurance (MP)	-	387	-	-	594	759
C10	Locate and Mark Quality Assurance (HP)	-	42	-	-	78	99
C11	Damage Prevention Analyst Program (MP)	-	97	-	-	235	301
C12	Damage Prevention Analyst Program (HP)	-	22	-	-	45	57
C13	Locating Equipment (MP)	411	-	602	769	-	-
C14	Locating Equipment (HP)	94	-	134	171	-	-
C15-T1	Public Awareness Compliance - The Affected Public (MP)	-	191	-	-	250	303
C16-T1	Public Awareness Compliance - The Affected Public (HP)	-	-	-	-	57	69
C15-T2	Public Awareness Compliance - Emergency Officials (MP)	-	0	-	-	3	3
C16-T2	Public Awareness Compliance - Emergency Officials (HP)	-	0	-	-	1	1
C15-T3	Public Awareness Compliance - Local Public Officials (MP)	-	0	-	-	16	20
C16-T3	Public Awareness Compliance - Local Public Officials (HP)	-	0	-	-	4	5
C15-T4	Public Awareness Compliance – Excavators (MP)	-	72	-	-	20	25
C16-T4	Public Awareness Compliance – Excavators (HP)	-	16	-	-	5	6
C19	Damage Prevention Policy Activities (MP)	-	0	-	-	0	0

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[25]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C20	Damage Prevention Policy Activities (HP)	-	0	-	-	0	0
C21	Gold Shovel Standard Program (MP)	-	2	-	-	2	3
C22	Gold Shovel Standard Program (HP)	-	0	-	-	0	1
C23	Excess Flow Valve or Curb Valve Installation (MP)	104	-	293	374	-	-
C24	Pipeline Patrol and Pipeline Markers (HP)	-	680	-	-	669	854
C25	Company Excavator Training (MP)	-	141	-	-	134	171
C26	Company Excavator Training (HP)	-	18	-	-	18	24
C27	Warning Mesh (MP)	76	-	226	273	-	-
C28	Warning Mesh (HP)	17	-	51	62	-	-
C29	Ticket Risk Assessment and Evaluating City Permit Data (MP)	-	60	-	-	35	45
C30	Ticket Risk Assessment and Evaluating City Permit Data (HP)		14	-	-	8	10
C31	Enhance Ticket Management Software (MP)	35	1	90	114	1	2
C32	Enhance Ticket Management Software (HP)	8	-	20	26	-	-
M1	Automate Third Party Excavation Incident Reporting (MP)	-	-	-	-	13	16
M2	Automate Third Party Excavation Incident Reporting (HP)	-	-	-	-	2	3
M3	Locate and Mark Photographs (MP)	-	-	-	-	69	88
M4	Locate and Mark Photographs (HP)	-	-	-	-	11	14
M5	Electronic Positive Response (MP)	Included with C31					
M6	Electronic Positive Response (HP)	Included with C32					

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[25]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
M9	Outreach for Latent 3rd Party Damages (MP)	-	-	-	-	3	4
M10	Outreach for Latent 3rd Party Damages (HP)	-	-	-	-	1	1
M13	Pipeline Monitoring Technologies (HP)	-	-	1,524	2,202	54	77

Table 8: Risk Control & Mitigation Plan – Units Summary

ID	Control/Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	Locate & Mark Training (MP)	Training Hours		-	-	1,017	1,231
C2	Locate & Mark Training (HP)	Training Hours		-	-	163	197
C3	Locate & Mark Activities (MP)	Ticket Count		-	-	138,975	168,233
C4	Locate & Mark Activities (HP)	Ticket Count		-	-	31,675	38,344
C5	Locate and Mark Annual Refresher Training and Competency Program (MP)	Training Hours		-	-	31	37
C6	Locate and Mark Annual Refresher Training and Competency Program (HP)	Training Hours		-	-	7	9
C7	Locate and Mark Operator Qualification (MP)	Program		1	1	1	1
C8	Locate and Mark Operator Qualification (HP)	The units for this control are included in C7.					
C9	Locate and Mark Quality Assurance (MP)	FTE Headcount				3	3
C10	Locate and Mark Quality Assurance (HP)	The units for this control are included in C9.					
C11	Damage Prevention Analyst Program (MP)	FTE Headcount				3	3
C12	Damage Prevention Analyst Program (HP)	The units for this control are included in C11.					
C13	Locating Equipment (MP)	Number of Mobile Data Terminals (MDTs)		121	155	-	-
C14	Locating Equipment (HP)	Number of Mobile Data Terminals		38	49	-	-

ID	Control/Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
		(MDTs)					
C15-T1	Public Awareness Compliance - The Affected Public (MP)		Number of Communications Sent	-	-	1,510,739	1,828,789
C16-T1	Public Awareness Compliance - The Affected Public (HP)		Number of Communications Sent	-	-	344,329	416,819
C15-T2	Public Awareness Compliance - Emergency Officials (MP)		Number of Communications Sent	-	-	418	506
C16-T2	Public Awareness Compliance - Emergency Officials (HP)		Number of Communications Sent	-	-	95	115
C15-T3	Public Awareness Compliance - Local Public Officials (MP)		Number of Communications Sent	-	-	346	442
C16-T3	Public Awareness Compliance - Local Public Officials (HP)		Number of Communications Sent	-	-	79	101
C15-T4	Public Awareness Compliance – Excavators (MP)		Number of Communications Sent	-	-	44,384	53,728
C16-T4	Public Awareness Compliance – Excavators (HP)		Number of Communications Sent	-	-	10,116	12,246
C19	Damage Prevention Policy Activities (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
C20	Damage Prevention Policy Activities (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
C21	Gold Shovel Standard Program (MP)		Memberships	-	-	1	1
C22	Gold Shovel Standard Program (HP)	The units are included in C21					
C23	Excess Flow Valve or Curb Valve Installation (MP)		Number of Installations	12,645	15,307	-	-
C24	Pipeline Patrol and Pipeline Markers (HP)		Number of Items	-	-	28	34
C25	Company Excavator Training (MP)	The units are included in C26.					
C26	Company Excavator Training (HP)		Training Hours	-	-	207	251
C27	Warning Mesh (MP)		Number of Warning Mesh Rolls	2,872	3,477	-	
C28	Warning Mesh (HP)		Number of Warning Mesh Rolls	655	792	-	-
C29	Ticket Risk Assessment and Evaluating City Permit Data (MP)		FTE Headcount	-	-	1	1
C30	Ticket Risk Assessment and Evaluating City Permit Data (HP)	FTE Headcount (less than 1)					
C31	Enhance Ticket Management Software (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
C32	Enhance Ticket Management Software (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					

ID	Control/Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
M1	Automate Third Party Excavation Incident Reporting (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
M2	Automate Third Party Excavation Incident Reporting (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
M3	Locate and Mark Photographs (MP)		FTE Headcount	-	-	1	1
M4	Locate and Mark Photographs (HP)	The units for this mitigation are included with M3.					
M5	Electronic Positive Response (MP)	The units for this mitigation are included with C31.					
M6	Electronic Positive Response (HP)	The units for this mitigation are included with C32.					
M9	Outreach for Latent 3rd Party Damages (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
M10	Outreach for Latent 3rd Party Damages (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
M13	Pipeline Monitoring Technologies (HP)		Fiber	1	1	1	1

Table 9: Risk Control & Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	Locate & Mark Training (MP)	See Table 10			
C2	Locate & Mark Training (HP)	See Table 10			
C3	Locate & Mark Activities (MP)	3333	1.05	3504.2	590
C4	Locate & Mark Activities (HP)	0.17	4235.49	721.9	61
C5	Locate and Mark Annual Refresher Training and Competency Program (MP)	300	1.05	316	25
C6	Locate and Mark Annual Refresher Training and Competency Program (HP)	0.19	4235	815	317
C7	Locate and Mark Operator Qualification (MP)	See Table 10			
C8	Locate and Mark Operator Qualification (HP)	See Table 10			
C9	Locate and Mark Quality Assurance (MP)	300	1.05	315	1
C10	Locate and Mark Quality Assurance (HP)	0.19	4235	814	19
C11	Damage Prevention Analyst Program (MP)	290	1.05	305	40

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C12	Damage Prevention Analyst Program (HP)	0.19	4235	814	19
C13	Locating Equipment (MP)	275	1.05	290	179
C14	Locating Equipment (HP)	0.19	4235	801.2	456
C15-T1	Public Awareness Compliance - The Affected Public (MP)	296	1.05	311	17
C16-T1	Public Awareness Compliance - The Affected Public (HP)	0.19	4235	813	38
C15-T2	Public Awareness Compliance - Emergency Officials (MP)	300	1.05	316	20
C16-T2	Public Awareness Compliance - Emergency Officials (HP)	0.19	4235	815	51
C15-T3	Public Awareness Compliance - Local Public Officials (MP)	300	1.05	315	14
C16-T3	Public Awareness Compliance - Local Public Officials (HP)	0.19	4235	815	39
C15-T4	Public Awareness Compliance – Excavators (MP)	298	1.05	313	124
C16-T4	Public Awareness Compliance – Excavators (HP)	0.19	4235	814	287
C19	Damage Prevention Policy Activities (MP)	See Table 10			
C20	Damage Prevention Policy Activities (HP)	See Table 10			
C21	Gold Shovel Standard Program (MP)	See Table 10			
C22	Gold Shovel Standard Program (HP)	See Table 10			
C23	Excess Flow Valve or Curb Valve Installation (MP)	299	1.05	315	83
C24	Pipeline Patrol and Pipeline Markers (HP)	0.19	4235	811	5.7
C25	Company Excavator Training (MP)	See Table 10			
C26	Company Excavator Training (HP)	See Table 10			
C27	Warning Mesh (MP)	300	1.05	315	26
C28	Warning Mesh (HP)	.19	4235	810	2702
C29	Ticket Risk Assessment and Evaluating City Permit Data (MP)	300	1.05	316	1
C30	Ticket Risk Assessment and Evaluating City Permit Data (HP)	.19	4235	815	8
C31	Enhance Ticket Management Software (MP)	300	1.05	315	17
C32	Enhance Ticket Management Software (HP)	.19	4235	815	39

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
M1	Automate Third Party Excavation Incident Reporting (MP)	300	1.05	316	17
M2	Automate Third Party Excavation Incident Reporting (HP)	0.19	4235	815	31
M3	Locate and Mark Photographs (MP)	See Table 10			
M4	Locate and Mark Photographs (HP)	See Table 10			
M5	Electronic Positive Response (MP)	See Table 10			
M6	Electronic Positive Response (HP)	See Table 10			
M9	Outreach for Latent 3rd Party Damages (MP)	See Table 10			
M10	Outreach for Latent 3rd Party Damages (HP)	See Table 10			
M13	Pipeline Monitoring Technologies (HP)	See Table l0			

Table 10: Risk Control & Mitigation Plan - Quantitative Analysis Summary for RSE Unavailability

ID	Control/Mitigation Name	RSE Unavailability
C1	Locate & Mark Training (MP)	Providing Locator training is standard practice across the industry. The need for in-depth knowledge of the use of proper tools and resources is paramount for the efficient and accurate application of L&M procedures. There are no known sources to find data associated with operators who do not have a training program and SMEs are unable to reliably speculate on the quantitative benefits of training.
C2	Locate & Mark Training (HP)	Providing Locator training is standard practice across the industry. The need for in-depth knowledge of the use of proper tools and resources is paramount for the efficient and accurate application of L&M procedures. There are no known sources to find data associated with operators who do not have a training program and SMEs are unable to reliably speculate on the quantitative benefits of training.
C7	Locate and Mark Operator Qualification (MP)	Locate & Mark activities are “covered tasks” as defined in 49 CFR 192.801. As such the Op

ID	Control/Mitigation Name	RSE Unavailability
		Qual program is required for all individuals performing the tasks. The program was mandated in 2004. Data representing the status of the L&M program before that time is not available to provide comparison to the pre-Op Qual environment, and SMEs are unable to reliably speculate on the quantitative benefits of this longstanding program.
C8	Locate and Mark Operator Qualification (HP)	Locate & Mark activities are "covered tasks" as defined in 49 CFR 192.801. As such the Op Qual program is required for all individuals performing the tasks. The program was mandated in 2004. Data representing the status of the L&M program before that time is not available to provide comparison to the pre-Op Qual environment, and SMEs are not able to speculate on the quantitative benefits of this longstanding program.
C19	Damage Prevention Policy Activities (MP)	This activity involves the proactive participation at meetings and workshops with the Dig Safe Board, Regional Common Ground Alliance (CARCGA), both California One-Call centers, and meetings with State Assembly and Senator staff to advocate from the Operator/Excavator perspective, for sensible and comprehensive enhancements to state laws and regulations. Participation provides the opportunity to make positive and beneficial changes. Choosing not to participate could lead to poor, costly, and ineffective regulations. The Damage Prevention Strategies group began this activity in 2018 and are not aware of meaningful data that would provide for an RSE calculation at this time. SMEs are unable to quantify the benefits of this activity.
C20	Damage Prevention Policy Activities (HP)	This activity involves the proactive participation at meetings and workshops with the Dig Safe Board, Regional Common Ground Alliance (CARCGA), both California One-Call centers, and meetings with State Assembly and Senator staff to advocate, from the Operator/Excavator perspective, for sensible and comprehensive enhancements to state laws and regulations.

ID	Control/Mitigation Name	RSE Unavailability
		Participation provides the opportunity to make positive and beneficial changes. Choosing not to participate could lead to poor, costly, and ineffective regulations. The Damage Prevention Strategies group began this activity in 2018 and are not aware of meaningful data that would provide for an RSE calculation at this time. SMEs are unable to quantify the benefits of this activity.
C21	Gold Shovel Standard Program (MP)	Participation in this program is one component of SDG&E's contractor performance management programs and applies to a small subset of the excavator community – those contractors who perform construction work on SDG&E's behalf. SDG&E has been working with the GSS program to develop useful metrics but is currently unaware of their availability. SMEs are unable to quantify the benefits of this program.
C22	Gold Shovel Standard Program (HP)	Participation in this program is one part of our contractor performance management programs and applies to a small subset of the excavator community – those contractors who perform construction work on SDG&E's behalf. SDG&E has been working with the GSS program to develop useful metrics but is currently unaware of their availability. SMEs are unable to quantify the benefits of this program.
C25	Company Excavator Training (MP)	Providing training is a common, necessary, and expected practice regardless of the industry. It is important to properly train employees on the safe use of excavation implements or machines. When working around a hazardous material such as natural gas, many safety practices and protocols have been developed internally and by institutions such as OSHA to promote safety and personal wellbeing. It is unknown where data can be found to represent an entity that does not provide adequate training, and SMEs cannot determine the quantitative effects of these activities.

ID	Control/Mitigation Name	RSE Unavailability
C26	Company Excavator Training (HP)	Providing training is a common, necessary, and expected practice regardless of the industry. It is important to properly train employees on the safe use of excavation implements or machines. When working around a hazardous material such as natural gas, many safety practices and protocols have been developed internally and by institutions such as OSHA to promote safety and personal wellbeing. It is unknown where data can be found to represent an entity that does not provide adequate training, and SMEs cannot determine the quantitative effects of these activities.
M3	Locate and Mark Photographs (MP)	Locate & Mark photographs mitigation is included with the C-3 Locate and Mark Activities (MP)
M4	Locate and Mark Photographs (HP)	Locate & Mark photographs mitigation is included with the C-4 Locate and Mark Activities (HP)
M5	Electronic Positive Response (MP)	Electronic Positive Response is included with C-33 Enhance Ticket Management Software (MP)
M6	Electronic Positive Response (HP)	Electronic Positive Response is included with C-34 Enhance Ticket Management Software (HP)
M9	Outreach for Latent 3rd Party Damages (MP)	This is a new mitigation with no historical data. SDG&E's intent is to attempt to identify an excavator who damaged a pipeline in the past (via historic permit or USA ticket information) to provide the opportunity for outreach and education to minimize or prevent a similar occurrence in the future. With no historical data to provide any indication for a potential success rate, calculation of an RSE is infeasible, as it would require SME speculation about this activity.
M10	Outreach for Latent 3rd Party Damages (HP)	This is a new mitigation with no historical data. SDG&E's intent is to attempt to identify an excavator who damaged a pipeline in the past (via historic permit or USA ticket information) to provide the opportunity for outreach and education to minimize or prevent a similar occurrence in the future. With no historical

ID	Control/Mitigation Name	RSE Unavailability
		data to provide any indication for a potential success rate, calculation of an RSE is infeasible, as it would require SME speculation about this activity.
M13	Pipeline Monitoring Technologies (HP)	Increasing the ability to monitor and control the natural gas system is a prudent safety and reliability measure for California's energy grid. The CCM will allow for the system to be controlled or isolated faster in the event of a system incident. Likewise, the CCM will allow for potential issues in the system to be identified sooner, as opposed to patrols or a system with fewer monitor points, and potentially resolved before becoming an incident. This can include dig-in detection and response, over/under pressure awareness and response as well as increased flexibility to respond to the varying demands on the system throughout the year. Increased remote control can also alleviate employee exposure while operating equipment prior to, during or after an incident. Overall, the CCM will decrease the consequences of system incidents through the opportunity for quicker identification, more timely response, and fewer human asset involvement in potentially hazardous conditions. Since the CCM is still in the design phase and not operational yet, there is no historical data available to develop an RSE for the risk mitigations of Dig-Ins, and SME input cannot fill the information gap.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the risk control and mitigation plan for the Dig-in on the 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 also took into account modifications to the plan and constraints, such as budget and resources.

A. A1: MP; A2: HP Virtual Reality Training

The virtual reality Locate and Mark training simulator provides a portable and scenario-based training system. It allows for instructors to simulate a variety of real-world locate and mark scenarios. Virtual reality provides more flexibility in training curriculum and allows for more focused educational opportunities. More research is needed to identify system requirements and standardization scores and identify impacts to existing locate equipment and performance management software.

B. A3: MP; A4: HP GPS Tracking of Excavation Equipment

SDG&E has supported the Gas Technology Institute (GTI) and other research organizations in their efforts to help the industry improve damage prevention practices. Past and ongoing efforts included real-time GPS tracking of excavation equipment operating in pipeline rights-of-way and quick-shut breakaway meter set valves.

Real-time tracking of excavation is performed using a "black box" attached to the excavation equipment, such as backhoes, graders, and alike. The black box monitors the location of the equipment and can sense when the equipment is getting ready to dig. There is sophisticated software that monitors the GPS data in relation to its proximity to spatial pipe locations. If the box is detected near a company asset, then an alarm is triggered on the equipment alerting the equipment operator that there is a pipeline in the area. There is also an alert sent to the Company, so action may be taken to investigate the location.

The technology is not being pursued currently as the initial experience demonstrated false positives. Follow-up is needed to validate technology maturity.

Table 11: Alternate Mitigation Plan - Forecast Dollars Summary
(Direct After Allocations, In 2020 $000)

ID	Alternate Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Virtual Reality Training (MP)	-	-	94	120
A2	Virtual Reality Training (HP)	-	-	94	120
A3	GPS Tracking of Excavation Equipment (MP)	-	-	306	391
A4	GPS Tracking of Excavation Equipment (HP)	-	-	306	391

Table 12: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Virtual Reality Training (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
A2	Virtual Reality Training (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
A3	GPS Tracking of Excavation Equipment (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
A4	GPS Tracking of Excavation Equipment (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					

Table 13: Alternate Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
A1	Virtual Reality Training (MP)	300	1.05	315.6	0.006
A2	Virtual Reality Training (HP)	0.19	4235	815.3	0.015
A3	GPS Tracking of Excavation Equipment (MP)	300	1.05	315.6	0.0002
A4	GPS Tracking of Excavation Equipment (HP)	0.19	4235	815.3	0.001

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Appendix A: Summary of Elements of the Risk Bow Tie
Dig-in on the System: Summary of Elements of the Risk Bow Tie

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
C1	Locate & Mark Training (MP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C2	Locate & Mark Training (HP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C3	Locate & Mark Activities (MP)	DT.4, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C4	Locate & Mark Activities (HP)	DT.4, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C5	Locate and Mark Operator Qualification (MP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C6	Locate and Mark Operator Qualification (HP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C7	Locate and Mark Quality Assurance (MP)	DT.4, DT.5, DT.6, DT. 8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C8	Locate and Mark Quality Assurance (HP)	DT.4, DT.5, DT.6, DT. 8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C9	Damage Prevention Analyst Program (MP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C10	Damage Prevention Analyst Program (HP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C11	Locating Equipment and Supporting Computer Hardware/ Software (Purchase, Replace, Upgrades and Updates) (MP)	DT.4, DT.6, DT.7, DT.8, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C12	Locating Equipment and supporting computer Hardware/Software (Purchase, Replace, Upgrades and Updates) (HP)	DT.4, DT.6, DT.7, DT.8, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C13-T1	Public Awareness – Affected Public (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C14-T1	Public Awareness – Affected Public (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C13-T2	Public Awareness – Emergency Officials (MP)	DT.1, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C14-T2	Public Awareness – Emergency Officials (HP)	DT.1, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C13-T3	Public Awareness – Local Public Officials (MP)	DT.1, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C14-T3	Public Awareness – Local Public Officials (HP)	DT.1, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

C13-T4	Public Awareness – Excavators (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C14-T4	Public Awareness – Excavators (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C15	Increase Reporting of Unsafe Excavation (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C16	Increase Reporting of Unsafe Excavation (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C17	Damage Prevention Policy (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C18	Damage Prevention Policy (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C19	Gold Shovel Standard Program (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C20	Gold Shovel Standard Program (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C21	Excess Flow Valve or Curb Valve Installation (MP)	DT.1, DT.3, DT.4, DT.6, DT.7, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C22	Pipeline Patrol and Pipeline Markers (MP)	DT.1, DT.2, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C23	Pipeline Patrol and Pipeline Markers (HP)	DT.1, DT.2, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C24	Company Excavator Training (MP)	PC.2, DT.3, PC.1, PC.3, PC.4, PC.5, PC.6
C25	Company Excavator Training (HP)	DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C26	Locate and Mark Annual Refresher Training and Competency Program (MP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C27	Locate and Mark Annual Refresher Training and Competency Program (HP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M1	Automate Third Party Excavation Incident Reporting (MP)	DT.2, DT.4, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M2	Automate Third Party Excavation Incident Reporting (HP)	DT.2, DT.4, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M3	Locate and Mark Photographs (MP)	DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M4	Locate and Mark Photographs (HP)	DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M5	Electronic Positive Response (MP)	DT.2, DT.4, DT.5, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M6	Electronic Positive Response (HP)	DT.2, DT.4, DT.5, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M7	Leverage Technology for Difficult Locates (MP)	DT.5, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

M8	Leverage Technology for Difficult Locates (HP)	DT.5, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M9	Enhance Ticket Management Software (MP)	DT.2, DT.4, DT.5, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M10	Enhance Ticket Management Software (HP)	DT.2, DT.4, DT.5, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M11	Ticket Risk Assessment and Evaluating City Permit Data (MP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M12	Ticket Risk Assessment and Evaluating City Permit Data (HP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M13	Outreach for Latent 3rd Party Damages (MP)	DT.1, DT. 3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M14	Outreach for Latent 3rd Party Damages (HP)	DT.1, DT. 3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M15	Leverage Data Gathered by Locating Equipment (MP)	DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M16	Leverage Data Gathered by Locating Equipment (HP)	DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M17	Warning Mesh (MP)	DT.1, DT.2, DT.3, DT.4, DT.7, DT.8, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M18	Warning Mesh (HP)	DT.1, DT.3, DT.4, DT.2, DT.7, DT.8, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M19	Pipeline Monitoring Technologies (HP)	DT. 1, DT. 2, DT. 3, DT. 4, DT. 5, DT. 2, DT. 7, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

APPENDIX B: QUANTITATIVE ANALYSIS SOURCED DATA REFERENCES

Appendix B: Quantitative Analysis Sourced Data References

The SA Decision directs the utility to identify potential consequences of a risk event using available and appropriate data. The below provides a listing of the inputs utilized as part of this assessment.

Annual Report Mileage for Natural Gas Transmission & Gathering Systems
Agency: Pipeline and Hazardous Materials Safety Administration (PHMSA)
Link: *https://cms.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-natural-gas-*transmission-gathering-systems

Annual Report Mileage for Gas Distribution Systems
Agency: Pipeline and Hazardous Materials Safety Administration (PHMSA)
Link: *https://cms.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-gas-distribution-systems*

Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data
Agency: Pipeline and Hazardous Materials Safety Administration (PHMSA)
Link: *https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data*

United States Census Bureau Quick Facts
Agency: United States Census Bureau
Link:*https://www.census.gov/quickfacts/fact/table/US/PST045219*

Real Estate Property Costs
Agency: National Association of Realtors
Link: *https://www.nar.realtor/research-and-statistics/housing-statistics/county-median-home-prices-and-monthly-mortgage-payment*

San Diego Gas & Electric high-pressure pipeline miles
Source: 2020 internal SME data

DIRT - Damage Information Reporting Tool
Source: Internal Incident Data

Warning Mesh Usage Information
Source: Internal Cost (Labor and Material) and Mileage Data

Excess Flow Valve (EFV) Installation Data
Source: Internal Cost (Labor and Material) and Scope Data

Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-8)

Incident Involving An Employee

May 17, 2021

TABLE OF CONTENTS

RISK: INCIDENT INVOLVING AN EMPLOYEE

I. INTRODUCTION

The purpose of this chapter is to present SDG&E's risk control and mitigation plan for the Incident Involving an Employee risk (IIE Risk). Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018, and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter RAMP-B of this RAMP Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision, as discussed in Chapter RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs and cost estimates are provided for years 2022-2024, as further discussed in Chapter RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent

---

[1] D.16-08-018 adopted the requirements previously set forth in D.14-12-025. D.18-12-014, the Phase Two Decision Adopting Safety Model Assessment Proceeding (S-MAP) Settlement Agreement With Modifications, adopted the Settlement Agreement Among Pacific Gas and Electric Company, Southern California Edison Company, Southern California Gas Company, San Diego Gas & Electric Company, The Utility Reform Network, Energy Producers and Users Coalition, Indicated Shippers, and the Office of Ratepayer Advocates, which contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[2] Settlement Decision at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

with the GRC). Costs for each activity that directly address each risk are provided where those costs are available and within the scope of the analysis required in this RAMP Report.

Throughout this 2021 RAMP Report activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's IIE Risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters RAMP-A and RAMP-C, SDG&E has endeavored to calculate the Risk Spend Efficiency (RSE) for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or Subject Matter Expert (SME) opinion exists to calculate the RSE, SDG&E has included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

A. Risk Overview

Employee safety is a core value at SDG&E. SDG&E's safety-first culture focuses on its employees, customers, and the public, and is embedded in every aspect of the Company's work. Employees should be able to go home to their families and loved ones after work each day and be able to return to work safely the next day. Safety is not compromised for production, customer satisfaction, or any other goal, and no activity is so important that it should jeopardize safety.

The IIE Risk was included in SDG&E's 2020 Enterprise Risk Registry (ERR), and for purposes of this RAMP filing is defined as the risk of an incident, involving one or more on-duty employees, that causes serious injury or fatality to a company employee. The IIE Risk Chapter

---

3 Settlement Decision at 16.

4 *Id.* at 17.

5 See Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 (November 25, 2020) at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.").

focuses on controls and mitigations that address safety, including education, training, and other internal enhancements.[6] SDG&E's IIE Risk mitigation programs are founded on proven employee-based programs, safety training, workforce education, and SDG&E's Illness & Injury Prevention Program (IIPP). The elements of SDG&E's IIPP include:

- Commitment/assignment of responsibilities;
- Safety communications systems with employees;
- System for assuring employee compliance with safe work practices;
- Scheduled inspections/evaluation system;
- Accident investigation;
- Procedures for correcting unsafe or unhealthy conditions;
- Safety and health training and instruction; and
- Recordkeeping and documentation.

SDG&E's strong safety culture and commitment to developing process and programs is designed to manage the IIE Risk. SDG&E's safety performance measures have shown consistent improvement overall in recent years. As noted above, many of the IIE Risk mitigations identified herein also help mitigate these other risks. While the IIE Risk definition is limited in scope for purposes of this RAMP Chapter, it is important to note that the operational risks addressed in other Chapters of this RAMP Report[7] can result in an incident where an employee is seriously injured, or a fatality is present.

---

[6] The Electric Infrastructure Integrity (EII) Chapter (SDG&E-2) of this RAMP Report covers the risk event of an employee coming into contact with energized equipment. Even though the potential consequences of such a risk event are similar to those of an IIE Risk event (causing serious employee injury or fatality), they are included in the EII Chapter because mitigations for an EII Risk event are focused on infrastructure protections and improvements.

[7] *See*, *e.g.*, SDG&E-2: Electric Infrastructure Integrity; SDG&E-9: Incident Related to the Medium Pressure System Incident; SDGE-7: Excavation Damage (Dig-in) on the Gas System; and SDG&E-3: Incident Related to the High Pressure System.

B. Risk Definition

For purposes of this RAMP Application, SDG&E's IIE Risk is defined as the risk of an incident, involving one or more on-duty employees, that causes serious injury or fatality to a company employee.[8]

C. Scope

Table 1 below provides what is considered in scope for the Incident Involving an Employee Risk in this RAMP Application.

Table 1: Risk Scope

In-Scope:	The risk of an incident, involving one or more on-duty employees, that causes serious injury or fatality (as defined by OSHA) to a company employee.
Data Quantification Sources:	Subject Matter Experts provided data, as well as company data reviewed and adjusted by SMEs to SDG&E's applicable use. See Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision, this section describes the risk bow tie, possible drivers, potential consequences, and the risk score for the IIE Risk.[9]

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision instructs the utility to include a risk bow tie illustration for each risk included in RAMP.[10] As illustrated in the risk bow tie shown below in Figure 1, the risk event (center of the bow tie) is an Incident Involving an Employee, the left side of the bow tie illustrates drivers/triggers that lead to a potential IIE Risk event, and the right side shows the potential consequences of an IIE Risk event. SDG&E applied this framework to identify and summarize the information provided in

---

[8] A "serious injury" is defined in the California Code of Regulations 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." Title 8 California Code of Regulations (CCR) § 330(h).

[9] Settlement Decision at 33 and Attachment A, A-11 (Bow Tie).

[10] *Id.* at Attachment A, A-11.

Figure 1. A mapping of each mitigation to the element(s) of the risk bow tie addressed is provided in Appendix A.

Figure 1: Risk Bow Tie

B. Cross-Functional Factors

This RAMP filing includes separate cross-functional factor (CFF) sections that impact the IIE Risk and help to further mitigate SDG&E's IIE Risk. For instance, SDG&E's Safety Management System (SMS) is a CFF that will further mitigate the IIE Risk. SDG&E's enterprise-wide SMS is designed to enhance the Company's longstanding commitment to safety, which focuses on people safety (employee, contractor, customer and public), asset safety (all Company infrastructure), gas and electric operations safety, risk identification and management, and emergency preparedness and incident response. The SMS will develop a cohesive system that promotes improved communication, better documentation, and enhanced coordination to continue to build upon our strong safety culture and further reduce our IIE Risk.

Programs and projects discussed in the Emergency Preparedness and Response and Pandemic CFF, the Workforce Planning/Qualified Workforce CFF, and Records Management CFF also further mitigate IIE Risk.

C. Potential Drivers/Triggers[11]

The Settlement Decision instructs the utility to identify which element(s) of the associated risk bow tie are addressed by each mitigation.[12] When performing the risk assessment for IIE Risk, SDG&E identified potential leading indicators, referred to as drivers or triggers (DT). These include, but are not limited to:

- **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 an IIE.
- **DT.2 – Hazards in the work environment (work locations, roadways, etc.):** Unsafe work environments (work locations, roadways and parking places, customer premises) gas equipment conditions, Polychlorinated Biphenyls (PCB), lead from paint, asbestos, and fumigation chemicals, for example, could each lead to an IIE.
- **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 an IIE.
- **DT.4 – Unsafe operation of equipment or motor vehicles:** Failure to follow the law and/or other applicable safety practices could result in an IIE.
- **DT.5 – Damaged equipment and/or infrastructure:** Damage to gas or electric equipment or infrastructure could lead to an IIE.
- **DT.6 – Employee fatigue/complacency:** Employee fatigue or complacency could lead to an IIE.

[11] Potential drivers or triggers are an indication that a risk could occur; they do not reflect actual or threatened conditions.

[12] D.18-12-014 at Attachment A, A-11.

- **DT.7 – Employee impairment due to environmental factors:** Hazardous working conditions could lead to an employee becoming impaired which could lead to an IIE.
- **DT.8 – Inadequate employee training:** Failure to provide adequate safety training could result in an IIE.
- **DT.9 – Lack of oversight of employees' work:** Employees performing work without an appropriate amount of supervision and control may be prone to errors or become careless, which could lead to an IIE.
- **DT.10 – New/transferred employee inexperience:** New employees or employees transferred from another work area may not be as skilled in working as safely as an experienced employee which may lead to an IIE.
- **DT.11 – Inadequate or inaccurate information on utility or substructure location:** 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 an IIE.
- **DT.12 – Inadequate use of job-site safety plans or analysis:** Knowledge and use of job-site safety plans and/or analysis of job site hazards provides employees with the information needed to safely perform their work activities. If those plans or analysis are not adequate, it could lead to an IIE.

D. Potential Consequences of Risk Event

Potential consequences are listed to the right side of the risk bow tie illustration provided above.[13] If one or more of the drivers/triggers listed above were to result in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

- PC.1 - Serious injuries or fatalities;
- PC.2 - Property damage;
- PC.3 - Operational and reliability impacts;
- PC.4 - Penalties and fines;
- PC.5 - Adverse litigation; and
- PC.6 - Erosion of public confidence.

[13] *See id.* at A-8 ("Identification of Potential Consequences of Risk Event").

These potential consequences were used in the scoring of the IIE Risk in SDG&E's 2020 Enterprise Risk Registry.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[14] Chapter RAMP-C of this RAMP Application explains the Risk Quantitative Framework which underlies this Chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[15]

	LoRE	CoRE	Risk Score
Incident Involving an Employee	0.83	1,275	1,062

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to "use actual results, available and appropriate data, and/or Subject Matter Experts (SMEs) to identify potential consequences of a risk event . . . ."[16]

Historical internal data is used to model the uncertainty of safety frequency and consequence; SME provided data for financial and stakeholder satisfaction analysis. The probability distribution of safety and stakeholder satisfaction results per year is yielded using Monte Carlo method. Specific data sources will be provided in workpapers.

III. 2020 CONTROLS

This section describes the controls currently in place, as required by the Settlement Decision.[17] The controls in this section were in place as of December 31, 2020. Controls that will continue as part of the Plan are addressed in Section IV.

---

[14] *Id.* at A-11 ("Calculation of Risk").

[15] The term "pre-mitigation analysis," in the language of the Settlement Decision (Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," and "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score")), refers to required pre-activity analysis conducted prior to implementing control or mitigation activity.

[16] *Id.* at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

[17] Settlement Decision at 33.

A. Control 1 - Mandatory Employee Health and Safety Training Programs and Standardized Policies

SDG&E's employees receive extensive training because SDG&E believes safety starts with proactive upstream measures to reduce the likelihood of a safety incident from occurring. Much of the safety training is available on-line through the learning management system (LMS).

On-line/Learning Management System Training: Online training refers to a course, education materials, or program delivered online via the intranet or through SDG&E's LMS. Training courses are accessible at any time, from any location, and performed at the user's convenience. Additionally, completion of the training is tracked in SDG&E's LMS system to confirm compliance.

SDG&E's employee health and safety training programs comprise the following elements:

Injury Illness Prevention Program (IIPP): In California, every employer is required by law to provide a safe and healthful workplace for its employees.[18] Further, Title 8 of the California Code of Regulations requires every employer to have an effective IIPP.[19] SDG&E's IIPP is a written plan for preventing injury and illness that includes the following elements:

- Management commitment/assignment of responsibility;
- Safety communication system with employees;
- System for assuring employee compliance with 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.

Employee Safety Handbook/Standards: SDG&E's employee safety handbook is a collection of information, instructions, policies, and procedures intended to provide guidance on safe work practices.

[18] Cal. Labor Code § 6400.

[19] 8 CCR § 8350.

Safety standards are specifications designed to promote the safety of work activities or processes. Standards are rules that describe the methods that SDG&E uses to protect employees from hazards and are used to communicate safe practices to the workforce. These standards establish the framework and guidance for employee safety performance. Standards 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, and Asbestos and Lead Exposure Management.

Arc Flash Hazard Assessment Training: This training teaches SDG&E's employees how to properly assess electric arc and flash hazards, how to evaluate the types of hazards, and how to determine the level of protection needed. Initial training is mandatory for employees who may work on or near low- or high-voltage lines or equipment and as needed thereafter. The objectives of training are to identify:

- Hazards of electric arcs associated with energized lines and equipment;
- Safety practices and protective measures including flame-resistant/arc-rated clothing; and
- Regulations and Company policy/procedures.[20]

Confined Space Training: Confined Space Training is mandatory for employees who may:

- Enter or have the need to enter confined spaces; and/or
- Encounter confined spaces in the course of Company business.[21]

The objectives of the training are to: (1) identify characteristics of permit-required confined spaces and associated hazards; (2) understand the roles and responsibilities of each

[20] *See* 8 CCR § 3202, 8 CCR § 2940.6 and Title 29 Code of Federal Regulations (CFR) § 1910.269.

[21] 8 CCR § 5157.

entry team; (3) demonstrate how to manage, control and eliminate hazards; (4) perform safe entry procedures; and (5) understand how to read a permit-required entry permit.

Safety in Motion (SIM): SIM is an as-needed body mechanics education program to inform employees about body positioning to help prevent injury from, for example, sprains, strains, and tears. It is designed to equip each field employee with a consistent process for approaching each job safely by enhancing knowledge and skills and the ability to identify and use the best body positioning. This program provides customized training based on known risk factors such as intensity of effort (*e.g.,* jackhammering), awkward posture (*e.g.,* working on a pole or digging), and/or repetition (*e.g.,* wrenching) with the objective of providing employees with alternatives to decrease injury potential. SIM's overall goal is to reduce unnecessary strain on the body through use of engineering controls, tools, and physical techniques that allow employees to "work smarter not harder."

Emergency Action Plan (EAP): All Company facilities must have an EAP for the purpose of communicating to employees their responsibilities during an emergency. The plans include, but are not limited to: communication strategies, evacuation routes, and procedures for accounting for employees. The safety of all employees is the primary goal during a workplace emergency. SDG&E's EAP procedures are taught through web-based, in-person, and/or classroom training. Training is mandatory for employees designated to assist with emergency evacuations and all employees are trained on the EAP when they are hired, transferred, when the plan is changed, and when an employee is transferred to a new work area or when new hazards are introduced to an existing work area. Additionally, an evacuation drill is held annually.

Site and Vehicle automated external defibrillators (AED) Program: AEDs are available at all SDG&E work locations and are on crew vehicles with two or more employees. Designated employees are trained on the use of AEDs as well as general first aid, cardiopulmonary resuscitation (CPR), and bloodborne pathogens. With simple audio and visual commands, SDG&E's AEDs are designed to be simple to use for the layperson.

Electric and/or Magnetic Fields (EMF): Although recognizing that no conclusive research exists that EMFs pose a health hazard, the CPUC has directed the utilities to nonetheless take a number of steps to address the public's concerns. SDG&E's EMF Safety Program, developed in accordance with CPUC Decisions 93-11-013 and 06-01-042, includes the following:

- Maintaining a staff of informed representatives available to talk with customers and employees about EMF issues;
- Providing magnetic field measurements for customers requesting the service;
- Providing objective EMF health information to the public and notifying customers of research milestones as this information becomes available;
- Providing employee education on EMF issues;
- Supporting, funding, and monitoring EMF research;
- Implementing low-cost and no-cost measures, where appropriate, to reduce fields associated with new construction projects; and
- Participating in communication forums and regulatory proceedings to remain current on all EMF-related issues.

B. Control 2 - Drug and Alcohol Testing Program

SDG&E has implemented an employee drug and alcohol testing program managed in accordance with state and federal regulations. Sempra Energy's Substance Abuse and Testing (Fitness-For-Duty and Reasonable Cause) Policy (Substance Abuse Policy), which all SDG&E employees are responsible for knowing and complying with, prohibits, among other things, the use of drugs and/or alcohol during working hours and/or reporting to work in an unfit condition due to drugs and/or alcohol. Violations of this policy are cause for disciplinary action up to and including termination of employment.

Additionally, all supervisory personnel who oversee SDG&E employees that perform United States Department of Transportation (DOT) defined "safety-sensitive functions" (operation, maintenance, or emergency response on pipeline systems, and operators of commercial vehicles)[22] are required to complete Supervisor Substance Abuse Awareness training. This training educates supervisors about their responsibilities under DOT regulations and Company policy, including identifying physical, behavioral, speech, and performance indicators of probable substance abuse, and understanding the criteria for post-accident drug testing. Employees suspected of being under the influence of alcohol or controlled substances

[22] 49 CFR Part 40.

are subject to reasonable cause testing. Employees in safety-sensitive DOT positions are also subject to random testing.[23]

Reasonable Suspicion Identification and Testing applies to all employees. The Substance Abuse Policy requires supervisors to remove a suspected employee(s) from work if recognizable signs of impairment are observed after using the reasonable suspicion checklist.

Post-Accident Testing

- If Post-accident criteria are met, post-accident testing may be commenced under guidance of the HR Services department and/or designated employer representative (DER).
- Federal Motor Carrier Safety Administration (FMCSA) requirements include post-accident testing as soon as possible, but no later than 32 hours after, when there is an accident while driving a commercial motor vehicle requiring a commercial driver's license to operate and the following occurs:
  - loss of human life, or
  - Citation is issued by law enforcement and one of the following:
    - Medical treatment away from scene of the accident, or
    - A vehicle incurring damage as a result of the accident is towed from the scene.[24]
- PHMSA requirements include post-accident testing as soon as possible, but no later than 32 hours after a significant, reportable incident occurs that involves a gas pipeline or LNG facility.[25]

C. Control 3 - Strong Safety Culture (*e.g.*, safety meetings, committees, surveys, safety campaigns, stop the job, near miss reporting)

As further discussed in Chapter RAMP-D, SDG&E is committed to a strong safety culture and places the highest priority on employee, customer, and public safety. To

---

[23] *See* 49 CFR Part 382 (establishing a program designed to prevent accidents and injuries resulting from the misuse of alcohol or use of controlled substances by drivers of commercial vehicles); 49 CFR Part 199 (establishing an anti-drug and alcohol misuse prevention plan for employees in safety-sensitive positions that perform pipeline operations, maintenance, or emergency response functions as defined by Pipeline and Hazardous Materials Safety Administration (PHMSA)).

[24] 49 CFR § 382.303.

[25] 49 CFR § 199.105.

continuously strengthen our safety culture, Company employees attend safety meetings, tailgates, congresses, and are surveyed every two years to solicit their candid feedback, as further detailed below. SDG&E incorporated action items identified in the 2018 survey results to further strengthen its organizational safety plans and employee safety program and culture, and will do likewise based on results from the 2020 survey. SDG&E's efforts to establish a strong safety culture and further employee safety initiatives include:

Safety Stand-downs: A Safety Stand-down is a voluntary event for supervisors to talk directly to employees about safety. These events provide an opportunity to discuss hazards, protective methods, and the Company's safety policies, goals and expectations.

Safety Congress and Leadership Awards: Since 2002, this event has been held annually. It provides a forum for safety committee members, safety leaders, and others to share and exchange information and ideas through networking and workshops. At this event, safety leaders are recognized for living by the Company's safety vision, turning that vision into action, embracing the SDG&E safety culture, and demonstrating safety leadership.

Safety Tailgates: Safety tailgate talks are short informational meetings held with employees to discuss work-site related safety. The purpose of a tailgate is to inform employees of specific hazards associated to a task and the safe way to do a job. Tailgate talks also serve as a reminder to employees of what they already know while establishing the supervisor's credibility and conscientiousness about his/her oversight role.

Safety Meetings: The main objectives of safety meetings are to remind employees of **s**afe practices they have already learned and to introduce and build awareness of new techniques, new equipment, or new regulations that must be observed. Safety meetings occur every 10 days for employees engaged in field construction or construction associated activities and monthly for employees involved in operations, maintenance, or other manual work (employees who spend at least 50% of their time in the field).

Grassroots Safety Culture Change Teams (GRSC): Launched in 2009, SDG&E's GRSC involves a safety culture journey that goes beyond the 3 E's of engineering, enforcement, and education. The emphasis is on building trust, relationships, and partnerships that affect the Company's strategic focus areas, including safety. This approach uses an "iceberg analysis" to identify cultural norms and assumptions that cannot be seen (below the waterline) that may undermine established policies and procedures. Under a guidance team and team coach, GRSC

teams propose projects with goals to help move the Company's safety culture forward, improving awareness, preventing injuries, bridging communication gaps, and preserving pride in SDG&E's work.

These teams train and empower frontline employees to advance a positive safety culture in their workgroups by addressing behaviors and norms to take safety beyond compliance. This nationally recognized program is deployed in partnership with International Brotherhood of Electrical Workers (IBEW) Local 465.

Executive Safety Council (ESC) Team Meeting Dialogs: The ESC is the governing body for all safety committees. Led by SDG&E's Chief Operations Officer and Director – Safety, the ESC advances Company safety culture and addresses enterprise-wide safety strategy. The meeting dialogs are held at Company locations and integrate employee and supervisor dialog sessions so that employees have an opportunity to share safety experiences with Company leadership.

Biennial Safety Culture Survey: Every two years, SDG&E employees take a Safety Barometer Survey and share their candid insights on safety in six critical areas: Management Commitment, Supervisor Engagement, Employee Involvement, Safety Support Activities, Safety Support Climate, and Organizational Climate. The Safety Barometer Survey is provided by the National Safety Council (NSC), an independent non-profit organization that has advocated for employee and public safety for over 100 years.[26]

The NSC compares our survey results to those of other participating companies in their survey database (currently, 580). The results of SDG&E's 2020 survey placed SDG&E in the 98th percentile and in the top 2 percent of the 580 organizations in the NSC database who participated in the survey in 2020. The overall score for SDG&E increased by 8 points from the 2018 survey. Action plans based on the 2020 NSC survey results will be developed and executed.

The six critical areas of the NSC survey and SDG&E's 2020 rankings in those areas are:

- **Management Commitment (top 2%).** Management Participation items describe ways in which top and middle management demonstrate their leadership and

[26] National Safety Council, *NSC Safety Training, available at* https://www.nsc.org/.

commitment to safety in the form of words, actions, organizational strategy, and personal engagement with safety.

- **Supervisor Engagement (top 1%).** Supervisor Participation items consider six primary roles through which supervisors communicate their personal support for safety: leader, manager, controller, training, organizational representative, and personal engagement with safety.
- **Employee Involvement (top 5%).** Employee Participation items specify selected actions and reactions that are critical to making a safety program work. Emphasis is given on personal engagement, responsibility, and compliance.
- **Safety Support Activities (top 4%).** Safety Support Activities items probe the presence or quality of various safety program practices, with a focus on communications, training, inspection, maintenance, and emergency response.
- **Safety Support Climate (top 2%).** Safety Support Climate items asked employees across the organization for general beliefs, impressions, and observations about management's commitment and underlying values with regards to safety.
- **Organizational Climate (top 3%).** Organizational Climate items probe general conditions that interact with the safety program to affect its ultimate success, such as teamwork, morale, and employee turnover.

Stop Work Authority (*i.e.*, Stop the Job / Stop the Task): SDG&E employees, regardless of rank or title, are given the authority to "stop a job" at any time if they identify a safety hazard and are encouraged to raise a red flag whenever they feel it is needed.

Close Call/Near-Miss Program: SDG&E recognizes the importance of learning from close calls and near-misses to reduce the potential for a serious incident or injury in the future. The National Safety Council describes a close call or near-miss as an unplanned event that did not result in injury, illness, or damage, but had the potential to do so. SDG&E encourages employees to report close calls in tailgates, safety meetings, through an online process, or by using a newly developed smart device application. Reporting online or through the app allows employees to report anonymously. The information is submitted to Safety Services for review and then is shared with employees throughout the company, so they understand and benefit from overall awareness and lessons learned.

Incident Investigation: As part of improving its safety culture, SDG&E's Safety Department has established a comprehensive and robust incident investigation standard and reporting process. Applying this process uniformly across the Company will result in more consistent investigations and will allow lessons learned to be shared broadly. In addition, regular training is provided for those conducting incident investigations to confirm consistency and more thorough investigations.

Safety Committees/Sub-committees:

Field and Office Site Safety Committees: These site-specific committees are actively engaged in safety awareness through education, promoting a healthy lifestyle, encouraging work-life balance, and always maintaining a safe work environment. To keep the committees connected, quarterly meetings are held with committee chairpersons and co-chairpersons. During these meetings safety updates are shared, training is provided, and action planning steps identified. Like all other safety committees, site committees roll out to the ESC as the governing body.

Electric Safety Subcommittee (ESS): This committee brings management and electric front-line people together to discuss safety concerns from the perspective of those closest to the risks. The objectives are to make a lasting difference in reducing unnecessary risk, resolve division-wide safety issues/concerns, and have front-line employees bring information to their respective workgroups.

Gas Safety Subcommittee (GSS): This committee brings management and gas operations front-line people together to discuss safety concerns from the perspective of those closest to the risks. The objective is to reduce unnecessary risk, resolve gas safety issues/concerns, and communicate information back to front-line employees.

Office Safety Director Committee: This committee develops and shares best practices for SDG&E office employees. The committee initiates projects, initiatives, and action plans to reduce and eliminate office injuries at company facilities and identifies and monitors leading indicators.

As further detailed in the SMS CFF chapter of this RAMP Report, SDG&E's enterprise-wide SMS establishes a framework that connects and integrates each of the above-listed programs, initiatives and committees. Taking a proactive, systematic approach to safety, being able to assess risk across the entire organization, enhancing our communication, collaboration,

feedback and documentation, and using data and analytics to regularly measure our effectiveness and make continuous improvements will help make each of our safety programs more effective.

D. Control 4 - Employee Behavioral Accident Prevention Process Program

SDG&E's Behavioral Accident Prevention Process (BAPP®), formerly referred to as the Behavior Based Safety (BBS) Process, is a partnership between management and volunteers, front-line employees (employee led and management supported). The program provides a structured "process" for continuous safety improvements specific to the high-risk tasks and situations faced by front-line employees. BAPP volunteers rely on hazard and risk assessment checklists, developed from historical injury analytics, to perform observations focused on key areas of "critical risk." They conduct on the spot accountability conversations, defining "Safe" and "At Risk" behaviors, and also collect safety data. This data is further analyzed and utilized to identify and further act on undiagnosed risk exposure. The BAPP teams work with leadership to drive hazard and risk removal and mitigation efforts.

As part of SDG&E's long-term safety strategy, we are reinvesting into BAPP as our flagship safety employee-led process. Within the past year SDG&E reinstated the position of the BBS Specialist, a professionally trained, dedicated solely to improving the BAPP process. The BBS Specialist performs periodic assessments of the BAPP teams and leadership to identify growth opportunities and leadership support needs. This year will focus on using the assessment results to improve the process. One example is to better define roles and responsibilities for each level of the process, including for volunteer participants, the supporting leadership teams, or the front-line workers. We will also be reviving a governance team to assist in accomplishing key BAPP process improvement goals.

E. Control 5 - A Comprehensive Environmental & Safety Compliance Management Program

SDG&E uses an Environmental and 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 standard, ISO 14001. With ESCMP, the Company implements annual periodic 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.

The year-end ESCMP Certification process involves submittal of information into a database used to collect and record employee and facility compliance. For this submittal, two types of checklists are available and completed in the online system: An employee-based checklist and a facility-based checklist.

Employee-based checklist - Addresses safety and environmental training, awareness, and other safety and environmental employee-based concerns.

Facility-based checklist – Addresses safety and environmental permitting, spill reporting, and other safety and environmental facility-based compliance concerns.

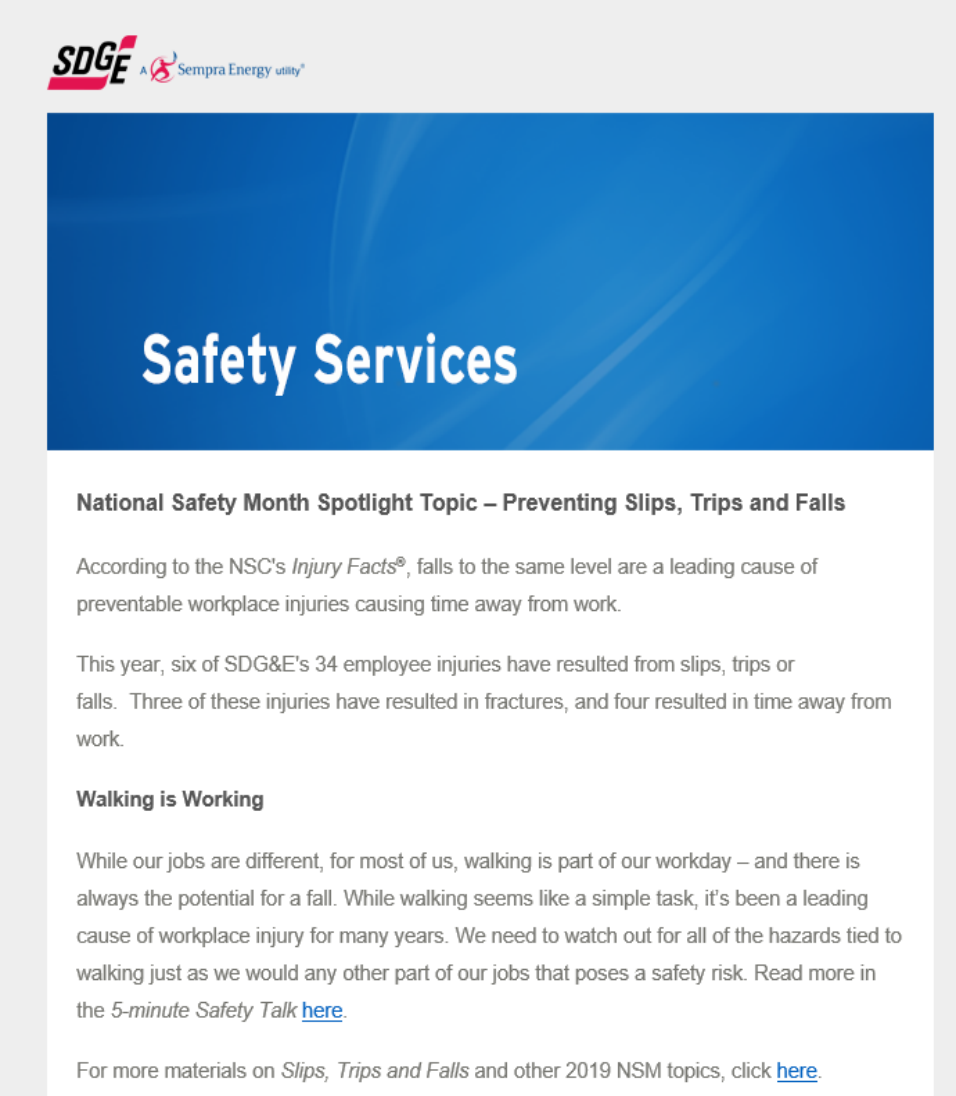
The Environmental Department and Safety Departments review submittals in the online system and confirm all required inspections were completed, assigned training was done, and all corrective actions were addressed. The annual reviews create an opportunity to identify gaps in compliance and implement corrective action.

F. Control 6 - Employee Safety Communications and Awareness Programs

Safety is a core value at SDG&E. As such, it is important to provide employees with safety-related information in a timely manner regarding standards and safe work practices. Safety communications are a tool used to inform employees about safety hazards and exposures, hazard mitigation, rules, regulations, warnings, goals, and progress reports through an array of media. SDG&E communicates information through safety bulletins, emails, newsletters, electronic bulletin boards (*e.g.*, digiboards), posted signage throughout the workplace, tailgate meetings and reports.

Figure 2 below is an example of a safety email communication distributed to all SDG&E employees:

Figure 2: Sample Employee Safety Communication



G. Control 7 - Employee Wellness Programs

Wellness Programs are designed to promote the physical and mental well-being of all Company employees, supporting SDG&E's commitment to providing quality health and wellness programs to motivate employees and promote safe and healthy lifestyles. Wellness Programs coordinates employee assistance services including:

- Health & Education Seminars/Lectures (Stress Management, Weight Management, Nutrition, Heart Disease, High Blood Pressure, etc.);
- Financial wellness education;
- Annual Flu immunizations;

- Health Screenings (*i.e.* Body Fat, Cholesterol, Blood Pressure, Glucose, Bone Density);
- Work-site programs (*i.e.,* Fitness Classes, Weight Watchers, Yoga, Walking Class, Chair Massages, Reflexology);
- Special Events (Safety, Health & Wellness Fairs, Blood Drives, lunch and learns, wellness safety events);
- Educational pamphlets/brochures on a variety of health & wellness topics;
- Employee Assistance Program (EAP) (professional and confidential counseling service providing assessment, treatment, and referral services to community resources and licensed counselors who specialize in specific areas of employee well-being);
- Formal and Mandatory EAP referrals;
- Evaluation management of mental health behaviors affecting job performance, critical incidents and fitness for duty determination;
- Safety stand-down support;
- Wellness newsletter; and
- Back up dependent and adult care.

Other examples of SDG&E safety and wellness programs include, but are not limited to:

- Occupational Health Nurse (OHN) Services – Occupational health nursing is a specialty practice that delivers health and safety programs and services to employees. The practice focuses on promotion and restoration of health, prevention of illnesses and injuries, education and protection from work related and environmental hazards.
- Telemedicine – The practice of healthcare diagnosis and physician consultation using telecommunications technology. Telemedicine eliminates any wait time to see a provider by allowing quicker, real-time, on-demand evaluation for first aid and healthcare. It supports on-site first-aid injury care and injury care management.

H. Control 8 - OSHA Voluntary Protection Program (VPP)

SDG&E participates in the Federal and California Voluntary Protection Program (Cal/VPP), which is a labor-management-government cooperative program designed to

recognize workplaces that manage outstanding health and safety management systems for protection of workers and go beyond minimal compliance with the Federal and Cal/OSHA Title 8 California Code of Regulations. SDG&E also participates in OSHA's Voluntary Protection Programs (VPP), which recognizes employers who have implemented effective safety and health management systems and maintain injury and illness rates below national Bureau of Labor Statistics averages for their respective industries.[27] In VPP, management, labor, and OSHA work cooperatively and proactively to prevent fatalities, injuries, and illnesses through a system focused on: hazard prevention and control; worksite analysis; training; and management commitment and worker involvement. To participate, employers must submit an application to OSHA and undergo a rigorous onsite evaluation by a team of safety and health professionals. VPP participants are re-evaluated every three to five years to remain in the programs.

I. Control 9 - Safe Driving Programs

SDG&E's safe driving 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 driving a safety culture committed to safe driving. This commitment includes written policies and procedures, review of motor vehicle incidents, a department of motor vehicles license pull program to confirm that all employees driving on behalf of the Company or on Company property are properly licensed, safe driving training, and development of training materials available to reinforce safe driving principles.

Smith System® Defensive Driving Program: Smith System® 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 as a way to increase an experienced driver's safety awareness and change poor driving habits. The Smith System® Five Keys to Space Cushion Driving are: (1) Aim High in Steering®--look farther ahead than other drivers, not just at the vehicle in front of you; (2) Get the Big Picture®--see more around you than other drivers, look for hazards such as other motorists, pedestrians, and vehicle doors opening; (3) Keep Your Eyes Moving®--Be more aware than other drivers, don't stare and use your peripheral vision; (4) Leave Yourself an Out ®--be in a better position in traffic than other drivers, monitor the space cushion around your vehicle; and (5) Make Sure

[27] United States Department of Labor, *Voluntary Protection Programs, available at* https://www.osha.gov/vpp/.

They See You®--make yourself more visible than other drivers, make eye contact and use signals such as headlights, brake lights, horn, and hand signals. These principles reinforce safe driving techniques.

Close Quarter Maneuvering Drivers Training: This SDG&E course 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/practiced 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. The blind spot identification exercise provides a hands-on view of the actual blind spots of the vehicle and perspective on just how many and how large the blind spots are. In the serpentine course, the driver weaves through the course going forward and learns how to use the vehicle's pivot points to safely maneuver without hitting cones. Once complete, the driver then backs the vehicle through the same course. The vanishing cone course provides an opportunity for the driver to get a better understanding of distance and perception when it comes to pulling forward or backing their vehicle. This training focuses on developing and/or improving skills and techniques to maneuver safely in challenging driving environments.

Circle of Safety Technique Training: In 1999, SDG&E adopted the Circle of Safety, which is the practice of walking around to check side, front, back, and above clearances and hazards to confirm that the area around the vehicle is safe before departing. When backing into a parking space or work area, the training guides employees to look for obstacles such as poles, other vehicles or concrete pillars. Whenever possible, employees are directed to back into a parking space or driveway to increase visibility when departing. If employees must stop or park the vehicle in a position that requires backing-up upon departing, the vehicle should be positioned to maximize visibility to the rear and critical areas adjacent to the vehicle.

Motor Vehicle Incident (MVI) Reviews and Reporting: Employees involved in a motor vehicle incident while at work and/or while driving on Company business are required to report the incident. These incidents are investigated and reviewed to identify the root cause and corrective actions and share lessons learned to prevent similar incidents.

National Safety Council Defensive Driving Training Modules: Employees can access online driving training modules on specific topics such as backing, close quarter maneuvering, and other driving topics to educate themselves on driving best practices.

DMV Driver License Employer Pull Notice Program: SDG&E participates in the California Department of Motor Vehicle (DMV) Driver's License Employer Pull Notice (EPN) program.[28] The EPN program allows SDG&E to electronically receive employees' driving records to monitor drivers' license records of employees who drive on behalf of our organization. The monitoring allows SDG&E to determine whether Company drivers have a valid drivers' license, and reveal employee driving records and certain driving behavior. The EPN automatically generates a driver record when there is a conviction, failure to appear, accident, drivers' license suspension or revocation, or any other actions taken against an employee's driving privilege.

Commercial Drivers' License Program: For employees required to hold a Commercial Driver's License (CDL), SDG&E receives reminders with driver license and Medical Examiner's Certificate (MER) expirations to confirm commercial drivers have the proper certificates and certifications. Driving a Commercial Motor Vehicle (CMV) in California requires a higher level of knowledge, experience, and skill than that required to drive a non-commercial vehicle. An applicant must pass both skills and knowledge testing geared to these higher standards to obtain a CDL.[29] Additionally, CDL holders are held to a higher standard when operating any type of motor vehicle on public roads.[30] Serious traffic violations committed by a CDL holder can affect their ability to maintain their CDL certification.[31] CDL holders are also required to obtain and maintain a valid medical examiner's certificate to validate that the CDL holder meets the physical qualification requirements to safely drive a CMV.[32]

SDG&E Safe Driving Videos: A library of on-line safety video resources are available for employees and supervisor to access at any time to use for safety training, safety moments, and briefings.

---

[28] *See* Employer Pull Notice Program Requirements, available at https://www.dmv.ca.gov/portal/file/employer-pull-notice-program-requirements-inf-1107-pdf/.

[29] *See* California Commercial Driver Handbook at 1-10 – 1-11, available at *https://www.dmv.ca.gov/portal/file/california-commercial-driver-handbook-pdf/*.

[30] *See, e.g., id.* at 1-14, Section 1.3.1. (stating that it's illegal to operate a CMV if your blood alcohol level is .04 percent or more, which is lower than the legal blood alcohol level for non-CMVs).

[31] *Id.* at Section 1.3.3.

[32] *Id.* at Section 1.2.

- "Active Passenger" was created to set expectations for the driver and passenger to assist each other to remain distraction free, share the Smith System® Five Keys to Space Cushion Driving, offer other insights and/or be a second set of eyes for driver awareness. Active Passenger is also designed to help new drivers who are not as experienced in driving large trucks.
- New Employee Orientation Safe Driving Education and Video – New employees attend general safety presentations as part of their new employee orientation, including driving safety and expectations while driving on company business and at company work locations.

J. Control 10 - Personal Protective Equipment (PPE)

The purpose of SDG&E's PPE program is to protect employees from the risk of injury by creating a barrier against workplace hazards. PPE includes clothing and equipment designed to protect employees while performing their job (*e.g.*, flame resistant clothing, gloves, protective eyewear). All employees who are required to use PPE are trained on when PPE is necessary, which PPE is necessary, how to properly don/remove/adjust/wear PPE, limitations of PPE and the proper care/maintenance/life/disposal of PPE.

K. Control 11 - Jobsite Safety Programs

SDG&E has in place a range of safety programs designed to identify, address, mitigate, and communicate workplace risks and hazards, and to contribute proactively to overall workplace safety and employee awareness of safety issues and concerns. These programs include:

Facilities Maintenance Program: Facilities capital projects are designed to make workspaces safer. Facilities maintenance programs are preventative, predictive, and corrective. Some examples include structural changes, asbestos inspection and abatement, and parking lot safety amenities.

Traffic control for employee, contractor and public safety at worksites: SDG&E, when performing work on, or adjacent to, a roadway, is responsible for installing and maintaining such devices which are necessary to provide safe passage for the public traveling through the work area and for the safety of the workers on the site. SDG&E uses both internal and external resources to fulfill this responsibility.

Work Methods and Standards: Business functions related to developing and maintaining construction standards, standards practices, and system design for electric service, primary and secondary systems.

L. Control 12 - Utilizing OSHA and Industry Best Practices and Industry Benchmarking

SDG&E collaborates with high-performers in environmental, health and safety across industry sectors and regions of the world through the National Safety Council Campbell Institute, and benchmarking with other utilities, industries, and leaders in safety performance. SDG&E benefits from building relationships with other safety leaders, accessing best practices on employee and contractor safety, and benchmarking on leading indicators and key safety program elements.

SDG&E participates in safety benchmarking forums to compare the Company's health and safety processes, assess performance against other participants to learn how to reduce incidents, improve compliance, and discuss best management practices to improve the Company's safety health. SDG&E's end goal is to send every employee home safely every day by targeting zero safety incidents. Some of the key organization we benchmark with are the Edison Electrical Institute, American Gas Association, Campbell Institute, and the Bureau of Labor Statistics.

Additionally, SDG&E attends the California Investor-Owned Utility and Municipality bi-annual meeting to discuss employee and contractor safety. This dedicated forum is a utility benchmarking initiative which addresses new regulations, legislation, best management practices and other safety topics of interest.

M. Control 13 - Enhanced Mandatory Employee Training (OSHA): Certified Occupational Safety Specialist, Certified Utility Safety Professional; Certified Safety Professional

Mandatory employee training courses are those required by OSHA regulation or Company policy. Non-mandatory training courses are those not required by regulation or Company policy, but which shall be provided to employees to enhance a job skill or increase their abilities to perform their jobs safely.

Certifications, including Certified Safety Specialist, Certified Utility Safety Professional, 10- and 30-hour OSHA training, and Incident Command System training demonstrate that SDG&E's safety advisors have undertaken education requiring knowledge testing and

specialized exams. Safety Advisors will also receive continuing education on the latest standards, regulations, best practices, and laws regarding safety and health in the workplace. Finally, 10-hour OSHA training is provided to executive and leadership teams to further their safety education and create an environment to support a positive safety culture.

The Safety Services management team expanded its role in activations during red flag warning and other emergency conditions by staffing the Safety Officer position in the Emergency Operations Center (EOC), deploying field safety officers to the impacted workgroup staging areas, and regularly communicating safety messages through safety bulletins and on-site district safety support.

In addition, Safety Advisors are required to have specific education, training, and certification including, but not limited to: Certified Occupational Safety Specialist or OSHA Institute certification, progression toward Certified Utility Safety Professional, OSHA 10- and 30-hour training along with continuing internal training related to incident investigation, responding to and reporting injuries/illnesses, substance abuse prevention, identification of reasonable suspicion and others.

All Safety Services management team and Safety Advisors are Federal Emergency Management agency (FEMA) ICS 100, 200 and 775 certified.

N. Control 14 - Enhanced Safety in Action Program

Designed for executives and field operations directors, the enhanced Safety in Action (SIA) initiative provides SDG&E with the necessary tools to measure Serious Injury and Fatality (SIF) exposure, understand the Company's specific SIF precursors, and design effective steps to mitigate SIF exposure. The SIF assessment was completed in 2020 and we received executive approval to move forward with implementing the SIF program. The 2020 SIF assessment project consisted of defining a SIF definition for SDG&E, developed a SIF decision tree, determined SIF metrics (leading and lagging), and incorporated a precursor analysis tool to reduce SIF exposure. A SIF Governance has been developed with clear objectives for the SIF program that demonstrates a forward-moving effort to improve safety.

O. Control 15 - Enhanced Employee Safe Driving Training (Vehicle Technology Programs)

SDG&E has installed vehicle technology in our company fleet. The technology allows SDG&E to develop safety metrics to provide a comprehensive view of the vehicle driver and

fleet performance through data driven vehicle analytics. The vehicle technology platform allows the company to evaluate driving behaviors by understanding hard braking, hard acceleration, hard cornering, speeding, and seatbelt use. This data will enable SDG&E to provide coaching and specific driver training to employees to reinforce safe driving habits. Additionally, by installing monitoring devices, vehicle information such as utilization, idle time, fuel usage, vehicle health, and vehicle location would be communicated through a dashboard and can be analyzed in real time. This technology will help improve employee safety by providing information on vehicle location, providing opportunity for driver feedback, discouraging risky driving behaviors, and detecting engine issues and fault codes so they can be corrected.

P. Control 16 - Energized Skills Training and Testing Yard

As a leader in reliability, wildfire mitigation and safety, SDG&E seeks continuous improvement to its system through new technology, new equipment and employee training. With employee safety standards and equipment continually evolving, SDG&E must introduce, train all personnel and update all impacted employees on new standards, procedures and/or equipment. To improve with performing these actions, SDG&E has converted an existing facility to an Energized Skills Training and Testing Yard to allow for hands-on training for electric crews, linemen foreman, electric operators, engineers, and/or trouble-shooters, improving their knowledge of the equipment and intricacies under a controlled environment. This converted facility provides a space for vendors and the engineering department to demonstrate new equipment and show how the equipment safely operates when energized, to assist with developing training videos and standards with improved visuals, and to improve upon the safe operation of equipment without customers being impacted. SDG&E believes that employees benefit from having this hands-on training and testing yard in lieu of a classroom setting, therefore resulting in safer operation of such equipment.

Q. Control 17 - Employee Wildfire Smoke Protection – Cal/OSHA emergency regulation

In July 2019, an emergency regulation was passed by the California Occupational Safety and Health Standards Board requiring employers to provide respirators to workers exposed to

unhealthy air because of wildfire smoke.[33] California employers were already required to protect workers from hazards like unhealthy air, as demonstrated above in Control 10 (Personal Protective Equipment), but the new requirement seeks to shore up requirements specifically addressing fine particulate matter from wildfires, which can reduce lung function and worsen heart and respiratory conditions. The rule requires employers to obtain the air quality index (AQI) for PM2.5, which is the smallest and most noxious particulate matter, from federal, state or local officials. If the measurement is higher than 151, eligible employers must notify and train employees and provide approved respirators, like N95 respirators. If the index is higher than 500, the use of the respirators is required.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.

Since each of SDG&E's IIE risk controls and mitigations have the same goal of reducing employee risk of injury or fatality, they have the same risk profile and are not further tranched.

Many of the activities discussed in Section III above are expected to continue during the TY 2024 GRC. For clarity, a current activity that is included in the control and mitigation plan may be referred to as either a control and/or a mitigation. For purposes of this RAMP, a control that will continue as a mitigation will retains its control ID unless the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. The table below shows which activities are expected to continue.

Table 3: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	Mandatory Employee Health and Safety Training Programs and Standardized Policies	X	X
2	C2	Drug and Alcohol Testing Program	X	X
3	C3	Strong Safety Culture	X	X

[33] *See https://www.dir.ca.gov/oshsb/Protection-from-Wildfire-Smoke-Emergency.html* for emergency rulemaking documents. The emergency regulation was adopted, effective February 1, 2021, at Title 8 CCR Section 5141.1 ("Protection from Wildfire Smoke").

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
4	C4	Employee Behavioral Accident Prevention Process Program	X	X
5	C5	A Comprehensive Environmental & Safety Compliance Management Program	X	X
6	C6	Employee Safety Communications and Awareness Programs	X	X
7	C7	Employee Wellness Programs	X	X
8	C8	OSHA Voluntary Protection Program	X	X
9	C9	Safe Driving Programs	X	X
10	C10	Personal Protective Equipment	X	X
11	C11	Jobsite Safety Programs	X	X
12	C12	Utilizing OSHA and Industry Best Practices and Industry Benchmarking	X	X
13	C13	Enhanced Mandatory Employee Training (OSHA): Certified Occupational Safety Specialist, Certified Utility Safety Professional; Certified Safety Professional	X	X
14	C14	Enhanced Safety in Action Program	X	X
15	C15	Enhanced Employee Safe Driving Training	X	X
16	C16	Energized Skills Training and Testing Yard	X	No
17	C17	Employee Wildfire Smoke Protection – Cal/OSHA emergency regulation	X	X
18	M1	Purchasing and testing more protective respiratory protection for wildfire smoke particulates\.	No	X
19	M2	Purchasing break/rest trailers with filtered air systems to reduce wildfire smoke exposure	No	X
20	M3	Automate notifications and employee communications when the Air Quality Index PM2.5 reaches specific thresholds during a wildfire in our service territory	No	X
21	M4	Instructional designer support to update & convert safety training curriculum to web based	No	X

For activities SDG&E plans to perform that remain unchanged, please refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in this section below.

A. Changes to 2020 Controls

The controls described above in Section III are ongoing safety programs and are planned for continuation through the 2024 GRC Test Year. As part of the Safety Management System continuous improvement framework, SDG&E tracks both leading and lagging indicators and continually reviews the effectiveness of its employee safety programs. Based on this review, employee safety programs may be changed, revised, or enhanced where necessary. In addition to, and beyond the scope of this ongoing review and continuous improvement effort, SDG&E identifies enhancements to a few of its employee safety programs in the mitigations described below.

SDG&E's comprehensive employee safety program consists of training courses, policies, standards, programs and efforts all aimed to reduce risk of injury or fatality to employees while on duty. Given the vast number of activities SDG&E performs to mitigate IIE Risk, SDG&E grouped like activities with like risk profiles into mitigations programs. Since each of SDG&E's IIE Risk mitigations have the same goal of reducing employee risk of injury or fatality, all controls and mitigations have the same risk profile and are not further tranched.

B. 2022 – 2024 Mitigations

1. Mitigation 1 - Purchasing and testing more protective respiratory protection for wildfire smoke particulates

More protective respiratory protection, such as Powered Air Purifying Respirators (PAPRs) are required if the Air Quality Index for PM2.5 concentration equivalent exceeds 550 ug/m3 during wildfire response work. Prior to purchasing, arc testing and electric shock testing of the PAPRs should be conducted.

The hardhat component of a PAPR is rated as Class G (tested up to 2200 Volts) and is not arc-rated. Electrical workers are required to wear Class E (tested up to 20,000 Volts) hard hats and arc-rated protective equipment. Procuring and testing more protective respiratory protection will mitigate wildfire smoke exposure improper use of personal protective equipment, and employees' impairment due to poor indoor air quality. If these drivers are not mitigated, serious illnesses or fatalities and penalties may be incurred for non-compliance.

2. Mitigation 2 - Purchasing break/rest trailers with filtered air systems to reduce wildfire smoke exposure

Protective measures, such as taking breaks in a vehicle or building with filtered air should be provided to reduce wildfire smoke exposures. 82% of our vehicles do not have cabin air filters and for most vehicles, modifications are not possible. Providing break/rest trailers with filtered air will provide relief for field employees engaged in wildfire response work.

Crews may be engaged in wildfire restoration work where there is a potential for wildfire smoke exposure for extended periods of time. Providing filtered air rest or break trailers will mitigate wildfire smoke exposure, employee fatigue or complacency, and employees' impairment due to poor indoor air quality. If these drivers are not mitigated, serious illnesses or fatalities may result.

3. Mitigation 3 - Automate notifications and employee communications when the Air Quality Index PM2.5 reaches specific thresholds during a wildfire in our service territory

Currently, the process to notify employees when the PM2.5 Air Quality Index values exceed 150 and 500 during wildfires is manual where a Safety team member monitors the AQI and sends emailed instructions for elevated levels. An automatic notification system would mitigate deviation from policies or procedures, exposure to wildfire smoke, not using appropriate personal protective equipment, employee fatigue or complacency, employees' impairment due to poor air quality, and lack of oversight of work. If these drivers are not mitigated, serious illnesses or fatalities and penalties may be incurred for non-compliance.

4. Mitigation 4 - Instructional designer support to update & convert safety training curriculum to web based

Safety has a list of 25 prioritized safety trainings which need to be updated/converted to web-based. Instructional designers will convert non-web-based safety training to web-based training. Modernized training will be customized to focus on the specific needs of each user group. E-learning capability will increase training efficiency by allowing timely instruction for new hires transfers, and any others on a non-standard training timeline.

V. COSTS, UNITS, AND QUANTITATIVE SUMMARY TABLES

The tables in this section provide a summary of the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided. SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data.

Table 4: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[34]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[35]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	Mandatory Employee Health and Safety Training Programs and Standardized Policies	0	817	0	0	776	940
C2	Drug and Alcohol Testing Program	0	200	0	0	171	208
C3	Strong Safety Culture	0	116	0	0	223	270
C4	Employee Behavioral Accident Prevention Process Program	0	777	0	0	818	990
C5	A Comprehensive Environmental & Safety Compliance Management Program	There are no recorded or forecasted dollars for this control because all costs are incremental and included in various other cost centers.					

[34] Recorded costs and forecast ranges are rounded to the nearest thousands. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[35] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with Controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[35]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C6	Employee Safety Communications and Awareness Programs	There are no recorded or forecasted dollars for this control because all costs are incremental and included in various other cost centers.					
C7	Employee Wellness Programs	0	769	0	0	733	888
C8	OSHA Voluntary Protection Program	0	219	0	0	475	575
C9	Safe Driving Programs	0	94	0	0	89	108
C10	Personal Protective Equipment	0	1,778	0	0	1,689	2,045
C11	Jobsite Safety Programs	352	2,750	654	791	2,108	2,551
C12	Utilizing OSHA and Industry Best Practices and Industry Benchmarking	0	703	0	0	668	808
C13	Enhanced Mandatory Employee Training (OSHA): Certified Occupational Safety Specialist, Certified Utility Safety Professional; Certified Safety Professional	0	11	0	0	14	17
C14	Enhanced Safety in Action Program	0	133	0	0	0	0
C15	Enhanced Employee Safe Driving Training	345	0	0	0	523	633
C17	Employee Wildfire Smoke Protection – Cal/OSHA emergency regulation	0	17	0	0	16	20
M1	Purchasing and testing more protective respiratory protection for wildfire smoke particulates.	0	0*	0	0	2	2
M2	Purchasing break/rest trailers with filtered air systems to reduce wildfire smoke exposure	0	0	0	0	143	173
M3	Automate notifications and employee communications when the Air Quality Index PM2.5 reaches specific thresholds during a wildfire in our service territory	0	0	0	0	38	46

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[35]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
M4	Instructional designer support to update & convert safety training curriculum to web based	0	0*	0	0	22	31

*****Minimal preliminary costs incurred at the end of 2020.

Table 5: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	Mandatory Employee Health and Safety Training Programs and Standardized Policies	Employees		0	4400	0	0	4400	4800
C2	Drug and Alcohol Testing Program	Employees		0	1704	0	0	1704	1960
C3	Strong Safety Culture	Surveys and conferences cost		0	116	0	0	223	270
C4	Employee Behavioral Accident Prevention Process Program	Employees		0	100	0	0	100	115
C5	A Comprehensive Environmental & Safety Compliance Management Program	Employees		There are no recorded or forecasted units for this control because all units are incremental and included in various other cost centers.					
C6	Employee Safety Communications and Awareness Programs	Employees		There are no recorded or forecasted units for this control because all units are incremental and included in various other cost centers.					
C7	Employee Wellness Programs	Employees		0	4400	0	0	4400	4800
C8	OSHA Voluntary Protection Program	VPP Locations		0	3	0	0	3	5
C9	Safe Driving Programs	Employees		0	2200	0	0	2200	2400
C10	Personal Protective Equipment	Employees		0	4400	0	0	4400	4800
C11	Jobsite Safety Programs	Employees		245	1985	735	845	1985	2282
C12	Utilizing OSHA and Industry Best Practices and Industry Benchmarking	EEI & other membership fees		0	703	0	0	703	808
C13	Enhanced Mandatory Employee Training (OSHA): Certified Occupational Safety Specialist, Certified Utility Safety Professional; Certified Safety Professional	Employees		0	30	0	0	30	34
C14	Enhanced Safety in Action Program	Professional services cost		0	133	0	0	0	0

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C15	Enhanced Employee Safe Driving Training	Employees		1650	0	0	0	1650	1800
C17	Employee Wildfire Smoke Protection – Cal/OSHA emergency regulation	Employees requiring medical evaluations		0	650	0	0	650	747
M1	Purchasing and testing more protective respiratory protection for wildfire smoke particulates.	Replacement filters		0	0	0	0	40	46
M2	Purchasing break/rest trailers with filtered air systems to reduce wildfire smoke exposure	Staging area trailers		0	0	0	0	10	15
M3	Automate notifications and employee communications when the Air Quality Index PM2.5 reaches specific thresholds during a wildfire in our service territory	Internal FTE		0	0	0	0	0.2	0.3
M4	Instructional designer support to update & convert safety training curriculum to web based	Internal FTE		0	0	0	0	0.2	0.3

Table 6: Risk Control & Mitigation Plan - Quantitative Analysis Summary
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	Mandatory Employee Health and Safety Training Programs and Standardized Policies	See Table 7			
C2	Drug and Alcohol Testing Program	See Table 7			
C3	Strong Safety Culture	0.87	1275	1110	78
C4	Employee Behavioral Accident Prevention Process Program	0.86	1275	1094	12
C5	A Comprehensive Environmental & Safety Compliance Management Program	See Table 7			
C6	Employee Safety Communications and Awareness Programs	See Table 7			
C7	Employee Wellness Programs	See Table 7			
C8	OSHA Voluntary Protection Program	0.85	1275	1085	14
C9	Safe Driving Programs	0.85	1275	1078	57
C10	Personal Protective Equipment	See Table 7			
C11	Jobsite Safety Programs	0.89	1275	1132	9
C12	Utilizing OSHA and Industry Best Practices and Industry Benchmarking	See Table 7			
C13	Enhanced Mandatory Employee Training (OSHA): Certified Occupational Safety Specialist, Certified Utility Safety Professional; Certified Safety Professional	0.84	1275	1069	138
C14	Enhanced Safety in Action Program	0.80	1275	1015	299
C15	Enhanced Employee Safe Driving Training	0.81	1275	1030	19
C17	Employee Wildfire Smoke Protection – Cal/OSHA emergency regulation	See Table 7			
M1	Purchasing and testing more protective respiratory protection for wildfire smoke particulates.	0.83	1275	1059	516
M2	Purchasing break/rest trailers with filtered air systems to reduce wildfire smoke exposure	0.83	1275	1059	7
M3	Automate notifications and employee communications when the Air Quality Index PM2.5 reaches specific thresholds during a wildfire in our service territory	0.83	1275	1059	26
M4	Instructional designer support to update & convert safety training curriculum to web based	See Table 7			

Table 7: Risk Control & Mitigation Plan - Quantitative Analysis Summary for RSE Exclusions

ID	Control/Mitigation Name	RSE Exclusion Rationale
C1	Mandatory Employee Health and Safety Training Programs and Standardized Policies	Mandatory Employee Health and Safety Training Programs and Standardized Policies are a foundational aspect of how SDG&E creates a safe and healthy workplace environment for its employees. This is a mandated program and SDG&E has not performed an RSE analysis because it is not feasible for SDG&E to stop performing this activity nor is it possible to calculate the risk reduction benefits received from performing this activity. SDG&E is unaware of any data that can be used to calculate how risks would increase if these activities are not undertaken. Additionally, no SME could establish a quantifiable value for the effectiveness of this control activity.
C2	Drug and Alcohol Testing Program	SDG&E performs these activities in accordance with DOT regulations. This is a mandated program and SDG&E has not performed an RSE analysis because it is not feasible for SDG&E to stop performing this activity nor is it possible to calculate the risk reduction benefits received from performing this activity. SDG&E is unaware of any data that can be used to calculate how risks would increase if these activities are not undertaken. Additionally, no SME could establish a quantifiable value for the effectiveness of this control activity.
C5	A Comprehensive Environmental & Safety Compliance Management Program	A Comprehensive Environmental & Safety Compliance Management Program is a foundational aspect of how SDG&E creates a safe and healthy workplace environment for its employees. SDG&E is unaware of any internal or external data that directly relates this activity to the reduction in IIE Risk events. Additionally, no SME could establish a quantifiable value for the effectiveness of this control activity.
C6	Employee Safety Communications and Awareness Programs	Employee Safety Communications and Awareness Programs is a foundational aspect of how SDG&E creates a safe and healthy workplace environment for its employees. SDG&E is unaware of any internal or external data that directly relates this activity to the reduction in incident rates or the

ID	Control/Mitigation Name	RSE Exclusion Rationale
		consequences thereof. Additionally, no SME could establish a quantifiable value for the effectiveness of this control activity.
C7	Employee Wellness Programs	Employee Wellness Programs are a foundational aspect of how SDG&E creates a safe and healthy workplace environment for its employees. SDG&E is unaware of any internal or external data that directly relates this activity to the reduction in incident rates or the consequences thereof. Additionally, no SME could establish a quantifiable value for the effectiveness of this control activity.
C10	Personal Protective Equipment	The procurement and usage of Personal Protection Equipment (PPE) is a fundamental aspect of how SDG&E conducts operations and maintains the safety of its employees. This is a mandated program and SDG&E has not performed an RSE analysis because it is not feasible for SDG&E to stop performing this activity nor is it possible to calculate the risk reduction benefits received from performing this activity. SDG&E is unaware of any data that can be used to calculate how risks would increase if these activities are not undertaken.
C12	Utilizing OSHA and Industry Best Practices and Industry Benchmarking	Utilizing OSHA and Industry Best Practices and Industry Benchmarking is a fundamental aspect of how SDG&E conducts operations and maintains the safety of its employees. SDG&E is unaware of any internal or external data that directly relates this activity to the reduction in incident rates or the consequences thereof. Additionally, no SME could establish a quantifiable value for the effectiveness of the control activity.
C17	Employee Wildfire Smoke Protection – Cal/OSHA emergency regulation	The procurement and usage of Wildfire Smoke Protection is a fundamental aspect of how SDG&E conducts operations and maintains the safety of its employees. SDG&E is unaware of any internal or external data that directly relates this activity to the reduction in incident rates or the consequences thereof. Additionally, no SME could establish a quantifiable value for the effectiveness of the control activity.
M4	Instructional designer support to update & convert safety training curriculum to web based	Instructional designer support to update & convert safety training curriculum to web based is a foundational activity that supports safety training.

ID	Control/Mitigation Name	RSE Exclusion Rationale
		SDG&E is unaware of any internal or external data that directly relates this activity to the reduction in incident rates or the consequences thereof. Additionally, no SME could establish a quantifiable value for the effectiveness of the control activity.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the risk control and mitigation plan outline above for the IIE Risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this risk control and mitigation plan also took into account modifications to the plan and constraints, such as budget and resources.

A. Alternative 1: Piloted Alert Driving

Piloted Alert Driving is an online driver training program meant to proactively improve driver behavior. High-Definition video is shot on-location to show real and familiar traffic hazards that employees must identify. Given the high cost for training and the similarity to other driving training modules available from our membership with National Safety Council (NSC) as well as in-house training, SDG&E is not planning to include Piloted Alert Driving in its mitigation plan.

B. Alternative 2: Modernizing Safety Video Library

Historically, SDG&E has offered a library of safety videos which users may check-out to enhance safety meetings. Most of these videos are in VHS format and need to be updated. Developing or procuring effective safety videos in a modern streaming platform (or similar) would provide an alternative method of communicating hazards and controls to our employees. SDG&E is currently focusing on updating and converting our safety training curriculum to web-based training instead of modernizing our safety video library.

Table 8: Alternative Mitigation Plan - Forecast Dollars Summary[36]
(Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Piloted Alert Driving	N/A	N/A	100	120
A2	Modernizing Safety Video Library	N/A	N/A	50	100

Table 9: Alternative Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
A1	Piloted Alert Driving		Employees	0	0	1650	1800
A2	Modernizing Safety Video Library		Contractor	0	0	0.5	1

Table 10: Alternative Mitigation Plan - Quantitative Analysis Summary
(Direct After Allocations, In 2020 $000)

ID	Alternative Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
A1	Piloted Alert Driving	See Table 11			
A2	Modernizing Safety Video Library	See Table 11			

[36] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

Table 11: Alternate Mitigation Plan - Quantitative Analysis Summary for RSE Exclusions

ID	Control/Mitigation Name	RSE Exclusion Rationale
A1	Pilot Alert Driving	Alert Driving training modules are meant to supplement current driving safety training. No data exists either internally or externally that directly relates this activity to the reduction in incident rates or the consequences thereof. Additionally, no SME could establish a quantifiable value for the effectiveness of the activity.
A2	Modernizing Safety Video Library	Modernizing the safety video library is a foundational activity that supports safety training. No data exists either internally or externally that directly relates this activity to the reduction in incident rates or the consequences thereof. Additionally, no SME could establish a quantifiable value for the effectiveness of the activity.

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Appendix A: Summary of Elements of the Risk Bow Tie

Incident Involving an Employee: Summary of Elements of the Risk Bow Tie

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
C1	Mandatory Employee Health and Safety Training Programs and Standardized Policies	DT.1; DT.2; DT.3; DT.4; DT.8; PC.1; PC.2; PC.4
C2	Drug and Alcohol Testing Program	DT.1; DT.4; DT.9; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
C3	Strong Safety Culture	DT.1; DT2; DT.3; DT.4; DT5; DT6; DT7; DT.8; DT.9; DT.10; DT.11; DT.12; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
C4	Employee Behavioral Accident Prevention Process Program	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.6
C5	A Comprehensive Environmental & Safety Compliance Management Program	DT.1; DT.2; DT.3; DT.4; DT.5; DT.8; DT.10; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
C6	Employee Safety Communications and Awareness Programs	DT.1; DT.2; DT.3; DT.4; DT.5; DT.6; DT.7; DT.8; DT.9; DT.10; DT.11; DT.12; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
C7	Employee Wellness Programs	DT.6; DT.7; PC.1
C8	OSHA Voluntary Protection Program	DT.1; DT.2; DT.3; DT.4; DT.5; DT.6; DT.7; DT.8; DT.9; DT.10; DT.12; PC.1; PC.2; PC.3
C9	Safe Driving Programs	DT.1; DT.2; DT.4; DT.8; DT.10; PC.1; PC.2; PC.4; PC.5; PC.6
C10	Personal Protective Equipment	DT.1; DT.2; DT.3; PC.1; PC.4; PC.5
C11	Jobsite Safety Programs	DT.1; DT.2; DT.4; DT.5; DT.8; DT.9; DT.11; DT.12; PC.1; PC.2; PC.3
C12	Utilizing OSHA and Industry Best Practices and Industry Benchmarking	DT.1; DT.2; DT.3; DT.4; DT.5; DT.8; PC.1
C13	Enhanced Mandatory Employee Training (OSHA): Certified Occupational Safety Specialist, Certified Utility Safety Professional; Certified Safety Professional	DT.1; DT.2; DT.3; DT.4; DT.5; DT.8; DT.9; DT.10; DT.12; PC.1; PC.3

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
C14	Enhanced Safety in Action Program	DT.1; DT.2; DT.3; DT.4; DT.5; DT.6; DT.7; DT.8; DT.9; DT.10; DT.11; DT.12; PC.1
C15	Enhanced Employee Safe Driving Training	DT.1; DT.2; DT.4; DT.6; DT.8; PC.1; PC.2; PC.5; PC.6
C16	Energized Skills Training and Testing Yard	DT.1; DT.2; DT.3; DT.4; DT.5; DT.8; DT.9; DT.10; PC.1; PC.2
C17	Employee Wildfire Smoke Protection – Cal/OSHA emergency regulation	DT.2; DT.3; DT.7; PC.1; PC.4
M1	Purchasing and testing more protective respiratory protection for wildfire smoke particulates\.	DT.2, DT.3, DT.7; PC.1; PC.4
M2	Purchasing break/rest trailers with filtered air systems to reduce wildfire smoke exposure	DT.2; DT.6; DT.7; PC.1
M3	Automate notifications and employee communications when the Air Quality Index PM2.5 reaches specific thresholds during a wildfire in our service territory	DT.1; DT.2; DT.3; DT.6; DT.7; DT.9; PC.1; PC.4
M4	Instructional designer support to update & convert safety training curriculum to web based	DT.1; DT.2; DT.3; DT.4; DT.6; DT.8; DT.10; PC.1; PC.2; PC.3; PC.4

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

The SA Decision directs the utility to identify potential consequences of a risk event using available and appropriate data. The below provides a listing of the inputs utilized as part of this assessment.

San Diego Gas & Electric Annual Serious Injuries and Fatalities (SIFs)

- 2015 –2020 internal SIF data

Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-9)

Incident Related to the Medium Pressure System (Excluding Dig-in)

May 17, 2021

TABLE OF CONTENTS

RISK: INCIDENT RELATED TO THE MEDIUM PRESSURE SYSTEM (EXCLUDING DIG-IN)

I. INTRODUCTION

The purpose of this chapter is to present SDG&E's risk control and mitigation plan for the Incident Related to the Medium Pressure System (Excluding Dig-in) risk, (Medium Pressure Incident risk). Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter RAMP-B of this RAMP Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process. The ERR process influenced how risks were selected for inclusion in this 2021 RAMP Report, consistent with the Settlement Decision's directives, as discussed in Chapter RAMP-C.

The RAMP Report's purpose is to present a current assessment of key safety risks and the proposed activities for mitigating those risks. The RAMP Report does not request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC) application. The costs presented in this 2021 RAMP Report are those costs for which SDG&E anticipates requesting recovery in its Test Year (TY) 2024 GRC. SDG&E's TY 2024 GRC presentation will integrate developed and updated funding requests from the 2021 RAMP Report, supported by witness testimony.[2] This 2021 RAMP Report is presented consistent with SDG&E's GRC presentation, in that the last year of recorded data (2020) provides baseline costs and cost estimates are provided for years 2022-2024, as further discussed in Chapter RAMP-A. This 2021 RAMP Report presents capital costs as a sum of the years 2022, 2023, and 2024 as a three-year total; operations and maintenance (O&M) costs are only presented for TY 2024 (consistent with the GRC). Costs for each activity that directly address each risk are provided where those costs are available and within the scope of the analysis required in this RAMP Report.

---

[1] D.16-08-018 also adopted the requirements previously set forth in D.14-12-025. D.18-12-014 adopted the Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with modifications and contains the minimum required elements to be used by the utilities for risk and mitigation analysis in the RAMP and GRC.

[2] *See* D.18-12-014 at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Throughout this 2021 RAMP Report activities are delineated between controls and mitigations, consistent with the definitions adopted in the Settlement Decision's Revised Lexicon. A "control" is defined as a "[c]urrently established measure that is modifying risk."[3] A "mitigation" is defined as a "[m]easure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[4] Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E's Medium Pressure Incident risk; however, many of the activities presented herein also help mitigate other areas.

As discussed in Chapters RAMP-A and RAMP-C, SDG&E has endeavored to calculate an RSE for all controls and mitigations presented in this risk chapter. However, for controls and mitigations where no meaningful data or SME opinion exists to calculate the RSE, SDG&E has included an explanation why no RSE can be provided, in accordance with California Public Utilities Commission (CPUC or Commission) Safety Policy Division (SPD) staff guidance.[5] Activities with no RSE value presented in this 2021 RAMP Report are identified in Section V below.

SDG&E has also included a qualitative narrative discussion of certain risk mitigation activities that would otherwise fall outside of the RAMP Report's requirements, to aid the California Public Utilities Commission (CPUC or Commission) and stakeholders in developing a more complete understanding of the breadth and quality of the Company's mitigation activities. These distinctions are discussed in the applicable control and mitigation narratives in Sections III and IV.

A. Risk Overview

Typically, the medium pressure distribution system uses a series of mains (pipes with larger diameter) to feed service lines, regulator stations, meters, and other appurtenance piping. Service lines are smaller diameter pipes which feed customer homes, businesses, and some commercial applications. Medium pressure pipelines are made of steel or plastic material.

---

3 *Id*. at 16.

4 *Id.* at 17.

5 *See* Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012 at 5 ("SPD recommends PG&E and all IOUs provide RSE calculations for controls and mitigations or provide an explanation for why it is not able to provide such calculations.") (November 25, 2020).

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. GO 112-F and GO 58 complement and enhance the requirements of 49 CFR 192 at the state level.

With regard to medium pressure pipelines, SDG&E currently operates approximately 14,900 miles of medium mains and services with approximately 5,900 miles being steel and 9,000 miles being plastic. The medium-pressure pipelines serve over 890,000 SDG&E consumers.

Various causes and events can lead to medium pressure pipeline incidents. Drivers can range from natural forces (such as natural disasters, fires, earthquakes), improper installation techniques, material defects, aging/environmental factors such as corrosion and material fatigue, improper operations, and inadequate maintenance of the pipeline infrastructure. For the purposes of this chapter, the Medium Pressure Incident risk focuses on risk events that result in serious injuries, fatalities, or impact 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 into 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, a pipe with a leak will continue to transport gas, and therefore is not considered a pipeline "failure" using the definition in American Society of Mechanical Engineering B31.8S.[6]

SDG&E's many risk mitigating activities focus on the safety of employees, customers, and the public. This is driven by a safety-first culture stemming from the Company's core values

[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.

of customer and public safety. An example of SDG&E's focus on safety are the safety-related customer communications that are an integral part of after-the-meter incident prevention in a customer's home, regardless of whether or not an SDG&E employee visits the premises. These communications are a proactive approach to inform our customers and the public how to detect possible safety issues within their homes, how to identify potential hazards, and how to avoid hazards that may result from damage occurring during a risk event. Gas public safety communications and field and public safety are two customer and public safety related controls that will be discussed in greater detail within this Chapter.[7]

B. Risk Definition

For purposes of this RAMP Application, SDG&E's Medium Pressure Incident risk is defined as the risk of asset failure caused by a medium pressure pipeline system[8] event which results in serious injuries or fatalities and/or damages to the infrastructure. This risk concerns a gas public safety event on a medium pressure distribution plastic or steel pipeline and/or its appurtenances (*e.g.*, valves, meters, regulators, risers) as well as on and beyond the customer meter.

In the 2019 RAMP Report SDG&E presented a stand-alone risk chapter associated with Customer & Public Safety that contained Customer Services type mitigations, *e.g.*, call center services, advanced meter activities, meter set assemblies, and beyond the meter activities, among others. For this report, the definition of the Medium Pressure Incident risk has been expanded to include all aspects of the medium pressure system and may include incidents downstream of the customer's meter. Therefore, certain customer and public safety related mitigations are presented within scope for this chapter.

C. Scope

Table 1 below provides what is considered in and out of scope for the Medium Pressure Incident risk in this RAMP Application.

---

7 The customer and public safety mitigations were previously included as part of the customer and public safety risk chapter in SDG&E's 2019 RAMP filing.

8 Maximum Allowable Operating Pressure (MAOP) at lower than 60 psig.

Table 1: Risk Scope

In-Scope:	The risk of damage, caused by a medium pressure system (maximum allowable operating pressure (MAOP) at or lower than 60 psig) failure event, which results in consequences such as injuries, fatalities, or impact to infrastructure. Includes beyond the customer meter.
Data Quantification Sources:	SDG&E engaged internal data sources for the calculation surrounding risk reduction; however, if data was insufficient, Industry or National data was supplemented and adjusted to fit the risk profile associated with the operating locations and parameters of the utilities. For example, certain types of incident events have not occurred within the SDG&E service territory; therefore, expanding the quantitative needs to encompass industry data where said incident(s) have been recorded to provide a proximate is justified in establishing a baseline of risk and risk addressed by activities. See Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision,[9] this section describes the risk bow tie, possible drivers, potential consequences, and the risk score for the Medium Pressure Incident risk.

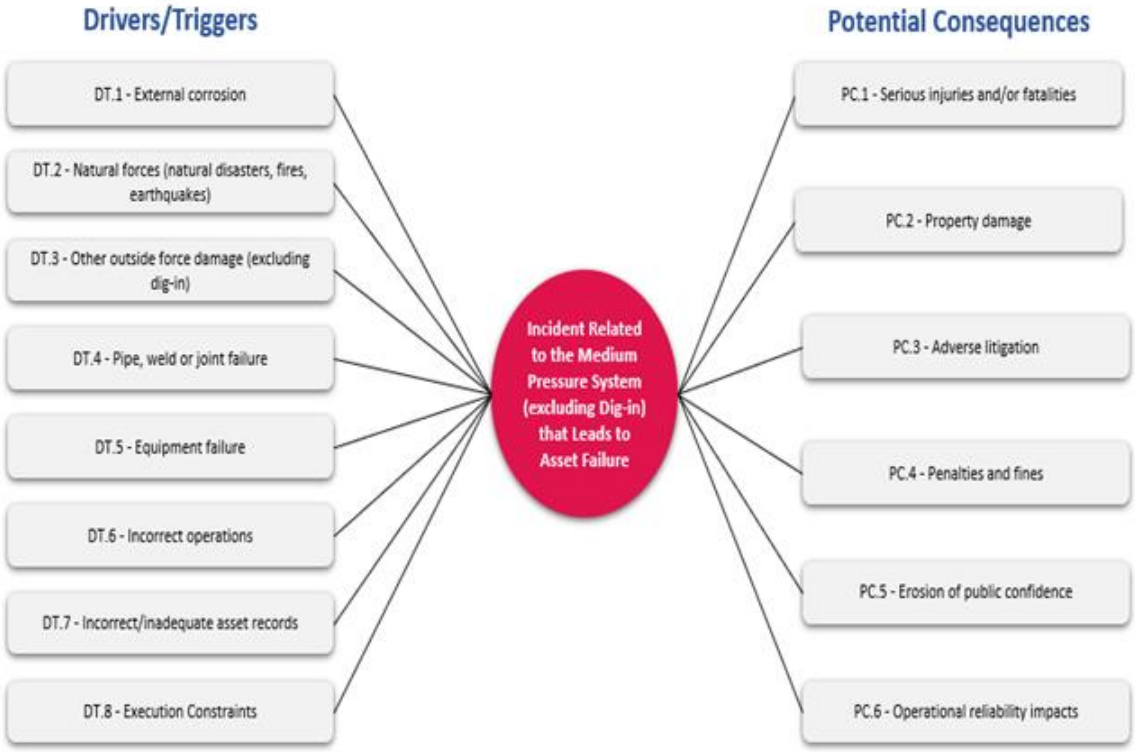
A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision[10] instructs the utility to include a risk bow tie illustration for each risk included in RAMP. As illustrated in the risk bow tie shown below in Figure 1, the risk event is that related to a Medium Pressure Incident risk leading to asset failure (center of the bow tie). The left side of the bow tie illustrates drivers/triggers that lead to the risk event occurring, and the right side shows the potential consequences of the risk event occurring. SDG&E applied 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 addressed is provided in Appendix A.

[9] D.18-12-014 at 33 and Attachment A, A-11 ("Bow Tie").

[10] *Id.* at Attachment A, A-11 ("Bow Tie").

Figure 1: Risk Bow Tie



B. Cross-Functional Factors

The following cross-functional factors (CFF) have programs and/or projects that affect this risk chapter: Climate Change Adaptation, Energy System Resilience, and GHG Emissions; Emergency Preparedness and Response and Pandemic; Foundational Technology Systems; Physical Security; Records Management; Safety Management Systems; and Workforce Planning/Quality Workforce. As an example, regarding the Workforce Planning/Quality Workforce CFF, all the RAMP O&M core activities include training to maintain and strengthen a qualified workforce. Safety is rooted in all phases of training pertaining to the medium pressure system. SDG&E is taking proactive action to enhance employee training, qualification, and work quality. An integral component of overall workforce proficiency is the Operator Qualification (Op Qual) program. As part of Op Qual compliance, employees are trained, either formally or informally, whenever significant changes occur in a work task or as required per SDG&E's Gas Standards, state pipeline safety standards in GO 112-F, and/or federal pipeline

safety standards under the Department of Transportation's (DOT) Pipeline Safety and Hazardous Materials Administration's (PHMSA) 49 C.F.R. § 192.

The work environment surrounding the medium pressure system is increasingly influenced and evolves by multiple training drivers. These drivers focus the training on the following core activities:

- Adoption of new regulations
- The need to maintain a trained and qualified workforce
- The need to support new field technologies and to facilitate the integration of these tools within the field and overall management practices.
- Increased workforce turnover: Workforce turnover presents issues of knowledge transfer, skills development, and overall proficiency of the replacement workforce.
- Introduction of new construction and maintenance methods into office and field functions.

C. Potential Drivers/Triggers[11]

The Settlement Decision[12] instructs the utility to identify which element(s) of the associated risk bow tie each mitigation addresses. When performing the risk assessment for the Medium Pressure Incident risk, SDG&E identified potential leading indicators, referred to as drivers or triggers. These include, but are not limited to:

- **DT.1 – Corrosion:** External corrosion 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. Internal corrosion is the deterioration of the interior of an asset as a result of the environmental conditions 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 needed.

---

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

[12] D.18-12-014 at Attachment A, A-11 ("Bow Tie").

[13] ASME B31.8S, "Managing System Integrity of Gas Pipelines."

- **DT.2 - Natural forces (natural disasters, fires, earthquakes)**: 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 dig-in):** Attributable to outside force 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:** Attributable to material 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:** 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, valves, meters, flanges, gaskets, collars, and couples. This driver/trigger is specific to the material properties related to the manufacturing process or post installation of the equipment.
- **DT.6 - Incorrect operations:** May include a pipeline incident attributed to insufficient or incorrect operating procedures or the failure to follow a procedure.
- **DT.7 - Incorrect/inadequate asset records:** The use of inaccurate or incomplete information that could result in the 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:** 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 be able to complete projects initiatives or meet operational compliance.

D. Potential Consequences of Risk Event

Potential consequences[14] are listed to the right side of the risk bow tie illustration provided above. If one or more of the drivers/triggers listed above were to result in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

- **PC.1 - Serious injuries and/or fatalities**
- **PC.2 - Property damage**
- **PC.3 - Adverse litigation**
- **PC.4 - Penalties and fines**
- **PC.5 - Erosion of public confidence**
- **PC.6 - Operational reliability impacts**

These potential consequences were used in the scoring the Medium Pressure Incident risk that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[15] Chapter RAMP-C of this RAMP Application explains the Risk Quantitative Framework that underlies this chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[16]

	LoRE	CoRE	Risk Score
Medium Pressure Incident	101.42	5.97	606

[14] D.18-12-014 at 16 and Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

[15] D.18-12-014 at Attachment A, A-11 ("Calculation of Risk").

[16] The term "pre-mitigation analysis," in the language of the S-MAP Settlement Agreement Decision (Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score")), refers to required pre-activity analysis conducted prior to implementing control or mitigation activity.

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, available and appropriate data (*e.g.*, Pipeline and Hazardous Materials Safety Administration data).[17]

Historical PHMSA data and internal SME input was used to estimate the frequency of incidents. To determine the incident rate per year for SDG&E, the national average incident rate per mile per year was applied to the medium-pressure pipeline miles at SDG&E. The safety risk assessment primarily utilized data from PHMSA, the reliability risk assessment was based on internal data, and the financial risk assessment was estimated based on both PHMSA and internal data. Internal SME input, based on recent damage repair costs, was used to estimate the financial consequence of incidents. Historical PHMSA medium-pressure gas incidents were also used in estimating financial and safety consequences. The reliability incident rate per year was estimated using internal data. Additionally, Monte Carlo simulation was performed to understand the range of possible consequences

III. 2020 CONTROLS

The Settlement Decision requires a utility to "clearly and transparently explain its rationale for selecting mitigations for each risk and for its selection of its overall portfolio of mitigations."[18] This section describes SDG&E's risk control and mitigation plan by each selected mitigation and control for this risk, including the rationale supporting each selected control and mitigation.

As stated above, the Medium Pressure Incident risk is the risk of damage, caused by a medium pressure system event, which could result in serious injuries or fatalities. The risk mitigation plan includes both controls that are expected to continue and projected mitigations for the period of SDG&E's Test Year 2024 General Rate Case (GRC) cycle. The controls are those activities that were in place as of December 30, 2020, most of which are compliance driven and have been implemented over decades, plus the addition of the Distribution Integrity Management Program (DIMP) that has been developed over recent years, to address this risk. SDG&E's mitigation plan for this risk consists of controls based on compliance with 42 CFR Part 192, GO 58, GO 112-F, and planned enhancements within existing controls.

---

[17] *Id.* at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

[18] *Id.* at Attachment A, A-14 (Mitigation Strategy Presentation in the RAMP and GRC).

For this RAMP chapter, the makeup of the portfolio of controls is a combination of compliance requirements and additional programs implemented by the DIMP within the last 7 years. The DIMP is continually evaluating the system threats and risk to determine if additional mitigations are appropriate. The threat and risk evaluation leverages leak repair, incident data, and subject matter expert (SME) input to evaluate and rank risk. As programs are developed, available data sets are leveraged to develop specific risk ranking, which supports risk-based prioritization of mitigations. For example, the Distribution Risk Evaluation and Monitoring System (DREAMS) steel replacement program utilizes leak rates, condition of the pipe, soil type and condition, and other factors to prioritize medium-pressure and high-pressure segments for replacement.

Not all programs and activities that would mitigate the Medium Pressure Incident risk are included in this risk mitigation plan. For example, the Mobilehome Park Utility Upgrade Program (MHP) is converting master-metered/sub-metered natural gas and/or electric services to direct utility services in mobile home parks and manufactured housing communities to improve the safety and reliability of service for residents of mobile home parks currently served by master-metered gas systems. The MHP is not included in this mitigation plan because MHP costs are not anticipated to be forecasted in SDG&E's next GRC.[19]

A. C1: 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 a confined space and an ignition source is introduced, there is the potential for injuries. Although SDG&E operations 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

[19] The Mobile Home Park Conversion Program began as a pilot program (authorized by and discussed in D.14-03-021 and Resolutions E-4878 (September 28, 2017) and E-4958 (March 14, 2019) and has evolved into a post-piloted Mobile Home Park Utility Conversion Program per D.20-04-004. Cost recovery is via a balancing account with a reasonableness review occurring in the GRC.

localized corrosion on the pipeline. Cathodic protection can be achieved by the installation of sacrificial anodes or impressed current systems.[20]

The directives prescribed by state and federal pipeline corrosion control standards[21] include the monitoring of CP areas, remediation of CP areas that are out of tolerance,[22] and preventative installations to avoid out of tolerance areas. The CP work in this CP Program constitutes the O&M activities that provide compliance to these regulations, supports the safety and integrity of the gas system, and mitigates risks defined in this RAMP chapter.

B. C2: 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 .[23] Examples include the installation of impressed current stations, deep well anode beds, magnesium anode systems, and the purchase 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 with third-party grounding systems that can drain current from the pipeline; or near customer meter set assemblies and risers, from improperly grounded customer owned electrical systems and dog or bicycle chains wrapped around risers and meter sets, thus reducing the level of protection and depleting anodes. SDG&E continues to identify necessary modifications to CP systems to shorts and current interference from these 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.

---

[20] 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 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.

[21] 49 C.F.R. § 192, Subpart I–Requirements for Corrosion Control; GO 112-F.

[22] Out of tolerance areas are defined as areas where CP measures are not efficiently mitigating the effect of the corrosive environment on steel assets.

[23] 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.

C. C3: Piping in Vaults Replacement Program

This project is for the replacement of piping located in underground vaults.[24] SDG&E has a number of piping and valves that are surrounded by a concrete vault to provide access to the valve for emergency operations. Any pipe segment, fitting, or valve exposed within a below grade vault is at risk for accelerated atmospheric corrosion due to the potential for water accumulation, pipe coating failure, and decreased cathodic protection effectiveness as these components within the vault are not protected for buried conditions and are exposed to the atmosphere. This on-going control follows the review of existing work orders determining the locations of all vaults containing medium and high-pressure facilities.

Once all vaults with exposed valves and piping are identified, the valve will be replaced with a valve appropriate for buried service, and the vault removed and backfilled so that the valve will be protected by cathodic protection. During this process, the valve continues to be accessible so that it can be used for emergency isolation. It is estimated that approximately 50 locations will require replacement. SDG&E will assess the coating and the condition of the above-ground and below-ground facilities within the vaults and prioritize for complete replacement.

D. C4: Regulator Station, Valve, and 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/or jeopardize public safety as evident by recent over-pressure events 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, not to exceed

[24] Vaults are rooms that allow for access to piping and piping components.

15 months to maintain 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 reduce the risk of over-pressure and the stations 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 segment 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 at its optimum effectiveness means that, for example, in the case of an earthquake or fire where an area needs to be isolated to reduce the risk of the incident, 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 escape of gas, these valves can be operated to allow for a safe environment, allow completion of the repairs to the pipeline, and minimize the risk of furthering the incident.

The meter set assemblies (MSA) reduce the pressure of natural gas and measure the volume of natural gas delivered to the customer. General Order 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 much higher pressure of natural gas 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.

E. C5: Regulator Station Replacements

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 472 regulator stations. SDG&E's O&M practices allow the useful lives of regulator stations to be extended through annual inspection and maintenance, however, it is 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 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 this manner, risks to employee and public safety can be mitigated.

F. C6: Leak Repair

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 consists of surveys at intervals of one or three years for steel mains and plastic. The frequency of this survey is determined by the pipe material and date of installation involved. Annual surveys are scheduled in business districts, and near public service establishments, such as schools, churches, hospitals, pre-1950 steel and pre-1986 plastic (Aldyl-A). 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 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 SB1371 based requirements.

G. C7: Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol)

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. [36]

H. C8: Underperforming Steel Replacement Program

The steel replacement program mitigates risk on underperforming CP protected steel pipelines that were installed using construction practices that are no longer considered best practices. The determination of where and when to implement mitigation measures is based on pipe attributes, operational conditions, and potential impacts on populations in the event of an incident. The Underperforming Steel Replacement Program proactively identifies the risk

factors for remediation before operational and safety issues arise. As this program continues to be evaluated, activity may vary between the tranches. SDG&E's early vintage program (pipeline) consists of the following elements: underperforming steel replacement program – threaded main (pre-1933 vintage), underperforming steel replacement program 1934-1965, and underperforming steel replacement program – other steel (post 1965). Each control is further described below:

1. C8-T1: Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage).

Prior to 1933, piping in the gas distribution system was joined by threaded couplings. This project aims to proactively remove a total of 165 miles of threaded main pipe over a 10-year period as well as associated services (it is estimated this also involves 218 miles of services). This is approximately a 10-year program which on average would require 15 miles of pipe per year, however mileage can vary slightly from year-to-year. Threaded pipe has a greater susceptibility to leaks at the joint connections and higher potential for joint failure during a seismic event. This is due to the thinning of the wall thickness from the cutting of the threads into the pipe.

This program mitigates the potential for gas leakage due to the replacement of vintage threaded steel mains and services.

2. C8-T2: Underperforming Steel Replacement Program (1934-1965 vintage).

The early vintage steel replacement program focuses on the replacement of poor performing steel. In early vintage steel mains, cold tar asphaltic wrap was used as the first layer of corrosion protection. Over time, the early generation pipe wrap degrades and disbonds from the pipe, causing cathodic protection current to leave the pipe around the disbonded coating thereby not providing adequate protection. Ultimately, this lack of corrosion protection will lead to increased leakage. SDG&E anticipates continuing this program while monitoring performance thereby continually reviewing the benefits and risk reduction accomplished. Examples of early vintage steel replacement indicators reviewed include leak repairs and incident leak rates related to the steel pipelines.

3. C8-T3: Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage).

The process for selecting pipelines requiring replacement due to a recurring leak history involves an evaluation tool or scoring system that considers various replacement elements, including but not limited to, leakage history, age of the pipe, main pressure, and location of the pipe relative to population density. These planned pipeline replacements processed in this manner, will therefore result in a list among all pipeline replacement candidates, of recommended pipeline replacements in priority order. Pipeline replacements can then be planned, with strong emphasis on a recurring leak history, from this list resulting in removal of the highest risk to the public from pipeline leakage.

I. C9: Early Vintage Program (Pipeline Component Removal)

The early vintage programs mitigate risk on certain early vintage pipeline components in the pipeline system. The determination of where and when to implement mitigation measures is based on pipeline component attributes, operational conditions, and impact on populations in the event of an incident. The early vintage program proactively identifies the risk factors for remediation before operational and safety issues arise. SDG&E's early vintage program (pipeline component removal) consists of oil-drip piping removal, Dresser mechanical coupling removal, and removal of valves separating high and medium pressure zones in the gas systems. Each mitigation is further described below:

1. C9-T1: Early Vintage Program (Components) - Oil Drip Piping Removal.

Pipeline oil drips were installed in low point high volume areas of the gas system to collect and purge unwanted liquids from gas mains. These systems were installed in the early days in the downtown areas when coal gasification was used and liquids were traditionally found in the system. Since liquids are no longer an issue for the SDG&E pipeline system, oil drips are obsolete. The buried oil drip piping facilities are at risk of excavation damage as their location and configuration historically were not captured with enough detail to identify them with precision on facility maps. These facilities often were symbolized by a "teardrop" on the maps. Because the feature lengths and attributes were not mapped in detail, it has led to difficulties in marking out as part of locate and mark requests. In recent history, a facility was damaged and caused an uncontrollable release of gas until the pipeline could be shut down. This incident caused a major freeway that serves southern San Diego County to temporarily be shut down for

safety. Gas Distribution has gathered partial historical oil drip location data and sites and marked the approximate location of these facilities in GIS; however, this effort needs additional validation.

This project will follow the review work orders and field validation of above ground and buried oil drip lines and containers. Additionally, this capital expenditure will be associated with the validated oil drip line locations and containers that are no longer necessary and will be removed from the system thus improving the safety and reliability of the system.

2. C9-T2: Early Vintage Program (Components) - Dresser Mechanical Coupling Removal.

The Dresser mechanical coupling joins two pipes together without the need for welding. This type of coupling cannot resist lateral movement, and over time the rubber pressure containing seal degrades. Dresser mechanical couplings require lateral support and are not as strong as modern mechanical couplings which have rubber mechanical seals. In the event of land movement, pipe separation/rupture may occur and create an incident. These types of incidents are low frequency, but potentially high consequence events because the Dresser mechanical couplings are primarily located in high population density areas. They exist in both the medium and high-pressure systems.

This project consists of evaluating locations where Dresser mechanical couplings exist, excavating, removing the Dresser mechanical couplings, and welding pipes back together. This mitigates the risk of an incident caused by the leakage of gas from these couplings.

3. C9-T3: Early Vintage Program (Components) - Removal of Closed Valves between High/Medium Pressure Zones.

SDG&E has identified 130 valves which separate high-pressure from medium-pressure systems. These valves are permanently locked out and tagged out in the closed position to serve as a physical barrier between high pressure and medium pressure. This condition is a result of a MAOP uprating of a pipeline which was previously interconnected to a distribution system and operated at a lower MAOP. Simply closing and locking the valve between high- and medium pressure systems is no longer an acceptable practice as there is inherent risk should the valve be operated in error, operated in an act of sabotage, or the valve leak pressure downstream to the lower MAOP system potentially causing an overpressure condition of the downstream system.

This project will verify valve locations in the field, excavate, and remove the closed and locked valves currently connecting high-pressure piping to medium pressure piping thus improving the safety and reliability of the system.

J. C10: 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.

One component of this activity is installing barricades to protect meter set assemblies (MSA) from vehicular damage. Barricades are installed to protect the MSA from vehicular traffic at existing customer locations in accordance with 49 C.F.R. § 192.353(a) and GO 112-F. The installation of meter barricades creates a more secure environment at the MSA location, which in addition to increasing public safety, results in increased longevity and performance of the MSA equipment. Furthermore, the increased growth in the SDG&E service territory brings increased population density, creating a higher probability for conflicts with vehicular traffic at MSA locations. Recent trends in architecture to maximize saleable square footage have resulted in less room for MSAs, increasing the demand for meter barricades to protect MSAs.

Another component of this activity (budget code 507) is the removal of inoperable valves. When a valve has been discovered inoperable through normal maintenance and inspections, it will be reported replaced with an operable valve. A valve that is operating properly can be used to 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 damaged 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.

K. C11: Gas Distribution 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 ensure 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 making the scene safe. These dedicated "specialist" crews responding to gas emergencies reduce the risk of injuries and property damage to both the public and crew responding to the incident.

L. C12: Cathodic Protection System Enhancements

The CP system enhancement tracks projects specifically associated with creating dedicated high-pressure and medium-pressure distribution pipeline CP systems. SDG&E's existing CP station coverage areas often include a mixture of high-pressure and medium-pressure pipelines. Typically, CP systems protecting medium-pressure pipelines are more susceptible to shorts compromising CP protection levels. SDG&E has initiated creating dedicated CP systems for high-pressure pipelines where any adverse conditions due to corrosion pose a higher risk. This Cathodic Protection System Enhancement control was created to track projects specifically dedicated to separating high-pressure and medium-pressure CP systems and other specialty CP system improvement surveys above and beyond the typical activities normally performed as part of the CP Program – Capital (SDG&E-9-C2). Since the inception, SDG&E has identified an increasing number of areas that need dedicated CP systems or CP system improvements.

In addition, SDGE has about 19,700 services, referred to as CP10s that will continue to be monitored, inspected, and maintained on a ten-year cycle as required in 49 CFR § 192.465. CP10s are separately protected service lines that are surveyed on a sampling basis where at least ten percent of these services are sampled each year, thus ensuring that the entire group of CP10s are tested in a ten year period. These inspection activities are covered under control C1. However, as the CP10s go beyond their useful life and protection levels are reduced, they will be evaluated for replacement and the replacement will occur as part of this CP system enhancement project area.

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 and appropriate replacement of CP10 service lines will reduce the risk of corrosion and subsequent corrosion caused leaks in the distribution pipeline system.

M. C13: Human Factors Mitigations – Gas Handling Plans.

A series of structure fires and explosions occurred in Massachusetts in 2018 after high-pressure natural gas was released into a low-pressure natural gas distribution system resulting in

multiple fatalities and injuries. Within their final report[25], the National Transportation Safety Board (NTSB) found there was "…weak engineering management that did not adequately plan, review, sequence, and oversee the construction project…", and recommended that the local utility should:

> …Revise the engineering plan and constructability review process across all of your subsidiaries to ensure that all applicable departments review construction documents for accuracy, completeness, and correctness…

After reviewing this accident and its application to SDG&E, SDG&E management decided that a gas handling plan (GHP) shall be required for all high-pressure mains and mains operating at or less than 60 psig and services using any fitting larger than a 2" service tee at the service-to-main connection, The GHP is developed, reviewed and signed by design, engineering, and construction supervisory personnel and is a site specific document with detailed procedures and graphical flow depictions describing the step-by-step processes, to "handle" the diversion of gas flow internal to the piping system. A GHP provided for the applicable gas system pipeline construction projects can reduce the risk of an incident occurring due to a miscommunication or human error.

N. C14: Human Factors Mitigations - Operator Qualification Training and Certification

All gas pipeline operators are required to create and maintain a written Op Qual program to establish compliance policies for the Department of Transportation (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 per this Op Qual program. Such programs are reviewed by the Operator Qualification 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 ensures adherence to proper company policy and procedures and

[25] NTSB Report Number PAR-19-01, Over-pressurization of Natural Gas Distribution System, Explosions, and Fires in Merrimack Valley, Massachusetts.

therefore mitigates the risk of hazardous conditions developing and increases the overall awareness and response to unsafe activities.

O. C15: Human Factors Mitigations - QA/QC Program – Mandated Compliance Activities

In addition to SDG&E's Operator Qualification program to ensure operations are performed in a safe and proficient manner, 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 determine the effectiveness and adequacy of the procedures used in normal operations and maintenance. In addition, the assessors validate the conformance of employees to these policies and procedures. The assessors identify if abnormal operating conditions (AOCs) are present and ensure that 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 and recorded to communicate lessons learned and to help develop refresher training. Adherence to proper company policy and procedures mitigates the risk of hazardous conditions developing and increases the overall awareness and response to unsafe activities.

P. C16: Distribution Integrity Management Program (DIMP)

DIMP Programs/Projects Addressing Risk (PAARs) enhance pipeline safety by continually assessing, mitigating, and reducing risk for distribution pipelines through threat identification and risk analysis, management and the development of specific programs/projects, and other activities to address risk.

As these DIMP programs continue to be evaluated, activities may vary. SDG&E's DIMP currently consists of the following elements: 1. DREAMS – The vintage integrity plastic plan and 2. replace balance of CP daisy chained services. Each control is further described below:

1. C16-T1: Distribution Integrity Management Program (DIMP).

The vintage integrity plastic plan (VIPP) falls within the umbrella of the Distribution Risk Evaluation and Monitoring System (DREAMS). Plastic pipe manufactured and used for gas service from the 1960s through the early 1980s (SDG&E has over 1,500 miles of this type of pipe) can exhibit a brittle-like cracking characteristic that could cause a leak to grow and release

natural gas, increasing the risk of natural gas gathering and igniting causing injuries and/or fatalities. Given the higher potential for a release of gas, the frequency of performing leak surveys has been increased to yearly versus every five years for plastic pipelines within this vintage. The initial focus of the VIPP is early vintage plastic manufactured pre-1973. This vintage of plastic exhibits the brittle-like cracking characteristics discussed, but also exhibits a sow ductile inner wall issue that further exacerbates the brittle-like cracking issues when external loads are applied. The manufacturers of this pipe have issued notices informing of the issues. The initial focus of SDG&E's VIPP will be a wholesale replacement of pre-1973 plastic pipe, with a priority given to poor performing segments by utilizing a relative risk model and dynamic segmentation. A secondary focus will be to leverage the same relative risk model and dynamic segmentation to continue to focus on the replacement of poor performing early vintage plastic for pre-1986 plastic pipe. As SDG&E's infrastructure continues to age and more leak data is accumulated through annual inspections, SDG&E anticipates continuing to increase the level of replacement over the next 6-8 years while monitoring performance to continually review the benefits and risk reduction accomplished through VIPP through indicators such as leak repair and incident rates related to early vintage plastic.

2. C16 -T2: DIMP –Replace Balance of CP Daisy Chained Services.

The daisy chain riser remediation program was implemented to improve the risk profile of gas pipeline risers constructed in a daisy chain configuration. A daisy chain configuration uses buried plastic pipe's tracer wire to connect multiple steel risers to a central anode in order to provide cathodic protection. However, the bond wire is at risk of being inadvertently disconnected as a result of various activities such as maintenance or homeowner excavation. The disconnection of the wire would lead to an increased risk of having unprotected steel risers in the system.

Mitigation strategies to manage the risk of failure include eliminating the daisy-chained tracer wire, installing a new anode that is consistent with current CP standards, replacing mains and services with state-of-the-art polyethylene piping, and/or increasing the frequency of CP reads.

Remediating daisy-chained systems will decrease the likelihood of failure due to corrosion. SDG&E is currently in the last phase of this program and expects it to be completed by the end of 2021.

Q. C17: Control Center Modernization (CCM) Distribution Field Asset Real Time Monitoring and Control Site Installations/Upgrades & New Control Room Technologies

The Control Center Modernization organization will enhance distribution field assets by installing control and real time pressure monitoring capabilities. Increased operational awareness through the implementation of a centralized data management system and real time monitoring capabilities will help Gas Control personnel to quickly identify abnormal operating pressures within the system and will provide Gas Control personnel with remote control functionality to help prevent an overpressure. With the introduction of these new field assets and capabilities, the CCM will introduce new processes, training, and increase workforce. Additionally, these field assets will be supported by the implementation of new control room and IT system and network technologies.

The new control room technology features will focus on employee safety, security, ergonomics, training, and decision making while the CCM IT functionality will integrate both new and existing IT platforms to provide system-wide viewing of daily health and alarm information from the Company's new field pipeline technologies. Operators and region personnel will be able to leverage these new systems and data analytics to troubleshoot issues and/or perform proactive mitigations to prevent abnormal operating conditions. The installation and deployment of these CCM field assets and technology will ramp up in 2020 and be on-going throughout the next GRC cycle and beyond.

R. C18: Gas Public Safety Communications

SDG&E conducts public awareness efforts to enhance the safety of its customers and the general public. These efforts are designed to engage with the Company's customers and the public to inform them about the shared safety responsibilities. Without adequate communication and education programs, the public may not know how to safely dig on their property or how to keep themselves safe around company facilities that may be damaged during an event. Communication with the public also allows customers to be able to detect possible safety issues within and around their homes. Without adequate communications and education programs, a customer or member of the general public may not know how to identify a hazardous situation and subsequently report it or how to prevent one. Customer outreach, communication, and education are a few of the methods SDG&E uses to mitigate customer and public safety gas risk. The activities to mitigate this risk include safety-related messages delivered through multiple

communication channels. Communication channels include bill inserts, print media, radio, web, and social media. Messages include, but are not limited to, Carbon Monoxide safety, fumigation, and furnace safety.

S. C19: Field and Public Safety

SDG&E Customer Services' primary goal is providing safe, reliable, and efficient gas and electric service to customers, while complying with applicable federal, state, and local regulations. SDG&E has formal procedures, processes, and standards it adheres to and makes accessible to field personnel so they can adequately and safely do their jobs. Until SDG&E field employees are fully trained to do their jobs adequately and safely, they cannot perform work orders on their own. SDG&E Customer Service Field Dept. representatives have access to the Company's procedures and standards through their mobile data terminal (MDT). These reference materials instruct the employee on how work should be performed, how to perform procedures safely, and provide overall direction to employees. Below, are Call Center and Field activities managed by SDG&E related to safety:

Customer Service Field (CSF) orders related to public safety include:

- Carbon Monoxide - CSF employees respond to orders created for a customer experiencing carbon monoxide illness, a customer whose carbon monoxide alarm has sounded, or a "courtesy test" for a customer who is concerned about the possibility of their gas appliance producing carbon monoxide. Upon arrival, if carbon monoxide is detected the CSF employee will evacuate the premises, shut off the gas meter for safety, and call for medical attention if necessary. A carbon monoxide investigation on all gas appliances is performed.
- Gas Purge Orders - Purge orders are issued to ensure customer safety by confirming customer owned gas house lines are safe and leak-free and odorant is readily detectable. Purge orders usually involve large gas meter installations and customer owned gas systems for commercial and industrial customers. These jobs usually relate to new construction projects where Gas Distribution Pipeline Operations sets a large gas meter and the Company schedules a date to test and purge the houseline. The steps are below:

- Once the meter is set by Pipeline Operations Dept. personnel, CSF energizes and tests the houseline to make sure there are no leaks in the system.
- Once it is determined that the complete houseline has been pressure tested and it's leak free, SDG&E continues to purge gas out of the farthest point(s) of the houseline. When purging gas, the goal is to displace all of the air from the system. Purging continues until SDG&E no longer register gas indications using combustible gas indicators from the farthest point(s) of the houseline. This is important from a customer safety aspect because it makes sure that the system is safe and ready for use when gas equipment is fired off. During purging and once there are no longer gas indications, an odorant test is performed to confirm odorant is readily detectable. There have been instances when odorant is detected at the meter/riser location, but it is not detected on the customers houseline when purging. In situations when SDG&E is unsuccessful with odorant breakthrough, an odorant injection will be scheduled through SoCalGas.
- Last, SDG&E fires off all gas equipment that is connected at the request of the customer or contractor to make sure each piece of equipment is operating safely. There are many times that industrial or commercial gas equipment is involved, and SDG&E's customers prefer to have the vendor fire off their equipment initially.

- <u>High Gas Consumption Order</u> – Smart meter technology captures daily gas consumption data. Using a newly developed algorithm SDG&E can detect a "spike" or unusual gas consumption based on historical or recent gas usage. When this occurs, a high gas consumption order is created for a CSF employee to investigate. Findings vary, as a customer that has

simply added a new gas appliance, such as a gas pool heater, would cause a spike in gas usage; however, sometimes a gas leak on the customer's houseline or appliance is discovered (*e.g.*, appliance burner left on, fireplace or BBQ gas valve left on, but not in use).

- Turn On Orders with Safety Checks – CSF employees are responsible for turning on service valves for metering installations with capacities of 1,500 standard cubic feet per hour (SCFH) and below with delivery pressure of 2 PSI and below. When turning service valves on to restore gas, the customer's system is tested for safety purposes. Additionally, CSF employees adjust, inspect, communicate appropriate referrals, plus provide advisory service on energy efficiency and the safe utilization of gas appliances. Employees remain alert for hazardous or unsatisfactory appliance conditions and take appropriate corrective action for customer safety and protection of property.
- Soft Shut Off Gas Orders – To eliminate the need for a new tenant to provide access for a gas turn-on, the Energy Service Specialist (ESS) may issue a Soft Shut-Off (SSO) gas order. Based on safety considerations, CSF employees are to use their judgment as to whether an SSO should be converted to a regular shut-off when fielding this type of order. CSF personnel go out to the premises and perform a registration check at the meter to ensure that gas registration is within safe and allowable limits when considering whether to leave the gas on. If the registration check passes the test, the CSF employee will leave the gas meter on and also leave a "Gas is on" Form (SD6552) on the door of the premises. The purpose of this form is to notify a new occupant the gas has been left on, temporarily. Instructions are provided to prevent gas service interruption, and how to shut off the gas meter in an emergency.
- Read/Verify – Read and verify the meter number for Billing purposes. During this process, CSF employees will verify the read and meter number to ensure meter matches the account's address, then document the meter read. During this process, the CSF employee ensures the read still

indicates the gas is off and if not, ensures a follow up order to turn the gas off for safety purposes.

- Seasonal Checks and Appliance Checks – CSF conducts ongoing and seasonal appliance checks to perform appliance inspections, lighting pilots/turning-on appliances, and adjusting to ensure appliances are safe to use by SDG&E customers. Additionally, CSF communicates appropriate referrals, plus provides advisory service on energy efficiency and the safe utilization of gas appliances. Field employees remain alert for hazardous or unsatisfactory appliance conditions and take appropriate corrective action for customer safety and the protection of property.
- Fumigation - Prior to the "tenting" of a home or business CSF employees inspect the gas riser and properly shut off and secure the gas meter to avoid gas accumulating within the tent during fumigation. Upon completion of fumigation, a CSF employee will return to turn gas service back on and perform appliance checks on gas appliances.
- Hazardous and non-hazardous gas leaks - CSF employee will respond to all calls of gas leaks or gas odors and perform a gas leak investigation.

T. C20: Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing

This is a safety-related program for Energy Savings Assistance (ESA) Program participants. The purpose is to test in-home equipment for carbon monoxide hazards. SDG&E conducts Carbon Monoxide testing on homes weatherized through the ESA Program in accordance with the Statewide Energy Savings Assistance Program Installation Standards and the Statewide Energy Savings Assistance Program Policy and Procedures Manual. CPUC directives order SDG&E to charge the costs for the NGAT program to base rates rather than to the public purpose funds.

U. C21: CSF Quality Assurance (QA) Program

SDG&E field employees are trained to address safety hazards on customer premises. Public safety orders include carbon monoxide, fumigation, and hazardous and nonhazardous gas leaks. The QA Program is designed to verify the field employees are completing field orders according to established policy and procedures and to see that customers are receiving safe and reliable service. The program provides a snapshot of the quality of work being performed by the

CSF Employees on customer premises. QA Specialists (Inspectors) take a random sampling of field orders completed by field employees and inspect the work performed on the customer premises. Inspectors record all findings of each individual order onto an inspection form. That information is then utilized to develop refresher training and to provide feedback to the CSF employees.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[26]

All of the activities discussed in Section III above, except for DIMP – Replace Balance of CP Daisy Chained Services (C16 -T2) are expected to continue during the TY 2024 GRC time period. For clarity, a current activity that is included in the plan may be referred to as either a control and/or a mitigation. For purposes of this RAMP, a control that will continue as a mitigation will retains its control ID unless that the size and/or scope of that activity will be modified, in which case that activity's control ID will be replaced with a mitigation ID. The table below shows which activities are expected to continue.

Table 3: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	Cathodic Protection Program – O&M	X	X
2	C2	Cathodic Protection Program – Capital	X	X
3	C3	Piping in Vaults Replacement Program	X	X
4	C4	Regulator Station, Valve, and Large Meter Set Inspection	X	X
5	C5	Regulator Station Replacements	X	X
6	C6	Leak Repair	X	X
7	C7	Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol)	X	X
8	C8	Underperforming Steel Replacement Program	X	X
9	C8-T1	Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage	X	X

[26] *See* D.18-12-014, Attachment A at A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
10	C8-T2	Underperforming Steel Replacement Program (1934-1965 vintage).	X	X
11	C8-T3	Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage).	X	X
12	C9	Early Vintage Program (Pipeline Component Removal)	X	X
13	C9-T1	Early Vintage Program (Components) - Oil Drip Piping Removal	X	X
14	C9-T2	Early Vintage Program (Components) - Dresser Mechanical Coupling Removal	X	X
15	C9-T3	Early Vintage Program (Components) - Removal of Closed Valves between High/Medium Pressure Zones	X	X
16	C10	Code Compliance Mitigation	X	X
17	C11	Gas Distribution Emergency Department	X	X
18	C12	Cathodic Protection System Enhancements - Base	X	X
19	C13	Human Factors Mitigations – Gas Handling Plans	X	X
20	C14	Human Factors Mitigations – Operator Qualification Training and Certification	X	X
21	C15	Human Factors Mitigations - QA/QC Program – Mandated Compliance Activities	X	X
22	C16-T1	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIPP)	X	X
23	C16-T2	DIMP –Replace Balance of CP Daisy Chained Services.	X	-
24	C17	CCM Distribution Field Asset Real Time Monitoring and Control Site Installations/Upgrades & New Control Room Technologies	X	X
25	C18	Gas Public Safety Communications	X	X
26	C19	Field and Public Safety	X	X
27	C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	X	X
28	C21	CSF Quality Assurance (QA) Program	X	X
29	M1	Safety Control Valves	-	X
30	M2	Cathodic Protection System Enhancements – Real Time Monitoring	-	X

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
31	M3	Replace Curb Valves with EFV's	-	X

For activities SDG&E plans to perform that remain unchanged, please refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in this section below.

A. Changes to 2020 Controls

SDG&E does not anticipate any significant changes to the scope of the existing controls that are anticipated to continue into years 2022-2024.

B. 2022 – 2024 Mitigations

1. M1: Safety Control Valves.

Block valves and/or control valves are a critical part of a medium pressure system. Valves provide the operator with a means of maintaining the pipeline system through creating temporary unconnected sections of the system and provide alternative choices in how the operator will 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 the escaping gas, thus minimizing the risk to Company employees and the public from the consequences of exposure to the uncontrolled escape 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 with consideration for the need for valves as described above.

However, as a gas distribution system grows over time with multiple added segments, not often is the larger integrated gas system analyzed with a "big picture" look at the need for additional valves required for emergency response. This analysis should also include the consideration for additional valving to enhance the operator's ability to maintain the pipeline system with a minimum interruption to customers.

This project is an analysis of SDG&E's gas system using current system maps and modelling tools to identify potential locations for added valves. This would provide additional

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 to be included, but not limited to, are size and pressure of the pipeline, pipeline network considerations such as back-ties and single feeds, long existing back-ties between stranded areas, possible reduction in the number of customers affected, and valve access considerations.

2. M2: Cathodic Protection System Enhancements – Real Time Monitoring.

Cathodic Protection coating and monitoring can protect and extend the life of a steel asset by mitigating corrosion. The application of a CP current is necessary to overcome local corrosion currents along the pipeline, that left unabated would result in localized corrosion on the steel pipeline. Cathodic Protection can be achieved by the installation of sacrificial anodes or impressed current systems (rectifier stations).

Each cathodic protection rectifier station or other impressed current power source must be inspected six times each calendar year, but with intervals not exceeding 2 1/2 months, to ensure that it is operating.[27] Currently this is done manually by CP electricians who visit and inspect these rectifier installations every two months. This means that during the two months in-between inspections, if the rectifier becomes inoperable, the CP system could be off for the local area, increasing the likelihood of accelerated corrosion and the risk of leakage.

This project involves the installation of remote monitoring units (RMUs) to monitor the level of CP provided by rectifier stations to the steel pipeline system. These units would electronically monitor the rectifier stations on a continuous real-time basis to verify that the level of current from the rectifiers is adequately protecting steel pipelines. The RMUs send alarm notifications through landline or wireless communication to the department monitoring these devices when key parameters such as current levels are below or above a pre-set tolerance. In this way, CP protection can be monitored continuously rather than manually on a bi-monthly basis by employees under the current mandated periodic inspection program. This significantly improves the mitigation of the risk of corrosion of the steel pipeline system through the loss of the CP protection system.

[27] 49 CFR § 192.465.

3. M3: Replace Curb Valves with EFVs.

All newly installed or replaced service lines with installed meter capacity exceeding 1000 SCFH, must have installed either a manual service line shut-off valve (a "curb" valve or other manually operated valve) or an excess flow valve (EFV). This mitigation project will survey the gas system for installed curb valves, prioritize their replacement based on inaccessibility issues and schedule the replacement of these valves with EFVs.

In the past, if a curb valve was chosen, requirements for these manually operated valves from 49 CFR 192.385, include that they "be located near the service that is safely accessible to operator personnel or other personnel authorized to manually shut off gas flow to the service line, if needed." In addition, if a manual curb valve was chosen to comply with the service line shut off requirement, 49 CFR 192.385 also requires that it must be "installed in such a way to allow accessibility during emergencies." "…[they are]..subject to regular scheduled maintenance." If an EFV was chosen as the shut off device, it is buried as near as practical to the service to main connection. The EFV has an advantage over a curb valve (which requires periodic inspection and maintenance) in that it is designed to automatically shut off the service if a high flow is detected (such as that associated with a broken service line).

When there is a broken service line incident, based on the location requirements discussed above, the EFV (with automatic response) will protect the majority of the service line to the customer as opposed to the curb valve (requiring manual operation) located closer to the customers property will protect only a smaller portion of the service line. The EFV also does not have the location accessibility constraints that manually operated curb valves have in order to be operated.

Prior to the mandate to install EFVs in services, manually operated curb valves were installed in services for various reasons to remotely shut off a service line. Some of these valves, accessible from inside a curb valve box, may still be inaccessible due to their location in a parking strip where they could be covered with a parked vehicle, or located within high traffic areas. In addition, these curb valve boxes, which have not required inspection in the past, may have filled with street sand, or have been covered with street paving or sidewalk construction limiting access to the valve.

Because EFVs are automated and do not require manual operation, the response time to shut off a curb valve is much longer than the auto-shut off response time of an EFV. In addition,

EFVs are not subject to street and sidewalk location inaccessibility issues. This will significantly mitigate risk to the public and the affected customer by decreasing the response time to shut down a customer service, when required, due to damage of the service line from outside forces.

V. COST, UNITS, AND QUANTITATIVE SUMMARY TABLES

The tables in this section provide a summary of the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided. SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data.

Table 4: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[28]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[29]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	Cathodic Protection Program - O&M	-	1,965	-	-	1,853	2,245
C2	Cathodic Protection Program - Capital	3,670	-	17,795	21,540	-	-
C3	Piping in Vaults Replacement Program	190	-	8,605	10,420	-	-
C4	Regulator Station, Valve, and Large Meter Set Inspection	-	4,500	-	-	4,240	5,130
C5	Regulator Station Replacement	-	-	5,400	6,900	-	-
C6	Leak Repair	9,500	1,400	26,865	32,525	1,330	1,610
C7	Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth, and Pipeline Patrol	-	2900	-		2755	3335
C8-T1	Underperforming Steel Replacement Program -Threaded Main (pre- 1933 vintage)	1665	-	26270	31800	-	-
C8-T2	Underperforming Steel Replacement Program (1934 - 1965 vintage)	3755	-	20805	25185	-	-
C8-T3	Underperforming Steel Replacement Program - Other Steel (Post 1965 vintage)	1040	-	10165	12305	-	-

[28] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[29] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with Controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[29]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C9-T1	Early Vintage Program (Pipeline Component Removal)- Oil Drip Piping	195	-	6800	8235	-	-
C9-T2	Early Vintage Program (Pipeline Component Removal) - Dresser Mechanical Coupling Removal	1390	-	8825	10685	-	-
C9-T3	Early Vintage Program (Pipeline Component Removal) - Removal of Closed Valves Between High/Medium Zones	450	-	735	890	-	-
C10	Code Compliance Mitigation	1280	-	5900	7140	-	-
C11	Gas Distribution Emergency Department		2710	-	-	2595	3140
C12	Cathodic Protection System Enhancements	1250		2980	3610	-	-
C13	Human Factors Mitigations - Gas Handling Plans	285	-	995	1275	-	-
C14	Human Factors Mitigations - Operator Qualification Training and Certification	580	2115	1255	1520	2345	2840
C15	Human Factors Mitigations - QA/QC Program - Mandated Compliance Activities	-	270	-	-	340	415
C16-T1	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIPP)	40365	2680	157605	182490	2850	3300
C17	CCM Distribution Field Asset Real Time Monitoring and Control Site Installations/Upgrades & New Control Room Technologies	-	-	12420	17940	265	382
C18	Gas Public Safety Communications	-	2661	-	-	2395	3459
C19	Field and Public Safety	568	9,694	1623	1962	9209	11633
C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	-	111	-	-	105	322
C21	CSF Quality Assurance (QA) Program	-	65	-	-	185	224

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[29]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
M1	Safety Control Valves	-	-	6845	8745	-	-
M2	Cathodic Protection System Enhancements – Real Time Monitoring	-	-	2700	3450	-	-
M3	Replace Curb Valves with EFV's	-	-	7225	8745	-	-

Table 5: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C1	Cathodic Protection Program - O&M	No. of troubles orders		-	1,385	-	-	1,305	1,580
C2	Cathodic Protection Program - Capital	No. of deep well anode beds		39	-	137	166	-	-
C3	Piping in Vaults Replacement Program	No. of projects		2	-	57	69	-	-
C4	Regulator Station, Valve, and Large Meter Set Inspection	No. of inspections and related maintenance		-	1,020	-	-	816	988
C5	Regulator Station Replacement	No. of regulator stations replaced		-	-	11	14	-	-
C6	Leak Repair	No. of projects		564	635	1607	1946	601	728
C7	Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth, and Pipeline Patrol	No. of inspections/surveys		-	940	-	-	894	1082
C8-T1	Underperforming Steel Replacement Program -Threaded Main (pre- 1933 vintage)	No. of feet		1584	-	189003	228794	-	-

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C8-T2	Underperforming Steel Replacement Program (1934 - 1965 vintage)	No. of feet		10560	-	149676	181187	-	-
C8-T3	Underperforming Steel Replacement Program - Other Steel (Post 1965 vintage)	No. of feet		1718	-	73137	88534	-	-
C09-T1	Early Vintage Program (Pipeline Component Removal)- Oil Drip Piping	No. of projects		3	-	113	137	-	-
C9-T2	Early Vintage Program (Pipeline Component Removal) - Dresser Mechanical Coupling Removal	No. of projects		11	-	59	71	-	-
C9-T3	Early Vintage Program (Pipeline Component Removal) - Removal of Closed Valves Between High/Medium Zones	No. of projects		4	-	4	5	-	-
C10	Code Compliance Mitigation	No. of projects		1364	-	2836	3433		
C11	Gas Distribution Emergency Department	No. of responses		-	1030	-	-	1216	1472
C12	Cathodic Protection System Enhancements	No. of projects		18	-	137	166	-	-
C13	Human Factors Mitigations - Gas Handling Plans	No. of projects		386	-	1890	2415	-	-
C14	Human Factors Mitigations – Operator Qualification Training and Certification	No. of employees/contractors trained/certified		650	650	2005	2428	712	861

ID	Control/Mitigation Name	Units Description		Recorded Units		Forecast Units			
		Capital	O&M	2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
C15	Human Factors Mitigations - QA/QC Program – Mandated Compliance Activities	No. of internal QA/QC field audits			240	-	-	227	275
C16-T1	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIPP)	No. of miles		51		140	170		
C17	CCM Distribution Field Asset Real Time Monitoring and Control Site Installations/Upgrades & New Control Room Technologies	No. of control sites installed/inspected No. of real-time monitoring sites installed/inspected		-	-	Control: 13 Real-time:34	Control: 20 Real-time: 50	Control: 10 Real-time:20	Control: 14 Real-time: 29
C18	Gas Public Safety Communications	A measurable unit is not practical given the multiple means of communications used to implement this control.							
C19	Field and Public Safety	No. of orders		6784	123195	19334	23405	117036	160155
C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	No. of natural gas appliance tests		-	2840	-		2696	6953
C21	CSF Quality Assurance (QA) Program	No. of inspections		-	180	-	-	1509	1826
M1	Safety Control Valves	No. of projects		-		51	66	-	-
M2	Cathodic Protection System Enhancements – Real Time Monitoring	No. of upgraded rectifier stations		-	-	1180	1508	-	-
M3	Replace Curb Valves with EFV’s	No. of projects		-	-	361	437	-	-

Table 6: Risk Control & Mitigation Plan - Quantitative Analysis Summary

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	Cathodic Protection Program - O&M	97.98	5.97	584.9	13.4
C2	Cathodic Protection Program - Capital	94.95	5.97	566.9	24.6
C3	Piping in Vaults Replacement Program	101.0	5.97	603.0	6.3
C4	Regulator Station, Valve, and Large Meter Set Inspection	57.69	5.97	344.4	56.8
C5	Regulator Station Replacement	101.3	5.97	604.9	2.7
C6/C7	Leak Repair & Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol)[30]	30.0	5.97	179.3	14.9
C8-T1	Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage	100.5	5.97	600.0	5.7
C8-T2	Underperforming Steel Replacement Program (1934-1965 vintage).	100.6	5.97	600.7	6.3
C8-T3	Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage).	100.9	5.97	602.3	8.6
C9-T1	Early Vintage Program (Components) - Oil Drip Piping Removal	100.9	5.97	602.2	13.5
C9-T2	Early Vintage Program (Components) - Dresser Mechanical Coupling Removal	101.4	5.97	605.3	0.6
C9-T3	Early Vintage Program (Components) - Removal of Closed Valves between High/Medium Pressure Zones	101.4	5.97	605.3	6.2
C10	Code Compliance Mitigation	101.1	5.97	602.8	10.2
C11	Gas Distribution Emergency Department	78.62	5.97	469.3	144.0
C12	Cathodic Protection System Enhancements - Base	101	5.97	603	4.4
C13	Human Factors Mitigations – Gas Handling Plans	See Table 7			
C14	Human Factors Mitigations – Operator Qualification Training and Certification	101.1	5.97	604	0.4

[30] Pipeline Monitoring is a standalone activity with costs and units tracked as such. For purposes of calculating an RSE, Pipeline Monitoring was combined with Leak Repair as Pipeline Monitoring is only the work associated with inspections wherein risk mitigation thereof occurs in the Leak Repair activity.

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C15	Human Factors Mitigations - QA/QC Program – Mandated Compliance Activities	See Table 7			
C16-T1	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIPP)	98.02	5.97	585.2	3.4
C17	CCM Distribution Field Asset Real Time Monitoring and Control Site Installations/Upgrades & New Control Room Technologies	See Table 7			
C18	Gas Public Safety Communications	See Table 7			
C19	Field and Public Safety	100.3	5.97	598.9	0.2
C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	101.4	5.97	605.3	0.5
C21	CSF Quality Assurance (QA) Program	101.2	5.97	604.2	6.3
M1	Safety Control Valves	101.2	5.97	604.2	4.9
M2	Cathodic Protection System Enhancements – Real Time Monitoring	100.2	5.97	598.3	69.0
M3	Replace Curb Valves with EFVs	98.75	5.97	590	60.6

Table 7-SDG&E MP: Risk Control & Mitigation Plan – Quantitative Analysis Summary for RSE Exclusions

ID	Control/Mitigation Name	RSE Exclusion Rationale
C13	Human Factors Mitigation: Gas Handling Plans	The implementation of Gas Handling procedures is a direct result of lessons learned from the industry at large. SDG&E recognizes this is a prudent safety activity for pipeline operations and therefore is adopting as such. Because this activity is new to the utility, there exists no internal data to determine the decrease in incident rate or consequence of incidents with the implementation of Gas Handling procedures thereof. SoCalGas serves as the closest baseline in this area; however, Gas Handling Procedures have been a long-standing policy of SoCalGas. Since no discernable difference in incident rate between the two companies could be directly tied to a risk reduction associated with the mitigation, an RSE calculation was not performed.

ID	Control/Mitigation Name	RSE Exclusion Rationale
C15	Human Factors Mitigations - QA/QC Program – Mandated Compliance Activities	Quality assurance and control of pipeline activities like CP repairs/inspections, M&R inspections, Leak Mitigation, etc. is a crucial safety activity conducted by the Company; however, there is insufficient internal data to tie the risk addressed by this mitigation to the drivers described in the bow tie. The Company possess metrics around inspections completed and forecasted as well as when issues may be found (*e.g.*, when construction is not completed to company standards); however, the data to specifically tie incident causes to the lack of inspections or insufficient inspections does not exist. Likewise, there is no data, internal or external, to explicitly state a consequence would decrease by a quantifiable amount due to the implementation of inspections. The QA/QC program exists to determine compliance with Company standards or to determine if work was not completed. As such, no quantifiable means exists to determine the increase in likelihood or consequence due to inspecting pipeline construction projects. Similarly, no SME input exists that can explicitly tie the increase or decrease thereof; hence, an RSE could not be calculated.
C17	CCM SCG Distribution Field Asset Real Time Monitoring and Control Site-Installations/Upgrades & New Control Room Technologies	Increasing the ability to monitor and control the natural gas system is an important safety and reliability measure for California's energy grid. The CCM will enable SoCalGas to control or isolate the faster in the event of a system incident. Likewise, the CCM will enable SDG&E to identify potential issues in the system sooner, as compared to patrols or a system with fewer monitor points, and potentially resolve those issues before they become an incident. This can include dig-in detection and response, over/under pressure awareness and response, as well as increased flexibility to respond to the varying demands on the system throughout the year. Increased remote control also alleviates employee exposure to operating equipment prior to, during, or after an incident. The CCM overall decreases the consequences of system incidents by allowing the gas system to react faster to incidents with fewer human asset involvement in potentially hazardous conditions. SoCalGas tracks many sets of data that could

ID	Control/Mitigation Name	RSE Exclusion Rationale
		be used to quantify partial aspects of the CCM, such as response time to incidents, valve closure times, over/under pressure events, dig-in responses, SCADA installations/repairs, capacity analysis, etc.; however, in terms of an RSE, no singular data set or combination thereof can be used to appropriately and accurately quantify the decrease in the likelihood or consequence of a medium pressure system incident due to the CCM. Likewise, no SME input could be determined that could quantify a decrease in the number of system incidents attributable to the installation of the CCM.
C18	Gas Public Safety Communications	Educating the public regarding identification of potentially hazardous conditions involving the gas system is a prudent safety measure taken by the Company. It shows responsibility and high ethical value to customers and the public that exists around the gas infrastructure. SDG&E possesses data and metrics around these programs such as the number of communications issued annually, the likelihood or consequence of a medium pressure system event to the public and by what means; however, no data exists, internally or externally, to explicitly tie the reduction in likelihood and consequence of a medium pressure system incident. Additionally, no SME input exists to quantitatively frame the effect to medium pressure incidents from educating the public about the infrastructure and appliances.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the risk control and mitigation plan for the Medium Pressure Incident risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this risk control and mitigation plan also took into account modifications to the plan and constraints, such as budget and resources.

A. A1: Post-training Follow-up Field Evaluation

SDG&E considered an alternative that would provide new field Service Technicians and Meter Service Persons with a follow up field evaluation six months after being released from formal training. This evaluation would determine whether these new employees continue to follow the safety policies and procedures established during their formalized training. Any deficiencies in an employee's performance would be addressed on an individual basis and follow up training would be scheduled to remediate any issues. This alternative was not implemented because employees currently participate in annual reviews of safety- and risk-related policies and procedures (*e.g.*, Gas standards, monthly defensive driving training, ergonomic training, bi-weekly safety meetings, etc.). SDG&E employees attend week-long compliance/refresher training that covers pertinent policies, addresses Field QA findings and review recent incidents to help mitigate risk. At SDG&E, there is also no set time period to start QA inspections on new employees. When issues are found they are coached by the direct supervisor, which can lead to field rides by the Supervisor, Appliance Mechanic, Field Instructor, Instructor or QA Inspector. Thus, this alternative seemed unnecessary and would also result in additional costs.

B. A2: Soil Sampling Program

SDG&E considered expanding its collection of soil property information. SDG&E collects soil properties (rocky, clay, sandy) during excavations and repairs along its pipelines. These soil properties are an element within the relative risk models used for prioritization process of the vintage replacement program for plastic. Expanding the collection of soil properties beyond leak repair excavations may allow SDG&E to further refine its replacement efforts. The cost estimate of sampling the over 5,900 miles of medium pressure distribution pipe is $12.2 million; on average, 14 samples per day would be tested at intervals of two samples per mile. SDG&E decided to not include this mitigation as part of the control and mitigation plan because the overall assessment of the risk it would address is ongoing. As the risk assessment continues to mature for the corrosion threat, the benefit of additional information will enable this potential mitigation to be better understood. In the interim SDG&E will be researching available data sets and determining the benefit of additional granularity.

Table 8: Alternate Mitigation Plan - Recorded and Forecast Dollars Summary[31]
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Post-training Follow-up Field Evaluation	-	-	14	20
A2	Soil Sampling Program	-	-	3,690	5,330

Table 9: Alternate Mitigation Plan - Units Summary

ID	Alternative Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 (Low) O&M	TY 2024 (High) O&M
A1	Post training follow-up field evaluations	No. of evaluations		-	-	32	46
A2	Soil Sampling Program	No. of soil samples		-	-	3,544	5,119

Table 10: Alternate Mitigation Plan - Quantitative Analysis Summary
(Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
A1	Post Training Follow-up Field Evaluations	101.42	5.97	606	1.1
A2	Soil Sampling Program	101.38	5.97	606	0.019

[31] 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. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Appendix A: Summary of Elements of the Risk Bow Tie

Medium Pressure Incident: Summary of Elements of the Risk Bow Tie

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
C1	Cathodic Protection Program – O&M	DT.1, DT.4, DT.5 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C2	Cathodic Protection Program – Capital	DT.1, DT.4, DT.5 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C3	Piping in Vaults Replacement Program	DT.1, DT.2, DT.3, DT.4 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C4	Regulator station, Valve, and Large Meter Set Inspections	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C5	Regulator Station Replacements	DT.1, DT.2, DT.3, DT.4, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C6	Leak Repair	DT.1, DT.2, DT.3, DT.5, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C7	Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol	DT.1, DT.2, DT.3, DT.5, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C8-T1	Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage)	DT.1, DT.2, DT.4, DT.5, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C8-T2	Underperforming Steel Replacement Program (1934-1965 vintage).	DT.1, DT.2, DT.4, DT.5, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C8-T3	Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage).	DT.1, DT.2, DT.4, DT.5, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C9-T1	Early Vintage Program (Components) - Oil Drip Piping Removal	DT.1, DT.2, DT.3, DT.4, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C9-T2	Early Vintage Program (Components) - Dresser Mechanical Coupling Removal	DT.1, DT.2, DT.3, DT.5, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C9-T3	Early Vintage Program (Components) - Removal of Closed Valves between High/Medium Pressure Zones.	DT.1, DT.2, DT.5, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C10	Code Compliance Mitigation	DT.1, DT.2, DT.3, DT.5, DT.6 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C11	Gas Distribution Emergency Department	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C12	Cathodic Protection System Enhancements	DT.1, DT.4, DT.5 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C13	Human Factors Mitigation – Gas Handling	DT.1, DT.4, DT.5, DT.6, DT.7 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C14	Human Factors Mitigation – Operator Qualification Training and Certification	DT.1, DT.4, DT.5, DT.6, DT.7; DT.8 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C15	Human Factors Mitigation – QA/QC Program - Mandated Compliance Activities	DT.1, DT.4, DT.5, DT.6, DT.7 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C16-T1	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIPP)	DT.2, DT.4, DT.6, DT.7 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
C16-T2	DIMP –Replace Balance of CP Daisy Chained Services.	DT.1, DT.4 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C17	CCM Distribution Field Asset Real Time Monitoring and Control Site Installations / Upgrades & New Control Room Technologies	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6 PC.1, PC.2, PC.4, PC.5, PC.6
C18	Gas Public Safety Communications	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C19	Field and Public Safety	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C20	Natural Gas Appliance Testing (NGAT) or Carbon Monoxide Testing	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C21	CSF Quality Assurance (QA) Program	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M1	Safety Control Valves	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M2	Cathodic Protection System Enhancements – Real Time Monitoring	DT.1, DT.4, DT.5 PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M3	Replace Curb Valves with EFVs	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

APPENDIX B: QUANTITATIVE ANALYSIS SOURCE DATA REFERENCES

Appendix B: Quantitative Analysis Source Data References

The Settlement Decision directs the utility to identify potential consequences of a risk event using available and appropriate data.[32] The list below provides the inputs used as part of this assessment.

Annual Report Mileage for Natural Gas Transmission & Gathering Systems
- Agency: Pipeline and Hazardous Materials Safety Administration
- Link: *https://www.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-natural-gas-transmission-gathering-systems*

Link: Annual Report mileage for Gas Distribution Systems
- Agency: Pipeline and Hazardous Materials Safety Administration
- Link: *https://www.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-gas-distribution-systems*

Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data
- Agency: Pipeline and Hazardous Materials Safety Administration (PHMSA)
- Link: *https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data*

San Diego Gas & Electric Medium-pressure Pipeline miles
- Source: 2020 internal SME data

San Diego Gas & Electric annual leakage data, 2012-2017 data according to material

San Diego Gas & Electric overpressure/underpressure data

San Diego Gas & Electric quality assurance program internal data, 5 years aggregated error data

San Diego Gas & Electric inspection data – Bridge and span inspections, pipeline patrols, unstable earth inspections

United States Census Bureau Quick Facts
- Agency: United States Census Bureau
- Link:*https://www.census.gov/quickfacts/fact/table/US/PST045219*

Gas industry sales customers
- Agency: AGA (2016Y)
- Link: *https://www.aga.org/contentassets/d2be4f7a33bd42ba9051bf5a1114bfd9/section8divider.pdf*

SoCalGas end user natural gas customers

[32] D.18-12-014, Attachment A at A-8 (Identification of Potential Consequences of Risk Event).

- Source: SNL (2016Y, from the FERC Form 2/2-F, 3/3-A or EIA 176)
- Link: *https://platform.mi.spglobal.com/web/client?auth=inherit&newdomainredirect=1&#company/report?id=4057146&keypage=325311*

Real Estate Property Costs

- Agency: National Association of Realtors
- Link: *https://www.nar.realtor/research-and-statistics/housing-statistics/county-median-home-prices-and-monthly-mortgage-payment*

Risk Assessment and Mitigation Phase Cross-Functional Factor

(SDG&E-CFF)

Introduction

May 17, 2021

TABLE OF CONTENTS

CROSS-FUNCTIONAL FACTOR: INTRODUCTION

I. INTRODUCTION

SDG&E's inclusion of this cross-functional factor (CFF) Volume is similar to the cross-cutting factors first presented by PG&E in their 2020 RAMP submission, providing additional information regarding foundational, safety-related initiatives that are associated with more than one RAMP risk. In response to feedback received, the Companies created the CFF volume to address some of the various topics raised by parties that would not be standalone risk chapters. The CFFs provide this information in chapter format for ease of presentation, rather than dispersing it throughout the RAMP Report.

SDG&E's CFF Volume comprises the following eight chapters:

A. CFF-1: Asset Management

Asset Management is an enterprise-wide framework that provides a standardized approach for managing risk and safety across assets and activities. The framework integrates people, processes, data, and technology to enable data-driven decision making through governance, strategy, data consolidation and analytics, and continuous improvement. The Asset Management CFF therefore spans multiple lines of business and helps address several RAMP risks in this Report.

B. CFF-2: Climate Change Adaptation, Energy System Resilience, and Greenhouse Gas Emissions

Climate Change Adaptation, Energy System Resilience, and GHG Emissions are being introduced as CFFs due to the influence they may have on certain RAMP risks. The nature of these CFFs and the activities associated with them are not easily quantified with respect to measuring their effects on particular RAMP risks. However, these factors are discussed by SDG&E because of their significance and to share SDG&E's policies and activities in looking at ways to mitigate certain RAMP risks.

C. CFF-3: Emergency Preparedness and Response and Pandemic

SDG&E's Emergency Preparedness & Response (EP&R) and Pandemic is included in the 2021 RAMP as a CFF to describe how SDG&E's Emergency Management Department coordinates the emergency preparation and emergency operations of several internal departments and external agencies, and to describe the many activities initiated by different groups responded to the COVID-19 Pandemic. EP&R activities include planning, training, exercising, and

supporting responses and recovery efforts related to incidents, emergencies, disasters, and catastrophes. These provide a high level of safety through informed decision-making and improved responders' competency and confidence of responders across all operational areas. COVID-19 introduced several pandemic-related activities in 2020, with many of them carrying into and beyond 2021. While future pandemics are unpredictable, the applicable departments will implement the processes and procedures that were identified and refined during COVID-19 if similar events occur in the future.

D. CFF-4: Foundational Technology Systems

Foundational Technology Systems is included in the 2021 RAMP as a Cross Functional Factor due the criticality and necessity of providing SDG&E stable technology platforms. These foundational technology systems are used in every aspect of operations, customer engagement, and emergency response. Included are a significant portion of the Companies' software application systems, communication networks, monitoring systems, end-user systems, and hardware and software platforms hosted in the Companies' data centers and on internal and external cloud platforms. The safety and reliability of operations depends on Foundational Technology Systems; thus, it is critical for these systems to be resilient and recoverable to allow focus on mitigating risks.

E. CFF-5: Physical Security

Physical security encompasses the systems and activities that maintain the safety of employees, contractors, vendors, the public, SDG&E facilities, and infrastructure, through people, processes, and technology. Having a strong physical security program is foundational to many of our RAMP risks.

F. CFF-6: Records Management

Inadequately maintained records can have impacts on employee and public safety as well as reliability. For example, safety protocols must be followed in day-to-day operations, and if there are inadequate documents for asset operations or inaccurate operational systems integrity documents being relied upon, the safety repercussions can be detrimental. The presentation of Records Management as a CFF is to highlight the role that adequately maintained records, embedded within many of the RAMP risk controls and mitigations, may have in contributing to the company's overall safety and reliability.

G. CFF-7: Safety Management Systems (SMS)

Established in 2020, SDG&E's current Safety Management System (SMS) is a systematic, enterprise-wide framework to manage and reduce risk and promote continuous improvement in safety performance through deliberate, routine, and intentional processes. Safety is a core value at SDG&E, and its safety-first culture focuses on its employees, customers, and the public, and is embedded in every aspect of the Company's work. The SMS implements Five Pillars of Safety[1] to focus on both individual safety behaviors and process safety management. The Five Pillars of Safety are: (1) People Safety, (2) Asset Management, (3) Gas and Electric Operations, (4) Risk Identification and Management, and (5) Emergency Preparedness and Incident Response. Given the impact and reach of the SMS, it is included as a CFF.

H. CFF-8: Workforce Planning/Qualified Workforce

SDG&E endeavors to maintain a workforce with the proper skills and experience in order to execute work in a manner that's safe to both employees and the public. In order to accomplish that goal, SDG&E utilizes a decentralized workforce planning model whereby each department plans for its current and future resource needs and also identifies the necessary training that goes with those needs. This decentralized model is assisted by the Human Resources Organizational Effectiveness (OE) department that works with various operating departments to not only implement leadership training, but also to assist in developing and maintaining a skilled, safe, and qualified workforce. Workforce Planning/Qualified Workforce is "cross-functional" in that the activities and support provided by OE are built into many of the controls and mitigations associated with the RAMP risks.

[1] Refer to Figure 1 within SDG&E's SMS Cross Functional Factor Chapter (CFF-7).

Risk Assessment and Mitigation Phase

Cross-Functional Factor

(SDG&E-CFF-1)

Asset Management

May 17, 2021

TABLE OF CONTENTS

CROSS-FUNCTIONAL FACTOR: ASSET MANAGEMENT

I. INTRODUCTION

This Asset Management Cross-Functional Factor (CFF) Chapter describes how Asset Management activities impact the risks described in SDG&E's Risk Assessment Mitigation Phase (RAMP) risk chapters.

SDG&E is presenting CFF information in this RAMP Report to provide the Commission and parties additional information regarding the risks and mitigations described in its RAMP risk chapters. CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities or programs that may impact multiple RAMP risks. CFFs are also generally foundational in nature. Therefore, SDG&E's CFF presentation differs from that of its RAMP risk chapters (*e.g.*, no risk spend efficiency calculations or alternatives are provided). SDG&E's CFF chapters provide narrative descriptions of the CFF projects and programs that impact multiple SDG&E's RAMP risk chapters through the 2022-24 time frame. Related cost forecasts are provided as available, consistent with an expected test year (TY) 2024 general rate case (GRC) request.

As described below, Asset Management is an enterprise-wide framework that provides a standardized approach for managing risk and safety across assets and activities. The Asset Management CFF therefore spans multiple lines of business and helps to mitigate several RAMP risks in this Report.

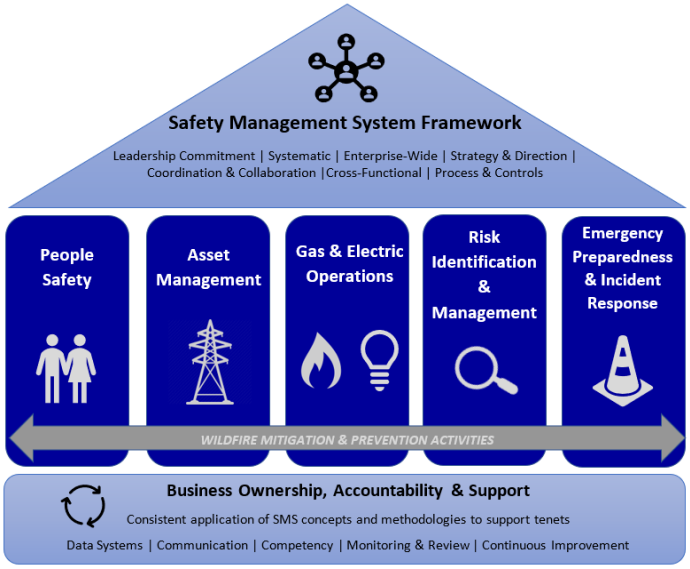
II. OVERVIEW

The SDG&E Asset Integrity Management (AIM) program, driven by the Asset Management organization, advances the development and implementation of a comprehensive, sustainable and risk-informed Asset Management System (AMS), encompassing people, process, data, analytics and technology. The AIM program builds the AMS to conform with ISO 55000, an international standard that specifies the requirements (ISO 55001) and application (ISO 55002) for establishing, implementing, maintaining, and improving a holistic AMS. The AMS is aligning with this standard to support regulatory direction on safety, wildfire mitigation, and electric system resilience and to reinforce an integrative approach to electric assets for governance, strategy, analytics, and continuous improvement. SDG&E's strategic aspirations for the AMS include enhanced asset safety, improved performance and measurement, risk-informed decision making, demonstrated compliance, and improved efficiencies and effectiveness of asset

utilization and operations. A comprehensive AMS, which includes process improvements, data analytics and system solutions, enables the following capabilities for SDG&E:

- Establishing an AMS provides an internal framework that supports SDG&E's optimal balancing of asset cost, asset risk, and asset performance, by making safe and effective management of its physical assets a core business function;
- Following ISO 55000 (a proven benchmark) leads to greater internal consistency across asset groups and repeatable and transparent business and asset management processes;
- The ISO 55000 framework promotes significant alignment across the organization and build "line of sight" to ensure employees at all levels fully understand their role in supporting the goals of the organization, at the top of which is safety;
- The access to and integration of data throughout the asset life cycle to develop asset health and risk index for critical assets supports risk-informed decision-making and advances SDG&E maturity from performing descriptive analytics to more predictive;
- Supports capital investment prioritizations and risk reduction strategies; and
- Prioritizes investment decisions across the portfolio of company assets, providing information to determine the cost and risk reduction programs.

SDG&E's AMS serves as a direct link to risk mitigation by using identified and prioritized enterprise risks to inform asset management strategic and long-term risk planning. Additionally, the implementation of ISO 55000 standards not only supports but enhances SDG&E's enterprise Safety Management System (SMS) framework, whereby operating assets are managed as an element of enterprise safety. The figure below illustrates the SMS framework with Asset Management as one of the core pillars.



Additional information on SMS and associated programs are outlined in SDG&E's SMS CFF Chapter. Alignment with international and industry standards furthers the Company's continued adherence to best practices and continuous improvements across risk and safety initiatives. SDG&E's implementation of an AMS that aligns with the ISO 55000 standard is characterized as a systematic and coordinated set of governing practices and activities to manage information about assets and asset systems, enabling better investment decisions in alignment with the Company's strategic values.

The integrated governance of SDG&E's AMS reinforces safety as our highest priority and promotes prudent and effective planning and managing our long-lived network of assets, in accordance with the service levels our customers value. It also effectively positions SDG&E to navigate current changes in the energy environment and to influence future change. This asset management initiative is directly aligned with and is a critical extension of SDG&E's enterprise risk management program and is a key component of managing asset safety across the Company. Developing a holistic enterprise for AMS is a multi-year effort and will continue to evolve and mature over time. SDG&E's current approach is focused on electric distribution and transmission operations but will be expanded into other operational areas, including gas, in future years. To date, the AIM program has achieved several milestones, all of which are ISO 55000 requirements:

Governance and Organizational Structure

- Development of organizational structure including executive oversight, asset management governance, program leadership, asset class owners and managers, implementation and support leaders, and subject matter experts;
- Determination of asset classes and identification of critical asset types within each class based on risk assessments;
- Development of asset management policy and integrated electric strategy;
- Completion of the Asset Management Plans (AMPs), operational plans for risk and life-cycle management of the electric distribution, transmission and substation assets;
- Establishing an AIM Operating Model, which is a process flow that leads and facilitates development of the strategic documents that define program governance, overarching standards and strategy for a sustainable AMS and integrated asset management plan implementation, in alignment with ISO 55000 standards. The AIM Operating Model includes the asset management framework, capabilities, and accountability needed to effectively adopt the asset management culture in the organization;
- Enhancement of organizational asset management capabilities leveraging existing engineering and risk methodologies and other maturing business proficiencies, and assessment and assignment of roles and responsibilities required for organizational development and implementation of the AIM program; and
- Development of high-level asset management processes and identification of sub-processes for integrated governance, strategy, analytics and performance evaluation.

Asset Data Integration and Analytics

- Initial development of alternative replacement strategy analyses and asset health indices for certain critical assets;
- Assessment and design of information systems needed to support electric asset management; and
- Development and implementation of information system solutions development for data integration, asset performance analytics and portfolio optimization.

Performance Measurement and Decision Making

- Development of an initial value framework utilizing strategic value drivers and determining value-based metrics for quantitative capital investment valuation and assessment of risk mitigation benefits of electric system projects; and
- Compilation of asset-related operational and performance metrics for consistent and comprehensive reporting and performance evaluation of the AMS for continuous improvement.

III. ASSOCIATED RISK EVENTS

Asset Management projects and programs are indirectly assessing and mitigating SDG&E's RAMP risks identified in chapters such as SDG&E-Risk-1, Wildfires Involving SDG&E Equipment (Including Third Party Pole Attachments) and SDG&E-Risk-2, Electric Infrastructure Integrity. The Asset Data Governance and Records Management program described below directly supports the risks identified in SDG&E-CFF-6, Records Management.

IV. 2020 PROJECTS AND PROGRAMS

A. Asset Integrity Management Program

In 2017, SDG&E began the implementation of its AIM program, aligning asset management functions and strategies across electric system operations and implementing an integrated and comprehensive asset management program in accordance with ISO 55000. As part of this alignment, SDG&E has been focused on setting the groundwork for organizational change and establishing the foundation to integrate ISO 55000 principles across electric operating units. The program has been focused on developing an Operating Model and AMP that align the various functional areas of risk, electric planning and operations, financial planning, asset management and portfolio management.

The AIM Operating Model is a process flow designed for electric system projects that outlines the different capabilities to lead and facilitate development of the strategic documents that define the program governance, overarching standards, and strategy for a sustainable asset management system and integrated asset management plan implementation in alignment with ISO 55000 standard. The operating model harmonizes with current company programs through alignment of objectives and leadership support, promoting assurance through risk-informed performance evaluation for continual improvement and focusing on greater asset utilization value. The AIM Operating Model also assists in the strategic development of asset strategies to

promote cross-functional alignment, consistency and/or an integrative approach with engineering and operations business units, the Wildfire Mitigation Program, and the Asset Management, Enterprise Risk Management (ERM), and Capital Portfolio Management organizations as they relate to regulatory filings.

The AMP is a governance document that provides a present-day overview of an asset class and its life cycle. The AMP provides transparency in identifying critical assets and replacement strategies and addresses performance and risk. Additionally, it captures the capital and operating expenses required in sustaining asset performance for electric assets. In future iterations as part of continuous improvement, the AMPs will serve as operational plans for risk and life-cycle management of the electric system assets.

These initiatives directly support alignment with ISO 55000 by establishing systematic and coordinated activities and practices through which an organization optimally and sustainably manages its assets and asset systems and their associated performance, risks and expenditures over their life cycles. Over the next several years, SDG&E anticipates implementing the AIM program enterprise-wide, operating under a comprehensive, sustainable, and risk-informed asset management system, and continually evolving the asset management system. The AIM program will continue the asset management system implementation for electric transmission, substation and distribution business segments through 2021 to 2022. Planning and implementation design for other assets supporting the electric system infrastructure will be in focus thereafter.

1. Asset Investment Prioritization

Because safety is the company's highest priority, the Asset Management organization is incorporating a multi-dimensional value framework for evaluating investments through a data-driven, quantitative, risk- and safety-based lens. This value framework utilizes the Company's strategic values and determines standardized value-based metrics to quantitatively compare projects, thereby enhancing the company's ability to cross-prioritize across the Company's portfolio and optimize investment decisions, including wildfire mitigation investments, while effectively spending ratepayer funds.

Since 2019, the Asset Management organization has embarked on a cross-functional project of streamlining an end-to-end process on investment prioritization and allocation. SDG&E is implementing a software solution in phases to improve investment prioritization capabilities. The purpose of this software solution implementation project is to develop business

processes and a system for capital investment optimization using an objective, risk-informed value framework. The first phase focuses on the initial value framework development for the electric system capital investments. The completion of this preliminary value framework in 2020 for electric system projects evaluates the benefits and costs of capital projects in terms of Safety, Reliability, Financial and Stakeholder Satisfaction attributes. This value framework will also serve as a foundation to build upon for other asset-intensive capital investments and eventually evolve to enterprise-wide value framework. The 2021 focus is the next phase of the software solution implementation project, which includes extending adoption across the different electric system projects in SDG&E's portfolio. Subsequently, other assets supporting the electric system infrastructure will be included in the multi-year phased implementation to achieve enterprise-wide investment prioritization and optimization.

B. Asset Data Systems & Records Management

Two centralized teams were formed within SDG&E's Asset Management organization to develop and implement a holistic and sustainable AMS for electric infrastructure assets with an integrative approach for governance, strategy, analytics and continuous improvement. Over the past year, the Asset Management organization addressed the dynamic electric system and collaborated with additional departments and subject matter experts to evaluate all electric assets and initiate the development of an Enterprise Asset Management data foundation and an Asset Investment Prioritization tool. This collaboration and development of enhancements to tools as well as databases will allow SDG&E to further expand its capabilities and improve the development of programs.

1. Enterprise Asset Management Data Integration

Beginning in September 2019, SDG&E developed tools and solutions allowing for more robust and comprehensive ways to manage electric asset data records. With the focus on electric distribution data systems, the team has been developing an asset data lake that aggregates critical asset data from multiple disparate sources systems from across the company that reside within each business unit and consolidate into per asset class views in a centralized repository for poles, overhead conductors, underground cables, and underground tee connectors. The development of these tools includes data engineering, integration, statistical and advanced analytics models and identification of data gaps. Consolidating asset data into a centralized repository enables

business units to utilize the data in a uniform and consistent manner and provides the ability to run advanced analytics on top of the data.

2. Data Analytics

Predictive machine learning models have been built on top of the centralized repository using geographic, nameplate, inspection, maintenance, and failure data to understand asset health and risk at an individual asset level. Ultimately, the asset health and risk scores are used to prioritize maintenance and replacement activities and stay informed on situations that might lead to potential outages or failures. Collection of this asset data also allows for long term planning on asset health to support capital investment prioritizations and risk reduction strategies. SDG&E has started to use the asset health scores to scope hardening work in the High Fire Threat District and to drive proactive maintenance and replacement of the distribution system. Understanding risks at a system level through asset health and risk indices will be adopted by a wide range of engineering and operations business units to generate projects and programs and to serve operational needs. Work in 2021 and beyond will be focused on integrating the available data into the business units' processes, policies, and procedures.

V. 2022-2024 PROJECTS AND PROGRAMS

A. Asset Integrity Management Program

The Asset Integrity Management Program will expand Operation Model activities to encompass the Distribution, Gas, IT and Fleet assets, creating cross-functional alignments between the respective accountable business units such as ERM, Asset Management, Engineering and Operations and Capital Portfolio Management as they relate to the Wildfire Mitigation Plan and/or other regulatory filings. The Asset Management Plans will expand to include Gas, IT, and Fleet asset management capturing the capital and operating expenses required in sustaining asset performance.

To further operationalize the AMS, the AIM program will also focus on developing the other key operating model capabilities, including performance evaluation, internal audit, and continuous improvement of the AMS. The performance evaluation capability will create business processes around identifying objectives and key performance indicators, determining action plans to monitor the effectiveness of the AMS, and documenting performance for management reporting. The management audit capability will establish business processes of verifying the effectiveness of the AMS and reporting on recommended corrective or

improvement actions. The continuous improvement capability will produce business processes on developing the approach and collaboration to address the recommended corrective or improvement actions. The efforts in developing these capabilities further reinforces the alignment with the enterprise SMS framework.

1. Asset Investment Prioritization

Throughout the next couple of years, SDG&E's goal is to extend Asset Investment Prioritization development and the software solution implementation across the enterprise, including Gas, IT, and Fleet assets, starting with a gap assessment of existing plans and processes.

2. Asset Data Systems & Records Management

Asset Data Systems & Records Management ongoing activities will continue for 2022-2024 with currently engaged business units and expansion into other areas of the business. The key objectives are to continue alignment and integration of asset information across various functional areas to enable data-driven, risk-informed initiatives, supporting capital investment priorities and advance asset data intelligence, integration and analytics.

3. Enterprise Asset Management Data Integration

SDG&E will spend the next few years continuing to build upon the data lake that was initiated in 2019, by integrating more asset types from various business units. The initiative includes identifying critical asset data from multiple disparate source systems and integrating the information into a single platform. The objective is to continue expanding the initiative across the company to provide a tool for decision support of capital and Operations & Maintenance (O&M) and replacement strategies, including health scores, criticality, probability of failure, risk, and visualization.

4. Data Governance and Records Management

SDG&E will build upon current asset data activities by forming a governing structure to oversee, monitor, and control the management of asset information. This includes the efforts to create asset information traceability and establish records management processes to identify data gaps, validate data quality, and perform data remediation.

Asset data governance will also include the development of asset data maturity metrics. Asset data maturity metrics will support the monitoring, controlling, and reporting of data sets and will measure how data quality progresses to an advanced state, for reporting purposes. Data

maturity metrics will be developed for each asset type and will be based on unique sets of data quality priorities established by subject matter experts.

By implementing an asset data governance structure, SDG&E will mitigate the safety and reliability risks associated with incorrect or incomplete asset records by dedicating proper resources to oversee information management of asset data.

5. Data Analytics

Predictive machine learning models and asset health and risk scores will continue to be developed for additional electric system assets and will be used to prioritize maintenance and replacement activities and to stay informed on situations that might lead to potential outages or failures. Near-term efforts will continue focus on Electric System Hardening in the High Fire Threat District and Electric Distribution Engineering. Additional business units will be added incrementally.

VI. COSTS

The table below contains the 2020 recorded and forecast dollars for the programs and projects discussed in this CFF. The dollars included in the table below duplicate dollars that are also reflected in the Wildfires Involving SDG&E Equipment (SDG&E-Risk-1) and Foundational Technology Systems (SDG&E-CFF-4) Chapters.

Costs (Direct After Allocations, in 2020 $000)[1]

Line No.	Description	Recorded		Forecast			
		2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
1	Asset Integrity Management (AIM)	4,000	473	25,000	35,000	1,200	1,500
2a	Asset Data System & Records Management (Gov, Quality, Rec Mgt)	72	79	2,700	3,300	400	700
2b	Asset Data Syst & Rec Mgmt (Data Integration)	11,923	150	19,800	24,200	350	500
3	AIMDAT (Data Analytics)	373	200	1,900	2,400	450	600

[1] Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are in 2020 dollars and have not been escalated in forecasts beyond 2020.

Risk Assessment and Mitigation Phase Cross-Functional Factor

(SDG&E-CFF -2)

Climate Change Adaptation, Energy System Resilience, and Greenhouse Gas Emission Reductions

May 17, 2021

TABLE OF CONTENTS

CROSS-FUNCTIONAL FACTOR: CLIMATE CHANGE ADAPTATION, ENERGY SYSTEM RESILIENCE, AND GREENHOUSE GAS EMISSION REDUCTIONS

I. INTRODUCTION

This Cross-Functional Factor (CFF) Chapter describes how activities related to Climate Change Adaptation, Energy System Resilience, and Greenhouse Gas (GHG) Emission Reductions impact the risks described in SDG&E's Risk Assessment Mitigation Phase (RAMP) risk chapters.

SDG&E is presenting CFF information in this RAMP Report to provide the Commission and parties additional information regarding the risks and mitigations described in its RAMP risk chapters. CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities or programs that may impact multiple RAMP risks. CFFs are also generally foundational in nature. Therefore, SDG&E's CFF presentation differs from that of its RAMP risk chapters (*e.g.*, no risk spend efficiency calculations or alternatives are provided). SDG&E's CFF chapters provide narrative descriptions of the CFF projects and programs that impact multiple SDG&E's RAMP risk chapters through the 2022-24 time frame. Related cost forecasts are provided where available, consistent with an expected test year (TY) 2024 general rate case (GRC) request.

As described below, Climate Change Adaptation, Energy System Resilience, and GHG Emissions can significantly impact particular RAMP risks, in that they can impact the likelihood or the consequence of an event. Climate Change Adaptation, Energy System Resilience, and GHG Emissions are not easily quantified with respect to measuring their effects on particular RAMP risks or measuring alternate approaches in order to calculate risk spend efficiency (RSE). Below, SDG&E describes the significance of Climate Change Adaptation, Energy System Resilience, and GHG Emissions issues and related SDG&E activities intended to mitigate certain RAMP risks and enhance safety.

II. OVERVIEW

A. Climate Change Adaptation

SDG&E recognizes the need to ensure safety and reliability of its services to customers and to adapt to weather- and climate-related threats to its system. The National Oceanic and Atmospheric Administration (NOAA) website states that 2020 holds the record of having the

most weather/climate events with 22 events with losses exceeding $1 billion each.[1] SDG&E is deeply committed to building safety and reliability protections against the most pressing threat of wildfire as well as the threat of other climate hazards expected to impact the region, with the same innovative and community-centric approach that SDG&E has pursued and will continue to pursue to mitigate the threat of wildfire. Extreme weather conditions, extreme temperatures, sea level rise, and cascading impacts are only a few of the many climate hazards with both short- and long-term ramifications to the San Diego region.

Climate hazards are expected to increase the severity and frequency of adverse weather and other natural events and create or enhance risks to SDG&E's system as a result. In addition to the wildfire threat risk, which is exacerbated by climate change, the other climate hazards listed above can pose safety risks to SDG&E's service territory. For example, the threat of a rising sea level poses safety risks to coastal regions, and SDG&E's safety risks can come in the form of damaged assets in its coastal regions as well as extended outages due to damaged assets. Similarly, the increasing frequency of extreme winter weather in the United States due to climate change,[2] as exemplified by the February 2021 Texas freeze (Storm Uri),[3] supports the need for a resilient energy system, which, for SDG&E electric and gas customers, may be enhanced by existing SoCalGas storage assets and potentially other technologies in the future.[4]

Climate hazards impact different groups in our community in varying degrees. Communities that lack resources, are located in areas experiencing greater impacts, have a greater number of residents with underlying medical conditions, and/or lack certain services will

---

1 NOAA, National Centers for Environmental Information, *Billion-Dollar Weather and Climate Disasters: Overview, available at https://www.ncdc.noaa.gov/billions/*.

2 Nature Communications, *Warm Artic episodes linked with increased frequency of extreme winter weather in the United States* (2018) at 2, *available at https://www.nature.com/articles/s41467-018-02992-9.pdf*.

3 *See, e.g.*, ERCOT March 4, 2021 Letter to Texas Senate and Texas House of Representatives (providing a list of generators experiencing an outage or a reduction in available power during the extreme cold weather emergency affecting the Texas power grid that occurred on February 14-19, 2021), *available at http://www.ercot.com/content/wcm/lists/226521/ERCOT_Letter_Re_Feb_2021_Generator_Outages.pdf*.

4 *See* Western Interconnection Gas – Electric Interface Study Public Report (June 2018), a study that identified potential threats to grid reliability at present and in the future, *available at https://www.wecc.org/Reliability/Western%20Interconnection%20Gas-Electric%20Interface%20Study%20Public%20Report.pdf*.

continue to be more adversely affected by these events. To address these risks, equity (more specifically climate equity) should be kept front and center when crafting policy initiatives and partnering with community stakeholders, as SDG&E has emphasized in many recent interagency workshops.[5]

To build comprehensive mitigations to wildfire and other climate hazards, SDG&E has combined the best available science (and has spearheaded scientific development where it is lacking), cutting-edge situational awareness technology, integration of sustainability principles, and subject matter expertise dedicated to solving complex climate change-related issues. SDG&E has taken a path of bold action and extensive collaboration to respond to climate change impacts. For example, in late 2020, SDG&E released a Sustainability Strategy describing its efforts and projects to reduce GHG emissions, promote energy affordability and resilience, and create a more just and equitable future for our customers.[6] SDG&E aims to make its system more resilient to climate change for the benefit of customers, and in doing so, decrease the impacts of certain RAMP risks.

B. Energy System Resilience

Energy system resilience is "[the] system's ability to prevent, withstand, adapt to, and quickly recover from system damage or operational disruption."[7] The discussion below describes SDG&E's role in building and maintaining a resilient and reliable energy system in the face of infrequent extreme weather events driven by climate change and energy system transitions to clean and sustainable energy. This section will also discuss how climate equity and vulnerability perspectives inform energy system resilience, which affects all SDG&E customers.

In light of recent extreme weather events in other parts of the United States and other countries, the need for the energy system to withstand or quickly recover from a systemwide disruption is becoming clearer. There are many activities that impact energy system resilience,

---

[5] *See, e.g.,* Rulemaking (R.) 20-05-002, Order Instituting Rulemaking [OIR] to Review Climate Credit for Current Compliance with Statute and for Potential Improvements (May 7, 2020); *see* Comments of San Diego Gas & Electric Company (U 902 E) Responding to Administrative Law Judge (ALJ) Hymes' January 28, 2021 Ruling (February 12, 2021).

[6] SDG&E, *Building a Better Future* (SDG&E's 2020 Sustainability Strategy), *available at* https://www.sdge.com/sites/default/files/documents/SDG%26E%20Sustainability%20Report_0.pdf.

[7] American Gas Foundation, *Building a Resilient Energy Future: How the Gas System Contributes to US Energy System Resilience* (January 2021) at 2, *available at https://gasfoundation.org/wp-content/uploads/2021/01/Building-a-Resilient-Energy-Future-Full-Report_FINAL_1.13.21.pdf.*

and SDG&E does not discuss them all here. Rather, this section introduces the concept of Energy System Resilience as a cross-functional factor, provides some examples and exclusions, and leaves further discussion to a future proceeding or filing. SDG&E will discuss how the existing natural gas system provides resiliency benefits during extreme weather events in addition to the day-to-day benefits it provides the electric system. SDG&E will also discuss how longer-duration energy storage, capable of storing energy for more than 8 hours, for days or even for weeks, could help reduce or mitigate risks. Although microgrids provide resilience against wildfires, that topic is addressed in SDG&E's Wildfire Mitigation Plan and in the RAMP Wildfire Chapter (SDG&E-Risk-1), and therefore will not be repeated here.

The natural gas system supports SDG&E's ability to provide resilient, safe, and reliable service, particularly as climate change related events such as wildfires and extreme weather increase in frequency and duration, and as the electric grid becomes increasingly dependent on intermittent renewable resources to provide electric system capacity. Electric generation plants, fueled by the natural gas infrastructure system, provide substantial generating capacity to the electric grid at all times. Peaker plants are often only activated as resources when the electric grid is approaching (or is in a time of) peak demand, which often occurs during extreme hot weather events, such as the August 2020 event.[8] The natural gas system allows SDG&E to remain resilient to extreme weather events while transforming to support a clean energy future and state climate change goals. The natural gas system, if decarbonized to meet long-term environmental goals through renewable natural gas, non-GHG emitting fuels such as hydrogen, or using carbon capture, holds the potential to provide alternate energy to homes and businesses that have gas connections when the electric system is de-energized and to provide electric capacity through existing natural gas-fueled power plants when renewables are not sufficient to meet peak demand.

The natural gas system helps to reduce the frequency and occurrence of electric power shortages by fueling electric generation plants. Additionally, the natural gas system reduces the impact of an electric outage event by providing customers access to gas-fueled heating or cooking systems in their homes and businesses. During an electric outage, use of the natural gas

[8] California Energy Commission, *CAISO, CPUC, CEC Issue Final Report on Causes of August 2020 Rotating Outages* (January 13, 2021), *available at https://www.energy.ca.gov/news/2021-01/caiso-cpuc-cec-issue-final-report-causes-august-2020-rotating-outages*.

system helps customers better recover from certain risk events because the electric system may be dependent on intermittent renewable resources like solar or energy storage systems, like batteries that cannot be charged if the intermittent renewable resources are not available and not able to charge the energy storage systems. Impacts could also be exacerbated into the future as our transportation sector continues to electrify and become more reliant on intermittent electricity sources.

SDG&E is implementing long-duration energy storage, such as the Borrego Springs Green Hydrogen Project, that will provide additional support to ensure the grid remains resilient.[9] Energy storage at grid scale can help mitigate the effects of renewable intermittency and energy shifting by allowing SDG&E to absorb grid disturbances while also providing a buffering capability to alleviate grid constraints.[10] These energy storage projects will also play a central role in the rollout of future microgrids, which will provide communities with power to critical services during Public Safety Power Shutoff (PSPS) events and other extreme weather events. The CPUC is considering adding 1,000 MW of long-duration storage in addition to other resources as part of its mid-term reliability analysis,[11] and SDG&E will look for other opportunities to diversify the energy grid for reliability and resilience.

A diverse energy grid is critical to building a resilient energy system that provides equitable energy to all SDG&E customers. Climate equity is a combination of environmental justice and social equity, with the overarching goal of providing equitable access to the energy transition and climate resiliency regardless of race, national origin, income, or social status. While infrastructure is a major part of the energy resiliency conversation, it is important to implement strategies that do not create disparate impacts or produce unintended social consequences on customers or communities. Integrating community concerns into energy project planning will create stakeholder efficiencies and enhance the overall resiliency of the

9 *See* https://www.sdge.com/more-information/environment/sustainability-approach#hydrogen.

10 *See* SDG&E's 2020 Sustainability Strategy.

11. R.20-05-003 ALJ's Ruling Seeking Feedback on Mid-Term Reliability Analysis and Proposed Procurement Requirements (February 22, 2021) at 17, "For all of these reasons, this ruling proposes that at least 1,000 MW of geothermal resources and 1,000 MW of long-duration storage (defined as providing 8 hours of storage or more) be required to be part of the procurement required by no later than 2025."

energy system. Working together, these strategies will help SDG&E meet energy system resilience and state and regional climate goals.

Strategies that include available distributed energy resources (DER), flexible load management, and energy storage also provide the potential to alleviate some of the concerns around peak resource adequacy and climate-related extended power outages. Additionally, fuel cells may also alleviate concerns if fueled by renewable natural gas, by hydrogen, or by natural gas combined with carbon capture technologies. The turbines that provide power within the electric generation plants are capable of adapting to renewable natural gas and low-level blends of hydrogen with natural gas, or may be replaced with turbines that can use a pure hydrogen fuel, to provide firm power while lowering GHG emissions. Energy efficiency (EE) programs and conservation measures intended for customers who may not have the upfront capital for higher cost conservation measures can help reduce demand and alleviate load on the grid. Because not every customer has the ability or means to implement solar, energy storage, and/or vehicle electrification on their own, it is important for SDG&E to continue to support these areas so that all customers can receive the same benefits of a resilient energy system. EE technologies and other sustainable energy practices are critical to accommodating the increasing electrification of the transportation and building sectors and the additional load on the grid, while continuing to meet GHG emission reduction goals. All of these are options for the future to avoid electric outages and to promote energy system resilience.

Climate change is a driver for energy system resilience mitigations. In 2019, the CPUC issued a decision in the Climate Change Adaptation OIR,[12] to enhance utility preparedness for climate change and related hazards. The CPUC issued a second Climate Change Adaptation OIR decision in 2020, which requires California utilities to conduct climate change vulnerability assessments and to develop Community Engagement Plans (CEP).[13] The vulnerability assessments will be system-wide and will analyze all assets under the utility's control, as well as utility operations and services. SDG&E has already begun work on both of these initiatives. SDG&E anticipates this work will enhance energy system resilience, as well as contribute to building resilience across the San Diego region.

[12] R.18-04-019; D.19-10-054.

[13] D.20-08-046, Ordering Paragraph 5 at 120.

C. GHG Emission Reductions

In addition to investing in Climate Adaptation and Energy System Resilience to respond to climate change, SDG&E supports California's efforts to mitigate GHG emissions in the first instance. In support of California's goal of achieving carbon neutrality by 2045, SDG&E has set a goal to reach Net Zero GHG emissions by 2045 and has adopted a Sustainability Strategy to facilitate the integration of GHG emission reduction strategies into SDG&E's day-to-day operations and long-term planning.[14] While GHG emissions are the collective result of various global and local activities, this discussion focuses on local activities that are a driver of GHG emissions and how GHG emissions are also a consequence of various risk factors.

SDG&E's pledge to reach Net Zero GHG emissions includes Scopes 1, 2, and 3 GHG emissions (as defined by the U.S. Environmental Protection Agency),[15] which would eliminate not only SDG&E's own direct emissions (Scope 1), but also those generated by other companies' generation of power we utilize (Scope 2) and customers' consumption of energy (Scope 3). These strategies and commitments, along with others such as Virtual Power Plants, green hydrogen, and collaboration with regional partners, will align our business operations with local and state emission reduction targets.

Achieving California and SDG&E's 2045 GHG reduction goals requires a focus on mid-term milestones. To that end, SDG&E must explore opportunities to reduce the Scope 1 GHG emissions associated with its gas generation fleet by 2030 (without compromising reliability). In addition, SDG&E's plans to reduce emissions from the company's business operations includes a reduction in fugitive emissions from our natural gas transmission and distribution systems. By 2030, SDG&E expects to have electrified 100% of our light duty fleet and aims to have a 100% zero emission vehicle (ZEV) fleet by 2035.[16] In the near-term, SDG&E must also explore and

---

[14] SDGENews.com, *SDG&E's Commitment to Achieving Net Zero GHG Emissions by 2045* (March 22, 2021), *available at http://www.sdgenews.com/article/net-zero-ghg-emissions-by-2045#:~:text=On%20March%2023%2C%202021%2C%20SDG%26E,by%20customers'%20consumption%20of%20energy.*

[15] *See* United States Environmental Protection Agency, *Greenhouse Gases at EPA, available at* https://www.epa.gov/greeningepa/greenhouse-gases-epa. *See, e.g.*, SDG&E's 2020 Sustainability Strategy at 16, *(*A detailed description of SDG&E's scope emissions.).

[16] SDG&E's 2020 Sustainability Strategy at 19.

pursue opportunities to reduce Scope 3 emissions associated with customers' consumption of energy, which comprise more than 80% of SDG&E's emissions portfolio.

According to the City of San Diego, which makes up a significant proportion of SDG&E's service territory, the sources of GHG emissions in San Diego in 2018 were 55% transportation, 21% electricity, 20% natural gas, 3% solid waste, and 1% water and wastewater.[17] SDG&E's Sustainability Strategy and Net Zero pledge are intended to de-carbonize or to reduce the GHG emissions from these sectors in San Diego. Strategies for reducing these emissions are being implemented across our service territory and regional community. For example, the City of San Diego, County of San Diego, the Port of San Diego, San Diego County Regional Airport Authority, and over a dozen local municipalities have all issued climate action plans or sustainability plans that aim to reduce GHG emissions and decrease the negative impacts of climate change.[18] To align with our regional partners, SDG&E's Sustainability Strategy identifies opportunities for decreasing emissions in other sectors of the economy – not just the emissions associated with SDG&E's direct operations or customers' consumption of energy.[19] SDG&E's Sustainability Strategy demonstrates SDG&E's intention to collaborate with other regional stakeholders and to leverage resources to achieve the region's decarbonization goals. For example, SDG&E partners with the City of San Diego, the County of San Diego, and the San Diego Association of Governments (SANDAG) to reduce air pollution and GHG emissions through transportation electrification and through the Accelerate to Zero Emission Collaboration. These emissions from the transportation sector are not SDG&E's Scope 3 emissions, but they advance the region's climate goals and leverage our collective resources to accelerate transportation electrification. SDG&E is also exploring opportunities to partner with stakeholders to pursue pilot and demonstration projects that can accelerate an equitable energy

---

[17] The City of San Diego, *Climate Action Plan 2020 Annual Report Appendix* (2020) at 2, *available at https://www.sandiego.gov/sites/default/files/cap-2020-annual-report-appendix.pdf.*

[18] *See,* The City of San Diego, *Climate Action Plan & Our Climate, Our Future, available at https://www.sandiego.gov/sustainability/climate-action-plan*; San Diego County, *Climate Action Plan, available at https://www.sandiegocounty.gov/content/sdc/sustainability/cap.html*; and Port of San Diego, *Climate Action Plan, available at https://www.portofsandiego.org/environment/energy-sustainability/climate-action-plan*.

[19] *See* SDG&E's 2020 Sustainability Strategy.

transition.[20] Collective and collaborative efforts are necessary to reduce GHG emissions and achieve climate goals.

SDG&E is also investing in hydrogen systems to demonstrate the potential to provide longer-duration energy storage and other decarbonization benefits.[21] Hydrogen systems can store electricity generated from solar and other renewable resources and convert that energy back into electricity at a later time, when intermittent renewable resources are not available to serve customers. SDG&E is investigating the use of hydrogen for combustion purposes in existing natural gas burning electric generation plants, which would have the potential to reduce the GHG emissions from these electric generation plants. SDG&E is investigating hybrid gas and energy storage enhancements at existing electric generation facilities that could have the potential to reduce the GHG emissions from these specific electric generation plants. SDG&E is monitoring efforts in carbon capture at SoCalGas and across the industry to determine if carbon capture, utilization, or sequestration is suitable for reducing GHG emissions in SDG&E's operations. Additionally, SDG&E has committed to planting 10,000 trees annually to sequester carbon and support local biodiversity through the "Right Tree, Right Place" Program, which also mitigates the overall wildfire risk.[22] With the support of local partners, we are exploring other nature-based solutions in our region, consistent with California policy.[23] SDG&E is monitoring renewable natural gas and biomethane activities to determine if they would be suitable for reducing GHG emissions in SDG&E's operations, particularly in the natural gas system. SDG&E and SoCalGas are investigating the use of hydrogen produced from renewable energy resources as a fuel for natural gas compressors in the gas transmission system, which would reduce GHG emissions. SDG&E is also investing in renewable energy resources to assist in

---

[20] *See* California Energy Commission, *GFO-20-606 - Zero-Emission Drayage Truck and Infrastructure Pilot Project* (November 19, 2020), *available at https://www.energy.ca.gov/solicitations/2020-11/gfo-20-606-zero-emission-drayage-truck-and-infrastructure-pilot-project*. Although SDG&E was not successful in this proposal to fund the deployment of 50 zero-emission Class 8 cross-border regional haul trucks, SDG&E will continue to partner with regional stakeholders such as the San Diego Air Pollution Control District, local businesses, and community-based organizations and non-profits to pursue opportunities such as this one.

[21] *See* SDG&E's 2020 Sustainability Strategy at 8, 11, 42, and 53.

[22] *See* SDG&E's 2020 Sustainability Strategy at 11 and 26.

[23] *See* Executive Order N-82-20 (issued October 7, 2020), available at *https://www.gov.ca.gov/wp-content/uploads/2020/10/10.07.2020-EO-N-82-20-.pdf.*

powering several microgrids that are currently under construction in SDG&E's Wildfire Mitigation Plan and assessing whether microgrids could be reliably powered solely by non-GHG emitting resources.[24] And, for decades, SDG&E has been implementing energy efficiency programs that have saved customers millions of dollars, hundreds of gigawatt hours, and thousands of metric tons of GHG emissions.[25]

Scientific studies have shown that reductions in GHG emissions would mitigate climate change by reducing the frequency and impact of climate-related risk events.[26] SDG&E cannot quantify the link between the GHG emission reduction with the risk to life, safety, or the reduction in drivers to risk events like wildfires or other climate change events, because climate change is affected by GHG emissions worldwide. If SDG&E and SoCalGas were to completely eliminate GHG emissions, climate change would likely still be driven by GHG emissions in neighboring states, neighboring countries, and global GHG emissions from every other part of the world. Thus, if SDG&E and SoCalGas were to completely eliminate GHG emissions, there would be no clear way to quantify the resulting reduction in climate change risk events. While the risk reductions cannot be measured or quantified, SDG&E nevertheless recognizes the importance of pursuing activities that do, and for that reason has provided this information regarding CFF GHG emissions activities. At this time, SDG&E is reviewing costs for its Sustainability Strategy and will provide them in its GRC (or other) application, as applicable, but complete cost information is not currently available to be provided for this program. SDG&E is actively pursuing partnerships, grants, and other opportunities that may lead to non-ratepayer funding for sustainability initiatives.

III. ASSOCIATED RISK EVENTS

The table below shows how Climate Change Adaptation, Energy System Resilience, and GHG Emission Reductions present drivers, consequences, and/or mitigations to the safety risks described in RAMP Risk Chapters (listed in the far-left column).

---

[24] SDG&E 2020-2022 Wildfire Mitigation Plan Update (February 5, 2021) at 76-78, *available at https://www.sdge.com/sites/default/files/regulatory/SDG%26E%202021%20WMP%20Update%2002-05-2021.pdf.*

[25] *See* SDG&E's 2020 Sustainability Strategy at 36.

[26] Intergovernmental Panel on Climate Change, *Assessment Report 5 Synthesis Report, Climate Change 2014, Headline Statements, available at https://www.ipcc.ch/report/ar5/syr/.*

Risk Chapter/Cross Functional Factor	Climate Change Adaptation	Energy System Resilience	GHG Emission Reductions
SDG&E-Risk-1 Wildfires Involving SDG&E Equipment	Consequence	Mitigation, Consequence	Driver, Mitigation
SDG&E-Risk-2 Electric Infrastructure Integrity	Consequence	Driver, Mitigation	Mitigation
SDG&E-Risk-3 Incident Related to the High Pressure System (Excluding Dig-In)	Consequence	Driver	Mitigation
SDG&E-Risk-4 Incident Involving a Contractor	Driver	-	-
SDG&E-Risk-5 Customer and Public Safety – Contact with Electrical Equipment	-	-	-
SDG&E-Risk-6/SCG-Risk-6 Cybersecurity	-	-	-
SDG&E-Risk-7 Excavation Damage (Dig-In) on the Gas System	Consequence	-	Mitigation
SDG&E-Risk-8 Incident Involving an Employee	Driver	-	-
SDG&E-Risk-9 Incident Related to the Medium Pressure System (Excluding Dig-In)	Consequence	Driver	Mitigation

IV. 2020 PROGRAMS

A. Climate Change Vulnerability Assessment

SDG&E is engaged in a system-wide climate change vulnerability assessment that will assess all SDG&E assets, operations, and services to understand what current and future climate hazards pose threats. The assessment will examine three future time horizons, identify vulnerabilities, inform enhancements and investments in the system, and will consider a multitude of climate hazards, including, but not limited to, extreme temperature, extreme precipitation, sea level rise, and wildfire. This assessment is being conducted pursuant to a CPUC mandate (in D. 20-08-046) and will be developed through iterations on four-year cycles.

B. Scripps Institution of Oceanography

SDG&E is committed to having the best available science surrounding climate change to enhance decision-making abilities as well as provide better information to be used across the region. In pursuit of this goal, SDG&E has developed a partnership with Scripps Institution of Oceanography to learn more about what climate change will bring to the San Diego region. Currently, there are two key research projects underway, one focused on the impact of autumn rainfall on catastrophic wildfires as well as one studying coastal flooding impacts in San Diego Bay.[27]

C. Community Engagement Plan

Climate change will impact everyone in SDG&E's service territory in some way, but of particular concern are Disadvantaged Vulnerable Communities, as defined in the Climate Change Adaptation OIR's 2020 decision.[28] SDG&E is committed to doing what it can to promote equity in these communities by engaging with local jurisdictions and other non-governmental organizations on the topic of climate change adaptation. The Community Engagement Plan will be a guiding document outlining how SDG&E will engage with these communities and best practices for involving communities in decision-making and planning regarding utility climate change adaptation efforts.

---

[27] SDG&ENews.com, *SDG&E Partners with Scripps Institution of Oceanography to Expand Climate Change Research* (February 3, 2021), *available at http://www.sdgenews.com/article/sdge-partners-scripps-institution-oceanography-expand-climate-change-research*.

[28] D.20-08-046, Ordering Paragraph 1 at 119.

D. California Energy Commission (CEC) Grant Opportunities

SDG&E is a key partner in two climate-related CEC-funded research projects. This research will provide key information to SDG&E for climate change adaptation and advance climate science statewide. This research will be incorporated into California's Fifth Climate Change Assessment and future iterations of Cal-Adapt.

V. 2022-2024 PROGRAMS

The activities listed above will continue through 2024, and there are no other planned enhancements or activities.

VI. COSTS

The table below contains the 2020 recorded and forecast dollars for the programs and projects discussed in this CFF. 2020 Recorded dollars duplicate dollars that are also reflected in the Wildfire Chapter.

Costs (Direct After Allocations, in 2020 $000)[29]

Line No.	Description	Recorded		Forecast			
		2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
1	Scripps Institution of Oceanography Climate Research	N/A	$125*	N/A	N/A	$383**	$469**
2	Climate Change Vulnerability Assessment	N/A	$157*	N/A	N/A	$460**	$562**
3	Community Engagement Plan	N/A	$000*	N/A	N/A	$000	$000
4	CEC Grant Opportunities	N/A	$000*	N/A	N/A	$000	$000

Notes:
* 2020 spend captured in Wildfire Chapter & Wildfire Mitigation Memo Account (WMPMA).
** 2022-2024 spend will be captured in Climate Change & Vulnerability Assessment Memo Account (CAVAMA).

[29] Costs presented in workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are presented in 2020 dollars and have not been escalated in forecasts beyond 2020.

Risk Assessment and Mitigation Phase Cross-Functional Factor

(SDG&E-CFF-3)

Emergency Preparedness and Response and Pandemic

May 17, 2021

TABLE OF CONTENTS

CROSS-FUNCTIONAL FACTOR: EMERGENCY PREPAREDNESS AND RESPONSE AND PANDEMIC

I. INTRODUCTION

This Emergency Preparedness and Response (EP&R) and Pandemic Cross-Functional Factor (CFF) Chapter describes how EP&R activities impact the risks described in SDG&E's Risk Assessment Mitigation Phase (RAMP) Chapters and describes the activities initiated in 2020 in response to the COVID-19 pandemic.

SDG&E presents CFF information in this RAMP Report to provide the Commission and parties additional information regarding the risks and mitigations described in its RAMP Chapters. CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities, or programs that may impact multiple RAMP risks. CFFs are also generally foundational in nature. Therefore, SDG&E's CFF presentation differs from its RAMP risk chapters (*e.g.*, no risk spend efficiency calculations or alternatives are provided).

As described below, EP&R provides a standardized approach for managing risk and safety across assets and activities. The EP&R CFF spans multiple lines of business and helps to mitigate several RAMP risks in this Report. Also discussed below are the temporary and permanent activities SDG&E implemented in 2020 to address safety and health related issues associated with the COVID-19 pandemic and, as applicable, future public health issues.

II. OVERVIEW

A. Emergency Preparedness and Response

The Emergency Management Department (EM) facilitates SDG&E's EP&R activities. EM's programs and processes include planning, training, exercising, and supporting responses and recovery efforts related to incidents, emergencies, disasters, and catastrophes.

B. Pandemic

While SDG&E has taken an all-hazards approach to emergency management, the significance and impacts associated with the COVID-19 pandemic warranted a strategic approach to emergency preparedness. As new information has become available, SDG&E has modified and created mitigation strategies, internal policies, and workforce engagement efforts to remain compliant with the local, state, and federal guidelines.

A cross-functional return to workplace team was established with representatives from across the Company to align and coordinate mitigation activities and employee engagement.

SDG&E will continue to monitor the COVID-19 situation, adjust mitigation strategies, workforce communication, and other policies and procedures to ensure alignment with industry-leading practices and mandated activities.

This section of the chapter provides a brief overview of the ongoing actions and activities taken to directly mitigate the risks associated with COVID-19. These activities have and will continue to apply to future public health risks based on the lessons learned from COVID-19.

III. ASSOCIATED RISK EVENTS

A. Emergency Preparedness and Response

Emergency Preparedness and Response is a CFF affecting all nine of SDG&E's 2021 RAMP risks: Wildfire Involving SDG&E Equipment, Incident Related to the Medium Pressure System, Incident Related to the High-Pressure System, Excavation Damage (Dig-In) on Gas System, Incident Involving an Employee, Incident Involving a Contractor, Customer and Public Safety - Contact with Electric Facilities, Electric Infrastructure Integrity, and Cybersecurity. EP&R is a factor in protecting operational reliability, ensuring the safety of employees and the public, and maintaining compliance with government regulations or guidelines.

B. Pandemic

SDG&E has implemented various policies and programs to address and mitigate health and safety concerns of the Company's employees and customers associated with the COVID-19 pandemic while continuing to provide safe and reliable energy services. These measures have provided continued safe working environments for SDG&E's office and field employees and have been modified as applicable based on federal and state guidelines as well as feedback from employees, management, and union representation. The level and duration of these programs and activities will be adjusted to align with the warranted level of risk mitigation.

IV. 2020 PROGRAMS AND PROJECTS

A. EP&R: Emergency Operations Center (EOC) Activations

The Emergency Operations Center (EOC) plays a substantial role in driving forward SDG&E's longstanding commitment to safety, reliability, and security risk mitigation. The EOC's strong safety culture contributes towards these goals through safety-focused information sharing and strategic collaboration. The EOC serves as a critical support function to ensure that SDG&E can respond effectively and efficiently to any hazard encountered, thereby safeguarding

SDG&E's employees, stakeholders, customers, the public, contractors, and other resources or individuals within the service territory.

The EOC response interconnects cross-functional teams representing every primary business line within the Company, functioning within a utility-compatible Incident Command System (ICS) framework. During an EOC activation, over 50 subject matter experts with various training and certification levels may be brought into the EOC from across the Company to provide strategic direction, coordination, and facilitate emergency response aspects through an event duration. Over four dozen external emergency management partners, such as the County Office of Emergency Services (OES) and Cal OES, are also folded into the response. These partners are embedded within SDG&E's EOC during emergency conditions. When activated, primary EOC responsibilities include:

- Acquiring and allocating critical resources;
- Providing consistent and aligned internal and external communications;
- Managing crisis information;
- Facilitating strategic and policy-level decision-making; and
- Providing centralized coordination of all aspects of the emergency.

SDG&E's EOC has four levels of activations, which have the following triggers and levels of response:

- **Level 1 (Catastrophic):** Requires a full complement of trained response teams. Activation triggers are severe events impacting Company services, requiring outside assistance. Catastrophic earthquakes and weather disasters that damage Company capabilities, compromise public or Company safety, or cause impacts to SDG&E private/public property.
- **Level 2 (Severe):** Requires a full cadre of trained responders. Activation triggers include Public Safety Power Shutoff (PSPS) events, moderate earthquakes, severe weather disasters, and gas/electric emergencies requiring significant company resources in the response.
- **Level 3 (Serious):** Limited to key responders based on incident requirements. Triggers include small events/incidents involving moderate Company impacts.

- **Level 4 (Active Monitoring):** On-duty call list actively monitoring changes to current conditions. Triggers include localized events with minimal disruption to services.

Depending upon the activation triggers (*e.g.*, PSPS, wildfire, earthquake), response personnel will report either physically or virtually to the EOC. As needed, SDG&E continues to evaluate and revise both the virtual and in-person EOC activation plans, processes, equipment, and communications protocols. This ongoing evaluation process ensures safe, effective, and efficient EOC operations and support.

B. EP&R: Training and Exercise Division

SDG&E's Training and Exercise Division develops and implements strategies and curriculum that complement SDG&E's utility-focused approach to ICS, which is designed to strengthen emergency response and recovery practices enterprise-wide. To establish a cohesive response across all risk factors, experienced staff will:

- Model training and exercises off the Competency-Based Training approach to focus on utility-specific outcomes and learning;
- Focus on training development, delivery, and evaluation;
- Meet or exceed current regulatory compliance training and adjust to newly implemented requirements, as needed;
- Develop, conduct, and evaluate iterative exercises based on policies, plans, and procedures;
- Leverage innovative virtual tools to ensure competency-based outcomes and certifications; and
- Maintain centralized training records and access to completion certificates.

C. EP&R: First Responder Outreach

SDG&E's First Responder Outreach Program provides safety-related information about SDG&E's operations and facilities as they relate to first responder activities. Specific activities include:

- Sharing well-researched and relevant information to first responders regarding natural gas safety and foundational operations information on SDG&E's facilities;
- Completing needs assessments for first responder agencies to enhance and develop appropriate and relevant training to meet target audience needs; and

- Partnering with Fire Coordinators to develop and deliver natural gas safety training and contingency planning to both internal and external stakeholders.

D. EP&R: EOC Training (Student Costs)

SDG&E provides both instructor-led ICS response structure training and instructor-facilitated ICS response structure exercises. With an annual EOC responder attrition rate of 40%, achieving certification and training targets is an ongoing focus area. The following activities help provide safe and effective EOC responses across all risk factors:

- Develop instructor-led ICS response structure training with competency elements;
- Mature facilitated ICS response structure exercises with competency elements;
- Leverage web-based proficiency and training;
- Coordinate and manage requirements from the Cal OES for up to 15 certifications tailored for each EOC position;
- Complete position-dependent certification training over three years for all EOC responders; and
- Enhance risk factor planning to include the review and revision cycle by building an appropriate planning unit staffing level.

E. EP&R: After-Action Review Program

SDG&E's After-Action Review (AAR) program involves conducting a comprehensive review with key stakeholders after tabletop exercises, EOC activations, and field incidents, where there are opportunities for continuous quality assurance and quality improvement. Findings and lessons learned from the AAR process are documented, communicated, assessed, and referenced to reduce the risk of reoccurrence. The following actions summarize the AAR programmatic response following an incident:

- Facilitating a comprehensive incident de-brief with key stakeholders, both internal and external, where appropriate;
- Documenting and storing lessons learned and/or findings in a shared and approved repository, made available to employees, as appropriate;
- Assigning findings and/or lessons learned to the responsible department(s), where accountability and timelines are then established; and
- Incorporating and or considering lessons learned gleaned from this process in designing and developing EOC-related skills training and exercises.

F. EP&R: Aviation Firefighting Program

SDG&E utilizes aviation assets for several business purposes. The main reasons are assisting in fire suppression activities in partnership with Cal Fire, inspecting SDG&E equipment, and assisting in construction activities. The Aviation Services Division (AS Division) provides the following services:

- Identifying and mitigating hazards using the Aviation Safety Management System (ASMS) approach. ASMS is a systematic, process-oriented approach to increasing safety and reducing accidents or incidents by improving the environment, work culture and proactive measures. By establishing methods to analyze the overall system and operations, accidents are prevented.
- Providing exceptional fire suppression capabilities through procured aerial firefighting resources to SDG&E's service territory, enhancing the Company's service reliability and reducing infrastructure damage.
- Providing standardized procedures in the Aviation operations manual regarding the performance of flight operations conducted on SDG&E's behalf. This manual outlines protocols to enable all aviation contractor personnel to carry out their assigned duties and responsibilities in accordance with AS Division policies, applicable laws, and Federal Aviation Administration regulations.
- Assisting in dispatching and coordinating fire assets on our flight operations base 365 days per year, using highly trained personnel. Activities include pre-flight planning assistance, assessment of conditions and personnel involved, coordination with line and maintenance personnel, aircraft assignment, following flights, communicating by radio for possible issue assistance and aircraft status, conducting post-flight activities, collecting lessons learned, and producing reports for actual conditions.

G. EP&R: Emergency Operations Center (EOC)

SDG&E's primary EOC serves as the location from which centralized emergency management is coordinated. An EOC activation assembles internal subject matter experts to assess and provide situational awareness to internal and external stakeholders and establish overarching incident objectives, planning, anticipation, response, communications, and coordination. There is a continued need for a virtual EOC response model and a back-up

location to support information-sharing, decision-making, and turn-key availability if access to the primary EOC location is hampered. The availability and utilization of the back-up EOC has enabled SDG&E to maintain an effectively operating EOC in situations as needed.

H. EP&R: Human Factors Engineering

In partnership with the Department of Energy and Pacific Science & Engineering Group, Inc. (via a Small Business Innovation Research (SBIR) grant and a Master Services Agreement (MSA)), SDG&E developed a Human-Machine Interface (HMI) and decision support concepts for real-time risk management and decision-making, called Human Factors Engineering. Human Factors Engineering is the process in which information such as behaviors, abilities, limitations, and working knowledge is used to design tools for increased safety, effectiveness, and productivity. The MSA continues to incorporate Human Factors Engineering in SDG&E's PSPS process by utilizing the science of HMI to evaluate and improve the PSPS Dashboard. These enhancements improve consistency and timeliness of safe and effective de-energization and re-energization decisions.

I. EP&R: Information Technology (IT) Support for EOC

The following programs provide ongoing support to various IT solutions that complement the EOC and offer 7/24/365 functionality:

- Technology solution support for IT applications and processes that improve information capturing, storage, and reporting.
- Noggin, SDG&E's multi-year, companywide situational awareness software tool, improves the ability to collect and disseminate information event-wide in near real-time through user input and system integrations. This tool also manages and stores incident-specific information by event for later reporting and analytics to streamline after-action reporting.

J. Pandemic: Safety Consultant Support for Pandemic Exposure Safety at Customer Homes

To maintain a high level of safety and reliability with live customer interactions, SDG&E modified several processes and procedures to mitigate the exposure to COVID-19 when entering customer homes. If there is potential COVID-19 exposure, a third-party safety consultant is brought onsite to the customer order location and assists the field technician(s) with donning/doffing additional personal protection equipment (PPE).

K. Pandemic: Procure Additional Supplies

SDG&E is continuously monitoring federal, state, and local guidance to assess and purchase the necessary supplies and PPE to combat and minimize the spread and impacts of the pandemic. Supplies include air filtration systems, disinfectant cleaning supplies, face coverings, hand sanitizer, respirators, nitrile gloves, shoe coverings, and coveralls.

L. Pandemic: Temperature and pandemic symptom screening of employees/contractors/visitors by vendor

SDG&E coordinated with a vendor to conduct onsite temperature and pandemic symptom screening of employees, contractors, and visitors at critical company locations every day. This process is essential to reducing the risk of transmission in the workplace and can also be used as a tool to prompt employees to seek treatment and begin quarantine sooner.

M. Pandemic: Polymerase Chain Reaction (PCR) Testing

SDG&E arranged for a contractor to facilitate offsite polymerase chain reaction (PCR) nasal swab testing of sequestered employees and onsite antigen testing of select employee groups, as needed. PCR testing can determine if someone currently has COVID-19 or other similar infection by detecting ribonucleic acid, or genetic material, specific to the virus. It can detect the virus within days of infection, even for those who have no symptoms. Direct access to testing helps to mitigate workplace exposure.

N. Pandemic: Advanced/Enhanced Cleaning Protocols for Facilities

SDG&E Facilities Operations Department has implemented a progressive multi-tier protocol for addressing increased disinfection requirements due to a pandemic event.

- **Tier Zero** provides employees with cleaning supplies to clean their personal workspace. Each organization/department is responsible for obtaining and making available the necessary cleaning products through the Company's supply process.
- **Tier One** provides the cleaning and disinfecting on a proactive and preventive basis. Facilities Operations will disinfect specific areas of concern by utilizing specific products to eliminate viral and biological pathogens. Protocols include twice-daily cleaning of common surfaces.
- **Tier Two** is referred to as a "suspected COVID-19 exposure" and requires (in addition to Tier 1 protocols), cleaning and disinfecting personal workstations including desktops, drawers, overhead cabinets, chairs, and armrests. Carpeted

floors will be cleaned with a HEPA vacuum and hard surface floors will be mopped.

- **Tier Three** engages a specialized cleaning crew after a confirmed COVID-19 case has been identified. Depending on the situation, the crew will spray a liquid disinfectant via an electrostatic process in exposed areas of the facility.

O. Pandemic: Enhanced Mechanical Systems

SDG&E Facilities Operations Department has implemented various enhancements to its heating, ventilation, and air conditioning (HVAC) systems to mitigate the potential for pathogen propagation due to a pandemic event. Specifically, superior commercial air filters that capture a vast majority of airborne pathogens as small as .03 microns were installed throughout the Company's HVAC systems. Where applicable, the maximum amount of outside air was increased to improve indoor air quality and sequences of operations have been changed to increase the amount of fresh air into spaces. Bi-polar ionization units have been installed in our major air handling systems to electrically charge ions that neutralize airborne particles in the ductwork, making them heavier and easier to trap in filters and cleaning the air stream.

In certain areas, SDG&E installed mobile air purification systems for 24/7 cleaning. Mobile Ultra-Violet (UV) air purification systems were deployed to be used for areas with larger populations that must remain on-site and operational during the pandemic event (*e.g.*, Customer Care Centers and the EOC). Specific HVAC systems are operated on a 24-hour basis to continuously circulate fresh air throughout the facility and maintain indoor air quality.

P. Pandemic: Clean and Disinfect Company Owned and Operated Fleet Vehicles

Safety and Fleet Services partnered to develop a comprehensive pandemic protocol for the cleaning and disinfection of company-owned and operated vehicles and trucks. The protocols also address situations when a single vehicle needs to be shared by multiple occupants. To the extent feasible, vehicles are only occupied by a single individual.

Q. Pandemic: Pandemic-Related Applications

Pandemic-related application tools enable Employee Care Services (ECS) employees to quickly assess the risk of potential COVID-19 exposures to other employees, facilities, vehicles, or customers. They reduce the time it takes ECS staff to research and identify employee interactions, initiate appropriate follow-up, assist ECS employees in managing and tracking

COVID-19 related cases and interactions with employees, and empower ECS employees to proactively set relevant touchpoints, to reduce the risk of exposure and enhance employee safety.

For instance, there is a Pandemic Dashboard and a Pandemic Analytics tool that provide leadership oversight of the current pandemic environment and identify trends to support decisions and policies. This dashboard tracks the impact of the pandemic within SDG&E's service territory and in California, the U.S., and the world. At the company level, the tools track the impact the pandemic is having on SDG&E employees, including confirmed and recovered cases.

The Company has also used additional tools to enhance employee safety during the pandemic, such as the Pandemic Case Management System, and Business Objects Contact Tracing Report.

R. Pandemic: Contact Tracing

Complementary to other COVID-19 countermeasures, SDG&E uses a contact tracing process to identify and notify employees and contractors who may have been in close contact with a suspected or confirmed COVID-19 case while at work. Contracted resources have been secured in this effort to conduct and deliver timely exposure notifications. These notifications, along with mandated quarantines, reduce the risk of COVID-19 transmission in the workplace.

S. Pandemic: Pandemic Management Plan

SDG&E created a template to help develop management plans for future pandemics, should the need arise. Based on a pandemic's characteristics, SDG&E would rapidly create an initial Pandemic Management Plan that would be updated in real-time, as possible, to reflect new information and/or evolution of the pandemic. Key staff will be trained on the plan and provide ongoing support and updates based on situational changes.

T. Pandemic: Remote Work Enablement

To reduce the risk of COVID-19 transmission in the workplace, SDG&E has established a new work-from-home (WFH) policy and companion resources. For example, employees have been offered reimbursement for home office supplies and a remote-work stipend to cover home expenses incurred to facilitate WFH. Increased access to and use of technologies has been implemented, such as virtual conferencing, cloud-based file sharing, and remote access to secure systems and databases. These policies, resources, and technologies to enable WFH has reduced the risks of employees contributing to the spread of infections.

U. Pandemic: IT Systems and Licenses

To establish adequate remote access for employees and contractors, SDG&E has purchased, set up, and implemented support IT systems and software. For example, SDG&E's IT Department has enhanced SDG&E's Virtual Private Network software and has secured associated equipment and licenses to facilitate the increased WFH traffic.

V. Pandemic: Alternate Work Sites

SDG&E Facilities Operations implemented two different initiatives for sequestered employees to provide social distancing and to minimize the spread of the COVID-19 virus. The first initiative established various geographic reporting locations for some of the Company's essential field employees. The locations consist of 11 separate sites that are spread throughout the Company's service territory, providing an area for reporting in the mornings and for dropping off vehicles, equipment, and materials in the evening, as needed. Physical fences, security guards, cameras, and other security applications secure the sites. The sites also provide temporary power (generators), temporary offices, lighting, water, ice, restrooms, hand sanitation facilities, and trash services.

The second initiative involves renting recreational vehicles (RV) to house the Company's essential transmission grid operations staff at the Mission Control Critical Facility. The operators are sequestered on-site for two-week assignments and do not leave the premises. The RVs include all utilities (electric, water, sewer) and housekeeping once a week.

W. Pandemic: Facilities Enhancements

SDG&E's Facilities Operations Department has implemented various enhancements to provide additional safety measures to help maintain a healthy work environment. The measures include equipment, signage, procedures, protocols, and communications.

- Specific equipment, including mitigating pathogen applications such as ultraviolet light and bipolar ionization units installed in HVAC systems, has been procured.
- As necessary, spaces have been reconfigured to physically separate workers by at least six feet using measures such as physical partitions or visual cues (*e.g.*, floor markings, colored tape, or signs to indicate where workers should stand).
- Specific paths of travel (egress/ingress) have been developed, to reduce the cross-contamination potential.
- Elevator occupancy has been limited to no more than two passengers at a time.

- Signage has been created to remind employees, the public, and customers of physical distancing and face coverings at all entrances and strategically throughout SDG&E facilities.
- Facilities will continue to have daily touchpoints to discuss the latest events, issues, and concerns and increase coordination during the event.

X. Pandemic: Advisory Services and Expert Medical Consulting

SDG&E identifies and retains infectious disease medical experts in an advisory capacity to discuss mitigation strategies and workforce concerns and to interpret evolving federal, state, and local guidance.

Y. Pandemic: Adherence to Official Guidance

SDG&E actively monitors county, state, and federal guidance to align mitigation activities with leading industry and science-based information. As new information becomes available, SDG&E modifies its mitigation strategies, internal policies, and workforce engagement to remain compliant with local, state, and federal requirements and recommendations.

Z. Pandemic: Monitor Local Trends

SDG&E monitors key indicators and local infection rates to better understand local and regional risks across SDG&E's service territory. Key indicators include seven-day averages, case rate, positivity rate, local intensive care unit bed availability, and the vaccine distribution plan. We also partner with and receive guidance from local health experts. These indicators help inform decision-making to extend WFH requirements and adjust PPE requirements for field crews working in higher-risk areas or entering customer homes.

V. 2022 – 2024 PROJECTS AND PROGRAMS

The following section provides an overview of planned new and expanded programs and projects that have been identified in part by EM's ongoing review of the applicability and effectiveness of existing programs and projects.

A. EP&R: Human Factors Engineering Expansion

Human Factors Engineering will be expanded from its current application of only PSPS activities to include projects with the following departments: Electric Distribution Operations, Electric Regional Operations, Mission Control Grid Operations, and the Safety Management

System. This expansion will enhance efficiencies and effectiveness in event and emergency operations by incorporating HMI interface with the Company's technology tools and systems.

B. EP&R: Training and Exercise Division and ICS Companywide Program Expansion

This program expansion will develop and deliver training and exercises to meet an ambitious year-round, all-risk schedule and planning program. Centralized under EM, the Training and Exercise Division will launch a companywide initiative to expand ICS protocols into all aspects of the Company's business, including routine and regularly scheduled work. By doing so, all field workgroups will be unified under one response structure for more effective and efficient emergency responses.

Benefits to integrating ICS as a standard companywide practice include:

- Aligning the Company with other gas and electric service providers and external response agencies by sharing common terminology and hierarchy during a response;
- Formalizing position-specific training and certification;
- Defining in-house ICS training with a utility-based focus and incident escalation triggers;
- Bringing consistency to the Company's response across all field crews from multiple districts; and
- Improving on-scene safety by formalizing resources request processes, how responders communicate up the chain, and how to assign authority at the appropriate level for the response.

C. EP&R: EOC Activation Capabilities Expansion

The newly formed virtual EOC response model was implemented by EM as a direct result of the COVID-19 pandemic. The initial transition to a virtual platform focused on meeting the Company's immediate need to minimize the spread of the COVID-19 virus. The virtual EOC is a tested and viable response solution, as deemed by executive leadership, but needs resources to identify gaps in equipment, technology, integration, and communications. EOC staff will need standardized equipment at home and IT support to ensure strong communications, information flow, and stable connectivity to support decision-making for all-risks, all-hazards. Also, SDG&E anticipates an increased demand for varied communications modes, support

software, and technology to seamlessly tie together the virtual EOC with the in-person EOC response.

Beyond technical enhancements, there is a continued need to develop and implement policies and protocols that govern activating the EOC in an entirely virtual setting or partial virtual and in-person (hybrid) setting.

Albeit convenient and effective, the virtual EOC model will not permanently replace the primary or back-up EOC. Specific risks and incidents (*e.g.*, a telecommunications outage) necessitate an in-person EOC response. If the primary EOC is inaccessible or an incident response requires additional space for planning and coordination, the back-up EOC facility must duplicate capabilities, capacity, and function. As such, the office space must adequately support the growing complexity of EOC responses and support technology and appropriately house the required number of EOC responders for a full EOC activation. Each varied EOC response model should reflect the commitment to public safety on which SDG&E prides itself and provide a fully functional EOC as well as a place to showcase that commitment.

The current EOC is an approximately 6,500 square-foot facility constructed over 20 years ago to serve as SDG&E's central command post in a natural disaster or significant incident impacting the region's electric and natural gas systems. Over time, the EOC has evolved to serve as the central hub to support the growing demands of emergency-based events, *e.g.*, SDG&E's wildfire mitigation, situational awareness, and outreach and collaboration initiatives. Although the EOC refresh is fully funded, construction has paused. During these unprecedented times, EM continues to monitor, evaluate, and adjust on an ongoing basis to establish best emergency response practices.

D. EP&R: First Responder Outreach Program

As a complement to the ICS expansion projects under the Training and Exercise division, a core Incident Support Team (IST) will be established to support the Field Incident Commander and other on-scene operational crews and personnel. Formalizing deployable resources and roles will enable the Incident Commander to focus on the operational response while the IST supports the overall safety and scene management, including effective and efficient on-scene coordination between SDG&E and first responder agencies for all risk responses. The 24/7 Watch Command Desk will tie directly into both the IST and ICS programs by serving as a critical resource for situational awareness when an incident threatens to escalate or intensify.

E. EP&R: Expanding IT Support for EOC

EOC's Technology Solutions Division will be responsible for maintenance, continued growth, and the enhancement of disaster recovery communications maintained by the Company. Should the widespread loss of power due to either a natural or human-made disaster occur, an alternative communications/messaging system will be critical to initiate and maintain the response and recovery efforts. This disaster recovery communications system will provide back-up capabilities to critical situational awareness and notification applications that are used during emergencies.

This division will partner with the IT department to identify and integrate the required communications resources in an emergency to ensure that SDG&E has interface capabilities to recover from these events and restore services to customers. Core duties include:

- Developing, supporting, and maintaining the expanded and enhanced IT functionality for all virtual, primary, and back-up equipment in the Rancho Bernardo back-up EOC.
- Maintaining and overseeing all EOC technical equipment, including displays, computers, network infrastructure, and communications tools.
- Analyzing workflows and employing technology (*e.g.*, automated tools) in business processes to allow for faster decision-making and response times.

F. EP&R: Aviation Firefighting Program Expansion

In 2022, SDG&E will take ownership of a new S-70M Firehawk helicopter. The helicopter will increase SDG&E's overall level of situational awareness and safety due to its increased maneuverability, heavier lifting capacity, and other upgrades relative to the currently leased Blackhawk helicopter. Enhanced night operations capability will also aid in future Cal Fire night firefighting capacity.

SDG&E continues to assess its aviation firefighting program's effectiveness and to develop opportunities or enhancements for improvements. The AS Division will incorporate helicopter video streaming capabilities into SDG&E's helicopter fleet to support this objective. Cameras mounted on the H145 helicopter will enable live streaming to applicable public safety entities, and ground stations connected to the helicopter live video down link can access imagery, video, or infrared video displayed by the cameras.

G. EP&R: Establishing a 24/7 Watch Command Desk Division

Implementing a 24-hour, 7 day-a-week Watch Command Desk Division within the EOC will ensure consistent and timely information gathering through increased monitoring of all risks. This group will perform real-time assessments of risk impacts to SDG&E's assets, customers, and employees.

The Watch Command Desk Division will replace the current coverage system, which rotates the monitoring responsibilities among on-duty department staff who concurrently perform regular work duties and coordinate critical tasks during sleeping hours. The following actions will improve this process by:

- Allowing for around-the-clock surveillance of potential risks based on real-time monitoring of regional, national, and global information.
- Enabling more effective and efficient situational awareness report preparations.
- Sharing information to aid in efficient senior management decision-making and reduce the reflex time for response actions.
- Increasing personnel efficiency by reducing or eliminating the potential for redundant information-gathering or issues being missed.
- Provides daily situational updates and analysis.
- Increases EM capacity by assisting in technical writing during administrative shifts.

This program further bolsters our effectiveness as a world-class emergency management program and promotes employee and customer safety.

H. EP&R: After-Action Review Program Enhancement

The AAR program will expand to include additional coverage to meet increasing demands for continuous quality improvement projects and stakeholder assessments. The Company has seen a steady increase over the years of post-incident discussions and evaluations, and we expect that trend to continue into 2021. In 2020, EM completed 50 AARs, which reflects the maturation of our continuous quality improvement efforts relative to years prior. The Company has set an aggressive training and exercise schedule for 2021, which will heavily involve the AAR process to ensure continuous improvement and consistency in our skills training. The enhanced program will include:

- Increased partnership and activity around operations-centric incidents (*e.g.*, Electric Regional Operations);
- Corrective actions bridged to core capabilities and collaboration with the Training and Exercise Division; and
- High-level reports of outcomes, capabilities, and progress to directors and managers.

VI. COSTS

A. EP&R

Table 1 contains the 2020 recorded and forecast dollars for the programs and projects discussed in this CFF. These dollars duplicate amounts that are also reflected in SDG&E's Wildfire Risk Chapter (SDG&E-Risk-1).

Table 1: Costs (Direct After Allocations, in 2020 $000)[1]

Line No.	Description	Recorded		Forecast			
		2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
1	Emergency Operations Center (EOC) Activations	0	4,294	0	0	3,865	4,724
2	Training and Exercise Division	0	4,782	0	0	4,445	5,433
3	First Responder Outreach	0	883	0	0	858	1,048
4	EOC Training (Student Costs)	0	Included in Line 2	0	0	Included in Line 2	Included in Line 2
5	After-Action Review Program	0	294	0	0	265	324
6	Aviation Firefighting Program	7,175	6,791	0	0	9,288	11,350
7	Emergency Operations Center (EOC)	2,638	0	9,423	11,520	225	275
8	Human Factors Engineering	0	0	0	0	126	153
9	IT Support for EOC	0	60	0	0	105	129
10	Human Factors Engineering Expansion	0	0	0	0	Included in Line 8	Included in Line 8
11	Training and Exercise Division and ICS Companywide Program Expansion	0	0	0	0	Included in Line 2	Included in Line 2
12	EOC Activation Capabilities Expansion	0	0	Included in Line 7	Included in Line 7	Included in Line 7	Included in Line 7
13	First Responder Outreach Program	0	0	0	0	Included in Line 3	Included in Line 3
14	Expanding IT Support for EOC	0	0	Included in Line 9	Included in Line 9	Included in Line 9	Included in Line 9
15	Aviation Firefighting Program Expansion	0	0	0	0	Included in Line 6	Included in Line 6
16	Establishing a 24/7 Watch Command Desk Division	0	0	0	0	810	990
17	After-Action Review Program Enhancement	0	0	0	0	Included in Line 5	Included in Line 5

[1] Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated in forecasts beyond 2020.

B. Pandemic

Because of the uniqueness of the current and any future pandemics, SDG&E has not included forecasted pandemic-related costs.

Risk Assessment and Mitigation Phase Cross-Functional Factor

(SCG/SDG&E-CFF-4)

Foundational Technology Systems

May 17, 2021

TABLE OF CONTENTS

Page

CROSS-FUNCTIONAL FACTOR: FOUNDATIONAL TECHNOLOGY SYSTEMS

I. INTRODUCTION

This Foundational Technology Systems Cross-Functional Factor (CFF) Chapter describes how Foundational Technology Systems activities impact the risks described in Southern California Gas Company's (SoCalGas) and San Diego Gas & Electric Company's (SDG&E) Risk Assessment Mitigation Phase (RAMP) risk chapters.

SoCalGas and SDG&E (the Companies) present CFF information in this RAMP Report to provide the Commission and parties additional information regarding the risks and mitigations described in their RAMP risk chapters. CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities, or programs that may impact multiple RAMP risks. CFFs are also generally foundational in nature. Therefore, SoCalGas and SDG&E's CFF presentation differs from their RAMP risk chapters (*e.g.*, no risk spend efficiency calculations or alternatives are provided). SoCalGas's and SDG&E's CFF chapters provide narrative descriptions of the CFF projects and programs that impact multiple SoCalGas and SDG&E RAMP risk chapters through the 2022-2024 timeframe. Related cost forecasts are provided as available, consistent with an expected test year (TY) 2024 general rate case (GRC) request.

As described below, Foundational Technology Systems is an enterprise-wide framework that provides a standardized approach for managing risk and safety across assets and activities. Therefore, the Foundational Technology Systems CFF spans multiple business lines and helps to mitigate several RAMP risks in this Report.

II. OVERVIEW

Foundational Technology Systems are necessary to provide safe and reliable service to the public. These systems are used in every aspect of operations, customer engagement, and emergency response. These systems include a significant portion of each company's software application systems, communication networks, monitoring systems, end-user systems, and hardware and software platforms hosted in data centers and on internal and external cloud platforms. The safety and reliability of operations depend on Foundational Technology Systems; thus, it is critical for these systems to be resilient and recoverable.

Three factors create a continuing need to invest in Foundational Technology Systems:

(1) Technology systems have become the foundation for operational, business, and customer engagement needs across the enterprise, where even the most routine tasks rely on an interdependent network of systems and services.

(2) Technology can quickly become obsolete and often requires lifecycle management activities such as maintenance, upgrades, and replacements to remain reliable and secure. Neglecting these activities may result in downstream impacts, performance issues, and/or security vulnerabilities.

(3) The industry is faced with constantly evolving threats from both domestic and foreign adversaries, as well as supply chain risks, third-party and insider threats, and natural hazards. Collectively, the dependency on technology systems, the pace of technology obsolescence, and the dynamic nature of technology threats, hazards, and risks requires that the Companies evaluate and leverage the latest solutions on the market and constantly adapt to securely, safely, and reliably provide services to the workforce and customers.

The initiatives associated with Foundational Technology Systems discussed herein work to reduce the frequency and consequences of technology-related system outages.[1] Technology outages can be caused by drivers such as ineffective processes, hardware malfunctions, legacy system infrastructure issues, natural disasters, power outages, software failures, or human error. A technology outage can have varied consequences to safety, business operations, customer service, and system reliability.

SoCalGas and SDG&E have identified three tenets – Resiliency, Recovery, and Lifecycle Management – that represent the Foundational Technology Systems initiatives outlined in this chapter, as described below:

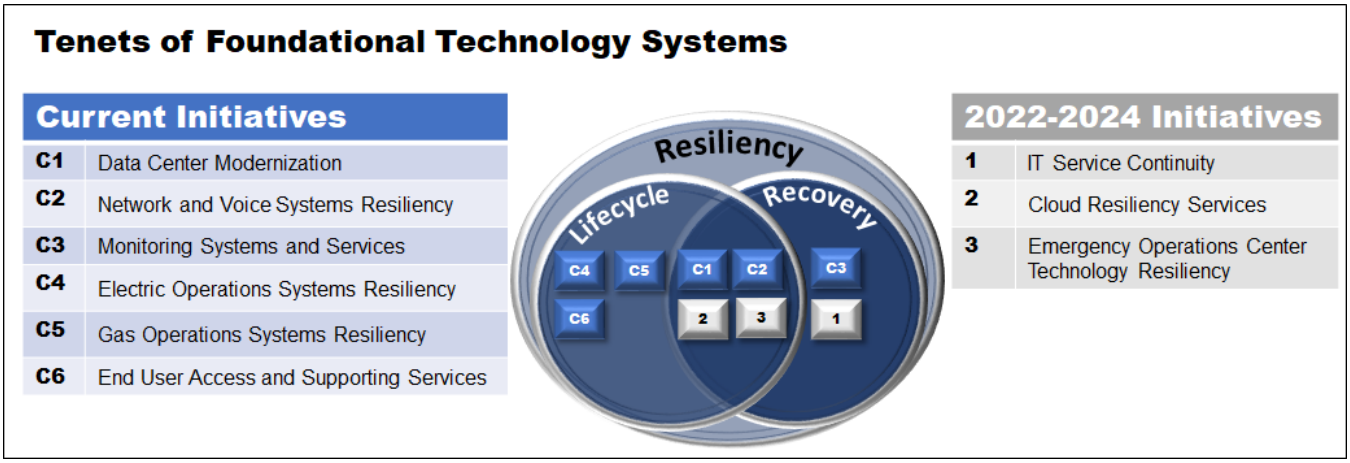
- **Technology resiliency** includes architectures, technologies, and processes for applications and infrastructure that focus on being prepared for any type of disruption – planned or unplanned – to mitigate the risk of downtime.

[1] The term "outage(s)" is used throughout this document interchangeably in reference to prolonged or extensive outages related to technology systems.

- **IT disaster recovery** is the ability to quickly recover systems and data after a disruption. Resilient systems and recovery work in tandem because increased resiliency reduces potential impacts and diminishes recovery implications.
- **Lifecycle management** is the holistic approach to maintenance, upgrades/replacement, and the planning process to ensure systems continue to operate as intended or to transition or retire legacy systems.

Figure 1 below shows the relationship between these tenets and the initiatives.

Figure 1



III. ASSOCIATED RISK EVENTS

Technology system outages can impact the frequency or consequences of the Companies' RAMP risks or Cross-Functional Factors and the ability to provide safe and reliable service. Foundational Technology System risks are not limited to one risk or risk event but rather impact several risks contained within this RAMP report. Given the varying degree by which an outage can impact the Companies' risks, only the risks that rely most heavily on technology systems are highlighted in this section.

- **Wildfire** - Wildfires Involving SDG&E Equipment, addressed in RAMP chapter SDG&E-Risk-1, may be more likely to occur without the use of monitoring tools dependent on Foundational Technology Systems. For example, SDG&E has various situational awareness programs that use advanced technologies to monitor weather conditions to evaluate the fire potential in SDG&E's service territory. If these situational awareness programs (*e.g.*, weather monitoring applications, cameras, and dashboards) did not operate or function as intended, there could be

adverse consequences. Unmonitored equipment failure due to outages in electronic monitoring and data management systems could cause ignitions and wildfires. For example, SDG&E uses critical software applications to track vegetation growth in relation to the electric infrastructure. One particular application supports all orders for vegetation management work and facilitates monitoring and response to vegetation-related events. SDG&E's wildfire mitigation programs, therefore, are susceptible to the overall health of Foundational Technology Systems.

- **Emergency Management and Climate Change Adaptation -** The inability to utilize electronic communication methods during a wildfire could inhibit a coordinated internal or external response to an event, which could create safety implications for the public and the workforce. Various emergency notification systems allow the Companies to alert customers and public safety partners regarding important safety notices. As discussed in the Wildfire section above, SDG&E's Weather Awareness System, dashboards, and other meteorology applications provide real-time situational awareness necessary for efficient wildfire response. For any activation, including wildfire response and Public Safety Power Shutoff (PSPS) events, the Emergency Operations Center (EOC) relies on critical safety and monitoring systems. During emergency events, the EOC's function could be impaired due to a technology outage.
- **Records Management, Enterprise Asset Management, Dig-ins, and Gas Incidents -** The availability and accessibility of accurate electronic data across the Companies can be affected during an outage. Many operational procedures depend on real-time data in order to conduct safe operations. If a technology outage were to occur, the lack of accessible data may result in an increased frequency of dig-in incidents, as accurate asset information is important to efficiently perform locate and mark activities. Enterprise Geographic Information System (GIS) is one example that uses asset records and data such as equipment type or valve position (open or closed) to create digital maps. These tools enable field personal to layer-in additional information onto the map, such as roads and facilities. During an outage, if employees in the field cannot access these

systems, marking of underground electric and natural gas facilities become inefficient and potentially less accurate. The underground service alert ticket management system allows excavators to request a callout for utilities, this technology coupled with the mobile GIS application reduces the likelihood of a dig-in. For electric transmission and distribution, GIS includes the electric connectivity model that feeds the electric network management application, allowing for the safe and reliable operation of the electric system. If these critical systems were unavailable, it could impact the performance of gas and electric operations at both Companies.

- **High-Pressure System Incident -** An outage could also increase the impact related to the Companies' Incident Related to the High-Pressure System RAMP risk chapters. As discussed in RAMP chapters SCG-Risk-1 and SDG&E-Risk-3, these risks are defined as the damage caused by a high-pressure pipeline that results in serious injuries, fatalities, and/or damage to the infrastructure. Pressure monitoring systems proactively detect operational issues to prevent safety incidents on the gas system. An incident on the high-pressure system could have exacerbated safety consequences if the incident is not detected using Foundational Technology Systems. Remediation and response efforts after high-pressure incidents during an outage could be hindered without access to supporting applications.
- **Gas Storage Incident -** SoCalGas's gas storage system's monitoring capabilities could be affected and require human intervention during a prolonged outage. SoCalGas utilizes advanced leak-detection technologies and practices that allow for early detection of leaks, helping to quickly identify anomalies. SoCalGas monitors the pressure of wells around-the-clock.. In addition, real-time wellhead gas monitors for leak detection and upwind/downwind ambient monitoring and SoCalGas meteorological stations are maintained using Foundational Technology Systems.
- **Electric Infrastructure Integrity -** Electric Infrastructure Integrity could be compromised as a result of an outage. As explained in RAMP chapter SDG&E-Risk-2, the Electric Infrastructure Integrity risk is defined as the risk of an asset

failure, caused by degradation, age, or operation outside of design criteria due to unexpected events or field conditions. The safe operation of electric infrastructure depends on many technological tools and applications for asset monitoring and awareness in the field. For example, SDG&E's outage and distribution management systems are systems used by distribution operators to support safe operations related to outage restoration. Supervisory Control and Data Acquisition (SCADA) provides operational data from electric assets in order to proactively monitor for and remediate asset failure. SCADA reduces the need for field personnel to perform manual operations, thus minimizing the safety risks to employees and/or contractors.

IV. 2020 PROJECT AND PROGRAMS

A. Data Center Modernization

This initiative enhances the data center infrastructure and applications to improve the recoverability, resiliency, and availability of the Companies' business systems. A data center is a physical location (facility) that houses networked (connected) information technology (IT) infrastructure, such as servers, and is primarily used to receive, store, process, and transmit large volumes of data. For example, a data center is used to store customer account data and process customer billing. Activities in this initiative relate to all three tenets of Foundational Technology Systems – resiliency, recovery and lifecycle management enhancements and upgrades.

Aging and overly complex system infrastructure can increase the probability of outages. The Data Center Modernization initiative focuses on simplifying and standardizing the Companies' data center infrastructure to reduce risks related to aging and obsolete systems and drive resilient operations. Part of a resilient data center strategy includes creating a secondary data center to mitigate effects of a natural disaster and minimize recovery time during outage events. Also, part of this strategy is to ensure data and system capacity requirements are met and easily scalable as needed.

Data center modernization improves and secures our data center network by isolating and separating each of the Companies' workloads, limiting the spread of the impact to the rest of the systems. It also improves the core hardware and simplifies the network design for the new server environment. In addition, an upgrade and expansion to the current backup and recovery

systems further enhances the recoverability of applications and systems at the secondary data center.

B. Network & Voice System Resiliency

This initiative enhances network and voice systems through maintenance and improved functionality. As a result, the risk of communication failures or lack of communication in remote locations of the service territory is reduced. Activities in this initiative are associated with the tenets of resiliency, recovery and lifecycle management enhancements and upgrades.

Networks are foundational at the Companies and enable the operation of key safety and reliability capabilities. In the event of an operational emergency, the inability to communicate in remote sites could inhibit the Companies' ability to receive information and respond to incidents. As part of this initiative, critical communication infrastructure and systems in the data center and in remote worksites leverage maintenance and improved functionality. The improvement of network and voice functionality minimizes the safety and operational risks associated with the inability to communicate in areas of the service territory without access to commercial cell coverage. For example, the implementation of a private Long-Term Evolution (LTE) network in SDG&E's service territory enables crews working in remote locations to remain connected to operations. Additionally, dispatch systems rely on technology to operate and communicate with employees. An outage may prevent the Companies from dispatching employees in a timely manner or responding to customer requests.

The Customer Contact Centers, which require a very robust and resilient network and phone systems, are also enhanced as part of this initiative. It is essential that customers can contact a call center to report safety-related and time-sensitive situations. Network issues impacting voice and Customer Contact Center Interactive Voice Response (IVR) functions can impede the Companies' ability to field safety-related emergency calls from customers. IVR is one of several main channels for enabling self-service for customers. The application acts as a first channel of customer support, so that customer calls are expeditiously addressed. An outage impacting data and communication tools in a contact center may inhibit the Companies' ability to respond to safety issues and meet customers' needs. Upgraded voice, IVR, and data technologies has allowed the Companies to communicate using a global standard to meet current and future communications needs.

C. Monitoring Systems and Services

This initiative enhances the IT system monitoring capabilities and dashboard software used to proactively identify potential issues and allow for early detection, which helps mitigate the risk of outages. Activities in this initiative include resiliency and recovery enhancements and upgrades.

This initiative improves the Companies' critical monitoring system's resilience by creating a failover capability for the system and establishing a framework and foundational capabilities for monitoring systems and applications in the cloud. These capabilities provide identification of network, system, and application anomalies, which allows support teams the ability to identify and potentially prevent an incident. The implementation of application performance monitoring capabilities provides insights into the health and performance of critical applications. This initiative improves the Companies' ability to monitor an application's availability by simulating user transactions against the application.

D. Electric Operations Systems Resiliency

This initiative enhances electric operations resiliency through electric system application upgrades and lifecycle management activities, allowing SDG&E to more effectively manage and operate the electric distribution and transmission grid.

Many critical applications that are used in day-to-day operations on the electric system require upgrades, enhancements, or replacements in order to operate effectively. Several examples are described below:

- Technology and application enhancements impacting the Corrective Maintenance Program (CMP) are made as part of this initiative. Enhancements to the CMP mobile application allows field employees to more effectively perform the CMP function and conduct required electric operations.
- GIS mobile application replacement and enhancement is also conducted as part of this initiative. GIS is used to identify location and specifics of equipment installed in the field, which reduces the incorrect identification and operation of assets.
- The grid management system used by distribution operators to conduct safe operations during outage restoration is linked to the call center and dispatch to predict electric outages and expedite the restoration of power to customers.

Improved integration with the SCADA system provides a number of safety benefits such as outage detection, recloser operation to mitigate fire risk and the de-energization of electrical equipment. This activity is responsible for issuing safety documents used for switching operations.

- Condition Based Maintenance is an application that uses data collected from transformers and other substation monitors to notify maintenance crews of any potential equipment failures/malfunctions. This application is continuously improved as warranted.

E. Gas Operations Systems Resiliency

This initiative enhances the resiliency of gas operations through application system upgrades and lifecycle management activities required for safe operations. These safety systems reduce the risk of gas incidents and improve recoverability after an incident. Activities in this initiative include resiliency and lifecycle management enhancements and upgrades.

Applications that prevent gas emergencies depend on Foundational Technology Systems. The enhancements within this initiative impact multiple applications needed for safe operations. Several examples are described below:

- Field sensors that collect, manage, and present real-time data to monitor the safety of the gas system. Electronic gas pressure monitoring and alarm data is sent to SCADA and stored in a real-time reporting system, where it is monitored by operators and engineers.
- GIS provides field crews with accurate asset information to prevent the incorrect identification and operation of assets and reduce the likelihood of a gas incident.
- SCADA is essential Operational Technology used to manage gas system infrastructure. SCADA allows for the remote operation of devices and data gathering/monitoring. With SCADA operations, there is a decreased need for field personnel to perform manual operations, which reduces employee-related safety incidents.

F. End-User Access and Supporting Services

This initiative enhances the security of Company systems and software by upgrading the tools and technology used for remote access. The threats and risks presented by malicious attempts to access Company systems have the potential to result in major safety, operational, and

business impacts. Activities in this initiative include resiliency and lifecycle management enhancements and upgrades.

The projects in this initiative enable end-users to remotely access the Companies' systems and networks through secure and reliable laptops, desktops, and communication software. Remote access software upgrades enable employees and contractors to securely access virtual desktops remotely to conduct work. Additional context on this initiative tied to end-user access and supporting services is outlined in the Emergency Preparedness and Response and Pandemic chapter (SDG&E-CFF-3), which includes activities associated with the COVID-19 Pandemic response.

V. 2022-2024 PROJECTS AND PROGRAMS

Many of the activities discussed in the 2020 Projects and Program section above are expected to continue during the TY 2024 GRC. For purposes of this RAMP, a project or program that continues, and the size and/or scope of that activity will be modified, is included and further described in the activity for 2022-2024 below.

A. IT Service Continuity

The IT service continuity initiative, along with the Data Center Modernization initiative, will improve the ability of critical systems to recover from outages through better governance and new technology enhancements. Activities in the IT service continuity initiative include resiliency and recovery enhancements and upgrades.

This initiative involves the rollout of a new IT Service Continuity Management program, which focuses on developing the processes for technology resilience. Efficient program design will be essential in allowing the Companies to quickly resume service after an outage. As part of the service continuity strategy development, application and data center recovery processes and business impact analyses (BIA) will be developed to minimize outage impacts based on business priorities. Disaster recovery tests, which improve the ability to respond to an outage, will be conducted as part of this initiative. The maturity of recovery strategy through automation will allow for quick resumption of critical systems. Annual maturity assessments will be conducted as part of this initiative.

B. Cloud Resiliency Services

Cloud technology is the delivery of computing services – including servers, storage, databases, networking, software, analytics, and intelligence – to offer faster innovation, flexible

resources, and economies of scale. Cloud enables the Companies' systems to be more resilient through highly available services, redundant systems, rapid deployment, and a robust suite of automated recovery capabilities across the technology portfolio. Activities in this initiative include resiliency, recovery, and lifecycle management enhancements and upgrades.

The Companies are investing in building cloud foundations, starting with the use of cloud processes, tools, and capabilities that enable resilient cloud-based business applications. Cloud allows the Companies to purchase the exact computing resources required and offers the flexibility to more quickly adjust the amount of resources needed and enables the Companies to capture increased operational efficiency by taking advantage of the cloud platforms' expertise in infrastructure management. In addition, cloud platforms allow the Companies to cost-efficiently take advantage of significant investments in new capabilities made by the cloud providers.

This initiative focuses on foundational components like the high-speed connection to the cloud platforms, the secured flow of information, and the ability to monitor our critical systems running in the cloud.

C. Emergency Operations Center (EOC) Technology Resiliency

This initiative allows for the improvement of IT services and systems needed for the EOC to continue functioning during an EOC activation. Activities in this mitigation include resiliency, recovery, and lifecycle management enhancements and upgrades.

The EOC utilizes numerous safety systems to respond to emergencies effectively and to operate a unified command with critical community stakeholders and partners. Maintaining communications with customers is critical during an emergency event. Communication tools allow the Company to notify customers and public safety partners of PSPS and other emergency events.

The future state for EOC critical systems is to enable modernization of EOC applications by adopting a cloud-based platform service and modifying systems to run in multiple geographic locations. Details involve migrating the EOC applications running on our internal infrastructure and some of our critical GIS applications into a cloud environment. For resiliency, the Companies will enable a local and multi-region recovery approach. To manage the new environments, the Companies will establish more structured and automated processes to develop and manage EOC applications and services. This will reduce the risk of an unavailable system

during EOC activations and also improves notifications of emergency events to both customers and public safety partners.

VI. COSTS

The table below contains the 2020 recorded and forecast dollars for the programs and projects discussed in this CFF. Some of the dollars reflected below may also be reflected in the SoCalGas Asset and Records Management, SDG&E Asset Management, and SDG&E Wildfires Involving SDG&E Equipment (SCG-CFF-1, SDG&E-CFF-1 and SDG&E-Risk-1) Chapters.

SoCalGas Costs (Direct After Allocations, in 2020 $000)[2]

Line No.	Description	Recorded		Forecast			
		2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
1	Data Center Modernization	24,944	2,276	65,534	83,738	2,049	2,618
2	Network & Voice System Resiliency	10,880	3,862	40,176	51,335	3,476	4,442
3	Monitoring Systems and Services	2,535	1,583	7,070	9,033	2,222	2,839
4	Gas Operations Systems Resiliency	20,068	6,526	109,051	139,342	5,873	7,505
5	End User Access and Support Services	1,513	1,640	30,419	38,869	1,724	2,203
6	IT Service Continuity	0	2,709	14,455	18,470	2,555	3,265
7	Cloud Resiliency Services	0	203	3,130	3,999	3,989	5,097
8	Emergency Operations Center (EOC) Technology Resiliency	1,424	983	3,505	4,478	884	1,130

[2] Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are in 2020 dollars and have not been escalated in forecasts beyond 2020.

SDG&E Costs (Direct After Allocations, in 2020 $000)[3]

Line No.	Description	Recorded		Forecast			
		2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
1	Data Center Modernization	20,568	1,801	13,411	17,136	1,621	2,071
2	Network & Voice System Resiliency	41,129	4,359	82,541	105,469	3,923	5,013
3	Monitoring Systems and Services	1,519	1,018	4,800	6,134	1,543	1,971
4	Electric Operations Systems Resiliency	26,740	3,031	89,918	114,895	2,728	3,486
5	Gas Operations Systems Resiliency	3,004	2,031	16,122	20,600	1,828	2,336
6	End User Access and Support Services	2,590	1,117	18,999	24,277	1,201	1,534
7	IT Service Continuity	0	2,230	9,720	12,420	2,099	2,682
8	Cloud Resiliency Services	4,601	159	3,130	3,999	3,137	4,008
9	Emergency Operations Center (EOC) Technology Resiliency	0	901	7,655	9,781	811	1,036

[3] Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are in 2020 dollars and have not been escalated in forecasts beyond 2020.

Risk Assessment and Mitigation Phase
Cross-Functional Factor

(SDG&E-CFF-5)
Physical Security

May 17, 2021

TABLE OF CONTENTS

CROSS-FUNCTIONAL FACTOR: PHYSICAL SECURITY

I. INTRODUCTION

This Physical Security Cross-Functional Factor (CFF) Chapter describes how Physical Security activities impact the risks described in SDG&E's Risk Assessment Mitigation Phase (RAMP) risk Chapters.

SDG&E is presenting CFF information in this RAMP Report to provide the Commission and parties additional information regarding the risks and mitigations described in its RAMP risk chapters. CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities or programs that may impact multiple RAMP risks. CFFs are also generally foundational in nature. Therefore, SDG&E's CFF presentation differs from that of its RAMP risk chapters (*e.g.*, no risk spend efficiency calculations or alternatives are provided). SDG&E's CFF chapters provide narrative descriptions of the CFF projects and programs that impact multiple SDG&E's RAMP risk chapters through the 2022-2024 time frame. Related cost forecasts are provided as available, consistent with an expected test year (TY) 2024 general rate case (GRC) request.

As described below, Physical Security is an enterprise-wide framework that provides a standardized approach for managing risk and safety across assets and activities. The Physical Security CFF therefore spans multiple lines of business and helps to mitigate several RAMP risks in this Report.

II. OVERVIEW

Physical security encompasses the systems and activities that maintain the safety of employees, contractors, vendors, the public, SDG&E facilities, and infrastructure, through people, processes, and technology. The three primary categories of physical security are described as follows:

- People – the skill and expertise of employees, contractors, and vendors who implement and support physical security.
- Process – the goals, regulations, guidelines, and instructions that establish actions for risk management (*e.g.*, plans, policies, procedures, training, and awareness).
- Technology – the hardware and software of the physical security system that is designed to deter, delay, detect, assess, communicate, and respond to potential

physical threats (*e.g.*, barriers, closed circuit television (CCTV) system, access management system, video analytics, and electronic keys).

Physical security mitigates incidents such as theft, robbery, burglary, vandalism, sabotage, terrorism and trespassing, which may result in a gas leak, fire, explosion, and/or operational outages. Physical security incidents may have direct safety consequences, such as the potential for serious injury or death related to electrocution, gas leaks or explosions, or may have indirect safety consequences, such as the disruption of electric or gas operations causing downstream outages affecting the general public. Effective physical security is essential to protecting the facilities, assets, and people that provide safe and reliable electric and gas services.

SDG&E implements a layered security system to protect employees, facilities, and infrastructure. Often referred to as "concentric circles of security" or "defense in depth," this principal involves using multiple layers of security to protect high-value assets. At each boundary, there is an opportunity to deter, detect, delay, assess, communicate, or respond to an adversary. This approach improves the opportunity for intruders to be interdicted at each layer with an appropriate security response.

III. ASSOCIATED RISK EVENTS

Physical security is a cross-functional factor affecting several risks including (Incident Related to the Medium Pressure System, Incident Related to the High Pressure System, Excavation Damage (Dig-In) on Gas System, Incident Involving an Employee, Incident Involving a Contractor, Contact with Electric Facilities and Cybersecurity). Physical security is a factor in protecting operational reliability, ensuring the safety of employees and the public, and maintaining compliance with government regulations or guidelines.

IV. 2020 PROJECTS AND PROGRAMS

A. Physical Security Systems

Physical security systems provide protection enhancements to facilities or infrastructure to improve access control, intrusion detection, and interdiction capabilities to deter, detect, delay, assess, communicate, or respond to undesirable events. Examples include, but are not limited to:

- Physical Barriers – Physical barriers are natural and man-made structures that physically and psychologically deter and delay adversaries and channel traffic through specified entry/exit points. Types of barriers include berms, fences, walls, gates, vehicle anti-ramming measures (*e.g.*, bollards, engineered planters

and benches, and landscaping boulders) window barriers, ravines, drainage ditches, and security doors.

- Access Control System – Access control systems limit or detect access to facilities and are commonly integrated across all security layers. They provide separation between common areas and higher security areas or critical assets. Access controls are typically found in the form of the electronic control systems (proximity card readers or electronic keys) and mechanical locks/keys.
- Intrusion Detection System (IDS) – IDS are an array of sensors, surveillance devices, and associated communication systems used to increase the probability of detection and the assessment of potential unauthorized access to facilities. The technologies used in IDS systems range from electrical contact mechanisms, tamper sensors, motion, heat, sound, or vibration sensors, radar, duress alarms, video analytics, and other devices.
- CCTV – CCTV is a self-contained surveillance system comprising cameras, recorders, control equipment, and displays for monitoring activities in real time. The CCTV system is intended to be an overt deterrent used to assess real-time security events and act as a forensic tool for investigations following an incident.

Corporate Security is making physical security planning, implementation, and maintenance more efficient through automation, analysis, and testing. A new access management reporting tool was introduced in 2020 to allow for analysis of access. The reporting tool will assist Corporate Security with identifying information such as locations with high alarm rates and badge access card usage. In addition, a new automated access request process was implemented to streamline the access request and approval process, to allow for performance metrics and analysis, and to reduce labor hours associated with providing access. Finally, a new security equipment testing lab was created to integrate and test the functionality of new security equipment prior to installation.

B. Contract Security

In addition to physical security systems, SDG&E employs contract security (security guards) to secure and protect assets and people. Security personnel are located at critical facilities and other work locations. Security personnel are used to complement and supplement existing security measures. Security personnel can also provide increased security capabilities as

an overt deterrence during security incidents or emergencies. Security personnel may be deployed permanently at a facility based on factors such as criticality, facility population, or compliance; or temporarily based on factors such as the threat environment, criminal activity, and past incidents.

C. Corporate Security Planning, Awareness, Risk Management, and Incident Management

The Corporate Security organization develops planning, awareness, risk management and incident management projects and programs to prevent, mitigate, or respond to security incidents. This control includes Corporate Security labor (training, investigations, etc.), intelligence services, and the Case Management System, which is used to track security incidents and investigations. This control incorporates services provided by Corporate Security, including:

- Physical security operations responsible for planning, design, development, testing, implementation, maintenance, integration, and coordination of physical security systems.
- Risk management to identify, assess, control, and monitor physical security risks potentially impacting the company.
- Intelligence analysis to continually assess threats and develop actionable intelligence for risk mitigation, security planning, infrastructure protection, and employee safety.
- Investigation of security incidents to determine and assist with corrective actions, litigation, and security practice improvement.
- Training, exercises, and drills of employees and public safety agencies to improve security awareness and response.
- Incident management to respond to incidents and coordinate with public safety agencies or other appropriate parties.
- Security oversight to establish and enforce regulations, guidelines, plans, policies, and procedures.

V. 2022-2024 PROJECTS AND PROGRAMS

Planning, Awareness, Risk Management, and Incident Management activities are tracked through a variety of methods. Physical security operations incorporate bi-weekly meetings to plan, design, develop, test, implement, maintain and coordinate physical security systems. Risk

management occurs at various levels including annual risk assessments, ongoing threat evaluations, and regulatory vulnerability assessments. Security incidents and investigations are tracked within a case management database. Analysis and review of security incidents are performed on a monthly and on an ad hoc basis by the director and managers of Corporate Security. Security guidelines, plans, policies, and procedures are reviewed regularly to complete appropriate updates.

A. Physical Security Upgrades

SDG&E plans to expand physical security upgrades to replace end of life equipment, to improve integration, to reduce nuisance alarms, and to incorporate recent industry security technology enhancements. Security enhancements to facilities and infrastructure improve access control, intrusion detection, and interdiction capabilities to deter, detect, delay, communicate, and respond to undesirable events.

B. Corporate Security Agent

SDG&E plans to expand its workforce to support Corporate Security. Expansion of the workforce will provide additional coverage of the large service area, reduce response time to security incidents, and increase the number of Site Security Reviews. This will determine security threats and mitigate vulnerabilities to ensure the safety of employees and the public, secure infrastructure and improve electric system and gas reliability.

VI. COSTS

Table 1 contains the 2020 recorded and forecast dollars for the programs and projects discussed in this CFF.

Table 1: Costs (Direct After Allocations, in 2020 $000)[1]

Line No.	Description	Recorded		Forecast			
		2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
1	Physical Security	1,133	0	3,653	4,465	0	0
2	Contract Security	115	2,330	673	823	2,320	2,836
3	Planning, Awareness, Risk Management, and Incident Management	0	568	0	0	528	607
4	Physical Security Upgrades	Included in line 1	0	Included in line 1	Included in line 1	0	0
5	Corporate Security Agent	Included in line 2	0	Included in line 2	Included in line 2	0	0

[1] Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated in forecasts beyond 2020.

Risk Assessment and Mitigation Phase Cross-Functional Factor

(SDG&E-CFF-6)

Records Management

May 17, 2021

TABLE OF CONTENTS

Cross-Functional Factor: Records Management

I. INTRODUCTION

This Records Management Cross-Functional Factor (CFF) Chapter describes how records management activities impact the risks described in SDG&E's Risk Assessment Mitigation Phase (RAMP) risk chapters.

SDG&E is presenting CFF information in this RAMP Report to provide the Commission and parties additional information regarding the risks and mitigations described in its RAMP risk chapters. CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities or programs that may impact multiple RAMP risks. CFFs are also generally foundational in nature. Therefore, SDG&E's CFF presentation differs from that of its RAMP risk chapters (*e.g.*, no risk spend efficiency calculations or alternatives are provided). SDG&E's CFF chapters provide narrative descriptions of the CFF projects and programs that impact multiple RAMP risk chapters through the 2022-24 time frame. Related cost forecasts are provided as available, consistent with an expected test year (TY) 2024 general rate case (GRC) request.

As described below, Records Management is an enterprise-wide approach to the management of operational records. Although this chapter is not intended to be a comprehensive discussion of all records in all departments, the Records Management CFF spans multiple lines of business and helps to mitigate several RAMP risks in this Report.

II. OVERVIEW

The goal of SDG&E's records management policies and practices is to provide consistent responsibilities for records management and to require the assignment of specific accountability for oversight and administration of records management. Accordingly, records management is a significant initiative, which strives to keep departments in compliance with changing rules and regulations at the local, state, and federal levels, as well as enforces generally accepted record-keeping principles (GARP). SDG&E's records management policies include, but are not limited to, definition and identification of records, processes and systems for retaining records, and document retention and disposition policy.

SDG&E has assigned records coordinators across the company. These records coordinators manage records and related issues, including compliance with records retention schedules, and are based within each of their respective business areas. They also share

information about updates to Sempra Energy's Information Management Policy and the Legal Hold and Records Preservation Policy (collectively, "Policies"). Additionally, the records coordinators coordinate annual records cleanup and compliance certifications.

For safety and compliance purposes, SDG&E has implemented various recordkeeping controls for its system in accordance with, for example, the following CPUC regulations, decisions and directives:

- General Order (G.O.) 95: Overhead Electric Line Construction
  - Rule 18: Recordkeeping requirements for corrective actions to remedy potential violations of G.O. 95.
  - Rule 44.2: Recordkeeping requirements for pole loading calculations.
- G.O. 128: Construction of Underground Electric Supply and Communication Systems
  - Rule 17.7: Recordkeeping requirements and responsibility for records pertaining to the location of underground facilities.
- G.O. 165: Inspection requirements for electric distribution and transmission facilities
  - Section III and Section IV: Records management requirements for the inspection and maintenance of electrical assets for distribution and transmission facilities, respectively. Additionally, Section III.D requires submittal of an annual report identifying the asset inspection work completed.
- G.O. 166: Standards For Operation, Reliability, and Safety During Emergencies and Disasters.
  - Standard 11: Annual reporting requirement reflecting compliance with the G.O. and any modifications to the emergency plan.
- G.O. 174: Rules For Electric Utility Substations.
  - Section III: Substation inspection program records and reporting requirements.
- CPUC Decision (D.)14-02-015: Requirement to report fire ignitions annually.
- Resolution WSD-011 – Wildfire mitigation plan required filings and wildfire related metrics.

- Resolution ESRB-8, D.19-05-042, and D.20-05-051: Public Safety Power Shutoff reporting requirements.

III. ASSOCIATED RISK EVENTS

SDG&E adheres to the Policies' requirement that every employee take responsibility for information management. Thus, the management of operational asset records, as well as administrative records, is decentralized. While the Policies list some approved records repositories to use, there is no centralized records management tool, application, or product that meets the variety of recordkeeping needs of all departments. In addition, SDG&E uses both onsite and offsite records storage facilities based on the needs of each department or operating group.

Records management is a CFF affecting several risks including Incident Involving a Contractor, Incident Involving an Employee, Wildfire Involving SDG&E Equipment, as well as other cross-functional factors such as Safety Management System, Foundational Technology Systems, and Asset Management. Inadequately maintained records can have reliability, employee safety, public safety, regulatory, and fiscal impacts. For example, safety protocols must be followed in day-to-day operations, and if there are inadequate or inaccurate operational systems integrity documents being followed, the safety and compliance repercussions could be detrimental.

IV. 2020 PROJECTS AND PROGRAMS

SDG&E's records management group administers the Policies and acts as a resource to assist assigned coordinators in each department with applying and adhering to the Policies in their respective organizations. SDG&E's records management group works closely with each records coordinator to be consistent in oversight and use of best practices.

SDG&E conducts the activities listed below to promote employee accountability and compliance with the Policies.

- **Training on records management policies and procedures**: Employees are required to complete records management training every other year. Newly hired employees will complete the required training regardless of the time they were hired in the required training cycle. SDG&E also hosts regular records coordinator training on records management procedures and the steps needed to complete leadership certifications.

- **Annual department self-assessment and compliance:** Every year, coordinators complete both onsite and offsite records cleanup efforts in alignment with the records retention schedule. This cleanup is then certified by the appropriate members of leadership, thereby confirming compliance with the Policies.
- **Periodic internal audits**: In 2020, periodic internal assessments of randomly selected records management procedures began. These assessments, or audits, include (i) a review of the mapping of any given department's document repositories, (ii) process review, and (iii) an assessment of whether the department can readily produce critical records.
- **Information management systems (IMS)**: SDG&E hosts a variety of approved document repositories to assist with departments' varying needs, including repositories for critical records held in our operations and asset management departments. Within these systems, teams house critical operations, maintenance, safety, legal, fiscal, and contractual records. The IMS allow employees to track and retain records and complete their day-to-day work tasks.

Some examples of supporting IMS include:

- SAP: Inventory control and material management.
- Customer Information System Corporate Objectives (CISCO): The core customer data management system, which is migrating to SAP in the Envision project and will be subsequently decommissioned. CISCO also includes the Distribution Planning and Scheduling System (DPSS) and some of the other customer-focused mainframe systems. Note: in the field, CITRIX is used to gain access to CISCO.
- Supervisory Control and Data Acquisition (SCADA): A system of software and hardware elements that allows the utility to control certain electric system processes locally or at remote locations; monitor, gather, and process real-time data; directly interact with devices such as sensors and valves; and record events into a log file.
- Network Management System (NMS): A distribution-network outage-management system that maintains the as-switched (current state) model of the electric distribution system.

- Pole Information Data System (PIDS): Web interface and repository that was created to store and display pole information such as general characteristics, loading information, aerial and avian information and the associated documents and images.
- Service Order Routing Technology (SORT): Dispatch software for Electric Troubleshooters (ETS)—the laptop computer system used to dispatch an ETS to a substation to investigate an alarm or conduct an inspection.
- Ignition Management Database: Fire ignitions are tracked and defined by CPUC Decision 14-02-015. A report of ignitions is submitted annually. Reports from this database are used to prioritize and track the success of ignition mitigation programs.
- Meteorology Database: Logs and houses historical wind speeds. This data is used heavily in the wildfire program to develop wind climatologies across the service territory that aide in decision-making during, for example, Public Safety Power Shutoffs (PSPS) events.
- Reliability Database: Program that categorizes system failures related to customer outages for use in developing wildfire ignition mitigation, system reliability improvement, and various public safety programs.
- Geographic Information Systems (GIS): Real-time information system for mapping and analytics. The geographic data is used in many ways, including the following:
    - Field Mobile Applications: Allows field staff to view their equipment locations and to update their work activities electronically.
    - Outage Management Integration: Provides the base network model enabling the operators to geospatially monitor their work activities and verifies the connectivity model to validate proper safe isolation points for field and public safety.
    - Emergency Operations: Provides real-time fire data, such as fire parameters, weather data, and crew locations, for decision making during an emergency event.

V. 2022-2024 PROJECTS AND PROGRAMS

SDG&E intends to hire a third-party records management vendor to perform a comprehensive program assessment of overall procedures and best practices, paying particular attention to records management practices for SDG&E's asset management and operations departments. This program assessment aims to map out the current state and detail potential roadmaps in areas needing improvement or adjustment. Some main aspects of this assessment include:

- Review RAMP and General Rate Case (GRC) filings regarding records management and its public safety risks, mitigation, and impacts;
- Review practices, Policies, regulations, general orders, and procedures at a high level (interviews and gap analysis);
- Complete a drill down assessment into system operations;
- Consider other efforts supporting asset management and RAMP risks; and
- Complete timely deliverables including but not limited to:
    - Assessment (current state);
    - Data governance review;
    - Strategy and standards review;
    - Regulatory and PUC obligations;
    - Technology and IMS inventory;
    - Records location and mapping;
    - Staffing and outsourcing;
    - Auditing;
    - Monitoring; and
    - Vendor will provide a completed roadmap of current state, recommendations, and timelines for new strategy implementations.

Additionally, SDG&E is working closely with Sempra to review the content of the biennial training to be included in the annual compliance training bundle. These conversations will be ongoing between SDG&E and Sempra.

VI. COSTS

Because of the manner in which the dollars associated with the programs and projects discussed in this CFF are tracked and/or forecast, there are no dollars identified for the programs and projects in this CFF.

Risk Assessment and Mitigation Phase

Cross-Functional Factor

(SDG&E-CFF-7)

Safety Management System

May 17, 2021

TABLE OF CONTENTS

CROSS-FUNCTIONAL FACTOR: SAFETY MANAGEMENT SYSTEM

I. INTRODUCTION

This Safety Management System (SMS) Cross-Functional Factor (CFF) Chapter describes how SMS activities impact the risks described in SDG&E's Risk Assessment Mitigation Phase (RAMP) risk chapters and CFF chapters.

SDG&E is presenting CFF information in this RAMP Report to provide the Commission and parties additional information regarding the risks and mitigations described in its RAMP risk chapters. CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities, or programs that may impact multiple RAMP risks. CFFs are also generally foundational in nature. Therefore, SDG&E's CFF presentation differs from that of its RAMP risk chapters (*e.g.*, no risk spend efficiency calculations or alternatives are provided). SDG&E's CFF chapters provide narrative descriptions of the CFF projects and programs that impact multiple SDG&E's RAMP risk chapters through the 2022-24 time frame. Related cost forecasts are provided as available, consistent with an expected test year (TY) 2024 general rate case (GRC) request.

As described below, SMS is a systematic, enterprise-wide framework to manage risk and to promote continuous improvements in safety. The SMS CFF therefore spans all lines of business and helps to further mitigate several RAMP risks in this RAMP Report.

II. OVERVIEW

SDG&E's SMS is a systematic, enterprise-wide framework to collectively manage and reduce risk and promote continuous improvement in safety performance through deliberate, routine, and intentional processes. The SMS is not a new safety initiative. SDG&E's SMS is the framework that ties together each of our existing and future safety initiatives, aligns our core operating units, integrates risk and safety, and allows us to assess risk across the entire organization for continued improvement and enhanced safety performance.

The SMS moves SDG&E forward in its journey towards "Target Zero."[1] SDG&E has a strong safety culture and many effective established safety programs. The SMS affirms, aligns, integrates, and brings further awareness and engagement to such programs by providing:

[1] "Target Zero" is SDG&E's goal and mindset to achieve an incident-free work environment.

- Greater communication, broad sharing of information and utilization of lessons learned;
- Enhanced documentation in the form of standardized processes and widely accessible document and data repositories;
- Strengthened employee feedback mechanisms, additional means/resources for consistent follow-up and communication;
- Early identification of risks, integration of risk and asset management with operations;
- Strong change management, where employees and contractors have the knowledge and tools to anticipate, identify and assess risk and are empowered to communicate risks to drive change; and
- Continual learning and improvement with greater reliance on data and analytics and increased use of leading indicators with strong review processes to continually measure effectiveness.

SDG&E demonstrated its longstanding commitment to safety in its TY 2019 GRC, stating: "At SDG&E, safety isn't a goal – it is part of the Company's DNA,"[2] and "SoCalGas and SDG&E have an unwavering commitment to protecting employees, contractors and the public."[3] Also in the TY 2019 GRC, SDG&E and SoCalGas witnesses testified that they "see the value in continuous improvement and are now seeking to more formally implement a safety framework that incorporates existing and new safety measures through a pipeline SMS and its related tenets (*i.e.*, API 1173) in the context of this GRC for their Gas operations."[4] For SDG&E specifically, in its TY 2019 GRC, SDG&E expressed its intent to implement an SMS for SDG&E's gas and electric operations.[5] In the final decision on SDG&E's TY 2019 GRC, the CPUC set forth its "support… for the improvement of Applicants' safety management and safety performance" and found "[t]hese issues are more appropriately raised and addressed in the

[2] A.17-10-007 (cons.), Exhibit SDG&E-01-R (Winn) at CAW-1.

[3] A.17-10-007 (cons.), Exhibit SCG-250/SDG&E-252 (Buczkowski and Geier) at DLB/DLG-3.

[4] *Id.*, at DLB/DLG-5.

[5] *Id.*, at Section II.B.

Applicants' RAMP proceedings."[6] And in fall 2019, SDG&E began the strategic initiative to develop an SMS for both its gas and electric operations. SDG&E provides herein details of its enterprise-wide SMS and its plan for further implementation and continuous improvement of the SMS.

SDG&E has strong safety performance, and its safety metrics continue to improve. This can be seen through SDG&E's 2020 safety performance, in which SDG&E achieved its lowest-ever employee safety incident rates.[7] To that end, it is SDG&E's intent that the effectiveness of its SMS will be measurable based on identified controls and metrics to identify opportunities for continuous safety improvement. The SMS leverages, integrates, and enhances each of SDG&E's existing safety programs and SDG&E's strong safety culture and aims to further reduce safety incidents.

SDG&E's enterprise-wide SMS is designed to enhance the Company's longstanding commitment to safety, which focuses on people safety (*i.e.*, employee, contractor, customer, and public safety), asset safety (*i.e.*, all Company infrastructure), gas and electric operations safety, risk identification and management, and emergency preparedness and incident response. As mentioned above, this commitment to safety is embedded in all that we do and is the foundation for who we are – from initial employee training, the design, installation, operation, and maintenance of our utility infrastructure, to providing safe and reliable service to our customers.

SDG&E's SMS is a process-based, integrated, continuous improvement framework aimed to reduce risk, further enhance the Company's safety culture, and prevent safety incidents. The collective efforts at the business unit and enterprise levels will become greater aligned, integrated, and systematic within the SMS framework. SDG&E's SMS will therefore provide a standardized approach for managing risk and safety across all assets and operations by implementing standardized processes and risk assessment methodologies that can be consistently applied enterprise-wide. The SMS framework creates an integrated approach and a Company-wide resource to guide our actions, decisions, and behaviors, so that we efficiently and effectively manage risk and continually improve upon all aspects of our safety performance.

---

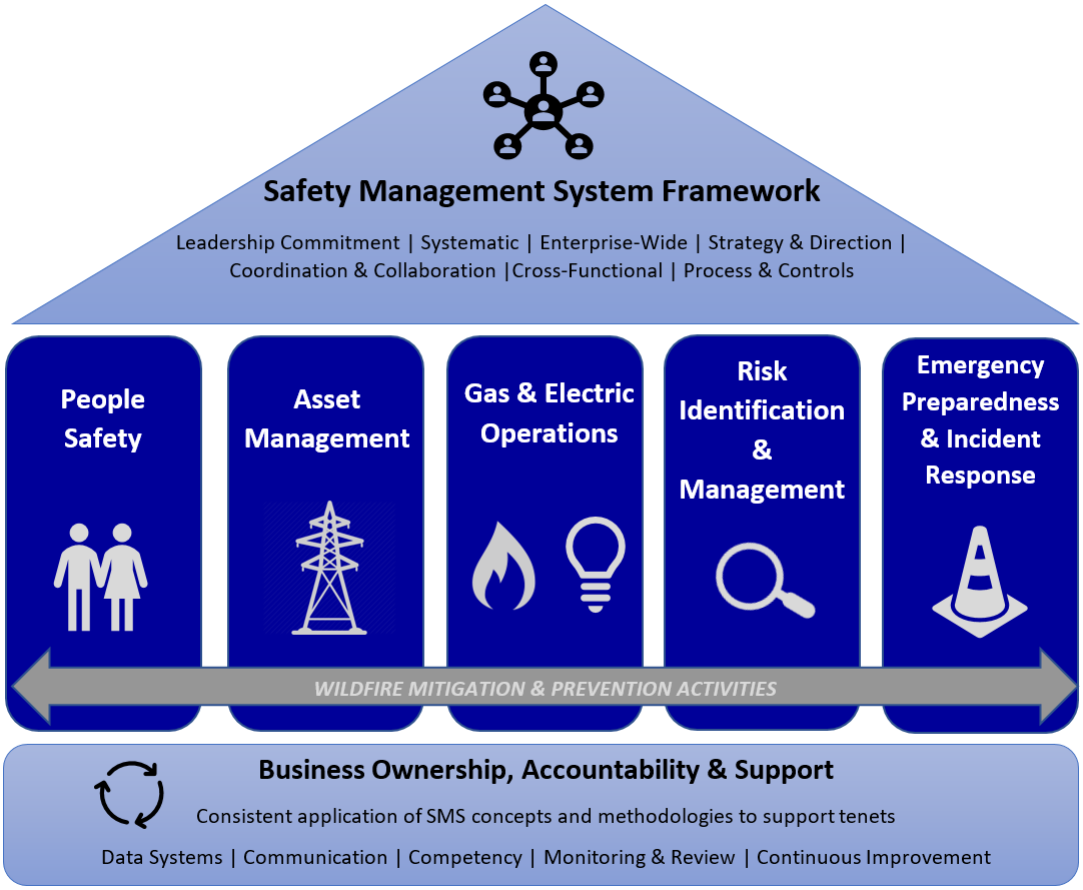
6 D.19-09-051 at 23.

7 OSHA recordable employee injuries improved 16% over our previous best year (2019). *See*, SDG&E 2020 Safety Performance Metrics Report, A.15-05-002, for further details.

SDG&E's SMS focuses on process safety, which broadly encompasses procedures, hazard analysis, training, equipment integrity, change management, incident investigation, emergency preparedness, and compliance. These factors and others affect the likelihood and consequence of such incidents and can contribute to their identification and prevention.

SDG&E's framework for its SMS is summarized in Figure 1 below:

Figure 1: SDG&E SMS Framework



SDG&E established this SMS Framework in 2020, which includes the Five Pillars of Safety, to focus on both individual safety behaviors and process safety management. The Five Pillars of Safety are: (1) People Safety, (2) Asset Management, (3) Gas and Electric Operations, (4) Risk Identification and Management, and (5) Emergency Preparedness and Incident Response. These pillars are the core of an integrated, comprehensive, and risk-informed approach to managing safety under the SMS, in line with basic safety principles and a broader process safety management focus. Activities to effectively manage the risks SDG&E faces,

including wildfire mitigation and prevention activities, are integrated throughout the Five Pillars of Safety and the SMS Framework.

An effective SMS requires that all Five Pillars of Safety have a strong interdependence, each contributing a vital aspect across the SMS Framework for exemplary safety performance. Each pillar is defined below:

- ***People Safety*** addresses the education of, communication to, effects on, and contributions of the people who comprise and support the organization.
- ***Asset Management*** considers the assets, systems, and equipment, their condition, maintenance, installation, prediction of failure, and how they affect worker and public safety.
- ***Gas and Electric Operations*** provides practical input into the development of acceptable safety processes, practices, and standards, and ensures proper application of SMS tenets and processes in executing operations, maintenance, and construction activities to protect worker and public safety.
- ***Risk Identification and Management*** proactively identifies safety risks, considers their likelihood and potential consequences, and identifies mitigations that reduce these risks to prevent safety incidents.
- ***Emergency Preparedness and Incident Response*** focuses on utilizing leading practices for all responses, large and small, that support situational awareness, collaboration, coordination, and strong command and control to minimize worker risk and public exposure.

Business Ownership, Accountability and Support provides the foundation for the Five Pillars of Safety within the SMS framework, as shown above in Figure 1. Critical common supporting elements that broadly apply to each of the pillars include data systems, communication, competency, monitoring and review, and continuous improvement.

SDG&E's SMS aligns with American Petroleum Institute's Recommended Practice for Pipeline Safety Management System (API 1173). While API 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 1173 to its electric operations. For example, SDG&E added elements

specific to wildfire mitigation that are not found in API 1173 throughout its SMS. SDG&E's SMS also incorporates elements of the following guidelines and standards:

- CPUC: Office of Safety Advocate 2018 Annual Report;
- International Standards Organization (ISO) 31000: Risk Management;
- ISO 55000: Asset Management: Overview, principles and terminology;
- ISO 55001: Asset Management: Management systems – Requirements;
- ISO 22320 and the Incident Command System: Emergency Management; and
- OSHA Occupational Safety Standards: Employee and Contractor Safety.

These integrated elements together support the development of a comprehensive and proactive safety program that produces ever-improving levels of safety.

The safe and effective operation of SDG&E's electric and gas systems requires awareness and management of many linked activities within complex processes. For instance, major accidents with high consequences may rarely occur, but when they do, it is often found to result from an alignment of weaknesses or failures across multiple activities. While safety efforts may be applied individually to each activity, more effective safety performance is achieved when viewing linked activities as processes that are better managed holistically; the SMS provides this holistic approach to process safety that expands beyond traditional occupational safety by placing critical emphasis on strong interdependencies with risk, asset, incident response, and operational management.

Managing processes requires different techniques than managing individual activities. The management of both complex and simple safety-related processes requires integration and coordination across the entire organization to address multiple dynamic activities, assets, scenarios, and circumstances. The SMS provides a framework for managing these integrated processes that support the continual, safe operation of SDG&E's electric and gas systems.

The overall objective of the SMS is to drive continuous improvement in SDG&E's safety performance. The following principles are aligned with the essential elements of API 1173 and the ISO and OSHA guidelines listed above to form the basis of SDG&E's SMS framework (*i.e.*, Figure 1, above):

- Commitment, leadership, and oversight from Company leadership and top management are vital to the overall success of the SMS;

- A safety-oriented culture is essential to enable the effective implementation and continuous improvement of SMS processes and procedures;
- Integrated risk management practices are an integral part of the design, construction, operation, and maintenance of SDG&E's electric and gas systems;
- SDG&E's electric and gas systems are designed, constructed, operated, and maintained in a manner that complies with federal, state, and local regulations;
- SDG&E conforms to applicable industry codes and consensus standards with the goal of reducing risk and minimizing the occurrence of abnormal operations;
- Defined operational controls are essential to the safe design, construction, operation, and maintenance of the electric and gas systems;
- Prompt and effective incident response minimizes the adverse impacts to life, property, and the environment;
- The creation of a learning environment for continuous improvement is achieved by investigating incidents thoroughly, fostering non-punitive reporting systems, and communicating lessons learned;
- Periodic evaluation of risk management effectiveness and system performance improvement, including audits, are essential to assure effective SMS performance;
- SDG&E employees throughout the organization must effectively communicate and collaborate with one another. Further, communicating with contractors to share information that supports decision making and completing planned tasks (processes and procedures) is essential; and
- Managing changes that can affect the safety of SDG&E's electric and gas systems is essential.

III. ASSOCIATED RISK EVENTS

Given that SDG&E's SMS is an enterprise-wide framework providing a standardized approach for managing risk and safety across all assets and activities, the SMS is cross-functional in nature and helps mitigate all of SDG&E's RAMP risks. The SMS continuous improvement framework and Plan-Do-Check-Act cycle can be applied to mitigations and programs identified within each RAMP risk chapter. SDG&E's risk mitigation and safety programs are guided by the elements of the SMS and subject to on-going assessments to evaluate

the health of the programs and identify areas for continuous improvement. Taking a systematic approach to safety, assessing risk across the entire organization, enhancing our communication, collaboration, feedback, and documentation, and using data and analytics to regularly measure our effectiveness and make continuous improvements will help make each of our risk mitigation and safety programs more effective.

In addition to helping mitigate risk, the SMS helps further enhance activities identified within the following CFF Chapters, including:

- **Asset Management** (SDG&E-CFF-1) – SDG&E's Asset Management System serves as a direct link to risk mitigation by using identified and prioritized enterprise risks to inform asset management strategic and long-term risk planning. Implementation of ISO 55000 standards not only supports, but enhances the SMS framework, whereby operating assets are managed as an element of enterprise safety. Similarly, the SMS enhances SDG&E's Asset Management initiatives by providing standardized processes and common risk assessment methodologies across the Company.
- **Emergency Preparedness and Response** (SDG&E-CFF-3) – Following all exercises and Emergency Operations Center activations, a comprehensive review with key stakeholders (internal and external where appropriate) are performed to ensure continuous quality assurance/quality improvement. The sharing of best practices and lessons learned and performing incident investigations are essential elements of an effective SMS. The SMS will further enhance these activities by applying standardized processes for incident investigation and for utilizing and sharing of findings and lessons learned.
- **Foundational Technology Systems** (SDG&E-CFF-4) – SDG&E seeks to integrate new technology to enhance worker and/or system safety (*e.g.*, data and analytic tools, communication tools) to measure the effectiveness of the SMS. Data and metrics are essential elements of an effective SMS, and SDG&E is continually assessing tools and systems to further automate, validate, communicate, track and store data.
- **Records Management** (SDG&E-CFF-6) **–** SDG&E's records management policies and practices are designed so that critical information and documents are

appropriately handled, stored, and disposed of throughout the record's life cycle. As further described below, in Section V.D., the SMS provides for enhanced documentation and recordkeeping practices.

IV. 2020 PROJECTS AND PROGRAMS

A. Development and Implementation of an Enterprise-Wide Safety Management System

SDG&E began developing an enterprise-wide SMS encompassing both its gas and electric operations starting in the Fall of 2019. SDG&E established the framework and made great strides in the development of its SMS throughout the course of 2020 and plans for continued development and implementation in 2021. The SMS is a systematic enterprise-wide framework to manage and reduce risk and promote continuous improvement in safety performance through deliberate, routine, and intentional processes.

SDG&E's gas operations follow the guidelines of API 1173. As stated above, there is not currently an electric recommended practice for SMS similar to the well-vetted API 1173. Nonetheless, SDG&E electric operations' culture largely aligns with the expectations of API 1173. SDG&E is therefore currently in the process of implementing an API 1173 equivalent for its electric operations, a first in the electric utility industry. SDG&E is moving the enterprise (both gas and electric) towards an SMS based on the ten essential elements, also referred to as "tenets," of API 1173. These include:

1. Leadership and Management Commitment;
2. Stakeholder Engagement;
3. Risk Management;
4. Operational Controls;
5. Incident Investigation, Evaluation, and Lessons Learned;
6. Safety Assurance;
7. Management Review and Continuous Improvement;
8. Emergency Preparedness and Response;
9. Competence, Awareness, and Training; and
10. Documentation and Record Keeping.

The Plan-Do-Check-Act (PDCA) cycle, as provided by API 1173, is a four-step model for carrying out the components within each of the above-listed ten essential elements of the

SMS. The PDCA cycle is applied to each of the above elements in a recurring manner for continuous improvement. The components of the PDCA cycle are:

- **Plan:** Establish objectives and processes necessary to deliver results in accordance with SDG&E's policies, principles, and objectives;
- **Do:** Execute the plan;
- **Check:** Review the results relative to the objectives; and
- **Act:** Determine corrective actions required to improve differences between actual and planned results, analyze the root causes, and determine where to apply changes to improve the plan, process, or product.

The PDCA methodology can be applied to both the SMS as a whole or to individual components and processes. The PDCA cycle is at the core of the SMS, and its primary objective is to encourage creating strategies and plans, executing those strategies and plans in line with guidelines, checking those actions for conformity, and using those results to adjust the next generation of plans. The PDCA cycle is iterative and is maintained to achieve continuous improvement.

The PDCA cycle is useful and can be applied when:

- starting a new project;
- developing a new or improved design of a process, product, or service;
- defining a repetitive work process;
- planning data collection and analysis;
- selecting and prioritizing threats or causes; and
- implementing change.

Therefore, applying the PDCA cycle to the SMS framework and its individual components and processes will drive continuous improvement in safety. Using API 1173 as a general standard for operational safety for electric operations requires alignment of risk management (based on ISO 31000), asset management (based on ISO 55000), and emergency management (based on the Incident Command System), with traditional views of safety management (based on OSHA) to support development of a comprehensive and proactive safety program that produces ever-improving levels of employee, contractor, and public safety.

In 2020, SDG&E hired two full-time dedicated employees to manage the development and implementation of the SMS. SDG&E developed processes to address the highest priority,

highest value elements of API 1173. SDG&E established the SMS framework, operating model, and a decentralized SMS governance structure. SDG&E's SMS governance structure is a cross-functional team including business leaders from SDG&E's gas operations, electric operations, employee safety, contractor safety, customer safety, public safety, asset management, risk management and emergency management departments who represent the Five Pillars of Safety within the SMS Framework. SDG&E's SMS governance structure comprises three teams that oversee, lead and are responsible for the successful implementation of an enterprise-wide SMS: (1) SMS Executive Steering Team, (2) SMS Governance Team, and (3) SMS Program Management Team. This decentralized governance structure provides cross-functional teams to assess risk and safety issues Company-wide, while retaining risk ownership and accountability appropriately at the operational levels.

The teams within the SMS governance structure actively engage SDG&E's operational employees to solicit input, insight, and feedback on safety issues. The SMS Governance Team raise and address issues regarding the scope, project plan, implementation, ongoing management, data analytics, and continuous improvement of SMS and make decisions within the scope and authority of this SMS Governance Plan as a collective, cohesive unit.

SDG&E continually reviews and works to enhance its data collection and metric efforts. SDG&E actively participates in proceedings and working groups at the CPUC that may also address these or similar items (*e.g.*, the S-MAP Technical Working Group). SDG&E's SMS-related efforts will complement and enhance such efforts.

V. 2022-2024 PROJECTS AND PROGRAMS

SDG&E anticipates integrating the programs identified in this section into its TY 2024 GRC Application. Given the "cross-cutting" nature of SDG&E's SMS (*i.e.*, the de-centralized governance structure where risk ownership and accountability reside within the operating units, which spans all lines of business), the SMS's specific impacts to each operating unit will be presented within SDG&E's next GRC. Similarly, costs for implementing activities under the SMS framework will be included within each operational area's respective GRC testimony.

A. Development and Implementation of an Enterprise-Wide Safety Management System

As stated above, SDG&E established an enterprise-wide SMS and is currently in the process of implementing the processes, plans, and activities developed within the SMS

framework. An effective SMS takes years to fully implement with ongoing employee and contractor engagement, awareness, training, and continuous review and improvement efforts. As SDG&E moves forward with implementation, continuous improvement efforts will be identified, including the need for additional processes, tools, and resources. SDG&E hired two full-time professionals dedicated to managing the development and implementation of the SMS. As the SMS evolves and produces increased data, analytics, stakeholder engagement, and feedback, for example, the need for additional support will also increase.

B. Enhanced Employee & Stakeholder Engagement, Including SMS Competence, Awareness, Survey and Training

An effective SMS requires extensive, on-going employee awareness and engagement efforts. SDG&E plans to develop and deliver SMS-specific training and create ways to measure and track such competencies. Creation of an employee 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.

The practice of training and establishing competency at all levels is a form of investment in our employees. Employee competency and engagement are critical to the sustainability of the SMS and its effectiveness. Investment in building competency, like continual learning, builds trust and confidence that management prioritizes safety, their employees and contractor personnel, and the public. When competencies are defined, identified gaps in qualifications are addressed, and skill sets are refreshed, SDG&E will further enhance its safety culture and will provide employees the tools and means to safely carry out their job duties and responsibilities.

The effectiveness of the SMS will be measurable. In addition to tracking leading and lagging safety indicator data, SDG&E plans to survey its employees and stakeholders to further measure the effectiveness of the SMS and to identify opportunities for continuous improvement through identified controls and metrics.

C. Integration of New Technology and Enhanced Data and Analytics Capabilities for Continuous Safety Improvement

Given that an SMS is based on a continuous improvement framework, SDG&E seeks to integrate new technology to enhance worker and/or system safety (*e.g.*, data and analytic tools and communication tools) to measure the effectiveness of the SMS.

In order to have an effective SMS, SDG&E will need to make an intentional and deliberate effort to reveal risks within its business operations, evaluate multiple risks and threats using "what if" scenarios, and predict potential failures that may occur in its infrastructure system. An effective SMS needs to be integrated with new technology so that it continues to evolve with the changing business environment. SDG&E plans to explore the use of an electronic platform or an application that manages large amounts of safety and operational data, hazards, errors, observations, and key performance indicators (KPIs) from people, assets, programs, processes, and operations, and to use artificial intelligence for predictive analysis of potential issues. This effort may require non-labor dollars for use of consultants and licensed products.

D. Enhanced Documentation and Recordkeeping Practices

Procedures and work practices must be documented. Strong documentation and recordkeeping practices lead to greater certainty that the electric and gas systems will perform as expected. This element of the SMS demonstrates commitment and discipline. Work products of each SMS element become essential records. As SDG&E continues to implement the SMS, it proposes to adopt enhanced documentation and recordkeeping practices to align document and recordkeeping processes to coordinate cross-functional access to support the SMS. Enhanced documentation that is widely accessible to employees will allow for the sharing of best practices, findings and lessons learned. These efforts will improve safety and also provide ample opportunity for increased efficiencies.

E. Expanded Quality Management Program Focused on Asset Safety

SDG&E's SMS includes quality assurances and quality controls to validate adherence to the system and its processes and to gauge reasonable progress toward full compliance with all expected standards of performance and the resulting safe operation of the gas and electric systems. Quality assurances provide confidence that the SMS and its processes are designed to create the desired safety results and employ analysis of results to drive and improve the SMS. Quality controls provide measurable targets against expected metrics or process steps to confirm adherence to SMS processes and to prevent incidents and injuries.

SDG&E seeks to expand its asset safety quality management program and plans by developing formalized processes, procedures, and accountability measures for quality assurance of safety-critical assets from design and specification, through manufacturing, delivery, and

acceptance, to installation for safe operation. Outputs of an expanded quality management program focused on asset safety will be used to drive continuous improvement efforts.

F. Enhanced Stakeholder Feedback and Key Performance Indicator Monitoring, Tracking and Reporting

Stakeholder engagement and feedback are essential elements of an effective SMS and are integrated into the SMS's continuous improvement framework. Additionally, the SMS will undergo regular review to measure its effectiveness. SDG&E proposes to expand processes for considering qualitative (*e.g.*, subject matter expert feedback) and quantitative (*e.g.*, KPIs and quality control results) to perform data analysis for trends and emergent issues to identify and mitigate new risks and to improve the SMS. SDG&E will use data and information from the implementation of the reporting and feedback system to identify new and emerging risks for future risk evaluation and to evaluate performance of risk mitigation measures.

G. Development and Implementation of a Strong Management of Change Platform

Management of Change (MOC) is also an essential element of SDG&E's SMS and aligns with the Operational Controls tenet of API 1173. SDG&E currently has several existing MOC processes and procedures. As part of SDG&E's process development efforts for its SMS, SDG&E has developed an MOC process that can be applied enterprise-wide to identify the risks associated with changes to technology, equipment, procedures, or organization, so that impacted stakeholders are prepared to safely handle changes. The objective of this standardized MOC process is to reduce the possibility of introducing additional risk, or inadvertently increasing the risk, to public or employee health and safety, the environment, or the community as the result of a change. Under normal (non-emergency) circumstances, the MOC process requires that technical, procedural, organizational, and operational changes and the associated risks are reviewed, assessed, documented, and communicated prior to implementation, and that impacted stakeholders in the Company are informed accordingly. When circumstances dictate preservation of health and safety of the public, employee, community, electric system, or pipeline system (*e.g.*, emergency situations), then a change may be implemented prior to the MOC review.

While the MOC process has been developed, successful implementation will require additional tools, resources, and a strong electronic platform. SDG&E plans to further develop its existing MOC processes and procedures under the SMS framework and to consolidate the

various MOC processes into one electronic platform. This will provide consistency and rigor for managing changes throughout the Company. A centralized MOC process would establish minimum requirements for company-wide operations. Furthermore, the MOC process would identify the types of changes that must be managed, the levels within the organization that have the authority to approve the changes, a threshold for changes that would need to go through the MOC process and the likelihood and consequence of the change, considering safety, reputational, financial, legal, strategic, and operational impacts. The centralized MOC process will also help facilitate communications and sharing of approved changes with impacted organizations.

H. SMS Program Benchmarking, Measurement and Maturity Assessment for Continuous Improvement

Applying multiple layers of safety assurances demonstrates a commitment to improved performance and effective risk management. These safety assurances, coupled with regular review, assessment and audit, help evaluate quality and completeness of programs and confirm that risk management processes are systematic and disciplined. SDG&E believes that its SMS should cultivate a culture of trust and openness, which is vital to an enhanced safety culture. To measure this, SDG&E plans to review, survey, benchmark, measure, validate and/or audit its SMS program effectiveness for continuous improvement no less than bi-annually.

Assessment of the SMS on an ongoing basis would confirm that it is achieving its desired goals and objectives and is making progress towards effective risk management and improved safety performance. The SMS would be assessed for conformity with appropriate external benchmarks and the system's growth and development beyond conformity, otherwise known as a maturity assessment.

As part of its 2020 development efforts, SDG&E created a process to conduct regular review of its SMS to measure its effectiveness and to make necessary changes or enhancements to the SMS for continual improvement. This program will provide the tools and resources to implement that process. A system performance evaluation looks at how well the SMS activities, governance and processes are working, including evaluation of the following elements:

- Commitment – leading, following, managing, planning, funding;
- Accountability – role, responsibility, discipline;
- Involvement – safety committees, feedback/suggestions, recognition;

- Identification – inspections, observations, surveys, interviews;
- Analysis – incidents, tasks, program, system;
- Controls – engineering, management, corrective actions, maintenance;
- Education – orientation, instruction, training, personal experience, awareness; and
- Improvement – change management, design, implementation.

SDG&E's process for regular review of its SMS includes the following steps:

- Perform baseline survey, evaluate what SMS programs and processes are in place, and identify any that are missing (*e.g.*, determine whether there has been any change in law, regulation, or business since the prior review that would necessitate new and/or revised processes);
- Review safety programs, policies, and plans; verify documentation is up-to-date and effectively communicated;
- Examine risk identification processes and controls;
- Review incident investigation and emergency action plans;
- Evaluate safety management practices;
- Analyze safety communications and documentation;
- Review safety program evaluation(s) and audit(s);
- Review safety performance metrics data (operational, asset, occupational);
- Conduct management reviews/surveys; and
- Benchmark SMS performance (internally and externally) and use the findings for continual improvement.

Performing such assessments on an ongoing, regular basis will enhance and mature SDG&E's SMS and will help realize the benefits and value of the SMS continuous improvement framework.

VI. COSTS

The table below contains the 2020 recorded and forecast dollars for the programs and projects discussed in this CFF chapter.

Costs (Direct After Allocations, in 2020 $000)[8]							
Line No.	Description	Recorded		Forecast			
		2020 Capital	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
1	Development and Implementation of an Enterprise-Wide SMS	0	1,800	0	0	500	600
2	Enhanced Employee and Stakeholder Engagement, including SMS Competence, Awareness, Survey and Training	0	0	0	0	400	600
3	Integration of New Technology and Enhanced Data and Analytics Capabilities for Continuous Safety Improvement	0	0	0	0	500	1,000
4	Enhanced Documentation and Recordkeeping Practices	0	0	0	0	100	300
5	Expanded Quality Management Program Focused on Asset Safety	0	0	0	0	200	300
6	Enhanced Stakeholder Feedback and Key Performance Indicator Monitoring, Tracking, and Reporting	0	0	0	0	200	300
7	Development and Implementation of a Strong Management of Change Platform	0	0	0	0	500	1,000
8	SMS Program Benchmarking, Measurement, and Maturity Assessment for Continuous Improvement	0	0	0	0	200	300

[8] Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollars and have not been escalated in forecasts beyond 2020.

Risk Assessment and Mitigation Phase
Cross-Functional Factor

(SDG&E-CFF-8)
Workforce Planning / Qualified Workforce

May 17, 2021

TABLE OF CONTENTS

CROSS-FUNCTIONAL FACTOR: WORKFORCE PLANNING / QUALIFIED WORKFORCE

I. INTRODUCTION

This Workforce Planning/Qualified Workforce Cross-Functional Factor (CFF) Chapter describes how workforce planning/qualified workforce activities impact the risks described in SDG&E's Risk Assessment Mitigation Phase (RAMP) risk Chapters.

SDG&E is presenting CFF information in this RAMP Report to provide the Commission and parties additional information regarding the risks and mitigations described in its RAMP Chapters. CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities or programs that may impact multiple RAMP risks. CFFs are also generally foundational in nature. Therefore, SDG&E's CFF presentation differs from that of its RAMP risk chapters (*e.g.*, no risk spend efficiency calculations or alternatives are provided).

As described below, workforce planning at SDG&E is a decentralized activity that is guided by the HR department. The HR department provides guidance to the operating groups in order to help them manage their workforce-related safety risks. The Workforce Planning/Qualified Workforce CFF therefore spans multiple operating departments and helps to mitigate several RAMP risks in this Report.

II. OVERVIEW

SDG&E utilizes a decentralized model of workforce planning. This model consists of each department planning for its workforce by analyzing current and future workforce needs, identifying current and future skill gaps, and implementing solutions, such as skills training, to ensure employee and contractor safety. SDG&E's HR department, including the Diversity & Workforce Management and the Organizational Effectiveness departments, work with the various operations departments to assess compensation, provide recruitment support, implement field leadership training, and manage succession planning such that each operations department is able to attract, develop, and maintain a skilled, safe, and qualified workforce. Technical training, knowledge transfer, and skill development for compliance and inspections is a particular area of focus. These activities support SDG&E's operations departments' focus on maintaining and improving safety-related impacts as well as reliability.

For the purposes of this RAMP Report, this cross-functional factor chapter focuses on SDG&E's efforts to employ a qualified workforce in the safety-related critical roles within eight different operations departments. Employees in critical roles are often highly specialized and

have knowledge and experience that is essential to safely operating and maintaining SDG&E's gas and electric systems.

A. Factors That Impact Workforce Planning and a Qualified Workforce

Essential to workforce planning is maintaining an awareness of factors that may impact developing and retaining a qualified workforce. Factors that impact workforce planning include, but are not limited to:

- **Economic factors** - Economic factors can accelerate or delay employee departures, as well as internal movement and development.
- **Regional/National Health Issues** - The COVID-19 pandemic has caused a change in working conditions, which has resulted in safety considerations such as the need for additional training, changing technology skill requirements, compliance issues, and mental and physical burnout.[1]
- **Labor market conditions** – Significant recruiting and staffing effort, and/or long internal train-up time, may be required to fill certain difficult-to-replace, safety-related core positions. For instance, lineman positions are difficult to fill due to the highly technical aspect of the position. In addition, increased demand for specialized skills may lead to competition in the industry for talent, resulting in attrition and vacancies.
- **Job satisfaction** - May accelerate or delay the number of employees seeking to leave their position or the Company.
- **Transition to new and emerging technology** - New workforce skills and more training for existing workers is needed as SDG&E continues to promote and adopt the use of technology in all areas of its business.
- **Retirement Eligibility –** SDG&E's historical, average 5-year retirement rate is 3.7%, which is slightly higher than the utility industry average retirement rate of approximately 2.9%.[2] Based on an aging workforce and workforce retirements, SDG&E expects the number of retirement-eligible employees to continue to

[1] See CFF-3: Emergency Preparedness & Response and Pandemic for additional discussion on pandemic related programs and projects implemented by SDG&E.

[2] PricewaterhouseCoopers (PwC), 2019 PwC Saratoga Benchmark Report.

increase through 2024. The potential for a significant number of retirements over the next few years heightens the need for and importance of successful workforce planning and knowledge transfer.

Each of the above factors may increase workforce attrition and movement, which in turn could create gaps in the skills and knowledge required of a qualified labor workforce that could ultimately lead to a safety incident. Thus, as these factors change, or in some cases continue, an active workforce planning framework (*e.g.*, workforce planning, training, knowledge transfer, succession planning, etc.) is necessary.

B. Potential Outcomes

Any of the above factors could contribute to a safety incident with consequences including but not limited to the following:

- Serious injuries;
- Property damage;
- Inefficiencies due to less experienced employees;
- Disruption to operations;
- Regulatory scrutiny; and/or
- Adverse liabilities.

III. ASSOCIATED RISK EVENTS

Each of the following risks chapters include at least one mitigation that involves personnel in an identified safety critical position, and therefore workforce planning activities affect the safety risks described in these chapters: Incident Related to the Medium Pressure System (Excluding Dig-in), Incident Related to the High-Pressure System (Excluding Dig-in), Excavation Damage (Dig-in) on the Gas System, and Electric Infrastructure Integrity.[3]

IV. 2020 SAFETY CRITICAL POSITIONS

As mentioned above, this CFF chapter highlights workforce planning challenges within each of the eight operations departments specific to safety-related critical roles. For each of the eight departments addressed below, there are a number of common workforce planning

[3] Although the Incident Involving Employee (IIE) and Incident Involving Contractor (IIC) chapters do not contain mitigations that involve safety-critical employees, it should be noted that the IIE and IIC chapters describe the safety framework, activities and certain training areas that employees and contractors, especially those in safety critical roles, must follow to maintain competency.

challenges, including an aging workforce, retirements and overall attrition, lengthy training times, new technology, new or increasing regulations, private sector career advancement opportunities, and managing a represented workforce. A high-level description of the safety-related critical roles within each department, as well as their specific workforce challenge scenarios, are described in detail below.

1. Gas Operations-San Diego Region

SDG&E's gas distribution system consists of a network of approximately 16,800 miles of interconnected gas mains, services and associated pipeline facilities that services approximately 890,000 customer meters. SDG&E routinely performs work to maintain the daily operation of the system, connect new customers, maintain the necessary capacity to serve all customers, replace damaged or deteriorating facilities, and relocate facilities to meet customer and governmental agency needs. Examples of critical roles in this department include: Pipeline Operations Supervisor, Gas Operations Site Lead, Locator, Working Foreman - Gas/Non-Arc Qualified, Working Foreman - Gas Arc Qualified, Instrument Supervisor, Instrument Tech, Electrician NACE, Patroller, Welding & Pipeline Inspection Supervisor, Operations Training Instructor, Shop Services Supervisor, and District Operations Manager.

Safety is rooted in all phases of gas distribution training. All the Gas Operations operations and maintenance (O&M) core activities such as valve inspections, large meter inspections, locate & mark and cathodic protection work, include training to maintain and reinforce a safe and qualified workforce. To that end, SDG&E is taking proactive action to enhance employee training, qualification, and work quality.

An integral component of workforce proficiency for employees in Gas Operations is the Operator Qualification (OpQual) program. As part of OpQual compliance, employees are trained whenever significant changes occur in a work task or as required per SDG&E's Gas Standards, state pipeline safety standards under General Order 112-F, federal pipeline safety standards under the Department of Transportation's (DOT) Pipeline Safety and Hazardous Materials Administration's (PHMSA) 49 C.F.R. § 192, and other applicable laws and regulations. The following additional factors also necessitate the need for ongoing gas operations training:

- The need to maintain a trained and qualified workforce;

- Workforce turnover presents issues of recruitment, knowledge transfer, skills development, and overall proficiency of the replacement workforce;
- The need to support new field technologies; and
- Introduction of new construction and maintenance methods.

2. Customer Field Operations

The Customer Field Operations (CFO) Department consists of the following departments: Customer Service Field, Workload and Emergency Response, Smart Meter Operations and Electric Metering Operations. Examples of critical roles in this department include: Appliance Mechanic, Relief Appliance Mechanic, Meter Service person, Electric Meter Tester, Meter Test Electrician, Instructors, Principal Engineer, Senior Engineer, Senior Electric Distribution Analyst, Crew Dispatcher, Service Dispatcher and Service Technician. CFO personnel are responsible for the following:

- **On Premise:** Gas and electric meter work such as installation, inspection and maintenance, establishing and terminating gas and electric service, lighting gas pilot lights, conducting customer appliance checks, investigating reports of gas leaks, investigating customer complaints of high bills, shutting off and restoring gas service for fumigation, as well as responding to structure fires (*e.g.*, to check for gas leakage/shut off gas service) and other emergency incidents.
- **Analysis:** Evaluating and approving new electric metering products and equipment, documenting new procedures, creating metering standards and specifications, performing meter failure analysis, and providing training and support to internal and external stakeholders on safe metering related issues.
- **Emergency Response:** All planned and unplanned work management including overall compliance and emergency response service-territory wide.

CFO critical roles include employees with vastly different skillsets and responsibilities. The workforce planning challenges faced by CFO include but are not limited to:

- Long training times - The Dispatch roles specifically have long and complex training times. To ensure employee competence, as well as skill and knowledge transfer to newer employees, Dispatch employees attend 4 weeks of classroom training focusing on the many aspects of the electric commodity, 8 weeks of on-the-job training, and then a minimum of 12 months anchoring their skills before

training on the gas commodity. In addition, training is lengthy for field workers such as Meter Service Persons, Service Technicians and Appliance Mechanics to skill up in order to advance into a quality assurance or instructor roles. Many other prolonged technical training exists for other critical roles such as Meter Service Person, Appliance Mechanics, and Electric Meter Testers.

- Skilled job market competition - External competition exists for highly skilled workforce positions, such as engineers.
- Different compensation structures for management jobs and union employees with the expertise to fill those jobs persists.

3. Kearny Maintenance & Operations

Kearny Maintenance and Operations (Kearny) is responsible for constructing and maintaining SDG&E's electric substation and transmission infrastructure. Included in this responsibility is the remote switching of Supervisory Control and Data Acquisition (SCADA) devices on the electric distribution system, testing of protective rubber goods, as well as the testing, repairing and calibrating of tools for electrical employees and other users at SDG&E. Examples of critical roles in this department include: Substation Electrician, Substation Working Foreman, Relay Specialist, Relay Technician, and Principal Engineer.

Kearny faces the following challenges when it comes to workforce planning.

- Long training times - Typically, a candidate for a Substation Electrician is an Electrician Assistant for a year prior to entering the apprentice program. After working as an Electrician Assistant for approximately a year, candidates enter a 3-year apprentice program, which typically has a relatively high failure rate. Additionally, because Substation Electricians are in high demand for other roles at the Company, there is turnover for this position as these employees move on to other positions, thus requiring a replacement (with three years of training). Similarly, both Lineman and Lineman Transmission also go through a similar apprentice program. For a Relay Technician A, which is the first level qualified to work on construction projects, an employee must first qualify as a Substation Electrician and then undergo a minimum of 4 years of training as a Relay Technician. Thus, when a Relay Technician is lost to attrition, it takes a minimum

of 7-8 years (1 year as an Electrician Assistant, 3 years as an Apprentice Electrician, and then 4 years as a Relay Technician) to train a replacement.

- Skilled job market competition - It is very difficult to fill the lineman and Relay Technician positions from the outside. For lineman, the job market is competitive, and the skillset needed to perform transmission line work is unique. For Relay Technicians, SDG&E requires classification as Qualified Electrical Workers (QEWs). Many other companies do not require their relay techs to be QEWs, which greatly limits the pool of external candidates.

4. Electric Regional Operations

Electric Regional Operations (ERO) is responsible for the construction, operations, maintenance, and restoration of power for SDG&E's electric distribution system. Other functions include: SDG&E's training center for field operations functions, electric crew scheduling, and helicopter operations. Examples of critical roles in this department include: Construction Project Coordinator, Fault Finding Specialist, Inspector A, Construction & Operations Planner, Troubleshooter, Lineman, Working Foreman, Sr. Line School Instructor, and Construction Supervisor-Electric.

ERO faces many challenges when it comes to workforce planning. The acceleration of workforce attrition and a changing business environment could result in not having a workforce with the right skills to meet operational requirements. Challenges specific to ERO include:

- Long training times – ERO employees typically have training times of 3 years or more. For example, the Construction Project Coordinator position requires 6 years of planning, construction, or construction support experience as well as significant training. Additionally, because of their extensive training and skills, employees in ERO positions are often candidates for other positions at the Company, requiring constant training of employees for replacement.
- Requirement for diverse skills - ERO employees must have highly technical subject-matter expertise leadership skills, as well as proficiency in oral and written communications.
- Skilled job market competition - Many ERO employees are QEWs with portable skills in high demand by contractors or other electric utilities offering significant compensation inducements which can have substantial workforce planning

consequences. It is challenging to fill Troubleshooter, Working Foremen, and Electric Construction Supervisor positions from the outside and internally. The job market for QEWs and Linemen is competitive, and the skillset needed for these roles is highly technical and specialized.

- Wage Compression - There is difficulty in attracting linemen into the Electric Construction Supervisor, Senior Line Instructor and other technical roles due to the compression issues between those positions and the Working Foreman role. One significant factor is those positions' inability to obtain overtime due to exempt status.

5. Electric Grid Operations

The Electric Grid Operations (EGO) organization is responsible for the safe, reliable, and efficient operation of SDG&E's electric transmission system. EGO works closely with the California Independent System Operator (CAISO) and Peak Reliability Coordinator to ensure adequate supply and readiness for optimal system safety and reliability. Additionally, EGO provides transmission outage coordination, operations planning and training, 24-hour real-time situational awareness of all transmission assets using EGO's state of the art Energy Management System (EMS), as well as inter-departmental platforms vital to the integration of new transmission and generation projects. Finally, EGO is responsible for ensuring employees adhere to physical and cyber security protocols for critical Grid facilities and information. Examples of critical roles in this department include: EMS Software Supervisor, Grid Operations Services Manager, Mission Control Training Manager, and Operations Shift Supervisor.

The main workforce planning challenges for critical roles in EGO (especially regarding the Operations Shift Supervisor position) include the following:

- Long training times - The training process is very lengthy (5+ years), and there is a long trainee development time (upwards of 2+ years).
- Skilled job market competition - Because of the necessary specialized knowledge (*e.g.*, NERC[4] certifications requirement), high industry demand for this skillset,

[4] The North American Electric Reliability Corporation (NERC) is a not-for-profit international regulatory authority whose mission is to assure the effective and efficient reduction of risks to the reliability and security of the grid.

and high compensation expectations, qualified individuals can be difficult to find. In addition, the trainers are also difficult to acquire as SDG&E's grid training program is centered around SDG&E's specific technology, which limits the number of candidates from outside of SDG&E.

- Employee Retirements & Movement – Due to Distribution System Operators having important technical skills to operate the electrical systems and meeting NERC Reliability Standard requirements, it's imperative that the pipeline for the Distribution System Operator positions is robust as these employees typically fill the Transmission System Operator role in EGO. Additionally, operators in both the EGO and Electric Distribution Operations (EDO) departments often move into training positions. This type of movement, although increasing broad skillsets, can lead to skills gaps when employees move on. Finally, an aging workforce at retirement level in EGO is also a challenge.

6. Construction Management

The Construction Management organization is responsible for overseeing gas, overhead and underground electric distribution, transmission, and substation contractor construction crews to budget, schedule and ensure project success. The department also oversees contract administration of gas and electric distribution infrastructure projects performed mainly by third-party contractors. Examples of critical roles in this department include: Civil Field Construction Advisor, Electric Field Construction Advisor, Gas Field Construction Advisor, and Construction Managers. These positions are highly trained and skilled technical employees that have Qualified Electrical Worker/Gas field leadership experience. A large percentage of the organization's workforce consists of Field Construction Advisors (FCAs) who have prime responsibility for field oversight of these projects.

Construction Management experiences multiple workforce planning challenges that include a labor pool reduction, an aging workforce, training and qualifications for leadership experience, and a changing environment.

- Job market competition - Positions in Construction Management require a combination of leadership experience and a suitable background as either a QEW or a qualified gas worker, both of which take many years to achieve. In addition, the changing environment for the utility industry is impacting the planning and

management within Construction Management. Federal and State regulations are becoming stricter with an emphasis on work methods and environmental protections. The increasing number of regulations ultimately requires more knowledge and skill, which requires more training and directly impacts the available labor pool for workforce management.

- Aging workforce and long training times - Construction Management runs the risk of not being able to replace retiring employees with properly trained, knowledgeable, and qualified employees. The lengthy training and qualification requirements in addition to the leadership requirements are vital for the safety and oversight of our contractor construction crews working on SDG&E electric and gas facilities, but could take upwards of 5-10+ years for an individual starting at an entry level position within the Company. Leadership experience plays a vital role in an employee's ability to interpret electric switch plans, understand Geographic Information System (GIS) maps, and interact knowledgably with customers, which only comes with internal SDG&E equipment and technical experience. Only a small percentage of the internal Company population qualifies for these roles and this population is shrinking due to attrition.

7. Electric Distribution Operations

Electric Distribution Operations (EDO) operates over 1,000 electric distribution circuits to provide safe and reliable service to SDG&E customers behind the 1.46 million electric meters in San Diego County and southern Orange County. The EDO department consists of three sections:

- The EDO Control department is staffed with Distribution System Operators (DSO) who oversee the planned switching during routine work and restoration switching during emergencies.
- An EDO Technology workgroup directly supports the control center with technology and process issues, especially ones related to the SCADA system. SCADA enables EDO to operate equipment remotely, enabling mitigation measures when weather conditions increase the risk of wildfires, and for use to speed up restoration to customers during system outages.

- An Enterprise GIS Services group manages records related to electric facility asset and connectivity changes. This information is stored in a GIS database and is used across the Company for managing switching on the system, asset risk/analytics programs, coordinating planned system enhancements, regulatory reporting, accounting, and many other functions.

Examples of critical roles in this department include: DSO, Working Foreman – System Operations, SCADA Operations Technologist, and Electric GIS Specialists and Technicians. Each section of the EDO department has its own workforce challenges which include:

- Long training times and low pass rate - The EDO Control department has a low supply of qualified DSOs. The DSO training program graduation rate is low (below 50%), there are long trainee development times (upwards of 2 years), and high industry demand for DSOs. Additionally, trainers are difficult to acquire, as SDG&E's DSO training program is centered around SDG&E's specific technology, limiting the availability of candidates outside of SDG&E.
- Skilled job market competition - The Enterprise GIS Services has a high year after year attrition rate due to the demand outside of SDG&E for this highly skilled workforce. Outside companies and other departments within SDG&E look at Enterprise GIS Services as a feeder pool for their vacancies due to the rigorous candidate selection and extensive training that Enterprise GIS Services employees receive. SDG&E uses ESRI's GIS software[5] which is recognized as the industry standard for geospatial databases thus making SDG&E employees trained in this software very marketable. For the EDO Technology group, one workforce planning challenge is attracting candidates with solid computer and database management skills to build and maintain SDG&E's advanced SCADA Headend system. These are critical roles that are difficult to fill and there is an ongoing need for adequately skilled staff to not only build and maintain the SCADA Headend system to meet accuracy and availability goals, but also to keep up with the growing number of new SCADA site installations across the service territory.

[5] Environmental Systems Research Institute (ESRI) is a supplier of GIS software, web GIS and geodatabase management applications.

8. Electric Engineering

The Electric Engineering (EE) department's main role is the engineering and design of transmission, substation, and distribution projects for the Company in accordance with industry and Company standards, and CPUC regulations. This includes developing and maintaining Company standards, work methods, and technical solutions to provide safe and reliable service to customers. The department consists of the following sections: Transmission Engineering & Design, Substation Engineering & Design, Electric Distribution Engineering, Civil/Structural Engineering, System Protection & Control Engineering, Distributed Energy Resources, and Electric System Hardening. Examples of critical roles in this department include: Construction Standards Administrator (includes Senior), Construction Standards Team Lead, Principal Engineer, Senior Engineer, Substation Designer (includes Senior), and Transmission Engineering Designer (includes Senior, and Design Advisor).

Electric Engineering's workforce has several critical employee classifications which are subject to attrition due to retirement or private sector career advancement opportunities. Additionally, recent attrition and historic employment cycles have generally created an aggregate experience profile skewed toward less-experienced personnel. EE must develop and retain employees across the critical role spectrum to maintain high standards for engineering and compliance with CPUC or other regulatory requirements. Experience level for proficiency in these critical roles generally ranges from five to 15 years. It is not uncommon for specialists in critical roles to possess 20 to 30 years of specialized experience. Attrition through retirement must be mitigated by consistent and long-term knowledge sharing. Formal training and mentoring programs of sufficient depth and multi-year duration are required to return to and maintain a more even distribution across experience levels.

V. SUMMARY

Each of the eight operations departments identified above continually monitors its own workforce needs to ensure that it has the right number of employees, with the right skills and training to prevent safety-related incidents. To address the challenges of employee movement, retirement, and job competition, each individual department regularly assesses its workforce planning and qualification needs. This includes planning for those needs via resource forecasting during the General Rate Case (GRC) cycle, monitoring headcount and attrition, as well as offering formal training and extensive on-the-job training to meet department-specific skill

needs. Both formal and informal trainings improve competence and allow for knowledge transfer. Further, from a compliance and inspection standpoint, each of the eight operations departments participates in the Environmental and Safety Compliance Management Program (ESCMP) to address compliance requirements, awareness, goals, monitoring, and verification related to all applicable environmental, health and safety laws, as well as Company safety standards. ESCMP is further described in the Incident Involving An Employee risk chapter's C5 mitigation.

These activities are included here to address the impact and cross-functional nature of workforce planning and a qualified workforce for safety across the Company. Importantly, SDG&E continues to strongly emphasize the importance of technical and developmental training as essential and the crux of the Company's safety culture, and the safety of its employees, contractors, and the public.

VI. 2020 SUPPORTING ACTIVITIES AND PROGRAMS

In addition to the operation departments' efforts in addressing their individual workforce challenges, the HR department, including the Diversity & Workforce Management and the Organizational Effectiveness (OE) departments partner with operations to proactively seek out and hire qualified applicants, provide field leadership training, succession planning, engagement survey and action planning, as well as provide information and data in order to make informed resource decisions.

Specifically, the Organizational Effectiveness Department offers the following programs:

- **Field Leadership Development Program –** (1) *Hiring and promoting new supervisors and field leaders*: OE partners with operations management to develop leadership skills, action planning, and assessments to select those supervisors and field leaders with potential for high effectiveness. (2) *Culture of Safety & Accountability*: OE partners with operations management to continue to create a safety and learning culture and implement systems to reduce risk in the organization. Creation of processes to help us learn from undesirable outcomes and how the behavioral choices and errors we make impact our customers, one another, and the organization. (3) *Respectful Workplace*: OE partners with operations management to continue to build and sustain a culture of respect where no one feels excluded and where every employee can: work free of harassment,

abuse and bullying; learn to appreciate and embrace differences; and engage in open and honest discussion with any other employee without fear. (4) *Training and Development*: OE will continue to design, implement, and sustain a blend of classroom, online and on-the-job training focused on supervisory and leadership skills with developmental assessments (checkpoints) to track progress and accelerate the learning curve.

- **Engagement Survey and Action Planning** –Bi-annually, SDG&E surveys all employees to obtain input on overall engagement and supervisor's effectiveness. HR will then assist the operations departments with post-survey action plans, as necessary, increase employee engagement and satisfaction with strategies such as coaching, training, and team building.
- **Succession Planning -** In the next five years, approximately 35% of SDG&E managers will be retirement eligible. This knowledge loss, which includes many long-term employees, as well as employees that transition onto other roles, requires proactive planning and leadership training to mitigate knowledge gaps that could lead to safety incidents. In addressing this issue, formal annual succession planning is critical over the next five years. It is essential that SDG&E not only focuses on accelerating advancement and development for the operations' management employees, but also mid-level employees as they will likely take over key roles for retiring employees.

The HR Diversity & Workforce Management department is partnered with outside organizations to create external training programs to expand SDG&E's candidate pool. An example is the Career Jumpstart program:

- **External Candidate Training** – Career Jumpstart is a program designed to develop a pipeline of qualified candidates for rewarding, key positions at SDG&E and other energy industry employers. In partnership with the San Diego Workforce Partnership and the Electrical Training Institute (ETI), a four-week training program is conducted onsite at ETI and provides candidates hands-on experience and exposure to tools, standard processes and procedures and safety protocol, all of which are necessary when performing in a skilled labor role such as the Laborer and Traffic Control positions at SDG&E.

The HR department overall has offered many resources during the pandemic including the following workforce-related resources:

- **COVID19 Pandemic** – To address employee mental and physical challenges with the COVID-19 pandemic, SDG&E HR has created many resources and benefits for employees. A "Parents Corner" internal website was created with information and resources for working parents such as tutoring assistance, childcare resources, and a parent's network. In addition, Company pandemic policies were created to address work-life balance and ergonomic safety such as remote working, ergonomic home office safety concerns, emergency paid sick leave and childcare/eldercare leave. Additionally, the Company surveyed the employee population for concerns about returning to work. Pandemic informational webinars were held – 32 in 2020 that had more than 1600 employees participate on subjects that included, "Motivating and Inspiring Remotely," "Work Life Balance," "Being Made Aware of Company Practices and Policies," and "Virtual Meeting Best Practices." The Company is also conducting other precautionary measures to ensure that essential employees working on-site are doing so safely, such as requiring and providing facemasks, sanitizer and other Personal Protective Equipment (PPE), where necessary, temperature testing, and limiting the number of individuals in work trucks, among other safety protocols. SDG&E is comparable to what other companies are doing when benchmarking was conducted.

VII. 2022-2024 SUPPORTING ACTIVITIES

As addressed above, each operations department assesses its own workforce planning needs and conducts extensive trainings to address potential knowledge, skill, and labor gaps that may lead to safety and operational issues. This department-by-department training will continue and is expected to evolve as needs change. Currently, SDG&E plans to expand or add various workforce planning/qualified workforce activities, including the following:

- **Gas Working Foreman Development Program** – This Gas Operations' department new program beginning in 2022 is geared to teach Working Foremen essential knowledge and skills to safely oversee their crews, public safety, and all aspects of the work in the field.

- **Meter Test Electrician Class** – Beginning in 2021, Customer Field Operations plans to expand the curriculum of this class to include additional employees and additional skills to supplement existing technical training.
- **Relay Technician School** – Beginning in 2021, this training program in the Kearney Maintenance and Operations department will be enhanced to enable Relay Technicians Class A and Relay Specialists to learn basic and more advanced-level theory in more of a class-based environment, as well as hands-on training.
- **COVID19 Pandemic – 2021 Return to Work strategy** – SDG&E has a Return-to-Work Taskforce that is working on developing a safe return to work strategy. As it is currently unknown when all employees will be able to return to their respective worksites and the strategy is still in the process of being created, it was found from the survey that having a possible "hybrid" work model wherein certain employees can work remotely part-time and part-time at a Company worksite could potentially benefit both the Company and employees. Benefits could include financial savings for both the Company and employee, enhanced employee work-life balance, and a reduced carbon footprint, amongst others.

VIII. COSTS

Because of the manner in which the dollars associated with the workforce planning activities to ensure a qualified workforce as discussed in this CFF are tracked and/or forecast, there are no dollars identified for those activities in this CFF.