Safety Policy Division

Staff Evaluation Report

on

SDG&E's and SoCalGas'

Risk Assessment and Mitigation Phase (RAMP) Application Reports

(A.) 21-05-011, (A.) 21-05-014

November 5, 2021

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Executive Summary

This is the Safety Policy Division's (SPD) evaluation of the Sempra companies' 2021 Risk Assessment Mitigation Phase (RAMP) Application. As articulated in D.14-12-025[1] and cited in D.18-12-014,[2] "The objective of RAMP is to incorporate the risk assessment approach used by each of the energy utilities, as developed in the S-MAP into the [General Rate Case (GRC)] process. This will provide a transparent process to ensure that the energy utilities are placing the safety of the public, and of their employees, as a top priority in their respective GRC proceedings." According to the Safety Model Assessment Phase (S-MAP) Settlement Agreement (SA), "the risk and mitigation analysis for RAMP and GRC proceedings and RAMP applications must meet minimum required elements."[3] SPD's evaluation aims to drive improvements in prioritization, quantification, and transparency in San Diego Gas and Electric's (SDG&E) and Southern California Gas Company's (SoCalGas) risk-based decision-making before their GRC filing in May of 2022.

The Sempra companies' RAMP Report provides an initial quantitative and probabilistic assessment of their respective safety risks, their plans to mitigate these risks, and estimates of costs associated with the proposed mitigations. Their mitigation plans and cost estimates are informed by Risk Spend Efficiency (RSE) calculations and analysis of hypothetical alternative mitigations. In this document, SPD evaluates the assumptions and methodologies in the chapters corresponding to each risk, as presented in the companies' RAMP Report.

The SA requires using a multi-attribute value function (MAVF) to evaluate and rank potential risk events. The MAVF is required to capture the safety, reliability, and financial impact of these risk events. As discussed below, the Sempra companies have included an additional attribute, Stakeholder Satisfaction, intended to capture the effects of a risk event on customers, employees, the public, government, and regulators. The MAVF is then used to calculate the risk scores for the risk events in the Sempra companies' Enterprise Risk Registers. D. 18-12-014, which approved the SA, calls for a minimum of 40 percent weight on the safety component of the MAVF. The Sempra companies opted to raise the safety weight to 60 percent in their 2021 RAMP Application. As discussed later, this choice significantly impacts Sempra's evaluations of the costs and benefits of their proposed mitigations.

Sempra's 2021 RAMP is their second effort (excluding the 2019 filing, which was dropped due to the change in the Rate Case Plan Schedule in Decision 20-01-002) and first under the terms of the SA approved D.18-12-014. SPD notes several improvements in this RAMP filing over prior efforts.

This is the first RAMP filed by an IOU to calculate Risk Spend Efficiency (RSE) values for most of the controls discussed in the Application. The inclusion of these values improved SPD's ability to compare existing risk control programs to new mitigation measures. Sempra is also the first IOU to propose a new attribute, Stakeholder Impact. SPD acknowledges the challenge in developing new methodologies and subjecting them to public and party review. Attributes like Stakeholder Satisfaction could be a new area of improvement to explore in the S-MAP process. Sempra also improved on the granularity of some risks. Examples include the separation of Electric Infrastructure Integrity risk from Electric Contact and Wildfire Risks. They also divided Dig-In risk

[1] D.14-12-25 at p. 35-36.
[2] D.18-12-014 at p. 30-31.
[3] D.18-12-014 Attachment A at p. A-4

into two focus areas, High-Pressure (HP) and Medium-Pressure (MP) systems. Finally, SDG&E includes Public Safety Power Shutoffs (PSPS) as a risk element in the Wildfire risk chapter. While other utilities have begun to conceptualize PSPS as a risk as well as a mitigation in their Wildfire Mitigation Plans[4] (WMPs), SDG&E is the first to do so in a RAMP filing.

In addition to these notable improvements in the RAMP filing, Staff found several areas where the SDG&E and SoCalGas RAMP joint filing was deficient and did not comply with the requirements of the SA. These are described in the Summary of RAMP-Wide Findings (below). Observations related to risk-specific risks and mitigations are covered in each chapter of the evaluation.

Ranking of Risk

Based on the history of prior incidents, the likelihood estimates for future events, and the attendant consequences, SoCalGas and SDG&E have appropriate risk rankings in their respective filings. SoCalGas's risks are shown in table 1 below. All of these risks have dedicated chapters. As pointed out in their report, SoCalGas's high-pressure pipelines span a dozen counties and the Arizona and Mexican Border. Over 1,100 miles of their high-pressure lines are within close proximity to residents and businesses. In addition to safety risks, properly functioning high-pressure pipelines are critical for a reliable energy supply. Likewise, SoCalGas's medium-pressure lines are extensive, with over 100,000 miles of medium pressure mains and services, including approximately 22,000 miles of steel mains and 25,000 miles of plastic mains. These medium-pressure pipelines serve over 21.8 million SoCalGas consumers.

TABLE 1. SDG&E RAMP Risks Ordered by Multi-Attribute Risk Score

RAMP Chapter Number and Subject	Risk Score	LoRE (events/Yr)	CoRE
SDGE-1 Wildfire Risk including PSPS Risk	16,459	NA	NA
SDGE-1 Wildfire (excluding PSPS Risk)	11,768	21.20	556
SDGE-1 Wildfire (PSPS Risk only)	4,691	4.00	1,173
SDGE-2 Electric Infrastructure Integrity	9,177	1,632.00	6
SDGE-3 High Pressure Pipeline Incident	2,029	0.88	2,301
SDGE-4 Contractor Safety Incident	1,894	1.83	1,033
SDGE-5 Customer and Public Electric Contact	1,396	1.17	1,197
SCG-6/SDGE-6 Cybersecurity	1,316	0.08	16,446
SDGE-8 Employee Safety Incident	1,062	0.83	1,275
SDGE-7 Pipeline Dig-In Incident (High Pressure)	815	0.19	4,235
SDGE-9 Medium Pressure Pipeline Incident	606	101.42	6

*N/A = LoRE and CoRE determined separately for Wildfire w/o PSPS, and for PSPS risks.

[4] See examples here: https://energysafety.ca.gov/what-we-do/wildfire-mitigation-and-safety/wildfire-mitigation-plans/2021-wmp/

TABLE 2. SoCalGas RAMP Risks Ordered by Multi-Attribute Risk Score

RAMP Chapter Number and Subject	Risk Score	LoRE (events/Yr)	CoRE
SCG-1 High Pressure Pipeline Incident	4,644	8.64	538
SCG-3 Medium Pressure Pipeline Incident	3,071	544.99	6
SCG-4 Gas Storage Incident	2,721	0.29	9,306
SCG-5 Employee Safety Incident	2,667	533.09	5
SCG-2 Pipeline Dig-In Incident (High Pressure)	2,180	0.70	3,114
SCG-6/SDGE-6 Cybersecurity	975	0.09	10,829
SCG-7 Contractor Safety Incident	469	144.77	3

Substantial areas of SDG&E's service territory include areas designated as high fire threat districts (HFTD). A combination of factors, including dry fuels and Santa Ana winds, make the region susceptible to high-consequence, catastrophic events. As a result, SDG&E has appropriately identified wildfire as their highest risk.

SDG&E points out in their Wildfire Chapter that "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 SDG&E's wildfire mitigation initiatives are targeted and prioritized in the HFTD, and thus, this Wildfire RAMP Chapter is focused on the HFTD." [5] In one example of the improved tranching in this report, SDG&E separated exposure analysis in HFTDs and non HFTDs into different chapters. The Electric Infrastructure Integrity (SDG&E-Risk-2) also includes safety considerations despite primarily addressing reliability concerns.

Also notable in SDG&E's filing is that their evaluation of wildfire risk considers the consequences of PSPS events in the overall risk assessment. Thus, their highest risk score represents the sum of the wildfire risk score and the risk score associated with PSPS customer impacts.

Time Period for Risk Assessment

The current RAMPs from the Sempra companies, SoCalGas and SDG&E, have been filed as an initial phase of the SoCalGas and SDG&E Test Year (TY) 2024 General Rate Cases to be filed in 2022. That rate case will use cost forecasts for 2022-2024 to establish a 2024 Test Year level of costs and determine a Revenue Requirement for 2025-2027 based on the Test Year. The cost forecasts are for specific programs and projects the utility plans to carry out during 2022-2024, using funding authorized in the previous rate case.

Sempra has taken the position that the appropriate period for risk assessment in the RAMP coincides with the period they will forecast cost for, i.e., the 2022-2024 period. The SoCalGas and SDG&E RAMPs present the results of risk reduction estimates for the mitigation programs they will conduct during that period, starting from a baseline level of risk in 2020.

[5] SDG&E RAMP at 1-4

As stated by TURN in their informal comments of February 12, 2021, "the purpose of the upcoming Sempra RAMP submission is to inform the Commission's decision in the GRC that will set revenue requirements for the years 2024 through 2027, based on a 2024 test year. Thus, the focus of the GRC and the RAMP needs to be the risk reduction impact of mitigations to be deployed in 2024 and subsequent years. To properly calculate the risk reduction benefits of mitigations proposed for 2024 and beyond requires that the baseline for the risk reduction calculations be the level of risk expected at the end of 2023."

The S-MAP Settlement Agreement, in Rows 10 and 11, requires utilities to consider the benefits of mitigations before the "GRC period under review." Therefore, this RAMP's baseline level of risk should include the benefits of mitigations through the end of 2023, not 2020. From the 2023 baseline, risk reductions for mitigations in 2024-2027 should be presented in the RAMP to inform the TY 2024 GRC period under review.

CPUC Decision D.14-12-025, *Decision Incorporating a Risk-based Decision-Making Framework into the Rate Case Plan* states as a Finding of Fact: "The logical starting point for prioritizing safety for the investor-owned energy utilities is in the RCP and the GRCs of each of the energy utilities because the GRC is the proceeding in which the utility requests funding for the test year and attrition years, and the Commission adopts and authorizes just and reasonable cost-based rates."[6]

SPD Staff have reviewed the finding from D.14-12-025, TURN's comments, and in consultation with the Energy Division, determined the correct time period for risk assessment in this TY 2024 RAMP is the 2024-2027 period, which is the GRC period under review in the forthcoming rate case. Staff also notes that PG&E, the first utility to file a RAMP under the current S-MAP Settlement Agreement[7] requirements, provided risk assessments for the Post-Test Year period.

The risk control and mitigation programs designed to replace infrastructure can provide significant risk reductions, and they tend to be the costliest. Due to these costs, infrastructure replacement programs are expected to prioritize mitigation of the highest risk segments and result in immediate and measurable reductions in risk. Since the Sempra Companies have ongoing infrastructure replacement programs in place through 2023, it is reasonable to expect the risk level addressed by those programs will result in lower overall risk scores than in 2020. Therefore, the utility should justify the cost of additional funds in their upcoming GRC using an updated risk assessment with 2023 as the base year for risk. With this new baseline estimate, Sempra Companies should calculate the expected risk reduction for the 2024-2027 period and provide a revised RSE. The risk calculations should be performed in accordance with Settlement Agreement requirements for tranche-specific LoRE and CoRE values.

[6] CPUC Decision D.14-12-025, *Decision Incorporating a Risk-based Decision-Making Framework into the Rate Case Plan*, Findings of Fact, at 49.

[7] CPUC Decision D.18-0-12-014, *Phase Two Decision Adopting Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with Modifications*, (Settlement Agreement) Appendix A.

RECOMMENDATION

For the TY 2024 GRC filing the Sempra utilities should, for each RAMP risk chapter:

1. Identify the risk mitigation programs (or projects) proposed to continue in 2024-2027.
2. Estimate the Risk Score for those programs for the end of 2023 as the base year.
    a. Apply tranche-specific LoRE and CoRE values to determine the Risk Score.
3. Estimate their expected risk reduction and RSE for 2024-2027.
4. Recalculate the 2021 RAMP RSEs for comparison.
    a. Apply tranche-specific LoRE and CoRE values for the 2021 RSEs
5. Provide rationales for the continuation of programs with lower RSE in the 2024-2027 period.

Application of the Multi-Attribute Value Function

High Safety Weight Results in High Implied Value of Statistical Life (VSL)

The high safety weighting (60%) relative to the financial weighting in the Multi-Attribute Value Function (MAVF) results in an implied value of statistical life (VSL) of $100 million, as presented by TURN in their informal comment and protest documents.[8] The implied VSL can be viewed as the implied mitigation cost Sempra is willing to spend to avert one statistical fatality. Although the $100 million implied VSL estimated in TURN's calculations does not necessarily mean Sempra consciously manages its risk mitigation strategy around this dollar value, it is more than eight times the latest guidance figure of $11.6 million for VSL published by the U.S. Department of Transportation.[9] A detailed computation to arrive at this $100 million value is contained in TURN's June 21, 2021, protest.[10] TURN's calculations of the implied VSL highlight the practical tradeoff between the prevention of one statistical fatality and the associated risk mitigation costs.

SPD noted a similar finding (also highlighted by TURN and the Mussey Grade Road Alliance) in evaluating Pacific Gas &Electric Company's RAMP application last year.[11] The high VSL results from the broad latitude afforded to utilities in the Settlement agreement to establish weights and ranges on particular attributes. The discussion on the acceptable practical level of VSL is more nuanced than comparing the implied VSL against published VSL guidance figures. For example, in an As Low As Reasonably Practicable (ALARP) risk management framework, a utility is expected to spend on mitigation programs until the mitigation costs grossly exceed the equivalent economic cost of harm prevented by the mitigation programs.[12] The concepts of ALARP and VSL are part of the larger topic of risk tolerance, which is within the scope of the currently active risk-based

[8] Informal Comments of The Utility Reform Network (TURN) To the Safety Policy Division on the Sempra Utilities' RAMP Report, received October 22, 2021 and Protest of the Utilitey Reform Network filed on May 7, 2021.

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

[10] https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M389/K148/389148357.PDF, pages 22 to 23.

[11] Safety Policy Division Staff Evaluation Report on PG&E's 2020 Risk Assessment and Mitigation Phase (RAMP) Application (A.) 20-06-012, Observation 4 on page 17 of the report. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M394/K802/394802119.PDF

[12] Safety and Enforcement Division Staff White Paper on As Low As Reasonably Practicable (ALARP) Risk-informed Decision Framework Applied to Public Utility Safety by Steven Haine. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M157/K359/157359431.PDF

decision rulemaking proceeding, R.20-07-013. The subject of risk tolerance will be addressed in Phase 2 of R.20-07-013.

TURN recommends in their informal comments of October 22, 2021 (attached to this report) that Sempra revise the safety range from 20 to 200, which would reduce the implied VSL by a factor of 10 to $10 million. The safety range is the maximum expected worst-case result in terms of fatalities and equivalent serious injuries. SPD staff notes that an increase in the range to 200 would push the consequence beyond the worst utility-related catastrophic fire Californians have ever experienced.

The MAVF framework provides any number of ways to modify weights and scales to suit a utility's desired consequence valuation to justify proposed expenditures. But those choices should be reasonable. For example, a safety range of 100 is not far from the number of fatalities and injuries experienced in the Camp Fire, which resulted in at least 84 fatalities and additional severe injuries, according to the Butte County District Attorney's Office.[13] SPD Staff calculates that if a safety range of 100 were combined with a safety weighting of 40 percent instead of 60 percent while maintaining the financial attribute weight of 15 percent, the implied VSL would become $13 million, which is in the approximate range of the current US DOT guidance figure.

While perhaps one of the more dramatic examples, the imputed value of life is not the only attribute where the implied values raise questions. TURN notes in their May 7th Protest[14], "Other equivalencies are implied by Sempra's proposed MAVF. Using the same approach described above for the SVL, one SAIDI minute is equivalent to $1.67 million, which implies that Sempra views it as worth spending $1.67 million on a mitigation designed to reduce the impact of a risk event from 100 to 99 SAIDI minutes."

RECOMMENDATION

While the use of weighting and scaling in the MAVF to derive high consequence values is not inconsistent with the requirements of the Settlement Agreement, the Commission and parties will evaluate the reasonableness of proposed expenditures in the GRC process. Accordingly, for the TY 2024 GRC filings, SPD Staff recommends that Sempra reevaluate the weighting and range factors in their MAVF to produce more defensible valuations of consequences.

Risk Assessment of Tranches

SDG&E and SoCalGas have identified tranches throughout the RAMP chapters. The purpose of a tranche is to select a sub-group of assets with uniform but distinctly different risk scores from the remainder of the risk category. This grouping facilitates granular risk assessments and mitigations. Each tranche can then have mitigation strategies according to the level of risk. However, the companies did not assign tranche-specific LoRE and/or CoRE values to the tranches.

For example, two of the identified tranches in the SoCalGas Medium Pressure (MP) pipeline risk recognize that vintage plastic and bare (unprotected) steel pipe materials pose a higher risk of

[13] The Camp Fire Public Report: A Summary of the Camp Fire Investigation, June 16, 2020. Available at: https://www.buttecounty.net/Portals/30/CFReport/PGE-THE-CAMP-FIRE-PUBLIC-REPORT.pdf?ver=2020-06-15-190515-977

[14]

failure than other kinds of pipe material in the system. Staff would expect these two tranches to have a different likelihood of risk event (LoRE) than the newer or better-protected pipe in the rest of the MP system. The S-MAP Settlement Agreement[15] requires tranche-specific LoRE and/or CoRE scores to account for the level of risk for each tranche.

SoCalGas and SDG&E do not present tranche-specific LoRE and CoRE values for most of the tranches in the RAMP report, but instead assign the same general pre-mitigation LoRE and CoRE to each tranche in a risk category, violating Rows 16, 19, and 22 of the Settlement Agreement. The pre-mitigation LoRE and CoRE values for these tranches are identical with each other and with the system-level tranche scores in the RAMP. The distinguishing characteristic of a tranche is that it exhibits a different risk score from the rest of the risk category.

The companies use an alternative method to calculate risk reductions at the tranche level that does not comply with Rows 16, 19, and 22. The Settlement Agreement permits a utility to submit additional information at its discretion as long as it satisfies the basic requirements in the Settlement Agreement. However, the RAMPs fail to present tranche-specific pre-mitigation and post-mitigation LoREs, CoREs, and risk scores at the Tranche level as Rows 16, 19, and 22 require.

RECOMMENDATION

For the TY 2024 GRC filings, SPD Staff recommends that Sempra develop tranche-specific LoRE and/or CoRE scores for each tranche to provide clarity of the risk for the tranche and to comply with the Settlement Agreement.

Granularity of Tranches

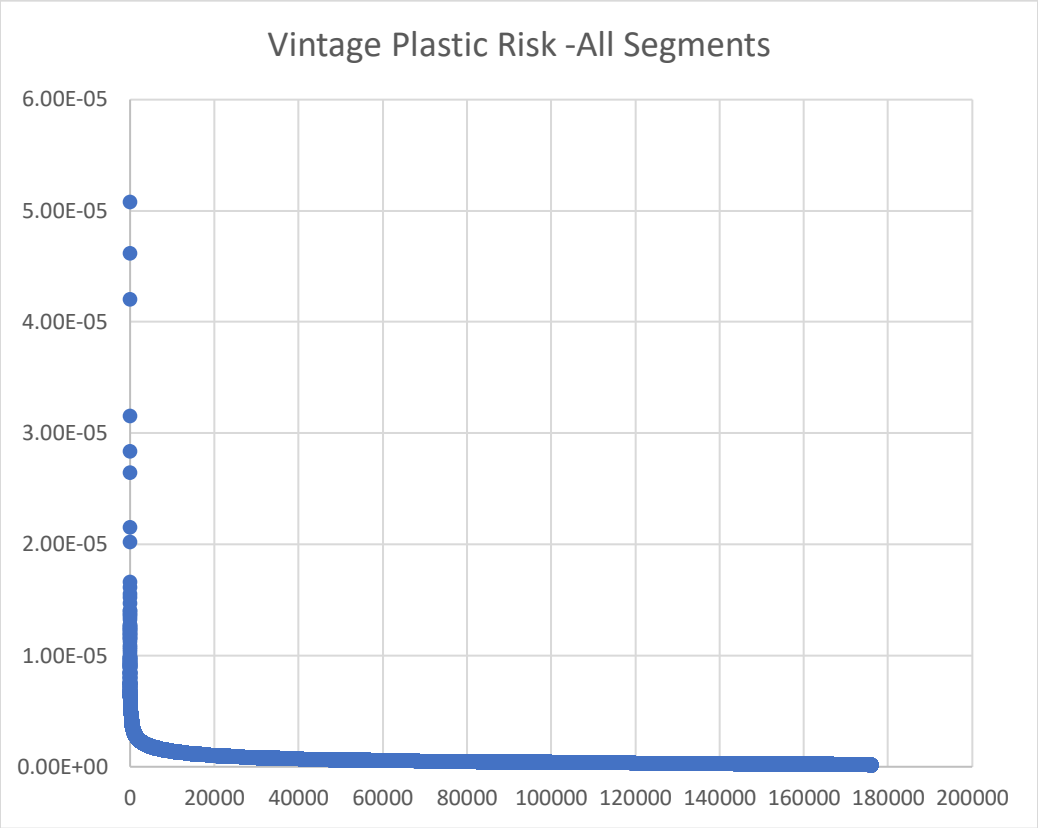
Finer granularity of tranches can help the utility and the Commission better understand which portions of a utility's system offer greater potential for effective risk reduction.

SoCalGas and SDG&E have identified tranches in each risk chapter. However, some of these tranches could be further divided by consideration of risk factors that occur within the tranche. An example is the tranching of the high-pressure pipeline into a High-Consequence Area (HCA) tranche and a non-HCA tranche, each containing hundreds of miles of pipeline. Pipeline risk factors such as older vintage welds, a history of internal corrosion, or an inability to be inspected with in-line devices ("pigs") could be used to create more granular tranches.

Another example of granularity is from the high-cost Vintage Integrity Plastic Plan (VIPP) which will replace vintage pipe with a less risky state-of-the-art pipe. SoCalGas and SDG&E have identified the entirety of their vintage plastic pipe as a tranche. However, Staff examination of the companies' "DREAMS" segment-level risk analysis indicates that a small portion of the segments carry the highest risk, as discussed in the Medium Pressure Risk chapters SCG-3 / SDGE-9 and illustrated in the figure below. Separation of the segments into tranches by risk level would demonstrate where mitigation will be most effective. It would be worthwhile to determine whether the lower-risk segments of vintage pipe have comparable risk to the non-vintage portion, in which case replacement may not be a cost-effective mitigation.

[15] Settlement Agreement, Appendix A at Row 16.

SCG-3 / SDGE-9 Figure 1. Probability of Serious Incident per Year, Vintage Plastic



RECOMMENDATION

Sempra should review SPD and party comments regarding tranching and respond in the GRC filing.

Wildfire Consequence Modeling

Staff has reviewed the Informal comments of Mussey Grade Road Alliance (MGRA)[16] on the SDG&E Wildfire risk chapter. Among other things, MGRA compares the gamma distribution model that SDG&E uses to a truncated power law distribution and asserts that the model used by SDG&E may significantly underestimate the probability of extreme wildfires at the tail end of the probability distribution. Staff appreciates MGRA's findings and recommendations. The comments are appended to this report.

RECOMMENDATION

SDG&E should complete the scenario analysis requested by MGRA and re-evaluate the use of their gamma distribution model prior to filing their GRC.

[16] A.21-05-011-014 - MGRA SDGE RAMP Informal Comments of October 22, 2021.

Wildfire Smoke Health Impacts

SPD Staff agrees with MGRA's findings and recommendations concerning wildfire smoke consequences. MGRA finds SDG&E's incorporation of wildfire smoke as a safety risk to be innovative and an overall positive development, although there are several shortcomings in the SDG&E analysis. According to the California Air Resources Board, "Wildfires produce a range of harmful air pollutants, from known cancer-causing substances to tiny particles that can aggravate existing health problems and increase the risk of heart attack or stroke." They continue, "Larger and more frequent and intense wildfires are a growing public health problem, contributing to reduced air quality for people living near or downwind of fire. Health problems related to wildfire smoke exposure can be as mild as eye and respiratory tract irritation and as serious as worsening of heart and lung disease, including asthma, and even premature death."[17] We encourage SDG&E (and other utilities) to continue developing more comprehensive and complete measures of consequences.

RECOMMENDATION

Sempra should review MGRA comments regarding wildfire smoke risk and respond in the GRC filing.

Late Workpapers and Delays in Providing Data

The Sempra Companies initially failed to submit sufficient and timely workpapers associated with their RAMP filings. As a result, SPD staff and parties were delayed in their ability to review documents essential to gain insight into the assumptions, calculations, and methodologies that underpin the RAMP reports in an already compressed and challenging timeframe.

RECOMMENDATION

Sempra and all utilities filing RAMPs should provide all information necessary for a timely and thorough review of their underlying methodologies, assumptions, and calculations concurrently with their RAMP reports. The timing of the submittal of Sempra's workpapers should not be seen as acceptable or precedent-setting, but rather as a counterproductive outlier that diverged from the timing in previous filings by PG&E and Southern California Edison.

Stakeholder Satisfaction Attribute

Sempra has introduced a new "Stakeholder Satisfaction" attribute to the required Safety, Financial, and Reliability attributes used in the Multi-Attribute Value Function (MAVF) to determine the consequence score for risk assessment in the RAMP. At two percent, the new attribute is given a low weighting in the MAVF. Still, it has a significant impact in the Electric Infrastructure Integrity (EII) risk, Chapter 2 of the SDG&E RAMP report. A more extensive discussion of SPD's concerns with this metric is in the EII chapter.

The Sempra Companies point out that introducing the Stakeholder Satisfaction attribute marks the first time an IOU has expanded the attributes in the MAVF beyond those required by the Settlement Agreement. SPD Staff appreciates that it is difficult to quantify these less tangible but important aspects of public experiences associated with risk events. Staff also believe a metric of this nature may be appropriate for events such as the Aliso Canyon leak. That event did not result

[17] https://ww2.arb.ca.gov/wildfire-smoke-health

in immediate serious injuries and fatalities but did cause widespread fear in the community, thousands of relocations (including schools), substantial political and regulatory reactions, and other significant repercussions not currently captured in the RAMP process.

However, Staff has concerns about using the Stakeholder attribute in justifying expenditures with the available data and relatively sparse justification and explanation. As described in the Sempra Companies' RAMP report, this attribute and sub-attributes appear to be entirely subjective and qualitative. Staff recognizes that many aspects of the attributes in the MAVF have subjective elements and qualitative evaluations based on SME judgment. However, at this time, based on the information provided, this attribute appears to lack objective measurements.

RECOMMENDATION

For the TY 2024 GRC filings, SPD Staff recommends that Stakeholder Satisfaction should not be used, as currently established, to calculate risk scores. Instead, Sempra, parties, and staff should continue to seek ways of measuring less readily quantifiable attributes, particularly environmental and community health impacts, to have a more comprehensive and complete accounting of risks associated with utility operations.

Cross-Functional Factors

The RAMP reports include chapters about elements of risk that have a cross-functional impact on the likelihood or the consequences of multiple asset risks. Sempra states they could not apportion or quantify these factors in the risk assessments. Examples are physical security, asset and records management, emergency preparedness, foundational technology, and climate adaptation/resiliency. Staff evaluated each of the cross-functional chapters.

SPD Staff appreciates the difficulty of quantifying these factors in the risk assessment but funds requested in the GRC for risk reduction should be supported with an estimated risk-benefit. Staff has summed the cost data from all the CFF chapters to determine the total forecast dollars for the Cross Functional Factors in 2022-2024.

Table 3. Recorded Cost and Cost Forecast in Millions, All Cross-Functional Factors

	2020 Recorded		2022-2024 Forecast		TY 2024 Forecast	
	Capital	**O&M**	**Capital Low**	**Capital High**	**O&M Low**	**O&M High**
SDG&E	$127.58	$39.63	$309.45	$396.42	$45.57	$60.58
SoCalGas	$81.42	$41.12	$365.33	$470.79	$52.60	$67.86
Total	$209.00	$80.75	$674.78	$867.21	$100.17	$128.44
One- Year Average			$257.00		$114.31	

Staff analysis indicates a 23 percent increase of capital expenditures from $209 million in 2020 to an annual average of $257 million in 2022-2024. The O&M forecast increases 50 percent from $80.75 million to an average of $114 million in TY 2024. The greatest component of the CFF costs is from the Foundational Technology chapter with annual average capital of $197 million and TY 2024 average O&M of $47 million.

RECOMMENDATION

For the TY 2024 GRC filings, although consideration of foundational activities costs in RSEs is not a requirement for this RAMP, SPD Staff nevertheless recommends that Sempra should incorporate foundational activities costs into the calculation of RSE scores for the GRC filing in a manner consistent with Ordering Paragraphs 1(e) and 1(g) in the Final Decision in Phase 1 of R.20-07-013 approved on November 4, 2021. If this is not feasible due to the foundational activities affecting multiple risks and multiple mitigations, this analysis would benefit from calculating portfolio RSE for all relevant Foundational Technology Systems programs using the "multi-portfolio" approach proposed by TURN in Phase 1, Track 1 of R.20-07-013.

Additional Findings and Recommendations

Each of the Risk Chapter evaluation sections in this report concludes with findings and recommendations.

RECOMMENDATION

For the TY 2024 GRC filings SPD recommends that Sempra should respond to the Risk Chapter evaluation findings and recommendations.

The GRC filing should include a narrative overview describing the way and in what sections of the filing that the companies have addressed all SPD and party recommendations.

Background and Introduction

Pursuant to 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, Southern California Gas Company (SoCalGas) and San Diego Gas and Electric (SDG&E) filed their 2021 RAMP applications on May 17, 2021. The filings are the first step in the submission of the test year (TY) 2024 General Rate Case (GRC).

The purpose of a RAMP report is to examine the utilities' assessment of its top safety risks and its proposed programs in accordance with the Commission's recently updated GRC Rate Case Plan, set forth in D.20-01-002, and present a Report on the utilities' safety risks in the manner required by D.18-12-014 (the Safety Model Assessment Phase [S-MAP] Proceeding Decision, and the Settlement Agreement adopted therein. The two RAMP applications have been given Commission proceeding numbers A.21-05-011 (SDG&E) and A.21-05-014 (SoCalGas), combined into one proceeding.

As directed by the combined Scoping Ruling in A.21-05-011 and A.21-05-014, the Safety Policy Division performs evaluations of the RAMP applications. This report summarized the results of the evaluation.

This RAMP is the first SoCalGas and SDG&E RAMP subject to the Settlement Agreement's terms adopted in the S-MAP Proceeding, A.15-05-002 et al.

Selection of Risks in RAMP

The Settlement Agreement in Step 1B, Row 8 specifies the process the utilities must use to select risks to be concluded in the RAMP. The process begins with the companies' Enterprise Risk Registers (ERR).

The Settlement Agreement in Step 2A, Row 9, describes the process whereby the initial enterprise risks in the risk register are evaluated for safety impacts and given an initial safety-only score. The resulting safety-only scores are then sorted, with the top 40 percent included in the RAMP. Sempra also had additional enterprise risks deemed to be a top priority in the preliminary list of risks.

Pre-filing RAMP workshops were held on October 15, 2020, and January 27, 2021. Per the Settlement Agreement, SoCalGas and SDG&E determined 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.

The selected RAMP risks were then fully evaluated using Sempra's Multi-Attribute Value Function (MAVF), which considered reliability, financial, and stakeholder satisfaction impacts in addition to safety. The risk evaluation then proceeded through the additional steps specified in the Settlement Agreement.

The process Sempra utilized to select the enterprise-level safety risks to be included in the 2021 RAMP Report conformed to the requirements laid out in the Settlement Agreement.

Explanation of Terms

RAMP Report – The main SoCalGas and SDG&E RAMP documents referenced in the RAMP application are referred to as the "RAMP Report." Supporting workpapers are also included as part of the RAMP Report.

2021 RAMP – IOUs and the CPUC customarily refer to RAMP Applications by the calendar year in which the application is filed. The Test-Year 2024 RAMP applications (A.21-05-011, (A.) 21-05-014) that were filed in calendar year 2021 are the "2021 RAMP."

Settlement Agreement (SA) – Refers to the settlement agreement reached between Pacific Gas & Electric Company, Southern California Edison Company, Southern California Gas Company, and San Diego Gas & Electric Company, The Utility Reform Network, Energy Producers and Users Coalition, and Indicated Shippers and the Office of Ratepayer Advocates in Phase 2 of the Safety Model Assessment Phase Proceeding, Applications A.15-05-002 and Related Matters A.15-05-003, A.15-05-004, and A.15-05-005 in Decision 18-12-014.

TY 2024 GRC – The CPUC and IOUs refer to General Rate Case (GRC) applications by the test year (TY) on which the general rate case estimates and calculations were based. Sempra refers to the upcoming GRC application that will be filed in calendar year 2022 as the "TY 2024 GRC." The 2021 RAMP was filed in connection with the TY 2024 GRC, covering years 2024 to 2027.

Risk Score – The product of risk Likelihood times risk Consequence.

LoRE – The Likelihood of a Risk Event, events per year.

CoRE – The Consequence of a Risk Event. As defined in the Settlement Agreement, CoRE is the sum of the weighted and scaled consequence attributes, including safety, financial, and reliability consequences.

RSE – Risk Spend Efficiency is the ratio of risk score reduction divided by the cost of the mitigation that reduces the risk.

Tranche – A tranche is a sub-group of an asset category that has different risk score than the remainder of the category.

MAVF – The Multi-Attribute Value Function calculates the CoRE value based on the IOU's choice of attribute weighting and scaling.

Scope and Methodology of Evaluation

Following the order of the RAMP Reports, this evaluation first examines the soundness and adequacy of the overall risk assessment and evaluation approach and whether that approach complies with the MAVF process specified in the S-MAP Settlement Agreement. Each risk chapter is evaluated in detail. One aspect of the evaluation revolves around the analysis of RSE scores. RSE of a mitigation program is defined as the amount of risk reduction divided by the cost of the mitigation program. To the extent that there are uncertainties and potential errors in the Sempra Companies' mitigation cost estimates, those uncertainties and potential errors would carry through to the RSE calculations, leading to potential errors in the mitigation decisions. The cost estimates should be substantiated in the TY 2024 GRC.

The Scoping Memo in the Sempra Companies' RAMP proceeding enumerates the following questions to be considered in the evaluation of these RAMP Reports:

1. Whether the RAMP Report and analysis is complete and in compliance with D.14-12-025, D.16-08-018 and the S-MAP Settlement adopted in D.18-12-014.

2. Whether there are gaps in the RAMP Report in identifying risks and considering mitigation options:

   a. Whether key safety risks have been adequately identified, assessed, and analyzed.
   b. Whether risk analysis is adequately supported.
   c. Whether effective mitigation programs have been developed and defined with sufficient granularity.
   d. Whether cost-effectiveness of mitigations has been reasonably assessed and analyzed.
   e. Whether alternatives have been fully considered and adequately discussed by the utility.
   f. Whether safety and other risks associated with PSPS have been considered in the RAMP process.

3. Whether the Multi Attribute Value Function (MAVF) and Risk Spend Efficiencies (RSE) calculations, including relative weightings and ranges for safety, financial, and reliability attributes, and whether their impact on risk estimates appropriately represent societal values, are reasonable and consistent with the S-MAP settlement.

4. Whether the utility's analysis is transparent and allows for independent validation of its results.

5. Whether RAMP feedback has been adequately incorporated into the utility's TY 2024 GRC filing.

6. Whether the proceeding should be closed or integrated into the utility's TY 2024 GRC.

PART A. RAMP Quantitative Chapter Evaluations

SCG-1 / SDGE-3 Incident Related to the High Pressure Pipeline System (Excluding Dig-In)

SCG-1.1/SDGE-3.1 Risk Description

SoCalGas and SDG&E define the risk as a failure of the high-pressure[18] gas system resulting in serious injuries or fatalities and/or damage to infrastructure.[19] The scope excludes excavation dig-in damage, which is evaluated separately.

SCG-1.2/SDGE-3.2 Bowtie

SoCalGas and SDG&E and provide identical risk bowtie diagrams:[20]

[18] Maximum Allowable Operating Pressure of higher than 60 psig (pounds per square inch gage pressure).
[19] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter 1 (SCG RAMP Ch. 1) at 5.
[20] SCG RAMP Ch. 1 at 6 / SDG&E RAMP Ch. 3 at 6.

Observations:

Drivers/Triggers 1 through 8 are based on the American Society of Mechanical Engineers (ASME) pipeline integrity standard B31.8S, 6 "Managing System Integrity of Gas Pipelines."[21] Staff finds that the choice of Drivers and Triggers is appropriate for the risk of gas pipeline failure.

Environmental Consequences

Natural gas is a potent greenhouse gas when released into the atmosphere. While most gas leaks due to pipelines may be relatively small, the consequences should be considered at least in the narrative discussion of a gas pipeline incident. While SDG&E's Cross-Functional Factor chapter discusses natural gas emissions as a climate change topic,[22] SoCalGas does not mention it.

SCG-1.3/SDGE-3.3 Exposure

SoCalGas

The utility describes its exposure as a total of 6,685 miles of pipeline in its high-pressure system, 3,341 miles of which are defined as transmission pipelines. It also notes that 1,100 miles of the transmission pipelines are in High Consequence Areas (HCA).[23]

SDG&E

SDG&E describes its exposure as 524 miles of high-pressure pipelines in its service territory, 218 miles of which are defined as transmission pipelines.[24] SDG&E estimates an HCA to non-HCA pipeline ratio of 33% to 67%.[25]

SCG-1.4/SDGE-3.4 Tranches

Both SoCalGas and SDG&E identify two major tranches: High Consequence Areas (HCAs) and non-HCA's. HCAs[26] have high building densities and concentrations of people. Other tranches are focused on projects such as the Ventura Compressor Station Modernization project.

Sempra does not track costs based on HCA or non-HCA status, so a fixed multiplier based on the ratio of HCA to non-HCA miles was applied to the cost and scope of the controls and mitigations.[27]

Observations:

The grouping of tranches by consequence is a logical approach to risk assessment. Staff expects that High Consequence Areas would have higher CoREs than non-High Consequence Areas. However, the RAMP reports do not provide tranche-specific CoRE consequence scores for the HCA

[21] SCG RAMP Ch. 1 at 3 / SDG&E Ch. 3 at 3

[22] SDG&E 2021 Risk Assessment and Mitigation Phase Report Cross-Functional Factor Chapter 2 (SDG&E RAMP CFF-2) at 7-10

[23] SCG RAMP Ch. 1 at 3

[24] SDG&E RAMP Ch. 3 at 2

[25] SDG&E RAMP Ch. 3 at 10

[26] HCAs are defined in the Federal Gas Safety codes, CCFR 49 § 192.903.

[27] SCG RAMP Ch. 1 at 10 / SDG&E RAMP Ch. 3 at 10

and non-HCA tranches, as required by Row 16 of the Settlement Agreement.[28] Sempra explained in response to SPD Data Request #7[29] that "increased consequences associated with projects in the HCA are captured in the post-mitigation risk score calculation using multipliers, based on PHMSA[30] data, to estimate differences in consequences between HCA and non-HCA." While that approach may produce beneficial results, the tranche-specific values of CoRE for the tranches are absent in the RAMP report or workpapers.

A more granular approach identifying sub-groups with different risk scores within these tranches, such as pipeline segments with older vintage welds, having a history of internal corrosion, or an inability to be inspected with in-line devices ("pigs"), would facilitate a better articulation of risks. Without this approach, a comprehensive understanding of the risk profile is unlikely to be achieved.

This issue is compounded by Sempra's decision to present only Pre-Mitigation LoRE and CoRE values for the entire system and not the separate tranches' Pre-Mitigation LoRE or CoRE values. These two factors result in a coarse understanding of the utilities' risk profile and impede staff's ability to assess whether mitigations are appropriately targeted.

SCG-1.5/SDGE-3.5 Likelihood of Risk Event (LoRE)

SoCalGas

The chapter presents a pre-mitigation LoRE of 8.64 events per year.[31] The next smallest LoRE is 0.70 events per year recorded in the high-pressure pipeline section of the Excavation Damage chapter[32] , and the next largest LoRE is 144.77 events per year recorded in the Contractor Incident chapter.[33]

SDG&E

SDG&E reports a pre-mitigation LoRE of 0.88 events per year.[34] The smaller LoRE for the San Diego system makes sense because SDG&E has 524 pipeline miles, roughly 10 percent of SoCalGas's 6,685 miles.[35]

Observations

The likelihood of risk events is presented as a single value for all the HP system infrastructure. For example, the pre-mitigation LoRE for tranche C23-T2, Ventura Compressor Station Modernization, is the same as the LoRE for the high-pressure system as a whole: 8.64 events per year.

[28] D.18-01-014, Decision Adopting S-MAP Settlement Agreement with Modifications (Settlement Agreement)
[29] https://www.socalgas.com/sites/default/files/SPD-DR07_08032021.pdf
[30] PHMSA is the Pipeline and Hazardous Material Safety Administration of the Dept. of Transportation.
[31] SCG RAMP Ch. 1 at 9
[32] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter 2 (SCG RAMP Ch. 2) at 13
[33] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter 7 (SCG RAMP Ch. 7) at 8
[34] SDG&E RAMP Ch. 3 at 9
[35] SDG&E RAMP Ch. 3 at 2

Examination of the workpapers indicates that the contribution of compressor incidents to the 8.64 total is 0.018 events per year.[36] It would follow that the LoRE for the compressor station tranche should be 0.018. However, the RAMP narrative describes the Ventura Compressor station components as nearing obsolescence. The likelihood that this station may fail due to a broken part that cannot be replaced readily should be included in the tranche LoRE. Staff expects the LoRE should represent the likelihood that the station may fail soon.

Further analysis of the Ventura Compressor station will be discussed in the Controls section below.

SCG-1.6/SDGE-3.6 Consequence of Risk Event (CoRE)

SoCalGas

SoCalGas reports a pre-mitigation CoRE of 538.[37] This CoRE covers the entire high-pressure system and includes both the HCA and non-HCA tranches. Compared to other risks, the next smallest CoRE is 5.63 reported in the medium pressure system chapter. The next largest CoRE is 3,114 presented in the high-pressure pipeline section of the Excavation Damage chapter.[38]

SDG&E

SDG&E reports a pre-mitigation CoRE of 2,301.[39]

The CoRE Scores are the sum of the four attributes of safety, reliability, financial, and stakeholder satisfaction:

SCG-1/SDGE-3 Figure 1. CoRE Consequence Attribute Scores

	Total CoRE	Safety	Financial	Reliability	Stakeholder
SoCalGas	538	49	11	378	99
SDG&E	2301	916	194	1040	150

Observations

San Diego scores are higher for all consequence attributes, which may be due to the higher proportion of high-consequence areas in SDG&E territory.

Tranche Scores

While both companies have identified HCA and non-HCA tranches, Sempra does not provide tranche-specific pre-mitigation CoREs for the HCA and non-HCA tranches, as discussed in the Tranche section.

[36] Final 2021 RSE Workpaper - SCG HP - TURN DR8 Q2.5
[37] SCG RAMP Ch. 1 at 9
[38] SCG RAMP Ch. 2 at 13
[39] SCG RAMP Ch. 3 at 9

No Change in Post-Mitigation CoREs

As shown in the Risk Scoring Workpaper tab provided by both utilities,[40] Sempra calculated the pre-mitigation CoRE by creating four categories of risk events (as shown in Figure 2 below) and determining each category's CoRE attribute scores. The LoRE of each category was then used to create a weighted average for each attribute score, displayed on the bottom row of the table. The sum of the weighted averages is the total CoRE of 538 points.

SCG-1/SDGE-3 Figure 2. SoCalGas Likelihood and Consequence Attributes per Category

Category	LoRE	CoRE Safety	CoRE Financial	CoRE Reliability	CoRE Stakeholder
High Cons. Transmission	0.22	1529	334	3199	340
Low Cons. Transmission	4.25	0	0	296	90
High Cons. Supply Line	0.10	871	190	1041	340
Low Cons. Supply Line	4.07	0	0	296	90
Weighted Avg		49	11	378	99

Staff observes that any change in the LoRE due to a mitigation of these event categories will impact the values for the CoRE attributes and, therefore, the post-mitigation CoRE value because each category attribute is weighted by the LoRE values in the Sempra method. For example, the safety attribute CoRE score of 49 is the average of the safety attribute category scores weighted by their likelihood LoRE values.[41] If a control or mitigation reduces the LoRE, the weighted average of each attribute must also change. For the safety attribute, if mitigations reduce the LoRE of High-Consequence events on the transmission pipeline by 50 percent from 0.22 to 0.11, the weighted average safety attribute[42] must change from 49 to 30. Then the post-Mitigation CoRE would change by 19 CoRE points from 538 to 519.

Sempra used this weighted average method to determine the pre-Mitigation CoRE in the high-pressure chapter and other risk chapters. However, it did not perform this weighted average calculation using post-Mitigation LoRE values to determine new post-Mitigation CoRE attribute scores. Instead, in Sempra's post-Mitigation risk score calculations,[43] the CoRE value remains unchanged. Staff finds that Sempra's technique violates the Settlement Agreement[44] by presenting a post-Mitigation CoRE that is not accurate based on their own method. Row 21 of the SA states, "the post-mitigation CoRE calculation will be conducted at the same level of granularity

[40] SCG Ch.1 Workpaper / SDG&E Ch. 3 Workpaper

[41] Weighted Safety Attribute = (0.22 X 1529 + 4.25 x 0 + 0.10 x 871+ 4.07 x 0) / 8.64 = 49.

[42] Example Safety Attribute = (0.11 X 1529 + 4.25 x 0 + 0.10 x 871+ 4.07 x 0) / 8.53 = 30.

[43] Sempra's formula for post-Mitigation risk:
post-Mitigation Risk = %change in LoRE x pre-Mitigation LoRE x pre-Mitigation CoRE

[44] Settlement Agreement, Row 21.

as the pre-mitigation risk analysis. The post-mitigation CoRE is the weighted sum of the scaled values of the post-mitigation levels of the individual Attributes using the utility's full MAVF."

SCG-1.7/SDG&E-3.7 Pre-Mitigation Risk Score

SoCalGas
SoCalGas presents a pre-mitigation risk score of 4,644, calculated by multiplying the LoRE and CoRE values as specified in the SA. This score is the highest in SoCalGas's 2021 RAMP.

SDG&E
SDG&E presents a pre-mitigation risk score of 2,029, which places it as the third-highest risk in SDG&E's 2021 RAMP.

Observations
The greater score for SoCalGas makes sense given the greater exposure of pipeline length, even though San Diego has a higher CoRE. However, Sempra has not provided distinct risk scores for tranches. There should be different risk scores for high-consequence areas.

SCG-1.8/SDG&E-3.8 Controls and Mitigations

SoCalGas Controls
SoCalGas lists 23 controls, defined as existing programs that are currently modifying risk.[45] In many cases, these controls are necessary for compliance with established regulations or standard industry practice. Of those controls, 12 are divided into two tranches, with Tranche 1 consisting of pipeline located in High Consequence Areas (HCA's) and Tranche 2 consisting of pipeline located in non-HCA's. Nine of the other controls are analyzed for the entire system as a single tranche. In addition, Control C22 is tranched according to phases of its projects, while C23 is tranched into two separate compressor modernization projects.

SDG&E Controls
SDG&E lists 16 controls. Like SoCalGas, most are necessary for compliance with established regulations or standard industry practice. Nine of the controls are divided into HCA or non-HCA tranches, while six controls are analyzed for the entire system as a single tranche. Control C16 is tranched according to phases of its projects.

Observations
Risk Calculation for Controls
To calculate the Risk Spend Efficiency of a control, the utilities must estimate the risk reduction impact being achieved. That risk reduction is calculated by describing the increased risk present if the control were no longer in place. SPD is concerned by the apparent discrepancy between the

[45] SCG RAMP Ch. 1 at 2

risk reduction methodology Sempra describes in the introductory RAMP Chapter C[46] ("RAMP-C") of both RAMPs and the calculations performed within the Workpapers provided by Sempra.[47]

In RAMP-C, Sempra explains that a control is analyzed by first estimating the pre-mitigation LoRE and CoRE for the risk and then calculating a post-mitigation LoRE and CoRE that would result if the activities described in the control were ceased.[48] Given this methodology, the expected outcome would be that the post-mitigation LoRE and/or CoRE would be higher than their initial pre-mitigation values since they represent an estimate of risk if the control were not in place.

However, for each of the controls in these RAMP chapters, the post-mitigation LoRE is lower than the Pre-Mitigation LoRE. Per the methodology described in RAMP-C, this would imply that removing a control would decrease the likelihood of a risk event, which is clearly not the case for these activities.

In response to SPD's Data Request #8, Sempra explained that this approach is used when the control involves yet-to-be performed projects that are not part of routine or cyclical work. Instead of showing an increase in the risk score had the work not been performed, Sempra opted to show the expected risk score once the yet-to-be performed work is complete, thus resulting in a lower post-mitigation risk score.

While Staff understands the logic of this approach, it runs contrary to the method described in RAMP-C and should be explained in the RAMP narrative.

Total LoRE Reduction

The RAMP workpapers present risk reduction calculation results for controls and mitigations as a percentage change in total high-pressure system LoRE. Staff examined these figures and found that all the changes in LoRE add up to greater than 100 percent. A sample of some of the SoCalGas controls illustrate this finding (similar values are found in the San Diego workpapers):

SCG-1/SDGE-3 Figure 3. Percentage Changes in System LoRE

Control ID	Description	% Change in LoRE
C11	Compressor Station – Maintenance	48
C21-T1	Integrity Assessment & Remediation for HCA pipeline	71
C21-T2	Integrity Assessment & Remediation for non-HCA pipeline	92
C22-T2	Ventura Compressor Station Modernization	52

The total risk reduction for the system from just these four controls adds up to more than 100 percent, suggesting a flaw in the Sempra risk calculation method, as these numbers indicate that more than all risk likelihood has been or will be reduced. Staff notes that the Sempra method

[46] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter C (SCG RAMP-C) / SDG&E 2021 Risk Assessment and Mitigation Phase Report Chapter C (SDG&E RAMP-C)

[47] SCG Ch.1 Workpaper / SDG&E Ch. 3 Workpaper

[48] SCG RAMP-C at 26

does not follow the Settlement Agreement requirements to determine tranche-specific values of LoRE and CoRE for each tranche.[49] It makes sense that the risk in a particular tranche could be reduced up to 100 percent, but the total risk reduction from all tranches and control or mitigation programs cannot exceed 100 percent of the system risk.

SoCalGas Mitigations

SoCalGas presents two planned mitigations:

M1: Gas Transmission Safety Rule – MAOP Reconfirmation.
SoCalGas is required to reconfirm the MAOP (Maximum Allowable Operating Pressure) of approximately 1,100 miles of transmission pipeline by 2035, by federal regulation. This mitigation is still in the early phases of planning, and as such, the provided cost figures are initial estimates.[50] SoCalGas expects to address 60 miles of HCA pipeline and 25 miles of non-HCA pipeline in the 2022-2024 period.[51]

M2: Gas Transmission Safety Rule – Material Verification and Attributes Verification.
Per federal regulations,[52] SoCalGas is required to verify the properties of transmission pipelines and associated assets that do not have "traceable, verifiable, and complete" records. The mitigation is still in the early phases of planning, and as such the provided figures are initial estimates.[53]

Of the two mitigations, most of the forecasted cost of $242 million is contributed by M1 at $240.5 million.

SDG&E Mitigations

SDG&E presented four new mitigations, as well as a preview mitigation (M5) that they don't plan to forecast in the General Rate Case.

M1: Pipeline Safety Enhancement Program (PSEP) Phase 2B.
SDG&E must follow the PSEP requirement to replace or pressure test all 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. These projects have been tranched as:

- 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)

[49] Settlement Agreement, requirements 16, 19, 21, and 22
[50] SCG RAMP Ch. 1 at 33-34
[51] SCG Ch. 1 Workpaper
[52] 49 CFR § 192.607
[53] SCG RAMP Ch. 1 at 33

M2: Gas Transmission Safety Rule – MAOP Reconfirmation.
Per federal regulations, SDG&E is required to reconfirm the MAOP (Maximum Allowable Operating Pressure) of approximately 130 miles of transmission pipeline by 2035. This mitigation is still in the early phases of planning, and as such the provided cost figures are initial estimates.[54] SDG&E expects to address 9 miles of HCA pipeline (Tranche 1) and 0.35 miles of non-HCA pipeline (Tranche 2) in the 2022-2024 period.[55]

M3: Gas Transmission Safety Rule – Material Verification and Attributes Verification.

Federal regulations[56] require SDG&E to verify the properties of transmission pipelines and associated assets that do not have "traceable, verifiable, and complete" records. The mitigation is still in the early phases of planning, and as such the provided figures are initial estimates. This mitigation is tranched into HCA (Tranche 1) and non-HCA (Tranche 2) pipeline.[57]

M4: Adobe Falls Pipeline Relocation Project.
SDG&E plans to relocate a portion of pipeline it deems as posing a safety and accessibility issue due to what it describes as a nearly vertical, 260-foot drop. This mitigation will involve relocating this pipeline to a safer route.[58]

M5: Moreno Compressor Station Modernization Project.
SDG&E plans to replace existing compressor equipment at the Moreno Compressor station with new equipment. Because these changes have a planned in-service date after the 2024 test year, SDG&E does not view it as part of the 2021 RAMP but chose to include it to facilitate stakeholder and Commission awareness of the project.[59]

SCG-1.9 / SDG&E-3.9 Risk Spend Efficiency (RSE)

SoCalGas RSE
SoCalGas estimated an RSE for 19 of the 23 current controls. Figure 4 shows the controls with the five highest reported program costs, as well as all planned mitigations.

[54] SDG&E RAMP Ch. 3 at 25
[55] SDG&E Ch. 3 Workpaper
[56] 49 CFR § 192.607
[57] SDG&E RAMP Ch. 3 at 25-26
[58] SDG&E RAMP Ch. 3 at 26
[59] SDG&E RAMP Ch. 3 at 27-28

SCG-1/SDGE-3 Figure 4. Top Five SoCalGas Controls by Cost, all Mitigations, and RSE

ID	Control and Mitigation Name	Program Cost, $ Millions	Risk Score Reduction	RSE
C21-T1	Integrity Assessments & Remediation (HCA)	246.9	3292.62	83.2
C21-T2	Integrity Assessments & Remediation (non-HCA)	427.7	4284.61	85.5
C22-T3.2	PSEP: Pipeline Replacement (Phase 2A, GRC base, non-HCA)	93.7	729.24	220.4
C22-T3.4	PSEP: Hydrotesting (Phase 2A, GRC base, non-HCA	269.7	1023.53	23.7
C23-T2	Ventura Compressor Station Modernization	178.8	2395.48	344.4
M1-T1	Gas Transmission Safety Rule – MAOP Reconfirmation (HCA)	170.8	27.18	2.7
M1-T2	Gas Transmission Safety Rule – MAOP Reconfirmation (non-HCA)	69.7	7.25	1.8
M2-T1	Gas Transmission Safety Rule – Material Verification (HCA)	0.5	0.05	0.7
M2-T2	Gas Transmission Safety Rule – Material Verification (non-HCA)	1.1	0.05	0.4

Observations

The controls and mitigations show a wide range of RSE, from 0.3 to 1336. The costs indicate that the programs with higher RSEs tend to have lower costs. An exception is Control C23-T2, the Ventura Compressor Station Modernization Project, with an RSE of 344 and a cost of $427.7 million. The planned mitigations M1 and M2 have relatively low RSEs, between 0.4 and 2.7.

Ventura Compressor Station Modernization

The Ventura Compressor Station Modernization (VC) project is identified as a tranche of Control C-23, Compressor Station Modernization Projects, and provides an example of the RSE calculation methods in this chapter and throughout the RAMP. SoCalGas states the objectives of these compressor station projects are to replace and modernize station infrastructure to comply with air quality regulations while prioritizing reliability, capacity, and system resilience. SoCalGas cites the previous General Rate Case Decision[60] which noted that most of SoCalGas' compressors were 50 years old and approved the utilities' requested funding for these projects.

No tranche-specific LoRE and/or CoRE was presented for the VC tranche. Rather, the risk reduction was estimated as a change to the overall risk score for the entire high-pressure system risk as reviewed below.

[60] D.19-09-051 at 116-117.

The risk reduction calculations are based on three percentages: 1) the percentage of the total system risk addressed, 2) the mitigation scope, and 3) the mitigation effectiveness. The three are multiplied together and applied to the entire system's pre-mitigation risk score to determine the risk reduction. The Level 2 workpapers requested by TURN[61] show the percentage risk addressed for the VC station is based on PHMSA national data for high-pressure system incidents where 40.2 percent involved compressors. The mitigation scope is 100 percent indicating all of the VC station will be modernized. The mitigation effectiveness accounts for the contribution of the VC station to the entire system capacity: 128.5%. The result is a 52 percent risk score reduction, presented as a change to the total HP system LoRE.

Staff notes that the percentages chosen incorporate capacity data for the station, and the mitigation is expected to prevent the risk of the lost capacity, which relates to the specifics of the tranche. However, there is no connection with the likelihood that this station will experience an equipment failure in the near future. Rather, SoCalGas has used national data to relate compressor incident risk to overall high pressure system risk, which may not account for the particular issue of aging infrastructure at the VC station. And, while there may be safety and other benefits associated with replacement of aging compressors, no part of the tranche risk assessment accounts for those directly.

SPD Staff concludes that a direct assessment of tranche-specfic pre- and post- mitigation LoRE and CoRE scores for the VC tranche, as required by the Settlement Agreement and discussed in the Tranche Section, would provide a clearer analysis of risks and benefits.

SDG&E RSE

SDG&E estimated an RSE for 13 of the 16 current controls and for all four mitigations (M5 was excluded because SDG&E did not view it as part of the RAMP). Figure 4 below shows the controls with the five highest reported program costs and all planned mitigations.

Observations

The RSE's range from 0.8 to 1074.6. Of the listed mitigations/controls, three stand out as having considerably higher costs: M2-T1 ($37.4 million), C15-T1 ($33.7 million), and C8 ($31.7 million).

SCG-1/SDGE-3 Figure 4. San Diego Top Five Controls by Cost, All Mitigations, and RSE

ID	Control and Mitigation Name	Program Cost, $ Millions	Risk Score Reduction	RSE
C3-T2	Leak Repair (non-HCA)	4.2	0.78	5.3
C5-T2	Shallow/Exposed Pipe Remediations (non-HCA)	6.0	1.24	5.9
C8	Compressor Station – Capital	31.7	112.38	90.8
C15-T1	Integrity Assessments & Remediations (HCA)	33.7	1921.38	355.3
C15-T2	Integrity Assessments & Remediations (non-HCA)	7.9	277.89	300.7

[61] Final 2021 RSE Workpaper - SCG HP - TURN DR8 Q2.5.

M1-T1.1	PSEP: Pipeline Replacement (Phase 2B, HCA)	10.0	258.07	730.4
M1-T1.2	PSEP: Pipeline Replacement (Phase 2B, non-HCA)	10.0	165.16	102.9
M1-T1.3	PSEP: Hydrotesting (Phase 2B, HCA)	10.0	258.07	160.8
M1-T1.4	PSEP: Hydrotesting (Phase 2B, non-HCA)	10.0	165.16	467.4
M2-T1	Gas Transmission Safety Rule – MAOP Reconfirmation (HCA)	37.4	15.08	6.9
M2-T2	Gas Transmission Safety Rule – MAOP Reconfirmation (non-HCA)	1.6	0.38	4.1
M3-T1	Gas Transmission Safety Rule – Material Verification (HCA)	0.03	0.02	6.3
M3-T2	Gas Transmission Safety Rule – Material Verification (non-HCA)	0.1	0.02	1.2
M4	Adobe Falls Relocation Project	2.0	11.81	167.9

SCG-1.10/SDG&E-3.10 Alternatives Analysis

SoCalGas

SoCalGas presents two alternative mitigations: A1, Proactive Soil Sampling and A2, Expanding Geotechnical Analysis. In both cases, SoCalGas states that fully assessing the benefits of these alternatives' benefits depends on the "maturing of the risk assessment."[62] SoCalGas also presents relatively low RSE values of 0.83 and 0.15 for these mitigations.

SDG&E

SDG&E presents the same two alternative mitigations, providing the same rationale as SoCalGas for rejection.[63]

Observations

SPD Staff agrees with the decision to not include these alternative programs.

SCG-1.11/SDG&E-3.11 Summary of Findings

Based on the observations presented above, findings are summarized here.

SCG-1.11.1/SDG&E-3.11.1 Environmental Impacts Excluded

Environmental consequences were not considered in SoCalGas's risk assessment.

SCG-1.11.2/SDG&E-3.11.2 Granularity of Tranching

Staff finds division of the high-pressure systems into two tranches, High Consequence Areas and non-High Consequence Areas, to be insufficiently granular for the purposes of properly targeting controls and mitigations.

[62] SCG RAMP Ch. 1 at 48-50

[63] SDG&E RAMP Ch. 3 at 37-39

SCG-1.11.3 /SDG&E-3.11.3 Tranche Risk Scores
Sempra does not provide distinct LoRE and/or CoRE values for the tranches, as required by the Settlement Agreement in Row 16.

SCG-1.11.4/SDG&E-3.11.4 LoRE Reductions exceed 100 percent
The sum of estimated reductions in likelihood for the existing controls exceeds 100 percent.

SCG-1.11.5/SDG&E-3.11.5 Post-Mitigation CoRE
Sempra does not provide an accurate post-Mitigation CoRE because they do not account for the changes in LoRE to calculate the weighted average sum of consequences from the different event categories.

SCG-1.11.6/SDG&E-3.11.6 Risk Reduction Calculation for Controls
The workpapers present pre- and post-mitigation risk scores inconsistent with the method described in RAMP Chapter C when accounting for the reduction effects of controls already in place.

SCG-1.12/SDG&E-3 Recommended Solutions to Address Findings and Deficiencies

SCG-1.12.1/SDG&E-3.12.1 Environmental Impacts
SoCalGas should discuss environmental impacts of gas released from pipelines incidents and consider inclusion as a consequence in the risk analysis.

SCG-1.12.2/SDG&E-3.12.2 Increased Tranche Granularity
Staff recommends further tranching of sections of the high-pressure systems to allow for improved targeting of assets with the highest risk scores.

SCG-1.12.3/SDG&E-3.12.3 Determine LoRE and CoRE Values for Tranches
Sempra should provide distinct pre-mitigation LoRE and CoRE values for all tranches.

SCG-1.12.4/SDG&E-3.12.4 Recalculation of post-Mitigation CoREs
Sempra should calculate each control and mitigation's post-Mitigation CoRE using the same method used to calculate the pre-Mitigation CoRE, including changes in the LoRE when it is used to weight the consequences from different event categories.

SCG-1.12.5/SDG&E-3.12.5 Recalculation of post-Mitigation Risk Scores
Because the Risk Score is dependent on the CoRE, Sempra should likewise perform an accurate calculation of each control and mitigation's post-Mitigation Risk Score using the newly calculated post-Mitigation CoRE.

SCG-1.12.6/SDG&E-3.12.6 Re-evaluation of Control Risk Reduction

SPD recommends that Sempra re-evaluates all controls presented in the chapters according to the methodology presented in RAMP-C by both utilities, and in each case where they do deviate from the methodology, provide an explanation of why that decision was made.

SCG-2 / SDGE-7 Excavation Damage (Dig-In) on the Gas System

SCG-2.1/SDG&E-7.1 Risk Description Sempra defines the risk event as "excavation damage on the gas system regardless of the party (first, second, or third) which results in significant consequences including serious injuries and/or fatalities" for both SoCalGas and SDG&E.[64] The first party refers to the company itself. Second parties are contractors working for the company, while third parties are not connected with the utility, such as excavation contractors or members of the public.

The dig-in risk is divided between medium-pressure (MP), less than 60 psig,[65] and high-pressure (HP), greater than 60 psig, portions of the gas system.

SCG-2.2/SDG&E-7.2 Bowtie
SoCalGas and SDG&E provide identical bowtie diagrams for their medium and high-pressure systems, respectively.[66]

The risk drivers/triggers and consequences presented are:

SCG-2/SDGE-7 Figure 1. Dig-In Risk Drivers and Triggers

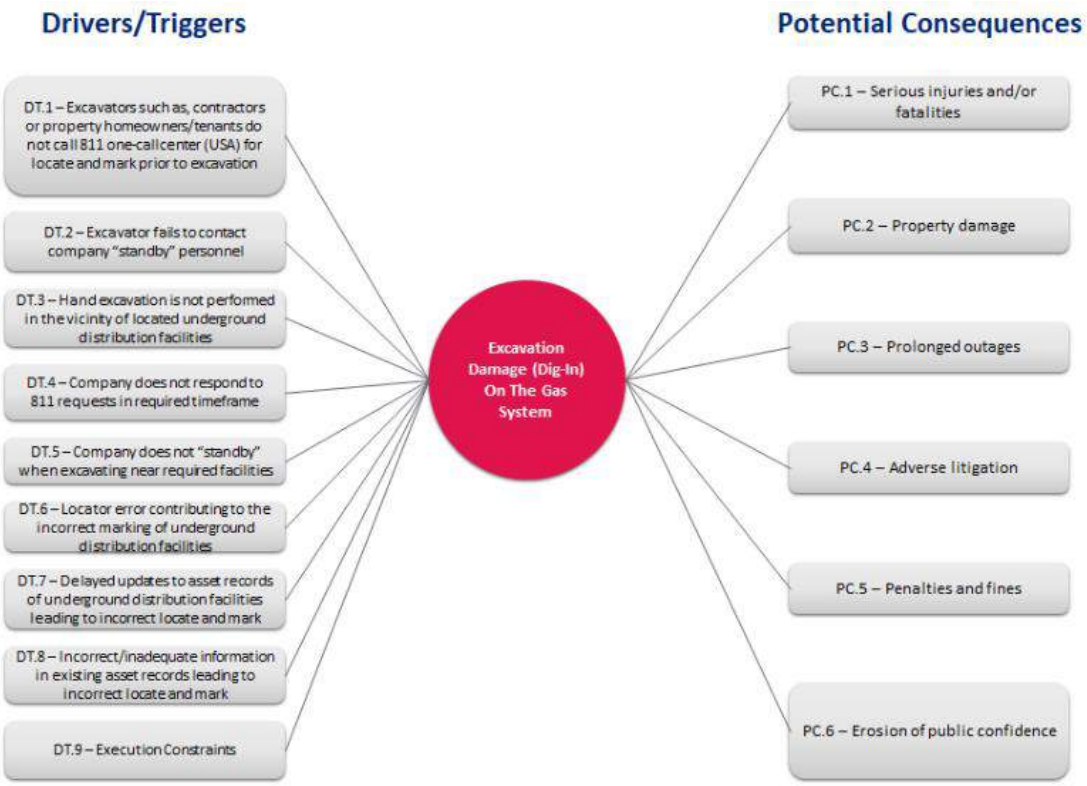
Driver/Trigger ID	Description
DT.1	Excavators do not call 811 one-call center (USA) for locate and mark prior to excavation.
DT.2	Excavator fails to contact company "standby" personnel
DT.3	Hand excavation is not performed in the vicinity of located underground distribution facilities
DT.4	Company does not respond to 811 requests in required timeframe
DT.5	Company does not "standby" when excavating near required facilities
DT.6	Locator error contributing to the incorrect marking of underground distribution facilities
DT.7	Delayed updates to asset records of underground distribution facilities leading to incorrect locate and mark.
DT.8	Incorrect/inadequate information in existing asset records leading to incorrect locate and mark
DT.9	Execution Constraints

[64] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter 2 (SCG RAMP Ch. 2) at 6 / SDG&E 2021 Risk Assessment and Mitigation Phase Report Chapter 7 (SDG&E RAMP Ch. 7) at 6
[65] "psig" = pressure measurement in pounds per square inch, gage pressure.
[66] SCG RAMP Ch. 2 at 8 / SDG&E RAMP Ch. 7 at 8-9

SCG-2/SDGE-7 Figure 2. Dig-In Consequences

Consequence ID	Description
PC.1	Serious injuries and/or fatalities
PC.2	Property damage
PC.3	Prolonged outages
PC.4	Adverse litigation
PC.5	Penalties and fines
PC.6	Erosion of public confidence

Dig-In Risk Bowtie



Observations:

SoCalGas identifies DT.1, third party failure to contact the toll-free Underground Service Alert hotline (811 USA), as the leading cause of Dig-in damage.[67] Staff finds the choice of Drivers and Triggers is appropriate for the risk of gas pipeline dig-ins.

[67] SCG RAMP Ch. 2 at 9 / SDG&E RAMP Ch. 7 at 10

SCG-2.3/SDG&E-7.3 Exposure

SoCalGas

In the RAMP chapter, the utility describes its exposure as over 101,000 miles of distribution pipeline and 3,385 miles of transmission pipeline.[68] SoCalGas emphasizes that most dig-in events occur because of improper practice by third parties, with about 58% of incidents occurring due to a third party failing to notify 811 USA and a further 26% occurring due "inadequate excavation practices" even when 811 USA has been notified and utility assets have been marked.[69]

SDG&E

SDG&E describes its exposure as over 14,500 miles of distribution pipeline and 232 miles of transmission pipeline.[70] Like SoCalGas, risk analysis is divided between MP and HP pipelines. SDG&E also attributes most dig-in events to improper practice by third parties, with about 58% of incidents occurring due to the third party failing to notify 811 USA and a further 30% attributed to inadequate excavation practices even when assets had been properly marked.[71]

SCG-2.4/SDG&E-7.4 Tranches

The companies do not identify the MP and HP portions of the system as tranches; however, they present separate pre-mitigation LoRE, CoRE, and Risk Scores for those asset groups, essentially making tranches of them.

The utilities identified sections of the Public Awareness programs, Controls C15 and C16, as "tranches." These program sections target four different audience groups: Affected Public, Emergency Officials, Local Public Officials, and Excavators.

Observations:

The tranches assigned to Public Awareness programs are not subgroups of utility infrastructure. A tranche is defined as "a logical disaggregation of a group of assets (physical or human) or systems into subgroups with like characteristics for purposes of risk assessment."[72] While it is sensible to apply different communications strategies depending on the message's target, and possibly prioritize spending on an analysis of risk reduction gained for dollars spent for these sections, identifying them as "tranches" seems inconsistent with the definition of a tranche. And, these tranches are not given separate pre-mitigation LoRE, CoRE, and Risk Scores as required in the Settlement Agreement, particularly Row 16.[73] Instead, risk calculations for these tranches are performed using the system-wide risk values for medium-pressure (C15) and high-pressure (C16) dig-ins.[74]

While it is reasonable to separate the medium and high-pressure systems, effectively creating two tranches of the dig-in risk, additional tranches within those system should be analyzed. One

[68] SCG RAMP Ch. 2 at 2-3
[69] SCG RAMP Ch. 2 at 5-6
[70] SDG&E RAMP Ch. 7 at 2
[71] SDG&E RAMP Ch. 7 at 5-6
[72] S-MAP Settlement Agreement at A-4
[73] D.18-01-014, Decision Adopting S-MAP Settlement Agreement with Modifications (Settlement Agreement), Row 16.
[74] SCG RAMP Ch. 2 at 19-23 / SDG&E RAMP Ch. 7 at 20-24

example is the difference in consequences of a gas release in High Consequence Areas vs. non-High Consequence Areas, as was done for the High Pressure risk. Greater tranching granularity is required for a comprehensive understanding of the risk profile of both the medium and high-pressure systems. Given the extent and the diverse circumstances of pipeline within the SDG&E and SoCalGas systems, further tranching is necessary to comply with Row 14 of the Settlement Agreement,[75] which states that assets must be tranched into groups with similar risk profiles.

SCG-2.5/SDG&E-7.5 Likelihood of Risk Event (LoRE)

SoCalGas

The RAMP report presents a pre-mitigation LoRE of 0.70 events per year for high-pressure system dig-ins and 2,914 events per year for the medium-pressure system.[76]

The high-pressure system LoRE of 0.70 is the third-lowest in the RAMP. However, the medium-pressure system at 2,914 is the highest reported in the RAMP by a significant margin, with the next highest reported for the Employee Incident chapter at 553.[77]

SDG&E

The San Diego LoRE scores are 0.19 for high pressure and 300 for medium pressure.
Compared to SoCalGas, the LoRE for dig-ins on SDG&E's high-pressure system is 3.5 times lower at 0.19, while the LoRE for SDG&E's medium-pressure is 10 times lower at 300.[78]

Observations:

These differences between SoCalGas' and SDG&E's LoRE make sense because of the significantly lower pipeline mileage, and thus exposure to risk, within SDG&E's system.

SCG-2.6/SDG&E-7.6 Consequence of Risk Event (CoRE)

SoCalGas

The RAMP presents a CoRE of 3,114 for dig-ins on the high-pressure system, and a much lower CoRE of 0.5 for the medium-pressure system.[79] The CoRE value for dig-ins in the high-pressure system is primarily driven by the reliability attribute, which contributes 2,274 to the score; the safety attribute value is 468.[80] For the medium-pressure system, safety and reliability contribute 0.25 and 0.14 points to the CoRE score.[81] See Figure 3 below.

The CoRE for dig-ins on the high-pressure system at 3,114 is the third highest in the SoCalGas RAMP, ranking after the Gas Storage CoRE at 9,306.[82] The CoRE is also significantly higher than the

[75] Settlement Agreement, Row 14
[76] SCG RAMP Ch. 2 at 13
[77] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter 5 (SCG RAMP Ch. 5) at 9
[78] SDG&E RAMP Ch. 7 at 14
[79] SCG RAMP Ch. 2 at 13
[80] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter 2 Workpaper - High-Pressure Dig-In (SCG RAMP HPDG Workpaper)
[81] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter 2 Workpaper - Medium-Pressure Dig-In (SCG RAMP MPDG Workpaper)
[82] SCG RAMP Ch. 4 at 11

next lowest CoRE, reported in the High-Pressure (Excluding Dig-in) chapter as 538.[83] In contrast, the CoRE for dig-ins in the medium-pressure system (0.5) is the lowest in the utility's RAMP, with the next highest CoRE found in the Contractor Incident chapter at 3.2.[84]

SDG&E

The CoRE for dig-ins on SDG&E's high-pressure system is higher than SoCalGas' at 4,235, while the CoRE for SDG&E's medium-pressure system is twice as high at 1.05.[85]

SCG-2/SDGE-7 Figure 3. CoRE Attribute Scores

System	CoRE Total	Safety	Financial	Reliability	Stakeholder Satisfaction
SoCalGas HP	3114	468	33	2274	340
SoCalGas MP	0.5	0.25	0.06	0.14	0.08
SDG&E HP	4235	694	33	3169	340
SDG&E MP	1.05	0.55	0.20	0.14	0.13

Observations

Safety Consquences

SPD Staff notes that while the total CoRE score value for the SoCalGas medium-pressure system is relatively low at 0.5, it is possible for a medium-pressure dig-in event to pose serious safety risks. The total CoRE value represents a weighted average of high-consequence (Staff abbreviates as High-Q) events and low consequence (Low-Q) events. High-Q events include safety consequences while Low-Q events do not. There are many more Low-Q events than High-Q events. The workpapers[86] present a likelihood of 1.1 High-Q events per year, with safety consequences in natural units of 0.22 fatalities (or equivalently 0.88 serious injuries), per incident. Staff finds that for High-Q events alone, the MAVF calculation gives a safety attribute score of 655 CoRE points. But for the total CoRE, that result is diluted by the 2913 events with low consequences to produce the weighted average safety attribute CoRE of 0.25 for the medium pressure system.

In comparison, the high-pressure safety attribute based completely on High-Q events is lower than the medum-pressure High-Q score at 468 CoRE points. The HP attribute is based on a natural unit value of 0.156 fatalities (or 0.62 serious injuries) per incident, with 0.7 expected incidents a year.

Staff finds that by using the high-consequence event LoRE times the safety CoRE attribute, we have the component of the Risk Score based on safety risk:

SCG-2/SDGE-7 Figure 4. Safety Risk Scores, High-Consequence Events Only

	High-Q LoRE	Safety CoRE	Safety Risk Score
MP System	1.1	655	720
HP System	0.7	468	327

[83] SCG RAMP Ch.1 at 9

[84] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter 7 (SCG RAMP Ch. 7) at 8

[85] SDG&E RAMP Ch. 7 at 14

Then, the safety risk for the MP system is more than double that of the HP system. Similar observations can be made when examining the SDG&E workpapers.[87]

Treatment of post-Mitigation Consequences

SPD Staff also notes that Sempra's RAMP reports indicate that all mitigations will only serve to reduce likelihoods, not consequences. However, SPD observes that some of the mitigations are targeted at reducing the consequences of risk event. For example, controls SCG-C24[88] and SDG&E-C23[89] involve the installation of valves designed to stop gas flow in the event that a pipeline is damaged. Such programs clearly reduce risk by reducing the consequence of a dig-in event, rather than it's likelihood; however, Sempra's calculations show a reduction in LoRE and no change in CoRE as a result of these programs.[90]

Sempra confirmed in the September 14, 2021 workshop session that they express any change in CoRE as a change in LoRE in the workpapers. Staff appreciates that a percentage change in LoRE would impact the overall risk reduction (and therefore RSE calculation) the same as an equivalent percent change in CoRE. This approach, however, creates confusion in determining what portion of any reduction in the LoRE value comes from an actual expected reduction in the likelihood of an event, and what portion comes instead from an expected reduction in the CoRE. Additionally, while RSE's are often discussed as the end goal, there is a value in accurately describing how often we expect an asset to fail (LoRE) and what consequences we can expect in such an event (CoRE).

Presentation of post-mitigation CoRE values is expected in the Settlement Agreement[91] requirements. Row 16 states, "The effects of a mitigation on a Tranche will be expressed as a change to the Tranche-specific pre-mitigation values for LoRE and/or CoRE. The utility will provide the pre- and post-mitigation values for LoRE and CoRE determined in accordance with this Step 3 for all mitigations subject to this Step 3 analysis." Staff finds that Sempra is not compliant with this Settlement Agreement requirement.

SCG-2.7/SDG&E-7.7 Pre-Mitigation Risk Score

SoCalGas

SoCalGas reports a pre-mitigation Risk Score of 2,180 for dig-ins in the high-pressure system, and 1,523 for its medium-pressure system.[92]

The Risk Scores for high-pressure and medium-pressure dig-ins are the fourth and third lowest of all the risks presented in SoCalGas's RAMP. The next lowest Risk Score is found in the

[87] SDG&E 2021 Risk Assessment and Mitigation Phase Report Chapter 2 Workpaper - High-Pressure Dig-In (SDG&E RAMP HPDG Workpaper) / SDG&E 2021 Risk Assessment and Mitigation Phase Report Chapter 2 Workpaper - Medium-Pressure Dig-In (SDG&E RAMP MPDG Workpaper)

[88] SCG Ramp Ch. 2 at 26-27

[89] SDG&E RAMP Ch. 7 at 27

[90] SCG RAMP MPDG Workpaper / SDG&E RAMP MPDG Workpaper

[91] Settlement Agreement, see requirements 16 and 21

[92] SCG RAMP Ch.2 at 13

Cybersecurity chapter (975),[93] while the next highest Risk Score is found in the Employee Incident chapter (2,667).[94]

SDG&E

The Risk Score for dig-ins in SDG&E's high-pressure system is about 2.5 times lower at 815 while the medium-pressure system is about 5 times lower at 316.[95]

SCG-2/SDGE-7 Figure 5. Pre-Mitigation Risk Scores

	Risk Score
SoCalGas HP	2,180
SoCalGas MP	1,523
SDG&E HP	815
SDG&E MP	316

Observations

The differences between SoCalGas and SDG&E make sense given the significantly lower pipeline mileage, which is somewhat balanced out by a larger percentage of SDG&E's pipeline located within more populous areas.

Staff review of the underlying attribute scores finds the risk scores associated with dig-ins for the high-pressure and medium-pressure systems are driven by different factors. While high-pressure dig-in risk is driven by low-likelihood and high-consequence events, the medium-pressure dig-in risk is driven by high-likelihood and low-consequence events. High-pressure dig-in risk is also driven predominately by reliability impacts of a dig-in event, while the medium-pressure dig-in risk is driven mostly by safety consequences.

SCG-2.8/SDG&E-7.8 Controls and Mitigations

SoCalGas

The RAMP report lists 21 existing programs. In most cases, SoCalGas separates these programs into controls for the medium-pressure and high-pressure systems (e.g. C1 is the Locate and Mark Training program for medium-pressure, while C2 is the equivalent program for high-pressure).[96]

SDG&E

SDG&E's chapter lists 17 existing programs. In most cases, SDG&E separates these programs into controls for the medium-pressure and high-pressure systems.

Observations

Risk Calculation for Controls

[93] SoCalGas/SDG&E 2021 Risk Assessment and Mitigation Phase Report Chapter 6 (SCG/SDG&E RAMP Ch. 6) at 14

[94] SCG RAMP Ch. 5 at 9

[95] SDG&E RAMP Ch. 7 at 14

[96] SCG RAMP Ch. 2 at 13-30

For all but one of the controls in each of the RAMP chapters, the post-mitigation LoRE is lower than the pre-mitigation LoRE. As discussed at length in SPD's review of the High-Pressure Chapters, these results conflict with the methodology presented in the introductory RAMP Chapter C[97] ("RAMP-C").

In response to SPD's Data Request #8, Sempra explained that this approach is used when the control involves yet-to-be performed projects that are not part of routine or cyclical work. Instead of showing an increase in the risk score once the yet-to-be performed work is complete, thus resulting in a lower Post-Mitigation risk score.

While SPD now understands the logic of this approach, it caused confusion for reviewers. The method was not explained in the RAMP narrative and runs contrary to the method described in RAMP-C. The Settlement Agreement, Row 29, requires transparency in the presentation of data and calculations.

Another concern about estimating risk reduction for controls is that the risk reduction is calculated from the current level of risk as a starting point, which the controls have already achieved. The risk reduction achieved by controls should have been determined from an estimate of the risk before the control was in place or from a hypothetical counterfactual situation where the control was not in place.

SoCalGas Mitigations

SoCalGas presented a total of 5 new programs in the RAMP. Each program is divided into medium-pressure and high-pressure mitigations, giving the chapter a total of 10 new mitigations:

M1 (MP), M2 (HP) – Automate Third Party Excavation Incident Reporting.
An initiative to centralize and standardize the reporting of gas incidents. SoCalGas points to benefits in simplifying the reporting process, as well as facilitating data analysis.[98]

M3 (MP), M4 (HP) – Locate and Mark Photographs.
SoCalGas will have locators record photographs for each locate and mark ticket. These pictures will aid in QA activities and detect errors in marking of GIS mapping.[99]

M5 (MP), M6 (HP) – Electronic Positive Response.
SoCalGas will provide an electronic response to the regional notification (DigAlert and USA North) that informs the excavator that the facility has either been marked or that there is no conflict in the excavation area. SoCalGas asserts this with improve communication between the utility and contractors.[100]

[97] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter C (SCG RAMP-C) / SDG&E 2021 Risk Assessment and Mitigation Phase Report Chapter C (SDG&E RAMP-C)
[98] SCG RAMP Ch.2 at 33-34
[99] SCG RAMP Ch.2 at 34
[100] SCG RAMP Ch.2 at 35

M7 (MP), M8 (HP) – Leverage Technology for Difficult Locates.
SoCalGas will coordinate with the excavator to use alternate methods when standard tools are insufficient to locate pipelines. The utility names vacuum excavation technology, Jameson Locators, and hands-on observation of excavations by utility employees. SoCalGas also anticipates these methods will also serve to improve safety for future projects, as they can serve to update records of the location of pipelines.[101]

M9 (MP), M10 (HP) – Outreach for Latent 3rd Party Damages.
SoCalGas will follow-up on any previously unknown damage it discovers during routine activities. The utility explains that in many of these situations, this damage occurs due to third party excavators that have not complied with safe excavations laws and practices. SoCalGas plans to leverage resources such as the Regional Notification Center and permits issued by local jurisdictions to determine the responsible party and contact them with reminders on safe excavation laws and requirements.[102]

Observations
In general, the forecasted costs of the proposed mitigations seem moderate. The largest costs are associated with the Locate and Mark Photographs program, with a high-end Test Year 2024 forecast of $501,000 for the medium-pressure system (M3) and $112,000 for the high-pressure system (M4). No other program exceeds $100,000 when combining the costs of the medium-pressure and high-pressure components.[103]

SDG&E Mitigations
SDG&E presented a total of seven new programs, with all but one divided into medium-pressure and high-pressure mitigations for a total of 13 mitigations.[104] The first ten mitigations are the same as presented in the SoCalGas chapter. However, to avoid repetition, staff will summarize the three mitigations not shared with the SoCalGas RAMP below:

M11 (MP), M12 (HP) – Leverage Data Gathered by Locating Equipment
SDG&E will provide locate and mark employees with tools and technology that will allow the utility to update records by using the location data generated by these tools to verify and update the utility's GIS records.[105]

M13 (HP) – Pipeline Monitoring Technologies.
The Central Control Modernization (CCM) organization will deploy new pipeline monitoring technologies along existing high consequence areas, evacuation challenged areas, and new or replaced transmission pipelines. SDG&E asserts that these new assets will provide faster response times and increased operational efficiency.[106]

[101] SCG RAMP Ch.2 at 35-36
[102] SCG RAMP Ch.2 at 36-37
[103] SCG RAMP Ch.2 at 41-42
[104] SDG&E RAMP Ch. 7 at 32-37
[105] SDG&E RAMP Ch. 7 at 36
[106] SDG&E RAMP Ch.7 at 36-37

SCG-2.9/SDG&E-7.9 Risk Spend Efficiency (RSE)

SoCalGas

SoCalGas presented an RSE for 24 out of 37 controls and 4 out of 10 mitigations. Figure 5 shows the controls with the five highest reported program costs, as well as all mitigations for which SoCalGas calculated an RSE.

For mitigations M5 through M8, SoCalGas states that no distinct RSE can be provided, as the programs are so closely tied to existing controls C33 and C36. Instead, the utility opted to include the impacts of the mitigations into the RSE calculations of their associated controls. For mitigations M9 and M10, SoCalGas states that no historical data exists to inform an estimate.[107]

SDG&E

SDG&E calculated RSE for 20 out of 32 controls and 2 out of 13 mitigations. Figure 6 shows the controls with the five highest reported program costs, as well as all newly proposed mitigations for which SDG&E calculated an RSE.

For mitigations M3-M6, SDG&E states that no distinct RSE can be provided, as the programs are so closely tied to existing controls C3-C4 and C33-C34. For mitigations M9-M10 (Outreach for Latent 3rd Party Damages – MP & HP), SDG&E states that no historical data exists to inform an estimate.[108] SDG&E does not provide a rationale for why no RSE exists for mitigations M7, M8, M11, and M12.

SCG-2/SDGE-7 Figure 5. Top Five SoCalGas Controls, all Mitigations by Cost and RSEs

ID	Control and Mitigation Name	Program Cost, $ Millions	Risk Score Reduction	RSE
C3	Locate & Mark Activities (MP)	19.5	15387	766.64
C4	Locate & Mark Activities (HP)	4.4	250	54.60
C14	Locating Equipment (HP)	4.1	28	30.95
C21	Prevention & Improvements – Fiber Optics (HP)	8.0	5	9.61
C35	Leverage Data Gathered by Locating Equipment (MP)	17.1	88	23.47
M1	Automate Third Party Excavation Incident Reporting (MP)	0.1	2	58.13
M2	Automate Third Party Excavation Incident Reporting (HP)	0.03	1	69.59
M3	Locate and Mark Photographs (MP)	0.4	0.2	13.03
M4	Locate and Mark Photographs (HP)	0.10	0.1	20.12

[107] SCG RAMP Ch.2 at 54

[108] SDG&E RAMP Ch. 7 at 47

SCG-2/SDGE-7 Figure 6. Top Five SDG&E Controls, all Mitigations by Cost and RSEs

ID	Control and Mitigation Name	Program Cost, $ Millions	Risk Score Reduction	RSE
C3	Locate and Mark Activities (MP)	5.2	3189	589.88
C4	Locate and Mark Activities (HP)	1.5	93.44	60.85
C9	Locate and Mark Quality Assurance (MP)	0.6	0.63	0.96
C13	Locating Equipment (MP)	0.7	26.05	178.57
C24	Pipeline Patrol and Pipeline Markers (HP)	0.7	4.22	5.68
M1	Automate Third Party Excavation Incident Reporting (MP)	0.03	0.10	17.04
M2	Automate Third Party Excavation Incident Reporting (HP)	0.004	0.03	30.81

SCG-2.10/SDG&E-7.10 Alternatives Analysis

SoCalGas

SoCalGas presents two alternative mitigations: A1, Virtual Reality Training and A2, GPS Tracking of Excavation Equipment. In both cases, SoCalGas states that more research and development of the technologies is needed before they are mature enough for deployment. SoCalGas estimates RSE's of 0.1 (MP) and 0.009 (HP) for Virtual Reality Training, and 0.1 (MP) and 0.003 (HP) for GPS Tracking of Excavation Equipment.[109]

SPD agrees with the utility's decision to exclude these programs.

SDG&E

SDG&E presents the same two alternative mitigation programs and gives the same rationales as SoCalGas for exclusion. SDG&E estimates RSE's of 0.006 (MP) and 0.015 (HP) for Virtual Reality Training, and 0.0002 (MP) and 0.001 (HP) for GPS Tracking of Excavation Equipment.[110] SPD agrees with the utility's decision not to include these alternative proposals within the mitigation plan.

SCG-2.11/SDG&E-7.11 Summary of Findings

Based on the observations presented above, findings are summarized here.

SCG-2.11.21/SDG&E-7.11.1 Granularity of Tranching

SPD finds the approach typical in the RAMPs to separate the gas systems into two groupings: High-Pressure and Medium-Pressure to be insufficiently granular to properly target controls and mitigations.

SCG-2.11.32/SDG&E-7.11.2 Control and Mitigations' Impact on CoRE

[109] SCG RAMP Ch.2 at 56-57

[110] SDG&E RAMP Ch. 7 49-50

Sempra does not show changes to the system's CoRE resulting from any control or mitigation, despite having programs designed to reduce the consequence of a risk event.

SCG-1.11.3/SDG&E-7.11.3 Risk Reduction Calculation for Controls
The workpapers present pre- and post-mitigation risk scores inconsistent with the method described in RAMP Chapter C when accounting for the reduction effects of controls already in place.

SCG-2.12/SDG&E-7.12 Recommended Solutions to Address Findings and Deficiencies
Based on the findings, Staff recommends the following solutions.

SCG-2.12.1/SDG&E-7.12.1 Increased Tranche Granularity
SPD recommends further tranching to allow for improved targeting of assets with the highest risk scores.

SCG-2.12.2/SDG&E-7.12.2 Recalculation of Post-Mitigation CoREs
Sempra should accurately calculate each control and mitigation's post-Mitigation CoRE using the same method used to calculate the pre-Mitigation CoRE.

SCG-1.12.3/SDG&E-3.12.3 Recalculation of post-Mitigation Risk Scores
Because the Risk Score is dependent on the CoRE, Sempra should likewise perform an accurate calculation of each control and mitigation's post-Mitigation Risk Score using the newly calculated post-Mitigation CoRE.

SCG-1.12.4/SDG&E-7.12.4 Re-evaluation of Control Risk Reduction
SPD recommends that Sempra re-evaluate all controls presented in the chapters according to the methodology presented in RAMP-C in the GRC filing. In each case where they deviate from the methodology, provide an explanation of why.

SCG-3 / SDGE-9 Incident Related to the Medium Pressure System (Excluding Dig-in)

SCG-3/SDGE-9.1 Risk Description

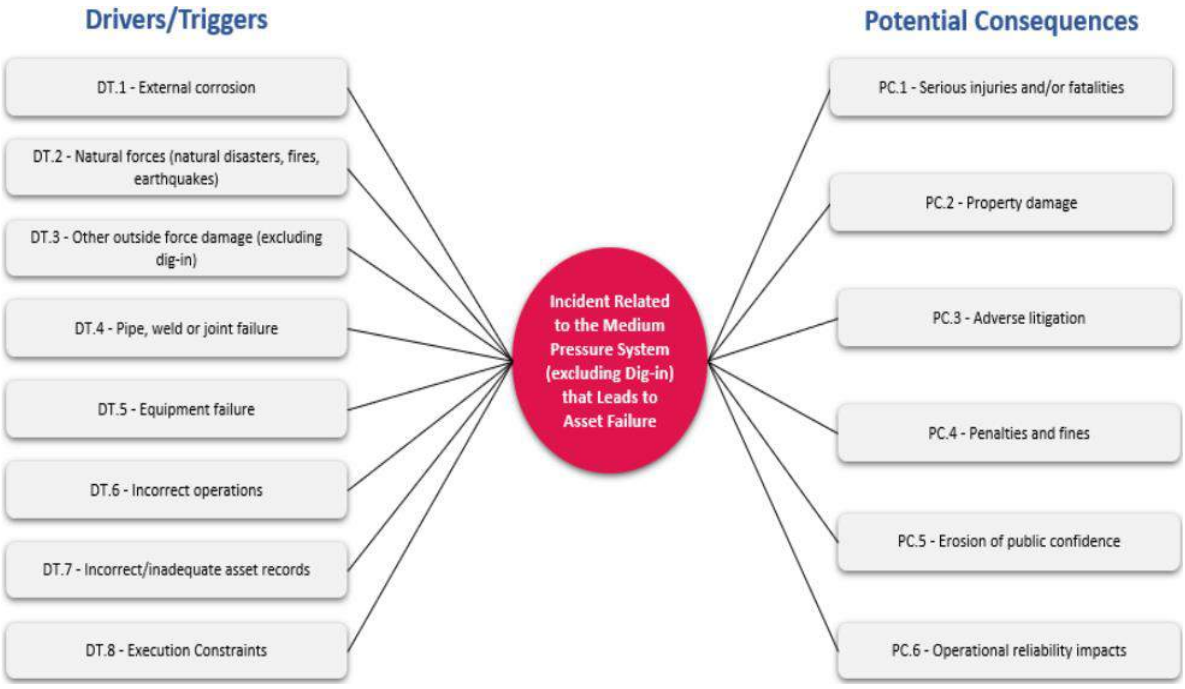
The risk is defined as medium pressure gas system failures which result in severe consequences such as injuries, fatalities, or services outages and includes consequences beyond the customer meter. Medium pressure (MP) is defined as a pipeline system with maximum allowable operating pressure (MAOP) at or lower than 60 psig[111] (psig = pounds per square inch, gauge pressure). The two risk chapters from the separate companies are very similar.

Observations:

Medium pressure gas systems include main and service pipelines that distribute gas to end customers. Distribution mains transport gas at medium pressures into neighborhoods and business districts, while service lines branch from mains to supply individual customers.

SCG-3/SDGE-9.2 Bowtie

The two companies present the same bowtie illustration of risk drivers and consequences as reproduced below. The risk drivers are consistent with common causes of failure such as corrosion, material and construction defects, and incorrect operations. The consequences include serious injuries/fatalities, property damage, adverse litigation, penalties/fines, erosion of public confidence and operational reliability impacts.



Observations:

[111] SoCalGas 2021 Risk Assessment and Mitigation Phase Report Chapter 2 (SCG RAMP-3) at 4.

The risk drivers are primarily taken from the American Society of Mechanical Engineers' standard B31.8S, "Managing System Integrity of Gas Pipelines." The consequences are logical for the risk of a pipeline failure; however, Staff is concerned that the consequences of adverse litigation and penalties/fines may need to be filtered to separate the distribution of costs passed on to ratepayers vs. shareholders. The RAMP chapter narratives do not mention that shareholder costs have been excluded.

SCG-3/SDGE-9.3 Exposure

SoCalGas gives an overview of the extent of the MP system: 21.8 million customers are served by approximately 100,000 miles of medium pressure mains and services, including over 22,000 miles of steel mains and approximately 25,000 miles of plastic mains.[112]

SDG&E states that they currently operate approximately 14,900 miles of medium pressure 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.

SCG-3/SDGE-9.4 Tranches

SoCalGas presents the entire MP pipeline system as a unitary tranche with two exceptions. The DIMP[113]-based DREAMS[114] Control C21, focuses on replacement of vintage plastic pipe in tranche C21-1 (VIPP[115] program) and bare steel pipe in tranche C21-2 (BSRP). However, those two tranches are not assigned tranche-specific risk scores but are given the same pre-mitgation LoRE and CoRE as the total MP system risk and are evaluated for risk reduction purposes in the context of the total MP system risk.

San Diego identifies a tranche for the similar VIPP program and adds tranches for other control programs such as C8, Underperforming Steel Program, and C9, Early Vintage Program (Pipeline Component Removal). None of the tranches are assigned tranche-specific LoRE and/or CoRE scores.

Observations:

Rows 14, 16, 19, 22, and 23 of the S-MAP Settlement Agreement[116] are relevant to the discussions that follow.

Row 14 requires Tranching as follows:

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[112] SCG RAMP-3 at 3.

[113] "DIMP" stands for the Distribution Integrity Management Program regulation in the Federal Gas Safety Code, CFR 49 Part 192 Subpart P.

[114] "DREAMS" stands for Distribution Risk Evaluation and Monitoring System.

[115] "VIPP" stands for Vintage Integrity Plastic Plan and refers to replacement of 'vintage' plastic pipe, which is all plastic pipe installed before 1986, with priority given to pre-1973 dates, most of which was made from Dupont Aldyl A plastic resins. Aldyl A has been found to be more leak-prone than more recent, 'State-of-the-Art' polyethylene pipes installed after that date.

[116] CPUC Decision D.18-0-12-014, *Phase Two Decision Adopting Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with Modifications*, Appendix A.

- "For each Risk Event, the utility will subdivide the group of assets, or the system associated with the risk into Tranches.
- Risk reductions from mitigations and risk spend efficiencies will be determined at the Tranche level, which gives a more granular view of how mitigations will reduce risk. The determination of Tranches will be based on how the risks and assets are managed by each utility, data availability and model maturity, and strive to achieve as deep a level of granularity as reasonably possible.
- The rationale for the determination of Tranches, or for a utility's judgment that no Tranches are appropriate for a given Risk Event, will be presented in the utility's RAMP submission.
- For the purposes of the risk analysis, each element (i.e., asset or system) contained in the identified Tranche would be considered to have homogeneous risk profiles (i.e., considered to have the same LoRE and CoRE)."

Row 16 states, "The effects of a mitigation on a Tranche will be expressed as a change to the Tranche-specific pre-mitigation values for LoRE and/or CoRE. The utility will provide the pre- and post-mitigation values for LoRE and CoRE determined in accordance with this Step 3 for all mitigations subject to this Step 3 analysis."

Rows 19 and 22 require that measurement of pre-mitigation and post-mitigation risk scores be calculated as the product of the respective pre-mitigation and post-mitigation LoRE and CoRE.

Row 23 requires that risk reduction provided by mitigation "be measured as the difference between the values of the pre-mitigation risk score and the post-mitigation risk score."

In summary,

- Row 14 requires Tranching of the MP risk and the calculation of risk reductions from mitigations at the Tranche level.
- Row 23 requires that the calculation of risk reductions must be shown as the difference of pre-mitigation and post-mitigation risk scores.
- Rows 16, 19, and 22 require that both pre-mitigation and post-mitigation risk scores be presented in the RAMP and be expressed as the product of the respective pre-mitigation and post-mitigation LoREs and CoREs.

<u>SoCalGas and SDG&E Tranche Compliance</u>

The companies identified additional tranches within the MP system, besides the system-level tranche. For example, the VIPP and BSRP program tranches recognize that certain kinds of pipeline material, such as vintage plastic and bare steel, pose a higher risk of failure. One would expect these two tranches to have a different likelihood of failure than the newer and better-protected pipe in the rest of the MP system.

SoCalGas and SDG&E do not present tranche-specific LoRE and CoRE values for tranches in the RAMP report, in violation of Rows 16, 19, and 22. The pre-mitigation LoRE and CoRE values for these tranches are identical with each other and with the system-level tranche in the RAMP. The S-MAP Settlement Agreement permits a utility to present additional optional information at its discretion as long as it also satisfies the basic requirements laid out in the Settlement Agreement.

However, the companies use an alternative methodology to present risk reductions at the tranche level that does not comply with Rows 16, 19, and 22. The RAMPs fail to present pre-mitigation and post-mitigation LoREs, CoREs, and risk scores at the Tranche level as Rows 16, 19, and 22 require.

the companies' alternative methodology is supported in the detailed spreadsheets provided in response to a TURN data request.[117] These spreadsheets calculate mitigation risk reduction for each tranche using three percentage figures that relate the effect of a mitigation on the risk score for the entire Medium Pressure system, which then determines the change in the system risk score, and ultimately produces RSE values for the mitigation. The three values are:

1. Percentage of system risk addressed by the mitigation.
2. Percentage of mitigation scope planned for the period evaluated.
3. Percentage effectiveness of the mitigation for the Tranche relative to the entire system.

In the workpaper, the risk characteristics of the tranche are accounted for in the "Percent Effectiveness" value of a mitigation applied to the tranche. For example, the Percent Effectiveness for the VIPP (vintage plastic) program is given as 305%, which means the risk for vintage plastic pipe is estimated at 3.05 times that of the entire MP system. From the three percentages, SoCalGas then determines a risk reduction value for the mitigation without determining a separate LoRE and CoRE; they start with an overall system risk score and then calculate how much reduction the mitigation of a tranche will achieve, and so the RSE for the mitigation. This method was discussed in post-filing workshops and was difficult for some parties to understand. A more intuitive approach would be to first calculate a unique LoRE and CoRE for the tranche itself as required in the Settlement Agreement and then determine the risk score reduction.

The Percent Effectiveness value is relied on to express differences in likelihood and consequence for the tranche. In the case of the VIPP, the spreadsheet explanation indicates that the vintage pipe is 3.05 times more likely to fail, based on relative leak rates as a proxy for the risk. However, SPD Staff is concerned that the consequences of a leak from the Aldyl A material of early-vintage pipe may not have been modeled. Staff understands that certain early-vintages of Aldyl A pipes that are susceptible to brittle-like failure are more likely to abruptly fail with no outward signs of a slow crack growth that has been developing for years inside the pipe. With low to medium pressure steel pipes, there would usually be a lot of warning (in the form of slow or pinhole leaks) before catastrophic failure. Because of that behavior, Staff would expect the vintage plastic tranche to have a higher consequence value. SoCalGas should review the consequence history for Aldyl A incidents and modify the risk calculation accordingly. If there are higher consequences for Aldyl A incidents, the effectiveness of mitigation would be greater.

The alternative method of calculating and presenting tranche-level risk reductions used by SoCalGas is not compliant with the requirements of the S-MAP Settlement Agreement. This alternative calculation and presentation methodology is not an acceptable substitution for the minimum requirements embodied in the Settlement Agreement's Rows 14, 16, 19, 22, and 23.

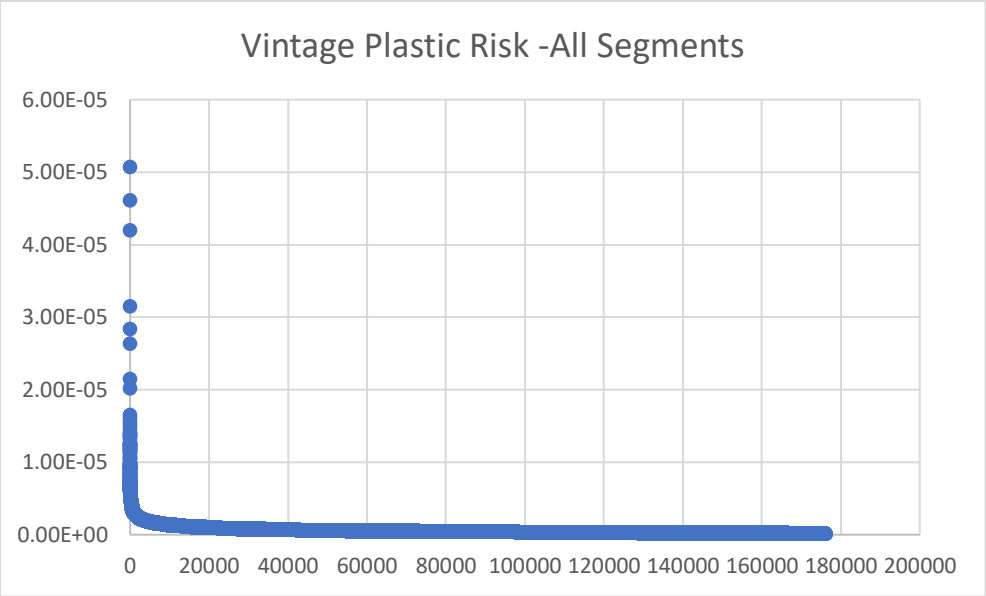
[117] Final 2021 RSE Workpaper - SCG MP - TURN DR8 Q2.5.

Granularity of Tranche Selection

Finer granularity of tranches can help the Commission better understand which portions of a utility's system offer the greatest potential for effective risk reduction. An expected result of risk assessment is to find that a small portion of a system poses the greatest level of risk. Then a mitigation that addresses that portion may have a greater risk spend efficiency (RSE) than a mitigation applied to a larger grouping.

A detailed segment analysis of a pipeline, for example, will reveal which segments offer the greatest risk reduction potential. In response to a data request[118] Sempra provided segment-level risk data from the DREAMS program for the 9,645 miles of vintage plastic pipe in the SoCalGas and SDG&E MP systems, divided into 176,110 segments. SPD staff analyzed this data by ranking the DREAMS risk scores from high to low and plotting the results in Figure 1.

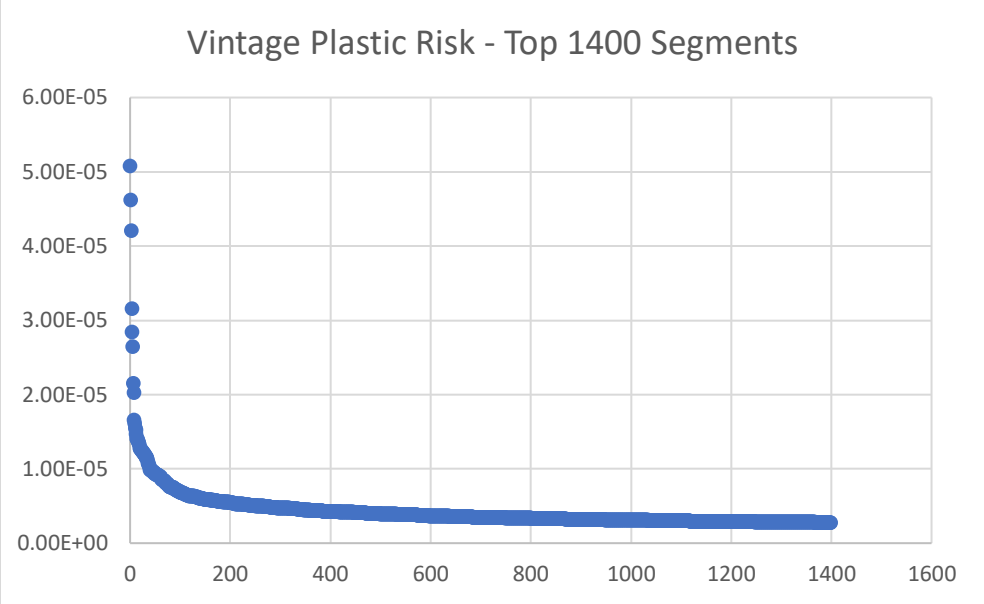
SCG-3/SDGE-9 Figure 1. DREAMS Probability of Serious Incident per Year, Vintage Plastic



The data take the form of a hockey stick, where a small number of segments exhibit the highest risk. To better examine the point where the curve begins to level out, Staff narrowed the data set to the first 1400 segments in Figure 2.

[118] Response to TURN DR#11, Plastic Risk Results DR worksheet.

SCG-3/SDGE-9 Figure 2. Detail of Vintage Plastic Risk, Probability of Serious Incident per Year



In Figure 2, Staff finds that the point where risk sharply reduces is near 100 segments. This analysis suggests that a more granular grouping of the vintage pipe could produce a series of tranches with diminishing risk reduction potential and RSEs. The end goal would allow the Commission to understand where the most significant risk lies and what incremental risk reduction can be expected with incremental spending, while respecting that the utility must comply with DIMP requirements to mitigate risk in their distribution system.

In the case of the VIPP as presented in the RAMP, it is not clear whether all vintage plastic must be replaced at the greatest practical rate, or if there is an acceptable level of risk that can be tolerated. A more granular division of Tranches, such as an 80/20 division of segments by risk, would provide better understanding of that question. Staff observes that the expected scope of the VIPP mitigation over the next three years is 284 miles, which roughly corresponds to the cumulative length of the first 1400 segments in risk order. The DREAMS data suggest that the greatest risk could be mitigated from fewer segments.

Staff understands that isolated replacement of only those highest-risk segments is limited by practical construction considerations, such that other nearby segments are best replaced at the same time and that some level of mitigation is required by the DIMP regulations. Nonetheless, a more granular examination of the risk reduction potential could be applied to choose the optimal scope and rate of replacement. Even if the risks for specific segments should change from the time of the RAMP filing to the time the work will be done, the granular tranching will provide better illustration of the pipeline scope to be mitigated to achieve the greatest cost-effectiveness.

<u>Other Tranche Granularity Considerations</u>

SPD Staff notes that the 2020 PG&E RAMP gas distribution risk chapter identified four tranches for gas mains and four for gas service lines, divided by high- and low- population areas and steel vs.

plastic pipe material. Staff expects there can be greater consequences if there are more people in the vicinity, or if the incident occurs on a higher-volume main than a small service line.

The DREAMS risk assessment worksheets include consequence-related data that could be used as a basis for more granular tranching. Factors such as whether a pipeline is in a business district or the distance to the nearest building could facilitate more insightful and outcome-oriented groupings.

SCG-3/SDGE-9.5 Likelihood of Risk Event (LoRE)

SoCalGas

The risk assessment produced a pre-Mitigated LoRE of 545 incidents per year for the 100,000-mile MP system. This LoRE is the highest of the SoCalGas RAMP risks; however, almost all of the 545 incidents detailed in the workpapers to determine the LoRE do not have safety impacts while only three (2.74) have expected injuries or fatalities.[119]

SDG&E

The San Diego pre-Mitigated LoRE is 101.4 expected events a year, second-highest after the Electric Integrity risk.

Observations:

The lower likelihood score for San Diego compared to SoCalGas is probably related to the lower length of pipeline exposed to risk.

The likelihood score is made up of the various incident drivers and triggers identified in the bow tie. In the 2020 PG&E RAMP, each risk driver was given a frequency percentage to show its contribution to the overall risk. While not specifically required in the Settlement Agreement, Staff found the presentation of driver frequencies in the PG&E RAMP helped to demonstrate the importance of each driver and the reasoning for proposed mitigations to address those drivers. Staff recommends that driver frequencies should be included with the risk data provided in the General Rate Case and future RAMPs.

SCG-3/SDGE-9.6 Consequence of Risk Event (CoRE)

SoCalGas

The consequence, or CoRE, value of 5.63 indicates a low level of consequences should a risk event occur, compared to the High-Pressure Risk CoRE of 538 and the Storage Risk CoRE of 9,306.

SDG&E

San Diego Gas and Electric calculated a nearly identical CoRE of 5.87, (rounded up to 6 in the chapter). This CoRE is the lowest of the SDG&E RAMP risks.

[119] Final 2021 RSE Workpaper - SCG MP - TURN DR8 Q2.5.

Observations:

For the SoCalGas CoRE value of 5.63, safety is the highest component at 3.58 CoRE points. This score represents a low expectation of injuries and fatalities per incident. The RAMP worksheet provides a natural value safety index (number of expected fatalities plus equivalent injuries)[120] of 0.00129,[121] which seems quite small but when multiplied by the likelihood of 545 incidents per year represents about three serious injuries a year or equivalently one fatality in 17 months.[122]

While not specifically required in the Settlement Agreement, Staff found the presentation of consequence frequencies in the PG&E RAMP to help understand the importance of each consequence and the reasoning for proposed mitigations to address those drivers. Staff recommends that consquence frequencies should be included with the risk data provided in the General Rate Case and future RAMPs.

SCG-3/SDGE-9.7 Pre-Mitigation Risk Score

SoCalGas

The Risk Score of 3,071 is second highest in the RAMP report, after the High-Pressure System score of 4,644.

SDG&E

The Risk Score of 606 is the lowest of the nine SDG&E risks.

Observations:

The relatively high SoCalGas risk score is due to the high likelihood of events at 544 per year. Logically, the risk is lower than the High-Pressure risk because high pressure consequences can be more severe.

SCG-3/SDGE-9.8 Controls and Mitigations

Controls

The RAMP reports present lists of controls already in effect. The Code of Federal Regulations, Title 49, Part 192, requires an extensive set of gas pipeline inspections and maintenance activities. Many of the controls are in place to comply with these regulations. The ten highest-cost controls are presented in the RSE sections below.

Mitigations

No new mitigations are described for SoCalGas. SDG&E plans for three new mitigation programs, as shown in the RSE section below.

SCG-3/SDGE-9.9 Risk Spend Efficiency (RSE)

SoCalGas

SoCalGas presents an RSE value for twenty-six controls. The RAMP report explains that RSE for a further six controls could not be determined.

[120] Safety index = expected value of fatalities plus one-quarter of serious injuries.

[121] Final 2021 RSE Workpaper - SCG MP - TURN DR8 Q2.5.

[122] Final 2021 RSE Workpaper - SCG MP - TURN DR8 Q2.5.

The ten highest-cost controls and their RSEs are presented in Table SCG-3-1 below. A full list of all controls, mitigations, and RSEs was provided in an appendix to RAMP Chapter C.

TABLE SCG-3/SDGE-9.1. Top Ten SoCalGas Controls by Cost, with RSE

ID	Control/Mitigation Name	Total Cost ($M)	RSE
C21-T1	DIMP – DREAMS: Vintage Integrity Plastic Plan (VIPP)	$657.34	1.2
C32	Safety Related Field Orders	$298.77	3.0
C21-T2	DIMP – DREAMS: Bare Steel Replacement Program (BSRP)	$281.72	0.9
C22	DIMP: Gas Infrastructure Protection Program (GIPP)	$85.02	221
C20	Distribution Integrity Management Program - Distribution Riser Inspection Program (DRIP)	$73.51	21
C23	DIMP: Sewer Lateral Inspection Project (SLIP)	$73.51	11
C19	Main Replacements	$72.45	0.3
C30	Meter Set Assembly (MSA) Inspection Program	$66.52	12
C8/C17	Leak Survey and Main & Service Leak Repair	$66.51	23
C16	Capital CP 10 Service Replacement	$40.20	1.9

Observations:

Control C21-T1, the Vintage Integrity Plastic pipe replacement program (VIPP), has a high program cost of $657 million. The similar Bare Steel replacement program (BSRP) is also costly. The VIPP replaces older, 'vintage' plastic distribution pipe identified by the Distribution Integrity Management Program (DIMP)[123] as higher risk. The pipe material considered as vintage plastic is a type installed before 1986. The chemical composition of that material, typically Dupont Aldyl A, is known to fail more often than the current 'state of the art' (SOTA) plastic pipe available today.

Staff notes that the RSE for this high-cost program seems low at 1.2, for example compared to Control C8/C17, Leak Survey and Repair, with an RSE of 23. The VIPP RSE value is based on a small change in risk score combined with high cost. The workpapers[124] show that only 285 miles of the total 9,645 vintage pipeline miles would be replaced in the three-year period; Staff understands that is the maximum feasible replacement rate. SoCalGas calculates that replacement of vintage pipe has an effectiveness multiplier of 3.05 based on leak rates, but the overall risk reduction is small because of the small replacement mileage in proportion to the whole system.

RSE was determined as if the vintage portion of the system carried the same level of risk for all segments of vintage pipe. However, examination of the DREAMS data shows there is a pronounced difference in risk from one segment to another with a small subset at higher risk than the rest. An RSE based on mitigation of a series of tranches ranked by risk score would indicate

[123] DIMP required by the Federal gas pipeline safety rules CFR 49, Part 192.
[124] RSE Workpaper Tab, Final 2021 RSE Workpaper - SCG MP - TURN DR8 Q2.5.

which tranches yield the best RSE. This finding can be applied to all asset groups when there is significant variation of risk within the group.

Staff is aware of the history of catastrophic leaks from early-vintage plastic pipes that have concentrated in enclosed spaces, ignited, and resulted in destruction of buildings and fatalities. However, Staff is concerned about the RAMP report's small risk reduction and RSE for the VIPP. A more granular risk assessment could provide a clearer picture of the expected benefits for a series of tranches, and better support the company's planned pace of replacement decisions.

San Diego Gas and Electric

Table SCG-3 / SDGE-9.2 Top Ten SDG&E Controls by Cost, with RSE

ID	Control/Mitigation Name	Total Cost ($M)	RSE
C16-T1	DIMP – DREAMS – Vintage Integrity Plastic Plan (VIPP)	$174.90	3.4
C6/C7	Leak Repair & Pipeline Monitoring (Leak Mitigation, Bridge & Span, Unstable Earth and Pipeline Patrol)	$41.19	15
C19	Field and Public Safety	$30.79	0.2
C8-T1	Underperforming Steel Replacement Program – Threaded Main (pre-1933 vintage	$27.65	5.7
C11	Gas Distribution Emergency Department	$27.29	144
C8-T2	Underperforming Steel Replacement Program (1934-1965 vintage).	$21.90	6.3
C2	Cathodic Protection Program - Capital	$18.73	25
C14	Human Factors Mitigations – Operator Qualification Training and Certification	$12.01	0.4
C8-T3	Underperforming Steel Replacement Program – Other Steel (Post 1965 vintage).	$10.70	8.6
C9-T2	Early Vintage Program (Components) - Dresser Mechanical Coupling Removal	$9.29	0.6

Table SCG-3 / SDGE-9.3 SDG&E Mitigations by Cost, with RSE

ID	Control/Mitigation Name	Total Cost ($M)	RSE
M1	Safety Control Valves	$7.61	4.9
M3	Replace Curb Valves with EFVs	$7.61	61
M2	Cathodic Protection System Enhancements – Real Time Monitoring	$3.00	69

Observations:

As in the SoCalGas list of controls, the DIMP-DREAMS-VIPP has the greatest cost. The three new mitigations have RSEs that are comparable or superior to the existing control programs.

SCG-3 / SDGE-9.10 Alternatives Analysis

SoCalGas

The SoCalGas RAMP presented two alternatives:

Alternative	Change in LoRE[125]	RSE
A1 Technical Refresher Training	0.02%	1.3
A2 Post-Training Follow-up Field Evaluation	0.02%	2.1

Alternative A1 would provide periodic refresher training for technical field employees, "as an alternative to the training program set forth" in the current "C23" (actually C25) Field Employee Skills Training[126]. SCG rejected this alternative based on the results of their C28 Service Technician QA Program, that indicate the existing training is effective. Alternative A2 would add a post-training field evaluation of technicians, also rejected because the existing QA Program validates the adequacy of the current practices.

Observations:

Staff observes that the two programs should be considered as additional mitigations for the medium pressure risk, rather than alternatives to the existing training program. Staff agrees that these mitigations should be rejected, noting the low expected change in LoRE. However, these alternatives do not represent real alternatives to existing risk mitigations in the RAMP.

Other, more substantial, alternatives that might have been discussed include electrification instead of gas pipeline replacement, a current topic of interest in California. While there are likely many difficulties with that approach, presentation of electrification as an alternative would help advance the level of understanding of this important topic.

Another possible alternative to pipeline replacement is insertion of smaller diameter pipeline inside the vintage or bare steel lines, where feasible. That method would require less excavation and perhaps lower costs than conventional pipe replacement.

SDG&E

The San Diego RAMP presented two alternatives:

Alternative	Change in LoRE[127]	RSE
A1 Post-Training Follow-up Field Evaluation	0.002%	1.1
A2 Soil Sampling Program	0.04%	0.02

[125] RSE Summary Tab, Final 2021 RSE Workpaper - SCG MP - TURN DR8 Q2.5.

[126] SCG RAMP-3 at 47.

[127] RSE Summary Tab, Final 2021 RSE Workpaper – SDGE MP - TURN DR8 Q2.5.

In rejecting alternative A1, SDG&E states this alternative was not implemented because employees currently participate in annual reviews of safety- and risk-related policies and procedures that are week-long compliance/refresher training that covers pertinent policies, addresses Field QA findings and review recent incidents to help mitigate risk. When issues are found they are coached by the direct supervisor.

Alternative A2 would expand on the existing practice of collecting soil samples when pipeline leak repairs are made. SGD&E rejects the alternative because the use of soil samples in risk assessement is still in development, so collecting additional samples is premature.

Observations:

Staff agrees with the rationale for rejecting these alternatives and notes the low RSEs and that the expected change in LoRE seems to be neligible. Staff views these alternatives as potential mitigations rather than replacments of existing controls. More substantive mitigations that address some of the costlier controls would be more appropriate to discuss as alternatives.

SCG-3.11(opt) Scenario Analysis (if available)

SCG-3.12 Summary of Findings

Based on the observations presented above, findings are summarized here.

SCG-3.12.1 Fines, Penalties and Litigation Consequences

The chapter does not mention whether the costs of adverse litigation, penalties, and fines that shareholders would bear have been excluded from the consequence score.

SCG-3.12.2 Consequences of Vintage Plastic Pipe Incidents

The risk analysis does not appear to account for possibly greater consequences from the failure of early-vintage Aldyl A and similar vintage pipe materials compared to failure of non-vintage pipe. The risk reduction benefits of the VIPP are shown to reduce the likelihood of failure, but not the consequences.

SCG-3.13.3 Tranching

More granular tranching will provide better visibility of risk reduction benefits for controls and mitigations, as seen in the DREAMS data for pipeline integrity management. Also, SoCalGas did not discuss whether population density was considered as a tranche category. An RSE based on mitigation of a series of tranches ranked by risk score would indictae which tranches yield the best RSE.

SCG-3.13.4 Risk Reduction Calculations

Sempra did not follow the Settlement Agreement requirements to identify the LoRE and CoRE for each tranche.

SCG-3.13.5 Alternatives Analysis

The alternatives presented did not provide substantive alternatives to existing controls.

SCG-3.13.6 Workpaper Availability
The spreadsheets that provided the risk data and calculations were not provided on the filing date of the RAMP but were delayed by several weeks, which delayed the evaluation of the RAMP calculations for Staff and parties.

SCG-3.13.7 Risk Driver and Consequence Frequencies
The RAMP did not provide frequencies for each risk driver and consequence, which was helpful additional information provided in the PG&E RAMP.

SCG-3.14 Recommended Solutions to Address Findings and Deficiencies

SCG-3.14.1
Sempra should confirm that shareholder costs, such as adverse litigation and fines, are not included in the risks to be mitigated by ratepayers.

SCG-3.14.2
SoCalGas and SDG&E should study the consequences of Aldyl A incidents compared to non-vintage pipe and adjust CoRE and RSE accordingly.

SCG-3.14.3
SoCalGas and SDG&E should create tranches that provide more granular levels of risk, so that mitigations can be applied to address the highest risks more directly.

SCG-3.14.4
SoCalGas and SDG&E should determine distinct LoRE and CoRE values for each tranche and present the pre-mitigation and post-mitigation LoRE and CoRE. If a mitigation is expected to reduce consequences, the change should be presented in the post-mitigation CoRE.

SCG-3.14.5
Sempra should provide more substantial alternative mitigations and evaluate them in the RAMP, such as electrification of areas served by pipelines that are due to be replaced.

SCG-3.14.6
In future filings, all IOUs should ensure that all workpapers are available on the date the RAMP report is filed.

SCG-3-14.7
IOUs should provide driver and consequence frequencies.

SCG-4 Incident Related to the Storage System (Excluding Dig-In)

SCG-4.1 Risk Description

This risk is defined as the risk of damage to the storage system, including wells, reservoirs, and surface equipment, which results in "serious injuries, fatalities and/or damages to the infrastructure." This risk excludes dig-in incidents (usually beyond the utility's direct control and assessed separately).

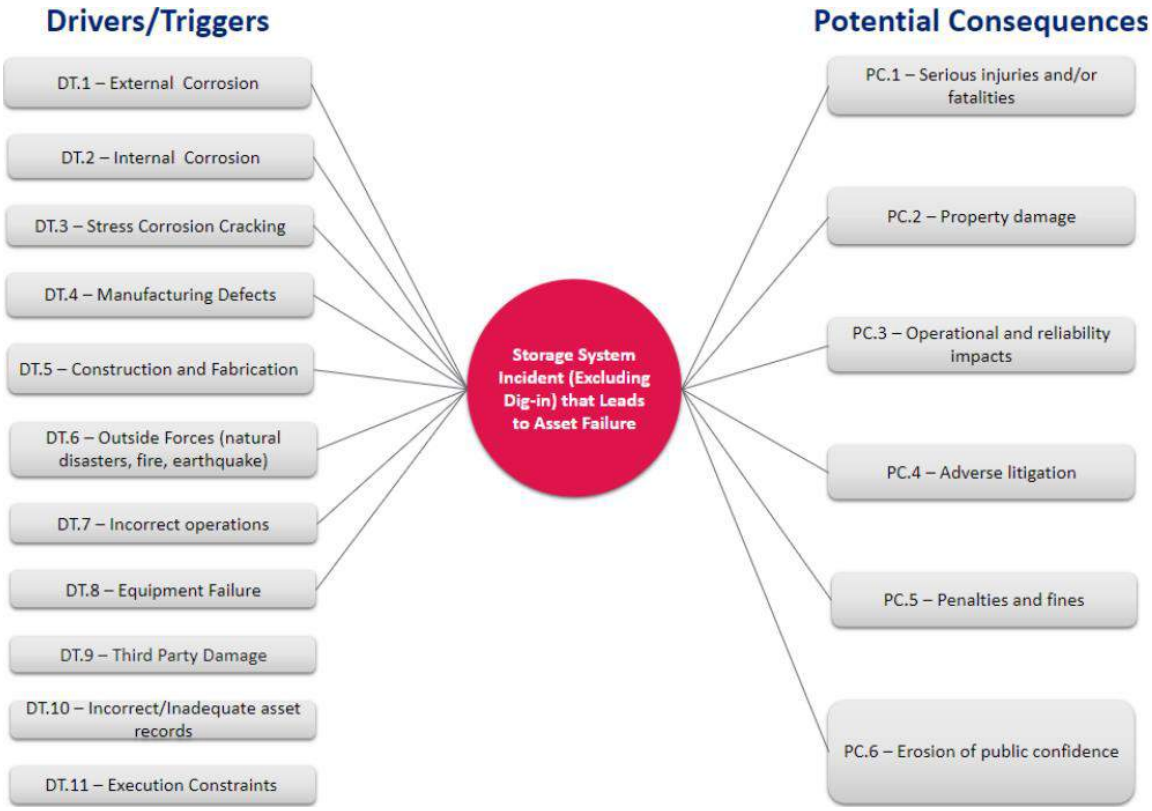
Observations:

The risk description includes appropriate elements of storage system infrastructure, including pipelines within the facility;[128] however, the stated consequences of damage to the physical plant, service outages, and serious injury/fatality are too limited.

Although these secondary consequences may be challenging to quantify, a more comprehensive risk description would include the adverse impacts to nearby communities.

SCG-4.2 Bowtie

A bowtie diagram is provided with eleven risk drivers on the left and six consequences on the right. The drivers and consequences are described in the chapter.



[128] Final 2021 RSE Workpaper - SCG STOR - Supplemental Level 2 (SCG Storage Workpaper 2).

Observations:

Most of the drivers, such as corrosion damage, construction flaws, and equipment failure, are taken from the list of pipeline integrity risks given in the American Society of Mechanical Engineer's standard B31.8S. This list makes sense since much of the storage system consists of pipelines and related structures.

The consequences are consistent within the defined scope of the risk, which is limited to serious injuries, fatalities, storage equipment damage, and service outages. Other potential consequences, such as the health impact of large volumes of gas in the atmosphere, are excluded from the analysis. A review of the underlying workpapers[129] indicates that these other impacts were not analyzed.

While not strictly required by the Settlement Agreement,[130] it would be helpful to include the frequencies (likelihood) for each risk driver and the frequencies for each consequence, as provided by PG&E in their most recent RAMP filing. Those frequencies indicate each driver's contribution to the risk and can support understanding whether proposed mitigations address the dominant drivers.

SCG-4.3 Exposure

The four SoCalGas storage facilities with their locations, number of wells, and capacities are described: Aliso Canyon, Honor Rancho, Goleta, and Playa del Rey. There are 159 wells in total.

Observations:

The storage facility information is consistent with Staff's understanding of the SoCalGas system and coincides with the defined scope of the risk. However, this limited definition of the risk excludes exposure of the community to gas release, such as that experienced in the Aliso Canyon event.

SCG-4.4 Tranches

No tranching of the assets was presented. SoCalGas aggregates the four storage locations and all the individual wells within the locations into a unitary risk.

Observations:

The Settlement Agreement (SA) defines several risk assessment requirements[131] in terms of tranches, where a tranche is a sub-group of an asset category that has a distinct risk score from other portions of that asset. The SA expects that the risk reduction effectiveness for each mitigation can be examined tranche by tranche to identify where mitigations may be most effective.

[129] SCG Storage Workpaper 2.

[130] D.18-01-014, Decision Adopting S-MAP Settlement Agreement with Modifications (Settlement Agreement).

[131] Settlement Agreement, see requirements 14, 16, 17, 19, 22, 23.

In this RAMP, SoCalGas has generally chosen to group assets such as the gas storage system into a single tranche. Likelihood, Consequence, and Risk Score are determined for that asset group. Risk reduction for a control or mitigation is then calculated by determining the portion of the group addressed by the control or mitigation. While this approach produces a risk reduction result for the purpose of RSE calculation, Staff is concerned that it may obscure the effectiveness of mitigations because the reduction is applied to the whole group, rather than the riskier elements; also, it does not provide an opportunity to see whether a larger or smaller number of tranches offer optimum risk spend efficiency.

A better approach to risk assessment would be to tranche the assets down to elements with different risk levels, perhaps down to individual wells within a storage field. That analysis could facilitate optimization of spending on the highest-risk elements.

SoCalGas states in Alternative 1, "Risk-Based Well Casing Inspection Frequency,"[132] that a well-by-well risk assessment could be performed to prioritize the frequency of well inspections. This proposed alternative suggests that tranching by individual well or groups of wells at similar risk levels can be explored.

At a minimum, tranching could be done based on the characteristics of each facility. For example, a study entitled the "Long-Term Viability of Underground Natural Gas Storage in California" conducted by the California Council of Science and Technology, found the "Playa del Rey facility, which has a long history of loss-of-containment incidents and is located near a large population center in a very high wildfire hazard zone, stands out as a facility with relatively higher risk to health and safety than the other facilities in California."[133] The same study created a hierarchy of relative risks of UGS facilities in the State.

SCG-4.5 Likelihood of Risk Event (LoRE)

The Likelihood value is presented as 0.29 events per year. Examination of the Level 2 Workpaper[134] indicates that the LoRE is the sum of likelihoods for medium consequence events and high consequence events. A high-consequence event involves a serious injury or fatality, and/or higher financial and reliability impacts. A medium-consequence event does not include safety impacts. The incident data is said to have come from company records, Subject Matter Expert (SME) input, and national data on gas storage events from PHMSA.[135]

Observations:

The combined LoRE value of 0.29, about one event in three years, is consistent with the data sources presented in the Workpaper.

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[132] Southern California Gas Company 2021 Ramp Application (SCG RAMP) Chapter 4-at 21.

[133] Long-Term Viability of Underground Natural Gas Storage in California, California Council on Science and Technology at ES-4 https://ccst.us/reports/long-term-viability-of-underground-natural-gas-storage-in-california-an-independent-review-of-scientific-and-technical-information/

[134] SCG Storage Workpaper 2.

[135] Pipeline and Hazardous Materials Safety Administration of the US Dept. of Transportation.

Interestingly, the LoRE given for a high-consequence event is 0.0833, or once in 12 years, based only on SME input.[136] The use of SME input, without inclusion of PHMSA data, suggests there were no high-consequence incidents in the PHMSA records. Then, it appears that the 2015 Aliso Canyon event is not considered as a high-consequence incident. While there are no indications of serious injury or fatality, Staff is concerned whether the reliability and financial cost impacts of Aliso Canyon were credited correctly in determining the high-consequence likelihood of once in twelve years.

SCG-4.6 Consequence of Risk Event (CoRE)

The Consequence score of 9,306 is the sum of the four attributes of Safety, Reliability, Financial and Stakeholder Satisfaction. Examination of the workpaper finds the contributors to the consequence attributes, broken into Medium-Consequence and High-Consequence events and summed to get the total Attribute CoRE value:

Table SCG-4.1 CoRE Attributes and Natural Units

Attribute	Med-Q Event Data	High-Q Event Data	CoRE Value
Safety (per incident)	0 Injury, 0 Fatality	4 Serious Injuries	855
Financial (cost to restore)	$37 Million	$291 Million	3,276
Reliability[137]	16,033,139	36,200,139	4,902
Stakeholder Satisfaction[138]	11	20	271

The biggest contributors to the consequence score are the Financial and Reliability attributes with values of 3,276 and 4,902. Safety is lower with a consequence score of 855.

Observations:

The CoRE attribute results make sense in the context of the limited scope of the Risk Description. The financial consideration is the cost to restore operations. The safety attribute is based on a Subject Matter Expert estimate of four serious injuries in the case of a high-consequence event. The stakeholder satisfaction index is also based on SME input.

However, the limited scope of the Risk Description doesn't appear to include consideration of the full range of potential consequences from an Aliso Canyon-type event. While there were no immediate serious injuries[139] or fatalities directly attributed to the event, the Los Angeles County Department of Public Health[140] found the "majority of households near the Aliso Canyon Storage Facility experienced health symptoms" that included "headaches, nasal congestion, sore throat, respiratory complaints, nausea, dizziness, skin rashes and nosebleeds." These symptoms persisted

[136] Final 2021 RSE Workpaper – SCG STOR – Supplemental_Level 2.
[137] Reliability data includes customer meters out of service and curtailment impact.
[138] Stakeholder Satisfaction based on SME input.
[139] "Serious injury" is generally defined as an event that requires hospitalization or a permanent disfigurement of an individual.
[140] Environmental Conditions and Health Concerns in Proximity to Aliso Canyon Following Permanent Closure of Well SS-25, Los Angeles County Department of Public Health, http://publichealth.lacounty.gov/media/docs/PublicHealthAssessment.pdf

even after the well was sealed. Residents of the Porter Ranch neighborhood had to relocate outside the area to avoid the cloud of sulfurous mercaptan-odorized gas mixed with hydrocarbon and other residues brought up from the former oil field. The gas released was estimated to add 97,000 metric tonnes of methane, a potent greenhouse gas, above the typical 413,000 tonnes a year for the South Coast Air Basin.

SPD requested additional information[141] about how and whether the Aliso Canyon event was included in the risk assessment. For the Aliso Canyon incident, SoCalGas replied that under a settlement agreement, SoCalGas has contributed $34.1 million of shareholder funds to establish the Aliso Canyon Methane Emissions Mitigation Fund, sufficient to mitigate methane emissions from the leak. These shareholder costs were not considered in the analyses of the Storage Incident risk in SoCalGas's 2021 RAMP, which is concerned with ratepayer costs.

For other health impacts, SoCalGas responded that they utilized available data to determine likelihood and consequences of a storage incident. The reliability analysis accounts for the current reduced capacity for storage at Aliso Canyon. The financial analysis includes ratepayer cost impacts.

It may be that the Stakeholder Satisfaction attribute could include impacts on residents such as those exposed to the Aliso Canyon emissions, but the RAMP doesn't provide that level of detail on the value assigned to the attribute.

SPD Staff recommends that future RAMP reports should provide narrative to explain how unusual circumstances with wide public concern, such as the Aliso Canyon incident, were accounted for, or could not be accounted for, in the risk assessment. The challenge of representing secondary impacts could be taken up in a future S-MAP proceeding.

SCG-4.7 Pre-Mitigation Risk Score

The pre-mitigation risk score of 2,721 is based on a LoRE of 0.2924 and a CoRE of 9,306. It ranks third after High-Pressure Pipeline and Medium Pressure Pipeline risks.

Observations:

This risk score, lower than the pipeline risk scores, seems reasonable considering the pipeline systems have a wider extent of exposure. As noted above, the score is mainly dependent on reliability and financial consequences. Safety is a small component based on the SIF[142] data available from past events. The score represents risk for the gas storage system as one tranche.

SCG-4.8 Controls and Mitigations

Controls

Seven controls are presented. Controls are often based on regulatory requirements, although the pace of implementation can sometimes be at the utilities' discretion and so affect the costs.

[141] https://www.socalgas.com/sites/default/files/SPD-DR05-07212021.pdf

[142] "SIF" = Serious Injuries and Fatalities.

Some of the controls currently in place had been introduced to comply with newer regulations. Control C4, 'Wellhead Leak Detection and Repair,' is based on the California Air Resources Board (CARB) Oil and Gas regulations dating from 2019. Control C1, 'Integrity Demonstration, Verification, and Monitoring Requirements,' embodies newer PHMSA[143] and CalGEM[144] gas storage integrity regulations.

Mitigations

One new mitigation, a Facilities Integrity Management Program, FIMP, is proposed. The program is intended to apply additional integrity management to portions of the storage system not already managed by existing programs such as pressure vessels, tanks, and certain piping at storage facilities. The RAMP report indicates there was O&M spending on the FIMP in 2020 of about S1.8 million. That spending level is proposed to continue through 2024.

Observations:

Integrity management is an established process for risk reduction that identifies and replaces equipment found to have a high risk of failure. It is a requirement for gas pipeline systems and has been applied to elements of the storage system with the Storage Integrity Management Program (SIMP) and with the control C1. It is logical that remaining portions of the storage facility not already included should receive an integrity management program, subject to review in the General Rate Case.

SCG-4.9 Risk Spend Efficiency

Table SCG-4.2 presents the Controls and Mitigations with their costs,[145] risk reduction, and Risk Spend Efficiency (RSE) values. The RAMP report explains that these cost forecasts are in alignment with the requirements for the next General Rate Case filing.

Table SCG-4.2 Mitigations and RSE

ID	Control or Mitigation Name	Program Cost, $ Millions	Risk Score Reduction	RSE
C1	Integrity Demonstration, Verification, Etc.	308.8	44.63	0.3
C2	Well Abandonment and Replacement	126.9	187.04	2.8
C3	Pressure Monitoring and Alarming	0.4	---	NA
C4	Wellhead Leak Detection and Repair	8.3	---	NA
C5	Storage Field Maintenance	34.4	1242.09	35.1
C6	Compressor Overhauls	15.6	280.95	82.7
C7	Upgrade to Purification Equipment	20.1	118.29	5.7
M1	Facilities Integrity Management Program	1.9	---	NA

[143] Pipeline and Hazardous Materials Safety Administration of the US Dept. of Transportation.
[144] California Geologic Energy Management Division of the Dept. of Conservation.
[145] Costs from SCG RAMP Chapter 4, Table 3.

Two of the controls, and the one proposed mitigation, do not present an RSE. SoCalGas explained that they had no relevant data to calculate a risk reduction, and the Subject Matter Experts (SMEs) could not estimate a risk value for these programs.

Observations:

Highest Cost Control

Staff observes that the highest cost control, C1, has the lowest RSE (change in risk divided by cost). This storage well integrity management control is capital intensive due to equipment replacement costs identified by the integrity assessments. The low RSE value results from the high cost and a small risk score reduction. While the mechanical integrity testing of gas storage wells is required by California Code 14 CCR § 1726.6, SoCalGas has proposed a lower-cost alternative subject to regulatory approval.

Examination of the risk reduction calculation for C1 leads to the three percentage values that are central to Sempra's method for risk reduction estimates. The RSE work paper[146] explains that an engineering study[147] determined that 3.3 percent of storage system incidents are addressed by well integrity management, 51 percent of the wells will be mitigated in the three-year spending period, and these mitigations have been 98 percent effective historically. The three percentages combine to produce the control's risk reduction for the storage system of 1.64 percent (3.3% x 51% x 98%).

It seems strange that an integrity management program focused on storage wells, which make up a large portion of the storage system, would only address 3.3 percent of storage incidents. However, a Staff review of the study by Integral Engineering (provided in response to a Data Request) confirms that figure.

Most Effective Controls

The highest RSE is found for Control C5, Storage Field Maintenance, at 35.1. The Risk Score reduction for C5 is calculated at 1242 points or 45% of the Storage risk. Another 10 percent reduction is attributed to C6, Compressor Overhauls.

Pre-Control Risk Score Approach

Staff is concerned about the approach taken to determine the risk reduction of controls, which are already modifying risk. For C1, the risk reduction percentage of 1.64 percent is calculated and then applied to the current risk score of 2721 to find the change in risk of 44.63 risk points. However, since this control is already in effect, it would be more accurate to apply the percent risk reduction to the greater level of risk that would have existed before the control was applied. So, the change in risk score would be greater than 44.63, and the RSE would be greater too. The RAMP report's approach may produce a conservative estimate of RSE, which may not properly demonstrate where risk spending is most effective.

[146] Final 2021 RSE Workpaper - SCG STOR - TURN DR8 Q2.7.

[147] Study conducted by the consulting firm Integral Engineering.

A greater margin of error is produced when the reduction percentage is larger. For example, control C5, Storage Field Maintenance, has a calculated risk reduction of 45 percent, or 1242 points. That percentage is applied to the current 'pre-mitigation' risk score. But the pre-mitigation risk score already includes the benefits of that existing control. Therefore, for more accuracy, the risk reduction benefit should apply to a higher pre-control level, which could generate a greater risk reduction and associated RSE.

Again, Staff recognizes that such a pre-control risk level may be challenging to determine but as an example, suppose that the pre-control score was estimated to be 45 percent higher than the current score, or 2,721 points x 1.45 = 3,945 risk points. Then if we apply the 45 percent reduction to that score, the risk score reduction is 1,775 risk points. That result is 1.4 times higher than determined by the SoCalGas approach, which means the RSE would also be 1.4 times higher.

SCG-4.10 Alternatives Analysis

Two alternative mitigations are presented. One considers a risk-based approach to determining well casing inspection frequency, while the other uses alternative methane leak measurement technology.

ID	Control or Mitigation Name	Program Cost, $ Millions	Risk Score Reduction	RSE
A1	Risk-based well casing inspection frequency	85.6	10.6	0.8
A2	Alternate technology for methane monitoring	3.8	5.9	7.1

The first alternative would alter the mandatory 24-month inspection cycle to a schedule based on risk assessments of well casing condition, so it requires approval from CalGEM to deviate from the regulation. SoCalGas expects that fewer wells would require inspection, saving cost. It is only a viable alternative if CalGEM approval is granted.

The second alternative would adapt the existing control C4, Wellhead Leak Detection and Repair, with newly developed measurement devices. But the alternative requires that such devices offer improvements as expected. The cost would be lower at $3.8 million compared to $8.28 million, and the alternative has an RSE of 7.1 while the existing control's RSE could not be determined.

Observations

The two programs are not strictly alternatives since they require approval from CalGEM or proof of the new technology's performance. However, SPD agrees with the intention to replace current controls with more efficient and less costly controls when feasible. They may be feasible alternatives if the conditions allow by the time the General Rate Case is filed.

SCG-4.11(opt) Scenario Analysis (if available)

SCG-4.12 Summary of Findings

Based on the observations presented above, findings are summarized here.

SCG-4.12.1 Granular Tranching
Based on the risk-based well casing inspection program described in Alternative 1, it appears that more granular tranching is possible.

SCG-4.12.2 Secondary Health Impacts
While not explicitly required by the Settlement Agreement, SoCalGas did not consider secondary impacts of notable events, such as those experienced by residents near Aliso Canyon.

SCG-4.12.3 Risk Driver and Consequence Frequencies
While not explicitly required by the Settlement Agreement, SoCalGas did not provide the contribution frequencies of the risk drivers and consequences like PG&E did in their RAMP filing.

SCG-4.12.4 Pre-Control Risk Score
For controls, the pre-mitigation risk score was based on assessment of risk under current conditions with the control already in place. Then the risk reduction achieved by the control is calculated from that level, rather than estimated from the higher level that existed without the control, which leads to a conservative value of control effectiveness.

SCG-4.12.5 Alternative Mitigations
The alternatives presented are only feasible if certain conditions are met in the future.

SCG-4.12.6 Likelihood of High-Consequence Event
It is not clear whether the high-consequence event likelihood LoRE of 0.08333 includes consideration of the Aliso Canyon incident.

SCG-4.13 Recommended Solutions to Address Findings and Deficiencies

SCG-4.13.1
SoCalGas should adopt more granular tranching of storage well assets, possibly based on each of the four facilities or well-by-well risk assessments or population density in the vicinity.

SCG-4.13.2
Utilities should include discussion of secondary impacts of special interest to the public and policymakers, even if not quantifiable, to indicate that consideration was given to them, and describe difficulties encountered with quantification. Proxies for secondary health impacts, such as the Acres Burned sub-attribute for wildfires, should be considered.

SCG-4.13.3
Utilities should include frequency data for drivers and consequences in RAMP.

SCG-4-13.4
SoCalGas should recalculate control RSEs to allow for the higher level of risk that would have been present before the control is applied.

SCG-4-13.5
SoCalGas should present alternative mitigations that are feasible at the time of the GRC filing.

SCG-4-13.6
SoCalGas should clarify the criteria used to define high-consequence vs. medium-consequence events and whether Aliso Canyon was included in the SME judgement of high-consequence incident likelihood.

SCG-5 / SDGE-8 Incident Involving an Employee

SCG-5 / SDG&E-8.1 Risk Description

SDG&E and SoCalGas (collectively, the Companies) examine the Incident Involving an Employee Risk (IIE Risk) in Chapter SDG&E-Risk-8 and Chapter SCG-Risk-5, respectively. For the purposes of the RAMP filing, the IIE Risk is defined as the risk of an incident, involving one or more on-duty employees, that causes serious injury or fatality, as defined by the Occupational Safety and Health Administration (OSHA), to a company employee.

SDG&E and SoCalGas both cite the use of its internal Annual Serious Injuries and Fatalities (SIFs) from 2015-2020 for the quantitative data needed to inform this risk chapter. Subject Matter Experts reviewed and adjusted the data for SDG&E's applicable use. SoCalGas stated that if internal data is insufficient, Industry or National data is supplemented and adjusted to fit the risk profile associated with the operating locations and perimeter of the utilities.

Observations

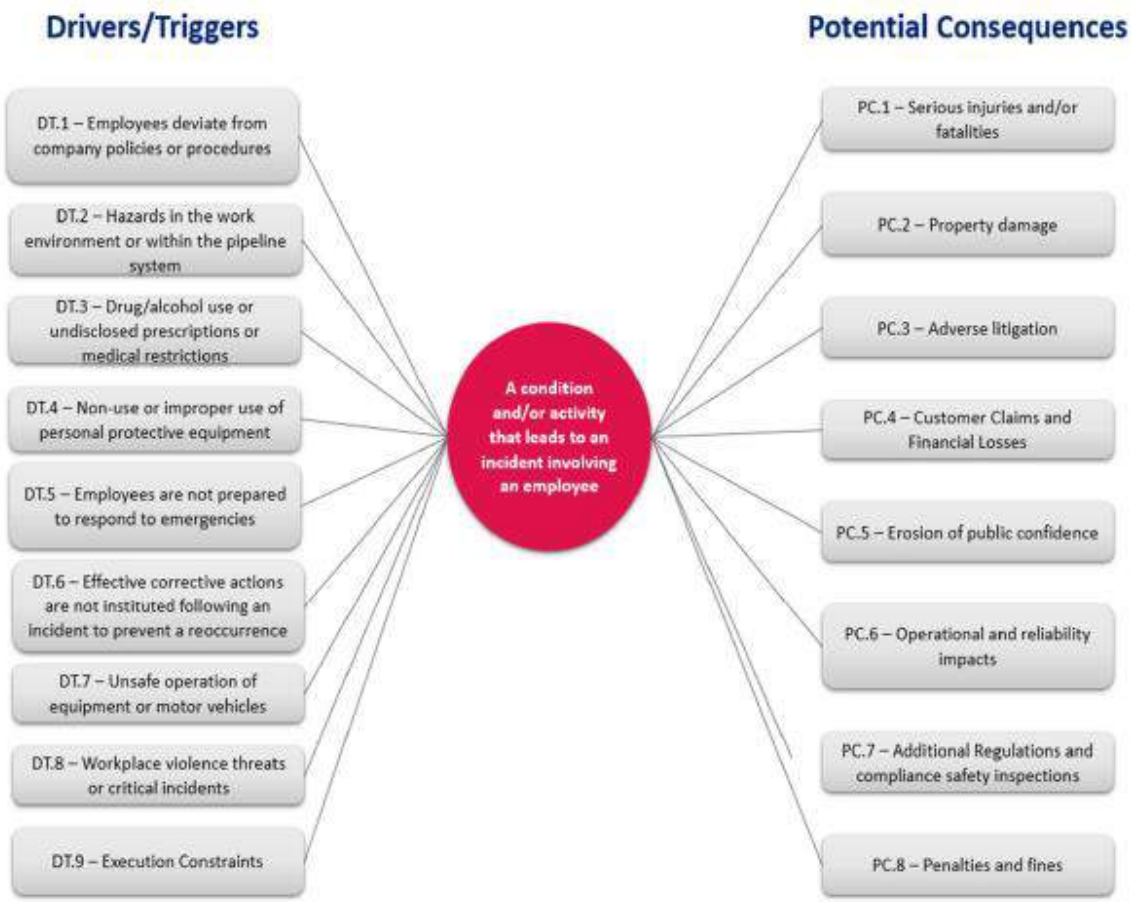
For additional context, both SDG&E and SoCalGas currently report Employee Serious Injuries and Fatalities (SIF) in their respective annual Safety Performance Metrics Report (SPMR). In its 2019 SPMR, SDG&E reported one fatality from a 10-year reporting period 2010-2019, and one serious injury incident in 2016, zero in 2017, zero in 2018, and one in 2019. In its 2019 SPMR, SoCalGas reported two fatalities and 12 serious injuries from a 10-year reporting period, 2010-2019. The metric is linked to the SDG&E and SoCalGas 2019 Executive and Non-executive Compensation Plans through five employee safety-related metrics.

SCG-5 / SDG&E-8.2 Bowtie

The risk bow tie represents risk event drivers and their frequencies on the left side of the diagram, risk event in the center, and consequences on the right. Risk Score of the bow tie is calculated by multiplying the LoRE and CoRE values. For Employee Safety Incidents, the risk score is 1,062, which is ranked seventh of the nine RAMP risks for SDG&E.

SDG&E's bow tie illustration is provided below, showing 12 risk drivers and triggers (DTs) and six potential consequences (PCs):

SCG's bow tie illustration is provided below, showing nine DTs and eight PCs:



Observations

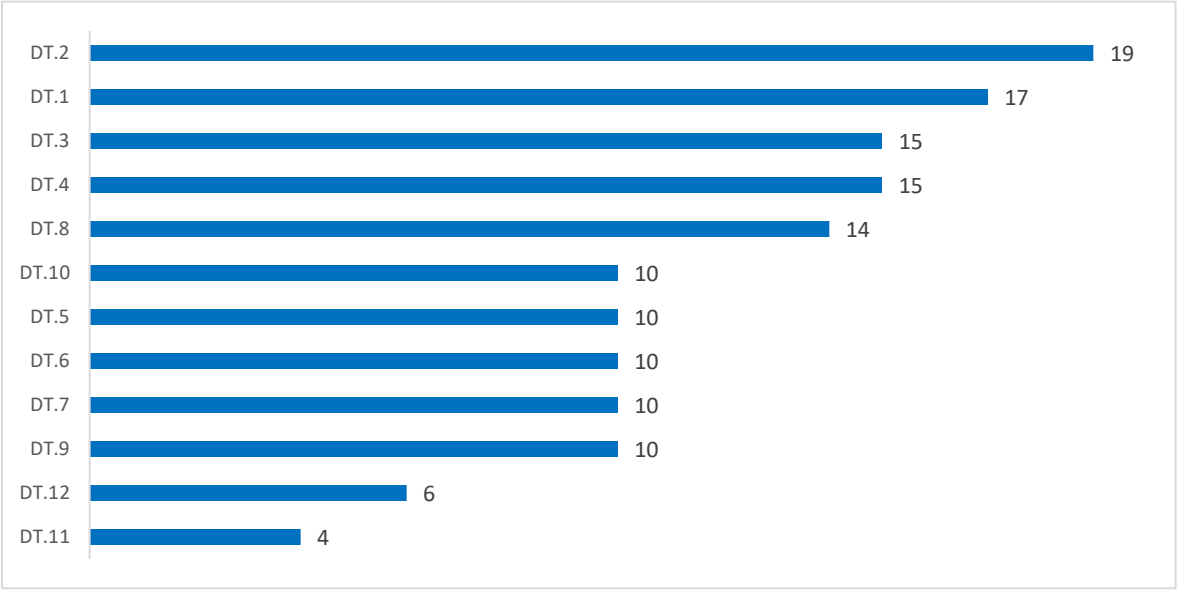
SDG&E lists 12 DTs in the bow tie analysis and SoCalGas lists nine DTs. Potential DTs are an indication that a risk could occur; they do not reflect actual or threatened conditions.[148]

Neither SDG&E nor SoCalGas provide expected frequency or LoRE with each DT, nor does it organize the DTs in any rank order, i.e., from highest to lowest frequency. Although this frequency information is not required by the Settlement Agreement, it would illustrate which DTs are a top concern or priority for SDG&E.

To analyze their priorities, Staff manipulated information provided in Appendix A of each Company's IIE Risk chapter and ranked DTs and PCs by total number of 2020 controls and proposed 2022-2024 mitigations.[149]

[148] SDG&E 2021 RAMP Report Chapter 8 (SDGE RAMP Ch. 8) at 6.
[149] SDGE RAMP Ch. 8 at A-1, 2 and SCG RAMP Ch. 5 at A-1.

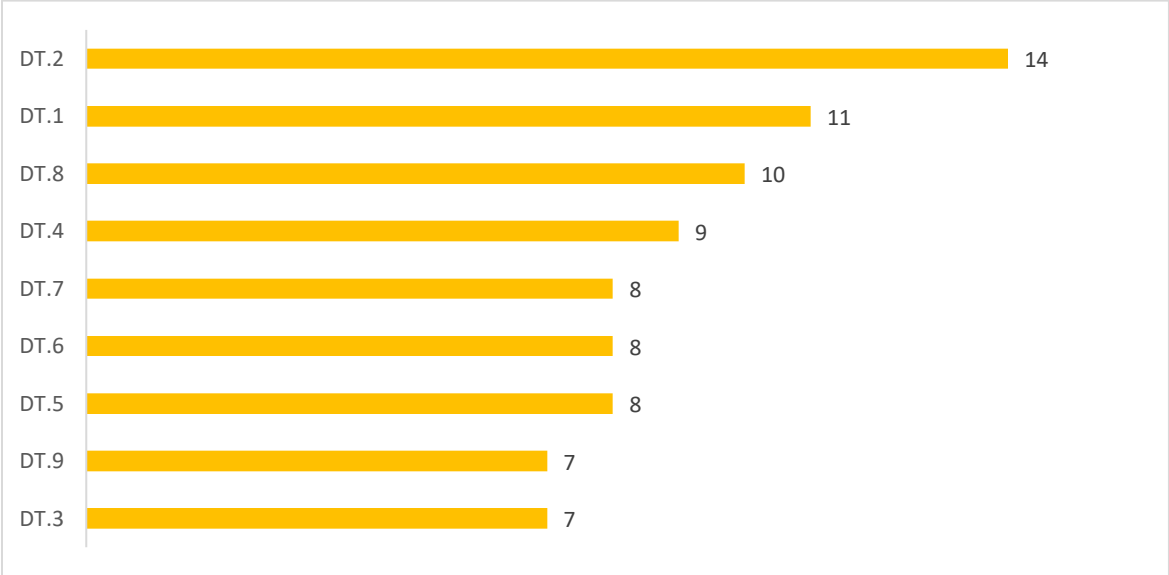
Figure SCG-5 / SDG&E-8.1. SDG&E DTs by Number of Controls and Mitigations



Based on the information in Figure SCG-5 / SDG&E-8.1, SDG&E may be particularly concerned about mitigating "DT.2 – Hazards in the work environment;" "DT.1 – Employees deviate from policies or procedures;" "DT.3 – Non or improper use of personal protective equipment;" "DT.4 – Unsafe operation of equipment or motor vehicles;" and "DT.8 – Inadequate employee training."

Based on the information in Figure SCG-5 / SDG&E-8.2, SoCalGas may be particularly concerned about mitigating "DT.2 – Hazards in the work environment;" "DT.1 – Employees deviate from policies or procedures;" and "DT.8 – Workplace violence threats or critical incidents."

Figure SCG-5 / SDG&E-8.2. SoCalGas DTs by Number of Controls and Mitigations



According to Figure SCG-5 / SDG&E-8.3 and Figure SCG-5 / SDG&E-8.4, mitigating "PC.1 – Serious injuries or fatalities" is a clear-cut area of concern among all potential consequences for both Companies.

Figure SCG-5 / SDG&E-8.3. SDG&E PCs by Number of Controls and Mitigations

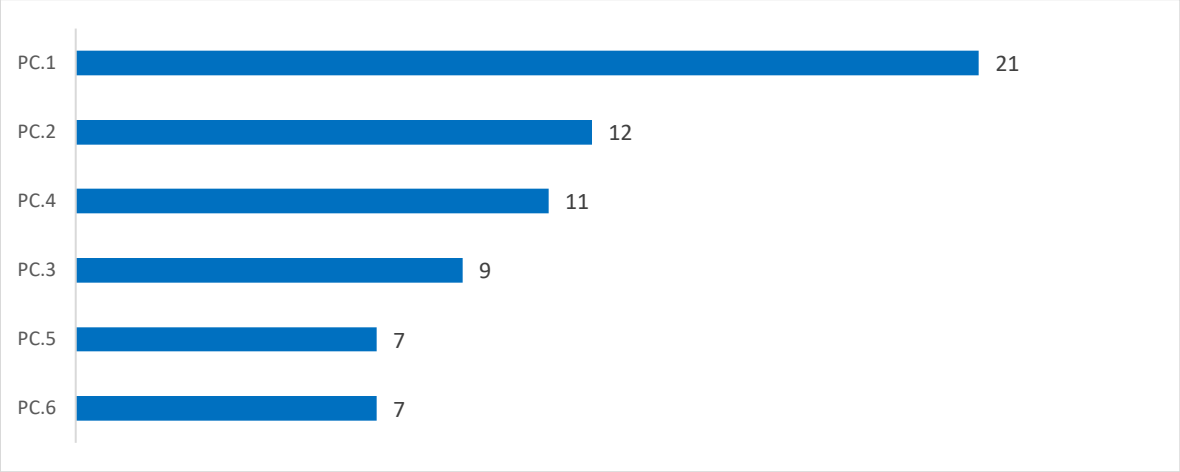
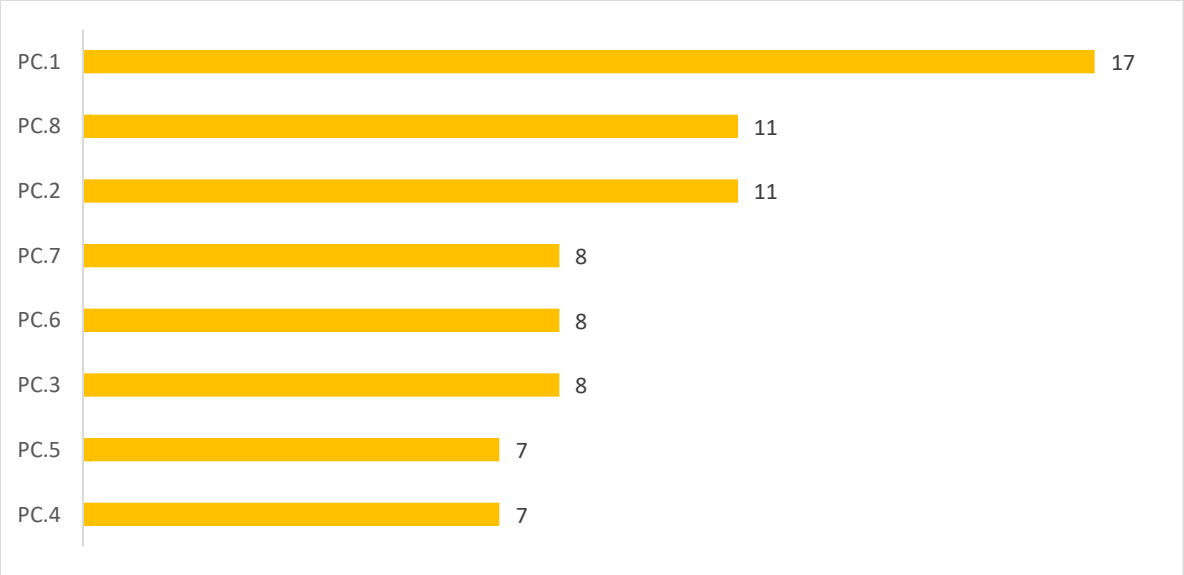


Figure SCG-5 / SDG&E-8.4. SoCalGas PCs by Number of Controls and Mitigations



SCG-5 / SDG&E-8.3 Exposure

Neither SDG&E nor SCG clearly specify the number or type of employees exposed to risk. SDG&E only defines exposure as "on-duty" employees.

Observations

In any description of risk, verifiable measurement units are essential to the assessment. SDG&E and SCG should always provide clear quantitative exposure to risk in the body of the RAMP's risk chapter.

SDG&E does not explicitly state the number of employees exposed to this risk, though the controls and mitigations discussion for the range of employees projected in 2024 is 4,400-4,800, based on 4,400 employees in 2020. SCG does not explicitly state the number of employees exposed to this risk either, but it estimates that its 2024 control and mitigations may address up to a projected seven full-time-equivalent employees (FTE), 21 FTE employees, or 32 FTE employees, depending on the activity.

Differences in exposure to risk for specific groups of employees would normally be apparent in the discussion on tranches. However, both SDG&E and SCG identify only a single tranche for this risk (see "Tranches" section below for further discussion).

SCG-5 / SDG&E-8.4 Tranches

SDG&E identifies only a single tranche: "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."[150]

Similarly, SoCalGas identifies only a single tranche: "Controls and mitigations in the Employee Incident risk have the same risk profile; thus, they are not further tranched."[151]

Observations

Staff does not agree that all employees share the same risk profile. At a minimum, more granular tranches could include, for example, office-only employees and field employees; and electric crew separate from gas crew. SDG&E may then find it appropriate to provide additional granularity by type of work.

SCG-5 / SDG&E-8.5 Likelihood of Risk Event (LoRE)

SDG&E determines the LoRE to be 0.83, based on internal SIFs data from 2015-2020. Twenty (20) percent of the expected number of annual incidents results in a fatality, while 80 percent results in a serious injury. This translates to approximately 1.66 expected fatalities and 6.64 serious injuries over a 10-year span.

While the expected frequency of a risk event is low for SDG&E, SCG's determination of LoRE is significantly higher with the expected frequency of a risk event determined to be 553.09, based on internal OSHA-reportable data, vehicular incident rate data, and data from the Bureau of Labor Statistics.

[150] SDGE RAMP Ch. 8 at 29.
[151] SCG RAMP Ch. 5 at 26.

Observations

The two Companies vary significantly in their determination of LoRE for the same risk and the reasons are not clear considering that both Companies appear to have a strong culture of safety, as seen in their respective SPM reports.

For SDG&E, compared to a related risk like SDG&E's Incident Involving a Contractor (Contractor Incident) risk, which has a LoRE of 1.83, SDG&E's LoRE for IIE Risk is expected to be lower by approximately one risk event per year. And compared to SDG&E's Wildfire Risk, with a LoRE of 21.2, and Electric Infrastructure Integrity risk, with a LoRE of 1,632, the expected frequency of incidents for IIE Risk is clearly lower.

Unlike SDG&E, SoCalGas has a higher LoRE for IIE Risk than it does for a related risk like SoCalGas' Contractor Incident Risk, which has a LoRE of 144.77. Among the seven SoCalGas risks found in the RAMP, IIE Risk has the second highest LoRE value after Excavation Damage (Dig-in) on the Medium Pressure Gas System, which has a LoRE of 2,914.10.

SCG-5 / SDG&E-8.6 Consequences of Risk Event (CoRE)

SDG&E determines the CoRE to be 1,275 while SoCalGas determines the CoRE to be 4.82, consisting of a Safety attribute, a Financial attribute, and a Stakeholder Satisfaction attribute. Both Companies determined reliability to have a value of zero as the issue of reliability does not affect this particular risk.

The CoRE Safety value makes up 93 percent of the total CoRE for SDG&E and 99.6 percent of the total Core for SoCalGas. SDG&E determines the Financial CoRE to make up three percent of the total CoRE while SoCalGas determines the Financial CoRE to make up less than half of a percent. SDG&E also determines the Stakeholder Satisfaction CoRE to make up four percent of the total CoRE while SoCalGas determines the Stakeholder Satisfaction CoRE to make up less than half of a percent.

SDG&E states they use a Monte Carlo simulation to determine the probability distribution of safety and stakeholder satisfaction results per year. Historical internal data is used to model the uncertainty of safety frequency and consequence; SME provided data for financial and stakeholder satisfaction analysis.

Observations

The two Companies vary significantly in their determination of CoRE for the same risk. Staff interprets the resulting difference in CoRE to indicate that the consequences are far less severe with incidents related to risk events for SoCalGas than they are for SDG&E.

For SDG&E, compared to a related risk, Contractor Incident Risk, which has a CoRE of 1,033, the CoRE for IIE Risk is expected to be higher. In fact, the CoRE value associated with IIE Risk is the second highest value among all nine SDG&E RAMP risks, except for Cybersecurity.

For SoCalGas, the CoRE value is extremely low among the SoCalGas risks found in the RAMP. Only Contractor Incident Risk, with a CoRE of 3, and Excavation Damage (Dig-in) on the Medium Gas System, with a CoRE of 0.5, rank lower.

SCG-5 / SDG&E-8.7 Pre-Mitigation Risk Score

The Settlement Agreement describes the pre-mitigation risk score as "the product of the pre-mitigation LoRE and the pre-mitigation CoRE for each Tranche subject to the identified Risk Event."

SDG&E determines the pre-mitigation IIE Risk score to be 1,062 and SoCalGas determines the pre-mitigation IIE Risk score to be 2,667.

The same pre-mitigation LoRE, CoRE, and risk score are associated with all controls and mitigations because the risk involves only a single tranche.

Observations

For SDG&E, despite the high CoRE value associated with the IIE Risk, the resulting pre-mitigation risk score ranks the risk score seventh out of the nine SDG&E RAMP risks, because of the low LoRE value.

For SoCalGas, despite the low CoRE value associated with the IIE Risk, the relatively high LoRE value results in a pre-mitigaiton risk score that is higher than equivalent risk score for SDG&E.

SCG-5 / SDG&E-8.8 Controls and Mitigations

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. The last year of recorded data in 2020 provides the baseline costs and the cost estimates are provided for years 2022-2024.

Controls

SDG&E presents 17 controls that were in place as of December 31, 2020. All controls, except for "C16 – Energized Skills Training and Testing Yard" are expected to be part of the Control and Mitigation Plan (Plan) from 2022-2024.

Table SCG-5 / SDG&E-8.1 provides a list of all 16 SDG&E control programs that are expected to be in place during the 2022-2024 period. SDG&E considers several control programs to be foundational programs or mandated programs for which SDG&E does not perform an RSE analysis. The total projected cost for the 2022-2024 period, including capital expenditures incurred in that time period plus test year 2024 operational and maintenance (O&M) costs, is nearly $19 million. Foundational and mandated control activities cost about $4.5 million, or 24 percent of total projected cost in 2022-2024.

For SDG&E, the two most expensive controls, as forecasted – "C11 – Jobsite Safety Programs" and "C4 – Employee Behavioral Accident Prevention Process Program" – account for over half (52 percent) of all forecasted costs in the 2022-2024 time period. Only one control program, "C11 – Jobsite Safety Program," is expected to have capital costs in 2022-2024. Programs in this control

include: a facilities maintenance program, traffic control at worksites, and work methods and standards.

Generally, controls can apply to all employees or a subset of employees, and include programs related to job training, enhanced safety training, protective equipment provisions, drug and alcohol testing, safe driving, and other such programs that would mitigate risk. Some controls, like "C13 – Enhanced Mandatory Employee Training (OSHA)" and "C17 – Employee Wildfire Smoke Protection" are required by Cal/OHSA.

Table SCG-5 / SDG&E-8.1. SDG&E Controls, 2022-2024

ID	Control Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $ Million
C1*	Mandatory Employee Health and Safety Training Programs and Standardized Policies	$858	N/A	N/A
C2*	Drug and Alcohol Testing Program	$190	N/A	N/A
C3	Strong Safety Culture	$595	48	78
C4	Employee Behavioral Accident Prevention Process Program	$2,582	32	12
C5*	A Comprehensive Environmental & Safety Compliance Management Program	N/A**	N/A	N/A
C6*	Employee Safety Communications and Awareness Programs	N/A**	N/A	N/A
C7*	Employee Wellness Programs	$811	N/A	N/A
C8	OSHA Voluntary Protection Program	$1,500	22	14
C9	Safe Driving Programs	$273	16	57
C10*	Personal Protective Equipment	$1,867	N/A	N/A
C11	Jobsite Safety Programs	$7,344	70	9
C12*	Utilizing OSHA and Industry Best Practices and Industry Benchmarking	$738	N/A	N/A

ID	Control Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $ Million
C13	Enhanced Mandatory Employee Training (OSHA): Certified Occupational Safety Specialist, Certified Utility Safety Professional; Certified Safety Professional	$45	6	138
C14	Enhanced Safety in Action Program	$155	48	299
C15	Enhanced Employee Safe Driving Training	$1,650	32	19
C16**	Energized Skills Training and Testing Yard	N/A	N/A	N/A
C17*	Employee Wildfire Smoke Protection – Cal/OSHA emergency regulation	$18	N/A	N/A

Note: C16 exists as a control in 2020, but is not in the Plan for 2022-2024.
* These controls are considered foundational programs or mandated programs. Costs for these programs are estimated by summing the capital costs from 2022-2024 time period and test year 2024 O&M costs, which are the costs that are being sought for recovery in TY 2024 GRC.
** There are no recorded or forecasted dollars for C5 and C6 because all costs are incremental and included in various other cost centers.

Table SCG-5 / SDG&E-8.2 provides a list of all 10 SoCalGas control programs that are expected to be in place during the 2022-2024 period. The total projected cost for the 2022-2024 period, including capital expenditures incurred in that time period plus test year 2024 operational and maintenance (O&M) costs, is nearly $17 million. Foundational programs and mandated programs cost over $2 million, or 13 percent of total projected cost in 2022-2024.

For SoCalGas, the two most expensive controls, as forecasted – “C10 – Workplace Violence Prevention Programs” and “C3 – Employee Wellness Programs” – account for 61 percent of all forecasted costs in the 2022-2024 time period. Only one control program, “C10 – Workplace Violence Prevention Programs,” is expected to have capital costs in 2022-2024. Programs in C10 include: physical security systems; contract security; corporate security planning, awareness, risk management, and incident management; new hire screening processes; and workplace violence mitigation team (WVMT).

Generally, controls can apply to all employees or a subset of employees, and include programs related to enhanced safety training, protective equipment provisions, drug and alcohol testing, safe driving, and other such programs that would mitigate risk.

Table SCG-5 / SDG&E-8.2. SoCalGas Controls, 2022-2024

ID	Control Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
C1*	Employee Health and Safety Programs and Standardized Policies	$927	N/A	N/A
C2	Drug and Alcohol Testing Programs	$498	14.98	29.2
C3	Employee Wellness Programs	$2,648	2.67	1.0
C4	Employee Safety Training and Awareness Programs	$438	19.62	43.5
C5	Safe Driving Programs	$1,179	13.60	11.2
C6*	Personal Protection Equipment (PPE)	$1,196	N/A	N/A
C7	Near Miss, Stop the Job, and Jobsite safety programs	$438	18.41	40.8
C8	Safety Culture Programs	$810	6.44	7.7
C9	Utilizing Industry Best Practices and Benchmarking	$1,066	5.27	4.8
C10	Workplace Violence Prevention Programs	$7,698	305.20	498.0

* These controls are considered foundational programs or mandated programs. Costs for these programs are estimated by summing the capital costs from 2022-2024 time period and test year 2024 O&M costs, which are the costs that are being sought for recovery in TY 2024 GRC.

** There are no recorded or forecasted dollars for C5 and C6 because all costs are incremental and included in various other cost centers.

Observations

For SDG&E, all current controls will be part of the Plan in 2022-2024, except for "C16 – Energized Skills Training and Testing Yard." There is no clear explanation as to why this control will no longer be available as of 2022. As part of C16, SDG&E 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 states that it "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."[152]

For SDG&E, the largest risk reduction comes from "C11 –Jobsite Safety Programs" with a risk reduction value of 70. For SCE, the largest risk reduction from "C10 – Workplace Violent Prevention Programs" with a risk reduction value of 306.

Mitigations

SDG&E is introducing four mitigations to the Plan in the period from 2022-2024, forecasted to represent three percent of total Plan costs in TY 2024 (see Table SCG-5 / SDG&E-8.3). The total projected cost of the mitigations in 2022-2024 is $603,000.

The M1, M2, and M3 mitigate against the effects of wildfire on its employees, totaling $576,000 in costs (see Table 1). M1 and M2 relate to additional purchases of protective respiratory equipment and break/rest trailers, respectively. M3 is an automatic notification system that would notify employees when the PM2.5 Air Quality Index values exceed 150 and 500 during wildfires.

In contrast, M4, with a forecasted cost of $27,000 in 2022-2024, would provide instructional designers with support to update & convert safety training curriculum to web-based training.

Table SCG-5 / SDG&E-8.3. SDG&E Mitigations, 2022-2024

ID	Mitigation Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $ Million
M1	Purchasing and testing more protective respiratory protection for wildfire smoke particulates.	$6	3	516
M2	Purchasing break/rest trailers with filtered air systems to reduce wildfire smoke exposure	$450	3	7
M3	Automate notifications and employee communications when the Air Quality Index PM2.5 reaches specific thresholds during a wildfire in our service territory	$120	3	26
M4*	Instructional designer support to update & convert safety training curriculum to web based	$27	N/A	N/A

[152] SDGE RAMP Ch. 8 at 28.

SoCalGas is introducing seven mitigations to the Plan in the period from 2022-2024, forecasted to represent 11 percent of total Plan costs in TY 2024 (see Table SCG-5 / SDG&E-8.4). The total projected cost of the mitigations in 2022-2024 is more than $2 million.

"M6 – Industrial Hygiene Program Expansion" is estimated to have the most risk reducing effect among the SoCalGas mitigations, with a risk reduction value of 9.21 at a cost of $150,000. M6 is an expansion of SoCalGas' Safety Department staff by increasing the number of certified hygiene professionals available to provide services such as safety and industrial hygiene education and compliance, incident prevention, analysis, reporting, and ensuring employees are prepared to respond to emergencies.

Meanwhile, "M2 – Industrial Hygiene Program Refresh" is estimated to have the least risk reducing effect, with a risk reduction value of 0.22. However, it happens to be the most expensive mitigation at a cost of nearly $1 million. One component of this mitigation provides for a review of all past records to identify records that are older than 10 years to assess whether those assessments need to be refreshed and updated.

Table SCG-5 / SDG&E-8.4. SoCalGas Mitigations, 2022-2024

ID	Mitigation Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
M1	OSHA Construction Certification Training	$54	1.82	32.8
M2	Industrial Hygiene Program Refresh	$971	0.22	0.2
M3	Proactive Monitoring for Indoor Air Quality and Chemicals of Concern	$60	1.03	16.7
M4	Creation of a Safety Video Library	$50	1.12	21.7
M5	Expanded Safety Culture Assessments	$50	0.46	8.9
M6	Industrial Hygiene Program Expansion	$150	9.21	59.6
M7	Workplace Violence Prevention Program Enhancements	$732	2.99	18.7

Observations

For both Companies, most of the proposed mitigations in 2022-2024 offer very little risk reduction relative to the control activities, with the exception of SoCalGas' M6. All other mitigations have a risk reduction value of 3 or less, while the average risk reduction value for SDG&E control programs is 34 and the average risk reduction value for SoCalGas control programs is 48.

SCG-5 / SDG&E-8.9 Risk Spend Efficiency

SDG&E

From 2022-2024, SDG&E expects to implement 16 controls and four mitigations in its Plan to mitigate the IIE Risk. Nine (9) of the 20 control and mitigation programs do not have an RSE because SDG&E considers the programs foundational or mandated.

The following eight controls and one mitigation do not have an analysis of Risk Spend Efficiency (RSE) and are excluded from the RSE analysis: C1, C2, C5, C6, C7, C10, C12, C17, and M4. SDG&E discussed these programs as "foundational" or "fundamental" aspects of safety in its operations with no good way of establishing a quantitative value or applying data related to these activities in the reduction of IIE Risk.[153]

The remaining 11 controls and mitigations in 2022-2024 have an RSE analysis: C3, C4, C8, C9, C11, C13, C14, C15, M1, M2, M3. Table SCG-5 / SDG&E-8.1 and Table SCG-5 / SDG&E-8.3 display the RSE results for SDG&E IIE Risk controls and mitigations.

The RSE ranges from a low of 7 RSE for "M2 – Purchasing break/rest trailers with filtered air systems to reduce wildfire smoke exposure" to a high of 516 RSE for "M1 – Purchasing and testing more protective respiratory protection for wildfire smoke particulates."

SoCalGas

SoCalGas expects to implement 10 controls and seven mitigations in its Plan to mitigate the IIIE Risk. Two (2) of the 17 control and mitigation programs do not have an RSE because SoCalGas considers the programs foundational or mandated. The following two controls do not have an RSE analysis: C1 and C6.

The remaining 15 controls and mitigations in 2022-2024 have an RSE analysis: C2, C3, C4, C5, C7, C8, C9, C10, M1, M2, M3, M4, M5, M6, and M7. Table SCG-5 / SDG&E-8.2 and Table SCG-5 / SDG&E-8.4 display the RSE results for SoCalGas IIE Risk controls and mitigations.

The RSE ranges from a low of 0.2 RSE for "M2 – Industrial Hygiene Program Refresh" to a high of 498 RSE for "C10 – Workplace Violence Prevention Programs."

Observations

The RSE can be misleading because the metric is a measure of cost efficiency and not necessarily effectiveness. Staff identifies which of the control and mitigation programs in SDG&E and SoCalGas had both a risk reduction score above the median and an RSE above the median as an initial approach for identifying effective and efficient programs. Staff identified control and mitigation programs that meet such standards, listed in descending order of RSE, as shown in Table SCG-5 / SDG&E-8.5 for SDG&E controls and mitigations and Table SCG-5 / SDG&E-8.6 for SoCalGas controls and mitigations.

[153] SDGE RAMP at 8-39.

Table SCG-5 / SDG&E-8.5. SDG&E "Effective" and "Efficient" Control and Mitigation, 2022-2024, by RSE Descending

ID	Control Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $ Million
C14	Enhanced Safety in Action Program	$155	48	299
C3	Strong Safety Culture	$595	48	78

For SDG&E, the median risk reduction score for control and mitigation programs is 22 and the median RSE is 26. Only two of SDG&E's 11 programs with an RSE analysis exceed these median thresholds – "C14 – Enhanced Safety in Action Program" and "C3 – Strong Safety Culture" (see Table SCG-5 / SDG&E-8.5).

For SoCalGas, the median risk reduction score for control and mitigation programs is 5.27 and the median RSE is 18.70. Five of SoCalGas's 15 programs with an RSE analysis exceed these median thresholds, one of which is a mitigation program.

Table SCG-5 / SDG&E-8.6. SoCalGas "Effective" and "Efficient" Controls and Mitigations, 2022-2024, by RSE Descending

ID	Control/Mitigation Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
C10	Workplace Violence Prevention Programs	$7,698	305.20	498.0
M6	Industrial Hygiene Program Expansion	$150	9.21	59.6
C4	Employee Safety Training and Awareness Programs	$438	19.62	43.5
C7	Near Miss, Stop the Job, and Jobsite safety programs	$438	18.41	40.8
C2	Drug and Alcohol Testing Programs	$498	14.98	29.2

SCG-5 / SDG&E-8.10 Alternatives Analysis

SDG&E considered two alternative mitigations in the IIE Risk chapter that will not be included in the Plan: "A1 – Piloted Alert Driving" (A1) and "A2 – Modernizing Safety Video Library."

A1 is an online driver training program intended to proactively improve driving behavior. SDG&E ultimately decided against including this mitigation in its Plan because of A1's high forecasted cost ($110,000 in TY 2024) and potential for redundancy with other available safe driving programs.

A2 is a plan intended to develop or procure effective safety videos in a modern streaming platform. SDG&E decided against this plan because it is currently focused on modernizing its video library by updating and converting its safety training curriculum to a web-based training.

SDG&E does not provide an RSE for either alternative due to lack of data directly related to risk reduction and because SMEs could not establish a quantifiable value for effectiveness.

SoCalGas considered three alternative mitigations in its Plan:

- A1 – Develop internal expertise for expanded safety culture assessments;
- A2 – OSHA Voluntary Protection Program; and
- A3 – Workplace Violence Prevention Training Alternative.

In A1, SoCalGas considers adding two full-time internal resources to conduct periodic safety culture assessments as an alternative to using a third-party consulting firm. Staff assumes that this is the alternative to "M5 – Expanded Safety Culture Assessments," which is cheaper and has a higher RSE with the same risk reduction result (see Table SCG-5 / SDG&E-8.7).

Table SCG-5 / SDG&E-8.7. SoCalGas Comparison of A1 to M5.

ID	Control/Mitigation Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
A1	Develop internal expertise for expanded safety culture assessments	$225	0.46	2.0
M5	Expanded Safety Culture Assessments	$50	0.46	8.9

In A2, SoCalGas considers participation in the OSHA Voluntary Protection Program (VPP). VPP assessments provide insight into baseline safety and health hazards to establish initial levels of exposures for comparison to future levels so change can be identified. A2 is a proactive approach to identify and address potential workplace safety and health hazards and therefore avoid potential consequences. Staff interprets SoCalGas' inclusion of A2, not as alternative program, but as a potential additional program. See Table SCG-5 / SDG&E-8.8 for description of cost, risk reduction, and RSE.

Table SCG-5 / SDG&E-8.8. SoCalGas A2 Analysis.

ID	Control/Mitigation Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
A2	OSHA Voluntary Protection Program	$350	5.26	14.6

In A2, SoCalGas considers participation in the OSHA Voluntary Protection Program (VPP). VPP assessments provide insight into baseline safety and health hazards to establish initial levels of exposures for comparison to future levels so change can be identified. A2 is a proactive approach to identify and address potential workplace safety and health hazards and therefore avoid potential consequences. Staff interprets SoCalGas' inclusion of A2, not as alternative program, but as a potential additional program. See Table SCG-5 / SDG&E-8.8 for description of cost, risk reduction, and RSE.

In A3, SoCalGas considers alternatives to the proposed mitigations as it developed the incremental mitigation plan for the Workplace Violence risk. A3 essentially represents alternatives for training and for physical security. Table SCG-5 / SDG&E-8.9 provides a comparison of a subset of the work provided by A3 to the larger C10 program. A3 represents about three percent of the total C10 cost, approximately 0.27 percent of the risk reduction, and more than 3 percent of the RSE.

Table SCG-5 / SDG&E-8.9. SoCalGas comparison of A3 to C10.

ID	Control/Mitigation Name	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
A3	Workplace Violence Prevention Training	$50	0.83	16.1
C10	Workplace Violence Prevention Programs	$7,698	305.20	498.0

Observations

Staff agrees with SDG&E's decision not to use the alternatives described in the IIE Risk chapter, however, with two safe driving programs already included in the Plan, C9 and C15, A1 as yet another supplemental driving program seems like a frivolous alternative consideration included in this IIE Risk chapter.

Staff would prefer that SoCalGas provide more careful consideration of alternatives selected in its IIE Risk chapter. Other than A1, neither A2 nor A3 adequately offer a substitute control or mitigation.

SCG-5 / SDG&E-8.11 Summary of Findings

Based on the observations presented above, findings are summarized here.

SCG-5 / SDG&E-8.11.1.

SDG&E and SoCalGas demonstrate a strong culture of safety against the risks of serious injuries and fatalities (SIFs), echoed by their annual SPMR report evaluations.

SCG-5 / SDG&E-8.11.2.

SDG&E and SoCalGas do not clearly state or show which risk drivers or triggers (DTs) are their priorities in the risk bow tie, using frequencies and/or rankings. Staff analyzes the effect of control and mitigation programs on the DTs to make an assumption that the Companies both prioritize the following two DTs: "Hazards in the work environment" and "Employees deviate from policies or procedures." And concerning potential consequences (PCs), the Companies share a concern for mitigating for "Serious injuries or fatalities."

SCG-5 / SDG&E-8.11.3.

SDG&E and SoCalGas do not explicitly state its exposure to the risk (i.e. number of employees). In any description of risk, verifiable measurement units are essential to the assessment.

SCG-5 / SDG&E-8.11.4.

SDG&E and SoCalGas identify only a single tranche, stating that all employees share the same risk profile.

SCG-5 / SDG&E-8.11.5.

SDG&E and SoCalGas vary significantly in their determination of LoRE for the same risk and the reasons are not clear considering both Companies appear to have a strong culture of safety, as seen in their respective SPM reports.

SCG-5 / SDG&E-8.11.6.

SDG&E and SoCalGas vary significantly in their determination of CoRE for the same risk and the reasons are not clear. Staff interprets the resulting difference in CoRE to indicate that the consequences are far less severe with incidents related to risk events for SoCalGas than they are for SDG&E.

SCG-5 / SDG&E-8.11.7.

SDG&E does not provide an explanation for the exclusion of "C16-Energized Skills Training and Testing Yard" for the 2022-2024 time period.

SCG-5 / SDG&E-8.11.8.

SDG&E and SoCalGas are incorporating mitigation programs in 2022-2024 that offer very little risk reduction relative to the control programs, with the exception of SoCalGas' "M6 – Industrial Hygiene Program Expansion." All other mitigations have a risk reduction value of 3 or less, while the average risk reduction value for SDG&E is 34 and the average risk reduction value for SoCalGas is 48.

SCG-5 / SDG&E-8.11.9.

Only two of SDG&E's 11 programs with an RSE analysis are both "effective" and "efficient," as determined by the median risk reduction and median RSE as minimum thresholds.

SCG-5 / SDG&E-8.11.10.
Five of SoCalGas' 15 programs with an RSE analysis are both "effective" and "efficient," as determined by the median risk reduction and median RSE as minimum thresholds.

SCG-5 / SDG&E-8.11.11.
Staff finds that the alternatives selected by both SDG&E and SoCalGas do not provide enough rigor or thoughtful consideration of substitute control and mitigation programs.

SCG-5 / SDG&E-8.12. Recommended Solutions to Address Findings and Deficiencies

SCG-5 / SDG&E-8.12.1.
SDG&E and SoCalGas should clearly state or show which risk drivers or triggers (DTs) and potential consequences (PCs) are their priorities in the risk bow tie, using frequencies and/or rankings.

SCG-5 / SDG&E-8.12.2.
SDG&E and SoCalGas should explicitly state its exposure to the risk (i.e. number of employees). In any description of risk, verifiable measurement units are essential to the assessment.

SCG-5 / SDG&E-8.12.3.
SDG&E and SoCalGas should create additional granular tranches for the IIE Risk. Staff does not agree that all employees share the same risk profile. At a minimum, more granular tranches could include, for example, office-only employees and field employees. SDG&E may then find it appropriate to provide additional granularity for field employees by tranching this group by specific duties performed.

SCG-5 / SDG&E-8.12.4.
SDG&E and SoCalGas should provide a written explanation in their upcoming rate case filing as to why the Companies vary significantly in their determination of LoRE.

SCG-5 / SDG&E-8.12.5.
SDG&E and SoCalGas should provide a written explanation in their upcoming rate case filing as to why the Companies vary significantly in their determination of CoRE.

SCG-5 / SDG&E-8.12.6.
SDG&E should provide a written explanation in their upcoming rate case filing as to it does not include "C16-Energized Skills Training and Testing Yard" for the 2022-2024 time period.

SCG-5 / SDG&E-8.12.7.
SDG&E and SoCalGas should consider developing an approach for selecting a set of control and mitigation programs in 2022-2024 that they consider to be both "effective" and "efficient." Staff provided a simple initial approach that could also be replicated by the Companies.

SCG-5 / SDG&E-8.12.8.
SDG&E and SoCalGas should consider a different set of alternatives that are more viable and thoughtful as substitutes for their current selection of control and mitigation programs in 2022-2024.

SCG-6 / SDGE-6 Cybersecurity

The Sempra utilities SoCalGas and San Diego Gas & Electric addressed Cyber-security as a joint-utility primary risk chapter. The Sempra utilities propose a uniform strategy and set of mitigation measures and present their approach as one combined risk chapter.approach. Their cyber-security mitigation strategy relies mainly on practical solutions such as employing security walls, keeping software up to date, using the cloud and its superior security features, and employing VDI (virtual desktop infrastructure).

SDG&E and SoCalGas report that their Cybersecurity spending for the two utilities will be approximately the same for the three years ending December 31, 2024. The Sempra RAMP estimates that combined costs per year for Cyber-security could be as high as $64 million per year for 2022, 2023, and 2024. Their Cyber-security program deploys risk management frameworks, including the National Institute of Standards and Technology (NIST) Cybersecurity Framework, Center for Internet Security (CIS-20), NIST 800-53, and MITRE ATT&CK framework.

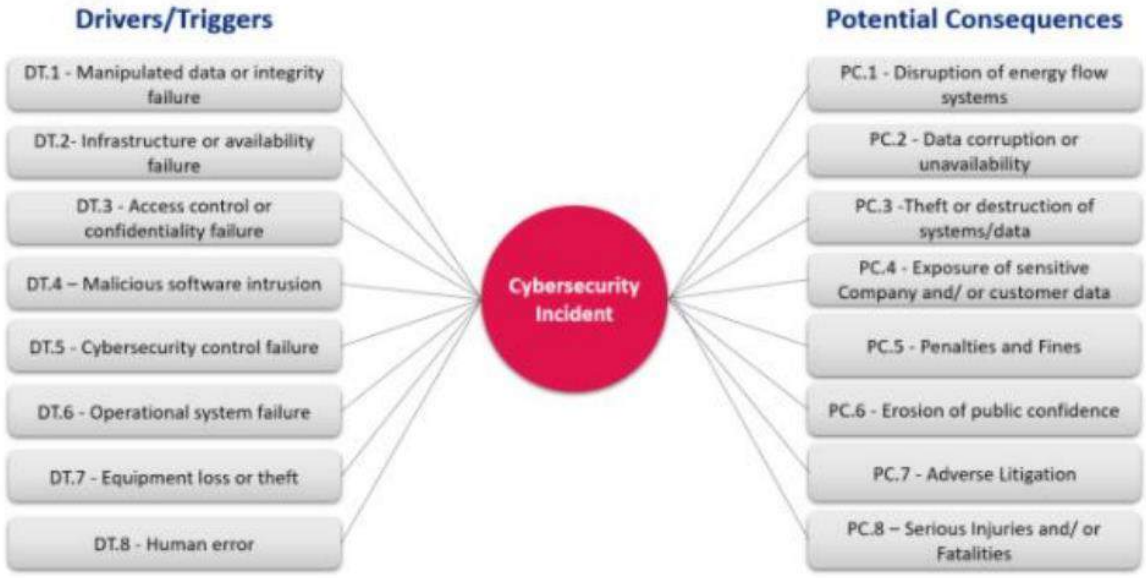
6.1 Risk Description

Cyber-security risk concerns the prospect of a significant breach incident, which could disrupt electric or gas service and operations (e.g., Industrial Control Systems, supply, transmission, distribution, storage) and damage the utilities' reputation or disclose sensitive customer or corporate data. According to the utilities, Cyber-security risk is unique in that it "deals with intelligent adversaries attempting to achieve their objectives by gaining access to [Sempra] systems or information through artifice." In addition, securing privileged information about the utilities' security controls and mitigation plans could be helpful to an adversary to harm the utilities directly and adversely impact the utilities' stakeholders.

6.2 Bowtie

Sempra provides a Bowtie diagram, including a list of potential drivers as inputs and corresponding outcomes, reproduced here:

Sempra Cyber-Security Risk Bowtie, from the Sempra RAMP Primary Risk Chapter



Sempra identifies its eight risk drivers as:

- DT.1 - Manipulated data or integrity failure: Any unintended changes to data due to 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 Cyber-security-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.
- 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 - Cyber-security control failure: A general failure of a Cyber-security 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 Cyber-security 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 devices 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.

Sempra identifies its eight potential consequences as:

- 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

Sempra's identified drivers and resulting consequences are appropriate for the Cyber-security risk.

6.3 Exposure

Sempra adequately explains that the cybersecurity risk applies to any malicious breach of the utilities' OT (Operational Technology, including power systems, controls such as SCADA), and IT (Information Technology, such as email and databases) systems. Sempra adequately explains the distinctions between OT and IT, the consequences of either system being compromised (including spillover impacts), and commonly accepted industry practices, which Sempra indicates it meets or exceeds.

Additionally, Sempra explains that an important "cross-functional" factor that informs the cybersecurity risk is the utilities' Foundational Technology Systems (addressed in Sempra's RAMP Crosscutting Risks Chapter, sub-chapters SCG-CFF-4/SDG&E-CFF-4), which are used in "every aspect of operations, customer engagement, and emergency response. These systems encompass the utilities' critical software application systems, communication networks, monitoring systems, end-user systems, and hardware and software platforms hosted in the utilities' data centers and on internal and external cloud platforms."

6.4 Tranches

Sempra does not employ tranches for the Cyber-security risk stating that a "single tranche is appropriate for a Cyber-security 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 countermeasures." Sempra continues, "sharing specific details of the individual risk mitigation activity can provide adversaries crucial information that could aid their ability to disrupt Sempra 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 Cyber-security and Obsolete IT Infrastructure and Asset Replacement) rather than each individual risk mitigation activity for the Cyber-security risk."

6.5 Likelihood of Risk Event (LoRE)

The LoRE score for SoCalGas is 0.09; and for SDG&E, 0.08. A LoRE score of 0.09 and 0.08 correspond to the likelihood of such an event occurring as 8 percent and 9 percent per year. Given

the high incidence of cyber attacks in recent years on U.S. corporations,[154] [155] [156] and energy companies[157] [158] in particular, Sempra's estimated likelihood of a risk event is reasonable. Cybersecurity breaches have increased at a rapid rate over the last decade. Since 2014, cybersecurity breaches have increased 67 % and steadily increased by 11% since 2018.[159] The average cost of a data breach is $4.24 million as of 2021.[160] As of August 2021, utilities have experienced a wide range of security breaches and cyberattacks that threatened public safety, health, and the continuity of utility services. More notable incidents included a zero-day attack on security software provider SolarWinds, a control breach at a wastewater treatment plant in Florida, and a ransomware attack on Colonial Pipeline that disrupted East Coast pipeline operations for days. While the reason for the security breach and cyberattack methods differed, these attacks further highlight the existing and growing risks and threats faced by utility providers.

[154] According to theFBI, from 2019 to 2020 there was a nearly 21 percent increase in reported ransomware cases, and a 225 percent increase in associated losses. *Compare Federal Bureau of Investigation, Internet Crime Complaint Center,* 2019 Internet Crime Report, *available at https://pdf.ic3.gov/2019_IC3Report.pdf, with Federal Bureau of Investigation, Internet Crime Complaint Center,* 2020 Internet Crime Report*, available at https://www.ic3.gov/Media/PDF/AnnualReport/2020_IC3Report.pdf.*

[155] *Treasury Takes Robust Actions to Counter Ransomware*, September 21, 2021, https://home.treasury.gov/news/press-releases/jy0364

[156] *Publication of Updated Ransomware Advisory; Cyber-related Designation*, https://home.treasury.gov/policy-issues/financial-sanctions/recent-actions/20210921

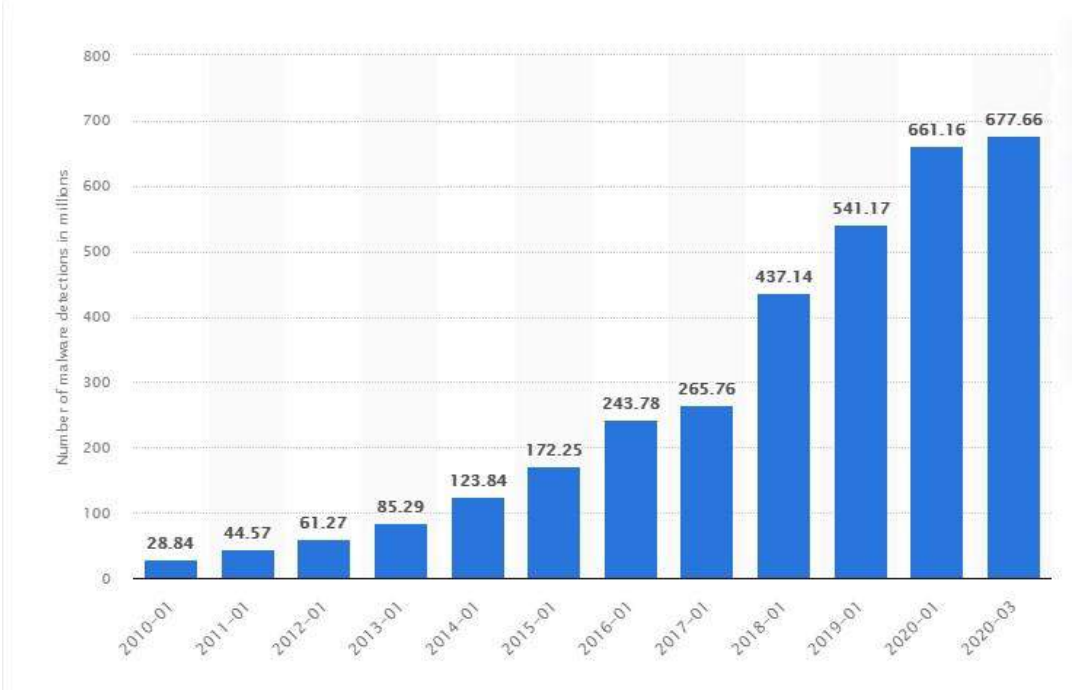
[157] *Hackers Breached Colonial Pipeline Using Compromised Password* by William Turton and Kartikay Mehrotra, Bloomberg Business News. https://www.bloomberg.com/news/articles/2021-06-04/hackers-breached-colonial-pipeline-using-compromised-password

[158] *Department of Energy asks Congress for $201 million to bolster cybersecurity in wake of attacks* by Amanda Macias, CNBC. https://www.cnbc.com/2021/06/24/energy-wants-201-million-to-bolster-cybersecurity-in-wake-of-attacks.html

[159] Rob Sobers, "134 Cybersecurity Statistics and Trends for 2021," *Varonis,* last modified March 16, 2021, https://www.varonis.com/blog/cybersecurity-statistics/.

[160] "Cost of a Data Breach Report 2021," *IBM,* accessed August 13, 2021, https://www.ibm.com/security/data-breach.

Global Malware Detections from January 2010 to March 2020



The number of cyberattacks occurring over the prior decade has steadily increased in volume and complexity. The diagram above shows that in January 2010, approximately 29 million malware programs were detected globally; however, by March 2020, over 667 million malware programs were detected – an increase of more than twenty-three times.[161]

A 2019 survey of utility security professionals revealed that the frequency and potency of attacks on utility systems are increasing, with 56 percent experiencing at least one attack in the past year resulting in a loss of data or outage.[162] Due to the confidentiality and privacy surrounding cyberattacks, economic impact data from cyberattacks is challenging to access through publicly available data.

6.6 Consequence of Risk Event (CoRE)

The CoRE score for SoCalGas is 10,829; and for SDG&E, 16,446, an indicator that this risk has the potential to result in extensive harm. As a basis for comparison, at the low end of the CoRE risk spectrum, SDG&E designates a CoRE score of about 6 for both Electric Infrastructure Integrity and Medium Pressure Dig In. Moving up to mid-range or moderate-level risks by CoRE standards would be Wildfire with a CoRE score of 556, Contact with Electric Equipment (CoRE of 1,197), and Incident Involving an Employee (1,275). Sempra indicates that CoRE values for Cyber-security for

[161] Joseph Johnson, "Development of Malware Worldwide 2015-2020," *Statista*, January 25, 2021, https://www.statista.com/statistics/680953/global-malware-volume/.

[162] "Caught in the Crosshairs: Are Utilities Keeping Up with the Industrial Cyber Threat?," *Siemens Energy,* accessed March 16, 2021, https://assets.new.siemens.com/siemens/assets/api/uuid:35089d45-e1c2-4b8b-b4e9-7ce8cae81eaa/version:1572434569/siemens-cybersecurity.pdf.

both its gas and electric business lines run at many multiples of its other risks, signaling an extreme risk as measured by CoRE. Sempra adequately justifies its CoRE assigned value for this risk within supplemental work papers, as shown in the tables below.

SoCalGas LoRE and CoRE Summary Table, Submitted by Sempra at Request of SPD

Overall	*LoRE*	0.09
	CoRE Safety	2,595.24
	CoRE Financial	1,881.37
	CoRE Reliability	5,732.64
	CoRE Stakeholder Satisfaction	620.00
	Total CoRE	10,829.24
	Pre-Mitigated Risk Score	974.63

SDG&E Gas LoRE and CoRE Summary Table, Submitted by Sempra at Request of SPD

Overall	*LoRE*	0.08
	CoRE Safety	679.68
	CoRE Financial	3,088.20
	CoRE Reliability	11,957.90
	CoRE Stakeholder Satisfaction	740.00
	Total CoRE	16,465.78
	Pre-Mitigated Risk Score	1,317.26

6.7 Pre-Mitigation Risk Score

The Pre-mitigation risk score for Cyber-security for SoCalGas is 975; and for SDG&E, 1,316.

For SoCalGas, Cyber-security is ranked 7th of 8 risks presented by the utility in the RAMP. As a basis for comparison, its highest-ranking risk, the Gas High Pressure System, was assigned a value of 4,644; and its lowest ranking risk score, for Contractor safety, was 469.

For SDG&E, Cyber-security is ranked 7th of 9 primary risks presented by the utility in the RAMP. By comparison, its highest-ranking risk, for Wildfire, was assigned a value of 16,459; and the lowest ranking risk score, for Gas Dig-in Medium Pressure, was 316.

Sempra adequately supports its methodology for deriving its risk scores and conveys that the utilities experienced certain historic data limitations from which to draw on as data points, explaining that “Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, and available and appropriate data. Given the emerging and evolving nature of Cyber-security risk, particularly in the Operational Technology (OT) domain, there is limited information to assess the risk using historical information. Therefore, the utilities 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 Cyber-security

incident was evaluated with consideration for the different risk profiles of the OT infrastructure of the gas and electric systems."

6.8 Controls and Mitigations

Existing Controls (Expected to persist through end 2020, and then carry over through 2024 as the proposed mitigation plan (preferred alternative))

Control 1 - *Perimeter Defenses*, Sempra explains, are designed to "prevent attacks, protect the integrity of, and detect unauthorized access to the [utilities'] internal information technology systems. The information technology environment includes the entire business technology system, including email, information storage, billing, and customer records. The operational technology environment also uses Perimeter Defenses to protect operational technology assets."

Control 1 projects frustrate an attacker via multiple approaches and layers of protection, such as defensive redundancies, which slow and decrease the prospects for a successful attack. These projects 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

Control 2 - *Internal Defenses*, Sempra explains, are designed to "detect and prevent unauthorized users, and malicious software (i.e., malware)" from breaching the utilities' IT and OT systems. The controls in this category detect unauthorized users moving laterally or vertically within the IT system or into the OT system, which improves the utilities' ability to more quickly identify and respond to threats. "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," Sempra explains.

Control 2 projects 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

Control 3 -- *Sensitive Data Protection* projects, Sempra explains, "enhance technology to reduce the risk of unauthorized access" to the utilities' information by understanding where sensitive data is stored, how it is transmitted, and how it is used."
Control 3 projects are intended to:

- Identity Access Management Enhancements,
- Data Loss Prevention & Enhancements,
- Forensics Infrastructure Enhancements,
- Mobile Device Security, and
- Data Crawler Technology.

Control 4 – *Operational Technology Cyber-security* program is responsible for securing the utilities' electric and gas control systems, as OT systems are indispensable in performing the essential functions of service delivery. Key features of the security package include network anomaly detection, endpoint detection, and security event monitoring, all of which improve visibility into the OT environment.

Control 4 projects include:

- OT Cyber-security 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

Control 5 – *Obsolete Information Technology Infrastructure and Application Replacement*
Technology lifecycles are short and require frequent upgrades to ensure maximum reach of necessary security standards and capabilities. As such, ongoing software replacement and installation by the utilities that keep pace with security upgrade cycles as they come to the market allow for appropriate cyber security technology to go online. As such, continuous software upgrade efforts are foundational to the utilities' cyber protection approach.
Control 5 projects include:

- Technology updates, 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

Ongoing Controls (Expected to commence January 2022 and persist through December 2024 – all proposed controls are identical to existing controls described above)

Mitigations
(Expected to commence January 2022 and persist through December 2024 – all proposed controls are identical to existing controls described above)

6.8.1 Proposed Mitigation Plan - Preferred Alternative
Alternative A: The Proposed Plan (Preferred Alternative)
Sempra's proposed plan is detailed above within Section 6.8. and is identical to the plan described in that section.

Although Sempra presents its plan within the Controls section as a portfolio of controls, the IOUs note that for this risk chapter, they use the terms controls and mitigations interchangeably. Sempra explains that its proposed plan when it commences in 2022 will be a continuation of the identical set of measures now in effect, with no changes or additions planned.
Sempra characterizes its proposed mitigation plan as the balanced project portfolio option that incorporates high- and medium-impact projects delivering the highest RSE among the three alternatives presented.

Cost and Expected Budget
Sempra provides O&M for the single year 2024, while Capital is provided as a three-year period total. Sempra provides both a High- and Low-cost number for each budget item. The program budget tables proposed by each Sempra utility in the RAMP application are shown below.
SoCalGas Spending Forecast Table for Cyber-security, from the Sempra RAMP Primary Risk Chapter

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

SDG&E Spending Forecast Table for Cyber-security, from the Sempra RAMP Primary Risk Chapter

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

The RAMP report indicated that the utilities "are currently not planning any new mitigations during the 2022-2024 period." However, they do anticipate potentially considerable spending increases. For SoCalGas, considering the forecast average cost for 2022 to 2024, total cost (O&M + average capital) could rise between 19 percent and 36 percent. For SDG&E, total cost (O&M + average capital costs) could increase between 4 percent and 25 percent. In particular, capital expenditures on Sensitive Data Protection increase from zero in 2020 up to a range of $7 million to $9 million for SoCalGas and zero to $6.8 to $8.7 million for SDG&E for the three-year period in 2022-2024. However, the utilities do not explain how the cost for a control goes from nothing to costing millions of dollars, nor do they generally explain or justify the increasing cost of the controls.

6.9 Risk Spend Efficiency (RSE)

Sempra's RSEs for Cybersecurity perform relatively well on their cost-to-risk reduction returns. RSE scores and rank are within the top three quartiles, with SoCalGas's RSE rankings somewhat higher among their fewer measures.

Of 152 mitigations and controls ranked for SoCalGas's 2021 RAMP (ranging from a high value of 1,336 to a low of 0.003), the highest RSE cyber measure ranks 18th (well within the RSE top quartile), with an RSE of 160. The lowest RSE cyber measure appears at rank 58 (well above the cutoff for qualifying for the second quartile, whose bottom rank is 76), with an RSE of 56.

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

Of 205 total mitigations and controls ranked for SDG&E's 2021 RAMP (ranging from a high score of 2,702, to a low of 0.0002), the highest RSE cyber measure ranks 43rd (well within the RSE rank top quartile, whose bottom rank is 51.25), with an RSE of 160; and the lowest RSE cyber measure appears at rank 105 (just missing the second quartile, whose bottom rank is 102.5), with an RSE of 56.

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

In reviewing this primary RAMP risk chapter as first submitted, it was not readily apparent what the resulting measurable risk reduction would be due to Sempra's proposed mitigation program. However, a review of supplemental work papers furnished by Sempra in response to a staff data request sufficiently illuminates this issue and is discussed below.

SoCalGas RSE Summary Table for Cyber-security by Program, Submitted by Sempra at Request of SPD

ID	Mitigation Name	Risk Reduction	Discounted Time	RSE per $Million	Data Sources
SCG-SDG&E-RISK-6-P1	A1: Operational Technology (OT) Cybersecurity	347.93	4.58	109.48	> "Cost of Cyber Crime" studies (2017, 2019) > SME input
SCG-SDG&E-RISK-6-P2	A2: Operational Technology (OT) Cybersecurity	500.73	4.58	111.77	> "Cost of Cyber Crime" studies (2017, 2019) > SME input
SCG-RISK-6-C04	Planned: Operational Technology (OT) Cybersecurity	477.36	4.58	112.34	> "Cost of Cyber Crime" studies (2017, 2019) > SME input

The table above indicates that the planned SoCalGas "control 4," OT, one of five mitigation measures that comprise its proposed plan for Cyber-security, results in risk reduction of 477.36. This RSE is the highest of the three alternatives and is the second-highest in terms of risk reduction. The proposed program represents a balanced approach, with risk reduction performance falling between the other two options' benefits while outperforming both on RSE.

SDG&E RSE Summary Table for Cyber-security by Program, Submitted by Sempra at Request of SPD

ID	Mitigation Name	Risk Reduction	Discounted Time	RSE per $Million	Data Sources
SCG-SDG&E-RISK-6-P1	A1: Operational Technology (OT) Cybersecurity	470.24	4.58	110.36	> "Cost of Cyber Crime" studies (2017, 2019) > SME input
SCG-SDG&E-RISK-6-P2	A2: Operational Technology (OT) Cybersecurity	645.18	4.58	138.97	> "Cost of Cyber Crime" studies (2017, 2019) > SME input
SDG&E-RISK-6-C04	Planned: Operational Technology (OT) Cybersecurity	645.18	4.58	141.76	> "Cost of Cyber Crime" studies (2017, 2019) > SME input

Similarly, the table above indicates that the planned SDG&E "control 4," OT, one of five mitigation measures that comprise its proposed plan for Cyber-security, results in risk reduction of 645.18, with risk reduction levels equal to or substantially better than those offered by OT alternatives, and superior RSE returns.

6.10 Alternatives Analysis

The utilities put forth three plan alternatives.

Alternative A: The Proposed Plan (Preferred Alternative)

Alternative A is detailed above within Section 6.8. and is identical to the plan described in that section.

Sempra justifies its choice of this mitigation plan as the balanced alternative that incorporates both high- and medium-impact projects. Sempra explains that Alternative A offers the highest RSE among the three alternatives, resulting in more risk reduction per dollar spent.

Alternative B: High-Impact Projects

Alternative B consists of what the IOUs term "high-impact projects," without specifying what these projects are or what the term high-impact refers to. Sempra explains that if the high-impact projects-only Alternative B were implemented, it would bring Sempra less security than Alternative A and a lower RSE, resulting in additional risk exposure than the preferred alternative.

Alternative C: All-Impact Projects

Alternative C consists of low-, medium-, and high-impact projects. Sempra explains that were this portfolio of projects to be implemented, it would bring Sempra the most security, with a lower RSE, resulting in less risk exposure but with a higher cost than the preferred alternative.

6.11(opt) Scenario Analysis (if available)

6.12 Summary of Findings

The Sempra utilities SoCalGas and San Diego Gas & Electric have adequately profiled cybersecurity as a primary risk chapter in their 2021 RAMP filed May 17, 2021. The two Sempra utilities are proposing essentially identical mitigation strategies that rely largely on practical solutions such as employing security walls, keeping software up to date, using the cloud and its superior security features, and employing VDI (virtual desktop infrastructure). Sempra's five measures are first summarized as existing control measures. Sempra then explains that the existing five measures will be carried over and continued for 2022, 2023, and 2024, practically unchanged. Sempra further indicates that as such, for this risk the descriptor *control* or *mitigation* measures can be interchanged.

For their controls, Sempra forecasts a range of cost increases from relatively modest to potentially substantial. However, they do not explain the cost increases or indicate if additional risk will be reduced as the costs rise.

Staff finds that Sempra provided insufficient detail within this RAMP risk chapter to support the forecasted expenditure.

6.13 Recommended Solutions to Address Findings and Deficiencies

The most salient shortcoming in this report is the unexplained increase in "controls." While the utilities indicate they do not plan any new mitigations, costs for existing programs are forecast to increase substantially without explanation. In the clearest example, "sensitive data protection,"

which is portrayed as an existing control increase from zero dollars to millions of dollars. Yet, it is not clear from the utilities' report why this would occur or how much risk will be reduced as a result of additional spending.

SCG-7 / SDGE-4 Incident Involving a Contractor

SCG-7 / SDGE-4.1 Risk Description

SDG&E's contractor incident risk is 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.[163] The scope of the safety consequences includes contractor 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 with the potential to result in Serious Safety Incident.

In a similar chapter, SoCalGas's contractor incident risk is defined as the risk of an incident that threatens the safety of the contractor, SoCalGas employees, or the public caused by the contractor's non-adherence to the company's and/or contractor's policies, procedures, and programs, or by external factors.[164]

Observations:

SDG&E and SoCalGas have somewhat different definitions for contractor risk. Yet both address contractor-initiated risks that can impact contractor personnel, utility employees, and the general public.

SCG-7 / SDGE-4.2 Bowtie

SDG&E identified 13 drivers or triggers that could lead to safety incident for contractor incident risk.[165]

SoCalGas identified 9 drivers or triggers that could lead to safety incident for contractor incident risk. [166]

[163] SDG&E 2021 RAMP Report Chapter 4 (SDG&E RAMP) at 3.
[164] SoCalGas 2021 RAMP Report Chapter 7 (SCG RAMP) at 3.
[165] SDG&E RAMP at 4-5,4-6.
[166] SGC RAMP at 7-5.

SDG&E and SoCalGas' Drivers/Triggers

SDG&E Drivers[167]	SoCalGas Drivers[168]
DT.1 – Contractor crew deviation from policies/procedures	DT.1 – Deviation from policy/procedure, inadequate reporting of near misses
DT.2 – Contractor and sub-contractor crew inexperience	DT.2 – Inexperience or lack of training
DT.3 – Lack of oversight of contractor work	DT.3 – Inadequate oversight
DT.4 – Inadequate contractor training/supervision	DT.4 – Inadequate use of Job Site Safety Plans or Job Safety Analysis
DT.5 – Inadequate use of job site safety plans/job safety analysis	DT.5 – Inadequate utility and/or substructure location information
DT.6 – Inadequate or inaccurate utility and/or substructure location information	DT.6 – Unsafe operation of equipment or motor vehicle
DT.7 – Unsafe operation of equipment or motor vehicle	DT.7 – Contractor crew fatigue, complacency, or impairment
DT.8 – Inadequate employee training/supervision	DT.8 – Workplace violence threats or critical incidents
DT.9 – Contractor crew fatigue/complacency	DT.9 – Execution Constraints
DT.10 – Contractor impairment due to environmental factors	
DT.11 – Hazards in the work environment	
DT.12 – Non or improper use of personal protective equipment	
DT.13 – Damaged SDG&E equipment and/or infrastructure	

SDG&E and SoCalGas' Potential Consequences

SDG&E Potential Consquences[169]	SoCalGas Potential Consequnces[170]
PC.1-Serious injuries and/or fatalities	PC.1-Serious injuries and/or fatalities
PC.2-Property damage	PC.2-Property damage
PC.3-Additional compliance safety inspections	PC.3-Adverse litigation
PC.4-Operational and reliability impacts	PC.4-Customer claims and financial losses
PC.5-Adverse litigation	PC.5-Erosion of public confidence
	PC.6-Operational and reliability impacts
	PC.7-Additional regulations and compliance safety inspections
	PC.8-Penalties and fines

[167] SDG&E RAMP at 4-7.
[168] SGC RAMP at 7-7.
[169] SDG&E RAMP at 4-7, 8.
[170] SGC RAMP at 7-8.

Observations:

SDG&E and SoCalGas driver choices, such as contractor crew deviation from policies/procedures and inadequate oversight is reasonable. In contrast to SoCalGas, SDG&E does not include customer claims and financial losses as a consequence.

Although not explicitly required by the Settlement Agreement, SDG&E and SoCalGas did not include the frequency of the drivers/triggers or ranking of the drivers/triggers. SoCalGas numbered their drivers/triggers and potential consequences. However, SoCalGas did not note if the numbers corresponded with the rankings of drivers/triggers to most likely cause a potential consequence or consequences most likely to occur as a result of an incident. SDG&E and SoCalGas did not describe how they identified leading indicators. SDG&E noted they used a risk assessment[171], but they did not provide any further information about the risk assessment.

SCG-7 / SDGE-4.3 Exposure

SDG&E and SoCalGas do not specify the number of contractors subject to risk in the chapter narratives. However, the SoCalGas workpapers[172] include the number of employee and contractor hours as an exposure measurement: 14 million employee hours and 5 million contractor hours.

Observations:

Presentation of exposure data, such as the number of persons exposed to a risk, could provide helpful context in evaluating the risk assessment.

SCG-7 / SDGE-4. Tranches

Tranches are subgroups of the risk scope with specific risk profiles that differentiate them from other tranches. SGD&E and SoCalGas state that controls and mitigations for the Incident Involving a Contractor risk have the same risk profile; therefore the risk is not further tranched.[173]

Observations:

Staff is concerned there could be more than one tranche. Tranches indicate groupings with specific risk profiles that differentiate from other tranches. SDG&E and SoCalGas need to be more specific about the type of work that contractors are engaged in. With a single tranche, Staff assumes that all contractors are engaged in similar types of work. However, the range of contractor work may not reflect that reality. Field employees might have a different risk profile from office-only workers, as one may be inherently more dangerous than the other, for example.

SCG-7 / SDGE-4.5 Likelihood of Risk Event (LoRE)

SoCalGas' Pre-Mitigated LoRE is 144.77 events per year.
SDG&E's Pre-Mitigated LoRE is 1.83 events per year.

Observations:

[171] SDG&E RAMP at 4-14.
[172] Final 2021 RSE Workpaper SCG CONT TURN DR8.
[173] SDG&E RAMP at 4-15, SCG RAMP at 7-19.

SoCalGas' LoRE is significantly larger than SDG&E's. Staff speculates that this may be due to SoCalGas having a larger service territory, affording more opportunities for contractors to be involved in incidents.

SCG-7 / SDGE-4.6 Consequence of Risk Event (CoRE)

SoCalGas' CoRE is 3.24.
SDG&E's CoRE is 1,033.

Observations:
Staff observes a significant difference in the SDG&E and SoCalGas CoRE. After examining underlying attribute values, Staff found SoCalGas' safety index, 0.0008, is much smaller than SDG&E's safety index, 0.32. Staff expects that the higher safety index for San Diego includes the risk of electrical incidents, which don't exist for the gas company.

SCG-7 / SDGE-4.7 Pre-Mitigation Risk Score

SDG&E's Pre-Mitigation Risk Score is 1894, which ranks fourth behind Wildfire, Electric Infrastructure Integrity, and High Pressure Pipeline Incidents.

SoCalGas' Pre-Mitigation Risk Score is 469, which ranks seventh, or lowest, of the SoCalGas RAMP risks.

SoCalGas cited both internal and external data sources to develop the pre-mitigation risk score.[174] SDG&E used internal data only.

Observations:
Staff finds the difference in Risk Scores between the two companies is driven by the underlying safety consequences as noted in the CoRE section.

SCG-7 / SDGE-4.8 Controls and Mitigations

San Diego Gas and Electric Controls and Mitigations

ID	Control/Mitigation	RSE
C1	Contractor Oversight Program	139
C2	Field Safety Oversight	35
C3	Safety Culture	NA
M1	Enterprise-Wide Contractor Incident and Schedule Management	NA
M2	Enhanced Verification of Class 1 Contractor Employee Specific Training	86

[174] SCG RAMP at 7-9.

SDG&E employs three control programs, C1 to C3 in the Table above. Each program is said to have been expanded in 2021 to reflect implementation on an enterprise-wide basis into all business units that use "Class 1" Contractors.[175]

SDG&E proposes two new mitigations. M1, Enterprise-Wide Contractor Incident and Schedule Management, would improve tracking of incidents, hours worked, and scheduling safety observations. M2, Enhanced Verification of Class 1 Contractor Employee Specific Training, develops a process to verify that contractors are trained on specific safety programs according to their company specific requirements.

SoCalGas Controls and Mitigations

ID	Control/Mitigation	RSE
C1	Contractor Oversight Program	11
C2	Third-Party Administration Tools	182
C3	Contractor Engagement	202
C4	Construction Contractor Field Oversight	5

SoCalGas employs four controls and is not proposing any new mitigations during the 2022 – 2024 period.[176]

Observations:

San Diego's risk score is four times that of SoCalGas, and they have proposed two new mitigations to reduce risk. The low risk score for SoCalGas suggests that existing controls are managing the risk to an acceptable level so that additional mitigations are not necessary.

SCG-7 / SDGE-4.9 Risk Spend Efficiency (RSE)

San Diego Gas and Electric

SDG&E excluded RSE calculation for the control C3, and for the proposed mitigation M1 due to lack of suitable data or SME inability to estimate risk reduction. SDG&E's highest RSE was for C1, Contractor Oversight Program, at 139. The lowest RSE is for C2, Field Safety Oversight, at 35.

Observations:

Staff examined the RSE calculations and confirmed that the values are consistent with the data used by SDG&E. The RSE for the proposed mitigation M2 is in the range of RSEs for existing controls.

SDG&E gives a rationale for RSE exclusion of C3, Safety Culture, "that SME judgment 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."[177] However, in their description of this control, SDG&E explains how

[175] SDG&E RAMP at 4-15,16; SGC RAMP at 7-5.
[176] SDG&E RAMP at 7-20.
[177] SDG&E RAMP at 4-19.

they engage internal workforce and Class 1 Contractors with periodic safety culture assessments to better gauge where they are with their culture and maturity of the SDG&E Contractor Safety Program.[178] SDG&E also states "the results of these assessments are used for action planning and upcoming initiatives targeted to improve safety and cultural gaps."[179] Staff suggests that data from these safety culture assessments might be used to help determine an RSE score.

SoCalGas
SoCalGas provided RSEs for each of their controls. SoCalGas' highest RSE is for C3 Contractor Engagement, at 202.[180]

Observations:
In the workpapers supporting RSE calculations, SoCalGas includes internal data for OSHA Reportable Incidents, US Dept of Labor data, and SME input. SDG&E's data sources were internal SIF data and SME judgement. Staff assumes that the more limited scope of SDG&E's risk definition is the reason for not including US Dept of Labor data.

SoCalGas' highest RSE was for C3 Contractor Engagement and highest cost was also for C3 Contractor Engagement.

SCG-7 / SDGE-4.10 Alternatives Analysis

San Diego Gas and Electric
SDG&E provided two alternatives:

A1, SAP Contractor Incident Portal and Use Internal Resources
A2, Tools to Vet Contractors for Safety.[181]

SDG&E did not provide an RSE for A1, SAP Contractor Incident Portal, because 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.[182] A1 was rejected due to its complexity, the development of a portal that is more effective than what is currently in place has proven difficult to accomplish. A2 had an RSE of 13 and was rejected based on SDG&E's experience with using ISNetworld. A2 was judged to be not a cost-effective option.[183]

SoCalGas
SoCalGas provided two alternatives:

A1, Use Internal Resources and Tools to Vet Contractors for Safety
A2, Use a Different Third-Party Administration Tool to Vet Contractors for Safety.[184]

[178] SDG&E RAMP at 4-14, 15.
[179] SDG&E RAMP at 4-15.
[180] SoCalGas RAMP at 7-22.
[181] SDG&E RAMP at 4-20.
[182] SDG&E RAMP at 4-21.
[183] SDG&E RAMP at 4-20.
[184] SCG RAMP at 7-22.

Alternative A1 was rejected because while it supports the development of a portal that is more effective than what is currently in place, it has proven difficult to accomplish. A2 was judged to be not cost-effective.

Observations:

SDG&E and SoCalGas' reasons for rejecting alternatives appear reasonable based on the risks, inefficiencies, and barriers identified with implementation.

SCG-7 / SDGE-4.11 Summary of Findings

Staff note the following observations:

- SDG&E's score is four times that of SoCalGas, and SDG&E has proposed two new mitigations to reduce risk.
- Neither SDG&E and SoCalGas included the frequency of the drivers/triggers or ranking of the drivers/triggers.
- SDG&E and SoCalGas each have a single tranche for Contractor Safety.
- SoCalGas' LoRE is significantly larger than SDG&E's LoRE.
- Staff examined the RSE calculations and confirmed that the values are consistent with the data used by SDG&E.

SCG-7 / SDGE-4.12 Recommended Solutions to Address Findings and Deficiencies

SPD SDG&E and SoCalGas quantify the risk reduction benefits for all controls and proposed mitigations. SDG&E and SoCalGas should tranche contractor risks to reflect the variable risk of different tasks ranging from pipeline maintenance to vegetation management to office-related work.

Additionally, SDG&E and SoCalGas should rank their drivers/triggers to help Staff know which drivers/triggers are more likely to cause a potential consequence. This information would support Staff's evaluation of the RAMP by allowing Staff to analyze if the proposed mitigations are reasonable to address the top drivers/triggers.

SDGE-1 Wildfire Involving SDG&E Equipment

SDGE-1.1 Risk Description

Chapter SDG&E-Risk-1 examines the risk of wildfire involving SDG&E equipment (Wildfire Risk). This risk is described as "the risk of catastrophic wildfire, especially those initiated by SDG&E equipment, resulting in fatalities, widespread property destruction, and multi-billion-dollar liability."[185] And because PSPS as a mitigation has an impact on customers, the overall risk assessment is comprised of two components: the risk of catastrophic wildfire and the risk of PSPS impacts to customers.

The failure event is defined as any wildfire meeting CPUC Fire Incident Data Collection requirements for reporting. Under 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.

The Wildfire Risk chapter primarily focuses on the High Fire Threat District (HFTD), which has a greater potential for wildfires and represents approximately 64 percent of SDG&E's service territory. According to SDG&E, about 97 percent of all ignition consequences occur in HFTD.[186] Because only three percent of all ignition consequences occur in non-HFTD, essentially all programs outside of the HFTD are addressed in RAMP risk of Electric Infrastructure Integrity (EII Risk).

HFTD consists of a Tier 3 designation and a Tier 2 designation. Tier 3 represents an "extreme risk" for destructive utility-associated wildfires and accounts for approximately 61 percent of all ignition consequences in the total service territory. Tier 2 illustrates an "elevated risk" for destructive utility-associated wildfires and accounts for roughly 36 percent of all ignition consequences.

Observations:

Wildfire risks are the top safety risk for PG&E's 2020 RAMP Report, so SDG&Es assessment comports with statewide trends. SDG&E's incorporation of PSPS impact provides a fuller appraisal of the Wildfire Risk.

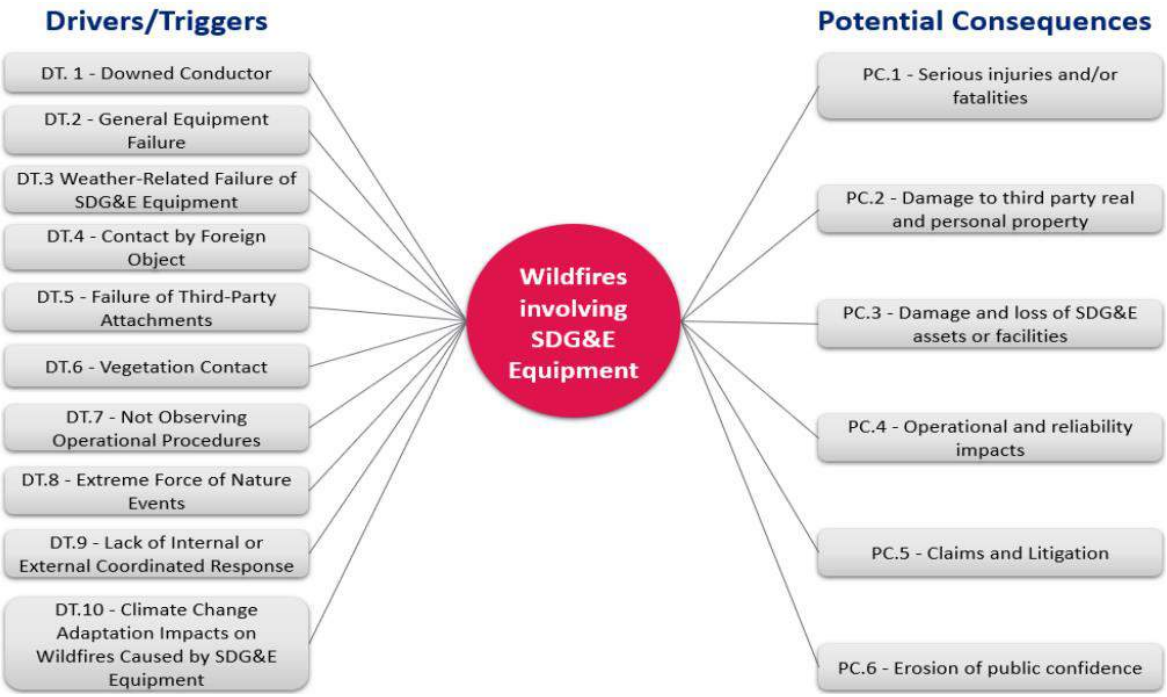
SDGE-1.2 Bow Tie

The risk bow tie represents risk event drivers and their frequencies on the left side of the diagram, the risk event in the center, and potential consequences on the right. The risk score of the bow tie is calculated by multiplying the LoRE and CoRE values. The wildfire risk alone (i.e., no PSPS impact)

[185] SDG&E 2021 RAMP Report Chapter 1 (SDG&E RAMP) at 1-4.
[186] SDG&E RAMP at 1-3.

has a pre-mitigation risk score of 11,768, ranking it highest among all risks in SDG&E's report, while the PSPS impact has a pre-mitigation risk score of 4,691. Combined with the PSPS impact, the Total Wildfire Risk Score (TWRS) is 16,459.

SDG&E's bow tie illustration is provided below:



SDG&E identifies several cross-functional factors (CFFs) associated with Wildfire Risk, but climate change adaptation is the only CFF included in the risk bow tie recognized as a driver or trigger (DT.10).[187]

Observations:

The Wildfire Risk alone makes up the most significant risk analyzed in this RAMP filing for either SDG&E or SoCalGas, and the TWRS is even larger with the inclusion of the PSPS impact. The overall risk score ranking is appropriate given that wildfire is currently, and for the foreseeable future, SDG&E's top safety risk.

SDG&E lists 10 risk drivers or triggers (DT) in the bow-tie illustration. According to SDG&E, "Potential Drivers/Triggers serve as an indication that a risk could occur. They do not reflect actual or threatened conditions."[188] SDG&E does not provide expected frequency or LoRE with each DT, nor does it organize the DTs in any rank order, i.e., from highest to lowest frequency. Although

[187] Other CFFs include: asset management, emergency preparedness and response, foundational technology system, records management, safety management system, and workforce planning/qualified workforce.

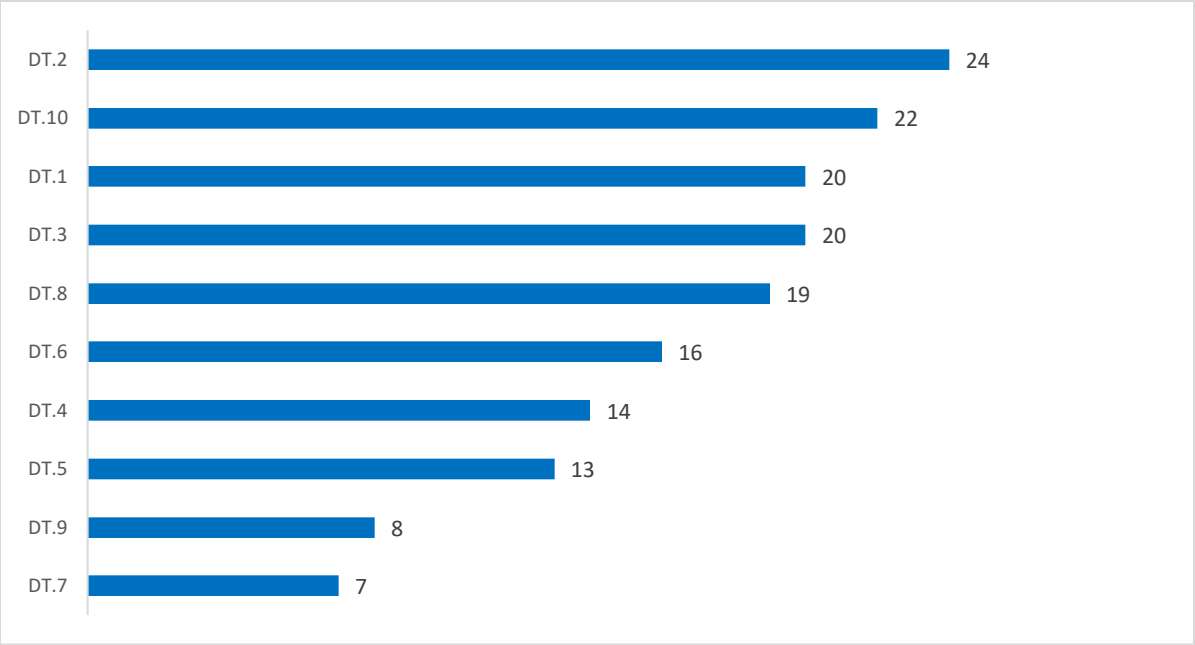
[188] SDG&E RAMP, Footnote 15, at 1-10.

the Settlement Agreement does not explicity require this frequency information, it would show which DTs are a top concern or priority for SDG&E.

To loosely analyze SDG&E's current priorities,[189] Staff manipulated information provided in Appendix A of the Wildfire Risk chapter and ranked the DTs in descending order by the total number of 2020 controls (43) intended to address the DT (see Figure SDGE-1.1).[190] One control can affect multiple DTs.

Based on the information in SDGE-1.1, SDG&E may be particularly concerned about mitigating "DT.2 – General Equipment Failure;" "DT.10 – Climate Change Adaptation Impacts on Wildfires Caused By SDG&E Equipment, "DT.1 – Downed Conductor;" "DT.3 – Weather-Related Failure of SDG&E Equipment", and "DT.8 – Extreme Force of Nature Events."

Figure SDGE-1.1. Risk Drivers and Triggers by Number of Controls and Mitigations



Three of the top five DTs – DT.10, DT.3, and DT.8 – are similarly situated, as all three relate to more severe weather and environmental conditions.

SDGE-1.3 Exposure

According to the Settlement Agreement, "exposure" is "the measure that indicates the scope of the risk, e.g., miles of transmission pipeline, number of employees, miles of overhead distribution

[189] The total cost of controls is not taken into consideration in this exercise due to inability to parse out and apportion funding priorities across multiple DTs.

[190] SDG&E RAMP at 1-A-1 to 1-A-2.

lines, etc. Exposure defines the context of the risk, i.e., specifies whether the risk is associated with the entire system, or focused on a part of it.[191]"

SDG&E does not explicitly quantify the exposure of its assets in this RAMP risk chapter. SDG&E only states that the main concern for Wildfire Risk are the assets that make up each of the Tier 3 and Tier 2 locations within the HFTD. SDG&E would later provide those circuit miles by type and location in a September 2, 2021, post-RAMP workshop on Wildfire Risk.

As provided in the workshop, the total overhead distribution exposure in the HFTD is 3,464 circuit miles, with 1,647 circuit miles in Tier 3 and 1,817 circuit miles in Tier 2. The total transmission exposure in the HFTD is 996 circuit miles, with 369 circuit miles in Tier 3 and 727 circuit miles in Tier 2. The total number of overhead circuit segments in the HFTD is 627, as provided in response to a Staff email inquiry.

Specific to PSPS risk, SDG&E states in the RAMP Wildfire Risk chapter that it has over 183,000 customers located within its HFTD.[192]

Observations:

In any description of risk, verifiable measurement units are essential to the assessment. SDG&E should always provide clear quantitative exposure to risk in the body of the RAMP's risk chapter. Some natural units are presented in the controls and mitigations description, but that information does not adequately describe the population of assets exposed to Wildfire Risk events.

Furthermore, despite PSPS impact serving as a component of Wildfire Risk, SDG&E does not directly quantify exposure to this risk in terms of the number and type of customers in the RAMP chapter itself.

SDGE-1.4 Tranches

Because SDG&E states that it "plans, manages, and prioritizes most [of] its wildfire mitigation work"[193] according to the location and tier, SDG&E first subdivides its assets into tranches according to location and tier, or HFTD Tier 3, HFTD Tier 2, and non-HFTD. As a result, in this Wildfire Risk analysis, all Tier 3 circuit miles share the same pre-mitigation Likelihood of Risk Event (LoRE) value, pre-mitigation Consequence of Risk Event (CoRE) value, and pre-mitigation risk score. Similarly, all Tier 2 circuit miles and all non-HFTD circuit miles are homogenized within their respective tiers.

SDG&E goes on to state that the control and mitigation programs themselves represent additional efforts by SDG&E to distinguish "asset-specific differences." Therefore, the final set of tranches are represented as control and mitigation programs broken down primarily by Tier 3 (referred to

[191] Settlement Agreement adopted through Decision (D.)18-12-015, in the Safety Model Assessment Phase proceeding (A.15-05-002 et al), at A-2.
[192] SDG&E RAMP at 1-29.
[193] SDG&E RAMP at 1-6.

as “T1” in the control and mitigation ID), Tier 2 (referred to as “T2” in the ID), and occasionally non-HFTD (referred to as “T3” in the ID) groupings.

SDG&E details 48 planned mitigations and controls in this risk chapter for the 2022-2024 period, representing tranches with risk analyses and RSE scores.

Observations:

Staff does not find the tranches presented in the risk chapter adequate for a full understanding and comparison of the risks to the system and SDG&E’s risk reduction effectiveness. First, the risk distinction in the HFTD, or Tier 3 versus Tier 2, is too broad for an accurate reflection of the varying risk consequences faced by assets within the HFTD. In this Wildfire Risk chapter, all Tier 3 circuit miles share the same pre-mitigation LoRE and CoRE values, as do all Tier 2 circuit miles. However, additional distinctions within the Tier 3 and Tier 2 groupings are important enough to warrant their own tranches and risk analyses. For example, SDG&E does not create tranches within each tier based on geographic, environmental, and weather variables, such as wind speeds, elevation, microclimate, and other factors, identifying and quantifying meaningful differences in risk profiles.

Second, using control and mitigation programs to represent an asset-specific breakdown of tranches is helpful but does not offer stakeholders a clear understanding of which circuit segments or how many miles of circuit segments within a tier are affected by a particular program. Nor does it provide stakeholders with insight into how multiple mitigations might affect risk exposure on specific circuit segments or miles. Preferably, SDG&E would show risk on a per circuit mile basis. Instead, the natural units expressed in the programs, such as the number of miles hardened, the number of trees trimmed, the number of expulsion fuses replaced, or some other unit, do not allow Staff to compare the reach of one program against another on similar terms.

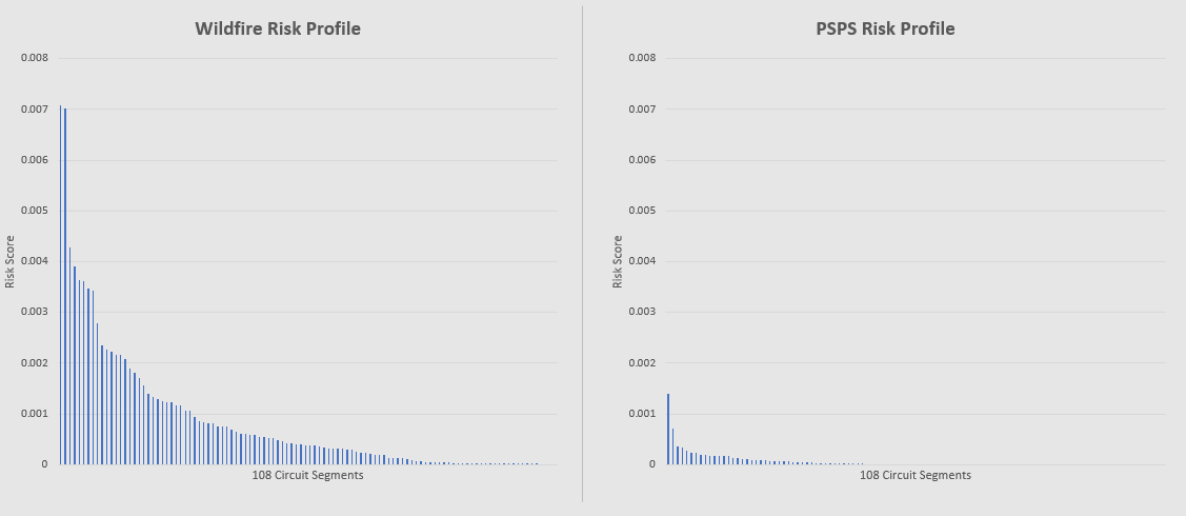
Finally, as Staff has seen in post-RAMP-filing workpapers, SDG&E can detail risk analysis (i.e., pre-mitigation LoRE, CoRE, and Risk Score) for both Wildfire Risk and PSPS impact at the circuit segment level using its Wildfire Next Generation System (WiNGS) model. SDG&E presents a grid hardening analysis conducted on 108 of the 627 circuit segments in 2023-2024.[194] SDG&E can produce risk scores for every circuit segment and create tranches based on quantiles from the range of risk profiles (and arranged further by asset-level differences) that would provide a portfolio-level analysis of risk mitigation or analysis that assesses the combined effect of multiple mitigations that are complementary.

As seen in Figure SDGE-1.2, the visual representation of the risk scores for 108 circuit segments targeted for grid hardening shows that much of the risk is disproportionately held by a small portion of the circuit segments. For Wildfire Risk, the 32 highest risk scores, or 30 percent, have 80 percent of the total risk among the 108 circuit segments. For the PSPS impact, the top 16 highest risk scores, or 16 percent, hold 80 percent of the entire risk among the 108 circuit

[194] SDG&E & SoCalGas Response to TURN Data Request 06,WiNGS Workpaper (WiNGS Workpaper).

segments. Tranches based on risk quantiles would help Staff, and interested parties, evaluate risk and risk reduction in a more focused way.

Figure SDGE-1.2 Risk Analysis of 108 Circuits Targeted for Grid Hardening using WiNGS, by Risk Score



Data Source: SPD analysis of WiNGs workpaper.

As for the risk of PSPS impact, SDG&E does not create customer-specific tranches to evaluate risk and the effect of mitigations. According to its workpaper, SDG&E does consider at least four large groups of customers that would be affected by control and mitigation programs and could present a starting point for potential tranching of PSPS Impact:

- Residential/Industrial/Commercial,
- Essential,
- Urgent, and
- Medical Baseline.

SDG&E should consider analyzing PSPS Impact differently from Wildfire Risk assets by creating tranches to reflect impacts to different types of customers from PSPS events.

SDGE-1.5 Likelihood of Risk Event (LoRE)

SDG&E measures two separate pre-mitigation likelihood of risk event (LoRE) values – one for the Wildfire Risk and another for PSPS impacts. The Wildfire Risk LoRE value is 21.17, and the PSPS impact LoRE value is 4.00.

SDG&E computes the LoRE for the entire system by separately determining the Wildfire Risk LoRE in Tier 3, Tier 2, and non-HFTD before summing the three LoRE values. The annual frequency of an event is used to estimate the LoRE. The expected value of the frequency of risk events, or reportable ignitions, per year in each location and tier are estimated based on a combination of 2015-2019 ignition data and subject matter expert (SME) input. The Wildfire Risk LoRE is 5.13 in Tier 3, 6.84 in Tier 2, and 9.20 in non-HFTD, giving the total Wildfire Risk a LoRE of 21.17.

The LoRE for PSPS risk, on the other hand, applies to the whole system (i.e., Tiers 3 and 2). The LoRE value of 4.00 risk events per year for PSPS risk is based on SDG&E's internal reliability data.

Observations:

The expected frequency of risk events from the Wildfire Risk and PSPS Risk, while not nearly as high as the anticipated frequency of the SDG&E electric infrastructure risk (LoRE of 1,632) and SDG&E's incidents related to the medium pressure gas systems (LoRE of 101.42), is still higher than other SDG&E risks.

SDGE-1.6 Consequence of Risk Event (CoRE)

SDG&E measures two separate consequence of risk event (CoRE) values in this risk chapter – one for the Wildfire RIsk and another for PSPS impacts. The Wildfire Risk CoRE value is 556, and the PSPS impact CoRE value is 1,173.

For the Wildfire Risk, SDG&E first determines the CoRE for Tier 3, Tier 2, and the non-HFTD based on the Safety, Reliability, Financial, and Stakeholder Satisfaction attributes. Tier 3 easily contains the most severe consequences among the three locations, with a CoRE value of 1,409. Tier 3's CoRE is more than twice that of Tier 2, which has a CoRE value of 623. And non-HFTD has a relatively tiny CoRE value of 30. SDG&E then computes an overall Wildfire Risk CoRE by calculating the weighted average of the three CoRE values for a CoRE value of 556.

In Tier 3 and Tier 2, the Financial and Safety attributes together make up more than 90 percent of the consequence score. The CoRE Financial value is more than 55 percent of its respective total CoRE. The CoRE Safety value is more than 35 percent, the CoRE Reliability value is nearly eight percent, and the CoRE Stakeholder Satisfaction value is approximately 1-2 percent.

SDG&E estimates nearly 0.09 significant fire incidents per year in the HFTD, or about nine significant fires every 100 years, and almost one (0.90) Serious injury and Fatality (SIF) per significant fire incident per year, based on internal data and SME input. And each significant fire incident is expected to create a financial consequence of about $2.4 billion in the HFTD.

For the PSPS Risk, SDG&E determines the consequence score for Tier 3 and Tier 2 based on a 70-30 percent split of assumed values for Safety, Reliability, Financial, and Stakeholder Satisfaction attributes over a total of four PSPS events per year that occur in the HFTD. The PSPS Tier 3 CoRE is 821, and the Tier 2 CoRE is 352. The Reliability attribute makes up approximately 70 percent of the total PSPS Risk CoRE, followed by more than 17 percent from Stakeholder Satisfaction. The Financial attribute makes up nearly 12 percent of the PSPS Risk CoRE, while Safety makes up only about one percent of the total PSPS Risk CoRE.

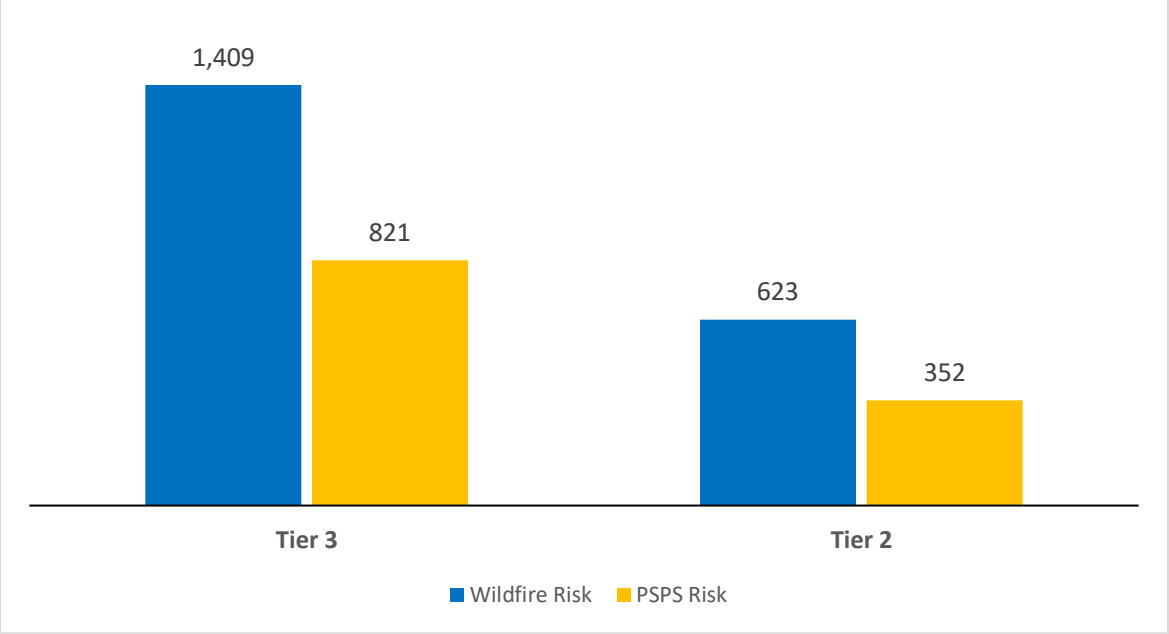
SDG&E estimates nearly 0.018 safety incidents per year in the HFTD, or almost two safety incidents every 100 years due to PSPS, based on internal data and SME input. And each significant fire incident is expected to create a financial consequence of about $2.4 billion in the HFTD.

Observations

At first glance, the Wildfire Risk CoRE (556) appears to be low. Not only is the PSPS Risk CoRE (1,173) more than double the result of the Wildfire Risk CoRE, but the Wildfire Risk CoRE is lower than all other SDG&E risks except for Excavation Damage on the Medium Pressure Gas System (1.0) and Incidents Related to the Medium Pressure System Excluding Dig-ins (5.97). However, the inclusion of the non-HFTD tranche in the overall Wildfire Risk CoRE diminishes the consequence score in Tier 3 and Tier 2 since the weighted average of the three CoRE values are dependent on their respective LoRE values, with the non-HFTD tranche having the highest LoRE and the lowest CoRE. A proper comparison of the Tier risks for Wildfire Risk and PSPS Risks can be seen in Figure SDGE-1.3.

The practical implications of including the non-HFTD in the Wildfire Risk CoRE do not appear to adversely affect the risk analysis, as SDG&E provides analysis of controls and mitigations according to specific Tier and tranche risk characteristics.

Figure SDGE-1.3. Comparison of CoRE values by Tier



Data Source: SPD analysis of SDG&E Wildfire Level 2 Final 2021 Workpaper, Risk Scoring Workpaper (Risk Scoring Workpaper).

Regarding PSPS impact CoRE, SDG&E states that they do not yet have a full and complete grasp of the consequences of PSPS: "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."[195]

[195] SDG&E RAMP at 1-16.

SDGE-1.7 Pre-Mitigation Risk Score

SDG&E uses the two separate LoRE and CoRE values for Wildfire Risk and PSPS Risk to compute the distinct pre-mitigation risk score for each risk. The pre-mitigation Wildfire Risk Score is 11,768 and the PSPS Risk Score is 4,691. SDG&E then adds the two scores together to determine a Total Wildfire Risk Score (TWRS) of 16,459.

The TWRS ranks as the highest pre-mitigation risk score, almost double the next highest pre-mitigation risk score held by EII Risk (9,177).

Observations:

The overall TWRS presents an important big picture view of relative risk across all risk categories, and the total Wildfire Risk, as expected, scores as the biggest risk. However, the risk analysis conducted at the tier- or location-level tranche allows for a more narrow and more focused analysis of SDG&E efforts to mitigate the Wildfire Risk. SDG&E uses the locational tranche risk analysis to determine the percentage effectiveness of its programs.

Table SDGE-1.1. Pre-mitigated Risk Score for Wildfire Risk and PSPS Impact, by Location Tranche

Location Tranche	Wildfire Pre-mitigated Risk Score	PSPS Pre-mitigated Risk Score
Tier 3	7,230	3,283
Tier 2	4,261	1,407
Non-HFTD	278	-
Total	11,768	4,691

Data Source: SPD analysis of Risk Scoring Workpaper.

SDGE-1.8 Controls and Mitigations

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.[196] The last year of recorded data in 2020 provides the baseline costs, and cost forecasts are provided for years 2022-2024, which will be updated when presented in the rate case filing in 2022.

Controls

A "control" is defined as a "[c]urrently established measure that is modifying risk."[197] SDG&E discusses 43 control activities (i.e., covering any location or tier) in place through the end of 2020, intended to mitigate Wildfire Risk. Forty-two (42) of these 43 control activities are expected to continue during the 2022-2024 time period. One activity, "C19 – Cleveland National Forest Fire Hardening," is anticipated to be complete in 2021 and, therefore, not expected to continue during the 2022-2024 time period. The total projected cost for the 2022-2024 period, including

[196] SDG&E RAMP at A-12.
[197] SDG&E RAMP at 1-2.

capital costs in 2022-2024 and TY 2024 operational and maintenance (O&M) costs, is nearly $2.4 billion for all 42 control activities.

The control activities fall under the following categories of work, as presented by SDG&E:

- Risk Assessment and Mapping (C1);
- Situational Awareness and Forecasting (C2 through C5);
- Grid Design and System Hardening (C6 through C21);
- Asset Management and Inspections (C22 through C30);
- Vegetation Management and Inspections (C31 through C34);
- Grid Operations and Protocols (C35 through C37);
- Data Governance (C38);
- Resource Allocation Methodology (C39 through C40);
- Emergency Planning and Preparedness (C41); and
- Stakeholder Cooperation and Community Engagement: (C42 through C43).

Among the 42 control activities expected in 2022-2024, SDG&E includes 13 foundational programs (see Table SDGE-1.2-A). No risk calculation is individually assessed for the 13 foundational activities.

Table SDGE-1.2-A. The 13 Foundational Controls, 2022-2024

ID	Control/Mitigation Name	2022-2024 Total Cost ($k)
C1	WRRM - Ops	$7,173
C2	Advanced Weather Station Integration	$1,806
C4	Fire Science and Climate Adaptation Department	$4,414
C5	High Performance Computing Infrastructure	$7,490
C20	LTE Communication Network	$201,226
C23	Transmission System Inspection	$2,175
C26	LiDAR Flights	$5,400
C38	Centralized Repository for Data	$62,864
C39	Asset Management	$388
C40	Wildfire Mitigation Personnel	$6,030
C41*	Emergency Management Operations	$23,377
C42*	Communication Practices	$9,752
C43	Non-Conductive Balloon Alternatives	$227

Note: The cost, risk analysis, and RSE for 2 of the 13 foundational activities, C41 and C42, are fully incorporated and assessed as part of a related control ("C37 - PSPS Events and Mitigation of PSPS Impacts").

Data Source: SDGE Ramp, Tables 10, 11, 12, and 13 at 1-97.

The remaining 29 control (and mitigation) activities expected to be in place during the 2022-2024 period are then separately identified by Tier 3, Tier 2, and/or non-HFTD, effectively serving as tranches. SDG&E identifies the tranche using the nomenclature "C#-T1" for HFTD Tier 3, "C#-T2" for HFTD Tier 2, and "C#-T3" for non-HFTD. As a result, SDG&E creates 48 scored control (and mitigation) activities, or tranches, with detailed costs, risk analysis, and RSE values (see Table SDGE-1.2-B).

Not including the SDG&E-determined foundational programs, SDG&E analyzes the effect of the 48 scored control and mitigation programs that comprise the portfolio of direct risk reduction programs for the Wildfire Risk and PSPS Impact Risk in the forecast years of 2022-2024. Eleven (11) of the 48 scored control and mitigation programs mitigate the risk of PSPS impacts. The total projected cost for these 48 scored controls for the period 2022-2024 is approximately $2 billion.

Table SDGE-1.2-B. The 48 Scored Controls and Mitigations, 2022-2024

ID	Control/ Mitigation Name	PSPS Impact Mitigation	WF Risk Mitigation	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
C3-T3	Wireless Fault Indicators (Non-HFTD)		√	$656	57	1,516
C6/M1-T2	SCADA Capacitors (HFTD Tier 2)		√	$1,791	39	381
C7/M2-T1	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 3)	√	√	$340,511	478	32
C7/M2-T2	Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 2)		√	$74,746	44	14
C8/M3-T2	Expulsion Fuse Replacement (HFTD Tier 2)		√	$3,079	33	187
C9/M4-T1	PSPS Sectionalizing (HFTD Tier 3)	√		$536	76	2,112
C9/M4-T2	PSPS Sectionalizing (HFTD Tier 2)	√		$4,089	292	1,063
C10/M5-T2	Microgrids (HFTD Tier 2)	√		$42,393	86	30

ID	Control/ Mitigation Name	PSPS Impact Mitigation	WF Risk Mitigation	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
C11/M6-T1	Advanced Protection (HFTD Tier 3)		√	$30,626	544	309
C12/M7-T1	Hotline Clamps (HFTD Tier 3)		√	$4,503	24	93
C12/M7-T2	Hotline Clamps (HFTD Tier 2)		√	$4,503	9	36
C13/M8-T1	Resiliency Grant Programs (HFTD Tier 3)	√		$7,900	71	76
C13/M8-T2	Resiliency Grant Programs (HFTD Tier 2)	√		$15,800	71	38
C14/M9-T1	Standby Power Programs (HFTD Tier 3)	√		$19,600	197	120
C15/M10-T1	Resiliency Assistance Programs (HFTD Tier 3)	√		$1,451	97	569
C15/M10-T2	Resiliency Assistance Programs (HFTD Tier 2)	√		$2,177	73	284
C16/M11-T1	Strategic Undergrounding (HFTD Tier 3)	√	√	$629,679	4,246	156
C16/M11-T2	Strategic Undergrounding (HFTD Tier 2)	√	√	$377,807	878	54
C17/M12-T1	Overhead Distribution Fire Hardening – Bare Conductor (HFTD Tier 3)		√	$5,130	12	53
C18/M13-T1	Overhead Transmission Fire Hardening – Distribution Underbuilt (HFTD Tier 3)		√	$3,121	8	63
C18/M13-T2	Overhead Transmission Fire Hardening – Distribution		√	$41,782	57	32

ID	Control/ Mitigation Name	PSPS Impact Mitigation	WF Risk Mitigation	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
	Underbuilt (HFTD Tier 2)					
C21/M14-T1	Lightning Arrestor Removal/Replacement Program (HFTD Tier 3)		√	$7,834	51	113
C22-T1	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 3)		√	$11,425	765	65
C22-T2	Distribution System Inspection – CMP – 5 Year Detailed Inspections (HFTD Tier 2)		√	$15,125	513	33
C24-T2	Distribution System Inspection – IR/Corona (HFTD Tier 2)		√	$524	174	322
C25-T2	Distribution System Inspection – CMP – 10 Year Intrusive (HFTD Tier 2)		√	$3,359	7	2
C27-T1	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 3)		√	$9,006	1,030	111
C27-T2	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 2)		√	$11	0.6	57
C28-T1	Distribution System Inspection – Drone Inspections (HFTD Tier 3)		√	$4,500	899	194
C28-T2	Distribution System Inspection – Drone Inspections (HFTD Tier 2)		√	$39,869	364	9
C29-T1	Distribution System Inspection – Circuit Ownership (HFTD Tier 3)		√	$125	2	13

ID	Control/ Mitigation Name	PSPS Impact Mitigation	WF Risk Mitigation	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
C29-T2	Distribution System Inspection – Circuit Ownership (HFTD Tier 2)		√	$250	2	7
C30-T1	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 3)		√	$1,495	1,053	684
C30-T2	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 2)		√	$1,775	682	373
C31-T1	Tree Trimming (HFTD Tier 3)		√	$44,848	8,851	192
C31-T2	Tree Trimming (HFTD Tier 2)		√	$54,072	5,817	104
C32/M15-T1	Fuels Management Program (HFTD Tier 3)		√	$18,619	131	7
C33/M16-T1	Enhanced Vegetation Management (HFTD Tier 3)		√	$15,011	72	111
C33/M16-T2	Enhanced Vegetation Management (HFTD Tier 2)		√	$17,768	47	61
C34-T1	Pole Brushing (HFTD Tier 3)		√	$7,915	2,128	261
C34-T2	Pole Brushing (HFTD Tier 2)		√	$8,958	1,404	152
C35-T1	Aviation Firefighting Program (HFTD Tier 3)		√	$63,702	178	24
C35-T2	Aviation Firefighting Program (HFTD Tier 2)		√	$37,542	62	14
C35-T3	Aviation Firefighting Program (Non-HFTD)		√	$2,846	0.3	1
C36-T1	Wildfire Infrastructure		√	$6,182	401	63

ID	Control/ Mitigation Name	PSPS Impact Mitigation	WF Risk Mitigation	2022-2024 Total Cost ($k)	Risk Reduction	RSE per $Million
	Protection Teams (HFTD Tier 3)					
C36-T2	Wildfire Infrastructure Protection Teams (HFTD Tier 2)		√	$2,626	152	56
C37-T1	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 3)		√	$30,750	4,594	145
C37-T2	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 2)		√	$34,803	4,291	120

Note: "C19 – Cleveland National Forest Fire Hardening" will not be a mitigation activity during 2022-2024.
Data Source: SDG&E RAMP, "Table 10," at 1-97 to 1-101 and SDG&E Workpapers.

Observations:

Of the 48 scored control and mitigation programs expected in 2022-2024, eight programs mitigate PSPS Impacts exclusively, 37 programs mitigate Wildfire Risks exclusively, and three programs lessen both risks (see SDGE-1.2). Curiously, "C7/M2-T2 – Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 2)" does not have an effect on the PSPS impact risk reduction even though it does for "C7/M1-T1 – Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 3)."

Two control and mitigation programs make up approximately 70 percent of the total cost of non-foundational control and mitigation programs from 2022-2024. "C16/M11 – Strategic Undergrounding" is the most expensive control in that period of time, at over $1 billion, or nearly 50 percent of the total cost. "C7/M2 – Overhead Distribution Fire Hardening – Covered Conductor" is $415 million, or more than 20 percent of the total cost.

Despite having the dual benefits of nearly eliminating wildfire risk in the targeted areas of work and eliminating the need for PSPS for customers benefiting from the underground system, "Undergrounding is, however, often the most expensive major hardening alternative on a per-mile basis."[198] SDG&E is deploying the mitigation activity strategically, using its WiNGS model to identify the circuit segments with the most risk. Given its high per-mile expense, SDG&E is using its WiNGS model to inform what circuit segments to perform undergrounding versus covered conductor work.

Overall, the computed risk reduction value in the pre-mitigation risk score in 2022-2024 ranges from a low of 0.3 ("C35 – Aviation Firefighting Program (non-HFTD)") to a high of 8,851 ("C31-T1 –

[198] SDG&E RAMP at 1-41.

Tree Trimming (Tier 3)"). SDG&E determined the largest risk reduction to occur from the following control and mitigation programs, with four of the top seven programs related to the work category of Vegetation Management and Inspections:

- "C31-T1 – Tree Trimming (Tier 3),"
- "C31-T2 – Tree Trimming (Tier 2),"
- "C37-T1 – PSPS Events and Mitigation of PSPS Impacts (Tier 3),"
- "C37-T2 – PSPS Events and Mitigation of PSPS Impacts (Tier 2),"
- "C16/M11-T1 – Strategic Undergrounding (Tier 3),"
- "C34-T1 – Pole Brushing (Tier 3)," and then
- "C34-T2 – Pole Brushing (Tier 2).

Tree trimming and pole brushing achieve such high reductions due to large, estimated reductions in annual ignitions, thereby reducing the LoRE. However, citing pole brushing as just one example, SDG&E deferred to SME judgment for assumed effectiveness of mitigation value of 40 percent without providing any corresponding justification in the workpapers. Any application of SME judgment should be subject to greater scrutiny from stakeholders.

Staff also observes that the risk reduction in the workpapers are primarily attributed to estimated reductions in ignitions and the LoRE side of the risk equation. However, in some cases, such as the Covered Conductor programs (C7/M2-T1 and C7/M2-T2) and Strategic Undergrounding (C16/M1-T1 and C16/M1-T1), the estimated reductions in ignitions are assigned entirely to the CoRE side of the risk equation. Although the effect of the reduction in ignitions (as a percentage or rate) can be applied to either the LoRE or the CoRE and produce the same risk score reduction, the Settlement Agreement requires SDG&E to specifically apportion the effect and magnitude of the mitigating activity to LoRE and CoRE as appropriate. Row 16 states, "the effects of a mitigation on a Tranche will be expressed as a change to the Tranche-specific pre-mitigation values for LoRE and/or CoRE. The utility will provide the pre-and post-mitigation values for LoRE and CoRE determined in accordance with this Step 3 for all mitigations subject to this Step 3 analysis."[199]

And finally, Staff observes that none of the costs of the 12 foundational programs, which total approximately $390 million in mostly capital costs in the 2022-2024 time period, were apportioned to the various risks. Although SDG&E is not required to apportion the costs of the foundational programs that contribute to the controls and mitigations that directly reduce risk, Staff recommends that SDG&E consider doing so consistent with the recommendation presented in the "Treatment of Foundational Programs & Activities" section of the Proposed Decision Addressing Phase I, Track 1 and 2 Issues in Rulemaking 20-07-013. This step would improve transparency and result in more accurate RSE calculations.

Mitigations

Control programs in 2020 that will continue in the 2022-2024 time period retain their control ID. But for those control programs that change in size and/or scope of activity, their control IDs will be replaced with mitigation IDs.

[199] Settlement Agreement adopted through Decision (D.)18-12-015, in the Safety Model Assessment Phase proceeding (A.15-05-002 et al), at A-12.

The following 16 pre-tranched control programs in 2020 are formally considered mitigation programs in the 2022-2024 time period:

- C6/**M1** – SCADA Capacitors
- C7/**M2** – Overhead Distribution Fire Hardening – Covered Conductor
- C8/**M3** – Expulsion Fuse Replacement
- C9/**M4** – PSPS Sectionalizing
- C10/**M5** – Microgrids
- C11/**M6** – Advanced Protection
- C12/**M7** – Hotline Clamps
- C13/**M8** – Resiliency Grant Programs
- C14/**M9** – Standby Power Programs
- C15/**M10** – Resiliency Assistance Programs
- C16/**M11** – Strategic Undergrounding
- C17/**M12** – Overhead Distribution Fire Hardening – Bare Conductor
- C18/**M13** – Overhead Transmission Fire Hardening – Distribution Underbuilt
- C21/**M14** – Lightning Arrestor Removal/Replacement Program
- C32/**M15** – Fuels Management Program
- C33/**M16** – Enhanced Vegetation Management

Observations:

All mitigation programs are a continuation of the control programs, except for a change in size and/or scope of work.

SDGE-1.9 Risk Spend Efficiency (RSE)

During the 2022-2024 period, there are an expected 48 scored control and mitigation programs with an RSE score. For the Wildfire Risk mitigation (i.e., excluding PSPS impact), the RSE ranges from a low of 1.0 RSE for "C35-T3 – Aviation Firefighting Program (Non-HFTD)" to a high of 1,516 RSE for "C3-T3 – Wireless Fault Indicators (Non-HFTD)") during the 2022-2024 time period.

For the PSPS impact programs, the RSE ranges from a low of 30 RSE for "C10/M5-T2 – Microgrids (HFTD Tier 2)" to a high of 2,112 RSE for "C9/M4-T1 – PSPS Sectionalizing (HFTD Tier 3)."

Observations:

Staff notes that the mitigation programs with the highest RSEs, C3-T3 and C9/M4-T1, have a risk score reduction below the median risk score reduction (114 risk points), so they may be cost efficient but not the most effective at risk reduction.

Staff examined which of the 48 scored control and mitigation programs had both a risk reduction score above the median (114) and an RSE above the median (85) as an initial approach for identifying effective and efficient programs. Staff identified 15 control and mitigation programs that meet such standards, listed in descending order of RSE, as shown in Table SDGE-1.3.

Table SDGE-1.3. Most Effective and Efficient Control and Mitigation Programs by RSE

ID	Control/Mitigation Name	PSPS Impact Mitigation	WF Risk Mitigation	Risk Reduction	RSE per $Million
C9/M4-T2	PSPS Sectionalizing (HFTD Tier 2)	√		292	1,063
C30-T1	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 3)		√	1,053	684
C30-T2	Distribution System Inspection – CMP – Annual Patrol (HFTD Tier 2)		√	682	373
C24-T2	Distribution System Inspection – IR/Corona (HFTD Tier 2)		√	174	322
C11/M6-T1	Advanced Protection (HFTD Tier 3)		√	544	309
C34-T1	Pole Brushing (HFTD Tier 3)		√	2,128	261
C28-T1	Distribution System Inspection – Drone Inspections (HFTD Tier 3)		√	899	194
C31-T1	Tree Trimming (HFTD Tier 3)		√	8,851	192
C16/M11-T1	Strategic Undergrounding (HFTD Tier 3)	√	√	4,246	156
C34-T2	Pole Brushing (HFTD Tier 2)		√	1,404	152
C37-T1*	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 3)		√	4,594	145
C14/M9-T1	Standby Power Programs (HFTD Tier 3)	√		197	120
C37-T2*	PSPS Events and Mitigation of PSPS Impacts (HFTD Tier 2)		√	4,291	120
C27-T1	Distribution System Inspection – HFTD Tier 3 Inspections (HFTD Tier 3)		√	1,030	111
C31-T2	Tree Trimming (HFTD Tier 2)		√	5,817	104

* The RSE representing C37 for PSPS events is made up of a combination of "C41 – Emergency Management Operations" and "C42 – Communication Practices" because C37 cannot be performed without C41 and C42.

Twelve (12) of the scored controls and mitigations found to be effective and efficient in Table SDGE-1.3 solely affect Wildfire Risk mitigation. Two (2) controls and mitigations, C9/M4-T2 and

C14/M9-T1, solely affect PSPS impact mitigation. And one (1) of the controls and mitigations, C16/M11-T1, involves both Wildfire Risk mitigation and PSPS impact mitigation.

Some of the most expensive controls and mitigations during 2022-2024, like C15/M11-T1, C31-T1, C31-T2, and C37-T1, are expensive but also effective and efficient.

SDGE-1.10 Alternatives Analysis

SDG&E selects their portfolio of grid hardening strategies in the control and mitigation plan, including a mix of undergrounding and covered conductor implementation. According to SDG&E, "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 18,000 customers. The total risk reduction estimated from this strategy is approximately 70 percent over a period of about 10 years."[200]

The short-term analysis of alternatives only considers the scope of work from 2023-2024. The year 2022 is excluded because the grid hardening projects are already planned and underway for that year and starting in 2023, the WiNGS model for segment-level analysis drives the scope of work.

SDG&E provided two alternatives to the proposed grid hardening control and mitigation plan and measured the scope, risk reduction, and RSE for both the short-term (2023-2024) and the long-term (2023-2030) (see Table SDGE-1.4).

Table SDGE-1.4. Grid Hardening Alternative Analysis

Alternatives	2023-2024			2023-2030		
	Scope	Risk Reduction	RSE	Long-term Scope	Long-term Risk Reduction	Long-term RSE
Proposed	275 miles of UG; 200 miles of CC	33%	100	584 miles of UG; 865 miles of CC	63%	69
Alternative 1	475 miles of UG	34%	85	1,449 miles of UG	71%	58
Alternative 2	475 miles of CC	21%	93	1,449 miles of CC	46%	67

[200] SDG&E RAMP at 1-118.

Note: "UG" is the acronym representing implementation of "undergrounding." "CC" is the acronym representing implementation of "covered conductor."
Data Source: SDG&E Ramp, "Table 14: Grid Hardening Alternative Analysis," at 1-119.

Alternative 1

In Alternative 1, SDG&E considers undergrounding all of the selected circuit miles as of 2023, rather than the proposed mix of undergrounding and covered conductor found in the proposed plan (Proposed). Alternative 1's RSE in both the short-term and long-term are lower than Proposed because of the higher costs of undergrounding, even though the risk reduction is greater than that of Proposed. SDG&E also adds, "taking an all-underground approach may not be feasible due to permitting, terrain constraints as well as resource availability."[201]

Alternative 2

In Alternative 2, SDG&E considers implementing covered conductors for all selected circuit miles as of 2023, rather than the proposed mix of undergrounding and covered conductor in Proposed. Due to Alternative 2's lower cost, the RSE is close to Proposed in both the short-term and the long-term. However, SDG&E states that the risk reduction potential is capped at approximately 50 percent.

Observations:

The results of the comparison appear reasonable. However, SDG&E's selection of Alternative 1, or 100 percent undergrounding of the selected circuit miles, does not represent a plausible option when most stakeholders already know that it would be infeasible due to high costs. Staff recommends that SDG&E analyze a program such as the Rapid Earth Fault Current Limiter (REFCL) or other feasible alternative with the potential to be a more cost-effective program than undergrounding in its next GRC filing. [202] A practical, realistic alternative would better meet the intent of the requirement to provide alternatives rather than what was presented in Alternative 1.

Also, SDG&E does not provide an alternative analysis for PSPS impact-only mitigation activities. With a component of the Wildfire Risk as important as the PSPS impact, SDG&E does not present an analysis of alternative mitigation tools specific to that risk. Staff would have been interested in seeing what other considerations were discussed by SDG&E in mitigating the risk of PSPS impacts.

SDG&E would also make its case stronger by providing all relevant information in a single table for comparison of Proposed to Alternative 1 and Alternative 2. While SDG&E provides forecast dollars for the alternatives in the RAMP chapter as well as total cost estimates in the workpaper, these projected costs represent years 2022-2024 rather than the 2023-2024 in this analysis. Moreover, there is no cost comparison of the long-term duration, 2023-2030. While it may be relatively easy for Staff and interested parties to estimate costs on their own, SDG&E should clearly make the comparison of costs easily accessible for the time periods in question, 2023-2024 and 2023-2020,

[201] SDG&E RAMP at 1-120.

across Proposed, Alternative 1, and Alternative 2, to justify its position that the chosen strategy found in Proposed is the most feasible, effective, and cost-efficient approach.

SDGE-1.11 Summary of Findings

Based on the observations presented above, findings are summarized here.

SDGE-1.11.1

The risk bow tie does not indicate an expected frequency or LoRE with each DT, nor does it organize the DTs in any rank order that would reflect top concerns and priorities for SDG&E.

SDGE-1.11.2

SDG&E does not explicitly quantify the exposure of its assets for the Wildfire Risk, or the customers exposed to PSPS impact risk. Exposure defines the context of the risk.

SDGE-1.11.3

The tranches presented for Wildfire Risk are not adequate for a full understanding and comparison of the risks to the system and SDG&E's risk reduction effectiveness:

1. The risk distinction in the HFTD tiers are too broad for an accurate reflection of the varying risk conditions faced by assets within the HFTD;
2. Control and mitigation programs represent asset-specific breakdowns of tranches, but not all programs lend themselves to a straight apples-to-apples comparison based on circuit miles or circuit segments affected by risk reduction. Nor can the effect of multiple mitigations be observed across similar circuit segments or circuit miles.
3. Staff has seen in post-RAMP-filing workpapers, SDG&E currently has the capability of detailing risk analysis for both Wildfire Risk and PSPS impact at the circuit segment level using its Wildfire Next Generation System (WiNGS) model.
4. SDG&E does not create tranches to reflect impacts to different types of customers from PSPS events.

SDGE-1.11.4

The PSPS Risk CoRE (1,173) is more than double the Wildfire Risk CoRE (556) due to the inclusion of the non-HFTD tranche in the Wildfire Risk CoRE and not in the PSPS Risk CoRE, which weighs down the Wildfire Risk CoRE value. However, when comparing Tier 3 Wildfire Risk CoRE (1,409) to Tier 3 PSPS Risk CoRE (821) and Tier 2 Wildfire Risk CoRE (623) to Tier 2 PSPS Risk CoRE (352), the results clearly show that the consequences from Wildfire Risk are more severe than that of PSPS Risk.

SDGE-1.11.5

"C7/M2-T2 – Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 2)" does not affect the PSPS impact risk reduction even though it does for "C7/M1-T1 – Overhead Distribution Fire Hardening – Covered Conductor (HFTD Tier 3)."

SDGE-1.11.6
Citing pole brushing as just one example, SDG&E deferred to SME judgment for an effectiveness of mitigation value of 40 percent without providing any corresponding justification in the workpapers. Any application of SME judgment should rightfully be subject to greater scrutiny from stakeholders.

SDGE-1.11.7
Although the effect of the reduction in ignitions (as a percentage or rate) can be applied to either the LoRE or the CoRE and produce the same risk score reduction, the Settlement Agreement requires SDG&E to specifically apportion the effect and magnitude of the mitigating activity to LoRE and CoRE as appropriate.

SDGE-1.11.8
Staff observes that none of the costs of the 12 foundational programs, which total approximately $390 million in mostly capital costs in the 2022-2024 time period, were apportioned to the various risks.

SDGE-1.11.9
The RSE can be misleading because the metric is a measure of cost efficiency and not necessarily effectiveness. For the highest RSE programs in both Wildfire Risk mitigation (C3-T3) and PSPS Impact mitigation (C9/M4-T1) mentioned above, the risk reduction for each program is below the median risk reduction score (114) for the 48 scored control and mitigation programs. C3-T3 is not a mitigation in the HFTD, the highest risk portion of SDG&E's service territory for Wildfire Risk.

SDGE-1.11.10
SDG&E presents Alternative 1, the full undergrounding of circuit miles, that is already known to be too costly for full implementation. The selection of Alternative 1, therefore, does not represent a plausible alternative.

SDGE-1.11.11
With a component of the Wildfire Risk as important as the PSPS impact, SDG&E does not present alternative mitigations specific to that risk once a PSPS action is initiated.

SDGE-1.12 Recommended Solutions to Address Findings and Deficiencies.
Based on its findings, Staff recommends that SDG&E implement the following changes with its subsequent filing(s) related to the Wildfire Risk, in the General Rate Case filing:

SDGE-1.12.1
SDG&E should present the DTs according to its top concerns and priorities, either through expected frequency or LoRE associated with each DT, or arranging the DTs in rank order, from highest priority or expected frequency to lowest priority or expected frequency.

SDGE-1.12.2
SDG&E should explicitly quantify the exposure of its assets for the Wildfire Risk and the customers exposed to PSPS impact risk.

SDGE-1.12.3
SDG&E should provide additional granularity of tranches by establishing distinct risk profiles within each tier or location tranche based on any number of characteristics, including distribution lines versus transmission lines, geography, environment, weather variables (i.e., wind speeds, elevation, microclimate, etc.).

SDGE-1.12.4
SDG&E should present the units of work in the control and mitigation programs according to circuit miles or circuit segments.

SDGE-1.12.5
SDG&E should present the full risk profile for all 627 overhead circuit segments in the HFTD, allowing Staff and interested parties to evaluate risk and risk reduction in a targeted way.

SDGE-1.12.6
SDG&E should analyze PSPS impact risk separately from Wildfire Risk assets by creating tranches to reflect impacts to different types of customers from PSPS events. SDG&E should consider additional residential customer demographics, as tranches or as a measure of consequence, including Access and Functional Needs and those enrolled and eligible for Medical Baseline, business customers, public utility customers, first responders, and local governments.

SDGE-1.12.7
SDG&E should provide the Wildfire Risk CoRE and the PSPS impact CoRE broken down by tier. Otherwise, interested parties might find it odd or problematic to see the overall Wildfire Risk CoRE lower than the PSPS impact CoRE.

SDGE-1.12.8
SDG&E should provide written explanation as to why "C7/M1 – Overhead Distribution Fire Hardening – Covered Conductor" has an effect on PSPS impact risk reduction in Tier 3 but not in Tier 2.

SDGE-1.12.9
SDG&E should always provide written justification or explanation of the reasoning for any application of SME judgment for an assumed effectiveness of mitigation.

SDGE-1.12.10
SDG&E should explicitly detail and apportion to which side of the bow tie – LoRE or CoRE – it attributes the effect and magnitude of risk reduction.

SDGE-1.12.11
SDG&E should treat foundational programs in a manner consistent with Ordering Paragraphs 1(e) and 1(g) in the Final Decision in Phase 1 of R.20-07-013 approved on November 4, 2021.

SDGE-1.12.12
SDG&E should provide supplemental data in the GRC filing to show which of the control and mitigation programs have a risk reduction score above the median and an RSE above the median, to indicate which programs are more effective and efficient for risk reduction.

SDGE-1.12.13
SDG&E should provide a different alternative by which to evaluate the selected Proposal than Alternative 1.

SDGE-1.12.14
SDG&E should also make its case stronger for selecting Proposed rather than the two alternatives by providing all relevant information – cost, risk reduction, RSE, etc. – in a single table for direct comparison of Proposed to Alternative 1 and Alternative 2.

SDGE-1.12.15
SDG&E should consider separating the analysis of PSPS Risk from Wildfire Risk, either as a distinct subchapter within the Wildfire Risk or a completely different risk chapter, whether or not it meets the threshold for the top 40 percent of ERR risks with a Safety Risk Score greater than zero. Doing so would free SDG&E up to provide detailed analysis of PSPS-specific tranches, risks, and PSPS-specific controls and mitigations.

SDGE-2 Electric Infrastructure Integrity

SDGE-2.1 Risk Description

SDG&E describes Electric Infrastructure Integrity (EII) risk as the risk of a failed asset[203] outside of the High Fire Threat Districts (HFTDs) in SDG&E's service territory resulting in an incident that impacts safety, reliability, potential liability, and stakeholder satisfaction.

While most of the electric asset failures in this chapter have a reliability consequence, a safety consequence example for this risk is an energized wire-down event caused by the failure of an electric component (e.g., a connector). If a member of the public contacts the energized wire, the asset failure could result in injury or death.

SDG&E clarified in the September 9, 2021, RAMP workshop[204] that the EII risk includes some incidents in High Fire Threat Districts (HFTDs) from underground assets, which do not entail wildfire risk. Most of the assets are in electric distribution. Transmission assets within the scope of CPUC jurisdiction are also included in the risk.

Observations

SDG&E states that this risk "has remained stable over recent years" and cites its history of industry awards for reliability. Reliability is the most significant consequence attribute in the risk score as discussed in the Risk Score section.

SDGE-2.2 Bowtie

The figure below is the bowtie diagram, Figure 1 from the SDG&E chapter. It illustrates the risk drivers that lead to electric asset failure and the associated consequences included in the utility's risk definition and scope.

The Risk Drivers or Triggers are:

DT.1 – In-service equipment past its useful life or that becomes obsolete.
DT.2 – Equipment in-service beyond design specifications.
DT.3 – In-service equipment failing prematurely.
DT.4 – Active in-service equipment and associated components failing to operate as designed.
DT.5 – In-service equipment failing with lack of or delayed company insight.
DT.6 – In-service equipment contacted by customers or third parties.
DT.7 – In-service equipment failing in large volume (i.e., simultaneous failure of numerous assets) due to acute climates or environmental conditions.

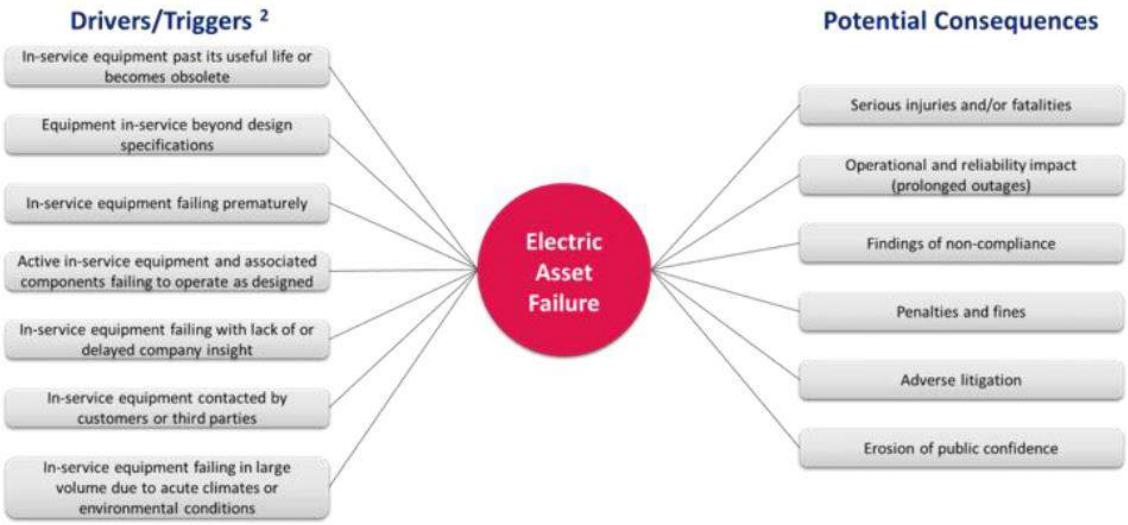
Potential Consequences in the EII risk assessment are:

PC.1 - Serious injuries and/or fatalities.

[203] SDG&E 2021 Risk Assessment and Mitigation Phase Report Chapter 2 (SDGE RAMP-2) at 4; failed asset is a utility asset that is no longer performing as designed or otherwise incapacitated
[204] Workshop recording at CPUC webpage: Risk Assessment and Safety Analytics (ca.gov)

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.

SDG&E EII Risk Bowtie, from their Risk Chapter



SDG&E-2.3 Exposure
No exposure data was provided in the chapter.

Observations
The S-MAP Settlement Agreement defines exposure as "the measure that indicates the scope of the risk, e.g., miles of transmission pipeline, number of employees, miles of overhead distribution lines, etc. Exposure defines the context of the risk, i.e., specifies whether the risk is associated with the entire system, or focused on a part of it."[205] Exposure information defines the context of the risk being evaluated and mitigated and was provided in the 2019 PG&E RAMP. Staff found limited discussion on risk exposure in this chapter.

SDG&E-2.4 Tranches
SDG&E provides a single LoRE and CoRE value to all EII risks in this chapter. But some of the controls are described as tranches. For example, Control C20, Substation Reliability for Distribution Components, is divided into eight tranches corresponding to equipment replacement projects for eight different substations. Each of these tranches has an associated risk reduction and RSE value.

[205] CPUC Decision D.18-0-12-014, *Phase Two Decision Adopting Safety Model Assessment Proceeding (S-MAP) Settlement Agreement with Modifications*, (Settlement Agreement) Appendix A at A-2.

Observations

While SDG&E calculated an RSE for each identified tranche, they did not present a unique LoRE or CoRE for them. As a result, the SDG&E RAMP filing is not consistent with the Settlement Agreement[206] requirements. In particular, Row 16 states: "The effects of a mitigation on a Tranche will be expressed as a change to the Tranche-specific pre-mitigation values for LoRE and/or CoRE. The utility will provide the pre- and post-mitigation values for LoRE and CoRE determined in accordance with this Step 3 for all mitigations subject to this Step 3 analysis."

SDG&E-2.5 Likelihood of Risk Event (LoRE)

Table 2 from the EII chapter shows a Likelihood of Risk Event (LoRE) of 1,632 events per year, an aggregate LoRE for the entire risk scope.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[14]

	LoRE	CoRE	Risk Score
Electric Infrastructure Integrity	1,632	6	9,177

According to SDG&E, the system-wide LoRE value of 1,632 is the sum of expected incidents per year based on internal reliability and SIF data from 2016 to 2020 according to SDG&E.[207] The Workpaper breaks down the incidents as: Distribution 1,623, Substation 7, and Manhole/Handhold/Plate 2. During the September 2021 RAMP workshops, SDG&E confirmed all EII incidents were service outages.

Observations

The EII LoRE is the largest of all the SDG&E RAMP risks and is the reason the risk score is relatively high. In the September 9, 2021 workshop,[208] Staff asked whether there was an increasing or decreasing trend in the number of incidents. SDG&E replied the data is spiky. SPD staff cannot conclude whether the current controls are sufficient to reduce the number of incidents, but a continuing effort should be applied because of the high risk score.

SDG&E-2.6 Consequence of Risk Event (CoRE)

SDG&E calculated a consequence score of 5.62 (displayed as 6) for this risk. The MAVF must include at least Safety, Reliability, and Financial attributes. Under the Settlement Agreement, additional attributes may be added. Sempra has defined a new attribute, Stakeholder Satisfaction, for this RAMP. For the EII risk, the largest attribute is Reliability, followed by Stakeholder Satisfaction, Safety, and Financial consequences.

TABLE SDG&E-2.1 EII CoRE Consequence Attributes

	Total CoRE	Safety	Reliability	Financial	Stakeholder Satisfaction
CoRE Score	5.62	0.38	3.8	0.16	1.29

[206] Settlement Agreement Appendix A.

[207] Final 2021 workpaper -SDG&E EII Level 2.

[208] Workshop recording on CPUC website here: Risk Assessment and Safety Analytics (ca.gov)

CoRE Contribution	100%	6.7%	67%	0.3%	23%
MAVF Weight, %		60	23	15	2

The very low EII CoRE of 5.62 ranks about even with the Medium Pressure pipeline CoRE but far below the others in the RAMP; the next highest is Contractor Safety with a CoRE of 1,033.

Observations

In this chapter, the safety attribute is based on a natural value safety index[209] of 0.000125 per incident. Then, for the total number of incidents of 1,632, the expected fatality number is 0.20 (one in five years), or equivalently one serious injury in 15 months. For this reason, the EII risk met the threshold for inclusion in the RAMP, even though there is ten times more reliability risk than safety risk.

Staff is concerned that Sempra's addition of the Stakeholder Satisfaction attribute to the MAVF risk model may skew the EII risk. It contributes 23 percent of the risk score compared to only 6.8 percent from the safety attribute even though it only comprises two percent of the weight in the MAVF. The relatively large influence of Stakeholder Satisfaction on EII is unique among the RAMP risks in the Sempra Companies' submittal. As such, it warrants some exploration and discussion here.

The companies introduced this new attribute to Staff and parties in the prefiling workshops held in October 2020 as "Trust/Reputation." When initially presented, it had a weighting of five percent rather than the current two percent. Based on party feedback, Sempra changed the name of the attribute to "to better reflect the attribute's intent and function."[210]

The Sempra Companies correctly point out that the use of this attribute marks the first time an IOU has expanded the attributes in the MAVF beyond those required by the settlement agreement. Staff agrees that expansion of attributes to more comprehensively capture risks of utility operations. We also appreciate that it is difficult to quantify these less tangible, but important aspects of public experiences associated with risk events. However, staff has concerns about its use in justifying expenditures at this point. As described in the Sempra Companies' RAMP report, this attribute and subattributes appear to be entirely subjective and qualitative. Staff recognizes that many aspects of the attributes in the MAVF have subjective elements and qualitative evaluations based on SME judgment. However, based on the information provided, this attribute appears to lack any objective measurements.

This attribute is intended to "measure changes in satisfaction levels" of the subattributes, which include customers, the public, employees, government, and regulators. Stakeholder Satisfaction is scored on a 0-100 scale with a maximum of 20 going to each subattribute.

The Sempra RAMP Report does not include sufficient information to evaluate this attribute. For example, how are the scores for customers and the public distinguished to avoid overlap? How are

[209] Safety index = number of expected fatalities plus ¼ of serious injuries.
[210] SCG/SDG&E-RAMP Chapter A at 10.

regulators and government separated? Why are the public and regulators provided the same maximum score of 20 ?

To illustrate the concept, the Sempra Companies provide the following 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 example in and of itself raises several additional questions that are not addressed in the utilities' filing. For instance, is reliability not a strong proxy for customer and public satisfaction? Few things are more frustrating for customers and members of the public than a loss of service. How does Sempra avoid this attribute acting as a multiplier on reliability? How are "customers" and the "public" distinguished when they are frequently the same population?

The gas line rupture example also brings up "mental health issues." In cases where utility-caused incidents resulted in traumatic experiences, they are subject to substantial civil liability expenses they are precluded from recovering under D.16-08-018. How do the utilities ensure whatever mental anguish is assigned to customers and the public is not already being compensated for in a legal settlement?

Further, aside from these methodological issues, there is also the question of whether or not this can be called a "measurement." According to the RAMP report, "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…"

Finally, in row 29 of the Settlement Agreement pertaining to transparency states, "When SME judgment is used, the process that the SMEs undertook to provide their judgment should be described." No such description is provided.

Given these challenges, the great extent of subjectivity involved, Staff do not believe that Stakeholder Satisfaction should be used at this point to calculate risk scores.

SDG&E-2.7 Pre-Mitigation Risk Score

The Pre-Mitigation Risk Score for this risk is 9,177 for all jurisdictional electrical assets not located in the HFTDs in SDG&E's service territory (but also including underground assets in HFTDs). As noted earlier, there are no separate risk scores for the tranches identified. The Risk Score is the product of the likelihood times the consequence (LoRE x CoRE).

The EII risk score is second only to the wildfire risk score of 16,459. This high score is driven by the large number of expected incidents, or LoRE. Although the CoRE is small, the risk score is sensitive to changes in CoRE due to the high LoRE.

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[14]

	LoRE	CoRE	Risk Score
Electric Infrastructure Integrity	1,632	6	9,177

Observations

In this chapter, SDG&E's risk modeling produces a single risk score for the entire system. This result leaves the impression that all assets outside the HFTDs have the same risk, despite differences in environments and equipment across its service territory, which is unlikely.

SDGE-2.8 Controls and Mitigations

Controls

SDG&E presents forty control programs such as C1, Overhead Public Safety, C4, Distribution Overhead Switch Replacement, C6, Vegetation Management (non-HFTD) and C20, Substation Reliability Program. Some of these Controls are divided into projects described as tranches, indicated by the "-T" suffix in the control ID. For example, C20 is broken down into eight tranches for eight different electric substations.

Observations:

All controls are reasonable and are common in the industry.

Mitigations

SDG&E proposes two mitigations in the EII chapter of the RAMP report: Wireless Fault Indicator and Underground Fault Detection. The first mitigation is a non-HFTD wireless fault indicator. The second is underground fault detection, a common utility mitigation practice.

SDG&E-2.9 Risk Spend Efficiency (RSE)

Twenty-nine of the forty controls have an RSE value. The exceptions were noted in the RAMP chapter with corresponding rationales.

Control RSEs

The higher cost controls tend to have lower RSEs. The controls with higher RSEs tend to have lower costs.

Table SDGE-2.2 Top 10 Controls by Cost with RSE

ID	Control/Mitigation Name	Total Cost ($M)	RSE
C6	Tree Trimming	$121.65	15
C15	Corrective Maintenance Program- Service Connections and Minor Capital Units	$44.63	61
C1	Overhead Public Safety (OPS)	$21.73	78
C3	4kV Modernization Program- Distribution (Overhead, Underground and package Substation removal)	$20.58	11
C14	DOE Switch Replacement	$19.43	60
C10-T2	Underground cable replacement program - UG Branch	$15.54	166
C10-T3	North Harbor Project	$14.91	201
C23	San Mateo Substation	$13.90	15
C20-T6	Scripps 12kV Replacements	$12.32	25
C18	Distribution Circuit Reliability Construction	$11.70	15

Table SDG&E-2.3 Top 10 Controls by RSE

ID	Control/Mitigation Name	Total Cost ($M)	RSE
C11	Tee Modernization Program	$11.47	938
C10-T1	Underground cable replacement program - UG Feeder	$0.53	465
C8	Avian Protection Program	$1.87	409
C4-T3	High Risk Switch Replacement program - Hook	$1.65	241
C10-T3	North Harbor Project	$14.91	201
C4-T2	High Risk Switch Replacement program - Gang	$0.42	190
C10-T2	Underground cable replacement program - UG Branch	$15.54	166
C20-T2	Bernardo 12 kV Breakers Replacements	$1.00	146
C4-T1	High Risk Switch Replacement program -SCADA	$0.62	101
C20-T5	Miramar 12kV Replacements	$1.42	101

Mitigation RSEs

SDG&E did not provide RSEs for the two proposed mitigations, stating for each that 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."

Observations:

Fourteen of the forty controls are labeled as tranches, but none have different risk scores, which is a defining characteristic of a tranche ("a logical disaggregation of a group of assets (physical or human) or systems into subgroups with like characteristics for purposes of risk assessment)."[211] Risk Spend Efficiency must be determined at the tranche level using the distinct LoRE and/or CoRE for each tranche. SDG&E did not present distinct scores for the tranches, so the RSE calculations do not meet Settlement Agreement requirements.[212] Instead, SDG&E used their own methods to calculate risk reduction for each control, which may or may not have produced similar results to the Settlement Agreement method.

SDG&E-2.10 Alternatives Analysis

SDG&E presents three alternative mitigation programs. The first alternative, A1 - Customer Owned E-Structure Reconfigure. This alternative applies to transformers located on fenced and secured customer property but not pad mounted. The mitigation consists of moving the transformers to pad mounts or locating facilities overhead to reduce the risk of exposed components, which are more likely to fail. This alternative is not currently included in SDG&E's safety proposals due to the administrative requirements that would be necessary to implement, e.g., property easements. SDG&E also states that it would have "minimal reliability benefit."

The second alternative, A2 - Modernize Manual Switches, is grid modernization by replacing manual switches. In this alternative, SDG&E proposes to replace every overhead and underground manual distribution switch with a SCADA switch. This modernization would upgrade distribution system operations, improve visibility of grid conditions, and improve situational awareness. SDG&E states that this alternative is not included since it would not directly impact public safety.

Finally, alternative A3 - Avian Protection Program expands the existing avian protection program to prevent bird and other wildlife contacts, which can cause asset failures. This is not currently included in SDG&E safety plans because SDG&E has determined that this alternative does not impact public safety.

Observations:

SPD Staff notes that the RSEs for these alternatives[213] do not compare favorably to the existing controls, which supports SDG&E rejection of them as mitigations.

SDG&E-2.12 Summary of Findings

[211] Settlement Agreement Appendix A at A-4.
[212] Settlement Agreement Appendix A, Row 16.
[213] SDGE RAMP-2 Table 10: Alternative Mitigation Plan - Quantitative Analysis Summary.

Based on the observations presented above, findings are summarized here.

SDG&E-2.12.1 Inclusion in RAMP
Although the safety element of this risk is small, it was large enough to meet the requirement for inclusion in RAMP.

SDG&E-2.12.2 Risk Scope Definition
SDG&E describes the risk as limited to non-HTFDs; however, they later clarified that underground assets in HFTDs were included.

SDG&E-2.12.3 Possible Non-Relevant Consequences
It is not clear whether the RAMP consequences of PC.3, Findings of non-compliance, PC.4, Penalties and fines and PC.5, Adverse litigation, may include shareholder costs. Further, PC.6, Erosion of public confidence, may be outside the concern of the CPUC's goals of safe, reliable, and affordable service.

SDG&E-2.12.4 Risk Exposure
The RAMP does not provide information on the risk exposure; in this case the number and type of assets that are subject to failure.

SDG&E-2.12.5 Tranche Risk Calculation
SDG&E identified tranches but did not present tranche-based risk scores, that indicate the different levels of risk that each tranche has. The Tranche analysis is not in compliance with Settlement Agreement requirements.

SDG&E-2.12.6 Stakeholder Satisfaction
SDG&E introduced a new Stakeholder Satisfaction attribute. Staff is concerned about this highly subjective qualitative metric impacting RAMP priorities. At the same time, these types of attribute may eventually help account for indirect impacts such as health, societal, environmental, or public health impacts and warrant further exploration.

SDG&E-2.12.7 Mitigation RSEs
SDG&E did not present RSEs for the proposed mitigations, explaining these are foundational programs.

SD&E-2.13 Recommended Solutions to Address Findings and Deficiencies

SDG&E-2.13.1
All RAMP reports should confirm each risk's inclusion in the RAMP by presenting the safety attribute score at the start of each chapter.

SDG&E-2.13.2
SDG&E should clarify that the Risk Scope includes underground assets in HFTDs in any future filings about the EII risk.

SDG&E-2.13.3

SDG&E should confirm that shareholder costs are not included in the consequences and revise risk scores accordingly. In addition, SDG&E should explain how PC.6, Erosion of public confidence, is appropriate for RAMP and revise risk scores accordingly.

SDG&E-2.13.4
SDG&E should present exposure information to give more context on the extent of the risk.

SDG&E-2.13.5
SDG&E should comply with the Settlement Agreement requirements for tranche risk scores.

SDG&E-2.13.6
Sempra should continue to refine the Stakeholder Satisfaction attribute. This attribute is highly subjective and of questionable value in the MAVF at this point. SDG&E should provide risk priorities with and without this attribute incorporated into the MAVF. If it significantly changes risk prioritization, SDG&E and SoCalGas should offer a transparent explanation as to how the numbers were derived.

SDG&E-2.13.7
SDG&E should treat foundational programs in a manner consistent with Ordering Paragraphs 1(e) and 1(g) in the Final Decision in Phase 1 of R.20-07-013 approved on November 4, 2021.

SDGE-5 Customer and Public Safety – Contact with Electric Equipment

SDGE-5.1 Risk Description

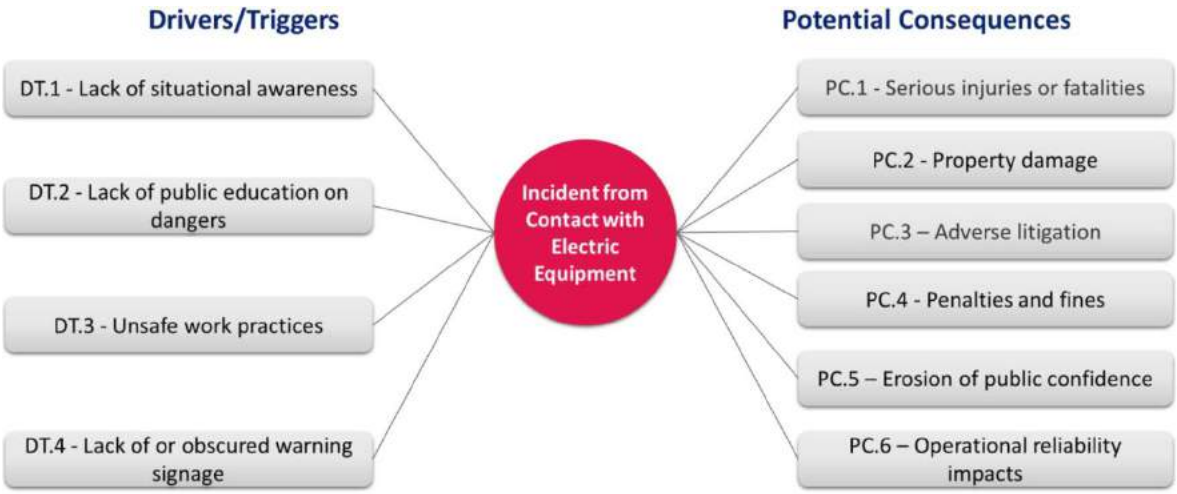
SDG&E's Electric Contact risk is defined as the threat of harm to a customer, third-party, or member of the public from contacting in-service electrical equipment that is operating in a normal configuration.[214] Consequences of Electric Contact risk include serious injury, fatality, and property damage.[215]

Observations:

The Electric Contact risk was not presented in the company's previous Risk Assessment Mitigation Phase (RAMP) Reports.

SDGE-5.2 Bowtie

SDG&E lists four drives/triggers: Lack of situational awareness, lack of public education on dangers, unsafe work practices, and lack of or obscured warning signage. SDG&E lists six potential consequences: serious injuries or fatalities, property damage, adverse litigation, penalties and fines, erosion of public confidence, and operational reliability impacts. [216]



Observations:

SDG&E included reasonably foreseeable drivers. However, the bow-tie lacked important details to evaluate the application. SDG&E did not rank their drivers/triggers. There was one likelihood score with no distinction between risk drivers that would reveal a basis for prioritization. SDG&E did not identify potential leading indicators. SDG&E noted they used a risk assessment, but SDG&E

[214] SDG&E 2021 RAMP Report (SDG&E RAMP) at 5-3.
[215] SDG&E RAMP at 5-2.
[216] SDG&E RAMP at 5-4.

did not indicate if the assessment ranked which triggers/drivers are more likely to cause a potential consequence.

SDGE-5.3 Exposure
SDG&E does not specify the number or scope of people subject to this risk.

SDGE-5.4 Tranches
There is no separation of the risk into tranches.

Observations:
The SDG&E RAMP report explains that their costs are not tracked by tranches of electric equipment assets, but instead by cost center and budget code.[217]

SPD Staff notes that the Settlement Agreement Requirement 14 states: "The determination of Tranches will be based on how the risks and assets are managed by each utility, data availability and model maturity, and strive to achieve as deep a level of granularity as reasonably possible. The rationale for the determination of Tranches, or for a utility's judgment that no Tranches are appropriate for a given Risk Event, will be presented in the utility's RAMP submission."

While it may be difficult to assign exact costs to tranches because of accounting practices, SDG&E should make an effort to define portions of the risk that have distinctly different risk levels and estimate the costs associated with control and mitigation programs focused on those tranches.

SDGE-5.5 Likelihood of Risk Event (LoRE)
SDG&E's LoRE is 1.17 risk events per year.

Observations:
The low number of expected events indicates that contact with live electrical equipment by a third party is not frequent.

SDGE-5.6 Consequence of Risk Event (CoRE)
SDG&E's total CoRE consequence score is 1,197.

Observations:
98% of SDG&E's CoRE is due to the safety attribute, which is based on a safety index of 0.39.[218] That safety index is equivalent to about one fatality, or four serious injuries, in 2.5 events, which explains the high consequence score.

SDGE-5.7 Pre-Mitigation Risk Score
SDG&E's pre-mitigated risk score is 1,396, which ranks fifth-highest of the SDG&E RAMP risks.

Observations:

[217] SDGE RAMP at 5-11.
[218] Final 2021 Workpaper SDG&E ContactwithElectric_Level 2.

The risk score is the product of the low LoRE and high CoRE.

SDGE-5.8 Controls and Mitigations

Controls

SDG&E expects to maintain control C1, General Safety Communications. General Safety Communications includes social media posts, paid media, press releases, safety messaging on SDG&E's website, and bill inserts/ads. In addition, SDG&E performs inspections of its electrical equipment under programs such as the Company's Corrective Maintenance Program (CMP), conducted pursuant to CPUC General Order 165.[219]

Observations:

The current controls are limiting electric contact events to about one a year. The RAMP does not provide any historical trend or other data to show if this rate has improved over time.

Mitigations

SDG&E proposed two new mitigations to address further the Electric Contact risk: M1, Kids Website Expansion, and M2, Direct Communications to At-risk Businesses.[220]

Mitigation M1is a significant 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 help further educate the community and reach younger audiences.[221]

M2 would expand direct communications with businesses to promote electric safety and identify electric hazards their employees should be aware of. Efforts in 2021 and after will work to develop and produce print material to be mailed to businesses annually.[222]

Observations:

The proposed mitigations appear to focus on further risk reduction. It would be helpful to know if the company has a reduction target they expect to achieve with these new efforts.

SDGE-5.9 Risk Spend Efficiency (RSE)

SDG&E could not quantify the risk reduction benefits for the existing General Safety Communications control or the two proposed mitigations.

Observations:

The RAMP does not include sufficient information for Staff to ascertain the relative efficacy of mitigations and controls.

[219] SDG&E RAMP at 5-6
[220] SDG&E RAMP at 5-9
[221] SDG&E RAMP at 5-9
[222] SDG&E RAMP at 5-10

SDGE-5.10 Alternatives Analysis

The alternatives analysis for the Electric Contact risk also considered modifications to the plan and constraints, such as budget and resources.[223] Alternative 1, K-12 School Curriculum Development, was not pursued due to challenges presented by different school districts within the service territory, distance learning issues, and political barriers for quick execution.[224] Alternative 2, Dedicated Safety Outreach 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 the volume of customer impact, etc.[225]

Observations:

SDG&E's reasons for rejecting alternatives appear reasonable based on the risks, inefficiencies, and barriers identified with implementation.

SDGE-5.11(opt) Scenario Analysis (if available)

SDGE-5.12 Summary of Findings

SPD found the following:

- SDG&E was unable to quantify the risk reduction benefits for the existing General Safety Communications control, or for the two proposed mitigations;
- SDG&E did not rank their drivers/triggers or identify potential leading indicators;
- The RAMP report does not provide the scope of exposure to contact with electric equipment;
- The low number of expected events indicates that contact with live electrical equipment by a third party is not frequent;
- SDG&E has presented a rationale that the way that risks and assets are managed prevents more granular tranching;
- SDG&E's reasons for rejecting alternatives appear reasonable based on the risks, inefficiencies, and barriers identified with implementation.

SDGE-5.13 Recommended Solutions to Address Findings and Deficiencies

SPD recommends that SDG&E quantify the risk reduction benefits for all controls and proposed mitigations in their GRC filing. Additionally, SDG&E should rank their drivers/triggers based on their contribution to the likelihood of risk event. This additional information would allow the CPUC to evaluate and analyze the reasonableness of proposed mitigations to address the top drivers/triggers.

[223] SDG&E RAMP at 5-14
[224] SDG&E RAMP at 5-14
[225] SDG&E RAMP at 5-14

PART B. RAMP Cross-Functional Chapter Evaluations

CFF-1: Asset and Records Management

Both SoCalGas and SDG&E presented Cross Functional Chapters on the topics of Asset and Records Management, labeled as CFF-1 by both companies. The SPD evaluation reviews SoCalGas first, followed by SDG&E.

SoCalGas

CFF-1: Asset and Records Management

SoCalGas has developed an Enterprise Asset Management (EAM) program to manage its assets. The EAM program was designed to be in alignment with the International Standards Organization (ISO) 55000 and the American Petroleum Institute (API) "ANSI/API Recommended Practice 1173: Pipeline Safety Management Systems". SoCal Gas states, "EAM enables SoCalGas to proactively mitigate asset-related risks by managing asset health and lifecycles in a strategic, data-driven method."

CFF-1.1 Risk Description

Asset and Records Management (ARM) is not specifically considered a RAMP risk. Rather SoCalGas considers ARM to be a driver of Risk Events. SoCalGas contends that having accurate and readily available data "will reduce the likelihood of employees or contractors having inaccurate information when undertaking a repair on a pipe or other facility including storage assets."[226]

SoCalGas lists a few examples of risks that their EAM process can impact. These include:

- Incidents Related to the Medium-Pressure System
- Incidents Related to the High-Pressure System
- Incidents Related to the Storage System (Excluding Dig-In)
- Excavation Damage (Dig-In) on Gas System

SoCalGas also discusses how the ARM processes could be considered a risk-driver. They state, "SoCalGas has existing Records Management policies and practices which are largely de-centralized." They continue, "There are a variety of risks that can be attributed to inconsistent records management policies and practices in critical areas associated with RAMP chapters (including those concerning gas incidents)."[227]

Staff agree that any asset failure resulting in a SIF, a near-miss event, loss of service, or loss of property that is the result of inaccurate, out-of-date, or incomplete records are ARM risks.

CFF-1.2 Bowtie

SoCalGas does not provide any Bowtie analysis. As noted above, SoCalGas contends, "CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities, or programs that may

[226] SEMPRA - Risk Assessment and Mitigation Phase Cross-Functional Factor: Asset and Records Management. (SCG-CFF) May 17, 2021. SCG-CFF at 1-7.
[227] SCG-CFF at 1-7.

impact multiple RAMP risks. CFFs are also generally foundational in nature. Therefore, SoCalGas's CFF presentation differs from that of its RAMP risk chapters."

CFF-1.3 Exposure
SoCalGas does not discuss exposure in this chapter because these risks are treated as CFFs.

CFF-1.4 Tranches
SoCalGas does not explicitly discuss tranches (See justification above). They do, however, discuss the development of the EAM system, which they divide into two phases - the current state and the future state of EAM development. For this document, we consider these initiatives and programs as similar to a tranche.

In the current state, critical elements identified by SoCal Gas include:

- The Transmission Integrity Management Program (TIMP) developed in accordance with Code of Federal Regulations (CFR) 192, Subpart O - Gas Transmission Pipeline Integrity Management.
- The Distribution Integrity Management Program (DIMP) developed in accordance with 49 CFR 192, Subpart P - Gas Distribution Pipeline Integrity Management.
- The Storage Integrity Management Program (SIMP) established to mitigate safety-related risks and validate and enhance storage surface assets, well, and reservoir integrity.
- The Facilities Integrity Management Program (FIMP) based on principles developed by the Canadian Energy Pipeline Association and the Pipeline Research Council International.

SoCalGas also describes several IT improvements, analytics development projects, and workflow integration projects under development. These initiatives "will provide asset health indices and additional analytics to support the IMPs and provide asset information not addressed within the IMPs."

Some of the key elements identified in this future include:

- a data lake to capture the asset data;
- a tool for asset investment planning to optimize expenditures;
- an operating model for governing asset management activities; and
- improved records management to enhance documentation of criteria used to make decisions.

CFF-1.5 Likelihood of Risk Event (LoRE)
SoCalGas does not assign LoRE values to these CFF risks (See justification above 6.2- BowTie)

CFF-1.6 Consequence of Risk Event (CoRE)
SoCalGas does not assign CoRE values to these CFF risks. (See justification above 6.2- BowTie)

CFF-1.7 Pre-Mitigation Risk Score
SoCalGas does not establish pre-mitigation risk scores for these CFFs. (See justification above 6.2- BowTie)

CFF-1.8 Controls and Mitigations

CFF-1.8.1 Controls

SoCalGas does not explicitly refer to its existing programs within ARM as controls. However, the utility does offer a summary of existing 2020-year systems and programs, which staff treat as controls.

- Administration of Records Management Policies
  - A Records and Information Management (RIM) program that administers corporate policy and procedure and acts as a steward for individuals and assigned records coordinators.
- Training on Records Management Policies and Procedures
  - All employees are required to complete annual records management training.
- Annual Monitoring and Self-Verification
  - An annual Record Retention and clean-up/disposal effort organized through the Enterprise Risk & Compliance group and the local IM Coordinators.
- Operational Compliance and Oversight
  - An Information Governance (IG) group that continues executing on the records management element of EAM and improves records management capabilities and oversight of day-to-day activities.
- Information Management Systems
  - A variety of information systems that fulfill the unique needs of all workgroups, including critical records, maintenance, safety, legal, fiscal, and contractual records.

CFF-1.8.2 Mitigation Plan

SoCalGas does not explicitly refer to its future programs within ARM as mitigations. However, the utility does offer a summary of future 2022-2024-year programs and initiatives, which the reviewer will treat as mitigations.

- Enhancements of Continuing Records Management Activities
  - The Information Governance (IG) program team (Section IV(D), above) intends to assess further the maturity of the current IG procedures and practices and map out the path to the future state in areas needing improvement or adjustment.
- Establish a Data Lake
  - SoCalGas envisions having a foundational data lake as the repository to capture data from the following asset sources: Geographical Information, Asset Registers, Materials Management, Financials, Leaks/Incident Reports, Project Management, Work Orders, and External Sources. The data lake will aggregate the data by asset class to identify risks and, ultimately, allocate resources to mitigate asset failure risk likelihood, frequency, and impact.
- Asset Investment Planning (AIP) Tool
  - An AIP tool will generate assessments that provide risk quantification criteria to enhance risk-based decision-making capabilities.
- Establish an Enterprise Asset Management Operating Model
  - A strategic initiative to integrate asset-based information into decision-making. This initiative includes elements that will develop or enhance programs in the following areas:

- Strategic organization and planning
- Visibility into asset health
- Information accuracy
- Analytics development
- Coordination of new systems
- Support for legacy systems
- Training programs
- Lessons-learned and accountability

CFF-1.8.2 Existing Costs and Expected Budget Request

SoCalGas does provide costs for the programs listed above. SoCalGas does not provide any context or justification for their forecast budget. The cost table is reproduced below.

Table 1: Costs (Direct After Allocations, in 2020 $000)[7]

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	Administration of Records Management Policies	0	42	0	0	38	48
2	Operational Compliance & Oversight	0	239	0	0	215	275
3	Information Management Systems	19,838	12,371	59,100	75,517	12,889	16,469
4	Continuous Improvement of Records Management	0	0	0	0	Included in Lines 1-3	Included in Lines 1-3
5	Establishing a Data Lake	0	0	8,867	12,808	2,925	4,225
6	Asset Investment Planning (AIP) Tool	0	0	6,743	9,740	686	991
7	Establish an Enterprise Asset Management Operating Model	0	0	10,530	15,210	1,890	2,730

CFF-1.9 Risk Spend Efficiency (RSE)

SoCalGas offers no RSE for this risk sub-category.

CFF-1.10 Alternatives Analysis

SoCalGas makes no mention of plan alternatives and offers no discussion of mitigation measures considered but not advanced.

CFF-1.12 Summary of Findings

Based on the observations presented above, findings are summarized here.

SoCalGas RAMP submission of CFF 1 clearly indicates that they have:

- An understanding of the role that Asset and Records Management plays in managing and reducing the likelihood of safety incidents
- A commitment to improving their systems and processes in this area
- A significant investment in developing a new strategic process that will further develop, enhance, and integrate EAM into decision-making.

While this basic EAM organizational framework is a good starting point, SoCalGas has not put forth any quantitative risk assessment of its ARM systems. There is no mention of any process they have used to evaluate the level of risk in the current state of ARM, nor any assessment of the expected improvements from the proposed mitigations.

For example, SoCalGas states that "a comprehensive records management system where asset data is readily accessed will reduce the likelihood of employees or contractors having inaccurate information when undertaking a repair on a pipe or other facility including storage assets." However, while SoCalGas recognizes this event can (and presumably does) occur, they provide no assessment or insight into how often this actually occurs. Nor do they provide any information about how many "near-miss" data gaps[228] might reside in their systems and data repositories.

Additionally, in its assessment of future needs, SoCalGas states that "The data lake will aggregate the data by asset class to identify risks and, ultimately, allocate resources to mitigate the likelihood, frequency and/or impact from asset failure risks." SoCalGas, however, does not provide the likelihood and frequency of these events under the current state without the proposed mitigations. However, SoCalGas provides the costs for the data lake initiative, which has a Capital budget of $8.8M to $12.8M and operating costs of $2.9M to $4.2M. Program costs with no quantified benefit do not provide the Commission with any basis to evaluate the value of this $10+M investment.

SPD concludes that SoCalGas has not adequately profiled the impact that ARM has on Risk Events. They have not provided any quantitative assessment of how their proposed mitigations would improve upon their current risk profile.

SoCalGas acknowledges that they have more work to do and states that their "EAM program, while meeting or exceeding compliance requirements, lacks advanced data analytics on asset health and lifecycle projections, as well as integration of additional data sources across operational platforms."[229]

While "advanced data analytics" may be useful at some point in the future, SoCalGas has not even provided a rudimentary analysis of risks to justify the $30+M costs of the EAM initiatives.

To summarize, some of the gaps in this RAMP submission are that SoCalGas:

[228] We refer to a "near-miss" data gap as some piece inaccurate or missing data of a critical asset or process that has not yet resulted in a Risk Event.
[229] SCG-CFF at 1-4.

- Does not provide any quantitative analysis to justify the value of program benefits;
- Does not identify ARM tranches;
- Does not comprehensively identify risk drivers;
- Does not quantify the current status of ARM risks; and
- Does not discuss or quantify the level of expected mitigation benefits.

While we have identified several gaps in SoCalGas RAMPS submission, we do not suggest that SoCalGas must use the SMAP risk modeling approach - i.e. bowtie, tranches, etc. - to characterize CFF risks. The indirect and interrelated nature of the CFFs may require an innovative and novel approach to generate a credible assessment of the risk impacts due to ARM processes. SoCalGas demonstrates that they are aware that creative and innovative actions will be needed, but has not yet made any reasonable or credible attempt to provide a quantitative assessment of the benefits that future ARM programs will have on the safe operation of their system.

CFF-1.13 Recommended Solutions to Address Findings and Deficiencies.

The SoCalGas report is a welcome first step, however, CFF 1 reads more like a vision document for a new strategic initiative rather than a rigorous assessment of the risks of ARM.

SoCalGas appears to have a well-considered plan but lacks a detailed assessment of the current needs and gaps necessary for a meaningful analysis.

To evaluate the proposed expenditures in the context of the RAMP, Staff would need additional information. This additional information includes but is not limited to:

- An assessment of the risk of inaccurate records
  - An estimate of the accuracy of records
  - What % of inaccurate records are associated with critical assets?
  - What % of critical assets have inaccurate records?
  - How often is this critical information needed?
  - What are the consequences – by tranche - of inaccurate information?
  - How are operational decisions impacted when there is inaccurate information?
- An assessment of the risk of missing records
  - An estimate of the percentage of missing records.
  - What percentage of missing data is associated with critical assets?
  - What percentage of critical assets have missing data?
  - How often is this critical information needed?
  - What are the consequences – by tranche - of missing information?
  - How are operational decisions impacted when there is missing information?
- An assessment of the Value-Of-Information (VOI) of missing or inaccurate records.[230] This task might be broken into subsets of high priority, medium, and low priority records (i.e., tranches) and then more detailed VOI into the mission-critical assets and operations-related records.
- The expected risk reduction that improved ARM processes could have in contributing to the company's overall safety and reliability.

[230] For background on VOI, see H*oward, Ronald (1966). "Information Value Theory". IEEE Transactions on Systems Science and Cybernetics.* ***2*** *(1): 22–26.*

- An estimate of the value of the benefits for each program.

While the CFF1 report made it clear that SoCalGas is already moving forward with these types of recommendations, SoCalGas should not delay reporting this information because a fully developed EAM system is not yet complete – i.e. a rudimentary analysis is better than no analysis at all.

The information provided in this chapter, including the lack of alternative analysis, leaves staff unable to determine if the recommendations listed above would require a $30+M budget and two years to complete and whether the investments described here would be cost-effective.

SDG&E

CFF-1: Asset and Records Management

SDG&E has developed an Asset Management System (AMS) to manage its assets. The AMS includes an Asset Integrity Management (AIM) program which is building compliance with ISO 55000 standards and requirements. SDG&E envisions that AMS will help fulfill several goals including "asset safety, improved performance and measurement, risk-informed decision making, demonstrated compliance, and improved efficiencies and effectiveness of asset and operations."[231]

CFF-1.1 Risk Description

Asset and Records Management (ARM) is not specifically considered a RAMP risk. Rather SDG&E considers ARM to be a driver of Risk Events. SDG&E, however, lists a few examples of risks that their AMS process can impact. These include:

- SDG&E-Risk-1, Wildfires Involving SDG&E Equipment (Including Third Party Pole Attachments)
- SDG&E-Risk-2, Electric Infrastructure Integrity
- SDG&E-CFF-6, Records Management

While SDG&E does not explicitly state it, CPUC staff asserts that any asset failure resulting in a SIF, a near-miss event, loss of service, or loss of property that is the result of inaccurate, out-of-date, or incomplete records are ARM risks.

CFF-1.2 Bowtie

SDG&E does not provide any Bowtie analysis. As noted above, SDG&E contends, "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."

CFF-1.3 Exposure

SDG&E does not discuss exposure in this chapter because these risks are treated as CFFs.

[231] SCG-CFF at 1-2.

CFF-1.4 Tranches
SDG&E does not explicitly discuss tranches (See justification above). They do, however, discuss the development of the AMS system, which they divide into two phases - the 2020 Projects and Programs and 2022-2024 Projects and Programs. For this document, we consider these initiatives and programs as similar to a tranche.

The critical elements identified by SDG&E include:

- The Asset Integrity Management Program: Integrates ISO 55000 into electric operating units. AIM also assists in the development of asset management strategies including critical asset replacement strategies, asset performance risk and asset life-cycle management.
- Asset Investment Prioritization: a multi-dimensional value framework for evaluating investments through a data-driven, quantitative, risk- and safety-based lens.
- Asset Data Systems & Records Management:
    - Enterprise Asset Management Data Integration: An initiative to develop a data lake to consolidate disparate sources of critical asset information into a centralized data repository
    - Data analytics: Algorithms to assess asset health and predict potential outages and systems failures.

CFF-1.5 Likelihood of Risk Event (LoRE)
SDG&E does not assign LoRE values to these CFF risks (See justification above 6.2- BowTie)

CFF-1.6 Consequence of Risk Event (CoRE)
SDG&E does not assign CoRE values to these CFF risks. (See justification above 6.2- BowTie)

CFF-1.7 Pre-Mitigation Risk Score
SDG&E does not establish pre-mitigation risk scores for these CFFs. (See justification above 6.2- BowTie)

CFF-1.8 Controls and Mitigations

CFF-1.8.1 Controls
SDG&E does not explicitly refer to its existing programs within ARM as controls. However, the utility does offer an overview of existing programs, which staff treat as controls. SDG&E's AMS operates as critical component of its Safety Management System (SMS). Within that framework, the AMS performs various functions including

- Provides and framework for balancing asset costs, risks, and performance
- Integrates ISO 55000 requirements and standards across asset groups
- Creates enhanced data visibility of asset health and risks
- Assess the risks and costs of assets in the SDG&E portfolio
- Supports asset investment decision-making based on cost and expected risk reduction.

CFF-1.8.2 Mitigation Plan

SDG&E does not explicitly refer to its future programs within ARM as mitigations. However, the utility does offer a summary of future 2022-2024-year programs and initiatives, which the reviewer will treat as mitigations. These mitigations mirror the tranches discussed above. In this section we list some of the expected 2022-2024 enhancements to these programs.

- The Asset Integrity Management Program:
    - Developing enhanced performance evaluations, internal audits.
- Asset Investment Prioritization
    - Extend the AIP program to Gas, IT and Fleet assets.
- Enterprise Asset Management Data Integration:
    - Expand the data lake and integrate more assets into the platform
    - Develop capability to assess the probability of asset failure
- Data Governance and Records Management:
    - Develop capability to trace asset records, identify data gaps, validate data quality, and perform remediation.
- Data Analytics:
    - Develop enhanced predictive power of learning models of asset health and risk. The initial focus of this effort will be on system hardening in High Fire Threat Districts and Electric Distribution Engineering.

CFF-1.8.2 Existing Costs and Expected Budget Request

SDG&E does provide costs for the programs listed above. SDG&E does not provide any context or justification for their forecast budget. The cost table is reproduced below.

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

CFF-1.9 Risk Spend Efficiency (RSE)

SDG&E offers no RSE for this risk sub-category.

CFF-1.10 Alternatives Analysis
SDG&E makes no mention of plan alternatives and offers no discussion of mitigation measures considered but not advanced.

CFF-1.12 Summary of Findings
Based on the observations presented above, findings are summarized here.

SDG&E RAMP submission of CFF 1 clearly indicates that they have:

- An understanding of the role that Asset and Records Management plays in managing and reducing the likelihood of safety incidents
- A commitment to improving their systems and processes in this area
- A significant investment in developing a new strategic process that will further develop, enhance, and integrate AMS into decision-making.

While this basic AMS organizational framework is a good starting point, SDG&E has not put forth any quantitative risk assessment of its ARM systems. There is no mention of any process they have used to evaluate the level of risk in the current state of ARM, nor any assessment of the expected improvements from the proposed mitigations.

For example, SDG&E discusses how data analytics can help identify "situations that might lead to potential outages and failures."[232] SDG&E , however, provides no assessment or insight into how often these events currently occur or how often data management issues are associated with these failures.

Additionally, in SDG&E's assessment of future needs, they state that the AIM program will "focus on developing the other key operating model capabilities, including performance evaluation, internal audit, and continuous improvement of the AMS."[233] SDG&E, however, does not provide any information about the scale or scope of the expected evaluation and audit programs or any assessment of the potential impact of enhanced evaluations and audits. SDG&E, however, does provide the costs for the AIM program , which has a Capital budget of $25M to $35M and operating costs of $1.2M to $1.5M. Program costs with no quantified benefit do not provide the Commission with any basis to evaluate the value of this $25+M investment.

In several instances, SDG&E discusses the that the AMS program is a "continuous" improvement process and the tools like "predictive machine learning models" will provide some benefit in the future. The systems architecture, however, are presented as aspirational goals for an ideal future system rather than a mature system that is in place and evolving.

The reviewer recognizes that predictive analytics and enhanced decision support tools could provide tremendous value. SDG&E, however, has not provided even a rudimentary analysis of the impact that these new systems and processes would have on the mitigation of risks that would justify the $45+M costs of the AMS initiatives.

[232] SCG-CFF at 1-8.
[233] SCG-CFF at 1-8.

SPD concludes that SDG&E has not adequately profiled the impact that ARM has on Risk Events. Nor have they not provided any quantitative assessment of how their proposed mitigations would improve upon their current risk profile.

To summarize, some of the gaps in this RAMP submission are that SDG&E:

- Does not provide any quantitative analysis to justify the value of program benefits;
- Does not identify ARM tranches;
- Does not comprehensively identify risk drivers;
- Does not quantify the current status of ARM risks; and
- Does not discuss or quantify the level of expected mitigation benefits.

While we have identified several gaps in SDG&E RAMPS submission, we do not suggest that SDG&E must use the SMAP risk modeling approach - i.e. bowtie, tranches, etc. - to characterize CFF risks. The indirect and interrelated nature of the CFFs may require an innovative and novel approach to generate a credible assessment of the risk impacts due to ARM processes. SDG&E demonstrates that they are aware that creative and innovative actions will be needed, but has not yet made any reasonable or credible attempt to provide a quantitative assessment of the benefits that future ARM programs will have on the safe operation of their system.

CFF-1.13 Recommended Solutions to Address Findings and Deficiencies.

Th SDG&E report is a welcome first step, however, CFF 1 reads more like a vision document for a new strategic initiative rather than a rigorous assessment of the risks of ARM.

SDG&E appears to have a well-considered plan but lacks a detailed assessment of the current needs and gaps necessary for a meaningful analysis.

To evaluate the proposed expenditures in the context of the RAMP, Staff would need additional information. This additional information includes but is not limited to:

- An assessment of the risk of inaccurate records
  - An estimate of the accuracy of records
  - What % of inaccurate records are associated with critical assets?
  - What % of critical assets have inaccurate records?
  - How often is this critical information needed?
  - What are the consequences – by tranche - of inaccurate information?
  - How are operational decisions impacted when there is inaccurate information?
- An assessment of the risk of missing records
  - An estimate of the percentage of missing records.
  - What percentage of missing data is associated with critical assets?
  - What percentage of critical assets have missing data?
  - How often is this critical information needed?
  - What are the consequences – by tranche - of missing information?
  - How are operational decisions impacted when there is missing information?

- An assessment of the Value-Of-Information (VOI) of missing or inaccurate records.[234] This task might be broken into subsets of high priority, medium, and low priority records (i.e., tranches) and then more detailed VOI into the mission-critical assets and operations-related records.
- The expected risk reduction that improved ARM processes could have in contributing to the company's overall safety and reliability.
- An estimate of the value of the benefits for each program.

While the CFF1 report made it clear that SDG&E is already moving forward with these types of recommendations, SDG&E should not delay reporting this information because a fully developed AMS system is not yet complete – i.e. a rudimentary analysis is better than no analysis at all.

The information provided in this chapter, including the lack of alternative analysis, leaves staff unable to determine if the recommendations listed above would require a $45+M budget and two years to complete and whether the investments described here would be cost-effective.

[234] For background on VOI, see H*oward, Ronald (1966). "Information Value Theory". IEEE Transactions on Systems Science and Cybernetics.* ***2*** *(1): 22–26.*

CFF-2 Energy Resilience, Climate Change

The energy system infrastructure in California is increasingly vulnerable to climate change. The risks of higher temperatures, sea-level rise, and wildfires can impact gas and electric utility systems and operations as risk drivers or consequence modifiers. These risks can affect more than one type of asset. Therefore, Sempra has presented climate-related risk information as Cross-Functional Factors (CFFs) rather than apportioning them to the various RAMP risk chapters.

CFF-2.1 Risk Description

The Southern California Gas Company (SoCalGas) gives their climate-related chapter the title of "Energy System Resilience." San Diego Gas & Electric Company (SDG&E) produced a chapter entitled "Climate Change Adaptation, Energy System Resilience, and Greenhouse Gas (GHG) Emission Reductions." Staff has combined the evaluation of both chapters.

As noted above, both SDG&E and SoCalGas include risks associated with climate change as CFFs, an approach similar to PG&E's cross-cutting factors, in its 2020 RAMP application. With that perspective, the Sempra utilities provide information regarding foundational, safety-related initiatives associated with more than one RAMP risk.

The potential impact of climate change on energy system infrastructure and operations has increased in California due to extreme heat and weather conditions, high temperatures, rise of sea level, flooding, cascading impacts, and wildfires. The risks associated with climate change for each of the Sempra utilities are listed in tables 2-1 and 2-2 below.

CFF-2.2 Bowtie

SDG&E and SoCalGas treat climate change risk as a CFF and, as such, do not provide any Bowtie analysis.

CF-2.3 Exposure

SDG&E and SoCalGas treat this risk as a CFF and consequently do not discuss exposure from climate change-related impacts in their fillings.

CFF-2.4 Tranches

SDG&E and SoCalGas treat this risk as a CFF and do not explicitly discuss climate change-related impacts on tranches in their submission.

CFF-2.5 Likelihood of Risk Event (LoRE)

SDG&E and SoCalGas do not explicitly discuss LoRE. (See justification above CFF2.2- BowTie)

CFF-2.6 Consequence of Risk Event (CoRE)

SDG&E and SoCalGas do not explicitly discuss CoRE. (See justification above CFF2.2- BowTie)

CFF-2.7 Pre-Mitigation Risk Score

SDG&E and SoCalGas do not explicitly discuss Risk Scores. (See justification above CFF2.2- BowTie)

CFF-2.8 Controls and Mitigations

CFF-2.8.1 SDG&E Controls and Mitigations

SDG&E identifies climate-related risk factors that can impact the consequences of risk events or increase the likelihood of an event driver. These factors are Climate Change Adaptation, Energy System Resilience, and GHG Emission Reductions. The way that each factor impacts the primary RAMP risks is shown in Table 2-1 below.

Table 2-1. SDG&E Climate Change Risk Factor Impacts[235]

SDG&E Risk Chapter	Climate Change Adaptation	Energy System Resilience	GHG Emission Reductions
Risk-1: Wildfires Involving Equipment	Consequence	Mitigation & Consequence	Driver & Mitigation
Risk-2: Electric Infrastructure Integrity	Consequence	Driver & Mitigation	Mitigation
Risk-3: Incident Related to High-Pressure System (Excluding Dig-In)	Consequence	Driver	Mitigation
Risk-4: Incident Involving a Contractor	Driver	—	—
Risk-5: Customer and Public Safety – Contact with Electrical Equipment	—	—	—
Risk-6: SDG&E and SoCalGas: Cybersecurity	—	—	—
Risk-7: Excavation Damage (Dig-In) on the Gas System	Consequence	—	Mitigation
Risk-8: Incident Involving an Employee	Driver	—	—
Risk-9: Incident Related to the Medium Pressure System (Excluding Dig-In)	Consequence	Driver	Mitigation

SDG&E does not cover Controls or Mitigation plans in their chapter, but they do discuss several CFF projects and programs that are in place to address climate change-related issues. The utility offers some examples of 2020-year programs. Climate change adaptation, energy resilience, and GHG emissions are CFFs but SDG&E does not quantify the effects on risk.

[235] Risk Assessment and Mitigation Phase Cross-Functional Factor (SDG&E-CFF-2) at 2-11

- SDG&E stated that in 2020, they established ambitious goals and sustainable strategies to reduce GHG emissions, establish energy resiliency, and provide equitable future benefits for their customers. SDG&E states these programs will decrease the impact of certain RAMP risks.
- SDG&E emphasized that long-term environmental goals of reducing GHG emissions through decarbonization will be met with renewable natural gas, hydrogen, solar, batteries, fuel cells, and carbon capture technologies. However, they note for peak demand events; intermittent energy sources will need to be supplemented by natural gas-fueled power plants to avoid power shortages.
- SDG&E has begun its systemwide vulnerability assessments and to develop a community engagement plan pursuant to D.20-08-046.
- In March 2021, SDG&E committed to achieving net-zero GHG emissions by 2045, which would eliminate their direct emissions and the emissions generated by their customers.
- By 2030, they expect to have a 100 percent electrified light-duty fleet and plan to have a 100 percent zero-emission fleet by 2035.
- SDG&E plans to plant 10,000 trees annually to sequester carbon, mitigate wildfire risk, and support biodiversity.
- They have implemented an energy efficiency program they estimate will reduce thousands of metric tons of GHG emissions to mitigate climate-related risk events.
- SDG&E indicated they are "committed to having the best available science" and technology to combat climate change and to provide better decision-making tools in the region. They cite two key research projects (wildfires and coastal flooding) in partnership with Scripps Institute of Oceanography.

CFF-2.8.2 SoCalGas Controls and Mitigations

SoCalGas identifies four climate-related risk factors. SoCalGas stated they have been researching climate change issues, potential impacts on their assets, and adaptation for several years. They cite efforts to deploy a systematic solution to address these vulnerabilities and improve resiliency.

SoCalGas does not refer to Controls or Mitigations, but they discuss several CFF projects and programs in place to address climate change-related issues. SoCalGas indicated natural gas is the primary source to complement renewable energy for consumers' intermittent needs and continues to play a role in maintaining an affordable, reliable, and resilient electric grid. They also point out that their gas storage assets fill the gap between abnormally high electric demand, driven by increased cooling loads, and low renewable energy generation due to wildfires.
The utility offers some examples of efforts they propose or already have underway to reduce emissions and mitigate climate-related risks. These include:

- SoCalGas intends to deploy microgrids and fuel cells technologies to improve resilience and continued operation during climate-induced energy supply disruptions. However, for extreme events, SoCalGas stated they would continue to use natural gas-fueled power plants whenever renewables are not sufficient to meet the peak demand to avoid power shortages.
- SoCalGas described efforts to transition to cleaner fuels to enhance energy resilience gas transmission and delivery to transport low to zero-carbon gases, such as hydrogen and renewable natural gas (RNG), to decarbonize their energy system. SoCalGas and SDG&E

proposed a hydrogen blending demonstration program in this Application (A.20-11-004)[236] to reduce the carbon content in their pipelines.

- SoCalGas has partnered with the National Fuel Cell Research Center (NFCRC) and the University of California, Irvine (UCI) to launch the US Power-to-Gas (P2G) project to power the campus using a solar electric system. This system feeds its renewable hydrogen to the campus power plant.
- To reduce GHG emissions to mitigate climate-related risk, SoCalGas sponsored Assembly Bill (AB) 3163 to promote biomethane, including gas from cellulosic waste from dead trees, organic waste, livestock manure, and landfills which release a substantial amount of GHG emissions. SoCalGas stated a commitment to replace 20 percent of the gas delivered to its customers with RNG by 2030.
- SoCalGas also cited efforts to decarbonize its fleets, equipment, and other infrastructure to reduce GHG emissions. For instance, SoCalGas converted over 30 percent of its fleet to renewable compressed natural gas vehicles (RCNGV) and created a network of internal-fueling infrastructure nodes. In addition, their goal is to replace 50 percent of their fleet with low-carbon vehicles by 2025 and 100 percent zero-emission vehicles by 2035.
- SoCalGas indicated they are considering powering more of their facilities using on-site renewable energy, including hydrogen, wind, solar, solar photovoltaic, fuel cell, combined heat and power (CHP), integration of smart devices, and battery storage technologies to reduce reliance on conventional power and reduce GHG emissions.
- SoCalGas also said that they are evaluating the feasibility of constructing a long-haul pipeline to deliver hydrogen to the Los Angeles basin and a CO_2 pipeline to transport the gas to a large storage site for its sequestration.

Table 2-2 shows the four-climate change-related hazards and potential consequences to the gas system cited in SoCalGas' RAMP filing.

Table 2-2. SoCalGas Climate Change Factors[237]

Hazard	Event	Consequences
Increased Frequency and Severity of Storm Events	Storm surge (El Nino events), flooding, high winds, heavy snow	• Increased in the frequency of emergency response from Gas Emergency Centers (GECs) and SoCalGas crews • Levee erosion or failure necessitating asset repair, replacement, or relocation to low-lying above-and below-ground gas assets • Exposure of underground pipelines

[236] Application of Southern California Gas Company (U904G), San Diego Gas & Electric Company (U902G),
Pacific Gas & Electric Company (U39G), and Southwest Gas Corporation (U905G) Regarding Hydrogen-Related Additions or Revisions to the Standard Renewable Gas Interconnection Tariff. (November 20, 2020).

[237] SDG&E-CFF-2 at 2-4.

Hazard	Event	Consequences
Change in Precipitation Patterns and Droughts	Subsidence, landslides, mudslides, weakened soil structure, drought-induced vegetation loss	• Horizontal subsidence causes compressive stresses resulting in buckling of gas pipelines[238] • Exposure of underground pipelines • Reduced access to pipeline rights-of-way • Diminished effectiveness of cathodic protection system which can lead to increased corrosion • Damage to pipelines in bridges or spans due to mudslides
Sea Level Rise	Erosion, coastal inundation, and potential flooding	• Levee erosion or failure necessitating asset repair, replacement, or relocation to low-lying above-and below-ground gas assets • Exposure of underground pipelines
Change in Temperature Extremes	Increased gas demand for electric generation to meet demand on more cooling days and/or for air conditioning (HVAC) demand. Increased ambient temperatures	• Increased cycling of the compressor station and maintenance schedules along with additional design requirements for compressor stations to support the increased cycling • Damage to pipelines in bridges or spans due to thermal expansion

CFF-2.9 Existing Costs and Expected Budget Request

SDG&E provides costs for some of the programs. However, they do not offer detailed contexts or justifications for their forecasted budget. SoCalGas does not provide costs, details, or justifications for their programs discussed earlier in this chapter. The following section presents SDG&E's approach on cost and budget.

CFF-2.9.1 SDG&E's Programs Cost and Proposed Budget Request

SDG&E plans to make investments in scientific partnerships to better understand climate change risks and adaptation and mitigation strategies. Table 2-3 summarizes the four climate-related projects, which show estimates of capital and O&M costs for its recorded and forecast allocations to mitigate and adapt climate resilience. No detailed explanations, calculations, and methodologies are provided or discussed. The Low- and High-cost estimates for forecast three-

[238] SoCalGas is not aware of research indicating that the climate change threats would result in horizontal

Subsidence, however, oil extraction and water extraction can potentially cause subsidence.

and one-year capital spending period increase substantially over the recorded costs with little explanation.

Table 2-3. SDG&E 2020 Recorded and Forecast Allocated ($K) Costs[239]

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	NA	$125	NA	NA	$383	$469
2	Climate Change Vulnerability Assessment	NA	$157	NA	NA	$460	$562
3	Community Engagement Plan	NA	—	NA	NA	—	—
4	CEC Grant Opportunities	NA	—	NA	NA	—	—

*2020 Spend Captured in Wildfire Chapter & Wildfire Mitigation Memo Account (WMPMA)

**2022-2024 Spend will be Captured in Climate Change & Vulnerability Assessment Memo Account

CFF-2.9.2 SoCalGas's Programs Cost and Proposed Budget Request

SoCalGas does not explicitly discuss their program's cost and budget associated with climate change-related events.

CFF-2.10 Risk Spend Efficiency (RSE)

SDG&E and SoCalGas offer no RSE for their risk sub-category. (See justification above CFF2.2-BowTie)

CFF-2.10 Alternatives Analysis

SDG&E and SoCalGas make no mention of alternatives and offer no discussion of mitigation measures considered but not advanced.

CFF-2.11 SDG&E and SoCalGas Summaries of Findings

In their 2021 RAMP applications, SDG&E and SoCalGas indicate they recognize the importance of ensuring safe and reliable energy services for customers, adapting to climate change, and providing energy resilience in the event of extreme weather-related climate threats. Staff has identified several gaps, including:

[239] SDG&E-CFF-2 at 2-13.

- The RAMP reports do not provide any scale or scope of anticipated climate change-related impacts.
- They do not discuss in detail or quantify the level of expected mitigation impacts for risk reduction.
- They do not identify climate change-related impacts on tranches.
- SDG&E's cost analysis is presented but with no justification or context.
- SoCalGas does not provide any cost analysis.
- They do not discuss the foundational relationship to risk events associated with CFFs.

SDG&E and SoCalGas acknowledged these gaps in their CFF chapters. The climate change-related CFFs are treated as both a driver and trigger of multiple RAMP risks. The Sempra companies indicate they have incorporated climate change into RSE and risk scores in various RAMP risks, but the extent of the impact is not quantified. SoCalGas cites climate change-related risk in their RAMP filing in two chapters - Incident Related to the High-Pressure System (Excluding Dig-In)) and Incident Related to the Medium Pressure System (Excluding Dig-in). They describe the potential impact of climate change-related risks as a driver or trigger.[240] SDG&E mentions climate change as either a consequence or driver into several risk chapters, including wildfire (SDG&E-Risk-1), Electric Infrastructure Integrity (SDG&E-Risk-2), and Incident Related to the High-Pressure System (SDG&E-Risk-3) and others.

The Sempra companies acknowledge that wildfires and other climate hazards are expected to increase throughout their territories, impacting vulnerable populations and posing safety risks, reliability risks, and threatening physical assets. However, neither company has attempted to provide a quantitative assessment of climate change's impact on risks in this filing.

Staff appreciates the high degree of uncertainty and difficulty quantifying the risks and benefits of climate change adaptation, energy system resilience, and GHG emissions. To that end, SPD has contracted with outside experts to assess IOUs efforts to evaluate climate change risks and propose methodologies to better account for climate change in the Risk-based Decision-making Framework. These efforts will be discussed with parties in R.20-07-013, and findings will be publicly available.

CFF-2.12 Recommended Solutions to Address Findings and Deficiencies

As noted, while both IOUs describe various efforts underway to reduce GHG emissions, they do not attempt to quantify the relative contribution climate change-related risks have on exposure, the likelihood of risk event (LoRE), and the consequence of risk event (CoRE). The rate and breadth of impacts associated with climate change are increasing. IOU's risk-based decision-making should explicitly account for these growing risks. Staff believes that to the maximum extent practicable, these risks should be analyzed and discussed in the RAMP at a granular level like other risk assessments.

[240] SoCalGas' Risk Assessment and Mitigation Phase Chapter SCG-Risk-1: Incident Related to the High-Pressure System (Excluding Dig-In) and SCG-Risk-3: Incident Related to the Medium Pressure System (Excluding Dig-in).

SDG&E and SoCalGas have not developed a framework for assessing the relationship between weather- and climate-related threats and risk events in their RAMP. In addition, they have not yet specified a process for establishing priorities that reduce the impact of climate change on RAMP risks. Staff recommends that to the maximum extent feasible, IOUs should quantify the relative contribution climate change has to the likelihood and consequences to RAMP risks impacted by rising sea levels, increased average temperatures, increased frequency of extreme weather events, and drought. Further, staff recommends that an effort be made to identify climate change-related impacts on tranches to allow for targeted mitigations against these rapidly worsening risks.

CFF-3 Emergency Preparedness and Response and Pandemic

CFF-3.1 Risk Description

SDG&E

The chapter describes how SDG&E's Emergency Management Department coordinates the emergency preparation and emergency operations and the company's response to the COVID-19 pandemic. EP&R activities cover planning, training, exercises, and supporting responses and recovery efforts related to incidents, emergencies, disasters, and catastrophes. According to SDG&E, coordination and planning associated with EP&R is intended to lead to informed decision-making and competency across operational areas and mitigate many of the risks identified in the RAMP Report.

Observations

Emergency Preparedness and Response affects 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.[241]

SoCalGas

In the 2021 RAMP, SoCalGas designates EP&R and Pandemic as a CFF. The chapter describes how EP&R activities impact the risks described in SoCalGas's RAMP Chapters and identifies the activities initiated in 2020 in response to the COVID-19 pandemic. SoCalGas notes that CFFs are drivers, triggers, activities or programs that may impact multiple RAMP risks.

Observations

SoCalGas' EP&R and Pandemic risks affect all seven of SoCalGas' 2021 RAMP risks: Incident Related to the Medium Pressure System (Excluding Dig-in), Incident Related to the High-Pressure System (Excluding Dig-in), Incident Related to Storage (Excluding Dig-in), Excavation Damage (Dig-In) on Gas System, Incident Involving an Employee, Incident Involving a Contractor, and Cybersecurity.[242]

CFF-3.2 Bowtie

SDG&E's and SoCalGas's EP&R and Pandemic discussions did not include a Bowtie illustration, as the utilities characterize EP&R and Pandemic as CFFs, which are not in it of themselves RAMP risks.

Observations

This chapter does not include enough information to evaluate whether or not the described activities would reduce the likelihood of risk incidents or mitigate potential consequences. As with

[241] SDG&E 2021 RAMP Application CFF Chapter 3 (SDG&E CFF-3) at 3-2
[242] SoCalGas 2021 RAMP Application CFF Chapter 3 (SoCalGas CFF-3) at 3-5

other CFF chapters, SDG&E and SoCalGas do not include the baseline or estimated risk reduction attributable to the EP&R and Pandemic Programs described in this chapter.

CFF-3.3 Exposure

SoCalGas and SDG&E do not discuss exposure in this chapter because these risks are treated as CFFs.

CFF-3.4 Tranches

SoCalGas and SDG&E do not apply tranching to EP&R and Pandemic Programs because these risks are treated as CFFs.

CFF-3.5 Likelihood of Risk Event (LoRE)

SDG&E and SoCalGas did not assign LoRE values data for risks potentially mitigated by implementing EP&R and Pandemic projects and programs as they are characterized as CFFs.

CFF-3.6 Consequence of Risk Event (CoRE)

SDG&E and SoCalGas did not provide CoRE values for risks potentially mitigated by implementing EP&R and Pandemic projects and programs as they are characterized as CFFs.

CFF-3.7 Pre-Mitigation Risk Score

SDG&E and SoCalGas did not establish a pre-mitigation risk score for risks potentially mitigated by EP&R and Pandemic projects and programs within its 2021 RAMP.

CFF-3.8 Programs and Projects

SDG&E

SDG&E listed nine 2020 EP&R projects and programs. These include Emergency Operations Center (EOC) Activations, Training and Exercise Division, First Responder Outreach, EOC Training (Student Costs), After-Action Review Program, Aviation Firefighting Program, Emergency Operations Center (EOC), Human Factors Engineering, IT Support for EOC.

SDG&E proposed eight new EP&R projects and programs. These include Human Factors Engineering Expansion, Training and Exercise Division and ICS Companywide Program Expansion, EOC Activation Capabilities Expansion, First Responder Outreach Program, Expanding IT Support for EOC, Aviation Firefighting Program Expansion, Establishing a 24/7 Watch Command Desk Division, and After-Action Review Program Enhancement.

SGD&E listed 17 2020 Pandemic projects and programs. These include Safety Consultant Support for Pandemic Exposure Safety at Customer Homes, Procuring Additional Supplies, Temperature and Pandemic Symptom Screening of Employees/Contractors/Visitors by Vendor, Polymerase Chain Reaction (PCR) Testing, Advanced/Enhanced Cleaning Protocols for Facilities, Enhanced Mechanical Systems, Clean and Disinfect Company Owned and Operated Fleet Vehicles, Pandemic-Related Applications, Contact Tracing, Pandemic Management Plan, Remote Work Enablement, IT Systems and Licenses, Alternate Work Sites, Facilities Enhancements, Advisory

Services and Expert Medical Consulting, Adherence to Official Guidance, and Monitoring of Local Trends.

Observations

SDG&E states that the Human Factors Engineering Expansion will enhance efficiencies and effectiveness in event and emergency operations by incorporating HMI interfaces with the company's technology tools and systems.[243] However, SDG&E does not provide information about how HMI interfaces with the company's technology tools and systems will enhance efficiencies and effectiveness.

SoCalGas

SoCalGas listed nine EP&R 2020 projects and programs. These initiatives include: Prevent & Protect, Policies and Procedures, Training, Exercises and Drills, Stakeholder Outreach, Incident Command System, Mutual Assistance, After Action Review Program, Crisis Communication Technology.

SoCalGas proposed four new programs: Watch Desk, Expert Advisory Support, EOC Enhancement Project at Pico Rivera, and Emergency Management Technology.

SoCalGas included five pandemic projects and programs: Public Health Safety, PPE and Sanitation Supplies, Facilities, Medical Services, Fleet, and Hybrid and Remote Work.

Observations

While SoCalGas provided a cursory explanation of the safety benefits of most projects listed, their application does not explain how the Enhancement Project at Pico Rivera adding additional space would enhance SoCalGas' response or preparedness capabilities. SoCalGas states that the vision for the department is to be an industry leader in emergency preparedness, response, and management;[244] however, it is unclear how the Enhancement Project at Pico Rivera would contribute to that.

CFF-3.3.1 Proposed Mitigation Plan - Preferred Alternative

Not Applicable.

CFF-3.3.2 Existing Costs and Forecast Costs

Citing the current and future pandemics' unique characteristics, SoCalGas and SDG&E did not include forecasted pandemic-related costs.[245]

CFF-3.9 Risk Spend Efficiency (RSE)

SDG&E and SoCalGas offer no RSE for implementing EP&R and Pandemic projects and programs.

CFF-3.10 Alternatives Analysis

[243] SDG&E CFF-3 at 3-13
[244] SoCalGas CFF-3at 3-18
[245] SoCalGas CFF-3 at 3-19

SDG&E and SoCalGas make no mention of plan alternatives.

CFF-3.11(opt) Scenario Analysis (if available)
n/a

CFF-3.12 Summary of Findings
SDG&E and SoCalGas' 2021 RAMP EP&R and Pandemic profiles provide brief project descriptions for implementation. There are no mechanisms mentioned in the EP&R and Pandemic to validate the connection between the proposed programs and the improvement of emergency preparedness and response and the pandemic. SDG&E and SoCalGas offer no process of measuring the effectiveness of EP&R and Pandemic/CFF implementation. Neither company provides costs from projects and programs related to the pandemic in their 2020 recorded dollars for the programs and projects discussed in this CFF.

CFF-3.13 Recommended Solutions to Address Findings and Deficiencies
Below is the summary of recommendations that itemize data/information for SDG&E and SoCalGas to submit during GRC:

1. To enable evaluation of the proposals, the Sempra Companies should provide a more detailed explanation of how the proposed projects reduce likelihood and mitigate consequences before and after the implementation of EP&R and Pandemic response.
2. SDG&E and SoCalGas should identify categories of risks likely mitigated by EP&R and Pandemic.

Although consideration of CFF-related costs in RSEs is not a requirement for this RAMP, SPD Staff recommends that Sempra incorporate Emergency Preparedness and Response into the calculation of RSE scores for the GRC filing in a manner consistent with Ordering Paragraphs 1(e) and 1(g) in the Proposed Decision in Phase 1 of R.20-07-013.

CFF-4 Foundational Technology

CFF-4.1 Risk Description

The chapter describes how Foundational Technology Systems activities impact risks. Sempra classifies Foundational Technology Systems as a Cross-Functional Factor (CFF). As defined in Sempra's RAMP application, 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."[246] However, Sempra does not explicitly define "foundational activities."

Observations:

As a CFF, Foundational Technology Systems are foundational activities and are not a risk. Although Sempra does not explicitly define foundational activities, it can be inferred based on the definition for CFF that foundational activities as described in the Sempra RAMP can reduce the likelihood or the consequence of two or more risk events by either enabling or providing support to two or more mitigations.

Sempra's operationalization of "foundational" differs slightly from the definition in the Proposed Decision in R.20-07-013 defines "foundational programs and/or activities" as "initiatives that support or enable two or more mitigation programs but do not directly reduce the consequences or the likelihood of risk events."[247] This definition was not in effect when Sempra filed their RAMP application but has now been approved. For the GRC filing, SDG&E should treat foundational programs in a manner consistent with Ordering Paragraphs 1(e) and 1(g) in the Final Decision in Phase 1 of R.20-07-013 approved on November 4, 2021.

CFF-4.2 Bowtie

Since Foundational Technology Systems are foundational activities and are not a risk, this chapter does not list any risk bowties. Foundational Technology Systems can affect two or more risk categories and their associated risk bowties as foundational activities. The relevant risk bow ties are found in the respective risk chapters affected by the Foundational Technology Systems. The following risk events are affected by Foundational Technology Systems:

- Wildfire
- Emergency Management and Climate Change Adaptation
- Records Management, Enterprise Asset Management, Dig-ins, and Gas Incidents
- High-Pressure System Incident
- Gas Storage Incident
- Electric Infrastructure Integrity

CFF-4.3 Exposure

[246] SDG&E/SCG-CFF-4-1

[247] Proposed Decision in R.20-07-013 at p. 19. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M407/K950/407950985.PDF

Since Foundational Technology Systems are foundational activities that enable or support two or more mitigations, the concept of exposure does not apply.

Cff-4.4 Tranches
Since Foundational Technology Systems are a suite of activities or programs that enable or support two or more mitigations, possibly spanning multiple risks, the concept of tranche does not directly apply.

CFf-4.5 Likelihood of Risk Event (LoRE)
Foundational Technology Systems are a suite of activities or programs that enable or support two or more mitigations, possibly spanning multiple risks. Since foundational activities are not themselves risks, the concept of likelihood of risk event does not apply.

Observations:
Although the concept of LoRE does not apply to foundational activities or programs, it may be possible to determine the reduction in LoRE of an associated risk event due to the effects of foundational activities and the mitigations they support. However, a revised LoRE would only be required if used to calculate the RSE of mitigations that include the costs of associated foundational activities. Since Sempra is not required to consider foundational costs in calculating mitigation RSEs in the current RAMP, Sempra is not required to provide revised LoREs to capture the effects of foundational activities.

CFF-4.6 Consequence of Risk Event (CoRE)
Foundational Technology Systems are a suite of activities or programs that enable or support two or more mitigations, possibly spanning multiple risks. Since foundational activities are not themselves risks, the concept of consequence of risk event does not apply to foundational activities.

Observations:
Even though the concept of CoRE does not apply to foundational activities or programs, it may be possible to determine the reduction in CoRE of an associated risk event due to the effects of foundational activities and the mitigations supported or enabled by those foundational activities. However, a revised CoRE would only be required if used to calculate the RSE of mitigations that include the costs of associated foundational activities. Since Sempra is not required to consider foundational costs in calculating mitigation RSEs in the current RAMP, Sempra is not required to provide revised CoREs to capture the effects of foundational activities.

CFF-4.7 Pre-Mitigation Risk Score
As foundational activities, Foundational Technology Systems are not risk events and do not have either pre-mitigation or post-mitigation risk scores.

Observations:
The same observations regarding LoRE and CoRE apply to risk scores.

CFF-4.8 Controls and Mitigations

Controls

All activities described in the Foundational Technology Systems chapter are existing activities as of 2020 and are projected to continue into the 2022 to 2024 period.

The following Foundational Technology Systems activities are listed for SoCalGas:

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

The following Foundational Technology Systems activities are listed for SDG&E:

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

Observations:

For each of the programs or activities listed in the two tables, Sempra provided a high-level summary. These high-level summaries provide insufficient details to describe the nature of the work involved adequately.

For example, Data Center Modernization is described as an initiative that "enhances the data center infrastructure and applications to improve the recoverability, resiliency, and availability of the Companies' business systems." … "Activities in this initiative relate to all three tenets of Foundational Technology Systems – resiliency, recovery and lifecycle management enhancements and upgrades." … "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. ... 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."

For the Network & Voice System Resiliency program, which is the second or third most expensive program among the list of Foundational Technology Systems activities, the short description vaguely states in various parts that "this initiative enhances network and voice systems through maintenance and improved functionality…", "Activities in this initiative are associated with the tenets of resiliency, recovery and lifecycle management enhancements and upgrades.", and "As

part of this initiative, critical communication infrastructure and systems in the data center and in remote worksites leverage maintenance and improved functionality."
For the Gas Operations Systems Resiliency initiative, the description lists enhancements for field sensors, GIS, and SCADA. The description for each of the three enhancement activities provides only high level, terse, and general descriptions but no meaningful details.
The descriptions for the other listed Foundational Technology Systems activities are similarly vague. The paucity of details in the descriptions is inadequate for the purpose of ascertaining the reasonableness for these programs that cost hundreds of millions of dollars in aggregate.

Mitigations
Since the existing controls are programs or activities that are expected to continue into the next GRC funding period, the mitigations can be classified as controls.

CFF-4.9 Risk Spend Efficiency (RSE)
No RSEs were provided for mitigation activities that included the foundational costs reflected in the Foundational Technology Systems programs.

Observations:
As previously stated, Sempra is not required to consider foundational costs in the calculation of mitigation RSEs in the current RAMP. Therefore, no RSEs were provided by Sempra for these Foundational Technology System. This issue of the treatment of foundational costs when calculating RSEs is being addressed in Track 1 of R.20-07-013, but any decision on the treatment of foundational costs will not affect this RAMP.

CFF-4.10 Alternatives Analysis
Sempra did not provide an alternative analysis for the Foundational Technology Systems programs.

Observations:
Due to the lack of detail, it is unknown which Foundational Technology Systems programs are amenable to an alternatives analysis. Based on the information provided, staff cannot discern to what extent Sempra could accomplish the same overarching objectives as the programs listed in this chapter with more cost-effective alternatives. Unfortunately, the vague program descriptions prevent any meaningful comparison across alternatives.

N.11(opt) Scenario Analysis (if available) (to be further developed)
No scenario analysis was requested by either SPD staff or intervenor parties on Foundational Technology Systems.

CFF-4.12 Summary of Findings
This chapter excludes information necessary to evaluate the listed mitigations and associated expenditures.
1. Costs for foundational activities are not included in the calculation of RSEs for the mitigations that the foundational activities support.

2. Since these Foundational Technology Systems programs cost hundreds of millions of dollars in aggregate over the current GRC cycle and upcoming GRC cycle, the omission of these foundational elements costs could significantly distort the RSEs of mitigations supported by these foundational elements.
3. The program and activity descriptions for the Foundational Technology Systems activities and programs are vague and lacking in detail. The descriptions do not contain enough detail to permit meaningful analysis or evaluation of reasonableness.
4. No alternative analysis was provided. Observations 1, 2, and 3 compound one another and make it impossible to render an opinion of reasonableness for these Foundational Technology Systems activities.

CFF-4.13 Recommended Solutions to Address Findings and Deficiencies

1. Although consideration of foundational activities costs in RSEs is not a requirement for this RAMP, SPD Staff nevertheless recommends that Sempra should incorporate foundational activities costs into the calculation of RSE scores for the GRC filing in a manner consistent with Ordering Paragraphs 1(e) and 1(g) in the Proposed Decision in Phase 1 of R.20-07-013. If this is not feasible due to the foundational activities affecting multiple risks and multiple mitigations, this analysis would benefit from calculating portfolio RSE for all relevant Foundational Technology Systems programs using the "multi-portfolio" approach proposed by TURN in Phase 1, Track 1 of R.20-07-013.[248]
2. Sempra should provide more detail describing programs and activities and the constituent elements in each of the programs and activities.
3. Sempra should provide alternative analysis to the programs and activities.

[248] TURN's Reply Comments in Phase 1 of R.20-07-013, at p.7, https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M392/K346/392346671.PDF

CFF-5 Physical Security (SDG&E)

Physical Security encompasses the systems and activities that maintain the safety of employees, contractors, the public, and SDG&E assets.

As with PG&E's 2020 RAMP, SDG&E's 2021 RAMP treats Physical Security as a cross-functional factor. Rather than a dedicated primary risk chapter, SDG&E covers physical security in a brief, six-page sub-chapter rather than a dedicated primary risk chapter. The cross-functional factor (CFF) approach provides a limited overview of a risk subject. As such, SDG&E does not provide mitigation plan alternatives, a risk bowtie diagram, or a discussion of risk reduction and resulting risk-spend efficiency. SDG&E's RAMP Physical Security summary offers a high-level overview of the program area and how it informs the RAMP's primary risks with limited analysis and discussion. SDG&E indicates that the "CFFs provide this information in chapter format for ease of presentation, rather than dispersing it throughout the RAMP Report."

CFF5.1 Risk Description

According to SDG&E, the IOU's Physical Security program "mitigates threat events such as theft, robbery, burglary, vandalism, sabotage, terrorism and trespassing, which may result in a gas leak, fire, explosion, and/or operational outages." SDG&E describes the threats of Physical Security incidents as those that "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."

Physical Security is a cross-functional factor affecting several SDG&E RAMP primary 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
- Cybersecurity

CFF5.2 Bowtie

As a CFF, SDG&E's Physical Security risk discussion does not include a Bowtie illustration, as the utility treats this threat category as one that merely informs and impacts primary risks.
SDG&E identifies its top Physical Security threat categories as aggravating these seven primary risk chapter subjects:

- 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
- Cybersecurity

SDG&E's sole identified Physical Security risk driver for its electric service is Contact with Electric Facilities, a term that typically describes unintentional serious injury or death of trespassers in the course of metal theft. The "indirect safety consequences" SDG&E tied to disruption of electric or gas operations causing downstream outages are not assigned an associated primary risk where they could be mitigated. For example, SDG&E's discussion does not include Physical Security threats such as sabotage by domestic terrorists.

Within its RAMP submittal, SDG&E does not identify potential specific consequences stemming from the Physical Security threat. However, based on a list of consequences from those in the utility's Cyber Security primary risk chapter and a discussion at a focused technical working group webinar,[249] the resulting consequences of a physical security incident would likely consist of at least the following possible outcomes:

- Disruption of energy flow systems (*electric and gas*)
- Data corruption or unavailability
- Theft or destruction of company assets
- Exposure of Company security and asset vulnerabilities
- Regulatory sanctions resulting in penalties and monetary fines
- Erosion of public confidence and corporate reputation
- Adverse litigation
- Serious injuries and/ or fatalities

Had SDG&E included a risk bowtie diagram and provided a more comprehensive and exploratory set of risk drivers and consequences associated with the Physical Security, they would have facilitated a better understanding of the threat presented by this risk, and the IOU's proposed approach to reducing the risk.

An additional problem with SDG&E's Physical Security RAMP summary is that it does not provide adequate justification for treating the subject as a cross-functional factor with a reduced level of analysis.

CFF5.3 Exposure

The utility explains that the Physical Security risk may apply to items such as theft, robbery, burglary, vandalism, sabotage, terrorism and trespassing, which may result in a gas leak, fire, explosion, and/or service outages.

[249] *SDG&E EII and Joint Utilities Cybersecurity* webinar September 9 2021, hosted and facilitated by Joe McCawley, SDG&E GRC Program Manager

SDG&E offers a three-category framework to present how the utility structures its response to the Physical Security threat:

- 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 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).

CFF5.4 Tranches

SDG&E does not employ tranches for Physical Security threats as they treat this risk as a cross-functional factor.

CFF5.5 Likelihood of Risk Event (LoRE)

SDG&E does not include LoRE data for Physical Security risks as they treat it as a cross-functional factor.

CFF5.6 Consequence of Risk Event (CoRE)

SDG&E does not include CoRE data for Physical Security risks as they treat it as a cross-functional factor.

CFF5.7 Pre-Mitigation Risk Score

SDG&E does not provide a pre-mitigation risk score for Physical Security within its 2021 RAMP.

CFF5.8 Controls and Mitigations

SDG&E does not refer to its existing programs as Physical Security controls or offer a distinction between any assigned controls and mitigations. Rather, the utility offers a summary of existing 2020-year programs. Existing programs are considered controls in the S-MAP settlement agreement.

SDG&E does not offer plan alternatives or discuss how the utility came to settle on its proposed plan for Physical Security mitigation.

Existing Controls (Characterized as in effect through end 2020)

Control 1 - *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 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 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 electronic control systems (proximity card readers or electronic keys) and mechanical locks/keys.
- Intrusion Detection Systems (IDS) are an array of sensors, surveillance devices, and associated communication systems used to increase the probability of detection and assess 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 is a self-contained surveillance system comprising cameras, recorders, control equipment, and displays for real-time monitoring activities. 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.
- Access management reporting tool was introduced in 2020 to allow for analysis of corporate facility and property access to locations with high alarm rates and badge access card usage.
- Automated access request process to increase labor efficiency and enable performance metrics and analysis.
- Security equipment testing lab established to integrate and test the functionality of new security equipment before installation.

Control 2 - *Contract Security*

In addition to Physical Security systems, SDG&E employs contract security personnel to secure and protect assets and people. Security personnel guard critical facilities and other work locations. Security personnel may be deployed permanently at a facility based on criticality, facility population, or compliance; or temporarily based on factors such as the threat environment or recent criminal activity or incidents.

Control 3 - *Corporate Security Planning, Awareness, Risk Management, and Incident Management*

Corporate Security staff 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 used to track security incidents and investigations. In addition, 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 with the potential to impact 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.

CFF5.8.1 Proposed Mitigation Plan - Preferred Alternative
Mitigation 1 – *Physical Security Upgrades*
SDG&E will replace expiring (end of useful life) equipment, improve integration, reduce nuisance alarms, and incorporate recent industry security technology enhancements to facilities and infrastructure. These changes are expected to improve access control, intrusion detection, and the ability to deter, detect, delay, communicate, and respond to Physical security incidents.

Mitigation 2 – *Corporate Security Agent*
SDG&E plans to expand its workforce to support its Corporate Security mission. They indicate the workforce expansion will allow the utility to expand coverage within its service territory, reduce response time to security incidents, and increase its quantity of Site Security Reviews.

CFF5.8.2 Existing Costs and Expected Budget Request
SDG&E offers a budget table to provide a snapshot overview of existing and expected program costs, but does not explain or justify the cost figures. The utility did not tally its program cost columns to provide a total cost figure. In its budget table, SDG&E combines O&M for the single year 2024, while capital is provided over a three-year period. Also, without context or explanation, SDG&E provides both a high- and low-cost estimate for the forecast three-year capital spending period and the forecast one-year (2024) O&M spending period representing three years of spending in one column. SPD staff reformatted the table for clarity and discussion purposes.

Annual total program costs based on the single year 2024 would be roughly $4.75 million, based on an average cost of the capital and O&M components. Annual cost of capital, low forecast and high forecast would be $1.44 million and $1.76 million. Annual cost of O&M, low forecast and high forecast would be $2.85 million and $3.44 million.

SDG&E Forecast Spending Table Submitted for Physical Security

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

CFF5.8.3 SPD Analysis of SDG&E Requested Budget

After reformatting the IOU's budget numbers, the annual budget request is shown to be about $4.75 million for 2022, 2023, and 2024. This figure represents a modest increase over existing spending, which in 2020 was $4.15 million. By comparison, this amount is less than one-fifth the amount SDG&E proposes to spend on Cyber Security. A review of the IOU's budget table reveals that SDG&E elected not to provide specific cost figures for each of its two proposed mitigation measures but instead lumped these spending amounts in with existing control measures. Additionally, the IOU provides no discussion of how existing controls are to be preserved and carried over into future years, why this would be done, and how such programs and spending are justified.

CFF5.9 Risk Spend Efficiency (RSE)

SDG&E offers no RSE for the Physical Security risk as they treat it as a cross-functional factor. As such, it is not possible for Staff to assess the cost-effectiveness for Physical Security mitigations.

CFF5.10 Alternatives Analysis

As noted above, SDG&E does not describe alternatives or discuss mitigation measures that were considered but not advanced.

CFF5.11(opt) Scenario Analysis (if available)

CFF5.12 Summary of Findings

The two Sempra utilities are proposing essentially identical Physical security mitigation strategies that carry over existing controls and propose one (SoCalGas) or two (SDG&E Gas) new mitigation measures. They rely primarily on low-cost, practical solutions such as employing security staff, changing keys and locks, employing concentric defenses to slow down and thwart an attack, and using earth berms, walls, and defensive technology to promote improved situational awareness.

The lack of explanation or justification in this analysis of Physical Security risks, controls, and mitigations summary leaves much open for interpretation and uncertainty for Staff. Given the cost range for potential budget figures and the lack of detail for the programs SDG&E proposes, Staff recommends the inclusion of substantive explanations to address these shortcomings as part of their GRC filing.

CFF5.13 Recommended Solutions to Address Findings and Deficiencies

The most practical way for SDG&E to improve their analysis of Physical Security risks would be to expand the writeup to either thoroughly explain why Physical security is not a primary risk or to treat this risk as a primary risk chapter with full Risk-Based Decision-Making treatment consistent with the S-MAP settlement agreement. Sempra's 2016 RAMP analysis of Physical Security for SoCalGas as a primary risk provides a model for this.

CFF-5 Physical Security (SCG)

CFF-5: Physical Security
Physical Security encompasses the systems and activities that maintain the safety of employees, contractors, the public, and SoCalGas assets. Physical Security is a threat that impacts many of SoCalGas's primary RAMP risks.

As with PG&E's 2020 RAMP, SoCalGas's 2021 RAMP treats Physical Security as a cross-functional factor within a chapter consisting of many such sub-risks. Rather than addressing the subject within a dedicated primary risk chapter, its treatment in six pages is a sub-chapter. The cross-functional factor (CFF) approach, in general, adopts a limited overview of a risk subject that does not include mitigation plan alternatives, a risk bowtie diagram, and a discussion of risk reduction and resulting risk-spend efficiency. SoCalGas's Physical Security subchapter provides a high-level overview of the program area and how it informs the RAMP's primary risks, with comparatively limited analysis and discussion.

The Physical Security sub-chapter provides summary information not otherwise included within primary risk chapters, and SoCalGas indicates that the "CFFs provide this information in chapter format for ease of presentation, rather than dispersing it throughout the RAMP Report."

CFF-5.1 Risk Description
According to SoCalGas, the IOU's Physical Security program "mitigates threat events such as theft, robbery, burglary, vandalism, sabotage, terrorism and trespassing, which may result in a gas leak, fire, explosion, and/or operational outages." SoCalGas describes the threats of Physical Security incidents as those that "may have direct safety consequences, such as the potential for serious injury or death related to gas leaks or explosions, or may have indirect safety consequences, such as the disruption of gas operations causing downstream outages affecting the general public."

Physical Security is a cross-functional factor affecting several SoCalGas RAMP primary risks, including:

- Incident Related to the Medium Pressure System
- Incident Related to the High Pressure System
- Excavation Damage (Dig-In) on Gas System
- Incident Related to the Storage System
- Incident Involving an Employee
- Incident Involving a Contractor
- Cybersecurity

CFF-5.2 Bowtie
SoCalGas's Physical Security risk discussion does not include a Bowtie illustration, as the utility treats this threat category as one that merely informs and impacts primary risks.

As mentioned above, SoCalGas identifies its top Physical Security threat categories as aggravating these seven primary risk chapter subjects:

- Incident Related to the Medium-Pressure System
- Incident Related to the High-Pressure System
- Excavation Damage (Dig-In) on Gas System
- Incident Related to the Storage System
- Incident Involving an Employee
- Incident Involving a Contractor
- Cybersecurity

As a single-fuel utility, SoCalGas is not subject to requirements of R.15-06-009, the Physical Security proceeding, that SDG&E and the State's other electric IOUs contributed to as part of a multi-year effort to formulate new electric distribution grid security requirements. As such, the Commission cannot rely on it as a parallel compliance track for receiving relevant information about planned SoCalGas Physical Security existing and mitigated risk levels and details of associated mitigation efforts.
Extending the physical security proceeding might provide the Commission additional insight into the utility's Physical Security proposed spending and capital programs by better quantifying risk reduction and risk-spend efficiency.

Unfortunately, there is no primary RAMP risk chapter within SoCalGas's 2021 application mapped to the Physical Security threats. Therefore, appropriate details on risk reduction, cost-effectiveness, and proposed mitigation plan alternatives are also absent.

SoCalGas does not identify specific potential consequences stemming from the Physical Security threat within its RAMP submittal. However, based on a list of consequences in the utility's Cyber Security primary risk chapter and a technical working group webinar discussion,[250] the results of a physical security incident would likely consist of at least some of the following possible outcomes:

- Disruption of energy flow systems
- Data corruption or unavailability
- Theft or destruction of company assets
- Exposure of company security and asset vulnerabilities
- Regulatory sanctions resulting in penalties and monetary fines
- Erosion of public confidence and corporate reputation
- Adverse litigation
- Serious injuries and/or fatalities

Had SoCalGas included a risk bowtie diagram and provided a more comprehensive and exploratory set of risk drivers and consequences associated with the Physical Security, they would

[250] *SDG&E EII and Joint Utilities Cybersecurity* webinar September 9, 2021, hosted and facilitated by Joe McCawley, SDG&E GRC Program Manager

have facilitated a better understanding of the threat presented by this risk, and the IOU's proposed approach to reducing the risk.

SoCalGas's Physical Security RAMP summary does not provide sufficient justification for treating the subject as a cross-functional risk addressed with a reduced level of analysis. The table below shows how the IOU's approach to Physical Security has evolved from Sempra's 2016 RAMP application[251] to its present 2021 filing.

Comparative Table of Physical- and Cyber-Security Risk Treatment Over Five RAMP Application Iterations, 2016 to 2021, Compiled by Safety Policy Division

		Physical Security	Cyber Security
Utility and RAMP Year	SoCal Gas 2021	**Xc**	**P**
	SDG&E 2021	**Xc**	**P**
	SoCal Gas 2016	**P**	**P**
	SDG&E 2016	**D**	**P**
	PGE 2020	**Xc**	**Xc**
	PGE 2017	**D**	**P**
	SCE 2018	**P**	**P**

Key

P – Primary. Risk topic afforded full analysis (e.g. bowtie, risk score, RSE) and treatment as a primary risk with an assigned chapter.
Xc – Crosscutting/Cross-Functional Factor. Risk topic afforded truncated analysis in an appended chapter because it describes foundational, safety-related initiatives associated with more than one RAMP risk.
D- Dispersed. Risk Topic appears in various primary chapters, but is linked to a control or mitigation.

The table highlights that SoCalGas initially treated Physical Security as a primary risk but subsequently demoted the topic in 2021 to a cross-functional factor.[252] However, the utility declined to explain its reasoning for doing so.

[251] The 2016 RAMP application by Sempra marked the first time a California utility had submitted such a compliance document

[252] In 2016, SoCalGas addressed *Physical Security of Critical Gas Infrastructure* within a primary risk chapter. For its part, in 2016, SDG&E addressed Physical Security as a factor impacting two primary risk chapters. The first, *Public Safety Events,* is analogous to SDG&E's 2021 RAMP primary risk chapter 5 *Customer and Public Safety*. (SoCalGas no longer addresses this item as a primary risk, and represents that the issue is now enfolded within its 2021 RAMP primary risk chapter 3 *Incident Related to the Medium Pressure System (Excluding Dig-In)*.) The second 2016 SDG&E primary risk chapter that addressed physical security, *Workplace Violence* and *Public Safety Events,* has been discontinued as an SDG&E primary risk, although the subject is addressed as a factor within the SoCalGas 2021 RAMP primary risk chapter 5 *Incident Involving an Employee*. It's

Additionally, the table above shows Physical Security has been treated inconsistently by the IOUs; a condition more easily identified when viewed alongside the Cyber Security risk, which has had more consistency in its treatment.

CFF-5.3 Exposure
The utility explains that the Physical Security risk may apply to items such as theft, robbery, burglary, vandalism, sabotage, terrorism, and trespassing, which may result in a gas leak, fire, explosion, and/or service outages.

SoCalGas offers a three-category framework to present how the utility structures its response to the Physical Security threat:

- 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 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).

CFF-5.4 Tranches
SoCalGas does not employ tranches for Physical Security as they treat this risk as a cross-functional factor.

CFF-5.5 Likelihood of Risk Event (LoRE)
SoCalGas does not include LoRE data for Physical Security risk as they treat it as a cross-functional factor.

CFF-5.6 Consequence of Risk Event (CoRE)
SoCalGas does not include CoRE data for Physical Security risk as they treat it as a cross-functional factor.

CFF-5.7 Pre-Mitigation Risk Score
SoCalGas does not provide a pre-mitigation risk score for Physical Security within its 2021 RAMP.

CFF-5.8 Controls and Mitigations
SoCalGas does not necessarily refer to its existing programs as Physical Security controls or offer a distinction between any assigned controls and mitigations. Rather, the utility provides a summary

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worth noting that although SDG&E includes a 2021 RAMP primary risk chapter 8 *Incident Involving an Employee*, the utility does not specifically address the issue of workplace violence.

of existing 2020-year programs. Existing programs are considered controls in the S-MAP settlement agreement.

SoCalGas does not offer plan alternatives or discuss how the utility came to settle on its proposed plan for Physical Security mitigation.

Existing Controls (Characterized as in effect through end 2020)

Control 1 - *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.
- Closed Circuit TV – CCTV is a self-contained surveillance system comprising cameras, recorders, control equipment, and displays for real-time monitoring activities. 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.
- Access management reporting tool was introduced in 2020 to allow for analysis of corporate facility and property access to locations with high alarm rates and badge access card usage.
- Automated access request process to increase labor efficiency and enable performance metrics and analysis.
- Security equipment testing lab established to integrate and test the functionality of new security equipment before installation.

Control 2 - *Contract Security*
In addition to Physical Security systems, SoCalGas employs contract security personnel to secure and protect assets and people. Security personnel guard critical facilities and other work locations. Security personnel may be deployed permanently at a facility based on criticality, facility

population, or compliance; or temporarily based on factors such as the threat environment or recent criminal activity or incidents.

Control 3 - *Corporate Security Planning, Awareness, Risk Management, and Incident Management*

Corporate Security staff 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 used to track security incidents and investigations. In addition, 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 with the potential to impact 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.

CFF-5.8.1 Proposed Mitigation Plan - Preferred Alternative

Mitigation 1 – *Physical Security Upgrades*

SoCalGas will replace expiring (end of useful life) equipment, improve integration, reduce nuisance alarms, and incorporate recent industry security technology enhancements to facilities and infrastructure. These changes are expected to improve access control, intrusion detection, and the ability to deter, detect, delay, communicate, and respond to physical security incidents. The utility cites the example project of converting existing physical keys to electronic keys whose use can be tracked and trended, and whose permissions can be revoked instantaneously.

SoCalGas does not plan to put forward a second mitigation measure – Corporate Security Agent – that SDG&E has proposed.

CFF-5.8.2 Existing Costs and Expected Budget Request

SoCalGas offers a budget table to provide a snapshot overview of existing and expected program costs, but does not explain or justify the cost figures. SoCalGas did not tally its program cost columns to provide a total cost figure. In its budget table SoCalGas combines O&M for the single year 2024, while capital is provided over a three-year period. Also, without context or explanation, SoCalGas provides both a high- and low-cost estimate for the forecast three-year capital spending

period and the forecast one-year (2024) O&M spending period representing three years of spending in one column. SPD Staff reformatted the table for clarity and discussion purposes.

Annual total program costs based on the single year 2024 would be roughly $4.01 million, based on an average cost of the capital and O&M components. Annual cost of capital, low forecast and high forecast would be $2.48 million and $2.75 million. Annual cost of O&M, low forecast and high forecast would be $1.39 million and $1.64 million.

SoCalGas Forecast Spending Table Submitted for Physical Security

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	190	1	6,654	8,133	17	21
2	Contract Security	24	629	94	116	532	650
3	Planning, Awareness, Risk Management, and Incident Management	0	878	0	0	841	969
4	Physical Security Upgrades	Included in line 1	0	Included in line 1	Included in line 1	0	0

CFF-5.8.3 SPD Analysis of SoCalGas Requested Budget

After reformatting the IOU's budget numbers, one arrives at an annual budget request of about $4 million for 2022, 2023, and 2024. By comparison, this amount is less than one-seventh the amount SoCalGas proposes to spend on Cyber Security. A review of the IOU's budget table reveals that it elected not to provide specific cost figures for each of its two proposed mitigation measures but instead lumped these spending amounts in with existing control measures. Additionally, the IOU does not discuss how existing controls are to be preserved and carried over into future years, why this would be done, and how such programs and spending are justified.

The forecast $4 million per year spending number represents a more than doubling of the IOU's existing annual spending amount, an increase which SoCalGas has not explained or attempted to justify. By comparison, SDG&E spent $4.15 million in 2020, and proposes to spend for $4.75 million per year for 2022-2024.

CFF-5.9 Risk Spend Efficiency (RSE)

SoCalGas offers no RSE for the Physical Security risk as they treat it as a cross-functional factor. As such, Staff can't assess the cost-effectiveness of Physical Security mitigations.

CFF-5.10 Alternatives Analysis

As noted above, SoCalGas does not describe alternatives or discuss mitigation measures considered but not advanced.

CFF-5.11(opt) Scenario Analysis (if available)

CFF-5.12 Summary of Findings

The two Sempra utilities propose essentially identical Physical Security mitigation strategies that carry over existing controls and add one (SoCalGas) or two (SDG&E Gas) new mitigation measures. The utilities rely primarily on low-cost, practical solutions such as employing security staff, changing keys and locks, employing concentric defenses to slow down and thwart an attack, and using earth berms, walls, and defensive technology to promote improved situational awareness.

The lack of explanation or justification in this analysis of Physical Security risks, controls, and mitigations summary leaves much open for interpretation and uncertainty for Staff. For example, as noted above, SoCalGas did not justify shifting its treatment of Physical Security from primary to cross-functional. Given the cost range for potential budget figures and the lack of detail for the programs SoCalGas proposes, Staff recommends the inclusion of substantive explanations to address these shortcomings as part of their GRC filing.

CFF-5.13 Recommended Solutions to Address Findings and Deficiencies

The most practical way for SoCalGas to improve the analysis of Physical Security risks would be to expand the writeup to thoroughly explain why Physical Security is no longer a primary risk or treat this risk as a primary risk chapter with full Risk-Based Decision-Making treatment consistent with the S-MAP settlement agreement. Sempra's 2016 RAMP analysis of Physical Security as a primary risk provides a model for this.

CFF-6 / SDGE CFF-7 Safety Management System

SDG&E and SoCalGas have been employing Safety Management Systems (SMS) to manage and reduce risks. SDG&E and SoCalGas recognize SMS as a systematic, enterprise-wide approach and identify cross-functional factors (CFFs) as drivers, triggers, activities, and programs that may impact multiple RAMP risks. In SDG&E's and SoCalGas CFF chapters, Sempra provides narrative descriptions of CFF projects and programs for the 2022-2024 timeframe. However, there are no numerical formulas or explanations for the functions of CFFs, their calculation of baselines, and the potential reduction of risks by implementing SMS/CFFs.

CFF-6 / SDGE CFF-7 .1 Risk Description

SDG&E

SDG&E categorizes SMS into "Five Pillars of Safety":

1. **People Safety**: Addresses education of, communication to, effects on, and contribution of people who comprise and support the organization
2. **Asset Management**: Considers the assets, systems and equipment, their condition, maintenance, installation, prediction of failure, and how they affect worker and public safety.
3. **Gas and Electric Operation**: Provides practical input into developing safety processes, practices, and standards and ensures proper application of SMS tenets and processes in executing the operation, maintenance, and construction activities to protect worker and public safety.
4. **Risk Identification and Management**: Identifies safety risks, considers their likelihood and potential consequences and identifies mitigations that reduce these risks to prevent safety incidents.
5. **Emergency Preparedness and Incident Response**: focuses on utilizing leading practices for all responses that support situational awareness, collaboration, coordination, and strong command and control to minimize worker risk and public exposure.

SDG&E proposes its SMS governance structure for implementing the Five Pillars of Safety:

1. **Safety Department:** Led by Chief Safety Officer who oversees the implementation of safety policies, training, and programs:
    a. Environmental & Safety Compliance Management Program
    b. Behavior-Based Safety Program
    c. Stop the Job Program,
    d. Close Call/Near-Miss Program,
    e. Incident Investigations,
    f. Safety Culture Assessments, and
    g. Contractor Safety Program.
2. **Asset Management Organization**: Develops, implements, and enables strategies for regulatory compliance, business technology, data management, and integrated asset management.
3. **Enterprise Risk Management Organization**: Implements the risk management process and integration of risk-informed decision-making across the company.

4. **Emergency Management Department**: Coordinates safe, effective and risk-based emergency preparedness. It includes:
    a. Aviation services,
    b. Business resumption,
    c. Emergency prepared and response operations,
    d. Information and technical services, and
    e. Operational field emergency readiness.

SDG&E established "Target Zero" as the goal to achieve an incident-free work environment. As CFFs and SMS are not in and of themselves RAMP risks, the SMS principles can benefit the enterprise by conducting the following:

1. Greater communication, broad sharing of information and utilization of lessons learned;
2. Enhanced documentation in the form of standardized processes and widely accessible document and data repositories;
3. Strengthened employee feedback mechanisms, additional means/resources for consistent follow-up and communication;
4. Early identification of risks, integration of risk and asset management with operations;
5. Strong change management, where employees and contractors have the knowledge and tool to anticipate, identify and assess risk and are empowered to communicate risks to drive change; and
6. 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.

Observations

Although SDG&E stated that it has formed organizations and departments for various programs, begun the strategic initiative to develop SMS, and implemented approaches mentioned above for gas and electric operation since 2019, there is no detailed breakdown of tasks, activities and programs that support the statement or any measures to demonstrate the effectiveness of safety management system and risk reduction.

SoCalGas

SoCalGas identified Seven Safety Values as the foundation of its SMS and for the continuous strengthening of its safety culture:

1. **Leadership Commitment:** the leadership oversees safety concerns, promotes safety culture by demonstrating safety behaviors, and empowers employees to identify risks and "Stop the Job."
2. **Risk Management:** SoCalGas identifies threats and hazards, assesses and prioritizes risks, implements mitigation efforts, and engages in assessment and reviews to understand risk mitigation effectiveness.
3. **Employee and Stakeholder Engagement:** SoCalGas encourages two-way formal and informal communication between the company and the public, employees and management, and contractors and the company.

4. **Competence, Awareness, and Training:** SoCalGas provides employees with proper tools, resources, training, and oversight to promote safe operations.
5. **Emergency Preparedness and Response:** SoCalGas establishes an Incident Command System for response planning, training, and coordination with first responders and external stakeholders, and an Emergency Operations Center for employees to efficiently take appropriate actions to respond and mitigate an emergency.
6. **Safety and Compliance Assurance:** SoCalGas uses Operational Control, and Records Management approaches to structure change when implementing new policies and procedures.
7. **Continuous Improvement:** SoCalGas focuses on three primary areas a) incidents, b) feedback, and c) performance measurement for its safety culture improvement.

SoCalGas's Chief Safety Officer, also the Chief Operating Officers, provides direct oversight to SMS implementation. There are multiple centralized programs as well as other safety practices operating groups to support the functions of SMS:

1. The **Safety Management System Organization** is structured around the "Plan-Do-Check-Act" model and is comprised of directors, managers, supervisors, and subject matter experts with the responsibilities of providing strategic guidance and establishing appropriate policies, standards, procedures, and key performance indicators; Leading incident investigation and sharing lessons learned; leading the annual management review and safety assurance functions, and collaborating with employees.
2. **Enterprise Risk Management Organization:** Facilitates the identification, analysis, evaluation, and prioritization of risks and integration of risk-informed decision-making across the company.
3. The **Integrity Management Organization** focuses on developing and implementing processes and procedures to manage transmission, distribution, and storage well integrity in compliance with regulatory requirements.

Observations

SoCalGas indicates that it strives for zero incidents and provides programs and committees/subcommittees to manage safety risks. However, there is no mention of records of how effective these programs are to achieve the goal of zero incidents or a mechanism to evaluate the reduction of safety risks through the implementation of the programs. SoCalGas proposes to conduct an annual management review of the SMS performance. But no parameters that link between the reduction of safety risk and SMS performance were provided.

CFF-6 / SDGE CFF-7 .2 Bowtie

SDG&E's and SoCalGas's SMS discussions did not include a Bowtie illustration, as the utilities describe that SMS and CFFs are not in and of themselves RAMP risks.

CFF-6 / SDGE CFF-7 .3 Exposure

SDG&E's and SoCalGas's SMSs indicated that the approach is enterprise-wide and would require all employees to participate. Utilities state that the business unit and enterprise level will be integrated systematically within the SMS framework by focusing on procedures, hazard analysis,

training, equipment integrity, change management, incident investigation, emergency preparedness, and compliance.

Observations

In implementing the SMS, utilities should establish baselines of exposure levels of multiple risks and how the implementation of SMS, with collective efforts of all employees, would reduce the exposure. There are no discussions of exposure levels for baseline and anticipated risk reduction benefits of implementing SMS.

CFF-6 / SDGE CFF-7 .4 Tranches

SDG&E and SoCalGas did not employ tranches for risks potentially mitigated by implementing SMSs as this is a Cross-Functional Factor.

CFF-6 / SDGE CFF-7 .5 Likelihood of Risk Event (LoRE)

SDG&E and SoCalGas did not include LoRE data for risks potentially mitigated by implementing SMSs as this is a Cross-Functional Factor.

CFF-6 / SDGE CFF-7 .6 Consequence of Risk Event (CoRE)

SDG&E and SoCalGas did not include CoRE data for risks potentially mitigated by implementing SMSs as this is a Cross-Functional Factor.

CFF-6 / SDGE CFF-7 .7 Pre-Mitigation Risk Score

SDG&E and SoCalGas did not provide a pre-mitigation risk score for risks potentially mitigated by SMSs within its 2021 RAMP.

CFF-6 / SDGE CFF-7 .8 Programs and Projects

SDG&E and SoCalGas began developing enterprise-wide SMSs in 2019 and anticipated to initiate its implementation in 2021. Following the release of American National Standards Institute/American Petroleum Institute Recommended Practice 1173 (API 1173) in July 2015, SDG&E and SoCalGas adopted the foundational principles of API 1173 into their own SMS.

<u>SDG&E</u>

SDG&E expects to move both gas and electric enterprises towards SMS which includes ten essential elements, also referred to as “tenets:”

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 SMS governance structure comprises three teams:

1. SMS Executive Steering Team,
2. SMS Governance Team, and
3. SMS Program management Team.

SDG&E anticipates integrating projects and programs listed below into its TY 2024 General Rate Case (GRC) for SMS implementation:

1. *Development and Implementation of an Enterprise-Wide Safety Management System*

SDG&E indicated that it takes years to develop and fully implement SMS. To that end, they have hired two full-time professionals to manage the development and implementation of the SMS. They began implementing their SMS in 2019 and plans effort to further operationalize their SMS through 2021 and beyond.

Based on the information provided, it is unclear to what extent SMS may already be reducing risk/improving the effectiveness of mitigations or how further implementation of the SMS will impact risks.

2. *Enhanced Employee & Stakeholder Engagement, Including SMS Competence, Awareness, Survey and Training*

SDG&E plans to develop and deliver SMS-specific training and create ways to measure and track such competencies for all levels. While recognizing the importance of building trust and confidence in prioritizing safety for employees, contractors and the public, SDG&E did not outline trainings for operational units and management, and the schedule and frequency of completing the subject trainings. It would be critical to incorporate key trainings into the SMS and identify the relationships between the trainings and the improvement of safety performance.

3. *Integration of New Technology and Enhanced Data and Analytics Capabilities for Continuous Safety Improvement*

SDG&E plans to reveal risks within its business operations, evaluate multiple risks and treats using "what if" scenarios, and predict potential failures by using new artificial intelligence technology of electronic platform or an application. The plan is lack of information of "new technology" and how the artificial intelligence will retrieve and compile safety and operational data, hazards, errors, observation, and key performance indicators from people, assets, programs processes and operation for predictive analysis of potential risks. SDG&E should provide a plan of acquiring new technology and how it will interconnect with existing data and analyze information. There is also no method mentioned to validate the use of new technology and the analytics for assessment of risk reduction.

4. *Enhanced Documentation and Recordkeeping Practices*

SDG&E states that enhanced documentation that will be widely accessible to employees will allow for sharing of best practices, findings and lesson learned. However, there is no detailed plan of what information to be shared, accessibility of records, and how to improve the information and management transparency for lessons learned.

5. *Expanded Quality Management Program Focused on Asset Safety*

SDG&E plans to conduct quality assurance and quality control to ensure 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. SDG&E proposes to use measurable targets against expected metrics and process steps for quality control but does not provide information of the process of identifying measurable targets as well as the evaluation procedures to validate the adherence to the SMS. Besides, SDG&E indicates that the asset safety quality management program will be expanded. SDG&E should provide more details regarding what processes, procedures and accountability measure will be formalized, and how they will be achieved and implemented.

6. *Enhanced Stakeholder Feedback and Key Performance Indicator Monitoring, Tracking, and Reporting*

SDG&E proposes to expand processes for qualitative and quantitative analysis for trends and emergent issues to identify and mitigate new risks and to improve the SMS. SDG&E did not provide the details of obtaining stakeholder feedbacks, and what and how the data will be quantified and analyzed for future trends and new risks.

7. *Development and Implementation of a Strong Management of Change Platform*

SDG&E states that it has developed a Management of Change (MOC) process that can be applied to identify risks associated with changes to technology, equipment, procedures or organization so that impacted stakeholders can safely handle changes. The objective of the standardized MOC process is to reduce the possibility of introducing additional risks, or inadvertently increasing the risk to public or employee health and safety, the environment and the community as the result of a change. As the MOC process has been developed, SDG&E did not provide how it will be implemented and how to measure the success of the MOC process. It also lacks the mechanism of how the MOC process will reduce the risks, the corresponding actions, and the magnitude of risk reduction. Besides, SDG&E mentioned that the centralized MOC process will help facilitate communication with impacted stakeholder. There is no description of how the information of MOC process will be shared.

8. *SMS Program Benchmarking, Measurement and Maturity Assessment for Continuous Improvement*

SDG&E plans to review, survey, benchmark, measure, validate and audit it's SMS program effectiveness no less than bi-annually, which exceeds the API recommended annual review. The SMS system performance will be evaluated according to 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.

Observations

SDG&E wrote that the efficacy of its SMS "will be measurable based on identified controls and metrics to identify opportunities for continuous safety improvement." This will be an important step, and Staff looks forward to learning more about SDG&E's progress on this front in the future as part of the Safety Culture Assessments that are being formalized in R.21-10-001. In a subsequent RAMP filing, if suitable metrics have been identified to evaluate the effectiveness of the SMS, the utilities should quantify the risk reduction benefits of these programs.

SoCalGas

SoCalGas started to develop its SMS/CFF based on API 1173 in 2016. The current SMS structure was founded in 2019 and SoCalGas continues to implement the following programs in 2020:

1. SMS Framework

SoCalGas started to build the SMS framework with the focuses on:

i. SMS Policy, Scope, Commitment, and Responsibilities: The purpose of establishing SMS framework is to define, develop, implement, maintain and improve the SMS.
ii. SMS Plan and Gas Safety Plan: These plans connect to and implement the Safety Values mentioned above. Both SMS Plan and Gas Safety Plan address the safety strategy and performance.
iii. Employee and Stakeholder Engagement: SoCalGas has developed an SMS Stakeholder Engagement Plan for communication and engagement of internal and external stakeholders regarding risk identification and management and safety performance.
iv. Centralized Electronic Management of Change Process: It reduces the possibility of introducing additional risk or inadvertently increasing the risk to public or employee health and safety, the environment, or the community due to the change.
v. SMS Maturity Assessment: The purpose is to examine the conformity of a SMS with external benchmarks.
vi. SMS Benchmarking: SoCalGas plans to compare its practices with other companies to improve safety performance and review other industry benchmarks.

2. Pipeline Safety and Compliance Oversight

The Pipeline Safety and Compliance Group in SoCalGas SMS is responsible for managing regulatory compliance issues including a) monitoring, distributing and tracking CPUC and DOT/PHMSA regulations, b) monitoring and reporting incidents, and c) regulatory audits and inspections.

3. Continuous Improvement and Quality Assurance
SoCalGas indicates that an Incident Evaluation Process has been established to gather information on incidents, evaluate the system and policy and procedures and identify corrective actions.

4. Technology and Analytics
SoCalGas has developed a dashboard to visualize Key Performance Indicators (KPIs), and will integrate new technologies for data analytics and risk management.

5. Develop Incident Evaluation Central Database and Further Enhance Causal Analysis Training
SoCalGas plans to build a centralized database for all incidents and near misses, and develop incident evaluation trainings.

6. Expand Quality Assessment Program
SoCalGas proposes to add new quality assessment programs through a risk ranking approach.

7. Expand Compliance Assurance Program
SoCalGas indicates that it will automate maintenance planning activities, enhance inspection forecasting reports, and create custom user interface.

8. Pipeline Safety Self-Assessment
A new self-assessment including odor intensity tests, pre-audit dry runs and inspections will be implemented.

CFF-6 / SDGE CFF-7.8.2 Existing Costs and Forecast Costs

<u>SDG&E</u>
SDG&E offers a table to provide a snapshot overview of existing and expected program costs for SMS programs. The cost for operating and maintaining the anticipated programs and projects (listed below) is estimated between 2.6 million dollars (low end) and 4.4 million dollars (high end), with an average of 3.5 million dollars for years from 2022 through 2024.

SDG&E Cost Forecast Table Submitted for Safety Management System (all dollars in thousands)

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.

SoCalGas

SoCalGas offers a table to provide a snapshot overview of existing and expected program costs for SMS programs. The total cost of operating and maintaining the identified programs and projects is forecasted between 4.74 million dollars (low end) and 5.93 million dollars (high end) with an average of 5.34 million dollars for years from 2022 to 2024.

Table 1: Costs (Direct After Allocations, in 2020 $000)[5]

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	SMS Framework	0	823	0	0	782	946
2	Pipeline Safety & Compliance Oversight	0	718	0	0	682	825
3	Continuous Improvement and Quality Assurance	0	2,042	0	0	1,940	2,349
4	Technology & Analytics	0	553	0	0	525	636
5	Develop Incident Evaluation Central Database and Further Enhance Causal Analysis Training	0	0	0	0	100	145
6	Expand Quality Assessment Program	0	0	0	0	113	164
7	Expand Compliance Assurance Program	0	0	0	0	300	434
8	Pipeline Safety Self Assessments	0	0	0	0	300	434

Observations

SDG&E and SoCalGas indicate throughout their respective SMS chapters that most programs will be expanded to improve safety management. They also indicate that they are developing metrics to evaluate the efficacy of the SMS and identify opportunities for continuous improvement. In future RAMP filings, when these evaluation processes are more developed, the utilities should report on the efficacy of these programs and quantify how other RAMP risks are reduced or mitigations improved.

CFF-6 / SDGE CFF-7.9 Risk Spend Efficiency (RSE)

SDG&E and SoCalGas offer no RSE for implementing SMS/CFFs.

CFF-6 / SDGE CFF-7.10 Alternatives Analysis

As with other CFF chapters, SDG&E and SoCalGas do not provide alternatives to SMS.

CFF-6 / SDGE CFF-7 .11(opt) Scenario Analysis (if available)

Not applicable.

CFF-6 / SDGE CFF-7.12 Summary of Findings

SDG&E's and SoCalGas Company's provide a brief, high-level summaries of their SMS programs and their respective implementation. Based on the information provided, both SMS hold promise for improved safety outcomes.

CFF-6 / SDGE CFF-7.13 Recommended Solutions to Address Findings and Deficiencies

As the companies develop their ability to assess the efficacy of the programs, it would seem that in future years, they should be able to quantify the risk reduction value of their SMS.

CFF-7 (SDGE CFF-8) Workforce Planning

CFF-7 Workforce Planning and Qualified Workforce

In the submission, "Risk Assessment and Mitigation Phase Cross-Functional Factor – Introduction," SoCalGas discusses its approach to assessing CFFs. Regarding the Workforce Planning and Qualified Workers [253], SoCalGas identifies essential elements to evaluate Workforce Management (WM) safety risks. These include the ability to recruit, retain, and train the appropriate number of qualified employees.

CFF-7.1 Risk Description

Workforce Management (WM) is not explicitly considered a RAMP risk. Instead, SoCalGas considers WM to be a driver of Risk Events in the RAMP. At a high level, these drivers may include " … a gap in experience or knowledge, lack of adequate workforce to respond to an emergency incident, and a lack of leadership skills potentially impacting employee engagement and adherence to safety protocols."

SoCalGas lists several examples of risks to the Workforce Management that could result in potential Risk Events. Example risks include

- **Insufficient staffing levels lead to delay in compliance or customer-generated work.**
- **Increased competition for qualified employees:** As the economy trends towards more high-tech jobs, the number of qualified candidates could drop. The company may face higher competition for a smaller number of candidates with the right skills.
- **Aging workforce leads to higher attrition**: SoCalGas has a large number of retirement-eligible employees who have served with the company for multiple decades. They have built valuable stores of institutional knowledge that are hard to replicate or replace. The number of employees retiring increased in 2020 compared to 2019.
- **Changing demographic of the workforce will change how the company works:** As more of the company's workforce is replaced with younger employees, the internal dynamic of career progression can be affected. Millennials are forecasted to become the majority of the country's workforce in the coming years. Millennials, on average, are more mobile and tend to move between departments, or even companies, more often. This can be disruptive to operations as it increases the need for training, transitions, and leaves more vacancies.

CFF-7.2 Bowtie

Treating this issue as a CFF, SoCalGas does not provide any Bowtie analysis.

CFF-7.3 Exposure

Treating this issue as a CFF, SoCalGas does not analyze or quantify exposure.

[253] In the remainder of this document, we will refer to Workforce Planning and Qualified Workforce as Workforce Management (WM)

CFF-7.4 Tranches
Treating this issue as a CFF, SoCalGas does not tranche this risk.

CFF-7.5 Likelihood of Risk Event (LoRE)
SoCalGas does not explicitly discuss LoRE for this CFF.

CFF-7.6 Consequence of Risk Event (CoRE)
SoCalGas does not explicitly discuss CoRE for this CFF.

CFF-7.7 Pre-Mitigation Risk Score
SoCalGas does not generate Risk Scores for this CFF.

CFF-7.8 Controls and Mitigations
SoCalGas does not necessarily refer to Controls or Mitigation plans for this CFF. Still, they discuss several programs to address workforce issues that Staff will treat as controls and mitigations. The utility offers examples of 2020-year programs.

- **Workforce Planning**
  - Workforce Planning provides SoCalGas with the ability to identify, focus on, and overcome workforce gaps in critical roles within the organization. Workforce Planning also helps with employee development so that employees have the right skills for current and future jobs within SoCalGas.
- **Succession Planning/Knowledge Transfer**
  - In the next five years, over 50% of managers at SoCalGas will be retirement eligible. In addition, many employees will transition to other roles. These two factors combined may lead to loss of critical knowledge within the company. Currently, SoCalGas conducts a formal annual succession planning and talent review process to identify a pipeline of talent for all director and officer level positions. SoCalGas utilizes these reviews and other efforts to support accelerated development for high potential employees.
- **Training**
  - Leadership training, such as the New Supervisor Onboarding Program, Leadership Training Camp, Leadership Challenge, and the Director Development Program are necessary vehicles to communicate the company's safety culture and to communicate the importance of the company's safety values.
- **Non-HR Technical Training**
  - Activities within the scope of technical training include revamping and redesigning current technical training on an enterprise-wide basis. The importance of skills training for employees to perform their jobs safely are discussed in more detail in the following RAMP Risk Chapters: Incident Involving an Employee, Incident Involving a Contractor, Incident Related to the High Pressure System (Excluding Dig-In), Incident Related to the Medium Pressure (Excluding Dig In), Excavation Damage (Dig-In) on the Gas System, and Incident Related to the Storage System (Excluding Dig-In).

SoCalGas also discusses 2022 – 2024 program enhancements and extensions. Under the current definition in the S-MAP Settlement Agreement,[254] these might be considered mitigations. The justification for these enhancements, however, are discussed in the context of meeting "increasing demands of business units" and increasing "efforts to implement, refresh, and expand specific knowledge management strategies" and address "skills gaps."

SoCalGas does not offer asafety-specific justification for these enhanced programs.

CFF-7.8.2 Existing Costs and Expected Budget Request
SoCalGas provides costs for the programs listed above. SoCalGas does not provide any context or justification for their forecast budget. The cost table is reproduced below.

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	Workforce Planning	0	585	0	0	940	1,105
2	Knowledge Transfer	0	35	0	0	140	195
3	Training	0	1,115	0	0	620	750
4	Training – Technical non-HR	0	295	0	0	280	340
5	Workforce Planning – Enhance		Included in Line 1			Included in Line 1	Included in Line 1
6	Knowledge Transfer – Enhance		Included in Line 2			Included in Line 2	Included in Line 2
7	Training – Enhance		Included in Line 3			Included in Line 1	Included in Line 3
8	Training – Technical non-RH - Enhance		Included in Line 4			Included in Line 4	Included in Line 4

CFF-7.9 Risk Spend Efficiency (RSE)
SoCalGas offers no RSE for this CFF.

CFF7.10 Alternatives Analysis
SoCalGas does not discuss any alternatives and offers no discussion of mitigation measures considered but not advanced.

CFF7.12 Summary of Findings
SoCalGas does not quantify the impact of WM on the likelihood or consequences of Risk Events.

The WM CFF RAMP Chapter:
- Does not provide any scale or scope to gauge anticipated WM impacts;

[254] The SA Decision defines "mitigation" as "a measure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event." SA Decision at 16-17

- Does not discuss or quantify the level of expected mitigation impacts;
- Does not identify WM tranches; and
- Does not justify or sufficiently explain planned expenditures.

CFF-7.13 Recommended Solutions to Address Findings and Deficiencies

While we have identified several gaps in SoCalGas RAMP submission (i.e., not including quantitative measures), we are not suggesting that SoCalGas must use the S-MAP risk modeling approach - i.e., bowtie, tranches, etc. - to characterize CFF risks. The indirect and interrelated nature of the CFFs may require an innovative and novel approach to generate a quantitative assessment of the risk impacts due to WM processes. The September 7th proposed decision in R. 20-07-013 requires foundational elements that meet a specified expenditure threshold, such as workforce management, to be apportioned to the mitigation efforts they enable.

Conclusion

The SoCalGas and SDG&E RAMP reports continue the ongoing effort to apply risk-based decision-making to rate cases. SPD's evaluation of the Sempra RAMP reports analyzed the quantitative assessment of the top safety and other risks and scrutinized their plans to mitigate these risks. SPD found that the RAMP reports generally followed the guidelines in the S-MAP Settlement Agreement approved in D.18-12-014. However, SPD staff and parties have observed areas where improvement is needed, found other issues, and made several recommendations.

Recommended Areas of Improvement

1. The base year of 2020 does not support risk assessment of the post-Test Year period for which rate recovery will be sought.
2. The weighting and scaling factors in the MAVF imply an unrealistic valuation of consequences.
3. The LoRE and/or CoRE for tranches are not tranche-specific.
4. Tranches should be more granular to differentiate risk.
5. SDG&E use of a gamma distribution model incorrectly predicts losses from extreme wildfires.
6. Wildfire smoke impacts should be re-assessed with consideration of MGRA comments.
7. The new Stakeholder Satisfaction attribute should be removed from the MAVF until the identified shortcomings have been addressed.
8. Cross-Functional Factor chapters do not quantify the expected benefits of mitigation programs.

Other Observations

SPD made additional findings within the individual risk chapters. Informal comments from parties provide additional evaluation and recommendations. Sempra should respond to these findings in the GRC filing.

Parties will be given an opportunity to file comments to the RAMP reports and SPD's evaluation report. The RAMP filing and comment process shall then form the basis of PG&E's assessment and proposed mitigations for its safety risks in the SoCalGas and SDG&E TY 2024 GRC filing. A workshop on this evaluation report is planned for November 22, 2021.

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PARTY INFORMAL COMMENTS on the RAMP

Appended to this Report:

MGRA SDGE RAMP Informal Comments 10-22-2021

TURN Informal Comments to SPD_final

SoCalGas and SDG&E Informal 2021 RAMP Comments 10-22-2021

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 21-05-011 (Filed May 17, 2021)
Application of Southern California Gas Company (U904G) to Submit Its 2021 Risk Assessment and Mitigation Phase Report.	Application 21-05-014 (Filed May 17, 2021)

MUSSEY GRADE ROAD ALLIANCE INFORMAL COMMENTS TO THE SAFETY POLICY DIVISION REGARDING SAN DIEGO GAS AND ELECTRIC COMPANY'S RAMP FILING

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Dated: October 22, 2021

1. INTRODUCTION

The Mussey Grade Road Alliance (MGRA or Alliance) submits these informal comments on the SDG&E 2021 RAMP filing[1] to the CPUC's Safety Policy Division (SPD) as per instructions.[2] These informal comments are prepared by Mussey Grade Road Alliance expert Joseph Mitchell.

In its Protest[3] and PHC Statement,[4] raised a number of issues that needed deeper examination in the RAMP proceeding, including:

- Adequate consideration of mitigation alternatives,
- Adequate disclosure of workpapers and sources, and the need for extensive discovery,
- Sensitivity of the SDG&E model to extreme values, and use of the gamma function rather than a power law function,
- Risks arising from power shutoff,
- Safety impacts from wildfire smoke, now incorporated into SDG&E's risk modeling,
- Statistical Value of Life equivalent to $100 million,
- Extreme wind as a cross-cutting factor,
- Lack of data quality estimations, and
- Tranches that depend on weather conditions,

MGRA has reviewed SDG&E's supplemental data and responses to intervenor data requests and has itself initiated eight data requests comprising over 50 questions.[5]

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[1] A.21-05-011; APPLICATION OF SAN DIEGO GAS & ELECTRIC COMPANY (U 902 M) TO SUBMIT ITS 2021 RISK ASSESSMENT AND MITIGATION PHASE REPORT; May 17, 2021, and A.21-05-014; APPLICATION OF SOUTHERN CALIFORNIA GAS COMPANY (U 904 G) TO SUBMIT ITS 2021 RISK ASSESSMENT AND MITIGATION PHASE REPORT; May 17, 2021. (RAMP)

[2] Email: Sempra RAMP Application Evaluation Deadline Extension Request; From: Benjamin.Turner@cpuc.ca.gov; September 17, 2021, 12:05 pm.

[3] A.21-05-011-14; MUSSEY GRADE ROAD ALLIANCE PROTEST ON SAN DIEGO GAS AND ELECTRIC COMPANY'S 2021 RAMP APPLICATION; June 9, 2021. (MGRA Protest)

[4] A.21-05-011-14; MUSSEY GRADE ROAD ALLIANCE PREHEARING CONFERENCE STATEMENT; July 7, 2021. (MGRA PHC Statement)

[5] SDG&E Data Request Responses to MGRA are included as Appendix A, as a separate document.

2. TECHNICAL ANALYSIS OF THE SDG&E RAMP

In this section, technical aspects of SDG&E's RAMP are examined in order to examine the extent to which SDG&E is correctly quantifying and prioritizing risks. Some of these issues were raised by MGRA in SDG&E's 2019 RAMP filing,[6] while others are based upon new information available in SDG&E's 2020 Wildfire Mitigation Plans, and MGRA participation in the PG&E RAMP (A.20-06-012) or the RDF/S-MAP proceeding (R.20-07-013). Suggestions regarding additional work that Staff should suggest that SDG&E incorporate into its GRC are included where appropriate.

2.1. Extreme Value Distributions and Power Laws

MGRA has been advocating for the use of power law distributions to describe extreme losses from wildfires based on numerous academic references.[7] MGRA urged SDG&E to examine the implications of a power law distribution in its protest.[8] SDG&E has been instead using a gamma distribution to describe extreme event behavior.[9] There is no theoretical basis for the use of the gamma function to fit wildfire loss distributions. While empirical fits (fits based on existing data rather than a hypothesis) can be reasonable for interpolation, their accuracy depends upon the availability of data for the initial fit. Using empirical fits for extrapolation beyond values seen in historical data is dangerous and likely to lead to inaccurate results.

MGRA found through data requests that SDG&E's gamma distribution function and its parameters were determined by a fit to a single data point.[10] SDG&E had purportedly also explored

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[6] I.19-11-010-1; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON SDG&E'S 2019 RAMP FILING; April 6, 2020; p. 2. (MGRA 2019 RAMP Comments)

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

[8] A.21-05-011-4; MUSSEY GRADE ROAD ALLIANCE PROTEST ON SAN DIEGO GAS AND ELECTRIC COMPANY'S 2021 RAMP APPLICATION; June 9, 2021; p. 19.

[9] Id.; p. 20.

[10] SDG&E Response to MGRA-DR-003, Question MGRA-4: "The fit parameters SDG&E used was based on SDG&E's historical data, specifically the 2007 Witch Fire financial loss, and SME judgement. Based on these parameters, the financial loss is estimated to be $2.4 billion on average and around $5 billion dollars at the 95th percentile."

using a power law for its fit, but was unable to find the supporting documentation reported by the SDG&E representative.[11] MGRA has therefore requested that SDG&E perform a sensitivity analysis using a power law distribution in its WiNGS model rather than a gamma function. The results of this analysis were not available in time for the preparation of these comments[12] and will be provided to SPD and the Commission when they have been received.

As MGRA has maintained in the RDF/SMAP proceeding and in PG&E's RAMP, the purpose of using a power law distribution is that it properly captures the probability of high consequence "tail" losses. While a utility might theoretically use a different function to describe losses, it is critical that the chosen probability distribution include a sufficient contribution from low-probability high-consequence events.

The probability distribution selected by SDG&E is the gamma distribution,[13] with a "shape parameter" *(k)* of 3 and "scale parameter" *(θ)* of 0.8.[14] SDG&E has calibrated its fit based on historical losses to have a median value of $2.1 billion.[15] Based on the selected distribution and parameters, SDG&E claims that 98% of its cumulative losses (P98) will be less than $6.0 billion.[16]

According to analysis by J. Mitchell in the MGRA White Paper and cited references, the cumulative statistical distribution of wildfire losses in California can be described by a power law with an exponent of -0.4 to -0.5.[17] One characteristic of power law distributions, however, is that they do not converge at large values. Deviations from power law behavior occur when the wildfires approach maximum feasible size for the landscape, so a maximum size needs to be chosen accordingly. A power law function that incorporates both high and low end cut-offs that has provided accurate fits to wildfire size distributions is:

$$y = C[(a+x)^{-\alpha} - (a+L)^{-\alpha}]$$

[11] SDG&E Response to MGRA-DR-006-Partial, MGRA-30. "While the representative stated his belief that some power law distribution may have been analyzed previously, SDG&E has conducted a reasonable inquiry but is unable to determine if it has responsive documents."
[12] SDG&E Response to MGRA-DR-008-Partial, MGRA-57.
[13] https://en.wikipedia.org/wiki/Gamma_distribution
[14] SDG&E Data Request Response MGRA-DR-003, Question MGRA-4.
[15] SDG&E Data Request Response MGRA-DR-008, Question MGRA-52.
[16] SDG&E Data Request Response MGRA-DR-008, Question MGRA-52.
[17] MGRA White Paper; pp. 5-8.

where a is the small size cutoff and L is the large size cutoff.[18]

In the table below, the gamma function chosen by SDG&E is compared against a power law with an exponent of -0.5. The scale of the two distributions is set to have the P50 point at $2.1 billion, as per SDG&E's SME judgement. A non-truncated power law is calculated, which does not converge, as well as a power law with a maximum loss set to $40 billion. Given the magnitude of known wildfire losses (specifically the Camp fire example), this may be sufficient for SDG&E's service area.

Wildfire Losses, $ Billions	Gamma (3,0.8)	Power Law (-0.5)	Power Law, $40 B Max
2.1	46.3814%	49.8813%	51.0296%
2.64	61.6927%	55.3316%	57.8912%
3.33	76.3285%	60.1893%	64.0067%
4.19	87.9305%	64.5187%	69.4570%
5.27	95.2107%	68.3772%	74.3147%
6.64	98.6246%	71.8162%	78.6440%
8.36	99.7388%	74.8811%	82.5026%
10.52	99.9707%	77.6128%	85.9415%
13.25	99.9983%	80.0474%	89.0065%
16.68	100.0000%	82.2172%	91.7382%
21.00	100.0000%	84.1511%	94.1728%
26.44	100.0000%	85.8746%	96.3426%
33.28	100.0000%	87.4107%	98.2764%
41.90	100.0000%	88.7798%	100.0000%

Table 1 - Probability of wildfire losses less than specified amount using gamma distribution (SDG&E), power law, and power law truncated at $40 billion (MGRA). The gamma function values were calculated using Microsoft Office Excel's GAMMA.DIST function, and match the P95 and P98 values reported by SDG&E in its data request responses.

[18] Moritz, M.A., Morais, M.E., Summerell, L.A., Carlson, J.M., Doyle, J., 2005. Wildfires, complexity, and highly optimized tolerance. Proceedings of the National Academy of Sciences 102, 17912–17917. https://doi.org/10.1073/pnas.0508985102

The calculation in the table above successfully reproduces SDG&E's P98 value of roughly $6 billion using the gamma distribution. As can be seen however, the behavior for larger losses is vastly different for the gamma and power law distributions. SDG&E's method, for instance, predicts that is virtually impossible for losses to occur that are greater than $10 billion (< 0.1% probability). Losses greater than $15 billion have less than a 0.0001% probability.

The truncated power law distribution, however, shows that losses greater than $15 billion have a 10% chance of occurring if the median loss is $2 billion. This is a difference of many orders of magnitude, and this will have a dramatic effect on wildfire risk calculations. As seen during the Camp fire as well, massive financial losses are often accompanied by numerous fatalities and injuries, so it is proper to use a power law to represent safety risks as well as financial losses.

In conclusion, it does not appear that a gamma function with the parameters chosen by SDG&E will adequately predict large losses. Instead, it predicts negligible probability of losses greater than $5 or $10 billion. SDG&E has provided no justification for its choice of a gamma function or the parameters it chose other than to say it was determined by an SME. Wildfire sizes, which will be related to losses, follow a power law and show a much higher probability of very large "tail" events. SDG&E should incorporate a power law distribution with an appropriate high-end cutoff for its service area in both its financial loss and safety risk calculations.

2.2. Risks from Wildfire Smoke

As MGRA noted in our protest,[19] SDG&E's incorporation of wildfire smoke as a safety risk is innovative and an overall positive development. However, the methodology SDG&E uses to calculate these impacts is incorrect, making a significant unit conversion error and being based upon outdated references. Alternative approaches that SDG&E might develop in its GRC are discussed. It will be shown that this is an area of active research and SDG&E should work with experts in the field to develop an optimal approach.

[19] MGRA Protest; pp. 11-13.

2.2.1. SDG&E's Wildfire Smoke Safety Impact Methodology

SDG&E now incorporates an "Acres Burned" contribution to its wildfire safety risk model, and it includes this as part of its safety attribute, with a weight of 0.0005 per acre burned, equivalent to one fatality or four severe injuries per 20,000 acres.[20] Wildfire has numerous impacts aside from the currently tracked attributes of deaths and injuries directly arising from the fire, and property lost. Prior to SDG&E's RAMP, no utility had incorporated deaths and injuries due to wildfire smoke[21] into its safety risk calculations. SDG&E correctly identifies wildfire smoke as a safety risk that can have negative health impacts on populations downwind of wildfires. SDG&E's estimate is based on emission of PM2.5[22] smoke in general pollution, but recent academic work has shown that fine particles emitted from wildfires are even more dangerous than particles arising from other sources.[23]

Additionally, even though no utility is currently incorporating environmental attributes into its multi-value attribute function (MAVF), area burned can serve as a proxy for this damage. While California landscapes are generally fire-adapted, fire that is too frequent or severe, or fire coupled with extended drought, may lead to permanent changes due to "type conversion" and loss of ecosystems and habitat.[24]

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[20] RAMP; p. C-15.

[21] In these comments, "wildfire smoke" injuries and fatalities are defined as injuries and morbidities resulting from downwind transport of wildfire smoke and exposure of populations at some distance from the fire. Technically, many direct fatalities from wildfire result from smoke inhalation (as opposed to burns), but these fatalities and injuries occur at the fire front and are included in casualty statistics associated with the wildfire.

[22] PM2.5 is used to described particulate emission smaller than 2.5 microns. These are generally believed to have the greatest impacts on human health, particularly pulmonary and cardiovascular health. See for example:
Xing, Y. F., Xu, Y. H., Shi, M. H. & Lian, Y. X. The impact of PM2.5 on the human respiratory system. J. Thorac. Dis. 8, E69 (2016), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4740125/ and
Pope, C. A. III & Dockery, D. W. Health effects of fine particulate air pollution: lines that connect. J. Air Waste Manag. Assoc. 56, 709–742 (2006)
https://www.tandfonline.com/doi/abs/10.1080/10473289.2006.10464485.

[23] Aguilera, R., Corringham, T., Gershunov, A., Benmarhnia, T., 2021. Wildfire smoke impacts respiratory health more than fine particles from other sources: observational evidence from Southern California. Nature Communications 12, 1493. https://doi.org/10.1038/s41467-021-21708-0

[24] Syphard, A.D., Brennan, T.J., Keeley, J.E., 2019. Drivers of chaparral type conversion to herbaceous vegetation in coastal Southern California. Diversity and Distributions 25, 90–101. https://doi.org/10.1111/ddi.12827

For its methodology, SDG&E uses three sources along with its internal data.[25] First, it uses Clinton et. al.'s[26] estimate that there were 17,400 metric tons of PM2.5 emissions from the 2003 Cedar fire. SDG&E then calculated the cost per metric ton of PM2.5 emissions using results from a European study from 2005 (AEA Study).[27] The results of this study were also summarized in the "Transportation Benefit-Cost Analysis" study, which provided SDG&E's baseline number of $63,339 (2007) per metric ton of PM2.5 emissions.[28] SDG&E then determines its cost per acre burned:

"*The formula is: 17,407.27 metric tons * 1.1 ton / metric ton * $63,339 per ton * 1.24 / 273,246 acres = $5503.8 per acre burned, which was rounded to $5,000 per acre burned.*

Based on 2021 RAMP MAVF, 1 fatality is equivalent to $100 million. So, 1 fatality is equivalent to 20,000 acres burned."[29]

It should be noted that SDG&E's safety impact is determined by financial impact. SDG&E takes the costs as determined by the AEA, which primarily looks at health impacts, and applies them to cost per acre. However, for the "fatality per acre burned" equivalency to be valid, however, SDG&E would need to use the same value of statistical life (VSL) that the AEA study does. They do not. In fact, the AEA study uses a VSL between €980,000 and €2,000,000 (2006 equivalent Euros) about $US 1-2 million (2021)[30]. This is a factor of 50-100 less than the value of $100 million used by SDG&E for VSL. As noted by intervenors,[31] the VSL used by federal agencies is $10 million. According to the values used by the AEA study, one fatality is equivalent to $1-2 M / $5000 per acre, or 200-400 acres per fatality, implying far more fatalities than the number used by SDG&E.

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[25] SDG&E response: THE UTILITY REFORM NETWORK DATA REQUEST TURN-DR-002 SDG&E/SOCALGAS 2021 RAMP REPORT – A.21-05-011/014; Question 12; July 14, 2021. SDG&E response: MGRA-DR-003 SDG&E/SOCALGAS 2021 RAMP REPORTS- A.21-05-011/014; September 10, 2021; Question 7.

[26] Nicholas E. Clinton, Peng Gong, Klaus Scott, "Quantification of pollutants emitted from very large wildland fires in Southern California, USA", 2006, doi:10.1016/j.atmosenv.2006.02.016.

[27] AEA Technology (2005), Damages Per Tonne Emission of PM2.5, NH3, SO2, NOx and VOCs From Each EU25 Member State, Clean Air for Europe Programme, European Commission (http://ec.europa.eu/index_en.htm).). (AEA Study)

[28] Transportation Benefit-Cost Analysis, http://bca.transportationeconomics.org/benefits/emissions/methodology

[29] SDG&E Response to MGRA-DR-003 Question 7.

[30] Accounting for inflation, one 2005 Euro is approximately equal to one 2021 US Dollar.

[31] MGRA Protest; p. 13.

2.2.2. Implications of SDG&E's Wildfire Smoke Results

As noted in the MGRA protest, SDG&E's addition of Acres Burned would have significant impacts if we look at the implication for some historical fires.[32]

Fire	Year	Fatalities	Injuries	Structures	Cost ($M)	Acres	Risk	Acres %	Fatl/Inj%	Cost%
Witch	2007	2	40	1711	1500	197990	1.78	16.7%	20.2%	63.1%
Kincade	2019	0	4	374	600	77758	0.60	19.5%	5.0%	75.4%
Laguna	1970	5		382	400	175425	0.71	36.9%	21.0%	42.1%
Thomas	2017	2		1063	2500	281893	2.36	17.9%	2.5%	79.5%
Camp	2018	85	17	18804	16700	153336	15.43	1.5%	17.3%	81.2%
Tubbs	2017	22		5636	5000	36807	4.47	1.2%	14.8%	84.0%
Butte	2015	2		921	450	70868	0.50	21.1%	11.9%	67.0%
Redwood Valley	2017	9	1	546	400	36523	0.63	8.7%	43.9%	47.4%
Dixie	2021	1		1329	1000	963276	2.22	64.9%	1.3%	33.7%

Table 2 - Comparison of major historical wildfires linked to utility infrastructure using weights and scales approximately derived from the weightings and scaling factors used in SDG&E's MAVF calculations. Relative contributions from direct fatalities/injuries from wildfire, acreage burned (which is a proxy for smoke fatalities and injuries), and financial impacts are shown in the last three columns. Additional details and assumptions can be found in footnote 32.

As can be seen, for larger fires the Acres Burned component can be a significant or even dominant component of the risk score. The Dixie fire, for instance (example added subsequent to MGRA's protest), has destroyed relatively few homes compared to other major fires, but burned a very large area. Using the method put forward by SDG&E, one would expect the major safety risk

[32] Table entries consist of the following: Most data was obtained from the CAL FIRE incident web page. Where costs were available from reliable public sources these were used. Otherwise, losses range between $500,000 and $ 2 million per structure destroyed in 2021 dollars, so $1 M per structure is used. Partial MAVF risk score is 0.6 * (fatalities + (0.25 * injuries) + (.00005 * acres))/20 + 0.15 * (cost / $200M) as per RAMP Report p. C-7. A variety of wildfires associated with electrical equipment has been included from the CAL FIRE "Top 20" lists for structures, fatalities, and acres burned. The Laguna fire was included because of its large size and smaller level of structure loss in order to demonstrate acreage contribution. It should be noted though, that population within the Laguna fire footprint has increased many-fold during the past 50 years, and a similar fire today would be far more destructive. Also, if fatalities for the subsequent mudslide are included for the Thomas fire, the relative contribution of Fatalities/Injuries would be much higher. Relative contributions of each risk component as a fraction are presented for comparative purposes.

from the Dixie fire to have been smoke. Of course, where fires occur relative to where people live is a critical consideration. Europe, where the AEA analysis was performed, is densely populated, so emissions are much more likely to affect population centers.

As mentioned previously, SDG&E makes a significant error in their assessment of acres per burned per fatality. The original "unit" used by the AEA analysis was fatalities, and then fatalities were converted into a monetary value. SDG&E converts this monetary value back into fatalities but uses a substantially larger number for the value of statistical life. SDG&E's conversion rate between these quantities is at least a factor of 50 different than that used by AEA. The table below is the same as Table 2, but corrects SDG&E's error. It maintains SDG&E's VSL of $100 M, but uses the European VSL of $2 M to assign number of fatalities per acre burned. This results in a conversion rate of .0025 (1 / 400 acres) rather than .00005 (1 / 20,000 acres).

Fire	Year	Fatalities	Injuries	Structures	Cost ($M)	Acres	Risk	Acres %	Fatl/Inj%	Cost%
Witch	2007	2	40	1711	1500	197990	16.33	90.9%	2.2%	6.9%
Kincade	2019	0	4	374	600	77758	6.31	92.4%	0.5%	7.1%
Laguna	1970	5		382	400	175425	13.61	96.7%	1.1%	2.2%
Thomas	2017	2		1063	2500	281893	23.08	91.6%	0.3%	8.1%
Camp	2018	85	17	18804	16700	153336	26.70	43.1%	10.0%	46.9%
Tubbs	2017	22		5636	5000	36807	7.17	38.5%	9.2%	52.3%
Butte	2015	2		921	450	70868	5.71	93.0%	1.1%	5.9%
Redwood Valley	2017	9	1	546	400	36523	3.32	82.6%	8.4%	9.0%
Dixie	2021	1		1329	1000	963276	73.03	98.9%	0.0%	1.0%

Table 3 - Comparison of major historical wildfires linked to utility infrastructure using weights and scales approximately derived from the weightings and scaling factors used in SDG&E's MAVF calculations. This is identical to Table 1, except that it corrects SDG&E's conversion error for VSL and replaces it with the AEA conversion. Effective number of fatalities per acre burned is .0025 rather than .00005.

As is evident in Table 3, when the European number for fatality per ton of emissions is used, the fractional contribution of safety risk from acres burned increases substantially, to over 90% for many major historical fires. Also noteworthy is the fact that the contribution of fatalities and injuries to the safety risk is much smaller, at 10% or less, even for major disasters such as the Camp fire.

Several intervenors, particularly TURN, have also raised the issue that SDG&E's VSL of $100 million is substantially greater than that used by the EPA and other federal agencies, which

use a VSL of $10 million. If the federal VSL value and the AEA value for fatalities per acre burned are used for major historical fires, the following results are obtained:

Fire	Year	Fatalities	Injuries	Structures	Cost ($M)	Acres	Risk	Acres %	Fatl/Inj%	Cost%
Witch	2007	2	40	1711	1500	197990	2.65	56.1%	1.4%	42.5%
Kincade	2019	0	4	374	600	77758	1.04	56.3%	0.3%	43.4%
Laguna	1970	5		382	400	175425	1.63	80.7%	0.9%	18.4%
Thomas	2017	2		1063	2500	281893	4.00	52.9%	0.2%	46.9%
Camp	2018	85	17	18804	16700	153336	13.94	8.2%	1.9%	89.8%
Tubbs	2017	22		5636	5000	36807	4.09	6.7%	1.6%	91.6%
Butte	2015	2		921	450	70868	0.88	60.7%	0.7%	38.6%
Redwood Valley	2017	9	1	546	400	36523	0.60	45.5%	4.6%	49.9%
Dixie	2021	1		1329	1000	963276	7.98	90.6%	0.0%	9.4%

Table 4 - Comparison of major historical wildfires linked to utility infrastructure using weights and scales approximately derived from the weightings and scaling factors used in SDG&E's MAVF calculations. This is identical to Table 1 and 2, with fatalities per acre burned of 0.0025 and VSL of $10 M instead of $100 M.

Comparing Table 3 and Table 4, one can see that the relative contribution of the acres burned component is reduced, since the imputed cost of smoke fatalities is lessened. One can also see that the relative contribution of direct fire fatalities and injuries has become de minimis. This is a counterintuitive result and raises questions about basic MAVF assumptions and methodology.

2.2.3. Current Research on Wildfire Smoke Health Impacts

The impact of wildfire smoke on human health is a very active field of research, and new results are appearing frequently in the literature.[33] From this standpoint, using results from 2005 and 2006, as SDG&E has done in its estimate, is not a good practice. Significant work has been done in this field since SDG&E's reference were published, and more up-to-date results should be incorporated.

[33] See, along with cited references: O'Dell, K., Bilsback, K., Ford, B., Martenies, S.E., Magzamen, S., Fischer, E.V., Pierce, J.R., 2021. Estimated Mortality and Morbidity Attributable to Smoke Plumes in the United States: Not Just a Western US Problem. GeoHealth 5, e2021GH000457. (O'Dell et.al.) https://doi.org/10.1029/2021GH000457

More recent studies have employed a variety of methodologies to quantify health impacts from wildfire smoke. Recent results vary widely in their estimate of number of fatalities attributable to wildfire smoke annually in the US, with 95% confidence level ranges varying from 720[34] to 32,000, a factor of 40.

The issue of wildfire smoke health impacts is complicated. A common way to consider the issue is to find the concentration of pollutants from wildfires, particularly PM2.5 (particulate matter smaller than 2.5 microns), and to look for health effects in populations as a function of that concentration. These concentrations can be estimated from both ground measurement stations,[35] satellite data, or chemical transport models. Hospitalizations, emergency room visits, and excess mortality are among the variables measured. The result is commonly given as a fractional increase in excess health events per unit concentration of the pollutant (commonly expressed as $\mu g/m^3$ for PM2.5). Aguilera 2021[36], for instance, in their study of Southern California wildfires find that wildfire smoke increased the number of respiratory hospital admissions by 10% (95% CL from 3.5% to 16.5%) admissions per 100,000 individuals for every 10 $\mu g/m^3$ increase in PM2.5, whereas non-wildfire smoke increased admissions by only 0.76% per 10 $\mu g/m^3$ (95% CL from 0.42% to 1.1%).

2.2.4. Comparison of SDG&E Wildfire Smoke Results with Other Methods

The AEA study uses a model to directly link emissions to fatalities. It therefore implicitly assumes a distribution model for the pollutants, since in order for a fatality to occur it is necessary for someone to be downwind to breathe the emissions. If a tree burns in the forest and nobody breathes the smoke, then there will be no health impacts. However, the AEA model assumes populations are exposed, and that therefore fatalities will occur. This makes it over-simplistic for SDG&E's application, which is to determine fatalities specifically from wildfire. Calculating such a response in a realistic manner would require significantly more effort than SDG&E has put into

[34] Neumann, J.E., Amend, M., Anenberg, S., Kinney, P.L., Sarofim, M., Martinich, J., Lukens, J., Xu, J.-W., Roman, H., 2021. Estimating PM2.5-related premature mortality and morbidity associated with future wildfire emissions in the western US. Environ. Res. Lett. 16, 035019. https://doi.org/10.1088/1748-9326/abe82b

[35] See https://aqicn.org/

[36] Aguilera, R., Corringham, T., Gershunov, A., Benmarhnia, T., 2021. Wildfire smoke impacts respiratory health more than fine particles from other sources: observational evidence from Southern California. Nat Commun 12, 1493. https://doi.org/10.1038/s41467-021-21708-0

the calculation. Since SDG&E has presented a method in its RAMP, however, it would be useful to compare this calculation on an apples-to-apples basis with more current results in order to determine whether the SDG&E calculation is providing useful risk information.

Determining a "wildfire acres burned to fatalities" metric from current models would require a number of simplifying assumptions that may or may not be accurate. Also, as pointed out above, recent fatality estimates from wildfire smoke vary by over an order of magnitude, so the results of any calculations based on them must be viewed as highly uncertain. Nevertheless, comparison of models can be useful as a sanity check on SDG&E's method.

Firstly, a "corrected" value using SDG&E's method needs to be determined. As shown in the previous section, SDG&E erred by a factor of 50 by using the wrong Value of Statistical Life to convert from fatalities to monetary values, using its own value ($100M) rather than the value used by ASE ($2 M). Instead of 1 fatality per 20,000 acres burned, SDG&E should have calculated 1 fatality per 400 acres burned. While this may seem like it would yield an excessive estimate for fatalities, the results of Aguilera, et. al. imply that effects from wildfire should be even worse, since they find that wildfire smoke leads to ten times more hospital admissions than "normal" PM2.5 emissions. If this same effect were to carry over into fatalities, we would expect one fatality per 40 acres burned. Hence a 400,000 acre fire would, according to the SDG&E methodology, be equivalent to 1000 fatalities from smoke.

A cross check can be provided by the recent results of O'Dell et. al. These researchers estimate total US fatalities from wildfire smoke to be between 4,800 and 7,800, which is in the logarithmic center of the range from other researchers (720 to 32,000). Most usefully, O'Dell et. al. provide an estimate for California fatalities from wildfire smoke per year, at around 800.[37] The average annual number of acres burned in California between 2006 and 2018 (the duration of the O'Dell analysis) is 917,000. Naively taking the ratio, there have been approximately 1,150 acres burned for every wildfire smoke fatality. Even considering the wide range of results available in publications, SDG&E's value of 40 acres per fatality (corrected for error and scaled for wildfire smoke toxicity) is an extreme outlier, as is the (erroneous) value it uses in its RAMP of one fatality per 20,000 acres.

[37] O'Dell et. al.; p. 11, Figure 4.

A more difficult comparison is afforded by Liu, et. al.[38] This paper describes the health effects of smoke from the 2020 fire siege on residents of Washington state. Complicating this comparison is the fact that Washington was impacted by fires spread over three states: Washington (0.7 million acres), Oregon (0.9 million acres), and California (2.3 million acres). It should be assumed that health impacts were experienced by residents of all three states, but the study only looks at those in Washington. Liu et. al. observes an excess of 100 deaths from this wildfire episode in the state of Washington, with a population of 7.6 million. Scaling this number to the residents of Oregon (4.2 million), and Northern California (15.4 million), one would expect a total of 360 excess deaths in the entire region. With acres burned totaling 3.9 million acres, this would yield a ratio of one fatality per 10,900 acres burned. However, it should be noted that the smoke plumes from the 2020 fire siege extended across North America, indeed around the world, and health effects would likely not be limited to the states of origin.[39]

The estimates above are crude and for illustrative purposes only. A more accurate method should be used for risk calculations. Ideally, smoke plume calculations and population health impacts could be incorporated into fire spread modeling since these models already incorporate meteorological data. Additionally, the sensitivity of populations to specific concentration of PM2.5 pollutants is a well defined and studied value, whereas "fatalities per acres burned" is not.

2.2.5. Wildfire Smoke During Power Shutoff Periods

Another consideration that needs to be considered by utilities is the effect of wildfire smoke on power shutoff (PSPS). On one side of this issue, the compounded safety risk arising from wildfire smoke increases the value of all measures that can prevent utility wildfire ignition, including power shutoff. On the other side is the question whether and to what degree wildfire smoke effects will be exacerbated for people without electrical power, particularly if these events coincide with high temperatures.

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[38] Liu, Y., Austin, E., Xiang, J., Gould, T., Larson, T., Seto, E., 2021. Health Impact Assessment of the 2020 Washington State Wildfire Smoke Episode: Excess Health Burden Attributable to Increased PM2.5 Exposures and Potential Exposure Reductions. GeoHealth 5, e2020GH000359. https://doi.org/10.1029/2020GH000359

[39] Patel, K., October 20, 2021. Wildfire smoke harms more people in the eastern U.S. than West, study shows. Washington Post. Cites O'Dell, 2021. https://www.washingtonpost.com/weather/2021/10/20/wildfire-smoke-deaths-eastern-us/

Both wildfire smoke effects[40] and the risk of power shutoff are increased during periods of Santa Ana winds and National Weather Service Red Flag Warnings. Because these risks have the same driver, there is an increased chance that they will be coincident with each other, for instance when a utility determines to conduct a power shutoff during a period when large wildfires (which may be unrelated to utilities) are burning.

The US Environmental Protection Agency recommends that under periods of unhealthy air quality that people remain indoors and rely on air conditioning:

"*The most common advisory issued during a smoke episode is to stay indoors. The effectiveness of this strategy depends on how well the building limits smoke from coming indoors, and on efforts to minimize indoor pollution sources. Staying indoors will provide some protection from smoke, especially in a tightly closed, air-conditioned home in which the air conditioner recirculates indoor air. Generally, newer homes are "tighter" and keep ambient air pollution out more effectively than older homes.*

Staying inside with the doors and windows closed can reduce the entry of outdoor air into homes, in some cases by a third or more (Howard-Reed et al., 2002). Homes with central air conditioning generally recirculate indoor air, though some smoky outdoor air can still be drawn inside (e.g., when people enter or exit or when the central system can be set to bring in outdoor air). In homes without air conditioning, indoor concentrations of fine particles can approach 70–100% of the outdoor concentrations; however, it is more common that the indoor concentrations of fine particles that come from outdoors are 50% or less of outdoor concentrations when windows and doors are closed (Allen et al. 2012, Chen and Zhao 2011, Singer et al. 2016). In very leaky homes and buildings, outdoor particles can easily infiltrate the indoor air, so guidance to stay inside may offer little protection. In any home, if doors and windows are open, particle levels indoors and outdoors will be about the same."[41]

[40] Aguilera, et. al.
[41] EPA, n.d. Wildfire Smoke Guide Publications | AirNow.gov [WWW Document]. URL https://www.airnow.gov/wildfire-smoke-guide-publications (accessed 8.26.21); p. 18.

The EPA guidance states that air conditioning can appreciably reduce the concentrations of PM2.5, particularly if filters of rating MERV-10 or higher are used.[42] Supplemental electrostatic precipitators (ESPs) can also be installed to reduce PM2.5 concentrations for sensitive individuals. Low cost and effective DIY (do it yourself) air filtration units can even be fashioned by combining filters with a high MERV rating with house fans.[43] However, all of these methods for reducing exposure require electrical power. Under warm Santa Ana conditions, in the absence of air conditioning it may not be possible to safely keep the windows closed without risking health effects from high temperatures.

The MGRA expert has done a cursory examination of air quality data[44] near areas affected by power shutoff using utility PSPS data submitted to the CPUC, OEIS, and in response to data requests. So far (up to 2020), no obvious coincidences of areas experiencing simultaneous power shutoff and low air quality were observed. Hence, this remains a theoretical threat at this time, and it is unlikely that data currently exists to test this hypothesis.

Nevertheless, utilities, including SDG&E, should begin to consider the presence of wildfire smoke as an attribute that they factor into their determination of power shutoff thresholds. This should be considered a potential area of "coincident risks" that have the potential to increase the safety impact of power shutoff.

2.2.6. Wildfire Smoke Impact Conclusion

Notwithstanding the errors and inaccuracies in SDG&E's calculations, SDG&E deserves recognition for bringing the issue of wildfire smoke impact to the Commission's attention. Nobody else, neither the Commission nor intervenors nor other utilities have given wildfire smoke attention up to now. If we attempt to apply SDG&E's methodology for safety impacts of wildfire smoke using corrected assumptions and more recent references, it is apparent that wildfire smoke is the likely source of the greatest public safety risk from wildfires. Using O'Dell's estimate of 800 annual excess fatalities from wildfire smoke in California, that is equivalent to ***ten Camp fire death tolls per year, every year***.

[42] Id; p. 21.
[43] Liu et. al.
[44] https://aqicn.org/data-platform/register/

Wildfire smoke, however, is a silent killer, and inordinately affects those who are at risk from other sources. Zhou et. al.,[45] for example, calculate that smoke from the October 2020 fires caused an excess of 750 deaths from COVID-19 in California, Oregon, and Washington. These deaths lack the visceral drama of people being killed by flames, and we would not know about them at all except for the efforts of scientists to extract their stories from a mountain of data. The federal judge overseeing PG&E's probation, for instance, was sufficiently horrified by the story of a young family dying in their car during the Zogg fire to issue new demands and protocols for PG&E to follow.[46] What then should be the response to hundreds of deaths?

One of the problems SDG&E and other utilities have faced when balancing safety impacts from wildfire against costs are that "wildfires are expensive".[47] In other words, the number of fatalities directly attributable to wildfires tends to be low with respect to property damage. People usually can escape from approaching fires. Their houses cannot. To compensate for this preponderance of monetary damage, utilities have set a Value of Statistical Life of $100 million, ten times larger than the $10 million used by federal agencies. TURN and Cal Advocates have argued against using such a high value, that we should adopt a cost/benefit approach that more appropriately incorporates the need for affordable electricity. Adding in the massive contribution of wildfire smoke to potential risk, it may no longer be necessary for utilities to "artificially" inflate the VSL in order to introduce a large aversion to loss of human life. There is likely to be a very large equivalent monetary loss associated with the health effects of wildfire smoke, even if the standard federal VSL is used.

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[45] Zhou, X., Josey, K., Kamareddine, L., Caine, M.C., Liu, T., Mickley, L.J., Cooper, M., Dominici, F., n.d. Excess of COVID-19 cases and deaths due to fine particulate matter exposure during the 2020 wildfires in the United States. Science Advances 7, eabi8789. https://doi.org/10.1126/sciadv.abi8789

[46] United States of America vs. Pacific Gas and Electric Company; PG&E'S RESPONSE TO POSTHEARING ADDITIONAL REQUEST FOR RESPONSES; Judge: Hon. William Alsup; Case 3:14-cr-00175-WHA Document 1369-2 Filed 03/29/21 Page 24 of 90.
"But what's worse? Four people burning to death alive in the car? Start out alive and they get baked to death, the kind of death nobody should go through.
To me, there's a very clear answer to that. We don't want to sail too close to the wind. We want to err on the side of public safety, not on the side of public convenience."

[47] A.20-06-012; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON THE PACIFIC GAS AND ELECTRIC COMPANY 2020 RISK ASSESSMENT AND MITIGATION PHASE REPORT AND THE SAFETY POLICY DIVISION STAFF EVALUATION REPORT; January 15, 2021; p. 8.

How to properly incorporate this loss, what values to use, and methodology, remain open questions. There is no question that SDG&E's method and sources err in significant and probably irremediable ways. However, an initial look into the issue reveals that wildfire smoke will likely have the greatest contribution to wildfire safety risk. This problem cannot safely be ignored or put aside. The "correct" long term solution will likely come from modeling of simulated smoke plumes and calculating population impacts using carefully selected epidemiological data. This is likely too difficult for SDG&E to accomplish prior to its GRC, so interim methods similar to its current approach but with corrected calculations and sources may be acceptable. For the time being, estimates based on a "fatalities per acre burned" methodology using values from a range of recent studies will allow safety risk from wildfire smoke to be incorporated into MAVF calculations without undue delay or burden. Sensitivity analyses should use the full range of values currently considered plausible by the most recent academic work. Studies using hospitalizations rather than fatalities can also be used by considering a hospitalization a "serious injury".[48]

The table below provides an illustrative example showing major historical power line fires. Based on the values and methodology in Table 2 through Table 4, relative MAVF contributions from safety (direct fatalities/injuries), acres burned (wildfire smoke fatalities/injuries), and financial contributions are shown for 1,000 acres per fatality (derived from O'Dell et. al. above) and 11,000 acres per fatality (derived from Liu et. al. above), using VSL of $10 million and $100 million.

Fire																	
	VSL	100				100				10				10			
	acre/ftl	11000				1000				11000				1000			
		Risk	Acres %	Fatl/Inj%	Cost%	Risk	Acres %	Fatl/Inj%	Cost%	Risk	Acres %	Fatl/Inj%	Cost%	Risk	Acres %	Fatl/Inj%	Cost%
Witch		2.02	26.7%	17.8%	55.6%	7.42	80.0%	4.8%	15.2%	1.21	4.4%	3.0%	92.6%	1.75	33.8%	2.1%	64.1%
Kincade		0.69	30.6%	4.3%	65.0%	2.81	82.9%	1.1%	16.0%	0.47	4.5%	0.6%	94.9%	0.69	34.0%	0.4%	65.6%
Laguna		0.93	51.5%	16.2%	32.3%	5.71	92.1%	2.6%	5.3%	0.36	13.2%	4.1%	82.7%	0.84	62.6%	1.8%	35.7%
Thomas		2.70	28.4%	2.2%	69.3%	10.39	81.4%	0.6%	18.0%	1.96	3.9%	0.3%	95.8%	2.73	31.0%	0.2%	68.8%
Camp		15.62	2.7%	17.1%	80.2%	19.80	23.2%	13.5%	63.2%	12.83	0.3%	2.1%	97.6%	13.25	3.5%	2.0%	94.5%
Tubbs		4.51	2.2%	14.6%	83.1%	5.51	20.0%	12.0%	68.0%	3.83	0.3%	1.7%	98.0%	3.93	2.8%	1.7%	95.5%
Butte		0.59	32.7%	10.2%	57.1%	2.52	84.2%	2.4%	13.4%	0.36	5.3%	1.7%	93.0%	0.56	38.2%	1.1%	60.7%
Redwood Valley		0.68	14.7%	41.0%	44.3%	1.67	65.5%	16.6%	17.9%	0.34	2.9%	8.2%	88.8%	0.44	25.1%	6.3%	68.6%
Dixie		3.41	77.1%	0.9%	22.0%	29.68	97.4%	0.1%	2.5%	1.02	25.9%	0.3%	73.8%	3.64	79.3%	0.1%	20.6%

Table 5 - Relative contributions of direct injuries/fatalities, smoke injuries/fatalities (Acres), and financial costs to losses from major historical power line fires using SDG&E's MAVF function. Uses acres/fatality derived from O'dell (100) and from Liu (11,000), and VSL of $100 M and $10 M. Details for each fire can be found in Table 2 through Table 4.

[48] In utility multi-attribute value functions, serious injuries are given ¼ the weight of a fatality.

More sophisticated and accurate approaches can be developed with expert scientific input as part of ongoing efforts by the CPUC and OEIS. As this issue affects all utilities and California residents, incorporation of wildfire smoke harm should be required for other utilities, and MGRA intends to raise this issue in the RDF/S-MAP Phase II proceeding and during OEIS risk modeling workshops.

What we have discovered, thanks to SDG&E's attempt to introduce wildfire smoke risk, is that we have been working on the wrong wildfire safety problem. Wildfire smoke blown downwind is responsible for killing and injuring far more Californians than those overrun by flame. The methodology used by SDG&E needs to be corrected prior to its GRC, and the Commission needs to ensure that this risk is properly incorporated by all utilities as they develop their RAMP filings and Wildfire Mitigation Plans.

Recommendations:

- The Commission should not accept SDG&E's current weighting of "Acres Burned" because it is based on erroneous calculations.
- SDG&E should consult with public health experts and academics in order to choose more appropriate references for public health effects from wildfire smoke.
- The correct long-term approach may be to include smoke plume effects along with fire spread simulations. SDG&E should inquire whether Technosylva or other vendors can incorporate plume spread along with population impacts.
- As an interim measure, SDG&E should compute "Fatalities per Acre Burned", using measured and calculated public health effects from wildfire and wildfire sizes, using a range of values for fatalities and hospitalizations supported by recent studies.
- The Commission should coordinate with OEIS to develop a common understanding of and modeling strategy for wildfire smoke risks.

2.3. Prioritization of Segments for Mitigation

SDG&E's RAMP projects its prioritization of projects based on its risk model and assumptions regarding the perceived costs and benefits of covered conductor versus undergrounding. The following section examines some of these assumptions. It also observes that SDG&E in some cases is failing to take into account previous ignition data and damage occurring

during PSPS events in identifying areas needing remediation. SDG&E also fails to consider community egress risks when prioritizing its hardening program. Ironically, one area where historical damage and ignitions and critical egress risk coincide and that is not in scope for hardening is the Dye Road area in Ramona, which threatens evacuations from the Mussey Grade Road corridor.

2.3.1. SDG&E Hardening Strategy

Based on SDG&E's planned hardening strategy for 2022-2024, the bulk of SDG&E's mitigation efforts will go into undergrounding programs and a smaller portion into covered conductor.[49] SDG&E's ease with undergrounding coincides with its finding that the Risk/Spend Efficiency (RSE) for covered conductor is essentially the same as that for undergrounding. This is at odds, however, with SCE's finding that the RSE for covered conductor is 10X higher than for undergrounding.[50] This is an unresolved discrepancy that will be addressed in this year's working groups organized by OEIS. However, in the immediate term SDG&E's claim that undergrounding and covered conductor are effectively identical from a risk/spend standpoint deeply affects the decisions made in its RAMP.

The circuits selected by SDG&E for inclusion in its 2022-2024 hardening program vary wildly in their overall cost and risk, as shown in the table below:

Circuits	19							
Miles	463	**CC**	200	**UG**	263			
Cost ($k)	1,029,899	**CC**	265,955	**UG**	763,944			
Circuits	**Value**	**ID**	**Length**	**Risk**	**RSE**	**Cost**	**Mitigation**	**Risk/mi**
Highest Risk	0.01762	222	41.1	0.017622	177.51	119,530	UG	0.042844
Lowest Risk	0.00014	SL1	4.8	0.000143	24.14	14,075	UG	0.002951
Highest Cost	145,180	445	57.1	0.006117	73.2	145,180	Mixed	
Lowest Cost	14,075	SL1	4.8	0.000143	24.1	14,075	UG	

[49] TURN DR6 Excel Responses.
[50] MGRA 2021 WMP Comments; p. 66.

Highest RSE	416	442	10.1	0.013031	416.2	29,507	UG	
Lowest RSE	21	524	30.8	0.00099	21.0	47,771	CC	

Table 6 - Circuits with highest and lowest risk, cost, and RSE of SDG&E circuits planned for hardening in 2022-24.

As can be seen in Table 6, SDG&E plans to harden segments of 19 circuits in the 2022-4 timeframe. Roughly equal miles of undergrounding and covered conductor are planned, with about one quarter of the cost being allocated for covered conductor and three quarters for undergrounding, for a total of approximately $1 billion.

The relative risk per unit mile for the circuits in scope varies by a huge amount – a factor of 15, as does the RSE, which varies by a factor of 20 between the lowest and highest values. SDG&E explains in its data request response that this is because SDG&E ranks segments, rather than circuits, and that "connectivity considerations" also play a role in prioritization.[51]

SDG&E's response to TURN Data Request 6 listed only the circuits in scope for SDG&E's hardening program, but did not include those that did not make the cut. MGRA, as a follow up, requested that SDG&E provide a listing of the 40 circuits with the highest risk rank, including the reason for the circuits not making the cut if not included. SDG&E did so and provided file "MGRA DR6 Excel Response_09282021".[52] Select entries from this table show the range of risk values:

ID	Rank	Risk (X 10^{-3})	Included?
222	1	17.6	Y
442	2	13.0	Y
79	3	7.2	Y
212	9	4.7	Y

[51] MGRA DR6 Excel Response_09282021 states that: "SDG&E prioritizes scoping of grid hardening mitigation by starting with a ranking of the segments rather than the ranking of circuits. As the team examines each segment based on its ranking, the team will pull in all segments in that same circuit in order to scope a coherent strategy for mitigating the wildfire risk as well as PSPS risk. This explains why some circuits that are ranked higher may not be prioritized for near-term mitigation. For example, although circuit 221 overall is ranked #15, from a segments standpoint, its highest risk segment is ranked 58 out of total 600+ segments with ~860 miles of overhead that are ranked higher than that segment so when it comes to prioritizing where the next ~475 miles of mitigation will go in the next 2-3 years, some segments take precedence based on their ranking as well as circuit connectivity considerations."

[52] The table is included in the accompanying data request attachment.

972	14	2.9	Y
221	15	2.6	N
214	17	2.3	Y
449	18	2.0	N
971	22	1.4	N
973	29	1.1	N
524	32	1.0	Y
909	35	0.9	Y
1233	40	0.6	N

The general comment made for all non-included circuits is: "Q1 2021: Higher wildfire risk segments in other circuits were prioritized over segments in this circuit for the near term."[53]

Regarding the choice of covered conductor versus undergrounding, SDG&E claims that only a modest change in RSE will be made if covered conductor is substituted for undergrounding, or vice versa:

Alternatives	**Scope**	**Total Risk Reduction**	**RSE**
Proposed	275 miles of UG 200 miles of CC	32.8%	100.35
Alternative 1: Underground	475 miles of UG	34.1%	85.11

Alternatives	**Scope**	**Total Risk Reduction**	**RSE**
Proposed	275 miles of UG 200 miles of CC	32.8%	100.35
Alternative 2: Covered Conductor	475 miles of CC	21.1%	93.36

Table 7 - SDG&E alternatives of all covered conductor versus all undergrounding, as presented in its RAMP.[54]

SDG&E also provided, at MGRA's request, alternative versions of the TURN DR 6 spreadsheet detailing the segments and circuits proposed for hardening. In the first (MGRA-38),

[53] Id.
[54] SDG&E Data Request Response MGRA-DR-006-Partial, Questions MGRA-38 and MGRA-39.

SDG&E assumed that only undergrounding would be used as remediation and in the second (MGRA-39) SDG&E assumed that only covered conductor would be used for remediation. After some additional analysis on these spreadsheets and TURN DR 6, the following results are obtained for risk, cost, and RSE.

Alternatives	Risk Reduction	Cost ($k)	RSE
Proposed	1.19	1,029,899	115.35
Undergrounding	1.23	1,343,570	91.86
Covered Conductor	0.77	696,276	110.79

Table 8 - Risk reduction, cost, and RSE for proposed (TURN DR 6) and alternatives (MGRA DR 6) using total PV risk reduction.

As can be seen above, according to SDG&E's estimates the proposed project is optimized from an RSE standpoint, and the RSE for the combined strategy is greater than for either undergrounding or covered conductor alone. The covered conductor option is considerably less expensive, but the remediated risk is also reduced, almost proportional to the cost.

All estimates, however, have as a basic premise SDG&E's estimate for covered conductor risk reduction, which they assert will be considerably less effective than undergrounding. SDG&E, based on SME judgement, assumes that covered conductor will reduce ignitions by only 62%, as shown in the table below.[55]

Derived from ignition database (2015-2019). Some occurred outside HFTD				
SDGE-SCG RAMP A.21-05-011 TURN DR06				
Mode	***Count of Ignitions before Covered Conductor***	***Count of Ignitions after Covered Conductor***	***Covered Conductor Effect (Residual Risk %)***	***Assumption***
Animal contact	5	0.5	10%	90% reduction in animal contacts
Balloon contact	9	0.9	10%	90% reduction in balloon contacts
Vegetation contact	10	1	10%	90% reduction in vegetation contact
Vehicle contact	13	10.4	80%	20% reduction in vehicle contact
Other	6	5.4	90%	10% reduction in 'other' ignitions
Equipment - All	27	5.4	20%	80% reduction in equipment related ignitions
Unknown	6	5.4	90%	10% reduction in 'unknown' ignitions
TOTAL	*76*	*29*	*62%*	

Table 9 - Ignition reduction from covered conductor, as estimated by SME. Response to TURN DR 6, Question 1.

[55] SDG&E Data Request Response MGRA-DR-003, Question MGRA-16.

These results appear to be very conservative. An ignition arising from covered conductor assumes that 1) there will be stripping or breakage of the insulating cover, and 2) the bare part of the conductor will, while live, contact another conductor or a path to ground. During workshops, other utilities expressed similar opinions about the effectiveness of covered conductor, however currently there is no data supporting these numbers. SCE has reported one vehicle collision with a pole carrying covered conductors, and it did not start a fire.

SDG&E also assumes a very high cost per unit mile, much higher than that which SCE has been able to achieve. Between the higher cost, and possible underestimation of effectiveness, it may be that the risk reduction and RSE for covered conductor is higher than that claimed by SDG&E. Over the next year, OEIS will be facilitating coordination between utilities regarding covered conductor, and the utilities will be providing more detailed information about its cost and effectiveness. This additional information needs to be incorporated into SDG&E's GRC.

Another issue that any modification in the efficacy or cost of covered conductors would affect is the usefulness of REFCL (Rapid Earth Fault Current Limiter). Examination of this technology by PG&E suggests that it may be effective in eliminating high impedance ground faults. In combination with covered conductor, this is almost a complete protection against ignitions and might provide an alternative to undergrounding.[56] Given SDG&E's high cost projections for covered conductor and its modest expectations for effectiveness, SDG&E's analysis of the effectiveness of REFCL concludes that a combination of REFCL and covered conductor would have overall costs approaching that of undergrounding.[57] If the assumptions regarding covered conductor effectiveness and cost change, however, then this technology should be revisited. SDG&E also is investigating alternative technologies such as "Falling Conductor Protection, Sensitive Ground Fault Protection, and Sensitive Profile Settings", and multiplicative effects of these technologies in conjunction with covered conductor should be examined in SDG&E's GRC.

[56] A.20-06-012; MUSSEY GRADE ROAD ALLIANCE COMMENTS ON THE PACIFIC GAS AND ELECTRIC COMPANY 2020 RISK ASSESSMENT AND MITIGATION PHASE REPORT AND THE SAFETY POLICY DIVISION STAFF EVALUATION REPORT; January 15, 2021; p. 20.
[57] SDG&E Data Request Response MGRA-DR-006-Partial, Question MGRA-37.

2.3.2. Ignition history and PSPS wind damage data

SDG&E uses ignition history as the basis of the ignition probability component of its risk modeling. As raised by MGRA in numerous fora, ignition history is not fully predictive of ignition probability potential if power shutoff is used as a mitigation strategy.[58] The reason is that no ignitions will occur if power is shut off, leading to a "blind spot" in the data in areas where PSPS is used. As a result, these areas will not appear to have the same ignition potential as areas where power is left on and ignitions occur, even though they may be inherently more dangerous under fire weather conditions (which is why SDG&E chooses to de-energize them).

To compensate for this bias, MGRA has urged utilities to collect and to incorporate damage data obtained during post de-energization inspections. During workshops, SDG&E representatives have stated that their goal is to incorporate this data, and that figuring out how to do so properly is an area of active work at SDG&E. However, in their response to an MGRA data request SDG&E states that: "Data from post-PSPS patrol damage reports were not incorporated in the 2021 RAMP wildfire risk modeling. SDG&E continues to evaluate how to incorporate this data in future modeling efforts."[59]

Even though the proper incorporation of damage data is a work in progress, SDG&E should still be using ignition and damage data to inform its risk estimations and circuit prioritization. If there are circuits or areas particularly subject to ignition there may be local excesses or "clusters" of ignition, damage, or wire down events that indicate a problem. We can see a number of such groupings in a map of the SDG&E service area:

[58] R.18-10-007; MUSSEY GRADE ROAD ALLIANCE SUPPLEMENTAL COMMENTS ON PHASE 2; September 6, 2019.
[59] SDG&E Data Request Response MGRA-DR-003, Question MGRA-13.

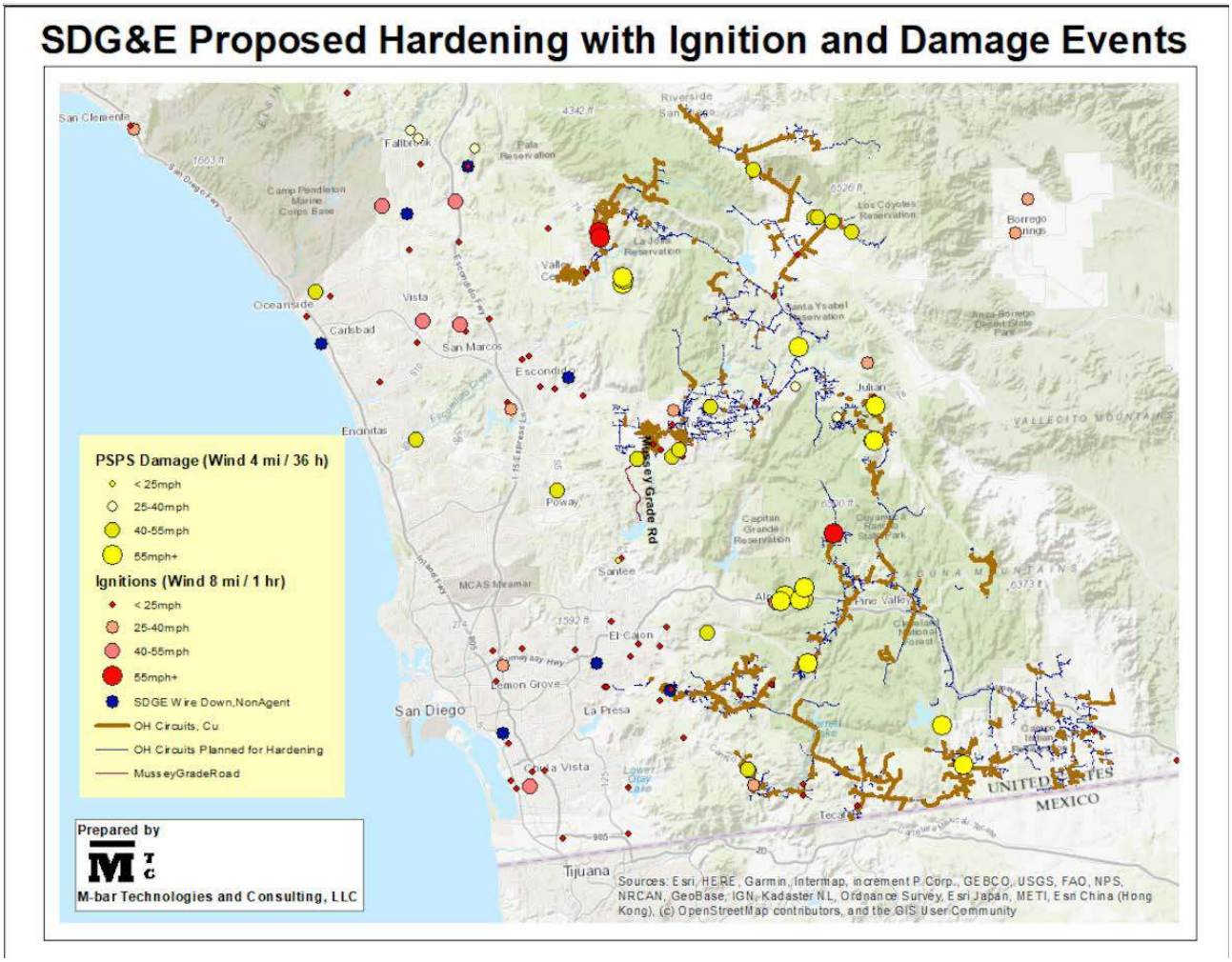

Figure 1 - Map of SDG&E service area showing circuits that will have some segments hardened from 2022-2024. Copper segments are shown in copper. Ignitions (red), PSPS damage (yellow), and wires down (blue) are also shown, along with the maximum nearby wind gust during the period associated with the event.

This map shows three types of events. Yellow circles represent PSPS damage events, while red circles represent ignition events. Blue floral patterns represent wire down events. The size and shade of the PSPS damage events and ignition markers are proportional to the maximum wind gust speed at the time of the event. This speed is determined by a Python script that uses the Synoptic API[60] to read all public weather station data within a specified distance and time of the event. For ignition events, the maximum wind gust speed at any weather station within 8 miles and one hour of the event was chosen. For PSPS damage events a different filter was used, since the exact time of the damage is usually unknown. For these events the maximum gust for any weather station within 4 miles of the damage point and within 36 hours prior to the time of discovery of the damage event is chosen. These measurements help to identify events associated with extreme weather behavior.

[60] http://synoptic.com

Data and software comprising this analysis will be published on the M-bar Technologies and Consulting, LLC website and are available for public use under the Gnu General Public License version 3.0.[61]

The circuits that SDG&E plans to harden segments of during the upcoming GRC cycle, as reported by SDG&E's response to TURN-006,[62] are shown as blue lines on the map. The location of these circuits was determined by the public data provided to OEIS supporting SDG&E's 2020 WMP. SDG&E's TURN response also made clear that the circuit segments being given the highest priority have copper conductor. Copper conductor segments are indicated by thicker, copper-colored lines on the map.

The map shows a number of spatial clusters of PSPS damage, ignition, and wire down events. It also indicates that SDG&E's 2022-2024 hardening plan is mixed as far as its efficacy in addressing these events. Some areas where hazard events have occurred are planned for remediation, such as Julian and Dulzura. Others, such as Viejas/Alpine and Ramona have circuit segments not planned for remediation despite having clusters of hazard events.

These areas are shown in more detail below.

[61] https://github.com/jwmitchell/mbar-weather
[62] TURN DR6 Excel Responses.

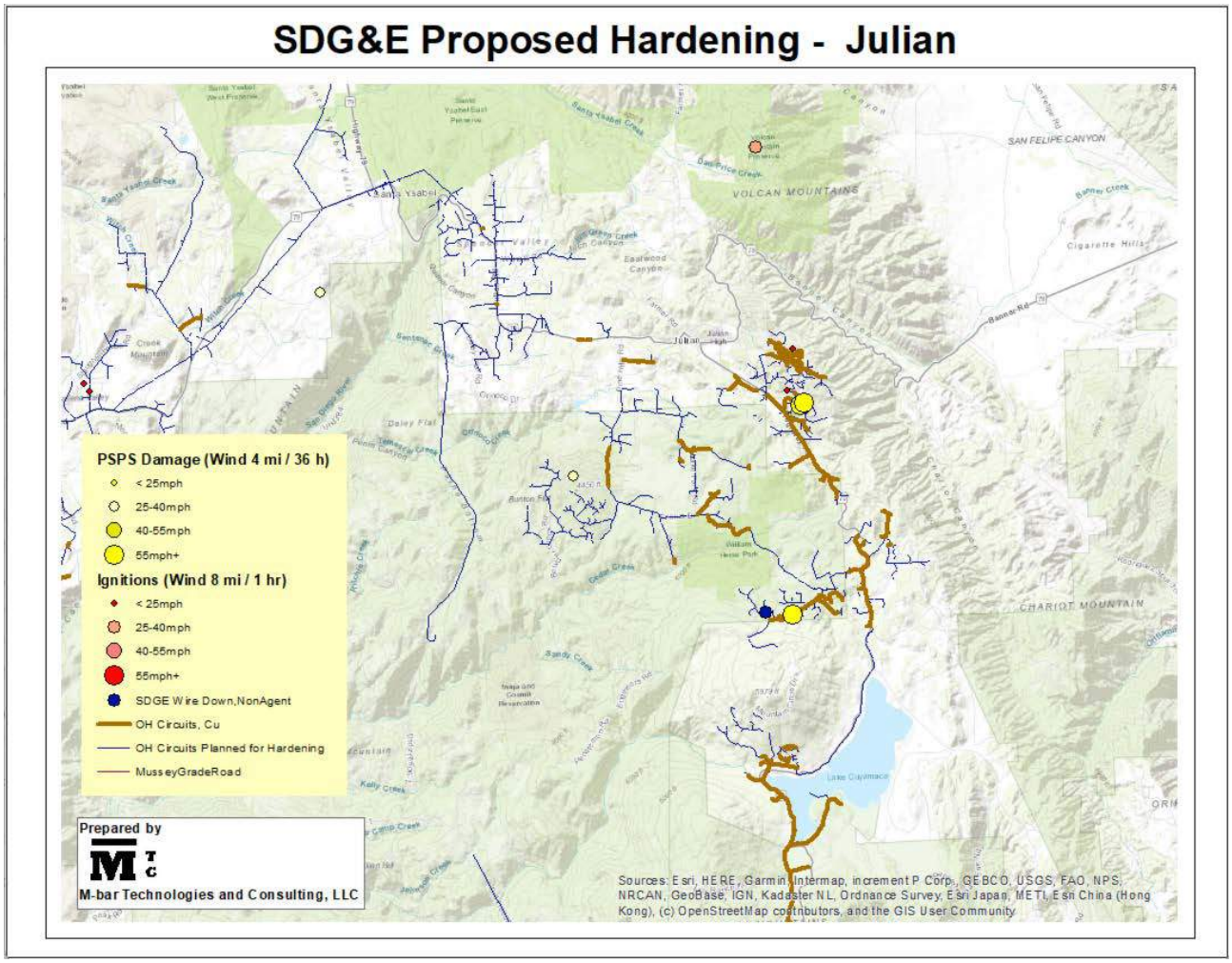

Figure 2 - SDG&E circuits near Julian, CA planned for hardening and historical ignitions, wire downs, and PSPS damage.

As the map indicates, there are a number of ignition points, PSPS damage points, and a wire down event associated with the circuit(s) planned for hardening. Most of these events have occurred on copper segments of the circuits. In this case, SDG&E's planned hardening program appears to address areas that have seen historical damage and ignitions.

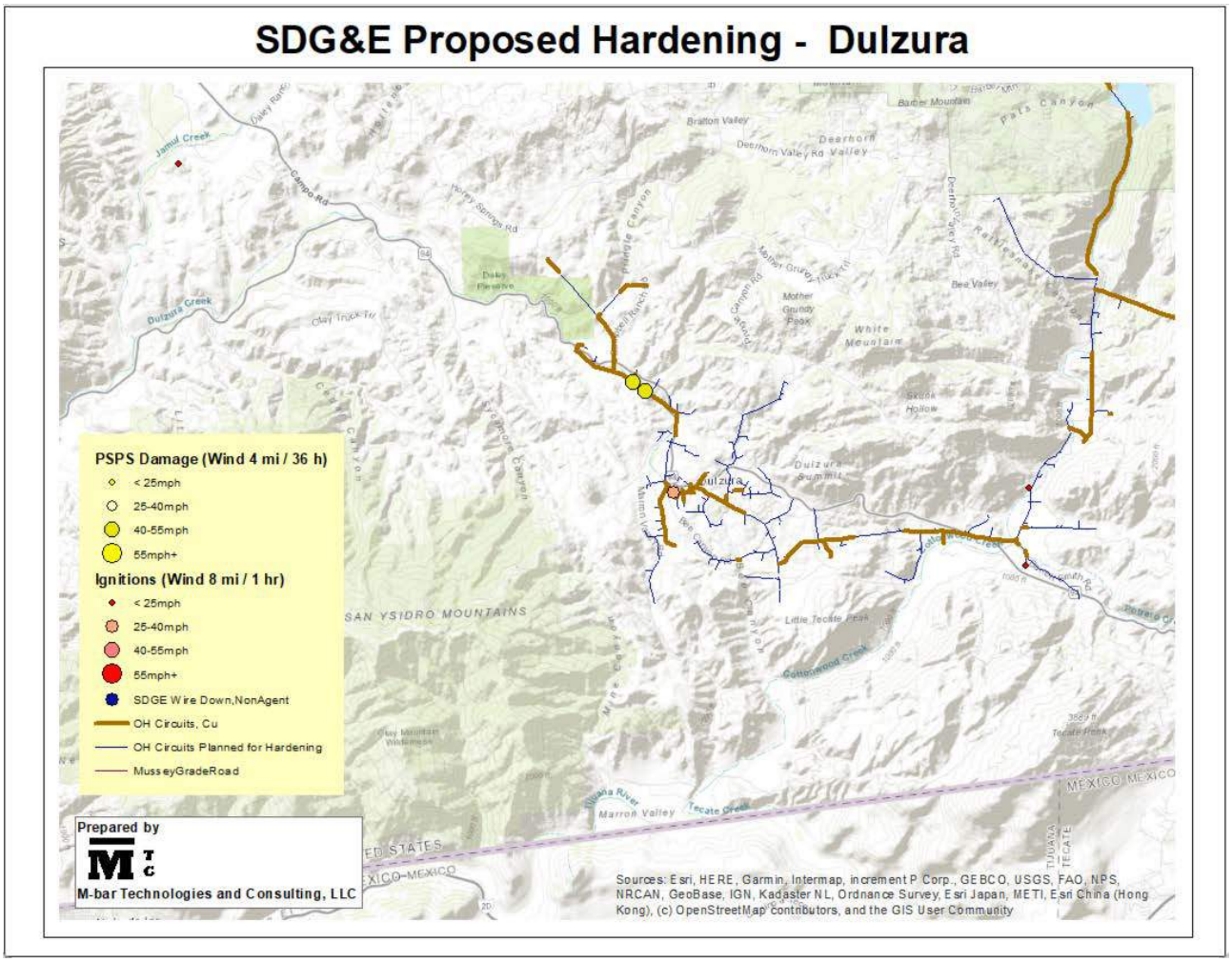

Figure 3 - SDG&E circuits near Dulzura, CA planned for hardening and historical ignitions, wire downs, and PSPS damage.

Figure 3 shows SDG&E's planned hardening and historical hazard events near Dulzura, CA. As can be seen, most of the hazard events occurred on copper conductor segments of the circuits. Some segments of the indicated circuits will be hardened. In this case as well, SDG&E's hardening program appears to target areas that have seen an excess of wind-related hazard events.

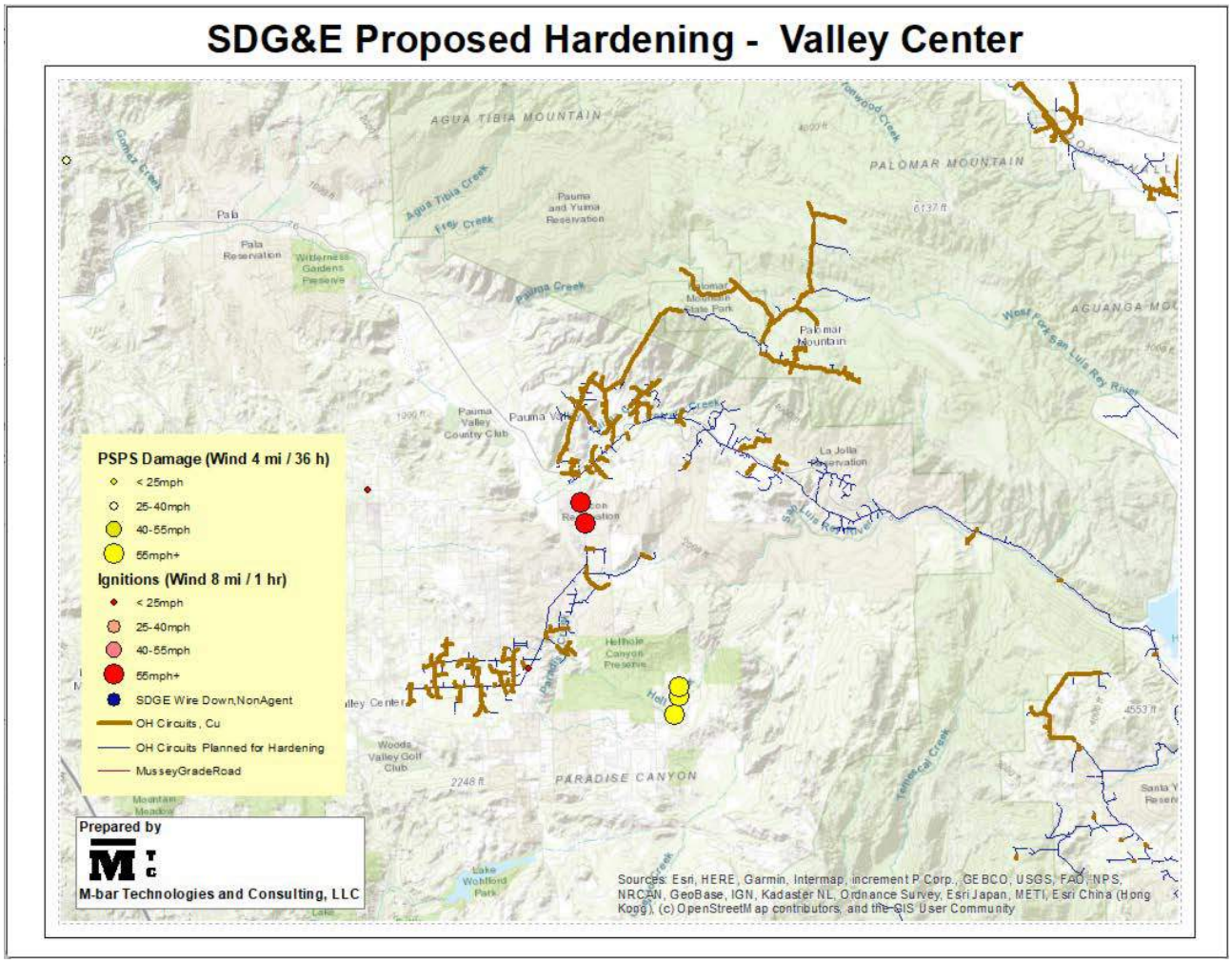

Figure 4 - SDG&E circuits near Valley Center, CA and the Rincon Reservation planned for hardening and historical ignitions, wire downs, and PSPS damage.

Figure 4 shows the area near Valley Center, CA and the Rincon Reservation. Clusters of events near Hellhole Canyon and the Rincon reservation are not addressed by the SDG&E 2022-2024 plan. SDG&E states that the Hellhole canyon area has already been addressed by a 2021 undergrounding effort.[63] SDG&E also states that the area in the Rincon area will be undergrounded, and this project is currently in the planning stage.[64]

[63] SDG&E Data Request Response MGRA-DR-007, Question MGRA-51.
[64] SDG&E Data Request Response MGRA-DR-007, Question MGRA-50.

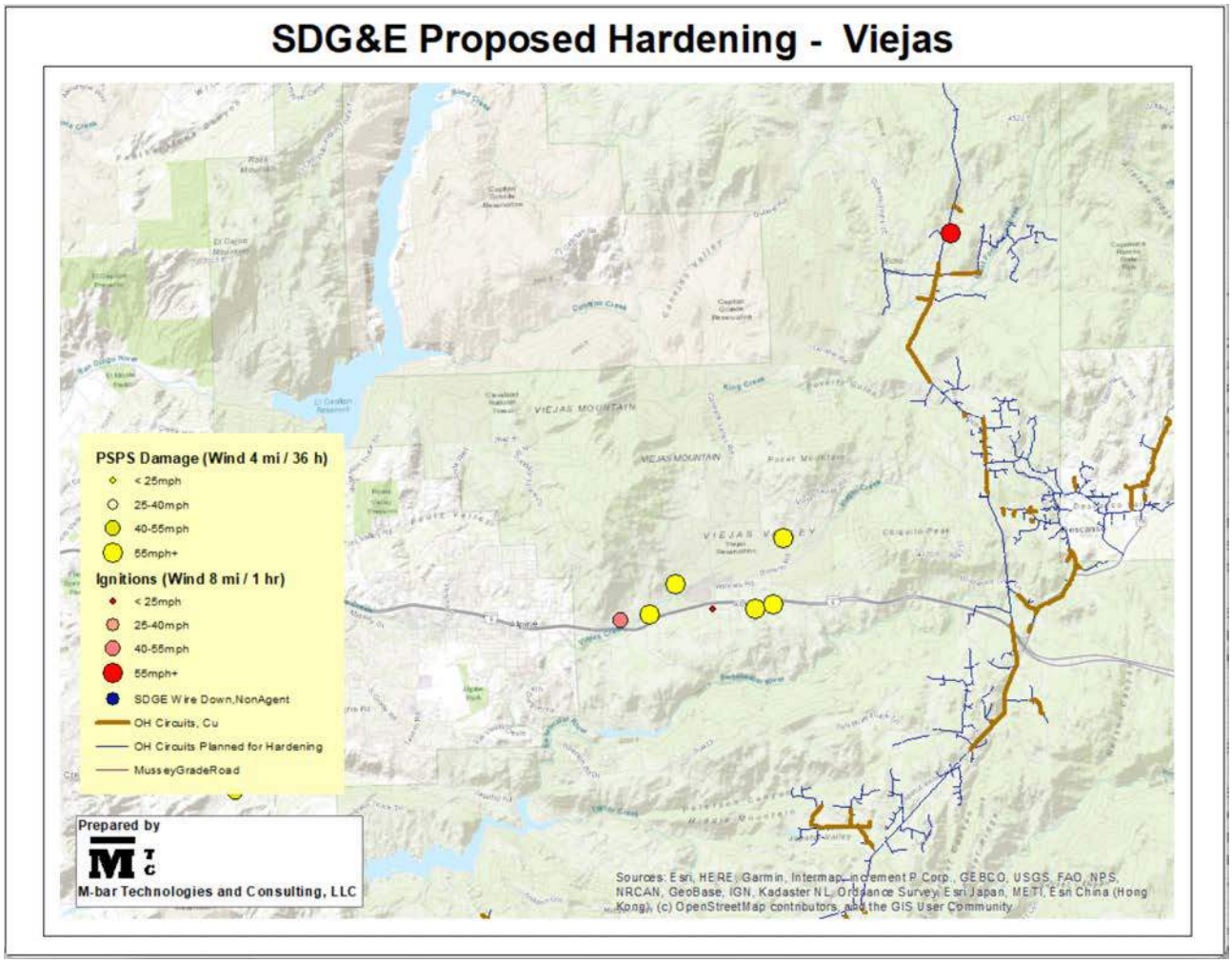

Figure 5 - SDG&E circuits near the Alpine, CA and the Viejas Reservation planned for hardening and historical ignitions, wire downs, and PSPS damage.

Figure 5 shows wind-related hazard events in the Viejas valley, east of Alpine CA and including the Viejas Reservation. SDG&E stated that one of the circuits feeding the area is under consideration for hardening in 2024, while the other was not chosen for prioritization in the 2022-2024 time frame based on its risk-ranking algorithm.[65]

[65] SDG&E Data Request Response MGRA-DR-007, Questions MGRA-48 and MGRA-49.

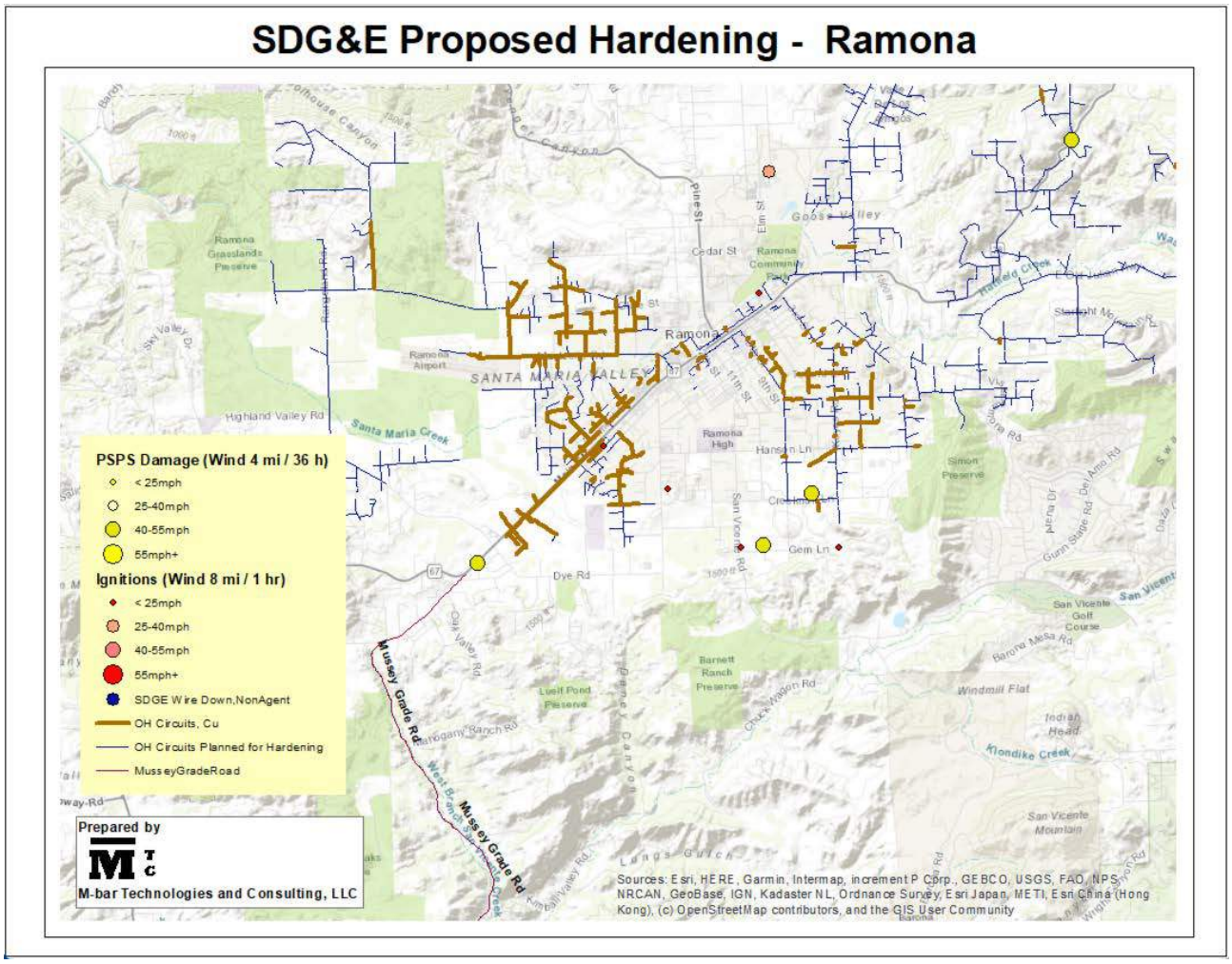

Figure 6 - SDG&E circuits near the Ramona, CA planned for hardening and historical ignitions, wire downs, and PSPS damage**.**

A number of damage events and ignitions on circuits not currently planned for remediation can be seen in the area south of Ramona, specifically in the Dye Road area. This indicates that there may be circuit or location specific risk factors that are ignored by the SDG&E risk ranking algorithm. Ignitions in this area are particularly worrisome to residents of the Mussey Grade Road corridor, who depend on a single egress from this neighborhood in the event of wildfire.

Issues of community egress, applied specifically to the Mussey Grade Road corridor, are further developed in the next section.

2.3.3. Community egress issues

The area of southwest Ramona where an excess of historical PSPS damage and ignition events occurred is shown in more detail below.

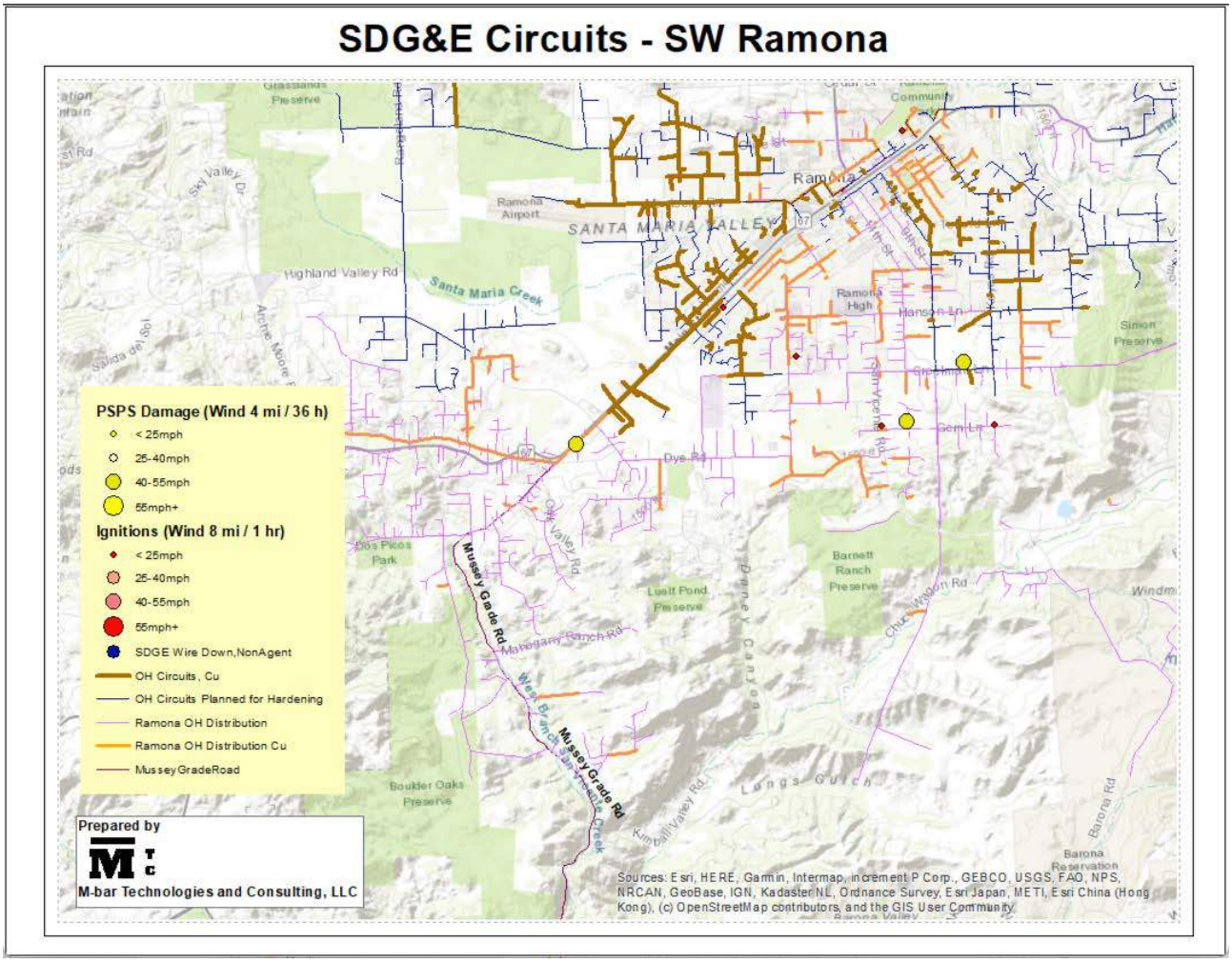

Figure 7 - Similar to the previous figure but showing more detail in the problem areas and also including all SDG&E circuits and not just those to be hardened in 2022-2024.

PSPS damage events have occurred on a number of circuit segments, as have ignitions. The ignitions were not associated with high wind gusts at local weather stations, but the PSPS damage events were. Most events also appear not to be associated with copper conductor.

This figure raises the question of how SDG&E prioritized hardening for the Ramona circuits. Circuits at risk include C-971, C-972, and C-973. Remediation work shown above is going into C-972. C-971 and C-973 are rated as having half or the risk of C-972.[66] SDG&E lists the following factors as contributing to this difference:

"*C-972 is a comparatively long circuit (53.77 miles).*

C-972 has, relative to other circuits, less hardening work completed.

[66] SDG&E Data Request Response MGRA-DR-006, Questions MGRA-27 and MGRA-28. Excel spreadsheet. See appendix.

C-972 has a larger average vegetation ignition factor compared to C-971 and C-973.

C-972 has a higher PSPS risk score associated with this circuit serving more than double the number of customers compared to either C-971 or C-973, and of particular note, there is a higher number of essential customers present on C-972."

These considerations do not include ignition clusters or PSPS damage, nor do they take into account community egress issues.

SDG&E was asked whether it incorporated egress into its risk model or into its considerations of when and where to de-energize. Its responses were:

"*SDG&E does not directly include egress from single access HFTD areas in its estimation of circuit risk, RSEs, or prioritization. SDG&E recognizes this as a potential opportunity for improvement in future versions of its models. While egress is not directly incorporated in the risk modeling, it is a consideration in the scoping phase of grid hardening implementation.*"[67]

"*SDG&E does not directly include egress from single access HFTD areas in its determination of whether to initiate a power shutoff for a given circuit.*"[68]

In order to determine wildfire risk, both generally and on an operational basis, SDG&E runs fire spread modeling for both historical and recent fires. It automatically runs simulations for all reported fires in the Integrated Reporting of Wildland-Fire Information (IRWIN).[69] This capability has also been operationalized:

"*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*."[70]

[67] SDG&E Data Request Response MGRA-DR-007, Questions MGRA-40.
[68] SDG&E Data Request Response MGRA-DR-007, Questions MGRA-42.
[69] RAMP; SDG&E 1-19.
[70] SDG&E WMP Update; p. 176.

SDG&E uses Technosylva's FireSim package, which "*has the ability to generate conventional fire behavior outputs based on specific ignition location points. These outputs include Time of Arrival (fire perimeter) for a specific forecasted time period (duration), and fire behavior characteristics including the rate of spread, flame length and fireline intensity…. To calculate risk for each asset, a fire spread prediction is simulated using the asset location as the ignition point(s). Millions of ignition points are defined along the assets to run the simulations for different start times during a daily weather forecast*."[71]

It should be entirely reasonable, therefore, to inquire of SDG&E what the consequences would be for an ignition in the Dye Road area in order to determine whether and how a wildfire from such an ignition would affect the Mussey Grade Road area including its evacuation route. SDG&E runs "millions" of point simulations, so a simulation for a given point should not be a great burden for it to produce. Such a request falls squarely under the auspice of sensitivity analysis required in the Settlement Agreement.

MGRA requested two such simulations in its data requests, and SDG&E refused.[72] SDG&E's reasons for refusal were baseless, but there was insufficient time to compel compliance prior to the production of this document.

Even though SDG&E refused to perform or share Technosylva fire spread modeling for ignitions in the Dye Road area, similar modeling has been performed at the request of the County of San Diego by Rohde and Associates as part of a study of the opening of the Boulder Oaks Preserve adjacent to Mussey Grade Road in Ramona.[73]

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[71] Id.; p. 83.

[72] SDG&E Data Request Response MGRA-DR-007, Questions MGRA-46, MGRA-47: "*SDG&E objects to this request under Rule 10.1 of the Commission's Rules of Practice and Procedure on the grounds that it requests SDG&E to perform a study or analysis on MGRA's behalf that does not exist. SDG&E further objects to this request on the grounds that it calls for speculation and is vague and ambiguous as to "consequences" and "implications for evacuation." SDG&E further objects to this request to the extent it seeks the production of information that is neither relevant to the subject matter involved in the pending proceeding nor is reasonably calculated to lead to the discovery of admissible evidence*."

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

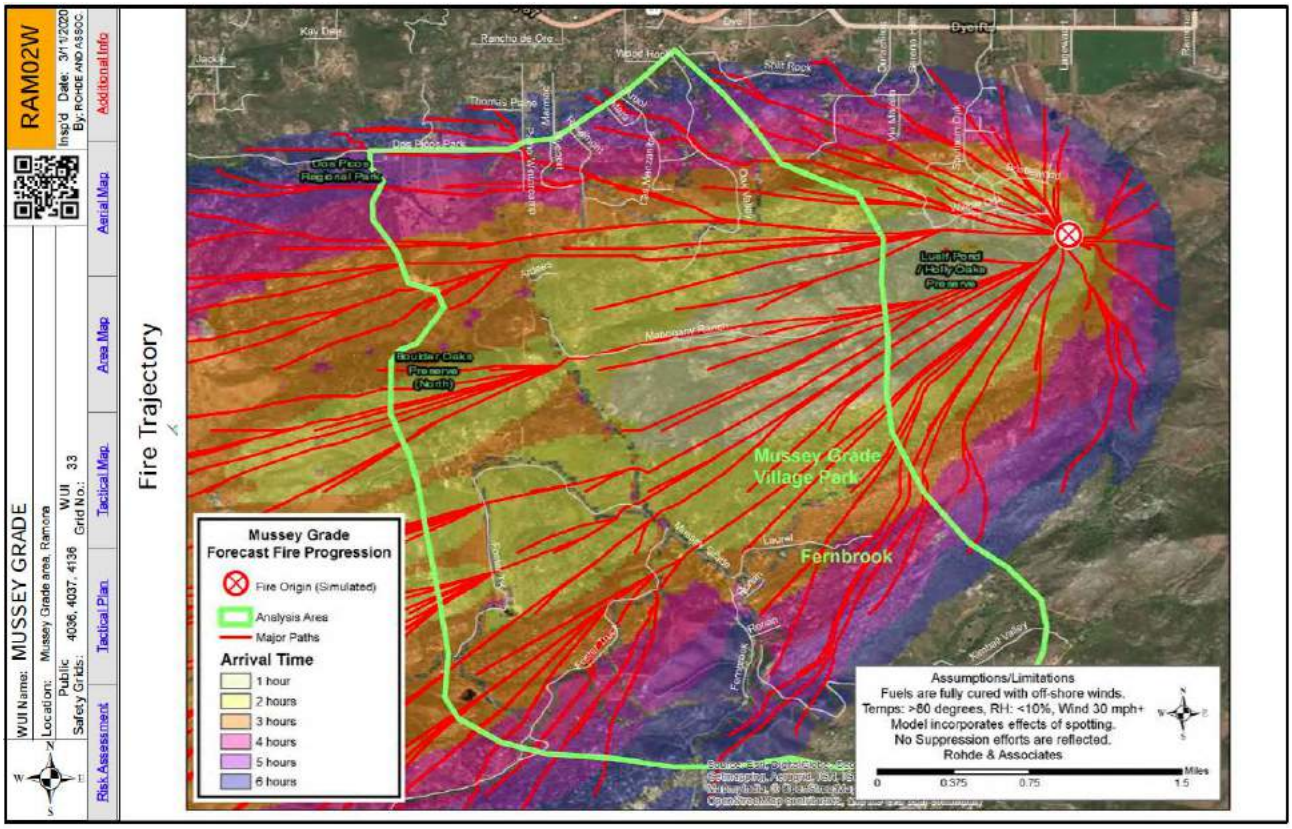

Figure 8 - Fire spread modeling for an ignition in the Dye Road area of Ramona, California, performed by Rohde and Associates at the behest of San Diego County. As can be seen, the Mussey Grade Road corridor can be impacted by the fire front in as little as an hour from ignition. The southern Mussey Grade Road corridor is home to hundreds of people and is a single-egress neighborhood depending on Mussey Grade Road for evacuation. This model does not take the effect of smoke into account, which could severely limit visibility along the evacuation route before the fire front arrives.

Rohde and Associates, the fire consultants hired by San Diego County, were hired to examine fire vulnerabilities and evacuation for the Mussey Grade area as part of an environmental assessment for the Boulder Oaks Preserve. Rohde and associates ran only one match-drop simulation (with multiple runs from the same ignition point). For their ignition point they chose a "worst-case" scenario: an ignition in the Dye Road area, coincidentally the same area where SDG&E ignitions and PSPS damage have been observed. The map shows potential fire paths in red. It also shows the fire spread as a color grade, with the lightest area being the spread in the first hour, and yellow the spread in the second hour. Assumptions included fully cured fuels, off-shore winds of over 30 mph, and temperature over 80 F. As can be seen, Mussey Grade Road (labeled in small letters, and which follows the wooded stream bed from northwest to southeast), could be impacted by the fire front in as little as one hour. This does not account for smoke impacts, which could greatly degrade visibility well before the fire front arrives, further hindering evacuation. Studies by the Alliance expert have shown that evacuation of the area, where hundreds of people reside, could

take well in excess of an hour, and there are no safe sheltering locations along the road. Hence, entrapment of residents and a large mass casualty event are possible in this scenario.

Generally, MGRA supports wildfire safety around the state as "typical" residents of a wildfire prone neighborhood. It was surprising to come to the realization as SDG&E data was analyzed that our area was at elevated risk for catastrophic power line fire compared to other areas of San Diego County. Other geographic areas not being addressed during SDG&E's 2022-24 RAMP cycle where excesses of ignitions and PSPS damage have been observed also include the Rincon and Viejas reservations. However, only the Mussey Grade area has the added complication of a 5-mile box canyon egress that would be directly threatened by an ignition in the area of concern. SDG&E should, as it prioritizes, look for vulnerabilities that are not yet incorporated into its risk modeling algorithms, including potential for egress problems and historical vulnerability to PSPS damage.

2.3.4. Segment Remediation and Prioritization Recommendations

Recommendations:

- Conclusions from this year's OEIS-facilitated workshops regarding covered conductor should be incorporated into SDG&E's GRC filing, including changes to cost and effectiveness estimates for covered conductor.
- SDG&E should provide analysis of future technologies such as "Falling Conductor Protection, Sensitive Ground Fault Protection, and Sensitive Profile Settings" in conjunction with covered conductor, as a potential alternative to undergrounding.
- SDG&E should cross-check its circuit prioritization algorithm against other available data, specifically location-specific clusters of ignitions, PSPS damage, and wires down.
- SDG&E should work with local fire agencies to identify single-egress communities that may be particularly vulnerable to ignitions blocking the egress. These considerations should be used for both hardening prioritization and shutoff threshold.
- Staff should request that SDG&E produce fire spread modeling as requested for specific locations.

3. GENERAL ISSUES REGARDING WILDFIRE RISK

3.1. Value of Statistical Life (VSL)

As mentioned in Section 2.2 on wildfire smoke, SDG&E uses a value of statistical life of $100 million. As intervenors have previously pointed out,[74] the VSL used by federal agencies is $10 million. MGRA has observed that "wildfires are expensive", in that the level of property damage done is very high when compared to the number of casualties, which means that property losses tend to drive risk calculations rather than threats to life and health. Sempra claims that it avoids making decisions based on VSL: "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. Moreover, the Commission is considering whether to adopt a risk tolerance standard as a statewide issue in the ongoing S-MAP OIR."[75] However, the very setting of weights and scales for safety and financial attributes implies a Statistical Value of Life, whether the Companies wish it or not.

One example of SDG&E's discussion of its tabletop exercise in comparing the tolerance of SDG&E staff for various risk events. Participants were asked "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?" (emphasis added) According to Sempra, elimination of the safety incident was always prioritized even though losses from an eight hour outage were estimated to be $1 billion.[76] Of course, this is not a realistic question. Outages are never harmless, and the projection of a $1 billion cost is predicated on the great customer harm and risk that an outage will cause, potentially including fatalities. In fact, the SDG&E example helps to demonstrate the IOU mindset that would prioritize a known direct safety risk over a less known but potentially larger secondary risk. This is exactly why utilities should not be left to themselves in setting priorities for life and death choices, but must instead take into account input from all stakeholders.

[74] Informal Comments of TURN In Response to the Sempra Pre-RAMP Workshops; February 12, 2021.
[75] RAMP Report; p. E-20.
[76] Ramp Report; p. C-13.

Finally, as indicated in the previous section, the actual safety risks of wildfire are likely dominated by wildfire smoke, a factor that has never previously been taken into account in SMAP or RAMP discussions. This may substantially re-weight the risk equation, adding a much greater public safety impact to the risk compared to financial impact.

Recommendation:

- Staff should investigate the impact of a $10 million effective VSL for comparison once wildfire smoke risks are properly incorporated.
- All impacts from power shutoff should be investigated and incorporated into the MAVF.

3.2. Safety Risks from Power Shutoff

The RAMP Report states that "PSPS was treated only as a solution and not as a safety risk in the 2019 RAMP Report" and explains that "SDG&E's Wildfire RAMP Chapter (SDG&E-Risk-1) consists of two components, the risk of wildfire and PSPS impacts."[77]

SDG&E's RAMP filing calculates the magnitude of its PSPS Risk based upon the 2009 Lawrence Berkeley study of financial losses due to power outages.[78] According to this methodology, SDG&E claims that an 8 hour system wide outage would result in approximately $ 1 billion in losses.[79]

SPD probed more deeply into SDG&E's methodology in its Data Request 6, Question 5. In its response, SDG&E stated that a "combination of industry research and subject matter expertise is used to, by attribute, bucketize the range of impact values and correspond them to an attribute consequence weighting."[80] MGRA followed up on this question by asking SDG&E to provide

[77] RAMP Report; p. E-9.
[78] 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.
[79] RAMP Report; p. C-12.
[80] SDG&E Data Request Response SPD-DR-006, Question SPD-5.

citations to this industry research. In response SDG&E provided links to two news articles regarding cell tower outages during power shutoffs.[81]

SDG&E explained in response to a different data request that it modeled impacts on "critical customers" using communication tower "to best represent a typical critical customer".[82] SDG&E further explains that "Industry research and SME input were leveraged to determine the expected impact of a communications tower power outage, assuming a lack of backup power, within each attribute type. These expected impacts were determined by examining past communications outages in other power shutoff events and using SME input to assess the potential safety impact from an outage to an individual communications tower."[83] While SDG&E presents its scoring scale in the response, no additional detail is provided how these values were derived.

SDG&E acknowledges that its quantification of de-energization impacts is incomplete, stating that "SDG&E will continue to pursue more advanced approaches to quantifying PSPS in the future and potentially conducting more studies to guide its assessments." [84] We would suggest that staff inquire more deeply into SDG&E workpapers and methods, because it is not clear whether SDG&E's PSPS risk estimate is reasonable. Additionally, while it is a positive step to have SDG&E incorporating PSPS risks, there are numerous other risks in the context of power shutoff during high fire risk periods that have been raised by parties in various contexts.[85] None of these have yet been incorporated into any utility review of de-energization risks. The Commission may take this issue up in Phase 2 of the current RDF/SMAP2 proceeding in order to develop a more uniform framework to help utilities properly determine de-energization risks.[86] Even though the current proceeding and the GRC will be concurrent with the RDF/SMAP2 proceeding, work on the problem of accurately determining PSPS risks will be valuable not only for SDG&E ratepayers and residents but also because it will inform RDF/SMAP2 in the longer term.

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[81] SDG&E Data Request Response MGRA-DR-003, Question MGRA-10:
"California Blackouts Hit Cellphone Service, Fraying a Lifeline"; Pogash, C., & Chen, B. X. (2019, October 31). The New York Times. https://www.nytimes.com/2019/10/28/business/energy-environment/california-cellular-blackout.html
"Cell phone towers shut off during PG&E power outage"; https://www.ktvu.com/news/cell-phone-towers-shut-off-during-pge-power-outage
[82] SDG&E Data Request Response MGRA-DR-003, Question MGRA-12.
[83] Id.
[84] SDG&E Data Request Response MGRA-DR-003, Question MGRA-11.
[85] D.09-09-030; pp. 42-63.
[86] R.20-06-012; ASSIGNED COMMISSIONER'S SCOPING MEMO AND RULING; November 2, 2020; p. 4.

Recommendations:

- SDG&E should be required to provide additional technical detail on how it transformed cell tower outage estimates into PSPS risk estimates.
- SDG&E should be required to show how the Lawrence Berkeley references were quantitatively incorporated into its PSPS risks.
- SDG&E should list other potential PSPS risks and either quantify them or show why they are expected to be de minimis compared to the communication tower proxy that it has used.

3.3. Wind as a Cross-Functional Factor (CFF)

In analogy to PG&E's "Cross-Cutting Factors", SDG&E has introduced the concept of a "Cross-Functional Factor" to describe risk drivers that can have an impact on multiple risks.[87] MGRA agrees with this approach both in the context of PG&E and RAMP filings, and has suggested that severe wind is a cross-functional factor that can be an external risk driver for both wildfire ignition and electrical infrastructure integrity. To show how wind changes the risk landscape, MGRA has modified SDG&E's risk bowtie diagrams for both wildfire and electrical infrastructure risks.

A bowtie diagram that illustrates wind's effects on wildfire would look like this:

[87] Ramp Report; p. E-11.

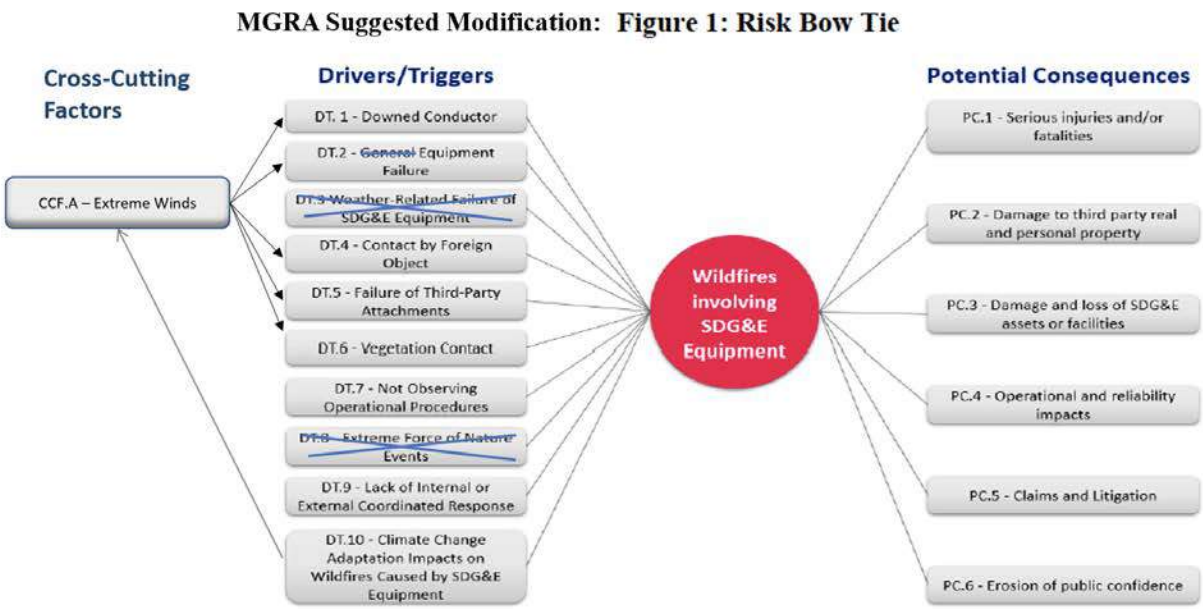

Figure 9 - Bowtie diagram incorporating extreme winds as an external cross-functional wildfire risk driver.

As can be seen, certain drivers and triggers are amplified by extreme winds and some are not. In this context, dividing equipment failure triggers into "weather related" and general is redundant, so DT.3 has been removed. Also, the extreme force of nature events was removed (though a specific entry for earthquake might be added in its place). Finally, climate change will affect extreme winds. According to recent modeling, the overall rate and amplitude of extreme wind events may decrease due to climate change, though annual rates may stay the same or increase due to the increase in length of the fire season.[88]

The Risk Bow Tie for Elastic Asset Failure is accurate and already has a single Driver / Trigger element, DT.7 – "In-service equipment failing in large volume due to acute climates or environmental conditions".[89] This driver/trigger incorporates the extreme wind case. However, in this context it is not completely accurate as stated. Equipment does not need to fail "in large volumes" to present a risk. What external environmental conditions do is to ***increase failure probability***. A large number of failures might occur if the probability and affected area is large enough, but even a single failure is enough to cause a potentially harmful risk event. This risk

[88] Guzman-Morales, J., Gershunov, A., 2019. Climate Change Suppresses Santa Ana Winds of Southern California and Sharpens Their Seasonality. Geophysical Research Letters 46, 2772–2780. https://doi.org/10.1029/2018GL080261

[89] RAMP Report; p. 2-10.

driver/trigger should instead be defined: "In-service equipment failing ***with increased probability*** due to acute climates or environmental conditions"

Recommendations:

- SDG&E should incorporate wind as a cross-functional factor that affects both wildfire ignitions and wires down.

3.4. Estimate Quality Determinations

SDG&E explains that it has omitted calculations of some RSEs because "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.'"[90]

The omission of data sources and quality estimations was also flagged by MGRA as a key flaw in SDG&E's 2019 RAMP filing, which stated that:

"In its 2021 RAMP, SDG&E should provide, in tabular form:

1. Data source for the estimate (or SME opinion).
2. A brief description of how the estimate was arrived at given the data input or SME expertise.
3. Uncertainty / quality of the estimate."[91]

SDG&E has provided no such information in its 2021 filing.

Even in the case where data exists, or SMEs have an estimate, not all estimates are created equal. Some are based firmly on proven models, quality data, or longstanding utility consensus, while others may be the opinion of one SME or based on a small statistical sample. In R.20-06-012 (SMAP II), PG&E proposed an "Estimate Quality" metric for each specific risk and mitigation.

[90] RAMP Report; p. E-23.
[91] MGRA 2019 RAMP Comments; pp. 8-9.

Ideally, as suggested by Professor Schulman of Berkeley, is to capture the range of SME estimates, possibly even starting with narratives.[92]

As seen in SDG&E's responses to MGRA data requests, there was an overreliance on "SME judgement", specifically in the areas of PSPS damage, the benefits of covered conductor, choice of references and methods for wildfire smoke impacts, and the estimation of extreme event contributions in the MAVF function. For the latter two, errors were uncovered by the MGRA analysis as described in Section 2. Whether the other SME estimates are reasonable or not is left for intervenors and the Commission to ponder.

SDG&E should be required to provide additional justification for "SME judgement" where it is used in its GRC application. Distributions of uncertain parameters can readily be used as inputs to Monte Carlo analyses, which form the basis of SDG&E's wildfire risk calculations. We would urge that the Commission require SDG&E provide more transparency into its RSE estimations and incorporate data quality and uncertainties into its risk estimates.

Recommendations:

- Staff should recommend that where "SME judgement" is used, that data and argument backing up this judgement be provided.
- Ranges of values should be incorporated into SDG&E risk estimations to represent uncertainties.

4. CONCLUSION

While SDG&E has made a number of improvements since its 2019 RAMP filing, there are still a number of fundamental issues that should be addressed as part of its GRC.

One recurring pattern in SDG&E's RAMP is that in many cases when the basis of subject matter expert (SME) estimates are probed through data requests, no reasonable factual or argumentative basis is provided for the SME estimate. Utilities should not be able to invoke "SME" as a buzz word that eliminates their obligation to provide transparent and complete visibility into

[92] SMAP Technical Working Group 1 meeting; April 14, 2021.

safety deliberations. Staff should further probe issues where subject matter expertise is used in lieu of factual input.

MGRA thanks SPD staff for reviewing these comments and looks forward to providing feedback on Staff's report.

Submitted this 22nd day of October, 2021,

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Informal Comments of The Utility Reform Network (TURN)
To the Safety Policy Division on the Sempra Utilities' RAMP Report

The Utility Reform Network (TURN) appreciates this opportunity to provide the Safety Policy Division (SPD) with our comments on the Sempra Utilities' RAMP Reports, which we hope will aid SPD with its November 5, 2021 report on the Sempra Utilities' RAMP filings.[1]

A summary of TURN's recommendations appears in the Appendix to these comments.

1. The Sempra Utilities Fail to Use the End of 2023 as the Baseline for Their Risk Analysis, Contrary to the SMAP Settlement

The SMAP Settlement requires the Sempra Utilities to use subject matter expert (SME) estimates of the risk reduction that will be achieved at the end of 2023 as the baseline for the pre-mitigation risk scores that are used to calculate RSEs. Specifically, Rows 10 and 11 of the Settlement require the Sempra Utilities to use "SME judgment that takes into account the benefits of any mitigations that are expected to be implemented prior to the GRC period under review." Sempra's Test Year 2024 GRC will be setting revenue requirements for the period 2024 through 2027. Moreover, the Sempra Utilities will move ahead with their planned mitigations in 2021 through 2023 and will not be basing their deployment of mitigations in those years on the upcoming decision on the 2024 Test Year GRC request, which is unlikely to come until the end of 2023 at the earliest. Accordingly, in this case, "the GRC period under review" begins in 2024.

Nevertheless, in direct violation of the Settlement, the Sempra Utilities chose to use 2020 as the baseline year to determine pre-mitigation risk scores.[2] As a result, Sempra's RSEs are inflated by counting risk reductions that will already have been achieved by work that the Sempra Utilities plan to perform in 2021, 2022 and 2023. For example, SDG&E plans to significantly accelerate its Wildfire mitigation undergrounding program from 29 and 25 miles in 2020 and 2021 respectively[3] to 80 miles in 2022 and 125 miles in 2023.[4] Using 2020 as the baseline means that 230 miles of undergrounding – and the attendant significant risk reduction --

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[1] Because of the expedited nature of RAMP proceedings and the failure of the Sempra Utilities to provide the supporting information required by Row 29 of the SMAP Settlement (see Section 5 below), the risks that TURN was able to review was not as comprehensive as TURN would have liked. The omission of a discussion of any issue with any risk chapter should not be construed as TURN's view that the presentation and analysis was satisfactory.

[2] SCG/SDG&E RAMP E-17.

[3] SDG&E 1-41.

[4] June 17, 2021 Workshop, Slide 79.

is not reflected in SDG&E's pre-mitigation aggregate risk score. As another example, when the Commission is deciding in the GRC whether and in what scope to approve the use of covered conductor for 2024 and beyond, the RSE analysis should not include covered conductor work and attendant risk reduction benefits that will have already been achieved before 2024. Because it is reasonable to expect declining marginal benefits as such programs are extended into lower priority parts of the utility system, it is essential that RSEs not be inflated by counting benefits that will already have been attained.

In addition, for the granular tranche RSEs required by the Settlement (discussed below), SDG&E's use of a 2020 baseline means that SDG&E's RSEs will reflect work that will already have been performed by the time the GRC decision is issued. In effect, in their RSE justification for mitigations proposed in their 2024 GRC, the Sempra Utilities would be able to double count risk reduction benefits that will have already been achieved. The result would be to benefit the utility at the expense of ratepayers by artificially inflating the benefits that can be achieved by mitigation activities in the upcoming GRC period.

This is a clear-cut case of a failure to comply with an explicit provision of the Settlement in Rows 10 and 11. The Sempra Utilities' arguments based on the Rate Case Plan are completely beside the point. Nothing in the Settlement indicates that the Rate Case Plan procedures for providing cost forecasts are to have any effect on the Settlement's requirements for calculating pre-mitigation risk scores and for the baseline for calculating risk reduction. The Sempra Utilities agreed to this provision and must be held to it. Moreover, the failure to use baselines updated by SME judgment (which under Row 29 of the Settlement is to be made transparent and thus subject to review and analysis by the parties) would make the RAMP a stale exercise that fails to reflect the best estimate of the risks facing the utilities as they enter into the GRC test year.

Accordingly, TURN urges SPD to make a clear and unequivocal finding in its upcoming report that the Sempra Utilities' use of the incorrect baseline violates the requirements of Rows 10 and 11 of the Settlement and must be corrected for the RSE analysis that the utilities present in their 2024 GRC submission and accompanying workpapers. Specifically, SPD should find that, in order to comply with the Settlement and as a matter of sound policy, the Sempra Utilities must use the end of 2023 as the baseline for the RSE analysis in the GRC.[5] TURN respectfully

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[5] TURN notes that in response to TURN Data Request 7, the Sempra Utilities purported to provide recalculated RSEs for two risks using a 2023 baseline. The response to that data request provides a lengthy and difficult to understand discussion of assumptions that were used for the exercise – a discussion that raises more questions than it answers. Ultimately, it is unclear to TURN whether the Sempra Utilities used a reasonable methodology and assumptions in responding to that data request. Moreover, the recalculated Wildfire risk RSEs are not provided for the granular tranches required by the Settlement (as discussed below) and

requests that SPD be clear and unequivocal about these findings so that the Sempra Utilities will know that, if they continue to use the wrong baseline, they will be defying an SPD conclusion.

2. The Sempra Utilities Have Failed to Comply with the Tranche Granularity Requirements of the Settlement

One of the most important requirements of the Settlement is the requirement to calculate, for each Risk Event (i.e., for each risk), RSEs for each tranche of the system or assets that are relevant to that risk. In this section, TURN will discuss the Settlement's specific requirements for tranche granularity, and how the Sempra Utilities have failed to comply with these requirements, both as a general matter and by reference to certain key risks. TURN's resource limitations prevented it from reviewing the granularity of Sempra's analysis for all risks. The fact that these comments do not address certain risks does not mean that TURN views the granularity of tranches for those risks to satisfy the Settlement's requirements.

2.1. The Settlement's Requirements for Tranche Granularity

Row 14 of the Settlement requires, "for each Risk Event, the utility [to] subdivide the group of assets or the system associated with the risk into tranches." The last paragraph of Row 14 provides the principal that the utility is to use in determining the composition of the tranches. Each element in an identified tranche is to "have homogeneous risk profiles (i.e., considered to have the same LoRE and CoRE)." In other words, to comply with the Settlement, 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.

In addition, Row 14 requires the determination of tranches to be "based on how the risks and assets are managed by each utility, data availability and model maturity." This requirement means that data that the utility uses to manage the risk and prioritize the execution of mitigations must be used in the determination of the tranches. As Row 14 states, the utility must strive to achieve as deep a level of granularity as reasonably possible.

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therefore fail to reflect the fact that SDG&E should already have addressed the highest risk tranches in work performed through 2023 and therefore fails to show how the tranche specific RSEs are reduced when 2023 is used as the baseline, instead of 2020. This data request response highlights the need for the Sempra Utilities to do a better job of explaining their data inputs and assumptions when they provide RSEs calculated with the 2023 baseline in their GRC submission – as well as the need to comply with the Settlement's tranche granularity requirements.

The Settlement explains why its Tranche requirements are important. The utility is required to calculate "[r]isk reductions from mitigations and risk spend efficiencies at the Tranche level" in order to "give[] a more granular view of how mitigations will reduce risk."

Finally, Row 14 includes a requirement for the utility to explain for each risk how the utility determined the tranches. Specifically, in its RAMP submission, the utility must provide its "rationale for the determination of Tranches, or for a utility's determination that no Tranches are appropriate for a given Risk Event."

As discussed below, the Sempra Utilities routinely fail to satisfy this requirement in the various risk chapters in their RAMP submissions.

2.2. Importance of the Granularity Requirement

2.2.1. Summary

The Commission's adoption of the SMAP Settlement alone shows that all of the required elements included in that Settlement are important and must be implemented by the utilities in order to comply with D.18-12-014. However, in Section 2.2.2, TURN will explain why compliance with the Settlement's Tranche requires is central to achieving the Commission's objective of balancing the achievement of safety and affordability goals. As the Commission stated in D.14-08-032, "[v]irtually everything a utility does [has] some nexus to safety and can be deemed to have some safety impact, *but the emphasis should be on those initiatives that deliver the optimal safety improvement in relation to the ratepayer dollars spent*."[6] Ensuring that the Sempra Utilities' safety initiatives are cost effective takes on even greater importance given the increasingly unaffordable levels of the Sempra Utilities' rates, as reflected in the Staff White Paper supporting the CPUC's February 2021 "Rates En Banc," which showed that SDG&E's average residential rate is much higher than that of PG&E and SCE[7] and, over the rest of this decade, projected to rise faster than the rates of those other two utilities.[8]

In summary, sufficiently granular tranches are necessary to achieve the goal of providing accurate information for GRC decision-making about the cost-effectiveness of proposed mitigations. When assets with different LoRE and CoRE values are grouped together, the resulting average RSE values will mask differences in individual asset RSEs. This matters

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[6] D.14-08-032 (Decision on PG&E's 2014 GRC), p. 28 (emphasis added).

[7] *Utility Costs and Affordability of the Grid of the Future, An Evaluation of Electric Costs, Rates, and Equity Issues Pursuant to P.U. Code Section 913.1* ("White Paper"), CPUC Staff, Feb. 2021, pp. 4-5, 70.

[8] White Paper, p. 8.

because a key objective of this quantitative analysis is to identify mitigations that will provide the greatest risk-reduction value for PG&E's customers, employees, and the public at large. Using average RSE values that do not account for individual asset differences prevents the Commission from having a record that allows it to make fine-tuned decisions about which mitigations to approve and in what scope, given affordability and other constraints.

The following section will provide a more detailed explanation of the serious problems that result from failure to implement the Settlement's Tranche requirements.

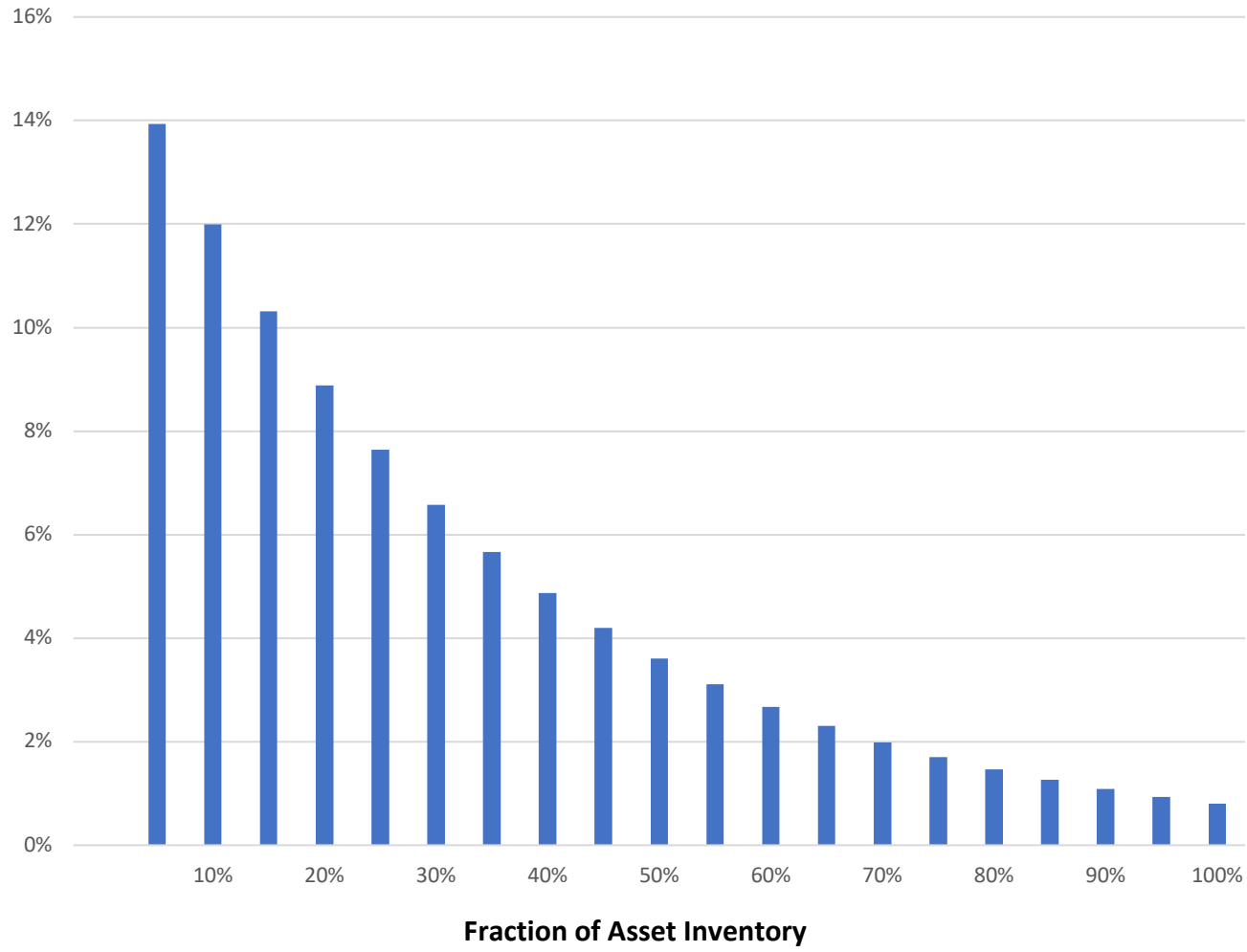
2.2.2. Analysis of Consequences of Non-Compliant Tranches

The consequences of failing to separate the assets into tranches are that (1) the amount of risk reduction provided by a mitigation are not computed as required by the Settlement; (2) RSE values for mitigations are not computed as required by the Settlement; (3) for most of the assets in the inventory, both the risk reduction and the RSE values are biased upwards; (4) the analysis is of little to no use in ensuring the scope of mitigations is based on targeting the activity to where it is most cost-effective; and (5) the most efficient program scope—how broadly to apply the mitigation to get the greatest risk reduction for the money spent recognizing the affordability constraint – cannot be discerned.

These conclusions are based on the following risk analysis, which will be explained in reference to the Sempra Utilities' High Pressure (HP) and Medium Pressure (MP) gas systems. However, this analysis is completely general and applies to any inventory of assets and, therefore, to all of Sempra's risks.

Consider the entire inventory of gas system assets, either high-pressure or medium-pressure. As required by the Settlement, break the inventory into approximately equal and relatively small segments (each segment comprising a small fraction of the total asset inventory) that have measurable and approximately equal risk characteristics (specified by LoRE and CoRE). For each segment, compute the risk (LoRE x CoRE). Divide the segment's risk by the fraction of the inventory in the segment to find the risk per unit of inventory over that segment. Order the inventory segments by decreasing risk per unit of inventory (where risk per unit of inventory = LoRE x CoRE divided by fraction of inventory in the segment). This creates a familiar bar chart with bars of decreasing heights, where the height of the bar is the risk per unit of inventory of the segment and the width of the bar is the fraction of the total inventory that is comprised by the segment. Therefore, the area of each bar is the risk of the segment. The important fact is that the sum of the areas of the bars is equal to the total risk over the inventory of assets. This is shown in Figure 1. Note that figure 1 presents bars of equal width. That need not be the case in any particular analysis—the fraction of the inventory in each segment can be variable.

Figure 1: Risk Distribution Of An Inventory of Assets



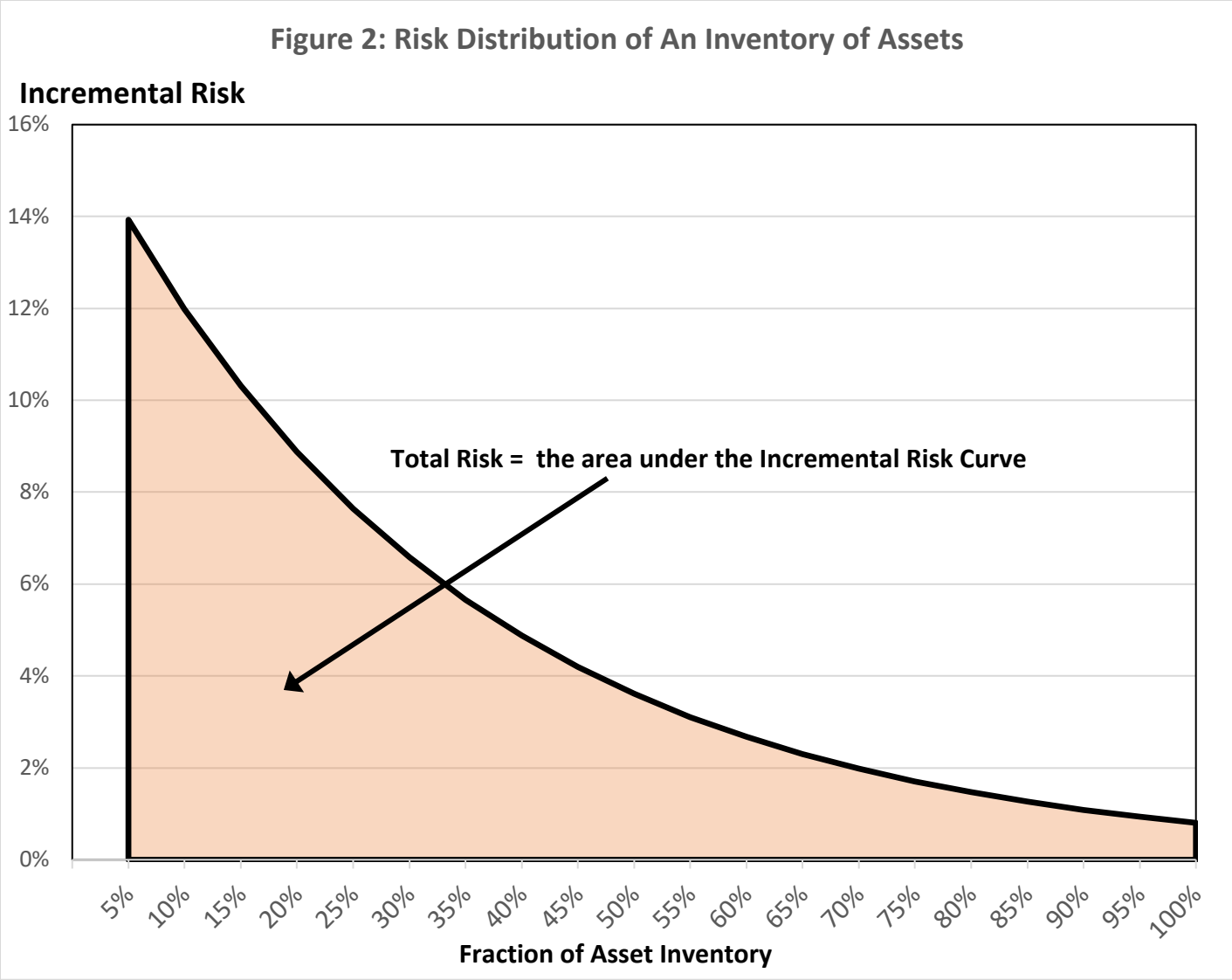
TURN does not have access to the actual Sempra data that describes the risk over the inventory of the gas systems, but we know that such data exists.[9] Nevertheless, we can make some general statements. For systems like this, the so-called "80-20 rule" (also known as the Pareto Principle) applies approximately. The principle states that, in this case, approximately 80% of the risk

[9] Response to TURN Data Request (DR) 11-1.a (database of results of DREAMS tool). Because of confidentiality issues, the Sempra Utilities provided TURN a redacted version of the Excel database of results.

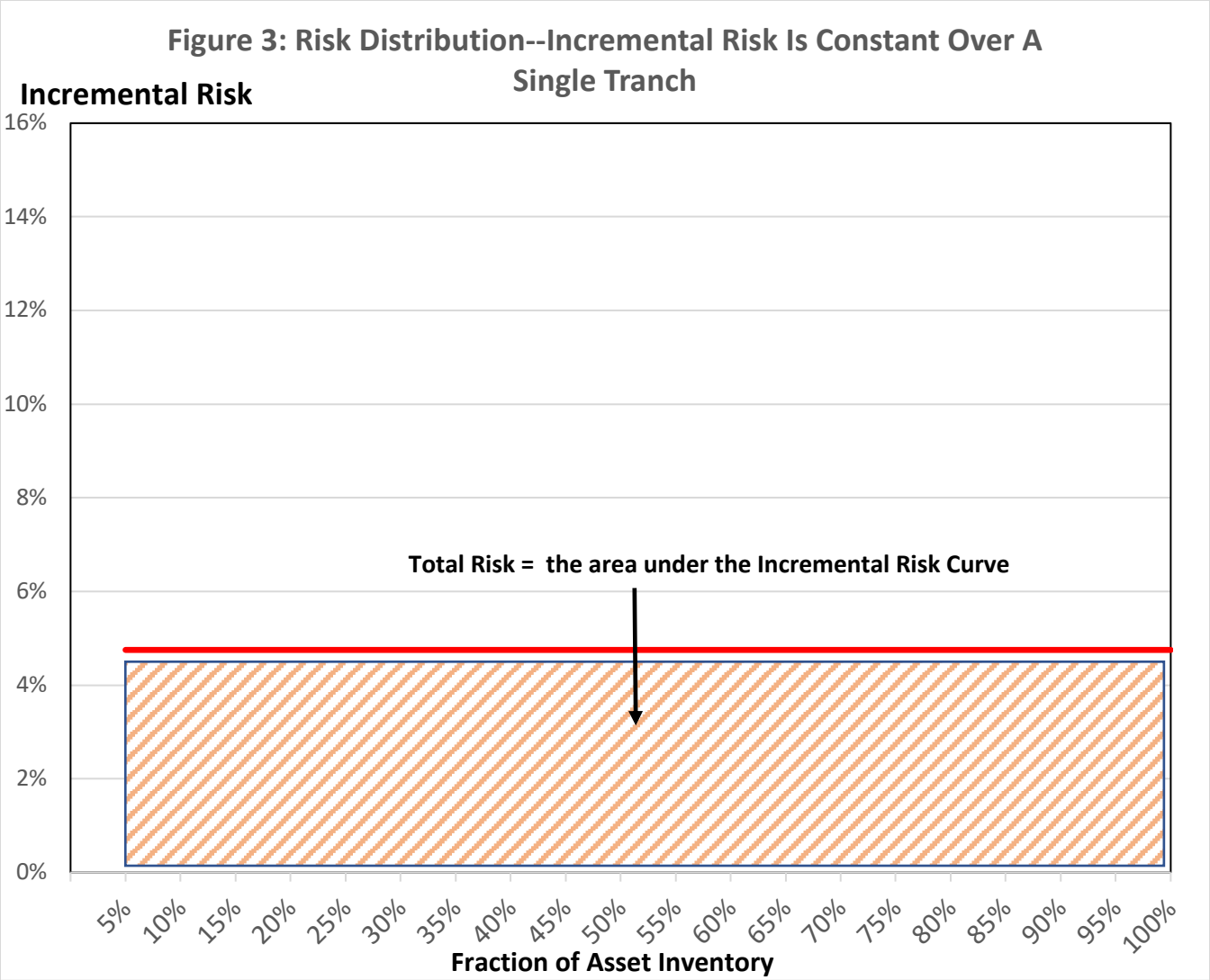
arises from approximately 20% of the inventory.[10] We have observed this behavior in other data for other risks, notably PG&E data for the wildfire risk.

With respect to Figure 1, this means that the heights of the bars sharply decrease as the cumulative inventory approaches 20% and then remain relatively low, while continuing to decrease, for the remaining 80% of the inventory. We can make the bar chart into a continuous function, as shown in Figure 2. The graph shows the relationship of incremental risk to fraction of inventory, so that, analogously to the sum of the areas of the bars, the total risk is the area under the curve, or the integral of the incremental risk function. This allows us to make the important point that in this graph, risk is equal to area. This is shown in Figure 2.

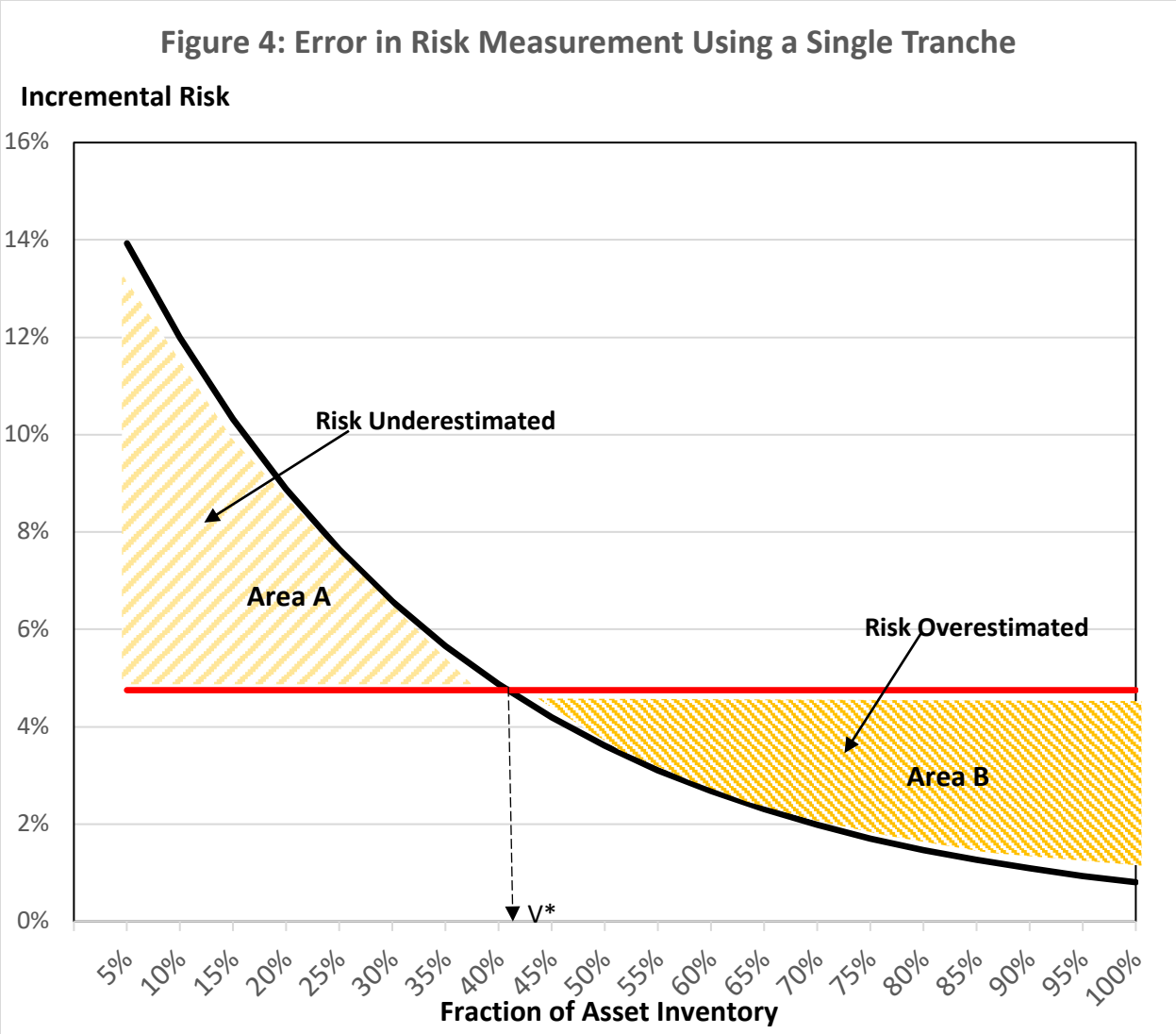
[10] As noted, this is a general principle that recognizes that a high proportion of the risk resides in a relatively small percentage of assets for a given risk. Depending on the risks and assets under study, the percentages can differ. TURN would expect that for certain assets and risks, 90% (or more) of total risk could be limited to 10% (or less) of assets.



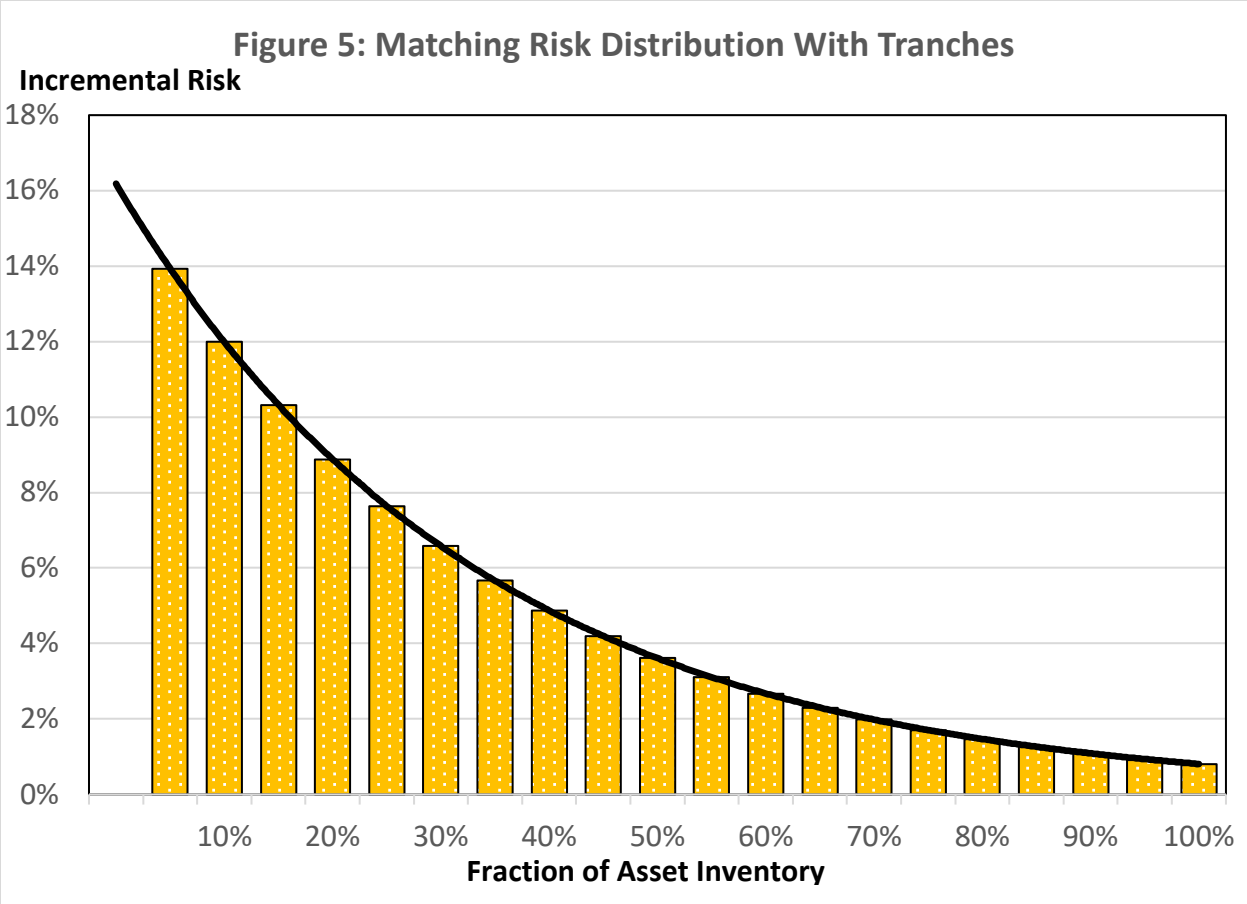
Now, consider what happens when the entire inventory is treated as a single tranche. This means that over the entire inventory, the incremental risk is constant, so the incremental risk function is horizontal, as shown in Figure 3 (see the red line). (It is worth noting that this is the defining property of a tranche: the incremental risk is constant over the entire tranche of assets.) Note that the area under the horizontal line, the area of the rectangle shaded in the figure, is the risk for the single tranche. The risk per unit of inventory for the single tranche is specified so that the area of the rectangle in Figure 3 is equal to the area under the curve in Figure 2.



Next, we combine Figures 2 and 3, as shown in figure 4. The areas under the curve and the rectangle must be the same (because the total risk is the same), so the height of the rectangle must be such that the area above the rectangle and below the curve (area A) must be equal to the area below the rectangle and above the curve (area B). That height is the incremental risk of the single tranche. The intersection of the rectangle and the curve identifies a critical fraction of the inventory, V*, as shown in Figure 4.



As shown in Figure 4, the risk of the assets in the relatively high risk fraction of the system that is less than or equal to V* is underestimated and the risk of the assets in the relatively low risk fraction of the system that is greater than V* is overestimated. As suggested in Figure 4, which shows only one tranche used to approximate the actual risk distribution over the entire inventory, the risk will be more accurately estimated if multiple tranches are constructed, as required by the Settlement, which would create a bar chart (such as in Figure 1) that more closely approximates the curve (shown in Figure 2), such that each bar is a tranche. This is illustrated in Figure 5. The figure shows bars of equal widths. In any particular analysis, that need not be the case. The tranches can contain any amounts of the asset inventory.



This analysis also implies that the risk reductions and the RSEs that Sempra calculates are similarly computed incorrectly. This follows because Sempra computes risk reduction for virtually all mitigations by reducing the pre-mitigation risk, LoRE x CoRE, by a fraction, say *f*, such that the risk reduction is equal to (1 - *f*) x LoRE x CoRE. Therefore, the risk reduction over the entire inventory is simply a scaled version of Figure 2 or Figure 3, where the height of the graph is reduced by the fraction (1 - *f*). The height of such a graph can be interpreted as risk reduction per unit of inventory. Further, if we make the simplifying assumption that the cost of a mitigation is some amount *C* per unit of inventory, then the RSE per unit of inventory is equal to (1 - *f*) x LoRE x CoRE/C, which is yet another scaled version of Figures 2 or 3. Therefore, Figures 4 and 5 apply to both risk reduction and RSE.

It is also reasonable to observe that the importance of tranching to achieving accurate RSEs depends on the steepness of the decrease in risk per unit of inventory that is shown in Figures 1 or 2. If the decrease in incremental risk is rapid, that is, if a small percentage of assets provide a large percentage of the total risk reduction, then a more extreme version of either Figure 1 or Figure 2 suggests that relatively few inventory segments need to be mitigated. In this case, tranching becomes even more important because treating all assets together in a single tranche will result in (i) overestimation of total risk reduction for most of the inventory (area B in

figure 4) and (ii) an incorrect RSE that supports excessive spending on applying a mitigation that provides little risk reduction over a large fraction of the inventory of assets.

2.3. SDG&E's Wildfire Risk Chapter Fails to Meet the Settlement's Tranche Requirements

2.3.1. Summary

SDG&E's wildfire risk analysis in its RAMP filing calculates RSEs for just three tranches – Tier 2 High Fire Threat District (HFTD Tier 2 or "Tier 2"), HFTD Tier 3 (or "Tier 3"), and in some cases non-HFTD.[11] However, SDG&E has a much more granular wildfire risk model, called Wildfire Next Generation System (WiNGS), which the utility uses to "help prioritize [its] grid hardening mitigations."[12] As explained in Section 2.1 above, because SDG&E uses the WiNGS model for managing the assets affected by the wildfire risk, the output of that model should have been used to determine the tranches of assets with homogenous risk required by Row 14 of the Settlement.

None of the WiNGS model's results are presented in the utility's RAMP filing or workpapers, but were provided to TURN in data requests for circuit segments with scoped grid hardening mitigations.[13] For the reasons stated herein, TURN recommends SDG&E's GRC filing include tranches with RSEs calculated at the more granular level presented in the utility's WINGS model. Further, the model should be utilized to derive risk reduction and RSE's for additional wildfire mitigations beyond covered conductor and undergrounding, including but not limited to vegetation management programs.

2.3.2. Analysis

The granularity of tranches presented by SDG&E in its RAMP for most wildfire mitigations --Tier 3 and Tier 2 HFTD -- is far too aggregated to meet applicable Settlement requirements. Indeed, WINGS model results illustrate that wildfire risk per mile based on this more granular analysis is highly heterogenous (see Figure 6 below), with a large amount of risk concentrated among relatively few miles. This result may be even more pronounced if it could be calculated for SDG&E's entire HFTD; however, SDG&E would not provide these model results to TURN.[14]

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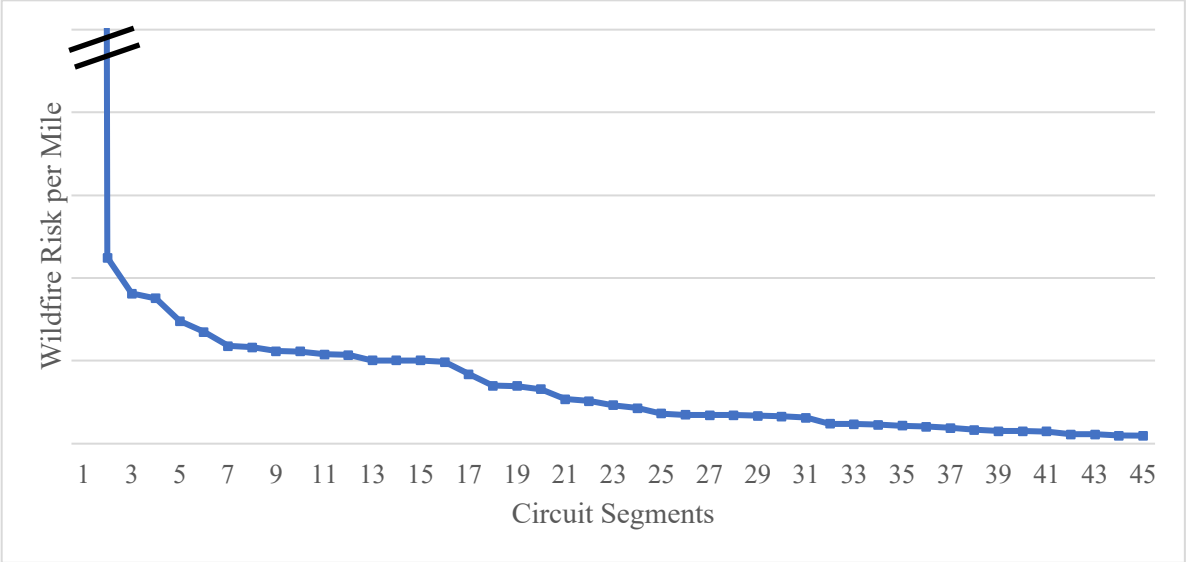
[11] SDG&E RAMP, pp. 1-5 to 1-6.

[12] SDG&E RAMP, p. 1-18.

[13] TURN-6, Question 1, Excel attachment. SDG&E would not provide the entire WINGS model for its HFTD. See response to TURN DR 9, question 1.

[14] TURN-9, Question 1.

Figure 6. Wildfire Risk per Mile – SDG&E "WINGS" Model Results[15]



The high degree of heterogeneity in wildfire risk illustrated in Figure 6 is completely lost when aggregating by HFTD tier. SDG&E's Tier 2 and 3 HFTD are comprised of around 1,800 and 1,600 overhead circuit miles, respectively,[16] compared to the WINGS model which calculates risk for circuit segments from one-tenth of a mile to around 30 miles in length.[17] WINGS model results also indicate that some Tier 2 circuit segments are actually *higher* risk than circuit miles located in Tier 3—a facet of wildfire risk that could not be ascertained with the results presented in SDG&E's RAMP filing. Indeed, the *highest* risk per mile circuit segment is located in Tier 2, according to the WINGS model results provided to TURN.[18] This illustrates again why highly granular tranches are critical to gaining an accurate understanding of the relative risk and RSE of mitigation proposals, which can then be utilized by the Commission and stakeholders to properly scope and prioritize utility risk mitigation programs.

[15] Calculated from TURN-6, Question 1, Excel attachment. The x-axis indicates the cumulative number of circuit segments for which SDG&E provided WiNGS results, from highest risk (per mile) segment to lowest risk segment. The y-axis is curtailed at a lower maximum value than calculated for the highest risk circuit, indicated by the black bars, in order to view the much lower risk values of lower-ranked circuit segments.

[16] SDG&E WMP Revised 2021 Filing, Excel Tables Attachment B, Table 8.

[17] TURN-6, Question 1, Excel attachment.

[18] Calculated from TURN-6, Question 1, Excel attachment, and sorted for wildfire risk per mile.

In addition, SDG&E has not utilized its WINGS model for any wildfire mitigations other than covered conductor and undergrounding.[19] SDG&E thus plans to request funds from ratepayers for tens of millions of dollars over the next GRC period for programs with non-granular RSEs that do not meet the requirements of the Settlement.[20] These include tree trimming (around $32-$38 million in TY 2024) and enhanced vegetation management ($10-12 million in TY 2024).[21] SDG&E seems to acknowledge the importance of calculating more granular RSEs for these programs, stating it "plans to explore the use of WiNGS to evaluate vegetation management prioritization in the near future."[22] SPD should recommend that the utility utilize the same tranches derived from WINGS to calculate RSEs for the vegetation management programs in the utility's upcoming GRC, rather than aggregating risk reduction and cost of its proposals by HFTD tier. Failure to do this would constitute a breach of the settlement agreement adopted by the Commission.

Finally, SPD and the Commission should not accept an excuse that the utility does not track costs at the tranche level. The Sempra Utilities have been on notice since they signed the Settlement in April 2018 and it was approved in December 2018 that they would be required to calculate RSEs, which require cost estimates for the denominator, at the tranche level. They should have implemented systems to at least provide credible estimates of costs of mitigations by tranche. SPD should make clear that absence of cost tracking systems should not be allowed to serve as a justification for failing to comply with the Settlement and that the Sempra Utilities should accelerate their efforts to enable reliable estimation of tranche-level costs.

2.4. The Sempra Utilities' Gas Risk Chapters Fail to Meet the Settlement's Granularity Requirements

The two Sempra Utilities each identified two RAMP risks that are related to the operations of the gas system – those related to the high-pressure (HP) system (Chapters SCG-1

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[19] Response to TURN-4, Question 1. TURN notes that this response misstates the Settlement's tranche requirements. As discussed in Section 2.1, Row 14 requires that the assets associated with a risk event be subdivided into tranches for each risk event. Thus, contrary to SDG&E's response, the utility may not pick and choose, based on mitigation, when to use the Settlement's required tranches for the analysis. To ensure consistency in the risk analysis, to enable comparison of the relative benefits of different mitigations at the tranche level, and to avoid errors such as Sempra made with the Gas HP risk (see Section 2.4.2.1 below), the same tranches must be used for each risk event, even if, for a particular mitigation, the results of the mitigation are uniform for many of the tranches.

[20] SDG&E RAMP, Table 10, pp. 1-97 to 1-109.

[21] SDG&E RAMP, Table 10, p. 1-100.

[22] SDG&E RAMP, p. 1-65.

and SDG&E-3) and those related to the medium-pressure (MP) system (Chapters SCG-3 and SDG&E-9). Contrary to the Settlement, the RSE analysis for mitigations for each of these risks fails to consider the separate tranches of assets that comprise the asset inventories of the HP and MP gas system. Instead, for the RSE analysis, Sempra treats each risk as if all the assets that are exposed to it comprise a single tranche. Even though the Sempra Utilities may seem to make a nod in the direction of tranching in differentiating between high and low consequence events in building their pre-mitigation risk scores for these risks, they do not properly use such distinctions to create separate tranches for their RSE calculations. In fact, as discussed below, in the case of the HP risk, the failure to create correct tranches appears to lead to a significant error that overstates the RSEs for the HP mitigations.

In any event, the variations in risk among the highly heterogenous assets for both the HP and MP risks require tranches that are far more granular than merely dividing assets into high consequence and low consequence areas. The result is all of the adverse consequences that are described in Section 2.2.2 above.

2.4.1. Medium Pressure Pipeline System[23]

SCG's medium pressure pipelines comprise approximately 100,000 miles of mains and services, with over 22,000 miles of steel mains and approximately 25,000 miles of plastic mains.[24] Although SCG builds its pre-mitigation risk score from separate consideration of high consequence and low consequence "events" (as opposed to assets in high consequence and low consequence areas), its RSE analysis is based on a single tranche with one aggregated value for LoRE = 544.99, CoRE = 5.63 and a Pre-Mitigated Risk Score = 3,071.[25]

SCG's most expensive MP risk mitigation programs are C21-T1, the Vintage Integrity Plastic Plan (VIPP) and C21-T2, the Bare Steel Replacement Program (BSRP). The VIPP addresses plastic pipe that is known to "exhibit a brittle-like cracking characteristic that could cause a leak to grow" (p. SCG-3-24). The BSRP "focus(es) on the replacement of bare steel with the highest leak rates." (p. SCG-3-25). For RSE calculation purposes, SCG shows the total cost of VIPP as $657,339,000[26] for 327 miles of pipe replacement[27] and the total cost of BSRP as

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[23] The analysis in this section focuses on SoCalGas (SCG), but applies equally to SDG&E's report, which uses the same methodology.

[24] SCG RAMP, p. 3-3.

[25] File labeled "Final 2021 RSE Workpaper – SCG MP – Supplemental_Level 2", "Risk Scoring Workpaper" tab.

[26] *Id.,* cell E17.

[27] SCG RAMP, p. 3-38, Table 5.

$281,718,000[28] to replace 139 miles of pipe.[29] SCG's RAMP report does not explain how it determined the specific proposed replacement mileage for these programs, only stating that it plans to increase the level of replacement over current levels.[30]

SoCalGas also notes that both these programs benefit from "the DREAMS tool [that] is used to prioritize risk mitigation on early vintage plastic and steel pipeline segments." (p. SCG-3-24). SCG further explains that this "algorithm includes pipe attributes, operational conditions and potential impact on population" and that the results of the DREAMS analysis "determine appropriate action to address risk for each segment and prioritize replacement investments based on a failure analysis." (p. SCG 3-24). TURN obtained through discovery a redacted version of the respective DREAMS databases for plastic and steel pipe. To illustrate the granularity of information that SCG maintains, the plastic database has 41 columns of detailed information for each of over 171,000 plastic pipe segments, all but one of which are less than 1 mile in length, many less than 0.10 mile long.[31]

As noted in Section 2.1, Row 14 of the Settlement requires tranches to be determined based on how the assets are managed by the utility, data availability and model maturity. SCG's RAMP report admits that it uses the DREAMS algorithm to make decisions about how to manage risks for its pipe segments, and clearly the necessary data is available to fashion granular tranches that group SCG's plastic and steel pipe based on homogenous risk profiles as required by the Settlement. At the September 14, 2021 workshop, SCG's representative acknowledged that the company could use the DREAMS information to break down their RSE analysis into tranches, but that they have not done so. By not determining granular tranches based on the operational information available to SCG via the DREAMS database, SCG is in plain violation of the tranche requirements of the Settlement.[32]

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[28] File labeled "Final 2021 RSE Workpaper – SCG MP – Supplemental_Level 2", "Risk Scoring Workpaper" tab, cell E16.

[29] SCG RAMP, p. 3-39, Table 5.

[30] SCG RAMP, p. 3-24.

[31] Response to TURN DR 11-1.a, Redacted Excel File "Plastic Risk Results_DR_Redacted", not available on SCG's website.

[32] Although tranching limited to plastic vs. steel pipe would be clearly inadequate to achieve tranches with homogenous LoRE and CoRE values, SCG does not even do that. This can be seen from the fact that SCG uses the same pre-mitigated LoRE value of 544.99 for both the VIPP and BSRP programs (indeed for all MP mitigations). (Final 2021 RSE Workpaper -SCG MP-Supplemental_Level 2, RSE Summary tab, cells G16, G17). If SCG had separate tranches for steel and plastic pipe, it would have calculated separate pre-mitigation LoREs for the two

The adverse consequences of SCG's use of a single tranche for the MP risk are exactly as described in section 2.2 above. The single aggregated RSEs for each of VIPP (1.16) and BSRP (0.88) both underestimate RSE for the relatively high-risk tranches that should be reflected in SCG's analysis and overestimate RSE for the relatively low-risk tranches, following the pattern shown in Figure 4 above. By failing to use the requisite tranches for its RSE calculations, Sempra, the Commission, and the parties are deprived of information to assess the tranche-by-tranche cost-effectiveness of MP mitigations such as VIPP and BSRP and make informed judgments about how to balance considerations of risk reduction and affordability.

In this regard, Sempra cannot accurately claim that the Commission has directed it to replace as much vintage plastic and steel pipe as its resources would allow and not consider cost-effectiveness and affordability.[33] In fact, while D.19-09-051 notes that SCG's current replacement rate of vintage plastic and steel pipe in not on pace with its original assessment, it also states that safety mitigation programs such as these "must . . . be prioritized and balanced with keeping rates affordable." (D.19-09-051, p. 192).

The required remedy to bring Sempra's RSE analysis for the MP risk is clear. Sempra has detailed information about its MP assets in the DREAMS database that it uses to prioritize its work. That information should be used, with other information that may be available to Sempra, to create the tranches that are required by the Settlement. Each tranche must contain assets that have the same likelihood of occurrence of the risk event (LoRE) and the same consequences if the risk event occurs (CoRE). While this is a requirement of the Settlement as discussed in section 2.1, it is also a matter of sound policy, as discussed in section 2.2. Using these tranches, Sempra must then calculate tranche-level RSEs, as required by Row 14 of the Settlement.

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types of pipe, which presumably would sum to the 544.99 aggregated LoRE for all of the assets combined. Note also that the CoRE for VIPP and BSRP – and indeed every MP mitigation is the same as the total system CoRE, 5.63 (Final 2021 RSE Workpaper -SCG MP-Supplemental_Level 2, RSE Summary tab, column P). Therefore, SoCalGas evaluated every mitigation as if all the assets subject to the mitigation were in a single tranche.

TURN points this out to show that, contrary to Sempra's misleading claims, SCG's calculation of separate RSEs for VIPP and BSRP should not be confused with separate tranches for plastic and steel pipe. Moreover, as discussed in connection with the HP risk in section 2.4.2.1, doing separate RSE calculations for subsets of assets without having separate pre-mitigation risk calculations for those separate assets is an incorrect methodology that leads to incorrect RSEs.

[33] See, e.g., response to TURN DR 11-1(c), incorrectly suggesting that the TY 2019 GRC decision, D.19-09-051, *requires* Sempra to accelerate the replacement of vintage plastic and steel pipe.

2.4.2. High Pressure Pipe System[34]

2.4.2.1. Apparent Tranche-Related Error in RSE Calculations

The SCG RAMP states that the company operates approximately 1,100 miles of high-pressure transmission lines in high-consequence areas (HCAs) out of a total of 3,341 miles of such pipe,[35] as well as approximately 3,300 miles of HP distribution pipe.

As with its MP pipeline system, SCG aggregates all of the different types of equipment in its HP system – pipelines, compressor stations, measurement and control stations, etc. - in these different areas into a single tranche for purposes of RSE calculations, contrary to Row 14 of the RAMP Settlement. Although the SCG Report indicates that most HP mitigations are divided into HCA and non-HCA "tiers", SCG uses aggregated pre-mitigation risk scores that do not distinguish between HCA and non-HCA assets in its RSE calculations.[36] Instead, for purposes of the RSE calculations, SCG calculates a single weighted average CoRE value of 537.6 for all HP risk events and aggregates the LoRE values of transmission and supply line events (including events at compressor stations), for a total of 8.64 events per year.[37] From this, SCG calculates a single pre-mitigation risk score of 4,644 (8.64 x 537.6). These are the values that SCG uses for all of its RSE calculations, instead of values for LoRE, CoRE and Risk Score that are differentiated by HCA vs. non-HCA, even though the entire concept of HCAs and non-HCAs means that events in these areas have different consequences.

The failure to conduct the pre- and post-mitigation risk analysis separately in HCA and non-HCA areas appears to cause a fundamental error in Sempra's calculations. The error renders all of the RSE values shown for the HP system incorrect and inflated because, together, SCG's analysis assumes distinct programs in HCAs and non-HCAs reduce more than 100% of risk. That is impossible. TURN's analysis finds that, based on the information SCG has provided, recalculated RSEs equating high and low consequence events with HCA assets and non-HCA assets (which may not be what SCG intended), would reduce all of the HCA RSEs by 69% and the non-HCA RSEs by 31%.

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[34] As was the case with Section 2.4.1, the analysis in this section focuses on SoCalGas, but applies equally to SDG&E's report, which uses the same methodology.

[35] SCG RAMP, p. 1-3.

[36] This violates Row 16 of the Settlement, which requires that the effects of a mitigation be "expressed as a change to the *Tranche-specific* pre-mitigation values for LoRE and CoRE." (Emphasis added).

[37] Excel file: "Final 2020 RSE Workpaper – SCG HP – Supplemental_Level 2", "RSE Summary" tab.

To understand this error, recall that the reported LoRE for the entire HP system is 8.64. SCG assumes that none of its mitigations reduce CoRE. Rather, the programs solely reduce LoRE values. Suppose a mitigation program reduces LoRE from the pre-mitigation value of 8.64 events/year to zero. Doing so would eliminate all risk because the mitigation program would have eliminated all risk events. Clearly, the number of post-mitigation risk events cannot be less than zero. Thus, if we consider the entirely separate mitigations designed for HCAs and non-HCAs -- because these areas are geographically distinct, there is no program overlap – then collectively they cannot reduce LoRE by more than 8.64. For example, if a non-HCA program reduces the pre-mitigation LoRE from 8.64 events/year to 2.0 events/year, the most an HCA mitigation program can reduce LoRE is by the remaining two events. Note that, in column B of the "RSE Summary" worksheet, the IDs for programs in HCAs are designated at the end as "TO1" and programs in non-HCAs are designated "TO2".

With this in mind, consider column F of the "RSE Summary" worksheet, which shows the "% Change in LoRE" values for each control/mitigation and column M, which shows the "Post-Mitigated LoRE" values for each control/mitigation. Next, we examine the "Integrity Assessments & Remediation" programs, which are two of the largest programs by expenditure. The SCG workpaper identifies a total cost of $246.9 million for the program in HCAs (C21-T01) and $427.7 million for the program in non-HCAs (C21-T02), or about $675 million in total. Because the programs are in different areas, there is no geographic overlap. Hence, both programs can be done independently.

As shown in cell F22, SCG reports a 71% reduction in LoRE for the HCA Integrity Assessment/Remediation Program. As shown in cell F23, SCG reports a 92% reduction in LoRE for the non-HCA program. Hence, as shown in cells M22 and M23, the resulting post-mitigation LoRE values are 2.51 for the HCA program and 0.67 for the non-HCA program. Thus, SCG assumes implementing the program in the HCAs reduces LoRE by 6.13 events/year (8.64 – 2.61) and implementing the program in the non-HCAs reduces LoRE by 7.97 events/year (8.64 – 0.67). Hence, the total reduction in LoRE in HCAs and non-HCAs combined is 14.1 events/year (6.13 + 7.97). Because the total pre-mitigated LoRE is 8.64 events/year, it is clearly impossible for these non-overlapping programs to reduce LoRE by 14.1 events/year.

This is the most egregious of the fundamental errors made by SCG arising from its aggregated calculations. SCG's HP workpapers show that this error extends throughout the various mitigations that are separated into HCAs and non-HCAs. The impact of this error is to significantly inflate the RSE values that SCG calculates.[38]

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[38] TURN discovered this apparent error as it was preparing these informal comments and well after the conclusion of the workshops. TURN believes its analysis is supported by a fair reading of Sempra's workpapers. If, as has happened before in this case, the seemingly

2.4.2.2. Inadequate Tranches

Even if the error described above is fixed and the RSE analysis is disaggregated between assets in HCA and non-HCA areas, tranches that merely distinguish between HCA and non-HCA assets would be plainly inadequate to meet the Settlement's tranche requirements.

With respect to the biggest category of HP system assets – pipelines -- SCG acknowledges that the risk of failure depends on a variety of factors, including stress on the pipe, the pipe material properties, and the geometry of the latent weak point on a pipeline,[39] which would include seam and weld type. Similarly, assets in the HP system that are distinct from pipeline, such as compressor stations and measure and control stations – and their constituent components – have different risk profiles from pipe and, likely, from each other, and thus need to be grouped into separate tranches. Like all gas utilities, the Sempra Utilities have a detailed operational database to meet federal and state regulatory requirement that would allow them to group their pipeline assets into tranches with homogenous risk profiles, as required by the Settlement. By failing to comply with the Settlement's tranche requirements, the aggregated (and seemingly incorrect, as explained above) RSEs presented by Sempra suffer from all of the problems discussed in Section 2.2.2 above. For all mitigations, including costly mitigations such as hydrotesting and pipeline replacement, the result is that the Commission and parties lack accurate RSE information to assess whether Sempra's proposed mitigation programs are cost-effective in scope.

The remedy to correct this failure to comply with the Settlement is the same as for the MP risk. Sempra must use its Integrity Management and other operational databases to divide its HP assets into tranches with homogenous risk profiles. Sempra must then calculate RSEs for each of those tranches, as required by Row 14.

2.4.3. Failure to Explain Rationale for Determination of Tranches

As noted in section 2.1, the Settlement requires the utility to provide the rationale for its determination of tranches, including its judgment that no tranches are appropriate for a risk event. With respect to both the MP and HP risks, Sempra's RAMP reports provide no such discussion, which is a blatant violation of the Settlement. TURN encourages SPD to include in its evaluation report an assessment of whether the Sempra Utilities have complied with this clear requirement with respect to each risk presented in their RAMP reports.

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incorrect outcomes reflect errors in the way Sempra has presented its workpapers, then this will be another example of the enormous difficulties posed by Sempra's inadequate, tardy, and poorly presented and explained workpapers, as discussed further in Section 5 below.

[39] SCG RAMP, p. 1-4.

3. Problems with the Calculation of RSEs

3.1. The Use of the So-Called "% % %" Method for Calculating Risk Reduction for Gas Risks Is Highly Problematic

For the gas risks, Sempra describes a method for specifying the risk reduction provided by a mitigation that is based on the expression:

$$Risk\ Reduction = \%\ risk\ addressed * \%\ mitigation\ scope * \%\ effectiveness * Pre-Mitigated\ Risk\ Score$$[40]

The Sempra Utilities often referred to this as the % % % method.

The three factors are defined as follows:

- % risk addressed is the fraction of the "overall risk that will be addressed by a given activity" by "evaluating the drivers/triggers that the specific mitigation addresses as a percentage of the risk event."
- % mitigation scope "is calculated as the percentage of units that will be addressed over the duration of the activity, relative to the number of units in the system prior to the start of the activity."
- % effectiveness "is a factor that represents how well the execution of the scope reduces the portion of the overall risk addressed by that activity."[41]

This method is problematic for several reasons.

The biggest problem is the opaque nature of the "% Effectiveness" value. We do not know how Sempra computes or specifies this factor, contrary to Row 29 of the Settlement, which requires the source of inputs to be clearly specified and, when that source is subject matter expert judgment, the process . However % effectiveness is being determined, the values that Sempra uses are highly questionable, most egregiously those that counterintuitively exceed 100%.

In its response to TURN data request 8-3, Sempra states that "in the case of full asset replacement, the new asset theoretically should alleviate all existing risk beyond the operation of the asset; therefore, the effectiveness will be close to, if not, 100%." Yet, as column J of the worksheet "RSE workpaper" in the HP gas spreadsheet workpaper "Final 2021 RSE Workpaper

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[40] Response to TURN DR 8-1.

[41] *Id.*

= SCG HP Supplemental Level 2.xls" shows, there are numerous mitigations with "% effectiveness" values that are greater than 100%, with the two highest values for the two largest-dollar programs for Integrity Assessment and Remediation in HCAs (387.60%) and non-HCA's (248.06%). For the MP risk, "% effectiveness" values are as high as 724% for Cathodic Protection – 100mV Requalification. For the two largest programs, the BSRP and VIPP programs, the "% effectiveness" values are 387.0% and 305.0%, respectively.

In its response to TURN data request 8-3, Sempra explains that "% effectiveness" values greater than 100% arise because "SDG&E and SoCalGas recognize that not all assets in operation face the same set of risks or are affected as such." Sempra continues, "When considering that the risk score is developed *at the system level* containing all asset types, and that the risk addressed percentage is also derived *from a system perspective*, an activity that is known to address *a more vulnerable part of or asset within the system* could potentially have a greater effect in reducing risk, since a more vulnerable asset would yield a greater number of incidents compared to a less vulnerable asset." (Emphasis added.)

This response strongly suggests that Sempra's questionable % effectiveness values result from its incorrect view that the pre- and post-mitigation risk scores used to calculate RSEs are supposed to be calculated at the aggregate "system level." As shown in section 2.1 above, this view is decidedly wrong because the Settlement requires risk scores and RSEs to be calculated at the tranche level, with each tranche consisting of a sub-group of assets having a homogenous risk profile. Sempra seems to view the % effectiveness value as a way to recognize that there will be tranches of assets that have above average risk scores and that mitigating such assets will have an above-average impact on reducing risk. However, the way that the Settlement requires this dynamic to be taken into account is to perform the RSE analysis at the tranche level, not to engage in guesswork that yields dubious % effectiveness values above 100%.

Logically, "% effectiveness" must be related either to a change in LoRE or a change in CoRE. In its HP and MP workpapers, Sempra indicates that the sole source of risk reductions are reduction in LoRE values. Hence, "% effectiveness" can be related only to reductions in LoRE. Sempra's response to TURN data request 8-3 claims that values greater than 100% are the result of targeting specific assets within a broader class of assets. However, in the case of MP pipe, the class of assets is a single tranche: all MP pipe. Thus, to develop its "% effectiveness" values, Sempra is, on the one hand, acknowledging different tranches of assets, with some tranches having greater LoRE values than others, while at the same time calculating RSE values that are applied to all pipe. Such an approach is not only logically inconsistent, it is a clear violation of the tranche requirements of the Settlement.

In addition, Sempra's technical explanation of the "% effectiveness" values for leaking pipe is inconsistent with the statement about more vulnerable assets quoted above. In the August 3, 2021 workshop, Sempra claimed that the 305% "% Effectiveness" value for its MP VIPP

replacement mitigation (RISK-3-C21-T1) stems from the fact that replacement pipe will have a leak rate that is 1/3 of existing pipe. This means that, if plastic pipe was replaced with pipe having the same leak rate, then the "% effectiveness" value would be 100%. As such, under the methodology, there would still be a risk reduction. But intuitively, replacing leaking pipes with pipe that has the same leak rate would not reduce risk at all. Yet, under Sempra's methodology, replacing existing pipe with new pipe having the same leak rate would reduce LoRE. Again, this points to serious methodological problems with the "% effectiveness" values.

Furthermore, as noted, contrary to Row 29 of the Settlement, there is no information provided as to how Sempra uses expert judgment to determine this factor. While the Settlement allows the use of expert judgment, that expert judgment must have some underlying basis that can be evaluated independently. The specificity of many "% Effectiveness" values leads TURN to believe there is some underlying, but unexplained, methodology for determining these values. For example, the MP controls RISK-3-CO1 and CO2, which address Cathodic Protection Base and CP10 activities, respectively, have "% Effectiveness" values of 343.90%, as shown in cells J13 and J14 of the worksheet "RSE Workpaper" in the Spreadsheet "Final 2021 RSE Workpaper – SCG MP Supplemental Level 2.xls." It strikes TURN as highly unlikely that an SME would select such a precise value without some underlying calculational basis. However, Sempra has never provided any such details, again contrary to the transparency requirements of the Settlement.

There are also problems with the "% Risk Addressed" values. For the HP and MP mitigations, those values sum to more than 100 percent. While TURN recognizes that the "% Risk Addressed" values arise from the bow tie and reflect the extent to which a given mitigation addresses drivers, the only way programs can address more than 100% of the total risk is for there to be program overlap. But, if programs overlap, then Sempra must account for the incremental risk reductions that programs achieve when calculating RSE values, rather than calculating risk reductions as if no other programs are implemented. Otherwise, if Sempra proposes to implement multiple, overlappying programs, the RSE values for those programs will suffer from upward bias.

To calculate risk reduction and RSEs in accordance with the Settlement, Sempra need to use a different methodology. A compliant methodology needs to begin by determining the tranches with homogenous risk profiles, as required by the Settlement. Once those tranches are determined, it should be much more straightforward to estimate the impact of a given mitigation on the tranche-specific LoRE values. For example, one would expect that replacement of faulty pipe with new pipe would reduce a significant percentage of the risk associated with that pipe. Thus, determining the risk reduction for a tranche with high risk pipe would be simply a matter of reducing the pre-mitigation LoRE for that tranche by the calculated percentage, which then easily allows the calculation of risk reduction for that tranche. To comply with Row 29 of the Settlement, Sempra must provide the source for any estimate of the percentage that a mitigation

would reduce the LoRE, and if the source was SME judgment, an explanation of the basis for the judgment.

3.2. Failure to Properly Discount the Values in the RSE Calculation

In addition to other problems discussed in these comments that lead to inflated RSE values, all of the RSE values calculated in the SDG&E and SCG RAMP reports are biased upwards because Sempra does not discount costs and benefits in the manner specified by the Settlement.

Row 25 of the RAMP Settlement requires that RSE values be calculated using present values for both risk reductions (the numerator) and costs (the denominator). Although the Settlement does not specify a discount rate value that must be used for all RSE calculations, the discount rate chosen should be consistent with basic economic and financial principles that reflect the time value of money.

In its RAMP reports on page C-31, the Sempra Utilities state that they use 3% to discount the risk reduction, the numerator of the RSE. Sempra cites a report[42] as justification for the 3% rate. (Although the link to footnote 43 where this report is cited did not work, TURN located and reviewed the report.) The discount rate used in the report is a 3% real discount rate, i.e., one that removes the effects of inflation and thus reflects the pure time value of money. This value is sometimes called the "social rate of time preference" and is sometimes used for analyses of public policies enacted by governments."[43]

In contrast, Sempra is a private firm, which uses monies provided by investors and ratepayers to fund expenditures. Thus, for purposes of RSE calculations, it would be appropriate to use a discount rate that reflects the time preferences of investors and ratepayers, including expected inflation, rather than using a pure, societal rate of time preference. For a private firm, the commonly accepted approach to do this is to use the firm's weighted average cost of capital (WACC). (This is the discount rate PG&E used for its RAMP analysis.) For example, if a firm's

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[42] 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).

[43] For a discussion, see, e.g., Mark Moore and Aidan Vining, "The Social Rate of Time Preference and the Social Discount Rate," Mercatus Symposium, Mercatus Center at George Mason University, Arlington, VA, November 2018. See also, U.S. EPA, "Guidelines for Preparing Economic Analyses," December 2010, Chapter 6.

WACC is 7.0%, then it will generally not pursue investments with a nominal return below 7%, because the investment returns will not even offset the cost to obtain funds.

Sempra does not discount costs in the RSE denominator at all. In its response to TURN Data Request 2-8, Sempra stated, "Because all costs in the GRC are presented in base year dollars to reflect a single year's dollar, without adjustment for escalation, SoCalGas and SDG&E 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, constant dollars." Sempra's statement is incorrect because it fails to adhere to the Settlement's requirement to use present values and fails to recognize the time value of money. Sempra does not discount costs by inflation, but even if Sempra were to use real (inflation-adjusted) dollars, ratepayers and investors still have a time value of money. Sempra's response to TURN-2-8 implies that the company would be indifferent to, say, a ratepayer paying their bill today versus paying their bill in the same inflation-adjusted dollars 10 years from now.

To understand why Sempra's discounting approach biases RSE values upwards, some simple arithmetic helps. Sempra's WACC reflects both its investors' overall rate of time preference and their collective expectations about future inflation. Let the real rate of time preference be **J** and the expected inflation rate be **I.** Then, the WACC = (1 + J) x (1 + I) - 1.

Sempra does no discounting for its cost estimates and uses only the real rate of time preference J to discount risk reduction benefits. Consider a two-year mitigation program that reduces risk by 2,000 units each year and requires spending $1 million inflation-adjusted dollars each year. Sempra's incorrect approach would calculate the RSE as { (2000 / (1.03)) + 2000 / $(1.03)^2$) / $2 million = 3,827 / $2 million = 1,913 per $ million.

Now, suppose inflation is 2.5% and Sempra's WACC is 7.0%. Factoring in inflation, the second year cost of the mitigation program is then $1.025 million. The new RSE value using the corrected approach is:

RSE ={ (2000 / (1.07)) + 2000 / $(1.07)^2$) / ($1 million + $1.025 million/(1.07)) = 3,616 / $1.95 million = 1,847 per $ million.

Thus, by using a 3% discount rate for benefits and not discounting costs, Sempra's RSE values for all programs are biased upwards. For purposes of calculating RSEs, Sempra should be required to use nominal costs for its mitigation programs and discount all costs and risk reduction benefits at its WACC.

3.3. Failure to Disaggregate Wildfire Risk Mitigation Programs for RSE Calculations

If a "program" consists of several different activities, each with its own cost and risk mitigation characteristics, these must be disaggregated to provide for an appropriate RSE

calculation at the level of granularity required by the Settlement. One problematic example is SDG&E's bare conductor replacement program, a wildfire mitigation. SDG&E states its "Distribution Overhead System Hardening program [for bare conductor replacement] 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."[44] These programs are distinct activities that require individual RSE calculations and should be treated as separate mitigations under the Settlement. While SDG&E does not foresee continuing these programs as currently constituted past 2022,[45] the Sempra Utilities should be urged to calculate individual RSEs for programs with distinct risk mitigation and cost characteristics, including but not limited to bare conductor and pole replacement programs.

4. The Sempra Utilities' Multi-Attribute Value Function (MAVF) Needs to Be Re-Designed to Reflect a More Reasonable Statistical Value of Life

The MAVF is the foundation upon which the consequences of risk events are measured. Unreasonable judgments in framing the MAVF can have a significant impact on the calculations of pre- and post-mitigation risk scores and therefore on the RSE calculations. The Sempra Utilities' MAVF is unreasonable in that it reflects a statistical value of life (SVL) that is far higher than is commonly used in such risk analysis.

The statistical value of life (SVL) is a measurement of the value of mitigating the risk of death. Importantly, SVL is not a valuation of any individual life. Instead, it is a measure of how much society is willing to pay for marginal reductions in the risk of dying across a broad population. The SVL is implied in the MAVF and is found by comparing the ranges (in natural units) and the weights of the Safety and Financial Consequences attributes. The weight of an attribute measures the relative value of changing the level of the attribute from the best level in the range to the worst level in the range.

For Sempra's MAVF, the implied SVL is $100 million. This is because the weight of the Safety attribute is 0.60, the weight of the Financial Consequences attribute is 0.15, and the ranges are from 0 to 20 fatalities and from $0 to $500 million, respectively. Hence, 20 fatalities have the same weight as four times $500 million or $2 billion, which implies that the SVL is

[44] SDG&E RAMP, p. 1-41.

[45] SDG&E RAMP, p. 1-43.

$100 million per fatality. In contrast, the accepted value used by federal agencies for safety policy analysis is approximately $10 million.[46]

Sempra's valuation means that it expects society to value a 1% reduction in the likelihood of occurrence of a single fatality at $1 million. In other words, a mitigation that accomplished this and nothing else each year is worth an expenditure of $1 million per year. This is an order of magnitude greater than the values used by U.S. government agencies for many years to weigh environmental and safety regulations that reduce risk.

To comport with accepted values used by federal agencies in risk analysis, the SVL should be reduced to $10 million. The simplest way to do this is to increase the upper limit of the range of the Safety attribute to 200, keeping the weight at 0.60. The main consequence of not reducing the SVL is that both the risk reduction and RSE are biased upward for mitigations that affect safety.

5. The Sempra Utilities Failed to Provide a Complete Report and to Satisfy the Transparency Requirements of the Settlement

5.1. Settlement Requirements

Row 29 of the Settlement sets forth the transparency requirements that must be met in RAMP and GRC filings. They include:

- Inputs and computations should be clearly stated and defined.
- The sources of inputs should be clearly specified.
- When SME judgment is used, the process that the SMEs undertook to provide their judgment should be described.
- All information and assumptions that are used to determine both pre- and post-mitigation risk scores must be specified.

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[46] The most recent values used by the U.S. EPA and U.S. Dept. of Transportation, which are based on studies from the academic literature, can be found in the following documents: U.S. EPA, "What Value of a Statistical Life Does EPA Use." The EPA uses a value of $7.4 million in 2006$, which is approximately $10 million in 2020$. See also, U.S. Dept. of Transportation, "2016 Revised Value of a Statistical Life Guide," August 8, 2016. The DOT uses a value of $9.6 million in 2016$, also equivalent to about $10 million in 2020$. The DOT also estimates the value of a severe injury at 26.6% of the SVL, or about $2.5 million.

- The mathematical structure of the methodologies used by the utility should be transparent and all algorithms should be identified.
- All calculations should be repeatable by third parties using utility data and assumptions.

These are requirements that must be met by the RAMP submission. Nothing in the Settlement offers any basis for concluding that a utility is free to delay meeting these informational requirements until weeks or months after the RAMP submission. The evident purpose of these requirements is to ensure that the analysis and computations in the RAMP are well-supported and can be understood by SPD and the parties. RAMPs are accelerated proceedings in which the bulk of the work needs to be concluded in 6-7 months. An interpretation that would make compliance with these requirements subject to utility discretion as to when they must be met renders the requirements meaningless in serving the purpose of supporting the conclusions and calculations in the RAMP report and facilitating review and analysis by SPD and the parties.

5.2. The Egregious Insufficiency of the Supporting Information

The only workpapers that the Sempra Utilities provided with their RAMP submissions are posted on their CPUC Proceedings webpage for this case under the heading "workpapers." Those workpapers do not come close to meeting the requirements detailed above, including failing to provide such basic information as the inputs for the pre-mitigation risk scores and the sources of those inputs and the inputs and sources for values that are critical to determining risk reduction and RSEs, including % change in LoRE. And because these are PDF workpapers, they do not indicate the formulas that were used for computations.

It is no exaggeration to state that the inadequacy of these workpapers forced TURN to devote most of its time and resources in this case – through workshops and data requests -- to obtaining the information that is required by Row 29. Key "supplemental" workpapers were not provided until July 9, 2021, almost two months after the Sempra Utilities were supposed to provide complete submissions. While those workpapers were an improvement, they still did not provide much of the required supporting information. As just one of many examples, SCG's supplemental workpapers for its gas risks still offered no explanation of the definition of % Mitigation Scope, % Risk Addressed and % Effectiveness (discussed above in section 3.1). Nor were any of the inputs for those values or the sources of those inputs provided. As a result, TURN was required to devote significant workshop time and data requests (e.g., TURN DR sets 8 and 10) to obtaining this information that should have been provided on May 17, 2021.

As TURN prepared for the workshops for each of the risks covered by workshops, TURN found numerous information gaps, inconsistencies, and errors in the supporting information, which consumed significant amounts of time that could have been devoted to more productive uses. For example, in the workshop discussion regarding SDG&E's Electric Infrastructure Integrity (EII) risk, TURN's questions revealed that SDG&E's workpapers were misrepresenting that all of the risk reduction from certain mitigations was coming from reductions in LoRE,

when, in fact, SDG&E was claiming some risk reduction from impacts on CoRE. To TURN's knowledge, SDG&E still has not corrected its EII workpapers to correctly show how CoRE impacts contribute to risk reduction.

Moreover, to TURN's enduring surprise, the Sempra Utilities have refused to post the additional Excel workpapers they have produced in discovery on their website, even though their website is the only publicly available repository of RAMP documents available to the Commission and the parties. As a result, there is no clear record of what workpapers have been produced and when, which has created problems for the preparation of these comments and the citation of the correct workpapers for the benefit of SPD and other parties. Sempra clearly has the capability to post Excel files on its website, as it has done so with its 2021 Wildfire Mitigation Plan. Rather than aid the parties and the process in this way, Sempra has insisted that TURN must file a motion to get a Commission ruling requiring it to post these workpapers on its website.

The Commission should not allow this experience to be repeated, by the Sempra Utilities or by any of the other utilities who are watching this proceeding to see whether the Commission intends to hold utilities to the requirements it adopted in D.18-12-014. Beginning with SPD's report on this RAMP, the Commission must make clear that utilities are required to provide all of the supporting information required by the Settlement with their RAMP submissions on the due date for those submissions. In addition, Sempra must be required to provide complete and updated workpapers compliant with Row 29 as part of its GRC filing in May 2022. Finally, the Sempra Utilities should be required to post any workpapers they provide to any party on their CPUC proceeding website.

5.3. Transparency Problems Related to the WiNGS Model

Because of the importance of the wildfire risk, special mention needs to be made of transparency problems with SDG&E's primary wildfire risk prioritization model (WiNGS).

First, the model was not presented in SDG&E's RAMP filing or associated workpapers and was only provided to TURN via data request.[47] The model is fundamental to SDG&E's analysis of wildfire risk. It should have been included with the RAMP submission and should be presented as part of SDG&E's filing in its upcoming GRC.

Second, critical components of the model are completely opaque, including calculations to derive wildfire risk, PSPS risk, and mitigation effectiveness values for each segment of the analysis.[48] TURN only ascertained in general how these values are derived through verbal

[47] TURN DR 5, Question 1; TURN DR 6, question 1, and supplemental responses.

[48] TURN DR 6, Question 1, Excel attachment.

responses to questions at a wildfire workshop.[49] SDG&E's GRC filing should provide these critical calculations, along with a narrative explanation of how segment-level results are derived and calculated.

Last but perhaps most significant for the purposes of this proceeding, SDG&E refused to provide the entire model to TURN when TURN requested it.[50] Rather, SDG&E only provided the portion of the model with scoped undergrounding or covered conductor work for 2023-2024, representing 688 of the 3,500 overhead miles SDG&E has analyzed in its WINGS analysis.[51] SDG&E's basis for not providing the model results was that these do not fall "within the scope of SDG&E's 2021 RAMP."[52] TURN chose not to pursue this matter further due to the time constraints of this proceeding.

This illustrates again SDG&E's tendency towards unnecessarily litigious positions in a proceeding where the primary purpose is to provide for the sharing of critical information with significant safety implications. Because the WINGS model provided to stakeholders was not complete, it is not possible to analyze wildfire risk for SDG&E's entire HFTD including how much risk relative to the entire territory is mitigated by SDG&E's forecasted mitigations, nor how much risk prior to the test year is expected to be reduced. While TURN agrees the latter is an important issue in the GRC, it is certainly not "out of scope" in the RAMP, and would have helped TURN and the Commission highlight any potential issues in advance of the utility's GRC filing.

SPD should recommend that SDG&E provide its full WINGS model results for its HFTD (and non-HFTD, if applicable) when it files its GRC, as well as in subsequent RAMP filings. SDG&E should also provide materials such as explanations and data sources, as well as underlying calculations, that demonstrate how key WINGS model outputs are derived, including but not limited to wildfire risk, PSPS risk, and mitigation effectiveness values.

6. Conclusion

TURN appreciates the opportunity to submit these informal comments. For the reasons set forth in these comments, TURN urges SPD to include the recommendations listed in the Appendix - Summary of Recommendations in its November 5, 2021 Report.

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[49] Virtual workshop on wildfire risk held on 9/2/21.

[50] TURN DR 9, Question 1.

[51] TURN DR 6, Question 1, Excel attachment; TURN DR 9, Question 1.

[52] TURN DR 9, Question 1.

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Appendix – Summary of Recommendations

TURN recommends that SPD's November 5, 2021 report include the following findings and recommendations:

1. The Sempra Utilities have failed to comply with the baseline requirement for calculating pre-mitigation risk scores in the SMAP Settlement (Rows 10 and 11), The Settlement requires the Sempra Utilities to use the end of 2023 as the baseline for their pre-mitigation risk scores. To comply with the Settlement, the Sempra Utilities should bring their RSE analysis for their upcoming GRC request into conformity with this requirement.

2. The Sempra Utilities have failed to comply with the Tranche granularity requirements of the Settlement with respect to at least the following risks: Wildfire, Medium Pressure Gas System and High Pressure Gas System. (TURN's time and resource limitations did not allow it to analyze this issue with respect to other risks.) The Sempra Utilities should remedy their non-compliance in their upcoming GRC as follows:

   a. With respect to the Wildfire risk, the Sempra Utilities should use the granular information from the WiNGS model to create tranches based on circuit segments with homogenous risk profiles that are used to calculate tranche-specific RSEs for all Wildfire mitigation activities.

   b. With respect to the Medium Pressure and High Pressure Gas Risks, the Sempra Utilities should use the detailed operational information in their various databases (DREAMS, Integrity Management, etc.) to create tranches based on groups of assets with homogenous risk profiles. The creation of tranches with the required granularity should avoid the RSE calculation error described in section 4.1.2 of these comments.

   c. The absence of cost tracking systems should not be allowed to serve as a justification for failing to satisfy the Tranche requirements of the Settlement. The Sempra Utilities should accelerate their efforts to enable reliable estimation of tranche-level costs.

   d. As required by Row 14, for every risk, the Sempra Utilities must provide the rationale for their determination of tranches, including the judgment that no tranches are appropriate for a risk event. The Sempra Utilities should provide this explanation in their upcoming GRC submission.

3. The Sempra Utilities should not use the so-called "% % %" method for calculating risk reduction for their gas risks (or any risks). The use of such a method would not be necessary if the Sempra Utilities used tranches with the granularity required by the Settlement.

4. The Sempra Utilities' practices regarding discounting (or lack thereof) of the numerator and denominator of the RSE calculation fail to comply with Row 25 of the Settlement. For purposes of calculating RSEs, Sempra should be required to use nominal costs for its mitigation programs and discount all costs and risk reduction benefits at its weighted average cost of capital.

5. For all risks, the Sempra Utilities should calculate individual RSEs for programs with distinct risk mitigation and cost characteristics, including but not limited to bare conductor and pole replacement programs.

6. The structure of the Sempra Utilities' MAVF reflects a statistical value of life (SVL) that is an order of magnitude higher than the SVL used by federal agencies for risk analysis, which biases the risk scores and RSE values upwards. To comport with accepted values for the SVL, the upper limit of the range of the Safety attribute should be increased to 200, keeping the weight at 0.60.

7. The Sempra Utilities' RAMP submissions failed to comply with the transparency requirements of Row 29 of the Settlement. SPD's report should make clear that utilities are required to provide all of the supporting information required by the Settlement with their RAMP submissions on the due date for those submissions. In addition, the Sempra Utilities should be required to provide complete and updated workpapers compliant with Row 29 as part of their GRC filing in May 2022. Finally, the Sempra Utilities should be required to post any workpapers they provide to any party on their CPUC proceeding website.

8. SDG&E should provide its full WINGS model results for its HFTD (and non-HFTD, if applicable) when it files its GRC, as well as in subsequent RAMP filings. SDG&E should also provide materials such as explanations and data sources, as well as underlying calculations, that demonstrate how key WINGS model outputs are derived, including but not limited to wildfire risk, PSPS risk, and mitigation effectiveness values.

SoCalGas and SDG&E Informal Comments on SoCalGas's and SDG&E's Respective 2021 RAMP reports

October 22, 2021

I. INTRODUCTION

Southern California Gas Company ("SoCalGas") and San Diego Gas & Electric Company ("SDG&E") (collectively "Companies") respectfully submit informal comments on SoCalGas's and SDG&E's respective 2021 Risk Assessment Mitigation Phase ("RAMP") Reports. These comments were solicited by a September 17, 2021, email from the California Public Utilities Commission's Safety and Policy Division ("SPD").

II. DISCUSSION

A. SoCalGas and SDG&E are Continuing to Improve on Their Risk-Informed Processes, and Their RAMP Reports are More Detailed, Quantitative, and Robust

SoCalGas and SDG&E appreciate the opportunity to submit informal comments in advance of SPD's report. The 2021 RAMP Reports continue the Companies' risk-informed decision-making framework processes and the California investor-owned utilities' ("IOUs") efforts to incorporate in their respective RAMP reports the "quantitative approach to risk assessment and risk prioritization"[1] approved by the Commission in Decision ("D.") 18-12-014, the Safety Model Assessment Proceeding ("S-MAP") Settlement Agreement Decision ("Settlement Decision"). Lessons learned, including through the filing of prior RAMP reports, the RAMP submissions of Pacific Gas and Electric Company ("PG&E") and Southern California Edison Company ("SCE"), as well as intervenor feedback, have resulted in RAMP Reports that are substantially more detailed, quantitative, and robust than the Companies' last RAMP filing. 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.

[1] D.18-12-014, p. 28.

The Companies detailed their compliance with RAMP requirements, including the steps outlined in the Settlement Decision, in the upfront chapters of their respective RAMP reports.[2] The upfront chapters also detail the changes made from the Companies' 2019 RAMP Reports in response to stakeholder feedback, including, increasing the number and percent of activities that have Risk Spend Efficiencies ("RSEs") performed[3] subdividing to a greater degree the risk-reducing activities into tranches, and creation of cross-functional factors.[4]

In preparing the RAMP Reports, the Companies reviewed current and newly-planned activities to evaluate usefulness and ability to create an RSE, and an RSE was included where there was meaningful data or SME judgment, as indicated by SPD.[5] This approach incorporated feedback on the Companies' 2019 RAMP Reports, in which the Companies generally did not calculate RSE values for existing controls that were performed to maintain compliance with state and federal mandated requirements. Within their respective 2021 RAMP Reports, the Companies provided RSE values for over 350 different controls and mitigations, including tranches and alternatives, compared to approximately 260 RSE values provided in the 2019 RAMP Reports.

With regard to tranching, the current RAMP filing reflects the subdivision of risk-reduction activities via a multi-tiered methodology. As compared to the Companies' 2019 RAMP Reports, the Companies have expanded and evolved the implementation of tranches across the 2021 RAMP Reports resulting, in general, with risk areas having a higher number of

[2] *See*, *e.g.*, Risk Assessment Mitigation Phase (SCG/SDG&E-RAMP-A) Overview and Approach (May 17, 2021) ("RAMP-A"); Risk Assessment Mitigation Phase (SCG/SDG&E-RAMP-E) Lessons Learned (May 17, 2021) ("RAMP-E").

[3] In instances where it was infeasible to perform an RSE (*e.g.*, no meaningful data or SME judgment is available), the Companies provided an explanation.

[4] RAMP-A, pp. A-7-A-12.

[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), p. 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.").

tranched mitigations. In addition, the Companies have identified a larger number of mitigations with additional tiers in the 2021 RAMP Reports. 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 the High Pressure Incident chapters, pipeline assets have been further tranched into two separate subdivisions, each with its own quantitative analysis, including cost, risk reduction, and RSE. The result of additional tranching is greater granularity created for activities included in the 2021 RAMP Reports. The Companies are currently exploring options for the use of additional tranches in preparation of their upcoming General Rate Case ("GRC") filing.

Also new in the 2021 RAMP Reports is the Companies' inclusion of cross-functional factor ("CFF") chapters in response to stakeholder feedback. These chapters address some of the various topics raised by parties that would not otherwise be standalone risk chapters. More specifically, CFFs provide additional information regarding foundational, safety-related initiatives that are associated with more than one RAMP risk. CFFs are not in and of themselves RAMP risks. Rather, CFFs are drivers, triggers, activities, or programs that may impact multiple RAMP risks.

The Companies are also the first in the State to apply a fourth attribute to their multi-attribute value function ("MAVF"), beyond the minimum attributes of safety, financial, and reliability. This fourth attribute, Stakeholder Impact, focuses on the impacts to customers, employees, the public, and government and/or regulators from a risk event. The intent in 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. The Companies also reviewed their MAVF and updated lower-level attributes. An

"acres burned" sub-attribute was added to the safety attribute to better capture the impact of wildfires.

On the whole, SoCalGas and SDG&E have made great strides in improving the RAMP Reports this cycle. The Companies look forward to incorporating additional feedback from SPD on how to further improve the risk quantification going into the GRC and in the next RAMP.

B. Response to Stakeholder Feedback Received Subsequent to the Filing of the RAMP Reports

SoCalGas and SDG&E appreciate the engagement and participation of SPD and other stakeholders after the filing of the RAMP Reports. The Companies respond below to issues raised by intervenors during workshops and/or at the prehearing conference.

1. Tranching

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."[6] The Companies complied with this requirement by subdividing their assets and systems to align with how the assets and systems are managed. The Companies will continue to strive for greater granularity in their tranching as appropriate in future RAMP Reports.

During workshops The Utility Reform Network ("TURN") suggested that the Companies did not tranche sufficiently and used SoCalGas's Distribution Integrity Management Program ("DIMP") as an example of how the Companies have additional data that could be used to tranche at a more granular level. In the DIMP, SoCalGas's Distribution Risk Evaluation and Monitoring System ("DREAMS") tool provides risk rankings used for operational decision-making. As discussed during workshops, DREAMS is a complex model that evaluates multiple

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

threats to pipeline segments to guide the prioritization of work. This model is not synonymous with RAMP risk tranching. DREAMS in particular is used to prioritize certain work in integrity management – the data included in DREAMS is not applied to every mitigation related to pipelines at the Companies.

A tranche dictates a logical disaggregation of risk, taking consideration to how work is managed. Although segment level data exists in DREAMS, its current use is that of risk score calculation and prioritization as it applies to the medium pressure gas system. In contrast, the RAMP serves as a presentation of many safety related mitigations the Companies perform across the enterprise and across asset classes. As other activities like Operations and Maintenance ("O&M") or Capital work are presented in RAMP and approval is subsequently requested in the GRC, a breakdown of said activities into segment-level data would not provide the most logical means to present risk for the majority of mitigations in RAMP or GRC. For example, leak surveys or Electronic Pressure Monitoring ("EPM") installs are several of many mitigations that are not forecasted or executed on a segment level basis. As another example of how specific segment level data should not be used for tranches, although DREAMS incorporates soil type as one piece of information used to inform risk and the prioritization of work, it would not make sense to tranche by soil type as soil type alone is not how the business prioritizes risk and the execution of projects, and is therefore not a logical disaggregation of risk.

2. RSEs

During workshops, the California Public Advocates' Office ("Cal Advocates") asked whether the Companies' RSE calculations are used for determining funding requests. In the Companies' upcoming GRCs, they will explain for each RAMP-related cost how RSEs were considered and factored into the funding request.

It should be clarified that, as stated in the workshops, there are no funding requests in the Companies' respective RAMP Reports. Rather, funding requests will be presented in the Companies' respective GRCs, which have yet to be filed. In addition, RSEs are but one data point and not a determinative factor in either mitigation selection or funding requests. There are many other factors and data points considered by each utility when making funding requests.

More broadly, SoCalGas and SDG&E are generally in support of the use of refinement of RSEs as a potentially useful tool to assist in decision-making. RSEs continue to have critical shortcomings, however, as discussed in the Companies' RAMP Reports.[7] The most notable shortcoming is that for many risks and mitigations, the available data is scant or incomplete. 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. All of the utilities and the Commission's staff have acknowledged the challenge with this dearth of data.[8] Other challenges include determining which data is most appropriate (especially where there is a lack of utility specific data), the infrequency of incidents, changes over time, changing methodologies and tools, and the need to rely on subject matter experts ("SMEs"). Although SMEs can be a strong source of input, SMEs can benefit from quantitative calibration and issues can arise when SME input is used without calibration, or without consistent care in how SME input is scrutinized. Perhaps equally problematic for RSEs is that there is much they do not capture. RSEs are data points that can be compared to other factors, including resource availability, permitting requirements, changing climate conditions, and coordination with other work.

The Companies look forward to improving on RSEs so that they can continue to become more effective data points for utility consideration.

3. Utility Specific Information

The Protect Our Communities Foundation ("PCF") has stated that the Companies did not use enough utility specific information in their RAMP Reports. SoCalGas and SDG&E disagree. As mentioned in the post filing workshops as well as in response to several data requests, when

[7] Risk Assessment Mitigation Phase (SCG/SDG&E-RAMP-C) Risk Quantification Framework and Risk Spend Efficiency (May 17, 2021).

[8] *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).

calculating likelihood and consequence of a specific risk event, the Companies first seek to utilize internal data to quantify the aforementioned. If the internal data does not exist, the Companies seek external data which could include industry and/or academic data. In many cases, the Companies utilize both internal and external data, often employing an amalgam to as accurately as possible estimate risk to the Companies. For example, in the High Pressure Incident chapters, the Companies sought to quantify the impacts due to compressor incidents. As neither SoCalGas nor SDG&E has had any historical compressor incidents, data from other utilities was used in conjunction with subject matter expertise oversight to shape the expected likelihood and consequence of a compressor incident. Additionally, in some cases where internal data is available, the Companies felt an external dataset may provide a more encompassing expectation of impacts due to the available number of data points. For example, in the SoCalGas High Pressure Incident chapter the number of data points for hazardous transmission incidents (incidents resulting in a safety impact and/or resulted in an ignition) is 2, compared to the industry data at 96. Therefore, due to the greater pool of data nationally available, the safety impacts for a high consequence high pressure incident was determined using the industry available data. Conversely, for the likelihood of SoCalGas's medium pressure high consequence incident, SoCalGas specific data that is publicly available was utilized since this data set created a more representative value of risk.

The quantification of risk is not a matter of internal data versus external data and the quantity as such, but rather the most accurate representation of what can be expected by the occurrence of a risk event. To determine the expected value of risk, available data sources should be examined, and the best set or combination thereof should be utilized. The Companies agree this could solely be internal data as was the case, for example, for the likelihood of after meter incidents in the medium pressure chapters and much of the likelihood and consequence values for the Incident Related to the Storage System. However, for other chapters, the use of both internal and external data, with the use of SME input, generated more accurate and confident risk quantification results. Lastly, a full understanding of data types and sets can be seen in the "Risk Scoring Workpaper" tabs of each workpaper.

4. Appropriate Baseline

TURN has commented that the Companies did not use the correct "baseline," or comparison point when calculating risk reduction benefits and RSEs, based on what SoCalGas and SDG&E believe is an incorrect interpretation of the Settlement Decision language "the GRC period under review."[9] As discussed previously in the upfront chapters to the RAMP report,[10] and in comments on a proposed decision ("PD") in R.20-07-013, the Companies disagree with TURN's position because: (1) the law requires that the Settlement Decision must be read within the context of the Commission's GRC Rate Case Plan; (2) using a forecasted baseline to analyze other forecasts is illogical; (3) there is no double counting of costs or risk reduction benefits under existing Commission-adopted processes, as TURN claims; and (4) selecting a "correct" baseline is not defined or prescribed by the Settlement Decision in the way TURN suggests.

The Companies are aware that the PD issued in R.20-07-013, if approved at a CPUC business meeting, would essentially adopt TURN's approach on the baseline issue. However, the Companies believe that this proposed adoption would be incorrect and the result of legal error, as stated in the Companies' comments in that proceeding.[11] SoCalGas and SDG&E's comments explained that their understanding of the Settlement Decision language "the GRC period under review"[12] is the period of years for which data and estimates are reviewed in a GRC proceeding, as set forth in the Commission's Rate Case Plan.[13] For SoCalGas's and SDG&E's

[9] Settlement Decision at A-8, No. 10.

[10] RAMP-E, p. E-14-E-20.

[11] Opening and Reply Comments of SoCalGas and SDG&E on Proposed Decision of Phase I, Track 1 and 2 Issues for Order Instituting Rulemaking to Further Develop a Risk-Based Decision-Making Framework for Electric and Gas Utilities (R.20-07-013) (October 7 and 12, 2021), pp. 2-6 and 1-3, respectively. In their Opening and Reply Comments, the Companies explained the PD's legal errors on this issue and requested further examination in the GRC context and in Track 3 of R.20-07-013.

[12] Settlement Decision at A-8, No. 10.

[13] D.07-07-004, Appendix A at A-31 (requiring that a utility's GRC request must "[f]urnish base year historical and estimated data and subsequent years with evaluation of changes up to and including the test year").

next (TY 2024) GRC, those years are 2021-2024.[14] For that reason, SoCalGas and SDG&E have viewed the years 2021-2024 as the "GRC period under review" in their current RAMP application proceedings. This interpretation is consistent with the "Governing Law" provision in the Settlement Agreement, which provides that the "Agreement shall be interpreted, governed and construed under the laws of the State of California, including Commission decisions, orders, and rulings …."[15] SoCalGas and SDG&E have also explained why they believe that their interpretation is the correct approach from a logical and practical perspective.[16]

Regardless of the merits of TURN's position on the appropriate baseline, in the interest of collaborating with intervenors during the RAMP process, the Companies conferred with TURN, and provided separate analyses for two risks that implemented a baseline that more aligns with what TURN believes is appropriate. The results of this sensitivity analyses were provided to TURN on August 23, 2021.

In sum, SoCalGas and SDG&E believe that their interpretation of the "GRC period under review," as reflected in the RAMP Reports, is the correct one, despite TURN's claims. The fact that TURN has taken a different position does not alter the fact that SoCalGas and SDG&E's interpretation in their RAMP Reports is reasonable, well-founded, and consistent with the Settlement Decision, as properly interpreted within the context of the Commission precedent, including the GRC Rate Case Plan.

5. Discovery

Throughout this proceeding, TURN has sought to paint SoCalGas and SDG&E as uncooperative parties. This characterization is not supported by the procedural history, which demonstrates that SoCalGas and SDG&E have endeavored to be transparent and responsive to the requests from parties and staff, all while working under time and resource constraints.

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[14] D.20-01-002, p. 8. As stated in the Commission's recent Decision modifying the Rate Case Plan ("RCP Decision"), "The Commission's decision is based on its extensive review of the test year forecasts." There is no similar rate case plan requirement for the provision of data and estimates or review of the post-test years (2025-2027).

[15] Settlement Decision at 6, Section H ("Governing Law").

[16] *See, e.g.,* RAMP-E, pp. E-14-E-20.

SoCalGas and SDG&E hosted and fully participated in every workshop requested by the parties and SPD, amounting to nine total workshops. SoCalGas and SDG&E ran scenario analyses at parties' requests, including the revised baseline RSE presentation requested by TURN (discussed above), and answered informal emails seeking further explanation or clarifications. In addition, SoCalGas and SDG&E have responded to approximately 30 sets of data requests, often including multiple questions and subparts to questions. SoCalGas and SDG&E made data request responses available to all parties (which are still available on the Companies' regulatory websites) within three business days. The Companies also began providing to all parties via email all data request responses that included attachments. This process is fully compliant with (and goes beyond) the Commission's discovery rules and is consistent with the Companies' commitments at the prehearing conference and their past discovery practices.

SoCalGas and SDG&E take their obligation to transparently provide all requested and necessary information to the parties and Commission staff very seriously and are in the process of streamlining the access process for parties in the Companies' next GRC.

III. CONCLUSION

SoCalGas and SDG&E appreciate the opportunity to provide these comments and look forward to reviewing the parties' comments and SPD's report in this proceeding.