Risk Assessment Mitigation Phase

(RAMP-D)

Risk Spend Efficiency – Methodology

November 27, 2019

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I. INTRODUCTION

This chapter addresses how Risk Spend Efficiencies (RSEs) are calculated in this 2019 Risk Assessment Mitigtion Phase (RAMP) Report. RSEs are numerical values that attempt to portray changes in risk scores per dollar spent. The change in a risk score is one data point that can help to inform decision-making and can be due to: (a) the amount of risk reduction when a new activity is completed, or (b) the amount of risk increase if a currently on-going activity is ceased.[1] The overall guiding principle of an RSE is that it presents the difference between the risk score over a certain span of time if the activity is undertaken versus if the activity is not undertaken. However, as discussed further in Chapters RAMP-C and RAMP-E, these data points should be viewed critically. This chapter: (1) illustrates how RSEs are created, with examples of RSEs for both Controls and Mitigations, (2) explains how benefits over time are treated, and (3) explains how the Company determined which activities to perform an RSE on in this RAMP Report (and which activities would not have RSEs).

II. DETERMINING RISK SPEND EFFICIENCIES

As discussed in Chapter RAMP-C, each risk has a Risk Score, calculated using the Risk Quantification Framework. The Risk Score that is developed is meant to represent the current risk situation. The current situation for each risk attempts to consider existing activities (known as Controls), current work standards, and all other current characteristics, such as asset conditions, environmental conditions, etc. As described in Decision (D.) 18-12-014, a Control is a "[c]urrently established activity that is modifying risk."[2] A Mitigation is an "activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event."[3]

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[1]   It should be noted that in reality risk reductions could be the result of other activities that have a positive effect, the improvement of industry wide data, or other factors not necessarily tied to the mitigation itself. *See* Chapter RAMP-E for additional discussion of this point.

[2]   D.18-12-014 at 16.

[3]   *Id.* at 17.

Risk Scores are calculated by multiplying the Likelihood of Risk Event (LoRE) and the Consequence of Risk Event (CoRE), where LoRE is the annual frequency of the Risk Event and CoRE is the output of the Risk Quantification Framework assuming a Risk Event occurred. Please see Chapter RAMP-C for more information on how LoRE and CoRE are created and used.

The risk score that results from using the Risk Quantification Framework is the baseline used when calculating RSEs. Next, a second estimate for LoRE and CoRE that considers a change in a risk-reducing activity is estimated. For Mitigations, the second LoRE and CoRE are estimated assuming the new activity is in place. For Controls, the second LoRE and CoRE reflect the estimated risk if the activity is ceased.

For purposes of this RAMP Report, the terms "pre-mitigation[4] LoRE" and "pre-mitigation CoRE" refer to the estimated risk values given current situations. The terms "post-mitigation LoRE" and "post-mitigation CoRE" refer to the estimated risk values if an activity is ceased or a new activity is undertaken. The same terminology applies to the Risk Scores, which are the product of LoRE multiplied by CoRE. In short:

$$pre-mitigation\ Risk\ Score = (pre-mitigation\ LoRE)\ x\ (pre-mitigation\ CoRE)$$

and

$$post-mitigation\ Risk\ Score = (post-mitigation\ LoRE)\ x\ (post-mitigation\ CoRE)$$

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

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

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

Later in this chapter, there is an in-depth discussion on the more detailed points of the RSE calculation, including concepts such as the duration of benefits and the present value of benefits pursuant to the SA Decision.[5]

A. Illustrative Example (One Year Mitigation)

The following is a more thorough example of a one-year mitigation that builds upon the brief example above. Suppose there is a risk in the Company's Enterprise Risk Register (ERR), known as Risk X, which has been assessed using the Risk Quantification Framework. Suppose the assessment generated an assumption that a Risk Event related to Risk X would occur four times a year. Further, the assessment considered the Potential Consequences when the Risk Events occur. Suppose, for this example, that when a Risk Event occurs, the assessment, consistent with methods described in Chapter RAMP-C, estimates a 1/10 chance that there will be four serious injuries, no reliability consequence, and an average financial consequence of $15 million to repair damage to equipment.

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

Table 1: Single Point [6]

Attribute	Scale	Weight
Safety	0-30	60%
Reliability	0-1	20%
Financial	0-$1B	20%

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

[6]   As discussed in Chapter RAMP-C, because of the wide range of possible choices available to each utility in assigning attributes, weights, scales, and other variables chosen through implementing the SA Decision, the Company has also chosen to provide a range of scoring, based upon two additional alternative Risk Quantification Framework methods. To simplfy this example, the Company is presenting only the Single Point methodology.

Step 2: Applying the formula explained in Chapter RAMP-C, CoRE would be calculated as:

$$CoRE = \left[\frac{0.1}{30}\right] x \ 60\% + \left[\frac{0}{1}\right] x \ 20\% + \left[\frac{\$5}{\$1000}\right] x \ 20\% = \ .003$$

Step 3: The final step is to multiply by 100,000, as discussed in Chapter RAMP-C, for readability purposes. Therefore, the pre-mitigation Risk Score is:

$$Risk \ Score = LoRE \ x \ CoRE \ x \ 100,000 = 4 \ x \ .003 \ x \ 100,000 = 1,200$$

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

Therefore, the post-mitigation Risk Score would be:

$$post - mitigation \ Risk \ Score$$
$$= (post - mitigation \ LoRE) \ x \ (post - mitigation \ CoRE) \ x \ 100,000$$
$$= 3 \ x \ .003 \ x \ 100,000 = 900$$

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

$$RSE = \frac{(post - mitigation \ Risk \ Score) - (pre - mitigation \ Risk \ Score)}{\$10M} = \frac{1200 - 900}{\$10M}$$
$$= \frac{300}{\$10M} = 3$$

B.   Illustrative Example (One Year Control)

A similar process is used when Control activities are considered. One important distinction for such situations is that in the RAMP Report, when considering the change in Risk Score if a control were no longer in place, the difference between the pre-mitigation Risk Score

and the post-mitigation Risk Score will still be shown as a positive number because the cost of the activity in the denominator would be savings. For consistency, in the RAMP Report both the numerator and the denominator will be shown as positive numbers.

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

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

$$CoRE = \left[\frac{2}{30}\right] x \; 60\% + \left[\frac{0}{1}\right] x \; 20\% + \left[\frac{\$50}{\$1000}\right] x \; 20\% = \; .05$$

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

$$Risk \; Score = LoRE \; x \; CoRE \; x \; 100,000 = 0.2 \; x \; .05 \; x \; 100,000 = 1000$$

Suppose there is a current activity that contributes to the Risk Score as it stands currently. Further, suppose there is a proposal to alter the activity in some way, such as changing the frequency of inspection. An example might be to stop a Quality Assurance program. Lastly, assume that based upon available data and subject matter expertise, it is believed that the likelihood of the risk event will be increased by 10% and save $25 million. In this example, the LoRE would therefore change from 0.2 to 0.22 (i.e. 10% more than 0.2 is 0.22). Ceasing this activity is not believed to affect the consequence if the Risk Event were to occur, so the CoRE stays the same.

Therefore, the post-mitigation Risk Score would be:

$$post-mitigation \; Risk \; Score = (post-mitigation \; LoRE) \; x \; (post-mitigation \; CoRE)$$
$$= 0.22 \; x \; .05 \; x \; 100,000 = 1,100$$

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

$$RSE = \frac{(pre-mitigation\ Risk\ Score) - (pre-mitigation\ Risk\ Score)}{-\$25M} = \frac{1000 - 1100}{-\$25M}$$

$$= \frac{100}{\$25M} = 0.4$$

The Control therefore has an RSE of 0.4.

III.   DURATION OF BENEFITS

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

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

Any activity that has a duration of benefits exceeding one year requires additional data points for the RSE calculation. In "Example (One Year Control)" above, the assumption was that the activity has a one year duration of benefits. However, if the assumption was raised to three years of benefits, the activity can be considered to affect three years of risk results. The two tables below illustrate the differnces in assuming the duration of benefits last for one versus three years.

Table 2: "Example (One Year Control)"

	Year				
	2020	**2021**	**2022**	**2023**	**2024**
Risk Score with Activity	980	1078	1078	1078	1078
Risk Score without Activity	1078	1078	1078	1078	1078
Difference	98	0	0	0	0

Table 3: "Example (Three Year Control)"

	Year				
	2020	**2021**	**2022**	**2023**	**2024**
Risk Score with Activity	980	980	980	1078	1078
Risk Score without Activity	1078	1078	1078	1078	1078
Difference	98	98	98	0	0

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

C. Discounting of Benefits

The SA Decision allows accounting of long term benefits of activities but requires an extra step before inclusion into the RSE.[7] The SA Decision mandates that future benefits have less value than present benefits. The Company meets this requirement by applying a "discount" rate to the difference in the Risk Score. In this RAMP filing, the Company uses a 3% discount rate for purposes of determining the present value of the risk reduction benefits or numerator of the RSE calcualtion. As shown in the example below, this discount rate lowers the benefits of years after the first by 3%, compounded each year. The Company applied a 3% discount rate based on federal recommendations.[8]

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

[8] *See* Centers for Disease Control and Prevention, Dataset Number SD-1002-2017-0, *Economic Burden of Occupational Fatal Injuries in the United States Based on the Census of Fatal Occupational Unjuries, 2003-2010* (August 2017) (citing 1996 recommendation from U.S. Department of Health and Human Services Panel on Cost-Effectiveness in Health and Medicine).

Table 4: "Example (Three Year Control)"

	Year				
	2020	**2021**	**2022**	**2023**	**2024**
Risk Score with Activity	980	980	980	1078	1078
Risk Score without Activity	1078	1078	1078	1078	1078
Difference	98	98	98	0	0
Discounted Difference	98 / (1) = 98	98 / (1.03) = 95.1	98 / (1.03)² = 92.4	0	0

As shown in the table above, the benefit decreases from 98 in the first year to 92.4 in the third year. The term "Present Value" can be used when discussing the future benefits of a long-term activity. For the example above, the present value of the benefit in 2022 is 92.4.

For activities that have multiple years of benefits, the simplified RSE calculation changes from:

$$RSE = \frac{(pre-mitigation\ Risk\ Score) - (pre-mitigation\ Risk\ Score)}{\$\ of\ activity}$$

to:

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

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

D.   Discounting of Costs

Similar to the discounting of benefits mentioned in the section above, the SA Decision requires that the cost of activities also be discounted if they span more than one year. However,

in a General Rate Case (GRC), the Company presents its forecasts in base year,[9] direct constant dollars. The base year for the Company's Test Year 2022 GRC is 2019.[10] While the Company will be seeking approval for Test Year 2022 forecasts for operations and maintenance (O&M) and 2020-2022 for capital expenditures, all these forecasts will be presented in 2019 constant dollars. Please note that these direct dollar forecasts will be converted into an overall revenue requirement through the Results of Operations (RO) model. In this RAMP Report, the Company is presenting costs in direct constant 2018 dollars. Therefore, for the purposes of the RSE calculation the costs are effectively already discounted prior to being used in the RSE calculation. Meaning, the cost for activities with multi-year expenditures does not take into account inflation prior to their usage for RSEs. For example, suppose there was a capital project that sought $10 million a year for all three years of the next GRC forecast period (2020 through 2022). In the RAMP and in GRC, the Company would present these costs as $10 million for each year, 2020, 2021, and 2022. No inflation is shown for those years; therefore, there is no need to further discount costs shown for years 2021 and 2022.

IV. APPLICATION OF RISK SPEND EFFICIENCIES

The RAMP Report includes 151 activities for SoCalGas and 224 activities for SDG&E. Of these, 100 and 146 activities for SoCalGas and SDG&E, respectively, had RSEs calculated.[11] RSEs were calculated for a wide variety of activities, including all in-scope non-mandated activities, certain mandated Controls, and all Mitigations whether they were mandated or not. RSEs were calculated for all non-mandated activities and all new activities. This was a

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

[10] The Company notes that as of the filing date of this RAMP Report, a Proposed Decision is pending before the Commission which could possibly change the anticipated filing date of the Company's next GRC application. *See* R.13-11-006, Proposed Decision Modifying the Commission's Rate Case Plan for Energy Utilities (October 4, 2019).

[11] The references here account for activities at the tranche level and also include the activities presented as alternatives.

substantial undertaking for the Company, especially when taking into account that this is the first implementation of these more quantitative analyses pursuant to the SA Decision.

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

1) Where there is mandated work that is difficult to separate from other work. For example, when a particular regulation, and therefore Control, has been in place for decades, it is difficult to separate how it impacts likelihoods and consequences of Risk Events. It is difficult to unravel the value of that Control to determine quantitatively the benefits it currently gives, especially in any meaningful way.

2) Where non-risk-reducing activities enable risk-reducing activities. For example, line inspections do not, by themselves, reduce risk directly but they do provide information to operators and field personnel which is then used to find appropriate remediations where necessary. In the case of inspections, they are bundled together with their remediations when calculating RSEs.

3) Where activities fall outside of the scope of the risk, but nevertheless are related to the risk and were included in the Risk chapter. From an analytic perspective, it is not appropriate to calculate an RSE for an activity that is not included in the scope of how the risk scores were calculated. An example of this is the Company's Customer and Public Safety risk. The scope of that risk is confined to events that are under the Company's control (see RAMP SCG-4 and SDG&E-5 for more details on risk scope). In other words, the risk scope for Customer and Public Safety risk does not include issues that are outside the control of the utility, and therefore the Risk Score does not assess those types of Risk Events. However, the Company performs activities that aim to mitigate public safety risk. Those activities that assist customers in being safe are presented in the Company's Customer and Public Safety risk chapter, but an RSE has not been

performed since those activities are outside of the scope of risk. For example, Company employees respond to all emergency calls from customers regarding gas leaks, and therefore the Company should be funded for that activity - but because essentially all emergency calls from customers are related to events that are outside the control of the Company, they are not considered within the scope of the risk score. Therefore, since responding to emergency calls is outside of the Customer and Public Safety risk scope, there is no change in the risk score due to the activity, which would result in an RSE score of 0.

V.   CONCLUSION

The calculation of RSEs in this RAMP Report represents the Company's best efforts and is in compliance with the SA Decision. The methodologies and processes herein have advanced the RSEs. As further discussed in Chapter RAMP-E, RSEs should be considered as a single data point, rather that the sole source for risk-based decision-making.

Appendix D-1

SoCalGas and SDG&E

RSE Ranking

Line No.	RAMP Chapter	ID	Control/Mitigation Name	RSE[1]		
				Low Alternative	Single Point	High Alternative
1	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-1-C6	GIPP - Tranche 1: Medium Pressure	63.58	**319.61**	746.34
2	Contractor Safety	SCG-3-C5	Contractor Engagement	25.47	**242.07**	603.08
3	Contractor Safety	SCG-3-C4	Third-Party Administration Tools	21.78	**207.00**	515.70
4	Cybersecurity	SCG-9-C1	Perimeter Defense	127.50	**130.75**	136.17
5	Cybersecurity	SCG-9-C5	Obsolete IT Infrastructure Modernization	66.06	**67.74**	70.55
6	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-5-C2	Cathodic Protection	10.51	**65.91**	158.25
7	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C6	Damage Prevention Analyst Program	44.59	**59.78**	85.10
8	Cybersecurity	SCG-9-C3	Sensitive Data Protection	58.13	**59.61**	62.08
9	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-M2	Establish a program to address the area of continual excavation	40.94	**54.89**	78.14
10	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-5-C1	GIPP - Tranche 2: High Pressure	8.69	**54.46**	130.74
11	Cybersecurity	SCG-9-C4	Operational Technology (OT) Cybersecurity	51.60	**52.92**	55.11
12	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C6	Damage Prevention Analysts Program	4.69	**39.50**	97.50
13	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-5-C3-T3	PSEP - Pipeline Replacement - Tranche 3: Phase 2A	8.00	**31.17**	69.77
14	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C16	Install warning mesh above buried company facilities	3.11	**26.14**	64.53
15	Cybersecurity	SCG-9-C2	Internal Defense	24.49	**25.12**	26.16
16	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-M8	Install warning mesh above buried company facilities (open trench new facilities only)	16.99	**22.78**	32.42
17	Contractor Safety	SCG-3-M1	Expanded Contractor Safety Oversight	2.26	**21.52**	53.63
18	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-5-C6	Transmission Integrity Management Program (TIMP)	3.29	**20.64**	49.56
19	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C8-T4	Public Awareness Compliance - Excavators	12.66	**16.97**	24.16
20	Employee Safety	SCG-2-M5	Expanded Safety Congress and expanded Executive Safety Council	1.74	**16.64**	41.46
21	Customer and Public Safety	SCG-4-C6	Quality Assurance and Controls Program	2.74	**15.06**	35.60
22	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-1-C7-T1	DREAMS: Vintage Integrity Plastic Plan (VIPP)	2.68	**13.45**	31.40
23	Employee Safety	SCG-2-C7	Near Miss, Stop the Job and jobsite safety programs	1.31	**12.48**	31.10
24	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C5	Locate and Mark Quality Assurance Program	9.14	**12.26**	17.45
25	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C8-T4	Public Awareness Compliance - Excavators	1.41	**11.88**	29.32
26	Employee Safety	SCG-2-M4	Safety video library	1.22	**11.65**	29.03
27	Employee Safety	SCG-2-M6	Expanded Safety Culture Assessments	1.22	**11.65**	29.03
28	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C9	Increase Reporting of Unsafe Excavation	8.41	**11.27**	16.05
29	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-M5	Enhance process to leverage excavation technology to help with difficult locates (vacuum excavation technology)	7.85	**10.53**	14.99
30	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-5-C4-T3	PSEP - Pressure Testing - Tranche 3: Phase 2A	2.62	**10.22**	22.87
31	Contractor Safety	SCG-3-C1	Contractor Safety Oversight	1.06	**10.12**	25.22
32	Employee Safety	SCG-2-M3	Establish proactive monitoring for indoor air quality (IAQ) and chemicals of concern	1.02	**9.71**	24.19
33	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C5	Locate and Mark Quality Assurance Program	1.00	**8.43**	20.80
34	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C9	Increase Reporting of Unsafe Excavation	0.83	**6.99**	17.25
35	Employee Safety	SCG-2-C8	Safety Culture	0.70	**6.69**	16.66
36	Employee Safety	SCG-2-M1	OSHA 30-hour construction certification training	0.68	**6.47**	16.13
37	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-1-C9	Distribution Riser Inspection Project	1.23	**6.21**	14.49
38	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C8-T1	Public Awareness Compliance - The Affected Public	4.24	**5.69**	8.10
39	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-1-C1	Cathodic Protection (CP)	1.01	**5.06**	11.81
40	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-1-C8	Sewer Lateral Inspection Project (SLIP)	0.89	**4.46**	10.43
41	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-M6	Promote process and system improvements in USA ticket routing and monitoring.	3.04	**4.07**	5.79
42	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C8-T1	Public Awareness Compliance - The Affected Public	0.48	**4.01**	9.89
43	Employee Safety	SCG-2-C5	Safe Driving Programs	0.41	**3.90**	9.72
44	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C8-T3	Public Awareness Compliance - Local Public Officials	2.81	**3.77**	5.37
45	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-1-C7-T2	DREAMS: Bare Steel Replacement Program (BSRP)	0.64	**3.20**	7.48
46	Employee Safety	SCG-2-C9	Utilizing Occupational Safety and Health Administration (OSHA) and industry best practices and industry benchmarking	0.33	**3.15**	7.85
47	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C12	Public Awareness - Remain Active Members of the California Regional Common Ground Alliance	2.14	**2.87**	4.08
48	Third Party Dig-in on a High Pressure Pipeline	SCG-7-M6	Promote process and system improvements in USA ticket routing and monitoring	0.34	**2.85**	7.03
49	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C8-T3	Public Awareness Compliance - Local Public Officials	0.32	**2.69**	6.65
50	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-1-C3	Meter and Regulator (M&R) Maintenance	0.47	**2.35**	5.50
51	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C11	Public Awareness - Meet with Cities with Highest Damage Rates	0.23	**1.92**	4.75

Line No.	RAMP Chapter	ID	Control/Mitigation Name	RSE[1]		
				Low Alternative	Single Point	High Alternative
52	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C12	Public Awareness - Remain Active Members of the California Regional Common Ground Alliance	0.22	**1.85**	4.56
53	Employee Safety	SCG-2-M2	Industrial hygiene program refresh	0.19	**1.80**	4.48
54	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C8-T2	Public Awareness Compliance - Emergency Officials	1.32	**1.77**	2.51
55	Third Party Dig-in on a High Pressure Pipeline	SCG-7-M5	Enhance process to leverage excavation technology to help with difficult locates (vacuum excavation technology)	0.15	**1.29**	3.18
56	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C8-T2	Public Awareness Compliance - Emergency Officials	0.14	**1.15**	2.84
57	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-5-C3-T2	PSEP - Pipeline Replacement - Tranche 2: Phase 1B	0.29	**1.14**	2.54
58	Employee Safety	SCG-2-C3	Wellness Programs	0.12	**1.10**	2.75
59	Third Party Dig-in on a High Pressure Pipeline	SCG-7-M2	Establish a program to address the area of continual excavation	0.13	**1.10**	2.72
60	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SCG-5-C5	PSEP - Valve Automation	0.49	**1.04**	1.96
61	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C11	Public Awareness - Meet with Cities with Highest Damage Rates	0.67	**0.90**	1.28
62	Storage Well Integrity Event	SCG-8-C6	Integrity Demonstration, Verification, and Monitoring Practices	0.62	**0.64**	0.66
63	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-M4	Utilize electronic positive response	0.46	**0.62**	0.89
64	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-C7	Prevention and Improvements - Refreshed Laptops	0.41	**0.54**	0.77
65	Third Party Dig-in on a High Pressure Pipeline	SCG-7-M4	Utilize electronic positive response	0.05	**0.44**	1.07
66	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C7	Prevention and Improvements - Refreshed Laptops	0.05	**0.38**	0.94
67	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-M3	Recording photographs for each locating mark ticket that is visited by the locator	0.26	**0.35**	0.50
68	Third Party Dig-in on a High Pressure Pipeline	SCG-7-C17	Prevention and Improvements - Fiber Optics	0.04	**0.34**	0.85
69	Third Party Dig-in on a High Pressure Pipeline	SCG-7-M3	Recording photographs for each locate and mark ticket visited by locator	0.03	**0.24**	0.60
70	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-M1	Automate Third Party Excavation Reporting	0.02	**0.03**	0.04
71	Third Party Dig-in on a High Pressure Pipeline	SCG-7-M1	Automate Third Party Excavation Incident Reporting	0.00	**0.02**	0.05
72	Third Party Dig-in on a Medium Pressure Pipeline	SCG-6-M7	Leverage data gathered by locating equipment	0.01	**0.02**	0.02
73	Third Party Dig-in on a High Pressure Pipeline	SCG-7-M7	Leverage data gathered by locating equipment	0.00	**0.01**	0.03

[1]The RSE ranges are further discussed in Chapter RAMP-C.

Line No.	RAMP Chapter	ID	Control/Mitigation Name	RSE[1]		
				Low Alternative	Single Point	High Alternative
1	Contractor Safety	SDG&E-2-C6	Contractor Safety Summit and Quarterly Safety Meetings	58.51	**356.94**	854.34
2	Electric Infrastructure Integrity	SDG&E-4-M3-T1	Proactive Substation Reliability for Distribution Components: Streamview Bank 30 Re-build	225.33	**225.33**	225.33
3	Wildfires	SDG&E-1-C15	Tree Trimming	151.32	**198.75**	277.80
4	Contractor Safety	SDG&E-2-C3	Third-Party Administration and Tools	32.24	**196.72**	470.84
5	Wildfires	SDG&E-1-M8	Hotline Clamps	137.89	**181.11**	253.15
6	Wildfires	SDG&E-1-Group3	PSPS Group	100.08	**131.45**	183.73
7	Cybersecurity	SDG&E-10-C1	Perimeter Defense	127.50	**130.75**	136.17
8	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C6	Damage Prevention Analysts Program	92.03	**126.35**	183.55
9	Wildfires	SDG&E-1-M7	Expulsion Fuse Replacement	92.16	**121.05**	169.19
10	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-M2	Establish a program to address the area of continual excavation	71.84	**98.63**	143.27
11	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-8-C1	Cathodic Protection	11.40	**91.00**	223.66
12	Electric Infrastructure Integrity	SDG&E-4-M3-T2	Proactive Substation Reliability for Distribution Components: Pacific Beach 12kV Replacement Re-build	82.20	**82.20**	82.20
13	Employee Safety	SDG&E-3-C8	OSHA Voluntary Protection Program (VPP) assessments	8.52	**73.12**	180.77
14	Cybersecurity	SDG&E-10-C5	Obsolete IT Infrastructure Modernization	66.06	**67.74**	70.55
15	Wildfires	SDG&E-1-M19	Enhanced Inspections, Patrols, and Trimming	51.39	**67.50**	94.35
16	Electric Infrastructure Integrity	SDG&E-4-C10	Vegetation Management (Non-HFTD)	39.34	**65.50**	109.10
17	Cybersecurity	SDG&E-10-C3	Sensitive Data Protection	58.13	**59.61**	62.08
18	Contractor Safety	SDG&E-2-C1	Contractor Safety Oversight Program	9.20	**56.13**	134.34
19	Cybersecurity	SDG&E-10-C4	Operational Technology (OT) Cybersecurity	51.60	**52.92**	55.11
20	Wildfires	SDG&E-1-M18	SCADA Capacitors	39.02	**51.26**	71.64
21	Electric Infrastructure Integrity	SDG&E-4-M1	Overhead Public Safety (OPS) Program	9.09	**47.54**	111.63
22	Wildfires	SDG&E-1-C28 / M32	Wildfire Infrastructure Protection Teams	34.46	**45.27**	63.27
23	Contractor Safety	SDG&E-2-M3	Near Miss/Close Call Reporting Portal/App	7.25	**44.26**	105.94
24	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-M8	Install warning mesh above buried company facilities (above open trench new facilities only)	30.42	**41.77**	60.67
25	Electric Infrastructure Integrity	SDG&E-4-C15	Distribution Circuit Reliability	40.25	**40.25**	40.25
26	Employee Safety	SDG&E-3-C3	Safety Culture	4.58	**39.24**	97.03
27	Employee Safety	SDG&E-3-M1	Enhanced Mandatory Employee Training (OSHA)	4.42	**37.91**	93.73
28	Wildfires	SDG&E-1-C29 / M33	Aviation Firefighting Program	27.33	**35.89**	50.17
29	Employee Safety	SDG&E-3-M4	Implementing findings from VPP program assessments	3.98	**34.12**	84.36
30	Wildfires	SDG&E-1-FiRM	FiRM Group	25.69	**33.74**	47.16
31	Employee Safety	SDG&E-3-M2	Safety In Action Enhancement Program	3.77	**32.33**	79.92
32	Wildfires	SDG&E-1-M10	Covered Conductor	24.30	**31.91**	44.61
33	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C16	Install warning mesh above buried company facilities	4.01	**31.85**	78.24
34	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-8-C6-T1	PSEP - Pressure Testing - Tranche 1: Phase 1B	5.27	**30.84**	73.45
35	Customer and Public Safety	SDG&E-5-C2	Field & Public Safety (CSF/AMO Quality Assurance Program)	4.83	**28.24**	67.24
36	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-6-M1-T2	Early Vintage Program (Pipeline) - Tranche 2: Early Vintage Steel Replacement	5.09	**27.53**	64.92
37	Electric Infrastructure Integrity	SDG&E-4-C14	Field SCADA RTU Replacement	26.65	**26.65**	26.65
38	Wildfires	SDG&E-1-Group2	FTZAP & LTE Communications Network	20.15	**26.47**	37.00
39	Wildfires	SDG&E-1-M17	Lightning Arrester Removal / Replacement Program	19.31	**25.36**	35.44
40	Electric Infrastructure Integrity	SDG&E-4-C19-T2	Underground Cable Replacement Program – Proactive - Tranche 2: Unjacketed Cable - Branch	25.32	**25.32**	25.32
41	Cybersecurity	SDG&E-10-C2	Internal Defense	24.49	**25.12**	26.16
42	Wildfires	SDG&E-1-C30	Industrial Fire Brigade	18.35	**24.11**	33.70
43	Wildfires	SDG&E-1-M4	Strategic Undergrounding: Underground Circuit Line Segments	17.52	**23.01**	32.16
44	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-8-C4	Transmission Integrity Management Program (TIMP)	2.81	**22.47**	55.22
45	Electric Infrastructure Integrity	SDG&E-4-M3-T4	Proactive Substation Reliability for Distribution Components: New Substation	21.36	**21.36**	21.36
46	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C6	Damage Prevention Analysts Program	2.68	**21.27**	52.26
47	Employee Safety	SDG&E-3-C4	Employee Behavior Based Safety (BBS) program	2.47	**21.18**	52.36
48	Wildfires	SDG&E-1-Group1	Non-Mandated Inspections Group	15.60	**20.49**	28.64
49	Electric Infrastructure Integrity	SDG&E-4-C3-T3	Distribution Switch Replacement Program - Tranche 3: Switches in Contamination District One with large customer count that could benefit from SCADA	20.46	**20.46**	20.46
50	Contractor Safety	SDG&E-2-M1	Expanded Contractor Oversight Program	3.02	**18.44**	44.12
51	Wildfires	SDG&E-1-M20	Fuel Management Program	13.93	**18.29**	25.57
52	Wildfires	SDG&E-1-PRiME	PRiME Group	13.70	**18.00**	25.15
53	Employee Safety	SDG&E-3-M3	Enhanced employee safe driving training (Vehicle Technology Programs)	2.00	**17.14**	42.38
54	Employee Safety	SDG&E-3-C9	Safe Driving Programs	1.98	**16.95**	41.90
55	Electric Infrastructure Integrity	SDG&E-4-C3-T1	Distribution Switch Replacement Program - Tranche 1: Hook Stick Switches and Solid Blades in Contamination District One	16.80	**16.80**	16.80
56	Electric Infrastructure Integrity	SDG&E-4-M4-T2	Substation Breaker Replacements – Tranche 2: Murray Breaker Replacement	16.53	**16.53**	16.53
57	Electric Infrastructure Integrity	SDG&E-4-C7	Tee Modernization Program - Underground	16.06	**16.06**	16.06
58	Wildfires	SDG&E-1-C9	Cleveland National Forest Fire Hardening	11.14	**14.63**	20.44
59	Employee Safety	SDG&E-3-M5	Energized Skills Training and Testing Yard	1.49	**12.79**	31.63
60	Electric Infrastructure Integrity	SDG&E-4-C2	Overhead 4kV Modernization and System Hardening - Distribution	4.11	**12.56**	26.65
61	Electric Infrastructure Integrity	SDG&E-4-M2	Replacement of Underground Live Front Equipment – Proactive	4.15	**12.29**	25.85
62	Electric Infrastructure Integrity	SDG&E-4-M3-T3	Proactive Substation Reliability for Distribution Components: Ash 12kV Cap Replacement Re-build	12.20	**12.20**	12.20
63	Electric Infrastructure Integrity	SDG&E-4-C3-T2	Distribution Switch Replacement Program - Tranche 2: Tie Switches (Gang or Hook Stick) in Contamination District One	11.81	**11.81**	11.81
64	Employee Safety	SDG&E-3-C7	Employee Wellness Programs	1.31	**11.22**	27.73
65	Electric Infrastructure Integrity	SDG&E-4-C19-T1	Underground Cable Replacement Program – Proactive - Tranche 1: Unjacketed Cable - Feeder	10.39	**10.39**	10.39
66	Electric Infrastructure Integrity	SDG&E-4-C8	Replacement of Underground Live Front Equipment – Reactive	2.63	**8.44**	18.13

Line No.	RAMP Chapter	ID	Control/Mitigation Name	RSE[1]		
				Low Alternative	Single Point	High Alternative
67	Employee Safety	SDG&E-3-C12	Utilizing OSHA and industry best practices and industry benchmarking	0.88	**7.53**	18.61
68	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C5	Locate and Mark Quality Assurance Program	5.22	**7.16**	10.41
69	Electric Infrastructure Integrity	SDG&E-4-C9	DOE Switch Replacement - Underground	7.00	**7.00**	7.00
70	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-6-M1-T1	Early Vintage Program (Pipeline) - Tranche 1: Early Vintage Threaded Main Replacement	1.20	**6.51**	15.35
71	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C8-T4	Public Awareness Compliance - Excavators	3.96	**5.43**	7.89
72	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-6-M1-T3	Early Vintage Program (Pipeline) - Tranche 3: Oil Drip Removal	0.98	**5.28**	12.46
73	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-6-C1	Cathodic Protection	0.77	**4.16**	9.81
74	Electric Infrastructure Integrity	SDG&E-4-M4-T1	Substation Breaker Replacements – Tranche 1: San Ysidro Breaker Replacement	3.55	**3.55**	3.55
75	Employee Safety	SDG&E-3-C11	Near Miss, Stop the Job and jobsite safety programs	0.39	**3.30**	8.17
76	Wildfires	SDG&E-1-C12 / M9	Wire Safety Enhancement	1.96	**2.57**	3.59
77	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-6-M2-T2	Early Vintage Program (Fittings) - Tranche 2: High/Medium Valve Separation Removal	0.45	**2.45**	5.77
78	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C9	Increase Reporting of Unsafe Excavation	1.68	**2.31**	3.35
79	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C8-T1	Public Awareness Compliance - The Affected Public	1.32	**1.81**	2.63
80	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C5	Locate and Mark Quality Assurance Program	0.20	**1.58**	3.87
81	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-M6	Promote process and system improvements in USA ticket routing and monitoring	1.03	**1.41**	2.05
82	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-6-C4	Plastic Pipe Replacement	0.24	**1.28**	3.03
83	High Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-8-C3-T2	Pipe Replacement - Tranche 2: Phase 1B (PSEP)	0.20	**1.19**	2.83
84	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C8-T4	Public Awareness Compliance - Excavators	0.15	**1.18**	2.91
85	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-M2	Establish a program to address the area of continual excavation	0.14	**1.09**	2.69
86	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C8-T3	Public Awareness Compliance - Local Public Officials	0.76	**1.05**	1.52
87	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C11	Public Awareness - Meet with Cities with Highest Damage Rates	0.71	**0.98**	1.42
88	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-6-C2	Assessment Buried Piping in Vaults	0.15	**0.81**	1.91
89	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C8-T2	Public Awareness Compliance - Emergency Officials	0.39	**0.53**	0.77
90	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C12	Public Awareness - Remain Active Members of the California Regional Common Ground Alliance	0.38	**0.53**	0.77
91	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-M5	Enhance process to leverage excavation technology to help with difficult locates (vacuum excavation technology)	0.36	**0.49**	0.71
92	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C9	Increase Reporting of Unsafe Excavation	0.06	**0.49**	1.20
93	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-C7	Prevention and Improvements - Refreshed Laptops	0.31	**0.43**	0.63
94	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C8-T1	Public Awareness Compliance - The Affected Public	0.05	**0.39**	0.96
95	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-M5	Enhance process to leverage excavation technology to help with difficult locates (vacuum excavation technology)	0.04	**0.36**	0.87
96	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-M6	Promote process and system improvements in USA ticket routing and monitoring	0.04	**0.30**	0.75
97	Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	SDG&E-6-M2-T1	Early Vintage Program (Fittings) - Tranche 1: Dresser Mechanical Coupling Removal	0.05	**0.28**	0.65
98	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C8-T3	Public Awareness Compliance - Local Public Officials	0.03	**0.22**	0.54
99	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C11	Public Awareness - Meet with Cities with Highest Damage Rates	0.03	**0.22**	0.54
100	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-M3	Recording photographs for each locate and mark ticket visited by locator	0.14	**0.19**	0.28
101	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C8-T2	Public Awareness Compliance - Emergency Officials	0.01	**0.12**	0.29
102	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C12	Public Awareness - Remain Active Members of the California Regional Common Ground Alliance	0.01	**0.11**	0.26
103	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-M4	Utilize electronic positive response	0.07	**0.10**	0.14
104	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-C7	Prevention and Improvements - Refreshed Laptops	0.01	**0.09**	0.22
105	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-M3	Recording photographs for each locate & mark ticket visited by locator	0.01	**0.04**	0.10
106	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-M4	Utilize electronic positive response	0.00	**0.02**	0.05

Line No.	RAMP Chapter	ID	Control/Mitigation Name	RSE[1]		
				Low Alternative	Single Point	High Alternative
107	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-M1	Automate Third Party Excavation Incident Reporting	0.00	0.00	0.01
108	Third Party Dig-in on a Medium Pressure Pipeline	SDG&E-7-M7	Leverage data gathered by locating equipment	0.00	0.00	0.00
109	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-M1	Automate Third Party Excavation Incident Reporting	0.00	0.00	0.00
110	Third Party Dig-in on a High Pressure Pipeline	SDG&E-9-M7	Leverage data gathered by locating equipment	0.00	0.00	0.00
111	Wildfires	SDG&E-1-M13	Public Safety Power Shutoff Engineering Enhancements	0.00	0.00	0.00
112	Wildfires	SDG&E-1-M16	Backup Power for Resilience - Microgrid	0.00	0.00	0.00
113	Wildfires	SDG&E-1-C31 / M34	Wireless Fault Indicators	0.00	0.00	0.00
114	Wildfires	SDG&E-1-M28	NMS Situational Awareness Upgrades	0.00	0.00	0.00

[1]The RSE ranges are further discussed in Chapter RAMP-C.