



Risk Assessment Mitigation Phase Risk Mitigation Plan

Catastrophic Damage Involving Third Party Dig-Ins (Chapter SDG&E-2)

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TABLE OF CONTENTS

1	Purpose.....	2
2	Background	3
3	Risk Information.....	4
	3.1 Risk Classification.....	5
	3.2 Potential Drivers	5
	3.3 Potential Consequences	9
	3.4 Risk Bow Tie.....	9
4	Risk Score	10
	4.1 Risk Scenario – Reasonable Worst Case	10
	4.2 2015 Risk Assessment	10
	4.3 Explanation of Health, Safety, and Environmental Impact Score	11
	4.4 Explanation of Other Impact Scores.....	11
	4.5 Explanation of Frequency Score	11
5	Baseline Risk Mitigation Plan.....	13
6	Proposed Risk Mitigation Plan	15
7	Summary of Mitigations.....	16
8	Risk Spend Efficiency	21
	8.1 General Overview of Risk Spend Efficiency Methodology	21
	8.1.1 Calculating Risk Reduction	21
	8.1.2 Calculating Risk Spend Efficiency	22
	8.2 Risk Spend Efficiency Applied to This Risk.....	23
	8.3 Risk Spend Efficiency Results.....	24
9	Alternatives Analysis	25
	9.1 Alternative 1 – Reduce Contract Locating Usage.....	25
	9.2 Alternative 2 – Dedicated Standby Group.....	25

Figure 1: Excavation Contact Process Flow..... 4

Figure 2: Risk Bow Tie 9

Figure 3: Significant Pipeline Excavation Incidents in California 12

Figure 4: Formula for Calculating RSE..... 22

Figure 5: Risk Spend Efficiency..... 25

Table 1: Risk Classification per Taxonomy..... 5

Table 2: Operational Risk Drivers 8

Table 3: Risk Score 11

Table 4: Baseline Risk Mitigation Plan..... 17

Table 5: Proposed Risk Mitigation Plan 19

Executive Summary

The Catastrophic Damage Involving Third Party Dig-Ins (Dig-Ins) risk relates to the potential impacts from third party activities that result in a dig-in.

To assess this risk, San Diego Gas & Electric (SDG&E) first identified a reasonable worst case scenario, and scored the scenario against five residual impact categories (e.g., Health, Safety, Environmental; Operational & Reliability, etc., discussed in Section 4). Then, SDG&E considered as a baseline, the SDG&E mitigations in place for Dig-Ins in 2015 (mitigations are discussed in Section 5) and estimated the costs (costs are summarized in Section 7). SDG&E identified the following controls as of 2015: (1) Training; (2) Locate and Mark Activities; and, (3) Damage Prevention Public Awareness.

These controls focus on safety-related impacts (e.g., Health, Safety, and Environment) per guidance provided by the Commission in Decision 16-08-018 as well as controls and mitigations that may address reliability.

Based on the foregoing assessment, SDG&E proposed future mitigations. For Dig-Ins, SDG&E proposed to continue the four control categories from its 2015 baseline. In addition, SDG&E proposed enhancements within each category as well as incremental programs that aim in reducing frequency. The enhancements include, for example, increased resources to perform locate and mark activities in anticipation of increase demand due to new legislation; an additional resource to analyze the excavation reporting collection and data and to develop improvement action plans; and issuing smart devices to capture photographs of location marks.

Next, SDG&E developed the risk spend efficiency (sometimes referred to as RSE). The risk spend efficiency is a new tool that SDG&E developed to attempt to quantify how the proposed mitigations will incrementally reduce risk. The assessment was completed using three mitigation groupings. The following is the ranking of the mitigation groupings from the highest to the lowest efficiency, as indicated by the RSE number:

1. In-field dig-in prevention and improvements and current public awareness (current controls)
2. In-field dig-in prevention and improvements (incremental mitigations)
3. Admin-side analysis (incremental mitigations)

Finally, SDG&E considered two alternatives to the proposed mitigations, and in the final section of this chapter, SDG&E explains the reasons those alternatives were not included into its proposal.

Risk: Catastrophic Damage Involving Third Party Dig-Ins

1 Purpose

The purpose of this chapter is to present the mitigation plan of San Diego Gas & Electric Company (SDG&E or Company) for the risk of a dig-in, caused by third party activities, which results in catastrophic consequences (e.g., dig-ins on underground piping and facilities, referred to herein as Dig-Ins). In many cases, people or companies excavate in the vicinity of a buried utility infrastructure without realizing the infrastructure is there.¹ These third party excavation activities can vary based on project sizes. An example of small excavation activity is a homeowner performing landscaping work in their yard. Larger excavation activities include farmers grading/tilling their land, and construction companies digging in roadways or performing other underground infrastructure work.

This risk is focused on the more serious results of third party damage that lead to a release of natural gas with the possibility of hazard to life and property. The release of natural gas may not just occur at the time of the damage. A leak or rupture may also occur after the infrastructure has been damaged and reburied but becomes weakened over time. Typically, contractors and homeowners do not intentionally damage underground substructures. This risk is limited to those cases where there is no intent to damage the gas infrastructure.

This risk is a product of SDG&E's September 2015 annual risk registry assessment cycle. Any events that occurred after that time were not considered in determining the 2015 risk assessment, in preparation for this Report. Note that while 2015 is used as a base year for mitigation planning, risk management has been occurring, successfully, for many years within the Company. SDG&E and Southern California Gas Company (SoCalGas) (collectively, the utilities) take compliance and managing risks seriously, as can be seen by the amount of actions taken to mitigate each risk. This is the first time, however, that the utilities have presented a Risk Assessment Mitigation Phase (RAMP) Report, so it is important to consider the data presented in this plan in that context. The baseline mitigations are determined based on the relative expenditures during 2015; however, the utilities do not currently track expenditures in this way, so the baseline amounts are the best effort of the utility to benchmark both capital and operations and maintenance (O&M) costs during that year. The level of precision in process and outcomes is expected to evolve through work with the California Public Utilities Commission (Commission or CPUC) and other stakeholders over the next several General Rate Case (GRC) cycles.

The Commission has ordered that RAMP be focused on safety related risks and mitigating those risks.² In many risks, safety and reliability are inherently related and cannot be separated, and the mitigations reflect that fact. Compliance with laws and regulations is also inherently tied to safety and the utilities take those activities very seriously. In all cases, the 2015 baseline mitigations include activities and amounts necessary to comply with the laws in place at that time. Laws rapidly evolve, however, the

¹ A discussion of potential dig-ins drivers is provided in Section 3.2.

² Commission Decision (D.) 14-12-025 at p. 31.

RAMP baseline has not taken into account any new laws that have been passed since September 2015. Some proposed mitigations do take into account those new laws.

The purpose of RAMP is not to request funding. Any funding requests will be made in the GRC. The forecasts for mitigation are not for funding purposes, but are rather to provide a range for the future GRC filing. This range will be refined with supporting testimony in the GRC. Although some risks have overlapping costs, the utilities have made efforts to identify those costs.

2 Background

Across the spectrum, third-party damage to pipelines can range from minor scratches or dents, to ruptures with an uncontrolled release of natural gas. Serious consequences may be realized if an event occurs because of this risk. For example, if a leak or rupture occurs, an ignition of the released gas could cause an explosion and/or fire where people nearby could be seriously injured.

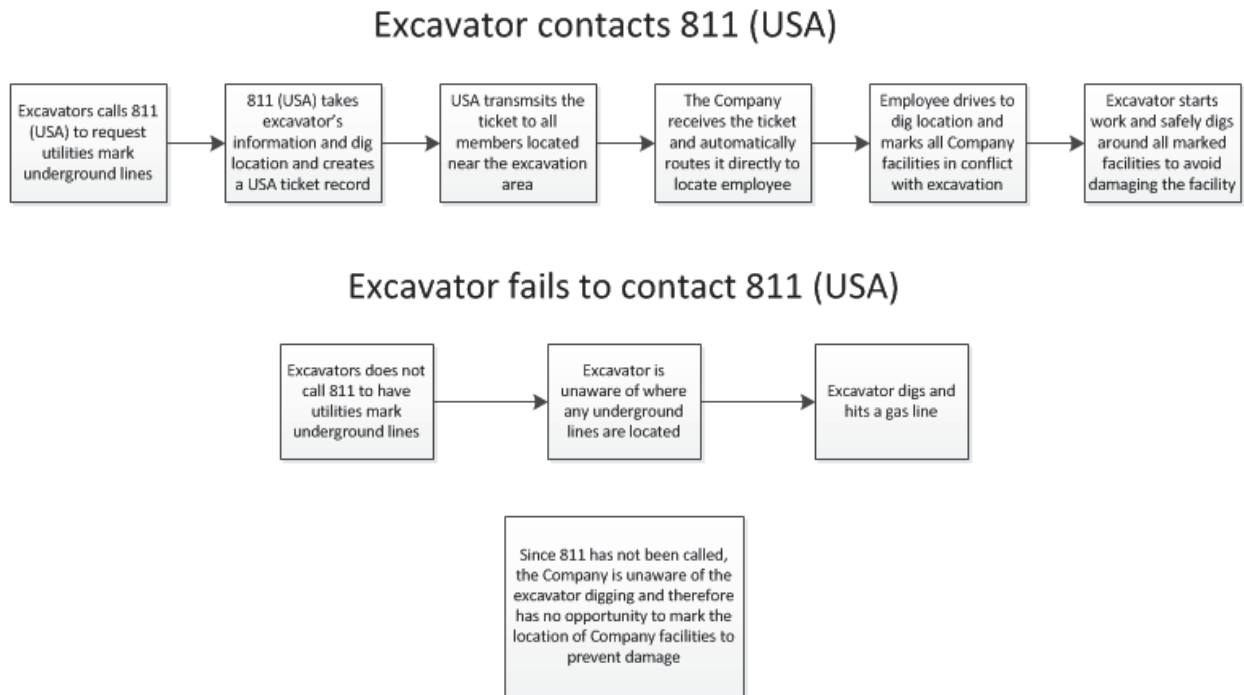
Past incidents substantiate these risks:

- In 2015 a Pacific Gas and Electric Company (PG&E) High Pressure Transmission line was ruptured when an excavator failed to schedule a standby for farm work near Bakersfield, California. The excavator proceeded to dig over the Transmission facility and struck the line, causing an explosion that killed the excavator, destroyed the excavation equipment, and damaged buildings miles away.
- In 2015 a PG&E High Pressure Transmission line was ruptured when an excavator failed to call 811 in Fresno, California. The excavator was grading over the Transmission facility and struck the line, causing an explosion that killed the excavator, and injured several others.

Under State Law, third parties planning excavation work have the responsibility of contacting the Regional Notification Center for their area, also known as 811, Underground Service Alert (USA), or DigAlert, at least two (2) full working days prior to start of their construction excavation activities. Once the third-party makes contact, the Regional Notification Center will then issue a USA Ticket notifying local utilities and other operators of the location and areas to be inspected for potential conflicts with the pending excavation work. Operators are required to mark their underground facilities via aboveground identifiers (e.g. Paint, chalk, flags, whiskers) to designate where underground utilities are positioned, thus enabling third-parties, like contractors and homeowners, to know where these structures are located. State law also requires third party excavators to use careful, manual (hand digging) methods to expose substructures prior to using mechanical excavation tools.

Figure 1 below illustrates the sequence of events when a third party calls 811 (USA) prior to conducting excavation work, and what can occur when they do not.

Figure 1: Excavation Contact Process Flow



As can be seen from the above flow charts, while there may be more steps when a third party calls 811 prior to commencing the excavation work, it is more likely to result in a positive outcome compared to when a call is not made. Having third-parties call 811 before digging is critical, and can significantly reduce the likelihood of a potential event if the correct processes are followed.

SDG&E operates and manages a natural gas system of over 14,000 miles of Distribution pipe and 228 miles of Transmission pipe within its 4,100 square mile service territory. This large piping network and large service territory exposes the Company to potential dig-in related issues.

3 Risk Information

As stated in the testimony of Jorge M. DaSilva in the Safety Model Assessment Proceeding (S-MAP) Application (A.) 15-05-002, “SDG&E is moving towards a more structured approach to classifying risks and mitigations through the development of its new risk taxonomy. The purpose of the risk taxonomy is to define a rational, logical and common framework that can be used to understand, analyze, and categorize risks.”³ The Enterprise Risk Management (ERM) process and lexicon that SDG&E has put in place was built on the internationally-accepted ISO 31000 risk management standard. In the application and evolution of this process, the Company is committed to increasing the use of quantification within

³ A.15-05-002, filed May 1, 2015, at p. JMD-7.

its evaluation and prioritization of risks.⁴ This includes identifying leading indicators of risk. Sections 3 – 9 of this plan describe the key outputs of the ERM process and resultant risk mitigations.

In accordance with the ERM process, this section describes the risk classification, possible drivers and potential consequences of the Dig-Ins risk.

3.1 Risk Classification

Consistent with the taxonomy presented by SDG&E and SoCalGas in A.15-05-002, SDG&E classifies this risk as a gas, operational risk as shown in Table 1.

Table 1: Risk Classification per Taxonomy

Risk Type	Asset/Function Category	Asset/Function Type
OPERATIONAL	GAS	HIGH PRESSURE (>60 PSIG)
OPERATIONAL	GAS	MEDIUM PRESSURE (≤60 PSIG)

3.2 Potential Drivers⁵

When performing the risk assessment for Dig-Ins, SDG&E identified potential indicators of risk, referred to as drivers. These include but are not limited to the following:

- 1. Third party contractors or homeowners/renters do not call a one-call center for locate and mark prior to their excavation.**

Despite the creation of Regional Notification Centers to make it easy for the public to have underground infrastructure located and marked, and large advertising campaigns to alert the public of the need for doing so, incidents are still occurring where excavations are conducted without calling the one-call center for locating and marking underground utility infrastructure. Third party failure to contact the Regional Notification Center prior to excavating is the leading contributor of damage to Company pipelines. Third parties can damage or rupture underground pipelines and potentially cause property damage, injuries or even death, if gas lines are not marked; lines cannot be marked if the regional notification center is not contacted.

This risk driver is the most frequent root cause of dig ins as it accounts for approximately 50% of dig-in damages to buried Company facilities. When an excavator chooses to dig without calling 811, the excavator assumes a risk that is out of the Company’s control. Without receiving an 811 ticket, the Company has no opportunity to mark its facility within the area of excavation.

⁴ Testimony of Diana Day, Risk Management and Policy (SDG&E-02), submitted on November 14, 2014 in A.14-11-003.

⁵ An indication that a risk could occur. It does not reflect actual or threatened conditions.

2. Company or Contractor employees performing locate and mark tasks do not mark the underground gas infrastructure correctly.

The Company or a Company Contractor, in some cases, inaccurately marks its facilities due to incorrect operations, such as mapping/data inaccuracies, equipment signal interference, and human error. When this happens, third parties are not provided accurate knowledge of underground substructures in the vicinity of their excavations, and the risk of damaging or rupturing gas pipelines increases.

3. Excavator fails to comply with excavation laws or best practices in the vicinity of located underground gas infrastructure.

Damages often occur because the excavator fails to follow excavation legal requirements and best practices after calling USA. California State law (see Government Code Section 4216 et. seq.) requires excavators to perform several duties so that underground facilities are not damaged; for example:

- Delineate the work location – The excavator is required to identify the excavation area with white markings so that the utility marks are provided in the correct area. If the excavator fails to delineate the work area, there is a risk that not all facilities may be marked.
- Confirm all utilities have been marked – Before the excavation can start, the excavator must confirm all utilities listed on the USA ticket have marked, or have communicated that there is no conflict with the proposed excavation. If the excavator does not perform this duty, the excavator risks digging into a line that has not yet been marked.
- Dig with care around marked facilities – Before using any power operated excavation or boring equipment, the excavator is required to hand expose, to the point of no conflict 24 inches on either side of the marked underground facilities, to determine the exact location of these structures. If excavators do not use care when digging near natural gas pipelines they put themselves and others at risk for injuries. The Company has an extensive public awareness program in place to educate contractors and homeowners about the dangers of not following safe excavation laws and best practices.
- Call for re-marks if the marked facilities are no longer visible – When the excavator can no longer see the USA marks in the area of excavation, the excavator is required to call all utilities back to re-mark their facilities. If the excavator continues excavation work without requesting re-marks from the utilities, there is a risk that a previously marked facility could be damaged.

4. Company does not respond to a one-call center request (e.g., USA) in the required timeframe.

The Company may not respond to USA requests within the required time frame (within two working days of notification, excluding weekends and holidays, or before the start of the excavation work, whichever is later, or at a later time mutually agreeable to the operator and the

excavator). This may happen because of, e.g., human error, poor communication, or system failures.

In these cases, third parties may not know that the locate and mark activity was not performed. They, therefore, may wrongly assume that not seeing any markings at their excavation site indicates there is no gas infrastructure nearby. Without the marked gas infrastructure, third parties can damage or rupture the infrastructure if they are performing excavation activities near pipelines.

5. Company does not perform “standby” duties when a third party is excavating in the vicinity of a high pressure (>60 psig) gas pipeline.

Because high pressure pipelines (those that operate over 60 psig) pose a higher risk of hazard to life and property when damaged or ruptured, additional precautions are taken by the Company to observe excavation activities in the vicinity of these facilities. Qualified Company personnel are required to be present during excavation activities within 10 feet of any high pressure gas line (the presence commonly referred to as “stand-by”). The stand-by presence allows for redundancy via a Company representative should the third party not follow proper protocol during the excavation (e.g., not hand excavate near the pipeline), or the marks are determined to be inaccurate. Stand-by presence increases the excavator’s awareness of all excavation requirements near the high pressure facility. These instances are given high priority since the impacts of an incident in these cases could be significant.

Table 2 below maps these five specific risk drivers to the larger driver categories in the taxonomy.

Table 2: Operational Risk Drivers

Driver Category	Dig-Ins Driver(s)
Asset Failure	Not applicable
Asset-Related Information Technology Failure	Not applicable
Employee Incident	<ul style="list-style-type: none"> • Company employees performing locate and mark tasks do not mark the underground gas infrastructure correctly • Company does not respond to a one-call center (e.g., USA) request in the required timeframe • Company does not have personnel perform “standby” duties when a third party is excavating in the vicinity of a high pressure (>60 psig) gas pipeline
Contractor Incident	<ul style="list-style-type: none"> • Excavator fails to comply with excavation laws or best practices in the vicinity of located underground gas infrastructure • Excavator does not call USA at least two working days before starting excavation work • Excavator begins work without notifying the Company, and as a result the Company does not perform “standby” duties during excavation near a high pressure (>60 psig) gas pipeline
Public Incident	<ul style="list-style-type: none"> • Third party contractors or homeowners/renters do not call a one-call center for locate and mark prior to their excavation • Excavator fails to comply with excavation laws or best practices in the vicinity of located underground gas infrastructure • Excavator begins work without notifying the Company, and as a result the Company does not perform “standby” duties during excavation near a high pressure (>60 psig) gas pipeline
Force of Nature	Not applicable

3.3 Potential Consequences

If one of the risk drivers listed above were to occur, resulting in an incident, the potential consequences, in a reasonable worst case scenario, could include:

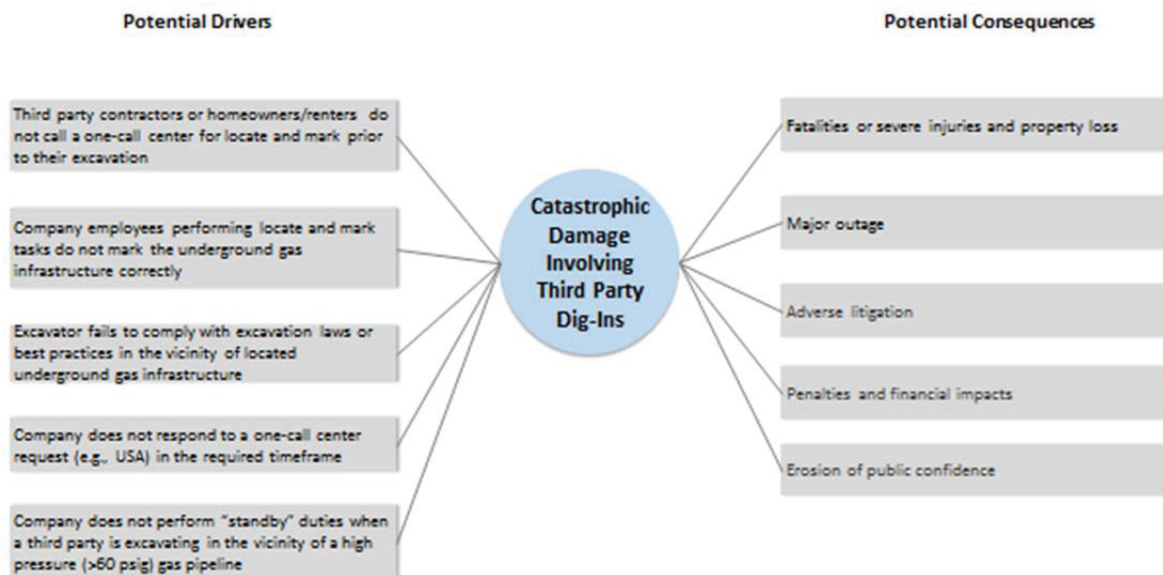
- Fatalities or severe injuries and property loss.
- Major outage.
- Adverse litigation.
- Penalties and financial impacts.
- Erosion of public confidence.

These potential consequences were used in the scoring of Dig-Ins that occurred during the SDG&E’s 2015 risk registry process. See Section 4 for more detail.

3.4 Risk Bow Tie

The risk “bow tie,” shown in Figure 2, is a commonly-used tool for risk analysis. The left side of the bow tie illustrates potential drivers that lead to a risk event and the right side shows the potential consequences of a risk event. SDG&E applied this framework to identify and summarize the information provided above.

Figure 2: Risk Bow Tie



4 Risk Score

The SDG&E and SoCalGas ERM organization facilitated the 2015 risk registry process, which resulted in the inclusion of Dig-Ins as one of the enterprise risks. During the development of the risk register, subject matter experts assigned a score to this risk, based on empirical data to the extent it is available and/or using their expertise, following the process outlined in this section.

4.1 Risk Scenario – Reasonable Worst Case

There are many, possible ways in which a dig-in can occur. For purposes of scoring this risk, subject matter experts (SMEs) applied a reasonable worst case scenario to assess the impact and frequency. The hypothetical scenario represented a situation that could be expected to happen, within a reasonable timeframe, and lead to a relatively significant adverse outcome. These types of scenarios are sometimes referred to as low frequency, high consequence events. The SMEs selected a reasonable worst case scenario to develop a risk score for Dig-Ins and the scenario selected to assess the Dig-Ins risk is:

- A natural gas pipeline ruptures due to third-party excavation work in a populated business district during business hours, which results in fatalities, injuries, and substantial property damage.

Note that the following narrative and scores are based on this scenario; they do not address all consequences that can happen if the risk occurs.

4.2 2015 Risk Assessment

Using this scenario, SMEs then evaluated the frequency of occurrence and potential impact of the risk using SDG&E's 7X7 Risk Evaluation Framework (REF). The framework (also called a matrix) includes criteria to assess levels of impact ranging from Insignificant to Catastrophic and levels of frequency ranging from Remote to Common. The 7X7 framework includes one or more criteria to distinguish one level from another. The Commission adopted the REF as a valid method to assess risks for purposes of this RAMP.⁶ Using the levels defined in the REF, the SMEs, applied empirical data to the extent it is available and/or their expertise to determine a score for each of four residual impact areas and the frequency of occurrence of the risk.

Table 3: Risk Score provides a summary of the Dig-Ins risk score in 2015. This risk has a score of 4 or above in the Health, Safety, and Environmental impact area and, therefore, SDG&E included this risk in the RAMP. These are residual scores because they reflect the risk remaining after existing controls are in place. For additional information regarding the REF, please refer to the RAMP Risk Management Framework chapter within this Report.

⁶ D.16-08-018 Ordering Paragraph 9.

Table 3: Risk Score

Residual Impact				Residual Frequency	Residual Risk Score
Health, Safety, Environmental (40%)	Operational & Reliability (20%)	Regulatory, Legal, Compliance (20%)	Financial (20%)		
6	4	3	4	5	233,365

4.3 Explanation of Health, Safety, and Environmental Impact Score

Dig-ins have led to fatalities and injuries; for instance, consider the two instances in 2015 discussed in Section 2.⁷ Accordingly, this risk was scored a 6 (severe) in the Health, Safety, and Environmental impact category.

4.4 Explanation of Other Impact Scores

Based on the selected reasonable worst case risk scenario, the following scores were assigned to the remaining residual risk categories.

- **Operational and Reliability:** Based on the scenario of a dig-in that results in a pipeline rupture, a score of 4 (major) was given in the Operational and Reliability impact category. This is due to past events that have resulted in major outages. Depending on the location of the damage, thousands of customers could lose service. The potential for one critical customer to lose service, especially in a business district, is far more likely to occur even in a less critical incident. Finally, loss of service over many days is not uncommon with these types of events, which may occur every 2-3 years.
- **Regulatory, Legal, and Compliance:** Next, a score of 3 (moderate) was given in the Regulatory, Legal and Compliance impact category because the controls and oversight SDG&E already has in place indicate current efforts to address this risk.
- **Financial:** Finally, a score of 4 (major) was given to the Financial impact category due to a potential costs associated with a catastrophic event, and the likelihood of multiple lawsuits and high value settlements.

4.5 Explanation of Frequency Score

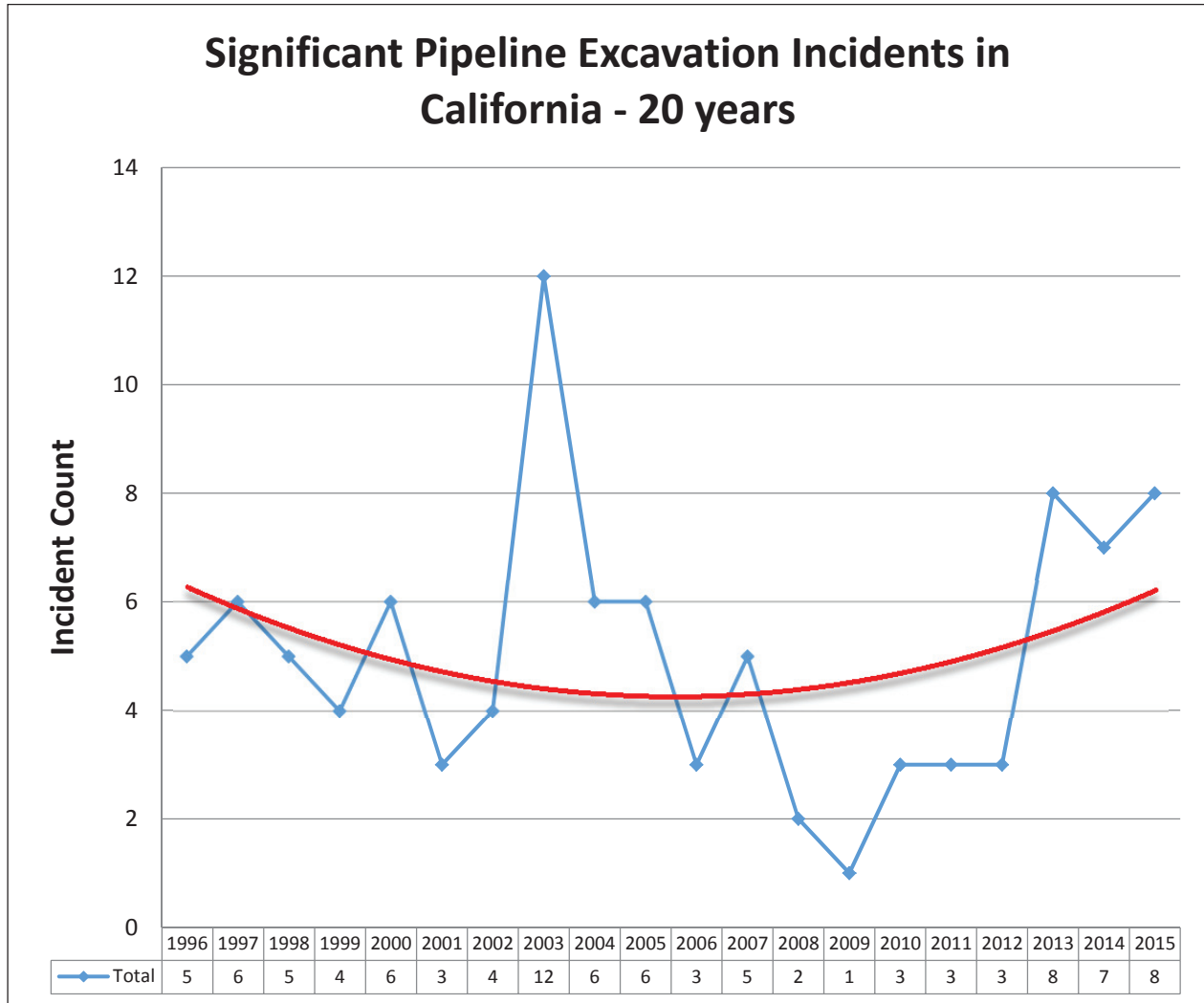
Based on the reasonable worst case scenario of a Dig-In, a score of 5 (extensive) was given for how likely this event is to occur. Although catastrophic dig-in related events have not recently occurred in SDG&E’s service territory, the risk of a catastrophic dig-in related incident is very real because of the frequency with which dig-ins occur. Damage occurs in the Company’s service territory almost once a day based on the 300 damage events in 2015. Approximately 50% of these damages did not have a USA Ticket.

⁷http://seuc.senate.ca.gov/sites/seuc.senate.ca.gov/files/12-17-15_background.pdf



The graph provided below illustrates the number of significant gas pipeline excavation incidents in California over a 20-year period, from 1996-2015.⁸

Figure 3: Significant Pipeline Excavation Incidents in California



As shown above, the significant incidents involving gas pipelines in California are on the rise. Significant incidents are defined as:

1. Fatality or injury requiring in-patient hospitalization.

⁸ The information is from the Pipeline and Hazardous Materials Safety Administration website: <http://www.phmsa.dot.gov/pipeline/library/data-stats/pipelineincidenttrends> .

2. \$50,000 or more in total costs, measured in 1984 dollars.
3. Highly volatile liquid releases of 5 barrels or more, or other liquid releases of 50 barrels or more.
4. Liquid releases resulting in an unintentional fire or explosion.

Thus, the probability of this type of event occurring once every 1-3 years is reasonable, if further mitigations are not put in place.

5 Baseline Risk Mitigation Plan⁹

As stated above, the Dig-Ins risk involves impact to gas infrastructure arising from third party dig-ins. The 2015 baseline mitigations discussed below include the current evolution of the utilities' risk management of this risk. The baseline mitigations have been developed over many years to address this risk. They include activities to comply with laws that were in effect at that time.

These controls focus on safety-related impacts¹⁰ (i.e., Health, Safety, and Environment) per guidance provided by the Commission in D.16-08-018¹¹ as well as controls and mitigations that may address reliability.¹² Accordingly, the controls and mitigations described in this section and in Section 6 address safety-related impacts primarily. Note that the controls and mitigations in the baseline and proposed risk mitigation plans are intended to address various events and is not limited to the reasonable worst case risk scenario used for the Risk Score (Section 4).

1. Training

This mitigation consists of two programs that provide employees the tools to perform activities associated with locate and mark: (1) Locate and Mark training and (2) Locate & Mark Operator Qualification. Adequately preparing employees, by offering educational opportunities and resources, gives them the knowledge to implement State and Company policies and procedures in a safe manner. This, in turn, helps SDG&E operate and maintain its system as well as protect employees, contractors and the public from the likelihood of an event attributable to this risk.

Locate and Mark training consists of approximately two weeks of classroom and hands-on training at the centralized training facility. This is a mandated activity in order to comply with Operator Qualification requirements, and to provide the basic knowledge to satisfactorily perform this critical task. Training schedule is dependent on annual demand.

⁹ As of 2015, which is the base year for purposes of this Report.

¹⁰ The Current and Proposed Risk Mitigation Plans may include mandated, compliance-driven mitigations.

¹¹ D.16-08-018 at p. 146 states "Overall, the utility should show how it will use its expertise and budget to improve its safety record" and the goal is to "make California safer by identifying the mitigations that can optimize safety."

¹² Reliability typically has an impact on safety. Accordingly, it is difficult to separate reliability and safety.

Locate and Mark Operator Qualification training provides demonstrated knowledge and competency to perform locate and mark activities. It is mandated by the U.S. Department of Transportation (DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) in Title 49 CFR Part 192, Subpart N – Qualification of Pipeline Personnel (192.801 through 192.809). Specifically, this enhanced training “requires pipeline operators to document that certain employees have been adequately trained to recognize and react to abnormal operating conditions that may occur while performing specific tasks.”¹³ Employing resources that are formally trained to be aware and react to unusual pipeline conditions allows SDG&E to potentially protect against an adverse event before its occurrence. Locators are qualified at the end of training and then every five years. This certification is an industry standard qualification program.

2. Locate and Mark Activities

This control is comprised of three activities that are related to performing or supporting locate and mark work: (1) Locate and Mark, (2) Pipeline Observation (stand-by), and (3) Staff Support. Verifying that SDG&E is executing such tasks safely can reduce the potential of an event occurring.

The first activity is Locate and Mark, which is the actual work performed by SDG&E gas operations required to respond to over 150,000 USA notifications per year. To do this activity, SDG&E physically goes to the job site, locates any and all pipelines in the vicinity of the excavation, and marks its location appropriately. Knowing the location of the pipeline allows the third-party to avoid that area or carefully perform the excavation work to avoid contact with the pipeline. This activity is mandated by State Law (California Government Code Section 4216, and Federal law (the Code of Federal Regulation, (CFR) Title 49 part 192.614). This control activity also includes all locators, their Supervisor time, vehicles, tools, Mobile Data Terminals (MDTs), Geographical Information System (GIS)-related costs, Ticket routing systems, Dispatch support, locating materials, fees to Regional Notification Centers, and quality assurance.

The second Locate and Mark activity is Pipeline Observation (stand-by). In accordance with Title 49 CFR 192.935, Pipeline Observation (stand-by) is a mandated activity that requires a qualified Company representative to be present anytime excavation activities take place near a covered pipeline segment. Furthermore, the Company requires this activity for all pipelines operating at high pressure (pressure above 60psig), which is an industry best practice. This activity occurs daily in both Distribution and Transmission operations. The purpose of this function is to decrease the likelihood of an event occurring that otherwise could have been prevented by having another pair of qualified eyes observing the work being done. This is a best practice in the gas industry, and is critical to the safety of employees, contractors and the public.

The third activity is staff support. Support staff consists of one SDG&E employee who is responsible for developing and maintaining policies, processes and procedures that guide and direct locators in properly performing their assigned tasks in compliance with Federal and State regulations. Staff is

¹³ <http://www.phmsa.dot.gov/pipeline/tq/oq>.

engaged daily in supporting operations by interpreting policies, tracking compliance, evaluating locate and mark tools and technologies, and providing refresher training as requested. This is a critical activity that allows the Company to meet or exceed State and Federal requirements, and align with industry best practices when applicable.

3. Damage Prevention Public Awareness

Public Awareness is mandated pursuant to Title 49 CFR 192.616. Its purpose is to develop and implement a continuing public education program focused on use of the one-call notification system; hazards associated with the unintended release of gas; physical indications that an unintended release of gas has occurred; steps that should be taken to protect public safety in the event of gas release; and procedures for reporting unintended releases of gas. SDG&E utilizes multiple channels for this communication such as billboards, bill inserts, radio announcements, bumper stickers, safety events, press releases, social media, and sponsorships to capture a vast audience.

6 **Proposed Risk Mitigation Plan**

The 2015 baseline mitigations outlined in Section 5 will continue to be performed in the proposed plan, in most cases, to maintain the current residual risk level. The Company's proposed mitigation plan consists of expanding some baseline activities as well as incremental programs that aim in reducing the frequency of a Dig-In.

1. Training

SDG&E is proposing to maintain this baseline activity with little to no changes. As discussed in Section 5, training is critical and aims to proactively reduce the potential of a dig-in based on factors that SDG&E can control (e.g., mismarks).

2. Locate and Mark Activities

As discussed in Section 5, this mitigation includes the work of performing Locate and Mark, Staff Support and Pipeline Observation (standby). SDG&E is proposing to increase the three activities.

a. Locate and Mark

Over the last 5 years, USA tickets have increased by 15%. This growth is forecast into the future as the current California excavation law gains additional enforcement, and existing public awareness efforts increase excavators' awareness of digging laws. In 2016, the California Governor signed Senate Bill (SB) 661 which established an enforcement Board that is authorized to take action against those parties who violate the excavation law. The amendments are expected to compel more excavators to call USA, which will add upward pressure to an already increasing ticket volume in the State. As a result, more employees will be needed to perform locate and mark activities in order for the Company to meet increasing USA ticket demands and prevent marking delays.

b. Support Staff

An additional management person is needed to analyze the excavation reporting collection and data to identify trends and develop continuous improvement action plans. This person will be specialized in targeting excavation trends needing the most attention, and will have a presence in the field to meet with excavators on the jobsite and provide safe digging education. This person will also work with internal stakeholders to improve internal locate and mark activities, and provide incident investigation support. One example of this person's activities will be to identify ways to prevent excavators from digging without a USA ticket, since 50% of the Company's damages are due to the excavator failing to call USA.

c. Pipeline Observation (standby)

As discussed in 2.a., above, with the rise in USA tickets, external focus and new laws, SDG&E is anticipating that there will be an increased need for pipeline observation. Pipeline observation helps to verify that employees and contractors are performing the work safely and following Company procedures. The proposed plan assumes that the Company's standby activities will grow in the year 2019.

3. Public Awareness

SDG&E is proposing to continue this baseline activity with little to no change. Current public awareness efforts involve a variety of methods for educating excavators and potential excavators about the excavation laws and best practices. These methods include bill inserts, media campaigns, damage prevention industry memberships, sponsorships, radio advertising, internet advertising, billboard advertising, safety meetings, and more.

4. Prevention and Improvements

SDG&E proposes to issue smart devices to locators. This new mitigation will allow SDG&E to proactively manage and mitigate the likelihood of Dig-Ins. Photographs are a common practice across the industry to protect companies from liability and enhance quality of locate and mark activities. Smart devices will give the Company the capability of capturing photographs of location marks at the USA ticket location. The photographs will provide additional documentation for each USA ticket thus offering quality assurance options not currently available. These additional quality audits will improve marking accuracy.

7 **Summary of Mitigations**

Table 4 summarizes the 2015 baseline risk mitigation plan, the risk driver(s) addressed by a certain control activity, and the 2015 baseline costs for Dig-Ins. While control or mitigation activities may address both risk drivers and consequences, risk drivers link directly to the likelihood that a risk event will occur. Thus, risk drivers are specifically highlighted in the summary tables. SDG&E does not account for and track costs by activity, but rather, by cost center and capital budget code. So, the costs shown in Table 4 were estimated using assumptions provided by SMEs and available accounting data.

Table 4: Baseline Risk Mitigation Plan¹⁴
(Direct 2015 \$000)¹⁵

ID	Control	Risk Drivers Addressed	Capital ¹⁶	O&M	Control Total ¹⁷	GRC Total ¹⁸
1	Training*	<ul style="list-style-type: none"> Company employees do not mark the underground gas infrastructure correctly Company does not respond to a one-call center request in the required timeframe 	n/a	\$130	\$130	\$130
2	Locate and Mark Activities*	<ul style="list-style-type: none"> Company employees do not mark the underground gas infrastructure correctly Company does not have personnel perform “standby” duties 	250	2,200	2,450	2,450
	Public Awareness*	<ul style="list-style-type: none"> Third parties do not call prior to their excavation Excavator fails to comply with excavation 	n/a	20	20	20
	TOTAL COST		\$250	\$2,350	\$2,600	\$2,600

* Includes one or more mandated activities

The mitigations and costs presented in Table 4 and 5 mitigate the risk of dig-ins. Some of the activities also mitigate other risks presented in this RAMP Report; specifically, Records Management has

¹⁴ Recorded costs were rounded to the nearest \$10,000.

¹⁵ The figures provided in Tables 4 and 5 are direct charges and do not include Company overhead loaders, with the exception of vacation and sick. The costs are also in 2015 dollars and have not been escalated to 2016 amounts.

¹⁶ Pursuant to D.14-12-025 and D.16-08-018, the Company is providing the “baseline” costs associated with the current controls, which include the 2015 capital amounts. The 2015 mitigation capital amounts are for illustrative purposes only. Because projects generally span several years, considering only one year of capital may not represent the entire mitigation.

¹⁷ The Control Total column includes GRC items as well as any applicable non-GRC jurisdictional items. Non-GRC items may include those addressed in separate regulatory filings or under the jurisdiction of the Federal Energy Regulatory Commission (FERC).

¹⁸ The GRC Total column shows costs typically presented in a GRC.

included GIS-related costs. Employee, Contractor, Customer, and Public Safety, as well as Workforce Planning, also included costs for Operator Qualification and Locate and Mark Training. Additionally, Catastrophic Damage Involving a High-Pressure Gas Pipeline Failure and Catastrophic Damage Involving a Medium-Pressure Gas Pipeline Failure have costs associated with Operator Qualification for specific personnel. Because these activities benefit Dig-Ins as well as the other aforementioned risks, the costs and benefits are being included in all applicable RAMP chapters.

A description of the costs provided in Table 4 is as follows:

1. Training

The costs represent the student or employee labor time of attending the training, as well as materials and instructor time. Given that SDG&E does not account for employees' time in a manner that explicitly provides details about the time spent per employee on training, high level cost estimates were used.

2. Locate and Mark Activities

The costs associated with Pipeline Observation (stand-by) and Staff Support are primarily labor. The Locate and Mark mitigation costs, as described in Section 5, also include labor as well as locating equipment (such as warning mesh, chalk, copper wire, and marker balls) and supporting technology.

3. Public Awareness

This mitigation includes estimated costs for excavator education, advertising and media expenses, promotional, instructional and educational materials, and labor associated with supporting these activities.

Table 5 summarizes SDG&E's proposed mitigation plan, associated projected ranges of estimated O&M expenses for 2019, and projected ranges of estimated capital costs for the years 2017-2019. It is important to note that SDG&E is identifying potential ranges of costs in this plan, and is not requesting funding approval. SDG&E will request approval of funding, in its next GRC. There are non-CPUC jurisdictional mitigation activities addressed in RAMP; the costs associated with these will not be carried over to the GRC. As set forth in Table 5 the utilities are using a 2019 forecast provided in ranges based on 2015 dollars.

Table 5: Proposed Risk Mitigation Plan¹⁹
(Direct 2015 \$000)

ID	Mitigation	Risk Drivers Addressed	2017-2019 Capital ²⁰	2019 O&M	Mitigation Total ²¹	GRC Total ²²
1	Training*	<ul style="list-style-type: none"> Company employees do not mark the underground gas infrastructure correctly Company does not respond to a one-call center request in the required timeframe Company does not have personnel perform “standby” duties 	n/a	\$120 - 140	\$120 - 140	\$120 - 140
2	Locate and Mark Activities*	<ul style="list-style-type: none"> Company employees do not mark the underground gas infrastructure correctly Company does not have personnel perform “standby” duties 	740 - 820	2,600 - 2,870	3,340 - 3,690	3,340 - 3,690
3	Public Awareness*	<ul style="list-style-type: none"> Third parties do not call a one-call center prior to their excavation Excavator fails to comply with excavation laws 	n/a	19 - 21	19 - 21	19 - 21
4	Prevention and Improvements	<ul style="list-style-type: none"> Third parties do not call a one-call center prior to their excavation 	n/a	20 - 30	20 - 30	20 - 30

¹⁹ Ranges of costs were rounded to the nearest \$10,000.

²⁰ The capital presented is the sum of the years 2017, 2018, and 2019 or a three-year total. Years 2017, 2018 and 2019 are the forecast years for SDG&E’s Test Year 2019 GRC Application.

²¹ The Mitigation Total column includes GRC items as well as any applicable non-GRC items.

²² The GRC Total column shows costs typically represented in a GRC.



ID	Mitigation	Risk Drivers Addressed	2017-2019 Capital ²⁰	2019 O&M	Mitigation Total ²¹	GRC Total ²²
		<ul style="list-style-type: none"> Excavator fails to comply with excavation laws Company employees do not mark the underground gas infrastructure correctly Company does not respond to a one-call center request in the required timeframe 				
	TOTAL COST		\$740 - 820	\$2,760 - 3,060	\$3,500 - 3,880	\$3,500 - 3,880

<input type="checkbox"/>	Status quo is maintained
<input checked="" type="checkbox"/>	Expanded or new activity
*	Includes one or more mandated activities

1. Training

SDG&E does not expect a significant change in this activity when compared to the historical financial information. Therefore, the basis for the forecasted costs is the five-year historical average of 2011 to 2015. A range was then developed because the amount of Locate and Mark training and Operator Qualifications may vary on an annual basis.

2. Locate and Mark Activities

The three projects/programs in this mitigation (Locate and Mark, Support Staff and Pipeline Observation) are being expanded in 2017-2019.

- Locate and Mark - The increased costs are labor-related and are based on employee classification wages related to each additional employee. A range was identified to provide flexibility with respect to the employee classification.
- Support Staff - The incremental costs are forecasted for a typical management salary for one employee. A range was identified to provide flexibility with respect to the level of employee and the desired expertise.
- Pipeline Observation - The costs are based on the 2015 recorded costs, and a percentage increase in standby work based on the forecasted increase in USA tickets.

3. Public Awareness

SDG&E does not expect a significant change in this activity from 2015. Accordingly, the basis for the forecasted costs is the five-year historical average of 2011 to 2015. A range was then developed because the amount of Public Awareness spending may vary on an annual basis.

4. Prevention and Improvements

Costs were estimated using a zero-based forecast methodology because this is a new mitigation. The costs in Table 5 include estimates for the acquisition of the initial smart device and ongoing monthly telecommunications service contracts.

8 Risk Spend Efficiency

Pursuant to D.16-08-018, the utilities are required in this Report to “explicitly include a calculation of risk reduction and a ranking of mitigations based on risk reduction per dollar spent.”²³ For the purposes of this Section, Risk Spend Efficiency (RSE) is a ratio developed to quantify and compare the effectiveness of a mitigation at reducing risk to other mitigations for the same risk. It is synonymous with “risk reduction per dollar spent” required in D.16-08-018.²⁴

As discussed in greater detail in the RAMP Approach chapter within this Report, to calculate the RSE the Company first quantified the amount of Risk Reduction attributable to a mitigation, then applied the Risk Reduction to the Mitigation Costs (discussed in Section 7). The Company applied this calculation to each of the mitigations or mitigation groupings, then ranked the proposed mitigations in accordance with the RSE result.

8.1 General Overview of Risk Spend Efficiency Methodology

This subsection describes, in general terms, the methods used to quantify the *Risk Reduction*. The quantification process was intended to accommodate the variety of mitigations and accessibility to applicable data pertinent to calculating risk reductions. Importantly, it should be noted that the analysis described in this chapter uses ranges of estimates of costs, risk scores and RSE. Given the newness of RAMP and its associated requirements, the level of precision in the numbers and figures cannot and should not be assumed.

8.1.1 Calculating Risk Reduction

The Company’s SMEs followed these steps to calculate the Risk Reduction for each mitigation:

1. **Group mitigations for analysis:** The Company “grouped” the proposed mitigations in one of three ways in order to determine the risk reduction: (1) Use the same groupings as shown in the Proposed Risk Mitigation Plan; (2) Group the mitigations by current controls or future mitigations, and similarities in potential drivers, potential consequences, assets, or dependencies

²³ D.16-08-018 Ordering Paragraph 8.

²⁴ D.14-12-025 also refers to this as “estimated mitigation costs in relation to risk mitigation benefits.”

- (e.g., purchase of software and training on the software); or (3) Analyze the proposed mitigations as one group (i.e., to cover a range of activities associated with the risk).
2. **Identify mitigation groupings as either current controls or incremental mitigations:** The Company identified the groupings by either current controls, which refer to controls that are already in place, or incremental mitigations, which refer to significantly new or expanded mitigations.
 3. **Identify a methodology to quantify the impact of each mitigation grouping:** The Company identified the most pertinent methodology to quantify the potential risk reduction resulting from a mitigation grouping’s impact by considering a spectrum of data, including empirical data to the extent available, supplemented with the knowledge and experience of subject matter experts. Sources of data included existing Company data and studies, outputs from data modeling, industry studies, and other third-party data and research.
 4. **Calculate the risk reduction (change in the risk score):** Using the methodology in Step 3, the Company determined the change in the risk score by using one of the following two approaches to calculate a Potential Risk Score: (1) for current controls, a Potential Risk Score was calculated that represents the increased risk score if the current control was not in place; (2) for incremental mitigations, a Potential Risk Score was calculated that represents the new risk score if the incremental mitigation is put into place. Next, the Company calculated the risk reduction by taking the residual risk score (See Table 3 in this chapter.) and subtracting the Potential Risk Score. For current controls, the analysis assesses how much the risk might increase (i.e., what the potential risk score would be) if that control was removed.²⁵ For incremental mitigations, the analysis assesses the anticipated reduction of the risk if the new mitigations are implemented. The change in risk score is the risk reduction attributable to each mitigation.

8.1.2 Calculating Risk Spend Efficiency

The Company SMEs then incorporated the mitigation costs from Section 7. They multiplied the risk reduction developed in subsection 8.1.1 by the number of years of risk reduction expected to be realized by the expenditure, and divided it by the total expenditure on the mitigation (capital and O&M). The result is a ratio of risk reduction per dollar, or RSE. This number can be used to measure the relative efficiency of each mitigation to another.

Figure shows the RSE calculation.

Figure 4: Formula for Calculating RSE

$$\text{Risk Spend Efficiency} = \frac{\text{Risk Reduction} * \text{Number of Years of Expected Risk Reduction}}{\text{Total Mitigation Cost (in thousands)}}$$

²⁵ For purposes of this analysis, the risk event used is the reasonable worst case scenario, described in the Risk Information section of this chapter.

The RSE is presented in this Report as a range, bounded by the low and high cost estimates shown in Table 5 of this chapter. The resulting RSE scores, in units of risk reduction per dollar, can be used to compare mitigations within a risk, as is shown for each risk in this Report.

8.2 Risk Spend Efficiency Applied to This Risk

SDG&E analysts used the general approach discussed in Section 8.1, above, in order to assess the RSE for the Dig-Ins risk. The RAMP Approach chapter in this Report provides a more detailed example of the calculation used by the Company.

The Proposed Risk Mitigation Plan in Section 7 identified five mitigations:

1. Training
2. Locate and Mark Activities
3. Public Awareness
4. Prevention and Improvements
5. Analysis

For purposes of calculating Risk Reduction, the Company further combined these four mitigations into three groups, based on their applicability to potential dig-in drivers, the inter-dependencies of their components, and whether they were current controls or incremental mitigations, as follows:

- (a) In Field Activities and Public Awareness (current controls) – includes mitigations 1, 2, 3, and 4
- (b) In Field Activities and Improvements (incremental mitigations) – includes mitigations 1, 2, and 4
- (c) Admin-side Analysis (incremental mitigations) – includes mitigation 4

An important aspect of this risk is that the starting risk score for Catastrophic Damage Involving Third Party Dig-Ins was the same for both SoCalGas and SDG&E. However, as SDG&E has less than 1/6 the mileage of pipe, and thus less than 1/6 the exposure to this risk, the RSE calculations for SDG&E dig-ins include an adjustment that considers each company's relative miles of pipeline.

- Current In-field dig-in prevention and improvements, and Current Public Awareness (Group a)

This mitigation grouping combines current Public Awareness, Locate and Mark, and other Dig-In Prevention activities, as they are inter-dependent. For example, if public awareness activities were discontinued, there would be far fewer, if any, calls for locate and mark; conversely, if locate and mark activities were discontinued, public awareness alone would not be effective in reducing dig-ins. The Company's analysis addressed each activity separately to identify their respective contributions to risk reduction and then combined the results to determine the overall risk reduction from this mitigation grouping.

- Analysis of Public Awareness activities: According to information in "Reliability-based Prevention of Mechanical Damage to Pipelines (PR-244-9729)," 60% of the people who are very likely to call when they are aware of the option to call in are responsible for 40% of the dig-ins. With an implied 40% of the people responsible for 60% of the dig-ins, the people who don't call cause 2.25 times the dig-ins than those that do. In 2015 SDG&E incurred 137 dig-ins where

there was a call and 175 incidents from failure to notify the one-call center. Multiplying the 137 by 2.25 resulted in an increase in the total number of dig-ins by approximately 55%. The risk assessment team used 54.9% for an estimate of the risk increase if funding for baseline public awareness were discontinued.

- Analysis of Dig-In Prevention activities: The assessment of the risk reduction contribution from current dig-in prevention activities was based on the analysis for incremental dig-in prevention, which is discussed below.
- Incremental In-field Activities and Improvements, and Incremental Admin-side Analysis (Groups b and c)

To assess the risk reduction contributions for the incremental mitigations in Groups b and c, SDG&E used its dig-in incident database, which categorizes dig-in damages by cause. First, for each of the mitigation categories (in-field work and admin-side analysis) the Company identified the share of each damage cause category associated with each mitigation category. Next, SDG&E then totaled the damages within each mitigation grouping. SMEs then estimated the effectiveness of each mitigation in reducing the likelihood of dig-ins in each respective mitigation group (e.g., the extent to which in-field work mitigations affected the in-field work share of the total dig-ins). Summing the resultant number of reduced dig-ins by category and dividing by the total dig-ins yielded that category's effectiveness:

- Incremental In-field dig-in prevention and improvements was determined to have a risk reduction effectiveness of 13%.
- Incremental Admin-side Analysis was determined to have a risk reduction effectiveness of 5%.

8.3 Risk Spend Efficiency Results

Based on the foregoing analysis, SDG&E calculated the RSE ratio for each of the proposed mitigation groupings. Following is the ranking of the mitigation groupings from the highest to the lowest efficiency, as indicated by the RSE number:

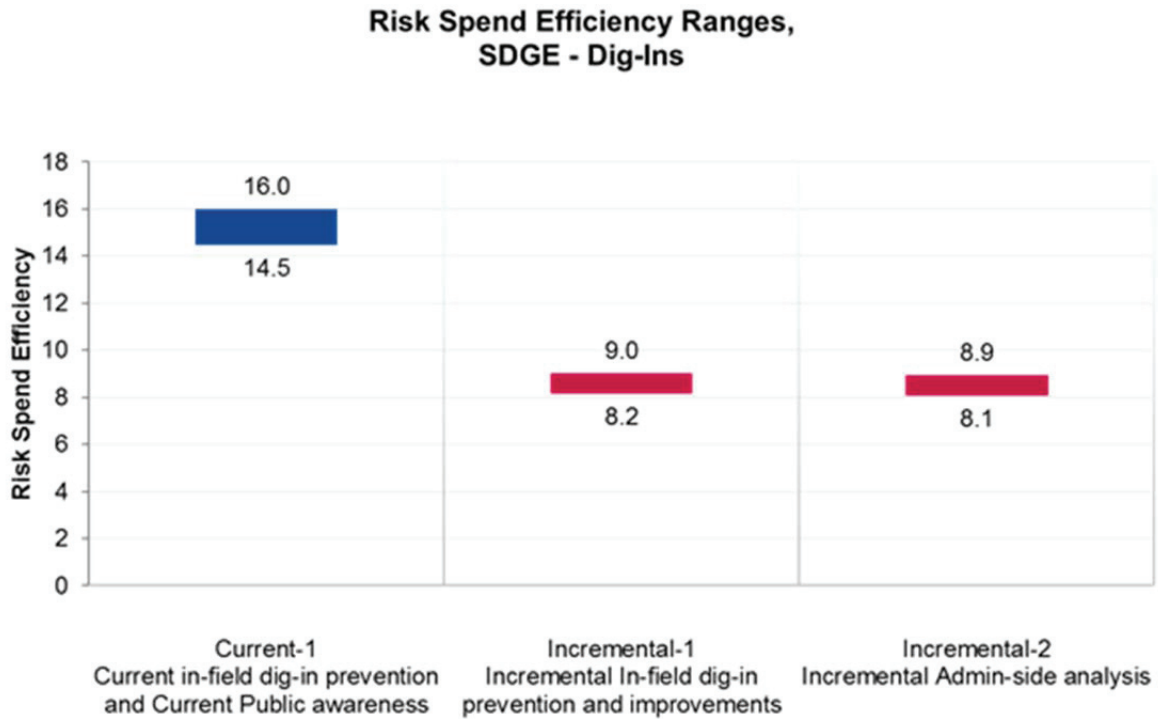
4. In-field dig-in prevention and improvements and current public awareness (current controls)
5. In-field dig-in prevention and improvements (incremental mitigations)
6. Admin-side analysis (incremental mitigations)

Figure displays the range²⁶ of RSEs for each of the SDG&E Dig-In risk mitigation groupings, arrayed in descending order.²⁷ That is, the more efficient mitigations, in terms of risk reduction per spend, are on the left side of the chart. As with most risks, the current mitigations provide the highest risk reduction per dollar, compared to the incremental mitigations.

²⁶ Based on the low and high cost ranges provided in Table 5 of this chapter.

²⁷ It is important to note that the risk mitigation prioritization shown in this Report, is not comparable across other risks in this Report.

Figure 5: Risk Spend Efficiency



9 Alternatives Analysis

SDG&E considered alternatives to the proposed mitigations as it developed the proposed mitigation plan for the Dig-Ins risk. Typically, alternatives analysis occurs when implementing activities, and with vendor selection in particular, to obtain the best result or product for the cost. The alternatives analysis also took into account modifications to the proposed plan and constraints, such as costs and likelihood of success.

9.1 *Alternative 1 – Reduce Contract Locating Usage*

SDG&E considered whether to reduce the level of its reliance on contractors. While contractors play a key role in the Company’s operations, their performance in this area has not been as high as those of the Company’s own locators. Selecting this alternative would require additional resources and, in turn, increase costs. Due to resource flexibility constraints, this alternative was not selected in favor of the proposed plan. Further, it should be noted that to address the issue of contractors’ performance, SDG&E has proposed improvements to its Contractor Safety program (see RAMP chapter, Employee, Contractor and Public Safety).

9.2 *Alternative 2 – Dedicated Standby Group*

SoCalGas also considered whether to separate Locators, who perform standby activities, into their own functional group. This would allow for more focused staffing levels around these efforts, particularly



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high-pressure pipelines which could have incidents with significant impacts. This alternative was dismissed because a dedicated group performing standby activities would eliminate the flexibility to use these Locators for other tasks when needed. Thus, creating the need for additional resources. Accordingly, the proposed plan is preferred because this alternative could limit operational flexibility and add incremental costs for additional resources.