



Risk Assessment Mitigation Phase

(Chapter SDG&E-7)

Third Party Dig-in on a Medium Pressure Pipeline

November 27, 2019

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Risk: Third Party Dig-in on a Medium Pressure Pipeline

I. INTRODUCTION

The purpose of this chapter is to present the Risk Mitigation Plan for San Diego Gas & Electric Company's (SDG&E or Company) Third Party Dig-in on a Medium Pressure Pipeline risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014, and the Settlement Agreement included therein (the SA Decision).¹

SDG&E has identified and defined RAMP risks in accordance with the process described in further detail in Chapter RAMP-B of this Report. On an annual basis, SDG&E's Enterprise Risk Management (ERM) organization facilitates the Enterprise Risk Registry (ERR) process, which influenced how risks were selected for inclusion in the 2019 RAMP Report, consistent with the SA Decision's directives.

The purpose of RAMP is not to request funding. Any funding requests will be made in SDG&E's General Rate Case (GRC). The costs presented in the 2019 RAMP Report are those costs which SDG&E anticipates requesting recovery for in the Test Year (TY) 2022 GRC. The information presented in the 2019 RAMP Report will be refined with supporting testimony and integrated into the TY 2022 GRC.² For the 2019 RAMP Report, the baseline costs are the costs incurred in 2018, as further discussed in Chapter RAMP-A. The 2019 RAMP Report presents capital costs as a sum of the years 2020, 2021 and 2022 as a three-year total; whereas, O&M costs are only presented for TY 2022.

Costs for each activity that directly addresses each risk are provided where those costs are available and are within the scope of the analysis required in this RAMP Report. Throughout the 2019 RAMP Report activities are delineated between controls and mitigations, consistent with the definitions adopted in the 2018 S-MAP Revised Lexicon per D.18-12-014. A "Control" is

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

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



defined as a currently established measure that is modifying risk. A “Mitigation” is defined as a measure or activity proposed or in process designed to reduce the impact/consequences and/or likelihood/probability of an event. Activities presented in this chapter are representative of those that are primarily scoped to address SDG&E’s Third Party Dig-in on a Medium Pressure Pipeline risk; however, many of the activities presented herein also help mitigate other risk areas as outlined in Chapter RAMP-A.

As discussed in Chapter RAMP-D, Risk Spend Efficiency (RSE) Methodology, no RSE calculation is provided where costs are not available or not presented in this RAMP Report (including costs for activities that are non-GRC jurisdictional and certain internal labor costs). Additionally, SDG&E did not perform RSE calculations on mandated activities. Mandated activities are defined as activities conducted in order to meet a mandate or law, such as a Code of Federal Regulation (CFR), Public Utilities Code statute, or General Order (GO). Activities with no RSE score presented in this RAMP Report are identified in Section VII below.

SDG&E has also included a qualitative narrative discussion of certain risk mitigation activities that would otherwise fall outside of the RAMP Report’s requirements, to aid the California Public Utilities Commission (CPUC or Commission) and stakeholders in developing a more complete understanding of the breadth and quality of SDG&E’s mitigation activities. These distinctions are discussed in the applicable Control/Mitigation narratives in Section V. Similarly, a narrative discussion of certain “mitigation” activities and their associated costs is provided for certain activities and programs that may indirectly address the risk at issue, even though the scope of the risk as defined in the RAMP Report may technically exclude the mitigation activity from the RAMP analysis. This additional qualitative information is provided in the interest of full transparency and understandability, consistent with guidance from Commission staff and stakeholder discussions.

SDG&E and the Southern California Gas Company (SoCalGas), collectively the “Companies,” own and operate an integrated natural gas system. The Companies collaborate to develop policies and procedures that pertain to the engineering and operations management of the gas system operated in both the SDG&E and SoCalGas territory to maintain consistency. However, execution of such policies and procedures are the responsibility of the employees at



respective geographically delineated operating unit headquarters. Accordingly, there are similar mitigation plans presented in the 2019 RAMP Report across the Companies’ third party dig-in related chapters.³

A. Risk Definition

For purposes of this TY 2022 RAMP Report, the Third Party Dig-in on a Medium Pressure Pipeline risk is defined as a dig-in on a medium pressure pipeline [Maximum Allowable Operating Pressure (MAOP), at or lower than 60 pounds per square inch gauge (psig)] caused by third party activities which results in significant consequences including serious injuries and/or fatalities.

B. Summary of Elements of the Risk Bow Tie

Pursuant to the SA Decision,⁴ for each Control and Mitigation presented herein, SDG&E has identified which element(s) of the Risk Bow Tie the Control or Mitigation addresses. Below is a summary of these elements.

Table 1: Summary of Risk Bow Tie Elements

ID	Description of Driver/Trigger and Potential Consequence
DT.1	Excavators such as, contractors or property homeowners/tenants do not call 811 one-call center (USA) for locate and mark prior to excavation
DT.2	Locator error contributing to the incorrect marking of underground gas structures
DT.3	Hand excavation is not performed in the vicinity of located gas pipelines
DT.4	Company does not respond to 811 requests in required timeframe
DT.5	Delayed updates to asset records of underground gas infrastructure leading to incorrect locate and mark
PC.1	Serious Injuries and/or Fatalities
PC.2	Property Damage
PC.3	Prolonged Outages
PC.4	Penalties and Fines
PC.5	Adverse Litigation

³ The other third party dig-in related chapters in the 2019 RAMP Report include: SCG-6 – Third Party Dig-in on a Medium Pressure Pipeline; SCG-7 – Third Party Dig-in on a High Pressure Pipeline; and SDG&E-9 – Third Party Dig-in on a High-Pressure Pipeline.

⁴ D.18-12-014 at Attachment A, A-11 (“Bow Tie”).

ID	Description of Driver/Trigger and Potential Consequence
PC.6	Erosion of Public Confidence

C. Summary of Risk Mitigation Plan

Pursuant to the SA Decision,⁵ SDG&E has performed a detailed pre- and post-mitigation analysis of Controls and Mitigations for each risk selected for inclusion in RAMP, as further described below. SDG&E’s baseline Controls for this risk consist of the following programs/activities:

Table 2: Summary of Controls

Control ID	Control Name
SDG&E-7-C1	Locate and Mark Training
SDG&E-7-C2	Locate and Mark Activities
SDG&E-7-C3	Locate and Mark Annual Refresher Training and Competency Program
SDG&E-7-C4	Locate and Mark Operator Qualification
SDG&E-7-C5	Locate and Mark Quality Assurance Program
SDG&E-7-C6	Damage Prevention Analyst Program
SDG&E-7-C7	Prevention and Improvements-Refreshed Laptops
SDG&E-7-C8	Public Awareness Compliance
SDG&E-7-C9	Increase Reporting of Unsafe Excavation
SDG&E-7-C10	Public Awareness - Secure Greater Enforcement through Legislation and California State Digging Board
SDG&E-7-C11	Public Awareness - Meet with Cities with Highest Damage Rates
SDG&E-7-C12	Public Awareness - Remain Active Members of the California Regional Common Ground Alliance
SDG&E-7-C13	Continue to Participate in the Gold Shovel Standard Program
SDG&E-7-C14	Locating Equipment
SDG&E-7-C15	Remain Active Members of the 811 California One-Call Centers

SDG&E will continue the baseline Controls identified above and describes additional projects and/or programs (*i.e.*, Mitigations) as follows:

⁵ *Id.* at Attachment A, A-11 (“Definition of Risk Events and Tranches”).

Table 3: Summary of Mitigations

ID	Mitigation Name
SDG&E-7-M1	Automate Third Party Excavation Incident Reporting
SDG&E-7-M2	Establish a program to address the area of continual excavation
SDG&E-7-M3	Recording photographs for each locate and mark ticket visited by locator
SDG&E-7-M4	Utilize electronic positive response
SDG&E-7-M5	Enhance process to utilize and leverage emerging excavation technology to help with difficult locates
SDG&E-7-M6	Promote process and system improvements in USA ticket routing and monitoring
SDG&E-7-M7	Leverage data gathered by locating equipment
SDG&E-7-M8	Install warning mesh above buried company facilities

Finally, pursuant to the SA Decision,⁶ SDG&E considered alternatives to the mitigations for the Third Party Dig-in on a Medium Pressure Pipeline Risk and summarizes the reasons that the alternatives were not included into the mitigation plans in Section VIII.

II. RISK OVERVIEW

Excavation damage, or dig-ins, to medium pressure underground gas infrastructure has been a risk to SDG&E for as long as pipe has been buried underground. This risk is not a risk unique to the Company. Third-party dig-ins are a common national problem for all industries and utilities with buried infrastructure. These “third-party” excavation activities can vary widely based on project scope and size. Examples can include a homeowner doing landscaping work, a plumber repairing a sewer line, or a city upgrading its aging municipal water or sewer systems.

Third-party excavation damage can range from minor scratches or dents, to ruptures with an uncontrolled release of natural gas. The release of natural gas may not just occur at the time of the damage. A leak or rupture may also occur after the infrastructure has sustained more minor damage, but then becomes weakened over time. Once damaged, the responsible party may not report non-gas release damages, bypassing the efforts of the Company to assess and make the appropriate repairs before a weakening of the pipe occurs.

⁶ *Id.* at 33.

Serious consequences may result if an event occurs because of this risk. For example, if a leak or rupture occurs, an ignition of the released gas could lead to an explosion, fire or both. The nearby public could be seriously injured, and property damage can be extensive.

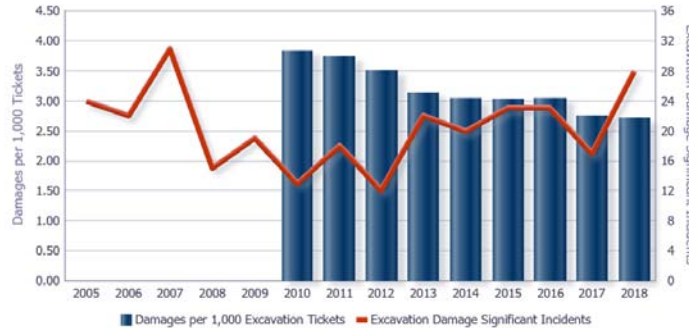
Federal and state agencies have responded to the third party dig-ins risk by adopting numerous regulations and industry standards⁷ and have promoted other efforts⁸ to help prevent third-party dig-ins. For example, the Department of Transportation (DOT) sponsored the “Common Ground Study”, completed in 1999. The “Common Ground Study” then led to the creation of the Common Ground Alliance (CGA), a member-driven association of 1,700 individuals, organizations, and sponsors in every facet of the underground utility industry. With industry-wide support, CGA created a comprehensive consensus document that details the best practices addressing every stake-holder groups’ activity in promoting safe excavation and preventing dig-in damages.

While these efforts are important and commendable, and the number of dig-ins per 1,000 excavation tickets has been trending down (Figure 1), the numbers still remain high. Figure 1 represents trends for third party dig-ins on distribution lines. Similar data is not available for transmission lines since transmission incidents caused by excavation are not common enough to trend. Thus, the Pipeline and Hazardous Materials Safety Administration (PHMSA) collects ticket totals in annual reports for distribution facilities but does not collect ticket information for transmission facilities.

⁷ 49 Code of Federal Regulations (CFR) § 192, *et al.*; *id.* at § 196; Cal. Govt. Code § 4216, General Order (GO) 112-F; American Petroleum Institute (API) Recommended Practice (RP) 1162.

⁸ Common Ground Alliance (CGA), Best Practices Guide (March 2019), available at <https://commongroundalliance.com/best-practices-guide>.

Figure 1: Excavation Tickets & Incidents⁹



Under California State Law,¹⁰ a third-party planning excavation work is required to contact the Regional Notification Center for their area, also known as 811 or Underground Service Alert (USA), at least two (2) full working days prior to the start of their construction excavation activities, not including the day of the notification. Eight-One-One (811) is the national phone number designated by the Federal Communications Commission (FCC), that connects homeowners who plan to dig with professionals through a local call center. California has two Regional Notification Centers, DigAlert and USA North, that split California at the Los Angeles /Kern county and Santa Barbara/San Luis Obispo county lines; USA North serves all counties north of the county lines and DigAlert serves all counties south of the county lines. DigAlert and USA North will be referenced as 811 USA for the remainder of this chapter. Once a third-party makes the contact, the Regional Notification Center will issue a USA Ticket notifying local utilities and other operators of the location and areas to be inspected for potential conflicts of underground infrastructure with the pending excavation work. Operators are required to provide a positive response to indicate that there are no facilities in conflict or 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 substructures are located. The law also requires third-

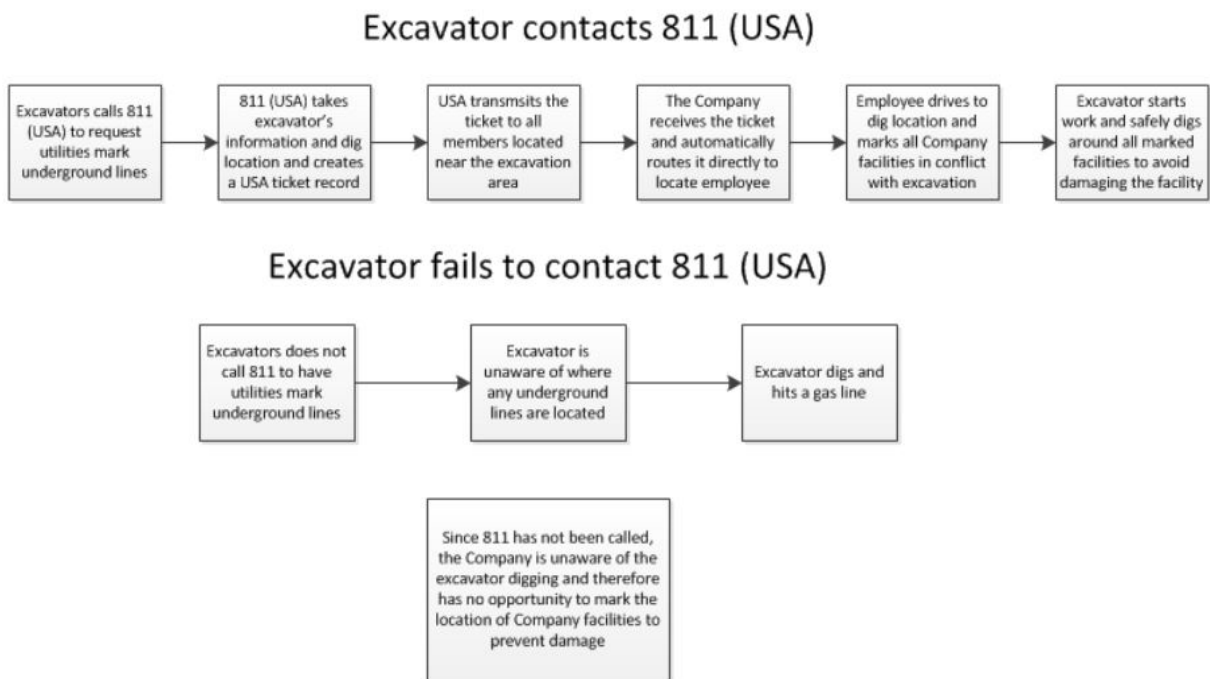
⁹ See United States Department of Transportation, *National Pipeline Performance Measures*, available at <https://www.phmsa.dot.gov/data-and-statistics/pipeline/national-pipeline-performance-measures/>.

¹⁰ Cal. Govt. Code § 4216.2(b).

party excavators to use careful, manual (hand digging) methods to expose substructures prior to using mechanical excavation tools.

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

Figure 2: Excavation Contact Process Flow



As can be seen from the above flow charts, while there may be more steps when a third party calls 811 USA 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 USA before digging is critical and can significantly reduce the likelihood of a potential event if the correct processes are followed.

SDG&E managed nearly 130,000 811 USA tickets and reported over 300 dig-in excavation damages in 2018. Further analysis of the reported damage incidents shows that 50% were due to a lack of notification to 811 USA for a locate and mark ticket and another nearly



36% were due to insufficient excavation practices even after the excavator called 811 USA and underground facilities were marked.¹¹

In addition to direct involvement with excavators and 811 USA, SDG&E engages in promoting safe digging practices through its Public Awareness Program¹² and corporate safety messaging through stakeholder outreach. The message is presented by way of multi-formatted educational materials through mail, email, social media, television, radio, events, and association sponsorships. This Control is further described in Section V.

III. RISK ASSESSMENT

In accordance with the SA Decision,¹³ this section describes the Risk Bow Tie, possible drivers, and potential consequences of the Third Party Dig-in on a Medium Pressure Pipeline risk.

A. Risk Bow Tie

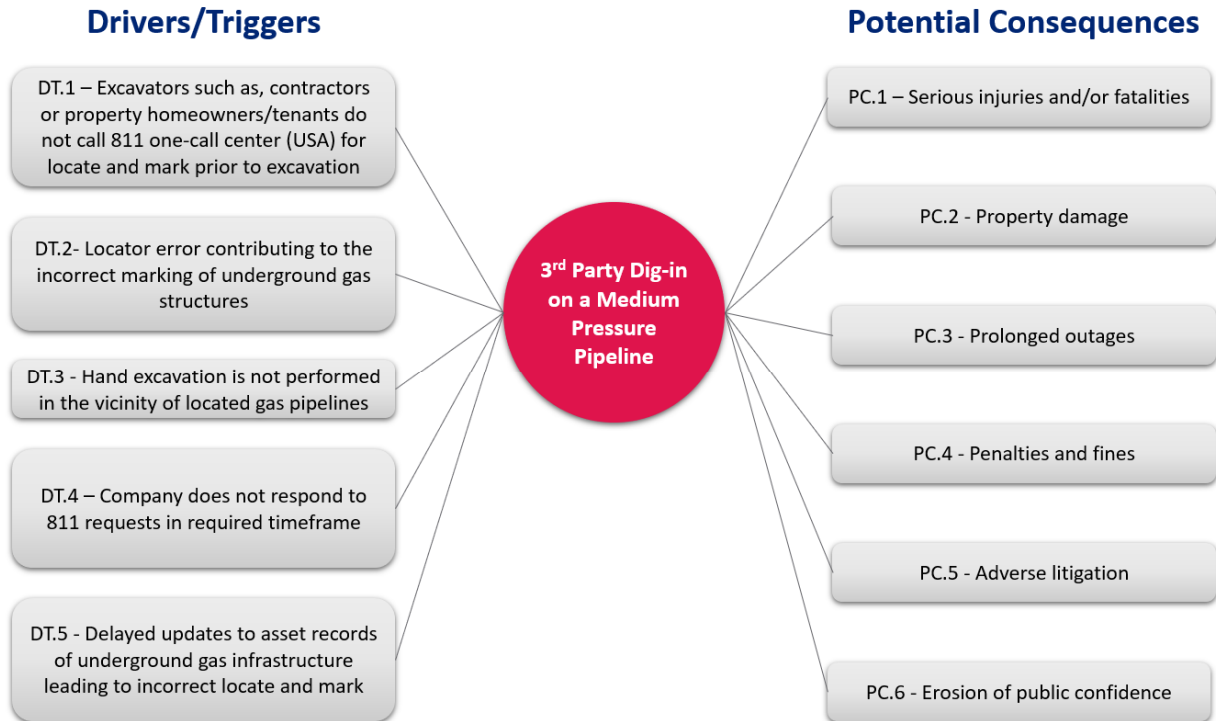
The Risk Bow Tie shown in Figure 1, below, is a commonly-used tool for risk analysis. The left side of the Risk Bow Tie illustrates drivers/triggers that lead to a risk event and the right side shows the potential consequences of a risk event. SDG&E applied this framework to identify and summarize the information provided above. A mapping of each Control/Mitigation to the element(s) of the Risk Bow Tie addressed is provided in Appendix A.

¹¹ Common Ground Alliance, *CGA Released 2018 Damage Information Reporting Tool (DIRT) Report*, available at <https://commongroundalliance.com/DIRT>.

¹² API 1162.

¹³ D.18-12-014 at 33 and Attachment A, A-11 (“Bow Tie”).

Figure 3: Risk Bow Tie



B. Asset Groups or Systems Subject to the Risk

The SA Decision directs the utilities to endeavor to identify all asset groups or systems subject to the risk. These assets primarily include the Natural Gas Pipeline Distribution System. SDG&E’s medium and high-pressure distribution pipeline system is comprised of plastic and steel medium and high pressure pipelines and appurtenances (*e.g.*, meters, regulators, risers). The aforementioned portions operating over 60 psig comprise the high-pressure portion of the system. Some Distribution pipelines operate at over 20% of the pipeline’s Specified Minimum Yield Strength (SMYS), and they are considered to be transmission pipelines by definition; however, these assets are operated by Distribution Operations.

C. Risk Event Associated with the Risk

The SA Decision¹⁴ instructs the utility to include a Bow Tie illustration for each risk included in RAMP. As illustrated in the above Bow Tie, the risk event (center of the bow tie) is

¹⁴ *Id.* at Attachment A, A-11 (“Definition of Risk Events and Tranches”).

a third party dig-in on a medium pressure pipeline event that results in any of the Potential Consequences listed on the right. The Drivers/Triggers that may contribute to this risk event are further described in the section below. The Risk Scenario (*i.e.*, a potential reasonable worst-case scenario used to assess the residual risk impacts and frequency) is assessed for SDG&E' 2018 Enterprise Risk Registry. This scenario does not necessarily address all Drivers/Triggers and Potential Consequences and does not reflect actual or threatened conditions.

D. Potential Drivers/Triggers¹⁵ of Risk Event

When performing the risk assessment for Third Party Dig-in on a Medium Pressure Pipeline, SDG&E identified potential leading indicators, referred to as drivers. These include, but are not limited to:

- **DT.1 – Excavators such as, contractors or property homeowners/tenants do not call 811 one-call center (USA) for locate and mark prior to excavation:** Despite the creation of Regional Notification Centers to inform and allow excavators to have underground infrastructure located and marked, and advertising campaigns alerting the excavator of the need to do so, incidents still occur where excavations are conducted without first calling 811 USA. In fact, third party failure to contact the Regional Notification Center prior to excavating is the leading contributor of damages to Company pipelines. Third parties can damage or rupture underground pipelines and potentially cause property damage, injuries, or even death if gas lines are not properly marked before excavation activities begin. Without receiving an 811 USA ticket, the Company has no opportunity to mark its facility within the area of excavation.
- **DT.2 – Locator error contributing to the incorrect marking of underground gas structures:** The Company or Company Contractors in some cases, inaccurately mark facilities due to incorrect operations, such as mapping/data inaccuracies, equipment signal interference, and human error. When this happens, third parties are not provided with accurate knowledge of underground

¹⁵ An indication that a risk could occur. It does not reflect actual or threatened conditions.

structures in the vicinity of their excavations and the risk of damaging or rupturing gas pipelines increases.

- **DT.3 – Hand excavation is not performed in the vicinity of located gas pipelines:** Before using any power operated excavation equipment or boring equipment, the excavator is required to hand expose, using “Hand Tools,”¹⁶ to the point of no conflict 24 inches on either side of the Medium-Pressure Gas Pipeline 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.
- **DT.4 – Company does not respond to 811 requests in required timeframe:** Company may fail to respond to 811 USA requests within the ‘legal excavation start date and time’¹⁷ (within two working days of notification, excluding weekends and state holidays, not including the date of notification, or before the start of the excavation work, whichever is later, or at a time mutually agreeable to the operator and the excavator). This may happen because of human error, poor communication, or system failures. In these cases, the third party may not know that the locate and mark activity was not performed and may wrongly assume that not seeing any marking at their excavation site indicates there is no gas infrastructure nearby. Without the marked gas infrastructure, third parties may damage or rupture the infrastructure if they are performing excavation activities near pipelines.
- **DT.5 – Delayed updates to asset records of underground gas infrastructure leading to incorrect locate and mark:** The Company may fail to supply the necessary information in a timely manner to update permanent mapping records necessary to meet federal, state, and local regulations, as well as corporate needs. This could result in underground infrastructure being incorrectly marked, which

¹⁶ Cal. Govt. Code § 4216(i).

¹⁷ *Id.* at § 4216(l).

could lead to third party damage if the excavator does not have the correct information on infrastructure location. In addition, in the event in which a pipeline is damaged, obsolete maps could cause delays in performing the necessary repairs.

E. Potential Consequences of Risk Event

If one or more of the Drivers/Triggers listed above were to result in an incident, the Potential Consequences, in a reasonable worst-case scenario, could include:

- Serious injuries¹⁸ and/or fatalities;
- Property damage;
- Prolonged outages;
- Adverse litigation;
- Penalties and fines; and
- Erosion of public confidence.

These Potential Consequences were used in the scoring of SDG&E's Third Party Dig-in on a Medium Pressure Pipeline Risk that occurred during the development of SDG&E's 2018 Enterprise Risk Registry.

IV. RISK QUANTIFICATION

The SA Decision sets minimum requirements for risk and mitigation analysis in RAMP, including enhancements to the Interim Decision 16-08-018. SDG&E has used the guidelines in the SA Decision as a basis for analyzing and quantifying risks, as shown below. Chapter RAMP-C of this RAMP Report explains the Risk Quantitative Framework which underlies this Chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

¹⁸ As defined by Cal/OSHA as “any injury or illness occurring in a place of employment or in connection with any employment which requires inpatient hospitalization for a period in excess of 24 hours for other than medical observation or in which an employee suffers a loss of any member of the body or suffers any serious degree of permanent disfigurement, but does not include any injury or illness or death caused by the commission of a Penal Code violation, except the violation of Section 385 of the Penal Code, or an accident on a public street or highway.” See 8 CCR § 330(h).

Table 4: Risk Quantification Scores¹⁹

Third Party Dig-in on a Medium Pressure Pipeline	Low Alternative	Single Point	High Alternative
Pre-Mitigation Risk Score	125	172	250
LoRE	338		
CoRE	0.4	0.5	0.7

A. Risk Scope & Methodology

The SA Decision requires a pre- and post- mitigation risk calculation.²⁰ The below section provides an overview of the scope and methodologies applied for the purpose of risk quantification.

Table 5: Risk Quantification Scope

In-Scope for purposes of risk quantification	The risk of a dig-in on a medium pressure pipeline (MAOP at or lower than 60 psig) caused by third party activities, which results in consequences such as injuries or fatalities or outages.
Out-of-Scope for purposes of risk quantification	The risk of pipeline event unrelated to a third party dig-in on a medium-pressure pipeline (MAOP at or lower than 60 psig) which results in consequences such as injuries or fatalities or outages.

Pursuant to Step 2A of the SA Decision , the utility is instructed to use actual results, available and appropriate data (e.g., PHMSA data).²¹

¹⁹ The term “pre-mitigation analysis,” in the language of the SA Decision (Attachment A, A-12 (“Determination of Pre-Mitigation LoRE by Tranche,” “Determination of Pre-Mitigation CoRE,” “Measurement of Pre-Mitigation Risk Score”), refers to required pre-activity analysis conducted prior to implementing control or mitigation activity.

²⁰ D.18-12-014 at Attachment A, A-11 (“Calculation of Risk”).

²¹ *Id.* at Attachment A, A-8 (“Identification of Potential Consequences of Risk Event”).

Historical PHMSA data and internal SME input was used to estimate the frequency of incidents. To determine the incident rate per year for SDG&E, the national average incident rate per mile per year was applied to the medium-pressure pipeline miles at SDG&E.

The safety risk assessment primarily utilized data from the PHMSA, the reliability risk assessment was based on internal data, and the financial risk assessment was estimated based on both PHMSA and internal data. Internal SME input, based on recent damage repair costs, was used to estimate the financial consequence of incidents. Historical PHMSA medium-pressure gas incidents were also used in estimating financial and safety consequences. The reliability incident rate per year was estimated using internal data. Additionally, Monte Carlo simulation was performed to understand the range of possible consequences.

B. Sources of Input

The SA Decision²² directs the utility to identify Potential Consequences of a Risk Event using available and appropriate data. The below provides a listing of the inputs utilized as part of this assessment.

- Annual Report Mileage for Natural Gas Transmission & Gathering Systems
 - Agency: PHMSA
 - Link: <https://cms.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-natural-gas-transmission-gathering-systems>
- Annual Report mileage for Gas Distribution Systems
 - Agency: PHMSA
 - Link: <https://cms.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-gas-distribution-systems>
- Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data
 - Agency: PHMSA
 - Link: <https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data>

²² *Id.* at Attachment A, A-8 (“Identification of the Frequency of the Risk Event”).

- SDG&E medium-pressure pipeline miles
 - 2017 internal SME data
- Gas industry sales customers
 - Agency: AGA (2016Y)
 - Link:
<https://www.aga.org/contentassets/d2be4f7a33bd42ba9051bf5a1114bfd9/section8divider.pdf>
- SDG&E end user natural gas customers
 - Source: SNL (2016Y, from the FERC Form 2/2-F, 3/3-A or EIA 176)
 - Link:
<https://platform.mi.spglobal.com/web/client?auth=inherit&newdomainredirect=1&#company/report?id=4057146&keypage=325311>

V. RISK MITIGATION PLAN

The SA Decision requires a utility to “clearly and transparently explain its rationale for selecting mitigations for each risk and for its selection of its overall portfolio of mitigations.”²³ This section describes SDG&E’ Risk Mitigation Plan by each selected Control and Mitigation for this risk, including the rationale supporting each selected Control and Mitigation.

As stated above, SDG&E’ Third Party Dig-in on a Medium Pressure Pipeline Risk involves impact to gas infrastructure arising from third party dig-ins resulting in significant consequences including serious injuries and/or fatalities. The Risk Mitigation Plan discussed below includes both Controls that are expected to continue and Mitigations for the period of SDG&E’ Test Year 2022 GRC cycle. The Controls are those activities that were in place as of 2018, most of which have been developed over many years, to address this risk and include work to comply with laws that were in effect at that time.

A. SDG&E-7-C1 – Locate and Mark Training

This program provides employees with the training to perform activities associated with locate and mark. Adequately preparing employees by offering educational opportunities and

²³ *Id.* at Attachment A, A-14 (“Mitigation Strategy Presentation in the RAMP and GRC”).



resources gives them the knowledge to implement governmental 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 threat of an event attributable to this risk.

Locate and Mark Training consists of approximately seven days of classroom and hands-on training at a centralized training facility, as well as eLearning. SDG&E will continue to implement a competency based training program that will encompass training designed for third-party dig-ins policy and procedural changes. A competency based online/video training module system enhances SDG&E's ability to incorporate new policies and increases learning at a faster pace. This system uses a comprehensive, multimedia, competency-based training approach which will include self-paced, individualized, modular instruction, eLearning, just-in-time training, structured on-the-job training and mentoring. This is a mandated activity in order to comply with Operator Qualification requirements and to provide the basic knowledge necessary to satisfactorily perform this critical task. The training schedule is dependent on annual demand, but occurs, on average, about every two months.

The training provides the participating employees several key components of locating, enabling them to locate and mark the below ground facilities accurately and in the appropriate time frame. The marked facilities provide the excavator with approximate locations of where the gas lines exist in the work area which enables the excavator to either avoid the areas or dig with hand tools so underground substructures are not accidentally damaged by the excavation work.

B. SDG&E-7-C2 – Locate and Mark Activities

This Locate and Mark Activity includes three efforts: (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 which is required to respond to over 130,000 811 USA notifications per year.²⁴ To do this activity, SDG&E's locators travel to the job site and locate and mark any and all company

²⁴ Represents 811 USA notifications for SDG&E's distribution and transmission system.



operated pipelines in the delineated work area. Understanding the physical 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 both State²⁵ and Federal law.²⁶ This Control activity also includes all aspects necessary to performing the mandated locate and mark activities, including locators, vehicles, tools, Mobile Data Terminals (MDTs), Geographical Information System (GIS)-related costs, ticket routing systems, 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 Code of Federal Regulation, section 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. 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 employees who are 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 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.

C. SDG&E-7-C3 – Locate and Mark Annual Refresher Training & Competency Program

All resources performing locate and mark activities must complete an annual re-training and re-fresh program. This program consists of local supervisors reviewing the gas standards

²⁵ Cal. Govt. Code § 4216.

²⁶ 49 CFR § 192.614.



with the locate and mark workforce. All employees are required to pass the refresher training in order to continue locate and mark activities. This refresher training involves all aspects of the Locate and Mark procedures to allow personnel to be able to successfully receive a ticket and provide a proper positive response. Similar to the Locate and Mark training mentioned above, refresher training will also be an interactive eLearning course, which potentially will consist of on-the-job training and mentoring. This is a mandated activity in order to comply with regulations and code requirements and to provide employees with the basic knowledge to satisfactorily perform this critical task.²⁷

D. SDG&E-7-C4 – Locate and Mark Operator Qualification

Locate and Mark Operator Qualification (OQ) training is an enhanced training which 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. It provides for an employee to field-demonstrate the employee's knowledge and competency to perform specific locate and mark tasks. The training demonstrates an employee's knowledge and competency to perform locate and mark activities and is mandated by PHMSA.²⁸ 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.

E. SDG&E-7-C5 – Locate and Mark Quality Assurance Program

The Locate and Mark quality assurance audit program reviews work activity to determine whether proper processes and procedures are being met. This includes, but is not limited to, employee qualification, equipment setup and use, regulatory code requirements, Company Gas Standard requirements, accuracy of locate and mark activities, proper and thorough documentation, use of the Korterra ticket management system, job observations, and stand-by observations.

²⁷ See Cal. Govt. Code § 4216.

²⁸ 49 CFR §§ 192.801 - 192.809.



SDG&E has developed guidelines for quality assessments of locate and mark activities. The Gas Compliance Quality Management (GCQM) team conducts the re-occurring assessments of all districts (or bases) in order to provide an independent check of processes and to verify that applicable documentation is accurate and complete. The assessments include equipment testing, documentation reviews, field checks, and operator qualification reviews. After the assessment is complete, the GCQM will review findings with base management and gas distribution operations. Base management acknowledges the final report and develops plans for corrective actions, which are provided to GCQM. Findings are tracked, recorded, and monitored by base supervision.

Adherence to proper company policy and procedures reduces the percentage of Locate and Mark mismarks, increases the overall awareness of unsafe activity, and expedites response times.

F. SDG&E-7-C6 - Damage Prevention Analyst

SDG&E Damage Prevention Analysts work to reduce the number of third-party excavation incidents in cities and jurisdictions with the highest number of reported occurrences by addressing the contractors and excavators operating in these jurisdictions. The intent of the SDG&E Damage Prevention Analyst program is to promote safe excavation practices and reduce the number of excavation damages. An important method of achieving this goal is to build and foster positive relationships with the excavator community through visibility, communication, and safe excavation education. Through this effort the desire is also for these employees to be viewed as a resource for contractors and to help overcome obstacles when excavating in the vicinity of underground SDG&E infrastructure. To achieve these objectives, the Analysts are equipped with the current 811 USA ticket information and GIS/mapping information for the local pipe network. Analysts also regularly partner with SDG&E's operating district personnel if additional infrastructure location information is needed.

The Damage Prevention Analysts prioritize their daily job site visits with the aid of a ticket prioritization software. Certain construction jobs may be more prone to excavation damage than others due to specific 811 USA ticket attributes and local environmental conditions. Eight-One-One ticket prioritization utilizes historical damage information as well as geographic,



environmental, and other publicly available information. The software then weighs the pertinent attributes and performs calculations using complex algorithms to identify excavation sites that may be more susceptible to third party damages. This prioritization allows for the Company to take appropriate and timely measures to avoid damages such as making an extra phone call or email to the excavator or scheduling a pre-excavation site meeting to discuss the project in detail.

The Damage Prevention Analysts routinely visit active construction sites with known 811 USA tickets in their jurisdiction but will also look out for other active construction sites that do not appear on their 811 USA ticket listing. The purpose for visiting the latter is to make positive contact with the excavator and determine whether the supervision and workers at those projects have followed the safe digging practices. If not, the Analyst explains the safety risks, law violations and potential ramifications, and asks the excavator to stop their job and contact 811 USA to get the proper underground markings. These interactions have been very successful in getting the excavator to halt further excavation work until 811 USA contact was established. The most common reason for “Stopping-The-Job” was due to the excavator not having an 811 USA ticket. In addition, some were due to unsafe excavation practices.

The Damage Prevention Analysts also visit with local municipality personnel to discuss the importance of safe excavation with the Planning and Permitting departments. Gaining a safe-excavation partnership with the entities that approve, permit, and inspect excavation work is seen as an integral part of the Damage Prevention Analyst Program. During the interactions with City officials, the Analysts offer to present educational information regarding the Dig Safe laws and practices to interested parties.

Another key activity that falls within the Damage Prevention Analyst job responsibilities is responding to dig-in damages. Their role is to support the Operations response team through accurate documentation of the incident and collecting all relevant information to enable accurate regulatory reporting, damage-cause trending, and appropriate cost recovery where warranted. This data is used by the Damage Prevention Strategy and Distribution Integrity Management Program teams to evaluate and trend the causes of excavation damage and pursue the appropriate mitigation activities.



G. SDG&E-7-C7 – Prevention and Improvements – Refreshed Laptops

Locate and Mark laptops and software are utilized by SDG&E to comply with the requirements of state and federal regulations.²⁹ SDG&E provides locate and mark technicians rugged laptops called Mobile Data Terminals (MDTs) containing KorMobile© Ticket Management Software to respond to 811 USA tickets in real-time. Using obsolete technology increases wait times, contributes to data communication failure, and increases the likelihood of not responding to an 811 USA ticket requests in the required timeframe.

SDG&E has a service territory that covers about 4,100 square miles, from San Diego to southern Orange counties. The service territory covers 2 counties, and 25 communities. Providing durable refreshed laptops increases efficiency and the ability to work in a rugged outdoor setting. Increasing the processor speed and extending the battery life also allows for prolonged working hours. The refreshed laptops contain a detachable screen with a built in camera allowing the on-site technician to photograph the surroundings and the excavating equipment associated with an 811 USA ticket. A 4G LTE Advanced multi carrier mobile broadband facilitates the response to 811 USA tickets in real-time.

H. SDG&E-7-C8 – Public Awareness Compliance

It is important for contractors and excavators to be informed of the potential safety issues that might arise when working around natural gas pipelines. Underground pipelines can be located anywhere, including under streets, sidewalks and private property – sometimes just inches below the surface. Hitting one of these pipelines while digging, planting or doing demolition work can cause serious injury, property damage, and/or loss of utility service.

Under Title 49 Code of Federal Regulation, section 192.616, SDG&E is required to educate the public, appropriate government organizations, and persons engaged in excavation related activities (1) about the use of a one-call notification system (811 USA) prior to excavation, (2) other damage prevention activities, (3) possible hazards associated with the unintended release from a gas pipeline facility, (4) physical indications of a natural gas release, (5) steps to be taken in the event of a gas pipeline release, and (6) procedures for reporting such

²⁹ 49 CFR § 192.614; Cal. Govt. Code § 4216.



an event. In addition to undertaking actions to meet the minimum requirements of section 192.616, SDG&E participates, promotes, and contributes to other public awareness and excavation improvement programs. To promote public awareness of the 811 USA program SDG&E utilizes various communication methods such as utilized bill inserts, media campaigns, damage prevention industry memberships, sponsorships, radio advertising, internet advertising, billboard advertising, and safety meetings. The four types of audiences identified in section 192.616 are the affected public, emergency officials, local public officials, and excavators. These types of audiences make up the four tranches further described below in Section VI.

I. SDG&E-7-C9 – Increase Reporting of Unsafe Excavation

Senate Bill (SB) 661 modified existing California Government Code section 4126 by establishing the California Underground Facilities Safe Excavation Board (Dig Safe Board). SDG&E has two groups involved in identifying excavators who frequently utilize unsafe practices and reporting those contactors to the appropriate state board. The Damage Prevention Strategies team informs Dig Safe Board investigators about unsafe practices SDG&E witnesses in the field. The Claims Recovery team reports incidents to the Contractor State Licensing Board (CSLB) when it becomes aware of them through its involvement with insurance and financial considerations as a result of incidents. The Dig Safe Board is developing regulations related to reporting and SDG&E plans to implement any new requirements.

J. SDG&E-7-C10 – Public Awareness - Secure Greater Enforcement through Legislation and California State Digging Board

SDG&E continues to actively participate in regulatory proceedings that will support the effectiveness of federal and state safe digging laws through legislation and enforcement of sanctions and penalties. Sanctions and penalties should be enforced against parties not following the well-established rules requiring third parties to call 811 USA to have pipelines marked prior to excavation. SDG&E supported California State Senate Bill SB 661, which modified California Government Code, section 4216, establishing the Dig Safe Board, by providing proposed language to increase protection of underground substructures..

In addition, SDG&E participates at board meetings of the Dig Safe Board, which was created by the Dig Safe Act of 2016 and is included in California's Government Code section



4216.12, Safe Digging law. The Dig Safe Board's charter is to coordinate education and outreach activities that encourage safe excavation practice; develop standards that support safe excavation practices; investigate possible violations of section 4216; and enforce section 4216 to the extent of granted authority.

Company involvement and participation at Dig Safe Board meetings and workshops help foster a positive working relationship with all stakeholders. These meetings and workshops provide the opportunity to raise the issues and concerns facing the Natural Gas industry and issues in regard to excavation damage prevention.

K. SDG&E-7-C11 – Public Awareness - Meet with Cities with Highest Damage Rates

SDG&E Damage Prevention Analysts work to reduce the number of third party excavation incidents in cities and jurisdictions with the highest number of reported occurrences. To achieve this objective, they partner with SDG&E' operating districts management and represented personnel to identify and meet with city officials with functions and responsibilities related to construction and excavation activities in their respective jurisdictions. This effort provides outreach and education to these officials on the proper 811 USA process and safe digging techniques. The officials can then pass those requirements on to the contractors operating in their cities as permits are granted or city inspectors visit job sites.

Cities have many resources and avenues for promoting and executing excavation safety within their communities. All planned work requiring a permit must start at the planning and permits department. Cities thus often have the first opportunity to educate applicants about excavation safety by providing 811 USA literature. On-site City inspectors could also potentially be tasked with patrolling and enforcing California Government Code section 4216 compliance as part of their daily work. City inspectors hold the authority to stop any job that violates code. Cities may also consider preventing excavators from working in their boundaries if the excavator is known to cause frequent excavation violations.

L. SDG&E-7-C12 – Public Awareness - Remain Active Members of the California Regional Common Ground Alliance

The California Regional Common Ground Alliance (CARCGA) is a group of California-based stakeholders who are impacted by excavation activities. CARCGA is the regional group



within the Common Ground Alliance (CGA). The CGA works with its membership to establish best practices for the 811 USA One-Call Centers, underground facility owners, excavators, locators, project owners, and designers. Through its Damage Prevention Strategies function, SDG&E participates with CARCGA members to inform CGA objectives from a regional perspective.

M. SDG&E-7-C13 – Continue to Participate in the Gold Shovel Standard Program

SDG&E requires construction contractors doing work on its behalf to participate in the Gold Shovel program. The program certifies an excavator's policies and procedures against the Gold Shovel Standard, a set of excavator training procedures designed to protect underground facilities. The Gold Shovel standard also publishes a rating which is an ongoing measure of an excavator's digging-safety-worthiness. This requirement serves to incentivize construction contractors to follow safe excavation laws and practices. The Gold Shovel Standard (GSS) is a nonprofit organization committed to improving workforce and public safety and the integrity of buried infrastructure. GSS believes that greater transparency in all aspects of damage prevention among buried-asset operators, locators, and excavators is essential to drive continuous improvement, and vital to increasing safe working conditions and communities. Certifying excavators who participate in the Gold Shovel Program complies with the requirements of Title 49 Code of Federal Regulations, section 192.614 and California Government Code, section 4216.

N. SDG&E-7-C14 – Locating Equipment

SDG&E utilizes locating equipment, updated GIS maps, and/or excavating (daylighting) to verify the physical locations of underground infrastructure. Part of this process involves uploading scanned construction drawings temporarily until the job is posted officially to GIS. SDG&E continues to remain compliant with codes and regulations and follow industry best practices and company policies and procedures as they apply to the safe and effective locating and marking of underground facilities. This Control includes written and accessible procedures, availability of proper equipment, and access to required information to enable personnel to successfully perform their duties. Locating equipment is utilized to comply with the



requirements of Title 49 Code of Federal Regulations, section 192.614 and California Government Code, section 4216.

O. SDG&E-7-C15 – Remain Active Members of the 811 California One-Call Centers

Title 49 Code of Federal Regulations, section 192.614 and California Government Code, section 4216 require natural gas utilities to remain members and actively participate in the activities of 811 USA local one-call centers. Excavators are required to notify the 811 USA one call centers of their intent to dig. Owners of underground facilities in close proximity to the dig site are required to provide a positive response with the location of their facilities that may be in conflict with the excavation and also to provide any other efforts that may be required to protect the integrity of their underground facilities. The members of the one-call centers actively meet to make the 811 USA process easier for excavators while also exploring ways to make the service more accessible on a variety of platforms. They also work to promote the safe digging message through various avenues.

The Controls addressed above will continue to be performed. The Company's Mitigations, addressed below, aim to further reduce the frequency of third party dig-Ins.

P. SDG&E-7-M1 – Automate Third Party Excavation Incident Reporting

Timely and accurate reporting of excavation incidents is a critical component of the continual improvement process. Enhancing the data collection of incidents helps measure the performance of adhering to compliance reporting obligations, and also assists the Company in filing various regulatory reports. The reporting system is the basis for excavation incident analysis and is used to understand the Company's opportunities for internal improvement for locate and mark activities. Through this analysis of excavation incidents, SDG&E can further understand the internal and external leading causes of dig-ins, trend incident locations, trend frequency of damages caused by individual excavators, trend which facilities are damaged the most, and stay informed about the most common damaging excavation equipment.

Currently, there are multiple systems and processes used to capture and report data, internally and externally, as a result of a gas incident. All systems and processes might not be updated simultaneously, thereby creating additional manual steps when using the data for



internal analysis for process improvements, or to generate reports for internal or external stakeholders. SDG&E is undertaking an initiative to consolidate these processes and systems into one system of record to minimize data quality issues, simplify reporting, and standardize data collection among its field supervisors. SDG&E is also actively enhancing its ability to improve data capture, data validation, and automated escalations. New Third Party Excavation Incident Reporting systems will provide accessibility and efficiency across multiple platforms reducing reporting and notification times by automating the reporting process. The upgraded reporting system efficiently analyzes accurate incident data and provides course corrections as locate and mark trends are identified.

Q. SDG&E-7-M2 – Establish a Program to Address Areas of Continual Excavation

Generally, a typical 811 USA ticket is valid for 28 days. However, there are some instances where a locate and mark request can be valid for longer.³⁰ Agricultural excavators who perform repetitive excavations prefer 811 USA Tickets that are valid for longer periods of time. Requiring 811 USA notifications every 28 days could discourage participation in the 811 USA process by agricultural excavators, who may find it too burdensome to renew a ticket. These situations are typically in flood control channels and agricultural fields where excavation and digging activities can occur continually. This mitigation program fulfills the California requirement³¹ to develop a process that would allow for certain agreements for continual excavation, called ACE tickets. In flood control and agricultural situations, SDG&E will meet with the landowner and develop an annual agreement that would allow for safe continual excavation activity within the parameters of the agreement.

³⁰ Although USA tickets are valid for 28 days from the date of issuance, if work continues beyond 28 days, the excavator may renew the ticket per Cal. Govt. Code § 4216.2(e).

³¹ California Senate Bill (SB) 661 modified Cal. Govt. Code § 4216, establishing an Area of Continual Excavation (ACE) Ticket.

Starting in July 2020, excavators working on agricultural and flood control lands may obtain an ACE ticket. The Dig Safe Board has drafted regulations³² requiring operators to address ACE tickets by completing newly developed forms, conducting onsite meetings, potentially excavating the facility, and providing additional records. ACE ticket's purpose is to improve communication and dialog between the agricultural industry and operators.

R. SDG&E-7-M3 - Recording Photographs for Each Locate and Mark Ticket Visited by Locator

Under this mitigation, locators will take photographs of the areas located and marked and the areas the excavators delineated either using white paint or other approved marking methods for each ticket they complete. The pictures taken by the locators will help the company audit the quality of locates and provide an opportunity to improve future marking efforts for the same location. Pictures will also mitigate potential disputes between excavators and SDG&E by providing visual confirmation of the location marks at the time the ticket was located and marked. The photographs will include a digital time stamp and geographical identification metadata.

S. SDG&E-7-M4 – Utilize Electronic Positive Response

SDG&E will utilize an electronic positive response system (EPS) which informs an excavator once a locate and mark activity is completed for the excavator's 811 USA ticket. For example, if the locator marks the jobsite, the excavator will be notified on their USA ticket that the company has completed markings at the ticket location. EPS gives excavators and the company a shared record of locate and mark activity completed by the locator. This will help excavators by providing them with the appropriate documented communication before they dig. Enhancing electronic positive response will be used to measure the performance of adhering to Title 49 Code of Federal Regulations, section 192.614.

³² Dig Safe Board, Resolution No. 19-07-01, *available at* <https://digsafe.fire.ca.gov/media/2197/resolution-19-07-01.pdf>.

T. SDG&E-7-M5 – Enhance Process to Utilize and Leverage Emerging Excavation Technology to Help with Difficult Locates (Vacuum Excavation Technology)

At times, an accurate locate cannot be made using the standard tools available to the locate and mark workforce. In these instances, SDG&E will work with the requesting contractor to help fulfill their request without creating an unsafe situation. More specifically, SDG&E will establish a process to work with the excavator to utilize various alternatives to locate gas facilities or enhance safe-digging technologies. These alternatives include stand-by and observe the contractor as they perform their excavation or use other tools such as a Jameson locator or vacuum technology that can expose the physical pipe for visual verification.

Vacuum excavation is recognized by the damage prevention industry as the safest excavation method that can be used today because the water and air used for excavation is adjustable, preventing damage to pipe and coatings. The Company plans to enhance its excavation practices by using hydro vacuum excavation technology which is typically installed onto a truck or portable trailer and allows the excavator to perform a keyhole excavation process, when applicable. Generally, a keyhole excavation process is utilized to excavate targeted areas.

Hydro vacuum excavation uses water at a high pressure to loosen the soil, this allows for precise excavation and vacuuming of the material. The use of water at a high pressure reduces the soil's cohesiveness thus helping to break the soil and suction easily. Dirt is stored in a debris tank, keeping the work area cleaner and avoiding the creation of dirt spoils. Hydro vacuum excavation is less invasive compared to other traditional methods of excavation. The benefits of hydro vacuum excavation include a reduced likelihood of causing third party damages, faster and precise excavations, and it also requires less manpower compared to conventional excavations.

The keyhole excavation process cost-effectively and safely exposes underground infrastructure to allow operators to perform repairs and maintenance without resorting to more costly and disruptive conventional excavation methods. The keyhole excavation process consists of performing work on the surface with smaller excavations, which can be performed on paved or non-paved areas. Pavement removal can be accomplished often by saw cutting and coring. The size of the pavement opening is determined upon the scope of the task at hand. The normal



process utilizing keyhole excavation involves coring, vacuum excavation, construction and maintenance activities, and finally backfill and pavement restoration.

The Company will enhance its processes to utilize this excavation technology to facilitate hard to locate facilities.

U. SDG&E-7-M6 – Promote Process and System Improvements in USA Ticket Routing and Monitoring

As part of continuous improvement efforts, an assessment of the current state of the 811 USA one-call ticket routing and monitoring process is underway. The intent of this effort is to query system users and managers on potential improvements that would provide benefits to the process. The software vendor, Korterra, has been engaged to provide software solutions for identified system enhancements that will allow for more streamlined data collection, better documentation capture capability, and more detailed reports for process supervision.

The primary focus of system improvements to the 811 USA ticket routing and monitoring will be to upgrade the ticket management system to automatically provide periodic reports on the status of ticket requests, send notifications as a ticket is approaching its deadline, and to capture and report data that will be used to monitor and evaluate performance per Title 49 Code of Federal Regulations, section 192.614.

These new tools will give the company the ability to better manage the 811 USA ticket load across the company. The tools and enhancements entail workflows requiring locators to input specific data into dedicated fields detailing mutual agreements. These fields will enable reporting for all mutual agreements giving SDG&E additional measures for ticket compliance. Other tools include automated notifications in the form of emails and/or texts for management when tickets are approaching the mutual agreement due dates. This will trigger follow up action to address tickets on time. This mitigation will include the resources that support the enhanced data collection and field management of ticket efforts and will also support 811 USA ticket prioritization. These resources are needed to manage data, perform analytics on the new volume of data and to identify system enhancements.

V. SDG&E-7-M7 – Leverage Data Gathered by Locating Equipment

SDG&E uses locating equipment that automatically captures GPS coordinates as the locator performs their locating activities. The GPS data may also be manually recorded when the locator pushes a designated button on the equipment console. The equipment's GPS data is downloaded through a physical connection with a terminal allowing the data to be saved then transmitted to the GIS group. Future enhancements may include the ability to wirelessly transmit the GPS data. The GPS data can then be used in GIS to compare real world locating data with GIS mapping data to evaluate discrepancies and potentially catch mapping errors or locating errors thereby increasing the accuracy of the locating activity. Correcting mapping errors or omissions using this data may potentially reduce damages caused by mapping issues. Leveraging data gathered by locating equipment improves adherence to Title 49 Code of Federal Regulations, section 192.614.

W. SDG&E-7-M8– Install Warning Mesh Above Buried Company Facilities (Open Trench New Facilities Only)

Plastic underground warning mesh is a high strength polypropylene mesh and is designed to alert excavators of the presence of buried utilities. It is typically installed at a minimum of 18 inches above the buried facility which provides the excavator awareness of a buried pipeline below. If an excavator was not expecting buried facilities in their excavation the mesh serves to alert them, identifies the presence of a gas line, and directs them to contact 811 USA before proceeding so that proper precautions can be implemented before further excavation. Providing this type of warning before excavating further into an underground gas facility substantially reduces the risk of third party damage and the associated consequences. SDG&E installs warning mesh during new pipeline installations. Warning mesh installation applies to high pressure pipelines (MAOP > 60 psig) and medium pressure pipelines (MAOP ≤ 60 psig).

VI. POST-MITIGATION ANALYSIS

As described in Chapter RAMP-D, SDG&E has performed a Step 3 analysis where necessary pursuant to the SA Decision. SDG&E has not calculated an RSE for activities beyond the requirements of the SA Decision but provides a qualitative description of the risk reduction benefits for each of these activities in the section below.

A. Mitigation Tranches and Groupings

The Step 3 analysis provided in the SA Decision³³ instructs the utility to subdivide the group of assets or the system associated with the risk into Tranches. Risk reduction from Controls and Mitigations and RSEs are determined at the Tranche level. For purposes of the risk analysis, each Tranche is considered to have homogeneous risk profiles (*i.e.*, the same LoRE and CoRE). SDG&E’ rationale for the determination of Tranches is presented below.

Third Party Damage prevention consists of training courses, policies, programs, and efforts aimed at reducing the risk of injuries or fatalities to the public, employees, and contractors. Given the vast number of activities SDG&E performs to mitigate the Third Party Dig-in on a Medium Pressure Pipeline risk, SDG&E grouped like activities with like risk profiles into mitigation programs.

Table 6: Summary of Tranches

ID	Mitigation/Control	Tranche	Tranche ID
SDG&E-7-C9	Public Awareness	External Education - The Affected Public	SDG&E-7-C8-T1
		External Education - Emergency Officials	SDG&E-7-C8-T2
		External Education - Local Public Officials	SDG&E-7-C8-T3
		External Education - Excavators	SDG&E-7-C8-T4

B. Post-Mitigation/Control Analysis Results

For purposes of this post-mitigation and post-control analysis, SDG&E utilized historical gas dig-in results year-over-year to calculate an overall risk reduction benefit of performing these activities.³⁴ SDG&E then looked at existing/continuing programs (*i.e.*, Controls), with the expectation of observing similar results (*i.e.*, percentage of risk reduction benefit by continuing the activity). SDG&E also accounted for the risk increase that would occur over time if the risk

³³ D.18-12-014 at Attachment A, A-11 (“Definition of Risk Events and Tranches”).

³⁴ *Id.* at Attachment A, A-5 (“MAVF Principle 4 – Risk Assessment”).



reduction activities were reduced or cancelled. For new and/or incremental mitigations, SDG&E expects to achieve further risk reduction. The specific risk reduction benefit percentages used for each identified Control/Mitigation is included under each of the program headings below.

1. SDG&E-7-C1 – Locate and Mark Training

A single tranche is appropriate for this program because SDG&E has an obligation to provide Locate and Mark Training for all Locators across its entire service territory as mandated by Title 49 Code of Federal Regulations, section 192 and General Order 112-F. Therefore, Locate and Mark Training has a single risk profile and does not warrant further tranching.

a. Description of Risk Reduction Benefits

Locate and mark training provides participating employees with the necessary knowledge and capabilities to locate and mark the below ground gas facilities accurately and in the appropriate time frame. At SDG&E, Locators have the responsibility to locate and mark gas facilities in response to an excavation request. Gas Operations Training and Development provides each Locator with the initial in-depth locate and mark training upon being newly assigned to a Locator position. Overall training is about an 8 week course with locate and mark training comprising about one week of that time. In 2019, SDG&E's Gas Operations Training and Development function is forecasting to provide Locate and Mark Training to about 12 Locators.

It is necessary to have a trained workforce to accurately locate and mark gas infrastructure to provide the necessary information for a third-party excavator to perform their work as safely as possible. Marked facilities provide the excavator with approximate locations of where the gas facilities exist within the delineated work area. Awareness of underground gas facilities allows the excavator to either avoid the areas or carefully dig with hand tools to prevent damage caused by the excavation work. Since a vast majority of the utility's assets are buried below ground it is imperative that proper action is taken to reduce the risk of accidental damage to these facilities by accurately communicating the locations to the excavators. Without a highly skilled and trained locate and mark workforce, excavators would have little knowledge and confidence of gas line locations which could lead to third party excavation damage. By improving knowledge and competency through training, locate and mark accuracy will increase,



and the number of mismarks should be reduced, leading to a decrease in the risk of third party excavation damage. Additionally, this training provides the workforce with the necessary understanding of not only the requirements for accurate locating and marking but also the importance of two-way communication with an excavator, thorough job documentation and timeliness of locate and mark completion.

SDG&E has not performed an RSE Evaluation on SDG&E-7-C1 because the program elements are mandated by law and/or regulation. SDG&E is required to comply with all applicable laws/regulations, and thus, SDG&E has not calculated the risk reduction benefits received for performing this activity.

b. Elements of the Bow Tie Addressed

SDG&E-7-C1 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

2. SDG&E-7-C2 – Locate and Mark Activities

A single tranche is appropriate for this program because SDG&E has an obligation to perform Locate and Mark Activities across its entire service territory as mandated by Title 49 Code of Federal Regulations, section 192 and California Government Code, section 4216. Therefore, Locate and Mark Activities has a single risk profile and does not warrant further tranching.

a. Description of Risk Reduction Benefits

The purpose of the Locate and Mark Activities are to prevent damage to gas infrastructure caused by third party excavators. They consist of three distinct activities:

- (1) locating and marking underground gas facilities before excavation occurs,
- (2) observing (stand-by) pipeline excavation activities; and
- (3) providing staff support for compliance and improvement.



The first of these activities, locating and marking, refers to the actual physical act of locating and marking of underground facilities. In 2018, SDG&E Gas Field Operations fulfilled approximate 130,000 locate and mark requests, with nearly all being classified as medium pressure. By providing a visual indication of the location of underground facilities, the excavator has the necessary information to proceed with their activities in a safe and controlled manner. The second locate and mark activity is Pipeline Observation (stand-by) in specific required situations. 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. The purpose of this function is to decrease the likelihood of an event occurring that otherwise could have been prevented by having a dedicated employee representing the operator who is specifically there to maintain the integrity of the gas pipeline. The third activity involves staffing to provide daily support in operations by interpreting policies, tracking compliance, evaluating locate and mark tools and technologies, providing refresher training as requested, and tracking and trending locate and mark data to proactively identify areas for improvement. This is a critical risk reduction activity that directly supports the field locator personnel in their daily activities and leads to more accurate and timely responses to locate and mark tickets.

Locating and marking underground gas infrastructure provides the excavator with the information necessary to avoid hitting or damaging gas facilities. This is done by understanding what type of facilities are underground and the approximate location. Once the facility is marked, the excavator can take the necessary steps to work around the gas pipe and/or use the appropriate excavation techniques. Third party excavation damage can result in an immediate gas leak or explosion, or it can create a situation where a leak or explosion could develop in the future. The activity also must be completed in a required timeframe. Performing an accurate and timely locate and mark activity helps to reduce serious injuries and/or fatalities, property damage, prolonged outages, penalties and fines, and adverse litigation.

SDG&E has not performed an RSE Evaluation on SDG&E-7-C2 because the program elements are mandated by law and/or regulation. SDG&E is required to comply with all



applicable laws/regulations, and thus, SDG&E has not calculated the risk reduction benefits received for performing this activity.

b. Elements of the Bow Tie Addressed

SDG&E-7-C2 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

3. SDG&E-7-C3 – Locate and Mark Annual Refresher Training & Competency Program

A single tranche is appropriate for this program because SDG&E has an obligation to provide a Locate and Mark Annual Refresher Training & Competency program for Locators across its entire service territory as mandated by Title 49 Code of Federal Regulations, section 192 and General Order 112-F. Therefore, Locate and Mark Annual Refresher Training & Competency Program has a single risk profile and does not warrant further tranching.

a. Description of Risk Reduction Benefits

All resources performing locate and mark activities must complete an annual re-training and re-fresh program. This program consists of local supervisors reviewing the gas standards with the locate and mark workforce. All employees are required to pass the refresher training in order to continue locate and mark activities.

The Locate and Mark Refresher Training and Competency program reinforces several key components of locate and mark. By reviewing the gas standards on an annual basis, employees performing locate and mark activities are provided an opportunity to review expected procedures, learn changes in procedures, and obtain clarification. Without an opportunity to refresh their understanding, the locate and mark workforce might not be up to date on the latest procedure, requirement, or technology. Refresher training enables trained personnel to perform their duties with greater accuracy and efficiency, and it increases trained personnel's ability to adopt to new technologies and methods. Marking facilities accurately provides the excavator



and public with greater safety assurance. It enables the excavator to either avoid the delineated areas or dig with hand tools to avoid damage that could result in an immediate or future incident.

SDG&E has not performed an RSE Evaluation on SDG&E-7-C3 because the program elements are mandated by law and/or regulation. SDG&E is required to comply with all applicable laws/regulations, and thus, SDG&E has not calculated the risk reduction benefits received for performing this activity.

b. Elements of the Bow Tie Addressed

SDG&E-7-C3 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

4. SDG&E-7-C4 – Locate and Mark Operator Qualification Program

A single tranche is appropriate for this program because SDG&E has an obligation of providing a Locate and Mark Operator Qualification program for Locators across its entire service territory as mandated by Title 49 Code of Federal Regulations, section 192 and General Order 112-F. Therefore, Locate and Mark Operator Qualification program has a single risk profile and does not warrant further tranching.

a. Description of Risk Reduction Benefits

Locate and Mark Operator Qualification (OQ) training demonstrates an employee's knowledge and competency to perform specific locate and mark activities that allow the employee to recognize and react to abnormal operating conditions that could occur, such as fire over the pipeline, the smell of gas, and dirt blowing from the ground. Locate and Mark Operator Qualification is administered by the Operator Qualification – Gas System Integrity function at



SDG&E and OQ certification is required every five years. This training is mandated by PHMSA.³⁵

Employing resources that are formally trained and Operator Qualified to perform Locate and Mark functions demonstrates both procedural knowledge and field implementation of the necessary tasks required to successfully perform these functions. Maintaining this level of prepared and qualified workforce allows SDG&E to meet its regulatory requirements and the demands of the excavator community and helps provide for a safe excavation environment.

SDG&E has not performed an RSE Evaluation on SDG&E-7-C4 because the program elements are mandated by law and/or regulation. SDG&E is required to comply with all applicable laws/regulations, and thus, SDG&E has not calculated the risk reduction benefits received for performing this activity.

b. Elements of the Bow Tie Addressed

SDG&E -7-C4 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

5. SDG&E-7-C5 – Locate and Mark Quality Assurance Program

A single tranche is appropriate for this program because SDG&E has an obligation to perform quality assurance activities for Locators across its entire service territory. Therefore, Locate and Mark Quality Assurance program has a single risk profile and does not warrant further tranching.

a. Description of Risk Reduction Benefits

The purpose of the Locate and Mark Quality Assurance Program is to verify that proper processes and procedures are being followed and implemented by the locate and mark workforce and to correct those instances where processes and procedures are not being followed.

³⁵ 49 CFR §§ 192.801 - 192.809.



SDG&E's Pipeline Safety and Compliance function visits every district at least once per year and performs 4 audits per day. During these visits, they evaluate employee qualifications, equipment setup and use, regulatory code requirements, Company Gas Standard requirements, accuracy of locate and markings, proper and thorough documentation, use of the Korterra ticket management system, job observations, and stand-by observations, for example. Feedback on a quality assurance audit is provided to each local supervisor who is responsible to follow-up with individuals or crews needing further or refresher training.

The Locate and Mark QA Program provides a variety of benefits to reducing the number of and potential for damage to gas infrastructure by a third party. By evaluating locate and mark activities that have been completed or are being performed, SDG&E can address gaps in performance with additional training or updating of company documentation or recordation of assets. Locate and mark workforce errors can result in an incorrect mark and locate or one that is not done within the required timeframe. Additionally, the QA review can highlight errors in the timely and/or accurate documentation of utility assets, which, if not corrected, could result in an incorrect locate and mark. Adherence to proper company policy and procedures reduces the percentage of Locate and Mark mismarks, increases the overall awareness of unsafe activity, and expedites response times.

b. Elements of the Bow Tie Addressed

SDG&E-7-C5 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, DT.5 - Delayed updates to asset records of underground gas infrastructure leading to incorrect locate and mark, DT.6 - Incorrect /inadequate information in existing asset records leading to incorrect locate and mark , PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	SMEs estimate that 100% of activities in the program would benefit from this mitigation.
Effectiveness	Assuming 5% effectiveness as QA program has above-marginal impact on reducing mismarks.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 3% of the causes (3% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.2%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		338.5070	
	CoRE	0.37	0.51	0.74
	Risk Score	125.64	172.49	250.57
	RSE	5.22	7.16	10.41

6. SDG&E-7-C6 – Damage Prevention Analyst Program

The Damage Prevention Analyst Program works to reduce the number of third-party damage to gas facilities by identifying at risk excavating contractors and educating them on proper 811 USA process and safe digging techniques. Therefore, any excavating contractors at risk that are identified by the damage prevention analysts pose the same safety risk and a single tranche is appropriate for this program.

a. Description of Risk Reduction Benefits

The Damage Prevention Analyst Program works to reduce the number of third party damages to gas facilities by identifying contractors at risk of causing dig-in damages and



educating them on proper 811 USA one-call and safe digging techniques. Through the Damage Prevention Strategies function, Damage Prevention Analysts focus on the districts with the greatest number of reported incidents, by driving to and physically inspecting excavation projects with 811 USA ticket requests. The Analysts will also stop at other construction projects to investigate whether proper 811 USA one-call and digging techniques are being used. In cases where the Analysts find an offense, they will stop the job and provide education to the contractor on the correct safe digging practices and procedures.

The benefits of the Damage Prevention Analyst function are threefold. First, it enables SDG&E to stop a job before an incident occurs if no underground markings are present or the excavator is not practicing safe digging techniques. Second, it provides an opportunity to educate contractors on their requirements before digging or when digging around gas facilities before damage is done. This education has far-reaching benefits as the contractor will perform future projects in other districts not currently part of the program, and the education could be applied to those future projects. Third, it creates a list of contractors who might be repeat offenders or of site characteristics to improve prioritization of future construction site inspections.

b. Elements of the Bow Tie Addressed

SDG&E-7-C6 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation, DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence

c. RSE Inputs and Basis

Scope	Damage Prevention Analyst program focuses on 100% of the excavation tickets through risk assessment.
Effectiveness	The effectiveness is assumed at 25% as analysts prioritize work, support training, stop unsafe jobs, support all districts, etc.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 36% of the causes (36% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 9%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		368.7690	
	CoRE	0.37	0.51	0.74
	Risk Score	136.87	187.91	272.97
	RSE	92.03	126.35	183.55

7. SDG&E-7-C7 – Prevention & Improvements- Refreshed Laptops

Providing hardware that is appropriate for the rugged outdoor environment and updated to run and efficiently provide correct information helps with accurately locating underground infrastructure. Laptops with the applicable Software are deployed across SDG&E’ territory. SDG&E has a service territory that covers about 4,100 square miles, from San Diego to southern Orange counties. The service territory covers 2 counties, and 25 communities. Therefore, no further tranching is appropriate.



a. Description of Risk Reduction Benefits

The workforce that performs the locate and mark activities relies on laptops, USA tickets, asset mapping, records data, and software. Using laptops in an outdoor setting, and often in construction areas, can reduce life expectancy due to the harsh environment. Therefore, SDG&E provides its workforce with ruggedized laptops that are designed to better withstand their operating environment. Additionally, as software and data are updated, and new features are added, new laptops with advanced capabilities are required so that all information can be provided to the locate and mark workforce and data can be updated. Approximately 40 laptops are replaced every 4 years.

Providing hardware that is appropriate for the rugged outdoor environment and updated to run and provide the right information in a timely manner helps with locating infrastructure correctly in a timely manner and using updated company maps and asset records. Updated ruggedized laptops contain a longer battery life and are able to run the required software faster and more efficiently. Updated hardware and software increase the effectiveness of performing locate and mark. The ruggedized laptops also have the ability to take a picture of the surroundings conditions of the excavation site to update mapping information for improved asset and mapping information. All features of the refreshed laptops work to reduce the number of errors that might occur in locating gas infrastructure through improved data and could be used to support the development of improved safe-digging procedures.

b. Elements of the Bow Tie Addressed

SDG&E-7-C7 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, DT.5 - Delayed updates to asset records of underground gas infrastructure leading to incorrect locate and mark, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	100% of laptops will be refreshed.
Effectiveness	Assuming negligible improvement in effectiveness (0.25%).
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 36% of the causes (36% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.09%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		338.3077	
	CoRE	0.37	0.51	0.74
	Risk Score	125.57	172.39	250.43
	RSE	0.31	0.43	0.63

8. SDG&E-7-C8 – Public Awareness Compliance

For the purposes of an RSE analysis, SDG&E separated Public Awareness into four tranches. Each of the four tranches reduces the likelihood of third party damage differently according to the RSEs.

Title 49 Code of Federal Regulation, section 192.616 requires utilities/natural gas providers to include efforts to educate the public, appropriate government organizations, and persons engaged in excavation related activities. The four types of groups identified in



section 192.616³⁶ are the affected public, emergency officials, local public officials, and excavators. Thus SDG&E-6-C8 – Public Awareness has been trached to match the four groups identified in section 192.616.

Periodically SDG&E participates in Distribution Public Awareness Council (DPAC) Benchmark studies to collect and compare membership data related to the effectiveness of public awareness and community safety outreach programs managed by gas utilities. There is a clear distinction between the general level of awareness between the affected public, emergency officials, local public officials, and excavators. In order to address this gap and reduce third party damage, targeted messaging campaigns are performed for each subgroup to increase overall awareness and education. Emergency officials and local public officials are often met with in person to discuss municipal third party damage trends. The public and excavators are further informed of 811 USA and safe digging practices using bill inserts, media campaigns, SDG&E damage prevention analysts, radio advertising, internet advertising, billboard advertising, and safety meetings. Public Awareness is mandated pursuant to section 192.616 and its purpose is to develop and implement a continuing public education program focused on use of the 811 USA 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. A summary of SDG&E's 2018 public awareness activities is shown in the table below.

³⁶ 49 CFR § 192.616 (emphasis added):

(d) The **operator's** program must specifically include provisions to educate the public, appropriate government organizations, and **persons** engaged in excavation related activities on:

- (1) Use of a one-call notification system prior to excavation and other damage prevention activities;
- (2) Possible hazards associated with unintended releases from a **gas pipeline facility**;
- (3) Physical indications that such a release **may** have occurred;
- (4) Steps that should be taken for public safety in the event of a **gas pipeline** release; and
- (5) Procedures for reporting such an event.



Table 7: Summary of SDG&E’s 2018 Public Awareness Activities

	Mailers	Email messages	Public Service Announcements (2019)	811 Unique Page views (2019 data)
Excavators	29,000	6,500	1	Over 15,000 page views CYTD for the gas safety-related pages on SDG&E.com
Public Officials	189,000	220	0	
Affected Public	550,000 customers and 175,000 live/work near high pressure	630,000	1	
Emergency Officials	339,000	4	0	

A comprehensive public awareness program works to reduce the number of gas incidents by educating the general public on the indication of a gas leak and what to do if they do identify the potential for one. This allows first responders and SDG&E to respond in a timely manner to avoid a gas incident or minimize its impact. More specifically, the Public Awareness Program works to reduce the number of potential gas incidents due to third party excavation activities. Third parties refer to a broader group than just excavators, it can also include “do it yourself” home and business owners. By providing information about the 811 USA one-call process and safe digging practices to these audiences, SDG&E can increase the number of locates performed by the gas utility and potentially reduce the number of incidents of damage to gas infrastructure.

9. SDG&E-7-C8-T1 – Public Awareness Compliance - The Affected Public

a. Description of Risk Reduction Benefits

Unsafe digging from construction and landscaping activities resulted in almost 400 natural gas leaks in San Diego and southern Orange counties in 2019. Work as simple as installing a mailbox or adding landscaping could result in damage to a gas line. In observance of National Safe Digging Day, SDG&E joined energy companies across America to highlight the



importance of calling 811 USA to have underground utility lines marked before digging. SDG&E promotes the awareness of the importance of calling 811 USA before digging underground utilizing various communication methods to reach the public such as bill inserts, media campaigns, radio advertising, internet advertising and billboard advertising. Homeowners should call 811 USA, or submit a request at Call811.com, at least two business days prior to digging. SDG&E will then mark the location of buried gas lines free of charge. It typically takes only 24–48 hours to complete a request to mark underground utility lines.

b. Elements of the Bow Tie Addressed

SDG&E-7-C8-T1 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	The affected public tranche of public awareness is assumed to impact 50% of the risk.
Effectiveness	Per SME input, effectiveness is marginal (1%). More effective than targeting local public and emergency officials, but less effective than excavators.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 97% of the causes (97% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.5%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		339.6393	
	CoRE	0.37	0.51	0.74
	Risk Score	126.06	173.07	251.41
	RSE	1.32	1.81	2.63

10. SDG&E -7-C8-T2 – Public Awareness Compliance - Emergency Officials

a. Description of Risk Reduction Benefits

Third party damages can result in a wide-range of inconveniences to the public including service outages and closed streets and places a strain on emergency officials. SDG&E coordinates liaison activities with Fire, Law Enforcement, Dispatch Centers, and other Cooperating Agencies to comply with the requirements of Title 49 Code of Federal Regulations, sections 192,192.615 and 192.616(e). There are significant benefits to creating strategic partnerships and promoting awareness with emergency officials. Communication and coordination are improved when it matters most. Public Awareness for Emergency Officials reduces the likelihood of third party damages and improves coordination during any kind of natural gas emergency.

b. Elements of the Bow Tie Addressed

SDG&E-7-C8-T2 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines,

PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	The emergency official’s tranche of public awareness is assumed to impact 5% of the risk.
Effectiveness	Emergency officials can help with all excavation cause codes and are assumed to have the same effectiveness as the Affected Public (1%).
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 28% of the causes (28% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.01%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		338.0473	
	CoRE	0.37	0.51	0.74
	Risk Score	125.47	172.26	250.23
	RSE	0.39	0.53	0.77

11. SDG&E -7-C8-T3 – Public Awareness Compliance - Local Public Officials

a. Description of Risk Reduction Benefits

Working directly with city officials involved in construction activities within their jurisdictions helps to educate external personnel to support SDG&E’s enforcement workforce to stop unsafe excavation practices that could result in damage to underground facilities. This interaction can involve several efforts. First is educating city personnel on the specific



requirements of the California safe excavation laws. Second is helping officials to understand their role in helping to enforce the laws by promoting the use of 811 USA for excavation tickets through their project review and permitting activities as well as the field inspections their employees perform. Third is to explain the city’s potential cost savings from avoiding their emergency personnel from having to respond to a blowing gas emergency due to non-compliant excavation damage. City officials can help avoid unnecessary emergency response if they promote safe excavation practices during their routine daily planning and permitting work. The following outreach is performed to be compliant with Title 49 Code of Federal Regulations, section 192.616 (d) subsections 1-5.

b. Elements of the Bow Tie Addressed

SDG&E-7-C8-T3 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	The local public official’s tranche of public awareness is assumed to impact 15% of the risk.
Effectiveness	Minimal impact since they’re not the excavators; assuming 1%.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 56% of the causes (56% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.1%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		338.2839	
	CoRE	0.37	0.51	0.74
	Risk Score	125.56	172.38	250.41
	RSE	0.76	1.05	1.52

12. SDG&E -7-C8-T4 – Public Awareness Compliance - Excavators

a. Description of Risk Reduction Benefits

Excavator awareness of 811 USA is very important. According to the Common Ground Alliance (CGA) Damage Information Reporting Tool (DIRT) Report, an underground utility line is damaged every six minutes in the United States because someone decided to dig but did not call 811 USA. Less than 1% of excavations cause damages in instances where excavators simply provide proper notice to 811 USA one-call before excavating. Promoting awareness of 811 USA amongst excavators can significantly reduce the number of unintended third party damages. Trenching, drilling, road work, building a deck, and installing landscaping are all examples of digging projects that necessitate a call to 811 USA before starting. Unreported damage, where gas lines are nicked or hit, can also lead to corrosion that can cause problems months or even years later. Contacting 811 USA before starting any project involving digging is the best way to avoid damage to underground utilities. Excavator outreach is performed to be compliant with Title 49 Code of Federal Regulations, section 192.616(d) subsections 1-5.

b. Elements of the Bow Tie Addressed

SDG&E-7-C8-T4 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (811 USA) for locate and mark prior to excavation DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	The excavator’s tranche of public awareness is assumed to impact 30% of the risk.
Effectiveness	Public awareness campaigns for excavators are expected to be more effective than for other diggers, and the effectiveness is set to a higher number of 3%.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 97% of the causes (97% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.9%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		340.9507	
	CoRE	0.37	0.51	0.74
	Risk Score	126.55	173.74	252.38
	RSE	3.96	5.43	7.89

13. SDG&E-7-C9 – Increase Reporting of Unsafe Excavation

The purpose of Increased Reporting of Unsafe Excavation is to identify and report excavators who frequently utilize unsafe excavation practices and to report those contractors to the Dig Safe Board and/or State Licensing Board (CSLB). Reporting of unsafe excavation is applicable to the entire SDG&E territory. Therefore, no further tranching is appropriate.

a. Description of Risk Reduction Benefits

The purpose of Increased Reporting of Unsafe Excavation is to consolidate and formalize the Company's internal procedures for identifying and reporting excavators who frequently utilize unsafe excavation practices and to report those contractors to the California Dig Safe Board and/or State Licensing Board (CSLB). This includes consolidating the efforts of the Damage Prevention Strategies Team with the Claims Recovery Team. Both internal groups engage in excavator education and outreach efforts on safe digging practices. The consolidation of efforts-includes a consistent methodology for identifying targeted excavators. Education and outreach efforts provides the excavators understanding of the implications of unsafe excavation practices.

By combining the information from two functions within SDG&E, this program provides a more complete effort to achieve the benefits of reducing third party damages. First, it provides the names of unsafe excavators to the appropriate state boards to support the state's objectives. Second, it provides an opportunity for the excavators to be educated and informed on their obligations, such as the contractor's requirement to call 811 USA prior to any excavation activity and to perform hand excavation in the vicinity of gas pipelines. With a better informed contracting community, who follow the appropriate procedures, the number of excavation activities around gas infrastructure without location marks or without following the correct excavation procedures should decrease. The number of resulting incidents from these contractors should also decrease.

b. Elements of the Bow Tie Addressed

SDG&E-7-C9 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation

DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	SMEs estimate that of excavators that are causing issues less than 1% are reported.
Effectiveness	Once the process is established, an increase in excavator notifications of 30% has been observed.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 27% of the causes (27% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.1%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		338.2738	
	CoRE	0.37	0.51	0.74
	Risk Score	125.55	172.37	250.40
	RSE	1.68	2.31	3.35

14. SDG&E-7-C10 – Public Awareness - Secure Greater Enforcement through Legislation and California State Digging Board

The purpose of securing greater enforcement through Legislation and the Dig Safe Board is to work with all members of the excavation community in achieving the Dig Safe Board’s objectives of providing education and outreach, developing safe excavation practices, investigating violations, and supporting the Board’s authority. Securing greater enforcement



through legislation and working with the Dig Safe Board is applicable to all third party excavations. Therefore, no further tranching is required.

a. Description of Risk Reduction Benefits

SDG&E actively participates in the California Underground Safe Excavation Board (Dig Safe Board) to provide input and education from the natural gas utility perspective. The purpose of this participation is to work with all members of the excavation community in achieving the Dig Safe Board's objectives of providing education and outreach, developing safe excavation practices, investigating violations, and supporting the Board's authority.

Through its involvement in board meetings and workshops and collaborating to achieve common objectives related to damage prevention, SDG&E fosters a positive and stronger working relationship with all stakeholders. By playing an active role in developing and enforcing utility and contractor requirements, a more complete education and cooperative environment can be achieved among all stakeholders. The Dig Safe Board provides a way in which effective safe excavation requirements can be cooperatively developed and disseminated to reduce third party damages.

SDG&E has not performed an RSE Evaluation on SDG&E-7-C10 because the program elements are mandated by law and/or regulation. SDG&E is required to comply with all applicable laws/regulations, and thus, SDG&E has not calculated the risk reduction benefits received for performing this activity.

b. Elements of the Bow Tie Addressed

SDG&E-7-C10 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation , DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, DT.5 - Delayed updates to asset records of underground gas infrastructure leading to incorrect locate and mark, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 –



Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

15. SDG&E-7-C11 – Public Awareness - Meet with Cities with Highest Damage Rates

The activities associated with this program include providing outreach and education on safe digging practices to city and community leaders, and in turn, to the excavators operating in those areas. Public awareness, meeting with cities with the highest damage rates is applicable to all cities across SDG&E’ territory. Therefore, no further tranching is appropriate.

a. Description of Risk Reduction Benefits

The purpose of meeting with cities with the highest damage rates is to reduce the number of third party excavation incidents by providing outreach and education on safe digging practices to city and community leaders, and in turn, to the excavators operating in those areas. More specifically, using its Damage Prevention Analyst function, SDG&E will meet with leaders in all of the approximately 19 municipalities in its service territory. Priority is given to the cities with the highest number of excavation incidents.

The Damage Prevention Analysts will meet with the permitting, inspection, and/or other pertinent officials within the municipalities to develop a strong working relationship to reduce third party damages. Concepts are discussed, such as asking the city inspectors to also look for proper utility markings, stop the job, or incorporate 811 USA literature with the permit application.

Working directly with the city officials involved in construction activities within their jurisdictions helps to develop an extended education and enforcement workforce to stop unsafe excavation practices that could result in damage to underground facilities. It also creates an additional opportunity to identify poor practices and the offending excavators so that education on contacting 811 USA prior to digging and on utilizing proper excavation techniques can be provided before any digging or damage has occurred. As excavators operate in multiple jurisdictions, any education of a contractor that occurs in one city can also be applied to the contractor’s future jobs in other jurisdictions. Finally, as the number of excavation incidents decreases, the demands on local first responders will also decrease.

b. Elements of the Bow Tie Addressed

SDG&E-7-C11 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	Meeting with the top 3% of cities (7 cities out of 240 total).
Effectiveness	Minimal impact since they are not the excavators. Assuming same effectiveness as public awareness for the affected public (1%).
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 89% of the causes (89% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.03%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		338.0877	
	CoRE	0.37	0.51	0.74
	Risk Score	125.49	172.28	250.26
	RSE	0.71	0.98	1.42



16. SDG&E-7-C12 – Public Awareness - Remain Active Members of the California Regional Common Ground Alliance

The purpose of remaining active members of the California Regional Common Ground Alliance (CARGA) is to work with all members of the excavation community in achieving the Dig Safe Board’s objectives of providing education and outreach, developing safe excavation practices, investigating violations, and supporting the Board’s authority. Securing greater enforcement through legislation and working with the California State Digging Board is applicable to all third party excavations. Therefore, no further tranching is required.

a. Description of Risk Reduction Benefits

SDG&E is an active member in the CARGA through its Damage Prevention Strategies function. CARGA is the regional organization associated with the Common Ground Alliance (CGA). The CGA is an underground utility industry association, across North America, whose mission is to prevent damage to underground infrastructure and to protect those who live and work near these assets through the shared responsibilities of stakeholders. CGA helps to develop best practices among industry stakeholders in all aspects of the safe excavation practices of underground infrastructure.

By participating in CARGA, SDG&E is able to play a role in developing best practices with other regional membership, to inform and help develop best practices on the national level, highlight localized issues that need to be addressed, and interact with contractors and other utilities to create safer excavation techniques and requirements. By working with all members of the underground industry, both locally and nationally, SDG&E not only helps to develop best practices but is also informed of other best practices in the industry which will help to improve utility and contractor implementation of safe digging techniques and procedures.

b. Elements of the Bow Tie Addressed

SDG&E-7-C12 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation , DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, DT. 4 – Company does not respond to regional notification center (USA) request in required

timeframe, DT.5 - Delayed updates to asset records of underground gas infrastructure leading to incorrect locate and mark, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	SMEs estimate is 50% as not all policies are affected.
Effectiveness	Maybe once every decade there is a practice that can be improved; however, improvement is marginal (0.05%).
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 100% of the causes (100% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.03%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		338.0845	
	CoRE	0.37	0.51	0.74
	Risk Score	125.48	172.27	250.26
	RSE	0.38	0.53	0.77

17. SDG&E-7-C13 - Continue to Participate in the Gold Shovel Standard Program

The Gold Shovel Standard (GSS) Program utilizes an external organization that certifies contractor’s policies and procedures to protect underground facilities against an established Gold Shovel Standard. This program is applicable to all third party contractors working for SDG&E.



All third party damages caused by contractors working for SDG&E poses the same safety risk. Therefore, no further tranching is required.

a. Description of Risk Reduction Benefits

The Gold Shovel Standard (GSS) Program is an external organization that certifies contractor’s policies and procedures to protect underground facilities against an established Gold Shovel Standard. The GSS provides positive reinforcement and reviews contractor’s excavation performance. SDG&E requires all of its contractors to participate in the Gold Shovel Program.

The GSS provides positive guidance to underground contractors, aligning their excavation practices against established safe digging practices and procedures. It helps to educate contractors on expected industry excavation standards and identify and address gaps in their processes. SDG&E requires contractors who perform excavation on behalf of SDG&E to be GSS certified. GSS serves as an additional quality check for its contractors. Actively supporting the Gold Shovel Standard Program helps to improve excavation contractors use of the 811 USA one-call requirement and to improve their safe digging techniques, such as hand-digging when near gas pipelines.

SDG&E has not performed an RSE Evaluation on SDG&E-7-C13 because the program elements are mandated by law and/or regulation. SDG&E is required to comply with all applicable laws/regulations, and thus, SDG&E has not calculated the risk reduction benefits received for performing this activity.

b. Elements of the Bow Tie Addressed

SDG&E-7-C13 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

18. SDG&E-7-C14 – Locating Equipment

SDG&E provides the locate and mark workforce with the tools and information needed to accurately locate and mark underground gas infrastructure, as mandated by Title 49 Code of



Federal Regulation, section 192.614 and California Government Code, section 4216. Therefore, no further tranching is appropriate.

a. Description of Risk Reduction Benefits

The purpose of the Locating Equipment Program is to utilize technology to standardize locating procedures and to provide the locate and mark workforce with the tools and information needed to accurately locate and mark underground gas infrastructure. The Locating Equipment program will provide the locate and mark workforce with standardized and compliant location devices and tools that are equipped with 811 USA ticket, asset records, and mapping information. Equipment will be provided to the workforce as part of the normal replacement cycle.

Reducing the potential for damage to underground facilities that is caused by excavation activities requires correct facility markings. Excavators use these markings to know when hand-digging and other safe digging practices should be followed. Finally, providing standardized equipment allows for consistent training and field use for the equipment across all operating districts for improved locate accuracy by the workforce.

SDG&E has not performed an RSE Evaluation on SDG&E-7-C14 because the program elements are mandated by law and/or regulation. SDG&E is required to comply with all applicable laws/regulations, and thus, SDG&E has not calculated the risk reduction benefits received for performing this activity.

b. Elements of the Bow Tie Addressed

SDG&E-6-C14 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.



19. SDG&E-7-C15 – Remain Active Members of the 811 California One-Call Centers

The California 811 USA One-Call Centers serve as the communication conduit between SDG&E and excavators. SDG&E is an active member of both Dig Alert and USA North. Dig Alert’s territory includes nine Southern California Counties: Imperial, Inyo, Los Angeles, Orange, San Bernardino, San Diego, Santa Barbara, Riverside and Ventura. USA North covers fifty Northern California Counties. SDG&E is mandated by Title 49 Code of Federal Regulation, section 192.614 and California Government Code, section 4216 to remain an active member of the California One-Call Centers. Therefore, no further tranching is appropriate.

a. Description of Risk Reduction Benefits

The California 811 USA One-Call Centers serve as the communication conduit between SDG&E and excavators to support safe digging practices. Excavators contact the one-call centers with their intent to excavate in a specific location. This information is made available to the owners and operators of underground infrastructure to provide location information before excavation occurs. SDG&E is an active member of local one-call centers. In calendar year 2018, SDG&E responded to approximately 130,000 requests for locate and mark activities of its distribution system through the local one-call centers, nearly all distribution pipe is considered as medium pressure.

As a member of the 811 USA one-call centers, SDG&E actively works with other industry stakeholders toward simplifying the process, improving its accessibility, and educating safe digging practices. The California one-call centers play a critical role in safe excavation practices and reducing the number of third party damages. The call centers provide a single source for all excavators to contact as well as a source for utilities, simplifying the communication process between many contractors and the various utilities, many of which are not known by the contractors. The one-call process also allows this communication process to take place before digging occurs, so that utilities can correctly locate and mark their facilities within an expected timeframe. Excavating with these marks, allows the contractors to practice safe digging techniques, minimizing the potential of hitting or damaging gas piping as they complete their work.



SDG&E has not performed an RSE Evaluation on SDG&E-7-C15 because the program elements are mandated by law and/or regulation. SDG&E is required to comply with all applicable laws/regulations, and thus, SDG&E has not calculated the risk reduction benefits received for performing this activity.

b. Elements of the Bow Tie Addressed

SDG&E-7-C15 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation , DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

20. SDG&E-7-M1 – Automate Third Party Excavation Incident Reporting

Automating Third Party Excavation incident reporting into one system will centralize the reporting and data analysis. This will assist in meeting compliance reporting obligations, developing a better understanding of the data collected in an investigation, simplifying reporting, and enhancing data analysis processes. SDG&E is mandated by Title 49 Code of Federal Regulation, section 192.614 and California Government Code, section 4216 to collect data on third Party Excavation Incidents. Therefore, no further tranching is appropriate.

a. Description of Risk Reduction Benefits

Automating third party excavation incident reporting will be the result of an effort to consolidate and simplify the data collection process involved in investigating a gas incident. Field supervisors complete the investigations of gas incidents. Currently, there are multiple systems and processes used to capture and report data, internally and externally, as a result of a gas incident. All systems and processes might not be updated simultaneously, thereby creating additional manual steps when using the data for internal analysis for process improvements, or to generate reports for internal or external stakeholders. SDG&E is undertaking an initiative to



consolidate these processes and systems into one system of record to minimize data quality issues, simplify reporting, and standardize data collection among its field supervisors.

Standardizing data collection into one system will centralize reporting and data analysis will assist in meeting compliance reporting obligations, developing a better understanding of the data collected in an investigation, simplifying reporting, and enhancing data analysis processes. This will facilitate improvements in SDG&E’s accuracy and timeliness in locating and marking its infrastructure.

b. Elements of the Bow Tie Addressed

SDG&E-7-M1 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	SMEs estimate that 100% of tickets are affected by improved routing and will be automated so that tickets are not lost (applies to all stakeholder groups).
Effectiveness	Marginal improvement is expected (0.5%).
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 1% of the causes (1% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.01%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20

Post-Mitigation	LoRE		337.9805	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.22	250.18
	RSE	0.00	0.00	0.01

21. SDG&E-7-M2 – Establish a Program to Address Area of Continual Excavation

SB 661 modified California Government Code, section 4216 establishing an ACE Ticket. ACE ticket’s purpose is to improve communication and dialog between the agricultural industry and operators. Starting in July 2020, excavators working on agricultural and flood control lands may obtain an Area Continual Excavation (ACE) ticket. This ticket is applicable to areas within SDG&E’s territory. All excavations performed with the use of an ACE ticket poses the same safety risk and a single tranche is appropriate.

a. Description of Risk Reduction Benefits

Generally, a typical USA ticket is valid for 28 days. However, there are some instances where a locate and mark request can be valid for longer.³⁷ These situations are typically in flood control channels and agricultural field where excavation and digging activities can occur continually. This mitigation program fulfills the California requirement to develop a process that would allow for certain agreements for continual excavation. In flood control and agricultural situations, SDG&E will meet with the landowner and develop an annual agreement that will allow for safe continual excavation activity within the parameters of the agreement.

Having to continually renew an 811 USA ticket may discourage some excavators from using the 811 USA process. This program will reduce dig-in risk as it will encourage landowners to use the one-call process before excavating and reduce the need to continually call every time digging needs to occur in the same area over the one-year timeframe of the ticket. By informing the 811 USA one-call center, and then the utility, the landowner can be made aware of

³⁷ Although USA tickets are valid for 28 days from the date of issuance. If work continues beyond 28 days, the excavator may renew the ticket per California Government Code, § 4216.2(e).

gas infrastructure in the area and develop an agreed-upon process to employ safe-digging techniques within the parameters established in the ACE ticket. Additionally, this process will assist the utility in accurately and timely marking the facilities as they will not have to make multiple, repeat visits to the same excavation site. By providing a mechanism to reduce effort for both the landowner and the utility, and providing the location of gas infrastructure to the landowner, the use of safe-digging practices should increase, and the amount of infrastructure damage should decrease.

b. Elements of the Bow Tie Addressed

SDG&E-7-M2 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	For assessment purposes, SMEs consider farmers to be equivalent to excavators fielding heavy machinery. The proportion of farmers to heavy machinery excavators is assumed to be 1 to 200, hence a scope of 0.5%.
Effectiveness	Effectiveness assumed to be high (90%) as the percentage of the targeted people (farmers) are likely to follow procedure and prevent a dig-in once aware of the situation.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 36% of the causes (36% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.2%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74

	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		337.3842	
	CoRE	0.37	0.51	0.74
	Risk Score	125.22	171.92	249.74
	RSE	71.84	98.63	143.27

22. SDG&E-7-M3 – Recording Photographs for Each Locate and Mark Ticket Visited by Locator

Recording photographs for each locate and mark ticket visited by locator is planned for all SDG&E’s above and belowground facilities within its entire service territory. These pictures will help the company audit the quality of locates and provide an opportunity to improve future marking efforts for the same location. Therefore, no further tranching is appropriate.

a. Description of Risk Reduction Benefits

The purpose of recording photographs of each locate and mark ticket is to improve the accuracy of the locating activity and to inform process improvements based on investigations of gas incidents and quality assurance audits. By having a record of the locate marks, SDG&E will be able to better perform root cause analyses of QA activities and investigations into gas incidents. These photographs could show incorrect markings, which would result in improved training, or they could show incorrect mapping and asset data, which could result in improved utility data. The benefits of this Mitigation is its role in improving future locate and mark accuracy to avoid damage to gas infrastructure.

b. Elements of the Bow Tie Addressed

SDG&E-6-M3 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	SMEs estimate that 100% of tickets will have associated photographs.
Effectiveness	The effectiveness is marginal in nature and considered to be 1% as the impact is only on lessons learned.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 3% of the causes (3% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.03%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		337.8990	
	CoRE	0.37	0.51	0.74
	Risk Score	125.42	172.18	250.12
	RSE	0.14	0.19	0.28

23. SDG&E-7-M4 – Utilize Electronic Positive Response

Electronic positive response is an electronic response provided to the regional notification center (DigAlert and USA North) that informs the excavator, prior to their excavation date, if the facility has been marked or if there is no conflict with the proposed excavation. Utilizing electronic positive response is applicable to all areas within SDG&E's territory. All excavations utilizing electronic positive response pose the same safety risk and a single tranche is appropriate.



a. Description of Risk Reduction Benefits

SDG&E is required to locate and mark its underground infrastructure within two days of receiving a locate and mark ticket request. Implementing a positive response feature with the regional notification centers, such as USA North and DigAlert, improves communication between SDG&E and excavating contractors. The system will inform the contractor that the utility has completed their task or, alternatively, will inform them if no gas infrastructure is in conflict with their excavation activities. This effort also provides a means to communicate stand-by requirements or if the locate task was not able to be completed due to weather or accessibility issues.

This program requires participation from contractors and SDG&E. It will avoid the potential of damage to gas infrastructure due to miscommunication between the contractors and SDG&E. This is especially important in situations where the utility was not able to provide markings within the required timeframe, but the contractor assumes no markings means no gas infrastructure. When there are no markings, the contractor may not employ safe digging procedures resulting in a hit to gas infrastructure.

b. Elements of the Bow Tie Addressed

SDG&E-7-M4 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	100% of tickets will have electronic positive response available.
Effectiveness	This mitigation improves communication but has a marginal impact on excavator behavior, therefore the effectiveness is assumed to be 1%.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 3% of the causes (3% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.03%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		337.9082	
	CoRE	0.37	0.51	0.74
	Risk Score	125.42	172.19	250.13
	RSE	0.07	0.10	0.14

24. SDG&E-7-M5 – Enhance Process Leverage Excavation Technology to Help with Difficult Locates (Vacuum Excavation Technology)

Vacuum excavation technology is an example of a hydro excavation tool that can be deployed to find the location of buried company facilities when a locator is not getting an indication of where the facility is located. Technology such as this has proven itself in the damage prevention industry as a safe alternative to hand tools to prevent damage when unknown buried facilities are encountered. Vacuum excavation is utilized on an as-needed, case-by-case basis during Locate and Mark activities or in a more programmatic way by first identifying areas that are known to be hard to locate. Vacuum excavation is applicable to all areas within SDG&E’s territory. All excavations utilizing vacuum excavation technology pose the same safety risk and a single tranche is appropriate.

a. Description of Risk Reduction Benefits

At times, an accurate locate cannot be made using the standard tools available to the locate and mark workforce. In these instances, SDG&E will work with the requesting contractor to help fulfill their request without creating an unsafe situation. SDG&E will establish a process to work with the excavator to utilize various alternatives to locate gas facilities or enhance safe-digging techniques. These alternatives include: stand-by and observe the contractor as they

perform their excavation or use other tools such as a Jameson locator or vacuum technology that can expose the physical pipe for visual verification.

Using locating tools that can provide the actual location of gas infrastructure by safely exposing the pipe will provide the most accurate location of the gas infrastructure. With this knowledge, the contractor is aware of when to employ safe digging techniques and company records can be updated with the actual piping location. Both of these benefits will work toward reducing the potential for damage to underground piping for the current project and future projects.

b. Elements of the Bow Tie Addressed

SDG&E-7-M5 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT.5 - Delayed updates to asset records of underground gas infrastructure leading to incorrect locate and mark, DT.6 - Incorrect /inadequate information in existing asset records leading to incorrect locate and mark , PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	SMEs estimate that 15% of targeted locations will be assisted with emerging excavation technology.
Effectiveness	Effectiveness is high and assumed to be 95%.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 3% of the causes (3% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.5%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74

	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		336.4294	
	CoRE	0.37	0.51	0.74
	Risk Score	124.87	171.43	249.03
	RSE	0.36	0.49	0.71

25. SDG&E-7-M6 – Promote Process and System Improvements in 811 USA Ticket Routing and Monitoring

The primary focus of system improvements to the 811 USA ticket routing and monitoring will be to upgrade the ticket management system to automatically provide periodic reports on the status of ticket requests, send notifications as a ticket is approaching its deadline, and to capture and report data that will be used to monitor and evaluate performance per Title 49 Code of Federal Regulation, section 192.614. Therefore, no further tranching is appropriate.

a. Description of Risk Reduction Benefits

As part of continuous improvement, an assessment of the current state of the 811 USA one-call ticket routing and monitoring is underway. The primary focus of system improvements to the 811 USA ticket routing and monitoring will be to upgrade the ticket management system to provide increased abilities to monitor and manage locate and mark ticket requests and to evaluate and measure performance on meeting timing commitments. In calendar year 2018, SDG&E fulfilled approximately 130,000 USA ticket requests from excavators for its distribution system, nearly all distribution pipe is considered to be medium pressure.

SDG&E has a time requirement to fulfill locate and mark ticket requests. If these time requirements are not met, contractors might assume that no marks mean there are no underground facilities in conflict with their project, and they might start their excavation processes. If this occurs, contractors could hit and damage underground gas infrastructure due to the lack of surface markings. By providing enhanced capabilities to monitor and manage ticket request workload, SDG&E will have the potential to be better able to prioritize ticket requests, assign crews, and balance workload among the locate and mark crews. Additionally, the data capture and reporting

enhancements can improve SDG&E’s ability to monitor its own processes and identify process improvements. These enhancements work toward improving SDG&E’s performance in meeting the locate and mark timeframe, thereby reducing the potential of contractors digging without knowledge of underground gas infrastructure.

b. Elements of the Bow Tie Addressed

SDG&E-7-M7 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 4 – Company does not respond to regional notification center (USA) request in required timeframe, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	SMEs estimate that 100% of tickets are affected by improved routing and will be automated so that tickets are not lost (applies to all stakeholder groups).
Effectiveness	Improvement of up to 15%. This mitigation is closely tied to the Damage Prevention Analysts program.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 1% of the causes (1% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.2%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20

Post-Mitigation	LoRE		337.4140	
	CoRE	0.37	0.51	0.74
	Risk Score	125.24	171.93	249.76
	RSE	1.03	1.41	2.05

26. SDG&E-7-M7 – Leverage Data Gathered by Locating Equipment

The current locating equipment has the capability of recording all information from a locate. This information could be used to assess the quality of each locate and the relative accuracy of pipe location in the GIS system. By having a quality measurement for each locate the company can further determine areas that need improvement. The data gathered by leveraging locating equipment will be used to evaluate performance per Title 49 Code of Federal Regulation, section 192.614. Therefore, no further tranching is appropriate.

a. Description of Risk Reduction Benefits

The purpose of the Leveraging Data Gathered by Locating Equipment Program is to utilize technology to improve the speed with which SDG&E mapping and asset records are updated and improve the accuracy of the resulting locate and mark activities. It provides the locate and mark workforce with the tools and technology to facilitate the ability to update Company records by capturing location coordinates found in the field, which can then be used to evaluate against existing company records to identify any mapping, records, or locating errors.

Reducing the potential for damage to underground facilities that is caused by excavation activities requires correct facility markings. Excavators use these markings to know when hand-digging and other safe digging practices should be followed. Using equipment with the latest technology assists in locating the infrastructure more accurately by providing specific location coordinates to the company's GIS system for updated records. Accurate mapping and company records on its facilities improves the accuracy of future locate and mark activities thereby providing excavators with an improved vision of underground piping.

b. Elements of the Bow Tie Addressed

SDG&E-7-M7 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT. 2 – Locator error contributing to the incorrect marking of underground gas structures, DT.5 - Delayed updates to asset records of underground gas infrastructure leading to incorrect locate and mark, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	A 25% scope is used as a middle ground (between 13% for damages on mains and 40% for damages from backhoes).
Effectiveness	Assume marginal effectiveness of 1%.
Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 1% of the causes (1% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.003%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		337.9999	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
	RSE	0.00233	0.00320	0.00465



27. SDG&E-7-M8 – Install Warning Mesh Above Buried Company Facilities (Open Trench New Facilities Only)

Warning mesh is a mitigation against those excavators that do not adhere to the 811 USA excavation safety notification requirement. Approximately 50% of company damages are caused by excavators not contacting 811 USA before they dig. Warning mesh would be installed when any new open trench company facility is installed before backfilling. This program is applicable to all SDG&E open trench buried new company facilities. Therefore, no further tranching is required.

a. Description of Risk Reduction Benefits

The purpose of installing warning mesh above underground gas pipelines is to provide a visual warning to excavators who have not called 811 USA of the existence of gas infrastructure. Warning mesh will be installed in all open trench applications in new construction.

The warning mesh is a visual indicator that can be exposed before the excavator damages the underlying gas infrastructure and can help to address other shortcomings in the mark and locate and safe digging process by both the utility and the excavator. It can serve as a reminder to the excavator to apply hand-digging techniques, it can act as a correction for inaccurate surface locate markings, and it could serve as a warning to an excavator who did not call to have underground facilities marked.

b. Elements of the Bow Tie Addressed

SDG&E-6-M8 addresses several Drivers/Triggers and Potential Consequences as outlined above in Section I. These include DT.1 - Excavators such as, contractors or property homeowners/tenants do not call one-call center (USA) for locate and mark prior to excavation DT.3 - Hand excavation is not performed by excavator in the vicinity of located gas pipelines, PC.1 – Serious Injuries and/or Fatalities, PC.2 – Property Damage, PC.3 – Prolonged Outages, PC.4 – Penalties and Fines, PC.5 – Adverse Litigation and PC.6 – Erosion of Public Confidence.

c. RSE Inputs and Basis

Scope	Used mesh procured with the proposed funding to arrive at the scope percentage (0.3%).
Effectiveness	Assuming 50% effectiveness since large machines can still cause damage.

Risk Reduction	Based on a mapping of the 2018 DIRT data causes, this mitigation addresses 36% of the causes (36% risk addressed). Using these assumptions, this mitigation could improve Dig-Ins safety, reliability, and financial risk by up to 0.05%.
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d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		337.8163	
	CoRE	0.37	0.51	0.74
	Risk Score	125.38	172.14	250.06
	RSE	30.42	41.77	60.67

VII. SUMMARY OF RISK MITIGATION PLAN RESULTS

SDG&E evaluated the constraints and challenges for the Risk Mitigation Plan. Third Party Excavation Damage continues to be a difficult risk to manage due to several factors. However, according to the CGA, if an 811 USA ticket is requested there is an over a 99%³⁸ chance that there will not be damage to one of SDG&E’ pipelines. One of the primary challenges faced in minimizing this risk is the actions by third party contractors and the failure to request 811 USA tickets. The requesting of a ticket allows SDG&E to locate and mark the natural gas underground facilities within the delineated area. SDG&E experiences a majority of the damages under this risk on small plastic lines within private property. When homeowners

³⁸ Common Ground Alliance, *Common Ground Alliance’s 2014 DIRT Report Confirms Importance of Calling 811 Before Digging for Fifth Consecutive Year* (August 11, 2015), available at https://commongroundalliance.com/sites/default/files/press_release_pdfs/2014%20DIRT%20Report%20Press%20Release%20FINAL.pdf.



excavate and perform work that does not require a work permit (sprinklers, landscaping, etc.) there is no requirement by state law to request an 811 USA ticket. In addition, both licensed and unlicensed, inexperienced, or negligent contractors doing work for homeowners may not pull a work permit nor consider the activities they are performing as excavation in nature (installing a fence, electrical ground rods, pouring a driveway, etc.). Another source of damage is due to excavators who do not practice safe excavation procedures even when they have a valid 811 USA ticket. Affecting positive behavioral changes to these stakeholder groups remains a significant challenge to driving down third party excavation damages. To remain a leader in damage prevention, new technologies and strategies must continue to be evaluated to determine how they complement the existing portfolio of mitigation measures.

Below ground utility infrastructure can be challenging to locate. It requires a trained and seasoned workforce, use of sophisticated electronic equipment, and access and use of online GIS, mapping, and historical installation information to accurately identify locations. Throughout the years, due to growth and modernization, the density of underground utilities within rights-of-way has increased significantly. This in turn can lead to increased difficulty in locating individual facilities due to locating signal interference from adjacent infrastructure. Techniques learned over the years by seasoned locators are invaluable when faced with hard to locate areas.

Additionally, implementing, operating and maintaining a mitigation such as an 811 USA ticket risk assessment tool assumes that the algorithm will properly identify the riskiest excavations and operators. The Company has to rely on legacy software programs and frequently perform updates to it in order to maintain the 811 USA ticket risk assessment tool. Computer hardware improvements increase the performance of the software and allow the Locate and Mark Technician to collect additional data and photographic documentation of the site with utility markings. Additional challenges on the locate and mark program are the occasions when tickets fail to be transmitted through the mobile data terminal (MDT) due to limited/no wireless service. This may lead the excavator to start their work prior to the utility properly delineating the under-ground substructures.

The plan was compiled using SDG&E's current capabilities for evaluating and prioritizing mitigation measures. SDG&E has made its best effort to identify the drivers and



consequences associated with each risk with the understanding that, over time, impacting factors may change and require adjustments to the plan. If any of the mitigations become mandated at a later date, cost and resource projects could also change.

Table 8 provides a summary of the Risk Mitigation Plan, including Control and Mitigation activities, associated costs, and the RSEs by tranche.

SDG&E does not account for and track costs by activity, but rather, by cost center and capital budget code. Thus, the costs shown in Table 8 were estimated using assumptions provided by SMEs and available accounting data.

Table 8: Risk Mitigation Plan Summary³⁹
(Direct 2018 \$000)⁴⁰

ID	Mitigation/Control	Tranche	2018 Baseline Capital ⁴¹	2018 Baseline O&M	2020-2022 Capital ⁴²	2022 O&M	Total ⁴³	RSE ⁴⁴
SDG&E-7-C1	Locate and Mark Training	T1	0	57	0	77 – 92	77 – 92	-
SDG&E-7-C2	Located and Mark Activities	T1	0	2,100	0	3,000 - 3,900	3,000 - 3,900	-

³⁹ Recorded costs and forecast ranges were rounded. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding.

⁴⁰ The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2018 dollars and have not been escalated to 2019 amounts.

⁴¹ Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2018 “baseline” capital costs associated with Controls. The 2018 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

⁴² The capital presented is the sum of the years 2020, 2021, and 2022, or a three-year total. Years 2020, 2021 and 2022 are the forecast years for SDG&E’s Test Year 2022 GRC Application.

⁴³ Total = 2020, 2021, and 2022 Capital + 2022 O&M amounts.

⁴⁴ The RSE ranges are further discussed in Chapter RAMP-C and in Section VI above.



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ID	Mitigation/Control	Tranche	2018 Baseline Capital ⁴¹	2018 Baseline O&M	2020-2022 Capital ⁴²	2022 O&M	Total ⁴³	RSE ⁴⁴
SDG&E-7-C3	Locate and Mark Annual Refresher Training and Competency Program	T1	0	12	0	12 – 62	12 – 62	-
SDG&E-7-C4	Locate and Mark Operator Qualification	T1	0	56	0	56 – 110	56 – 110	-
SDG&E-7-C5	Locate and Mark Quality Assurance Program	T1	0	14	0	14 – 39	14 – 39	5.22-10.41
SDG&E-7-C6	Damage Prevention Analyst Program	T1	0	59	0	110 – 130	110 – 130	92.03-183.55
SDG&E-7-C7	Prevention and Improvements - Refreshed Laptops	T1	0	0	370- 660	150 – 400	520 – 1,100	0.31-0.63
SDG&E-7-C8-T1	Public Awareness-Compliance - The Affected Public	T1	0	50	0	250 – 500	250 – 500	1.32-2.63
SDG&E-7-C8-T2	Public Awareness Compliance - Emergency Officials	T2	0	5	0	25 – 50	25 – 50	0.39-0.77



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ID	Mitigation/Control	Tranche	2018 Baseline Capital ⁴¹	2018 Baseline O&M	2020-2022 Capital ⁴²	2022 O&M	Total ⁴³	RSE ⁴⁴
SDG&E-7- C8-T3	Public Awareness Compliance - Local Public Officials	T3	0	15	0	75 – 150	75 – 150	0.76-1.52
SDG&E-7- C8-T4	Public Awareness Compliance - Excavators	T4	0	30	0	150 – 300	150 – 300	3.96-7.89
SDG&E-7- C9	Increase Reporting of Unsafe Excavation	T1	0	14	0	14 – 65	14 – 65	1.68-3.35
SDG&E-7- C10	Public Awareness- Secure Greater Enforcement through Legislation and California State Digging Board	T1	0	1	0	1 – 27	1 – 27	-
SDG&E-7- C11	Public Awareness- Meet with Cities with Highest Damage Rates	T1	0	1	0	1 – 50	1 – 50	0.71 - 1.42



ID	Mitigation/Control	Tranche	2018 Baseline Capital ⁴¹	2018 Baseline O&M	2020-2022 Capital ⁴²	2022 O&M	Total ⁴³	RSE ⁴⁴
SDG&E-7-C12	Public Awareness- Remain Active Members of the California Regional Common Ground Alliance	T1	0	0	0	22 – 88	22 – 88	0.38 - 0.77
SDG&E-7-C13	Continue to Participate in the Gold Shovel Standard Program	T1	0	21	0	21 – 22	21 – 22	-
SDG&E-7-C14	Locating Equipment	T1	0	21	0	21 – 250	21 – 250	-
SDG&E-7-C15	Remain Active Members of the 811 California One-Call Centers	T1	0	96	0	200 – 420	200 – 420	-
SDG&E-7-M1	Automate Third Party Excavation Incident Reporting	T1	0	0	7,100 – 12,500	0	7,100 – 12,500	0.00- 0.01
SDG&E-7-M2	Establish a program to address the area of continual excavation	T1	0	0	0	1 – 4	1 – 4	71.84- 143.27



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ID	Mitigation/Control	Tranche	2018 Baseline Capital ⁴¹	2018 Baseline O&M	2020-2022 Capital ⁴²	2022 O&M	Total ⁴³	RSE ⁴⁴
SDG&E-7-M3	Recording photographs for each locate and mark ticket visited by locator	T1	0	0	0	140 – 290	140 – 290	0.14 - 0.28
SDG&E-7-M4	Utilize electronic positive response	T1	0	0	0	290 – 520	290 – 520	0.07 - 0.14
SDG&E-7-M5	Enhance process to leverage excavation technology to help with difficult locates (vacuum excavation technology)	T1	0	0	0	50 - 1,000	50 - 1,000	0.36 - 0.71
SDG&E-7-M6	Promote process and system improvements in USA ticket routing and monitoring	T1	0	0	0	180 – 230	180 – 230	1.03 - 2.05
SDG&E-7-M7	Leverage data gathered by locating equipment	T1	0	0	0	50 – 75	50 – 75	0.0023 - 0.0046



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ID	Mitigation/Control	Tranche	2018 Baseline Capital ⁴¹	2018 Baseline O&M	2020-2022 Capital ⁴²	2022 O&M	Total ⁴³	RSE ⁴⁴
SDG&E-7-M8	Install warning mesh above buried company facilities (above open trench new facilities only)	T1	0	0	0	51 – 64	51 – 64	30.42 - 60.67
TOTAL COST			0	2,600	7,500 – 13,000	5,000 – 8,800	12,000 – 22,000	-



It is important to note that SDG&E is identifying potential ranges of costs in this Risk Mitigation Plan and is not requesting funding herein. SDG&E will integrate the results of this proceeding, including requesting approval of the activities and associated funding, in the next GRC.

While all the Controls, Mitigations, and respective costs presented in Table 8 mitigate the Third Party Dig-in on a Medium Pressure Pipeline Risk, some of these activities also mitigate other risks presented in this RAMP Report, including: Third Party Dig-in on a High Pressure Pipeline Risk.

In addition, as discussed in Section VI above, the table below summarizes the activities for which an RSE is not provided:

Table 9: Summary of RSE Exclusions

ID	Control/Mitigation Name	Reason for no RSE Calculation
SDG&E-7-C1	Locate and Mark Training	Mandated compliance activity per CFR Part 192/GO 112-F
SDG&E-7-C2	Locate and Mark Activities	Mandated compliance activity per CFR Part 192.614. California Government Code 4216
SDG&E-7-C3	Locate and Mark Annual Refresher Training & Competency Program	Mandated compliance activity per CFR Part 192/GO 112-F
SDG&E-7-C4	Locate and Mark Operator Qualification	Mandated compliance activity per CFR Part 192 Subpart N
SDG&E-7-C10	Public Awareness - Secure Greater Enforcement through Legislation and California State Digging Board	Mandated compliance activity per California Government Code 4216
SDG&E-7-C13	Continue to Participate in the Gold Shovel Standard Program	Mandated compliance activity per CFR Part 192.614. California Government Code 4216
SDG&E-7-C14	Locating Equipment	Mandated compliance activity per CFR Part 192.614. California Government Code 4216
SDG&E-7-C15	Remain Active Members of the California 811 One-Call Centers	Mandated compliance activity per CFR Part 192/GO 112-F

VIII. ALTERNATIVE ANALYSIS

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the mitigations for the Third Party Dig-in on a Medium Pressure Pipeline risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this Risk Mitigation Plan also took into account modifications to the plan and constraints, such as budget and resources.

A. SDG&E-7-A1 – Virtual Reality Training / Simulation to Improve Locator Proficiency

The virtual reality Locate and Mark training simulator provides a portable and scenario-based training system. It allows for instructors to simulate a variety of real-world locate and mark scenarios. Virtual reality provides more flexibility in training curriculum and allows for more focused educational opportunities. More research is needed to identify system requirements and standardization scores and identify impacts to existing locate equipment and performance management software.

Scope	Assuming 100% of locations would receive UTTO Virtual Reality Training Tools.
Effectiveness	Per internal SME assessment, utilizing UTTO Virtual Reality Locator Training Tools will have minimal impact on risk reduction, reducing risk by up to 0.01%.
Risk Reduction	The percent of dig ins risk addressed is assumed to be 2%. Using these assumptions, this mitigation could improve storage safety, reliability, and financial risk by up to 0.0002%.

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		337.9993	
	CoRE	0.37	0.51	0.74

	Risk Score	125.45	172.23	250.20
	RSE	0.01	0.01	0.02

B. SDG&E-7-A2 – GPS Tracking of Excavation Equipment

SDG&E has supported the Gas Technology Institute (GTI) and other research organizations in their efforts to help the industry improve damage prevention practices. Past and ongoing efforts included real-time GPS tracking of excavation equipment operating in pipeline rights-of-way and quick-shut breakaway meter set valves.

Real-time tracking of excavation is done using a “black box” attached to the excavation equipment such as a backhoe, grader, etc. The black box monitors the location of the equipment and can sense when the equipment is getting ready to dig. There is sophisticated software that monitors the GPS data in relation to its proximity to spatial pipe locations. If the box is detected near a company asset, then an alarm is triggered on the equipment alerting the equipment operator that there is a pipeline in the area. There is also an alert that is sent to the Company so action may be taken to investigate the location.

The technology is not being pursued at this point in time since it gave too many false positives. There is more work that needs to be completed and testing done before the device is ready for production.

Scope	A middle ground of 25% of available opportunities will be used as the scope for GPS tracking.
Effectiveness	Per internal SME assessment, utilizing GPS tracking of excavation equipment will have minimal impact on risk reduction, reducing risk by up to 0.01%.
Risk Reduction	The percent of dig ins risk addressed is assumed to be 1%. Using these assumptions, this mitigation could improve storage safety, reliability, and financial risk by up to 0.00003%.

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		338.000	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
Post-Mitigation	LoRE		337.9999	
	CoRE	0.37	0.51	0.74
	Risk Score	125.45	172.23	250.20
	RSE	0.0004	0.0005	0.0008

**Table 10: Alternative Mitigation Summary
(Direct 2018 \$000)**

ID	Mitigation	2020-2022 Capital ⁴⁵	2022 O&M	Total	RSE
SDG&E-7-A1:	Virtual reality training / simulation to improve locator proficiency	0	100-120	100-120	00.01-00.02
SDG&E-7-A2:	GPS Tracking of Excavation Equipment	0	236-391	236-391	0.0004-0.0008

⁴⁵ The capital presented is the sum of the years 2020, 2021, and 2022 or a three-year total.

APPENDIX A: SUMMARY OF ELEMENTS OF RISK BOW TIE ADDRESSED

ID	Control/Mitigation Name	Drivers/Triggers/Potential Consequences Addressed
SDG&E-7-C1	Locate and Mark Training	DT.2; DT.4; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C2	Locate and Mark Activities	DT.2; DT.4; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C3	Locate and Mark Annual Refresher Training and Competency Program	DT.2; DT.4; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C4	Locate and Mark Operator Qualification	DT.2; DT.4; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C5	Locate and Mark Quality Assurance Program	DT.2; DT.4; DT.5; PC.1; PC.2; PC.4; PC.5; PC.6
SDG&E-7-C6	Damage Prevention Analyst Program	DT.1; DT.2; DT.4 PC.1; PC.2; PC.4; PC.5; PC.6
SDG&E-7-C7	Prevention and Improvements-Refreshed Laptops	DT.2; DT.3; DT.5; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C8	Public Awareness Compliance	DT.1; DT.3; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C9	Increase Reporting of Unsafe Excavation	DT.1; DT.3; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C10	Public Awareness - Secure Greater Enforcement through Legislation and California State Digging Board	DT.1; DT.2; DT.3; DT.4; DT.5; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C11	Public Awareness - Meet with Cities with Highest Damage Rates	DT.1; DT.3; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C12	Public Awareness - Remain Active Members of the California Regional Common Ground Alliance	DT.1; DT.3; DT.4; DT.5; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C13	Continue to Participate in the Gold Shovel Standard Program	DT.1; DT.3; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C14	Locating Equipment	DT.2; DT.4; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-C15	Remain Active Members of the 811 California One-Call Centers	DT.1; DT.2; DT.3; DT.4; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6

ID	Control/Mitigation Name	Drivers/Triggers/Potential Consequences Addressed
SDG&E-7-M1	Automate Third Party Excavation Incident Reporting	DT.2; DT.4; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-M2	Establish a program to address the area of continual excavation	DT.1; DT.3; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-M3	Recording photographs for each locate and mark ticket visited by locator	DT.2; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-M4	Utilize electronic positive response	DT.4; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-M5	Enhance process to utilize and leverage emerging excavation technology to help with difficult locates	DT.2; DT.5; DT.6; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-M6	Promote process and system improvements in USA ticket routing and monitoring	DT.4; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-M7	Leverage data gathered by locating equipment	DT.2; DT.5; DT.6; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6
SDG&E-7-M8	Install warning mesh above buried company facilities	DT.1; DT.3; PC.1; PC.2; PC.3; PC.4; PC.5; PC.6