Risk Assessment and Mitigation Phase

(Chapter SDG&E-Risk-7)

Excavation Damage (Dig-In) on the Gas System

May 17, 2021

TABLE OF CONTENTS

RISK: EXCAVATION DAMAGE (DIG-IN) ON THE GAS SYSTEM

I. INTRODUCTION

The purpose of this chapter is to present San Diego Gas & Electric Company's (SDG&E or Company) risk control and mitigation plan for the Excavation Damage (Dig-in) on the Gas System risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014 and the Settlement Agreement included therein (the Settlement Decision).[1]

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

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

---

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

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

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

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

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

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

A. Risk Overviews

SDG&E operates and manages a natural gas system of over 14,500 miles of Distribution pipe and 232 miles of Transmission pipe within its 4,100 square mile service territory. Pipe mileage can be further segregated into general operating pressure categories of Medium Pressure

---

3 *Id*. at 16.

4 *Id.* at 17.

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

(MP), which operates at or less than 60 psig, and High Pressure (HP), which operates above 60 psig. SDG&E's large piping network and large service territory have exposure to potential dig-in related incidents. This risk highlights the consequence and likelihood of dig-in damage that cause a release of natural gas, damage property, or personal injury.

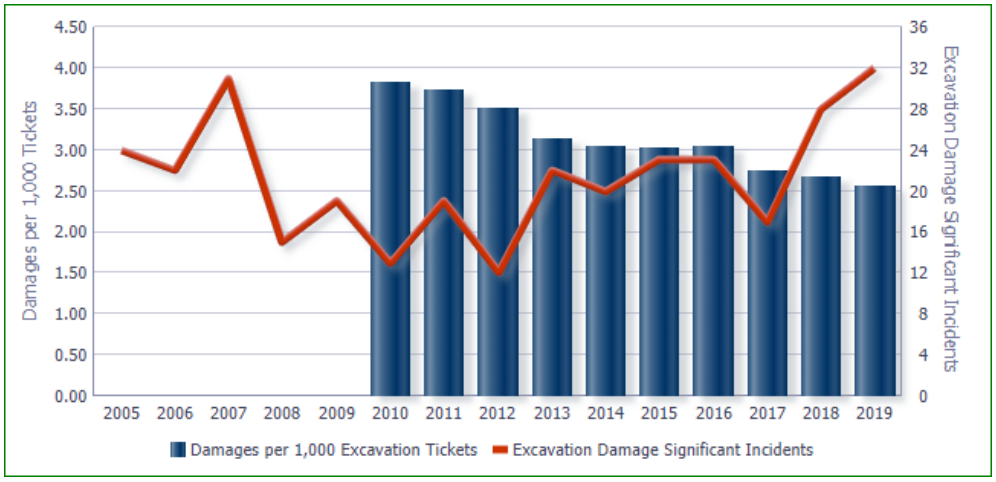
SDG&E has been mitigating dig-in risk to its underground gas infrastructure for decades. Dig-ins are a common national problem for all industries and utilities with buried infrastructure and are not unique to SDG&E. Excavation activities can vary widely based on project scope and size. Some examples are: a homeowner doing landscaping work, a plumber repairing a sewer line, or a city upgrading its aging municipal water or sewer systems. Excavation damage can range from minor scratches or dents to ruptures with an uncontrolled release of natural gas. The release of natural gas may not just occur at the time of the damage. A leak or rupture may also occur after the infrastructure has sustained minor damage accumulated over time. Minor damage that does not result in a release of gas is often not reported by the responsible party. Unfortunately, SDG&E cannot always assess the pipe for damage and make the appropriate repairs to preserve the integrity of the pipe.

Serious consequences may result if an event occurs because of this risk. For example, if a leak or rupture occurs, ignition of the released gas could lead to an explosion, fire, or both. The nearby public could be seriously injured, and property damage could be extensive. Federal and state agencies acknowledge the threat of dig-in risk and have responded by adopting several regulations and industry standards and supporting awareness efforts to help prevent dig-ins. For example, the Department of Transportation (DOT) sponsored the "Common Ground Study," completed in 1999. Subsequently, the "Common Ground Study" led to the creation of the Common Ground Alliance (CGA), a member-driven association of 1,700 individuals, organizations, and sponsors in every facet of the underground utility industry. With industry-wide support, CGA created a comprehensive consensus document that details the best practices addressing every stakeholder groups' activity in promoting safe excavation and dig-in prevention.

While these efforts are important and commendable, and the number of dig-ins per 1,000 excavation tickets has been trending down (Figure 1), incidents still occur. Excavation tickets are a common metric used throughout the industry to gauge the status of a damage prevention program. Figure 1 represents trends for dig-ins on distribution lines. Excavation data for

transmission incidents are less frequent and harder to trend. Thus, the Pipeline and Hazardous Materials Safety Administration (PHMSA) collects ticket totals in annual reports for distribution facilities but does not collect ticket information for transmission facilities.

Figure 1: Excavation Tickets & Incidents



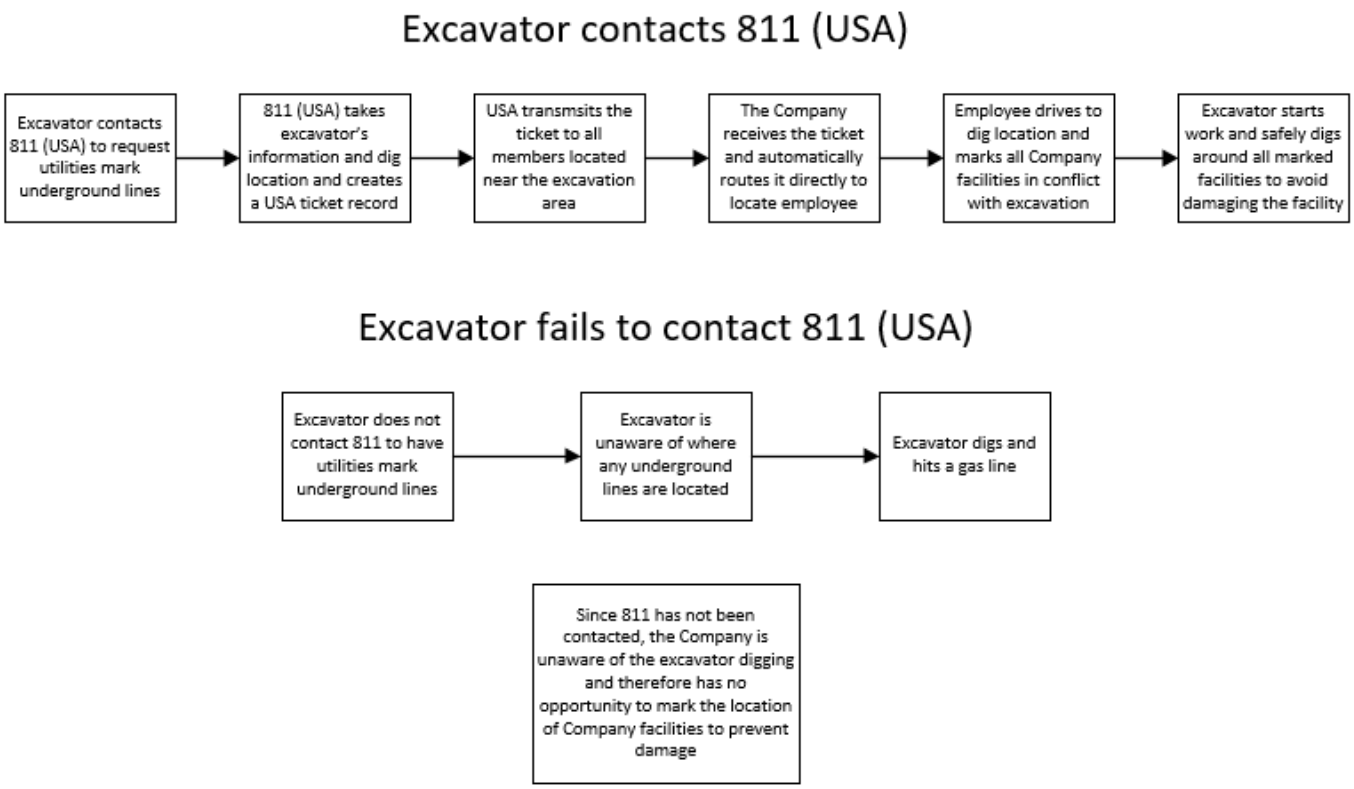
Under California State Law, an excavator planning excavation work is required to contact the Regional Notification Center for their area, also known as Eight-One-One (811) or Underground Service Alert (USA), at least two (2) full working days prior to commencing construction excavation activities, not including the day of the notification.[6] 811 is the national phone number designated by the Federal Communications Commission (FCC), that connects homeowners or contractors who plan to dig with professionals through a local call center. California has two Regional Notification Centers, DigAlert and USA North, that split California at the Los Angeles/Kern county, and Santa Barbara/San Luis Obispo County lines; USA North serves all counties north of the county lines and DigAlert serves all counties south of the county lines. SDG&E is served exclusively by DigAlert which will be referenced as 811 USA for the remainder of this chapter. Once an excavator makes contact, the Regional Notification Center will issue a USA Ticket notifying local utilities and other operators of the location and areas to be inspected for potential conflicts of underground infrastructure with the pending planned excavation work. Operators are then required to provide a positive response to indicate that there are no facilities in conflict or to mark their underground facilities via aboveground identifiers (*e.g.*, paint, chalk, flags, whiskers) to designate where underground utilities are positioned, thus

[6] Cal. Gov. Code § 4216.2(b).

enabling excavators, like contractors and homeowners, to know where substructures are located. The law also requires excavators to use careful, manual (hand digging) methods to expose substructures prior to using mechanical excavation tools.[7]

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

Figure 2: Excavation Contact Process Flow



As can be seen in the figure above, while there may be more steps when an excavator calls 811 USA prior to commencing excavation work, it can protect from a negative outcome that might result were a call not made. When excavators call 811 USA before excavating, the risk of a dig-in is significantly reduced.

SDG&E managed over 180,000 811 USA tickets and reported over 300 dig-in excavation damage incidents in 2020. Analysis of the data collected during routine damage investigations indicate that further analysis of the reported damage incidents shows that about approximately

[7] Cal. Gov. Code § 4216.4(a)(1).

58% were due to a lack of notification to 811 USA for a locate and mark ticket, and another 30% were due to inadequate excavation practices even after the excavator called 811 USA and underground facilities were marked.

In addition to direct involvement with excavators and 811 USA, SDG&E engages in promoting safe digging practices through its Public Awareness Program and corporate safety messaging through stakeholder outreach. This educational messaging comes in multiple formats, including mail, email, social media, television, radio, events, and association sponsorships.

B. Risk Definition

For purposes of this RAMP Application, SDG&E's Dig-in risk is defined as excavation damage on the gas system, regardless of the party (1st, 2nd, 3rd), which results in significant consequences, including serious injuries and/or fatalities.

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

In the 2019 RAMP Report, SDG&E presented two stand-alone risk chapters associated with Third Party Dig-in risks. They were separated by operating pressure: one for Medium Pressure and the other for High pressure piping facilities. For this RAMP application, the definition of Excavation Damage (Dig-In) On the Gas System has been expanded to include all aspects and parties involved with excavation damage. The gas system is considered gas pipelines upstream of the gas meter for both medium and high-pressure systems.

C. Scope

Table 1 below provides what is considered in and out of scope for the Dig-in risk in this RAMP Application.

Table 1: Risk Scope

In-Scope:	Excavation damage on the gas system, which includes both medium & high-pressure pipelines upstream of the gas meter, regardless of the party (1^{st}, $2^{nd,}$ 3^{rd}) which results in significant consequences, including serious injuries and/or fatalities.
Data Quantification Sources:	SDG&E engaged internal data sources for the calculation surrounding risk reduction; however, if data was insufficient, Industry or National data was supplemented and adjusted to fit the risk profile associated with the operating locations and perimeter of the utilities. For example, when certain types of incident events have not occurred within the SDG&E and

	SoCalGas territory; therefore, expanding the quantitative needs to encompass industry data where said incident(s) have been recorded provide a proximate and is justified in establishing a baseline of risk and risk addressed by activities. See Appendix B for additional information.

II. RISK ASSESSMENT

In accordance with the Settlement Decision,[8] this section describes the risk bow tie, possible drivers, potential consequences, and the risk score for the Dig-in risk.

A. Risk Bow Tie and Risk Event Associated with the Risk

The risk bow tie is a commonly used tool for risk analysis, and the Settlement Decision instructs the utility to include a risk bow tie illustration for each risk included in RAMP.[9] As illustrated below in Figure 3, the risk event (center of the bow tie) is Excavation Damage (Dig-In) On The Gas System, the left side of the risk bow tie illustrates drivers/triggers that lead to the Excavation Damage, and the right side shows the potential consequences of the Excavation Damage. SDG&E applied this framework to identify and summarize the information provided in Figure 3. A mapping of each Mitigation to the element(s) of the risk bow tie addressed is provided in Appendix A.

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

[9] *Id.*

Figure 3: Risk Bow Tie -
Excavation Damage (Dig-In) Medium Pressure

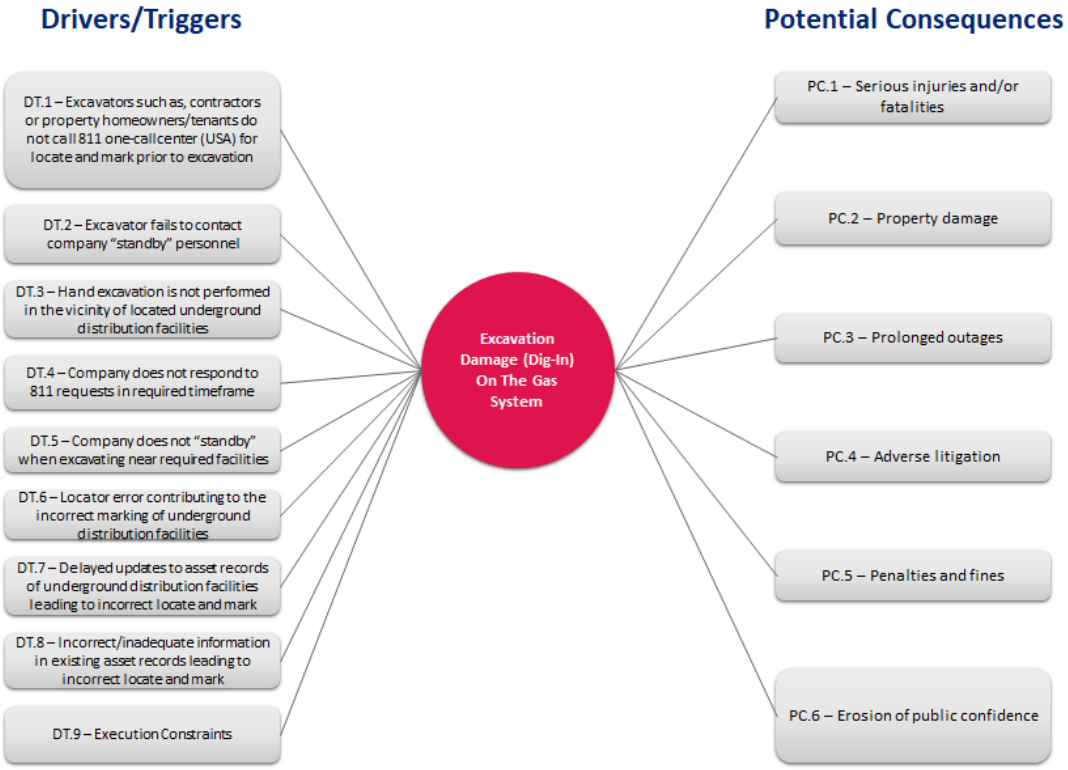
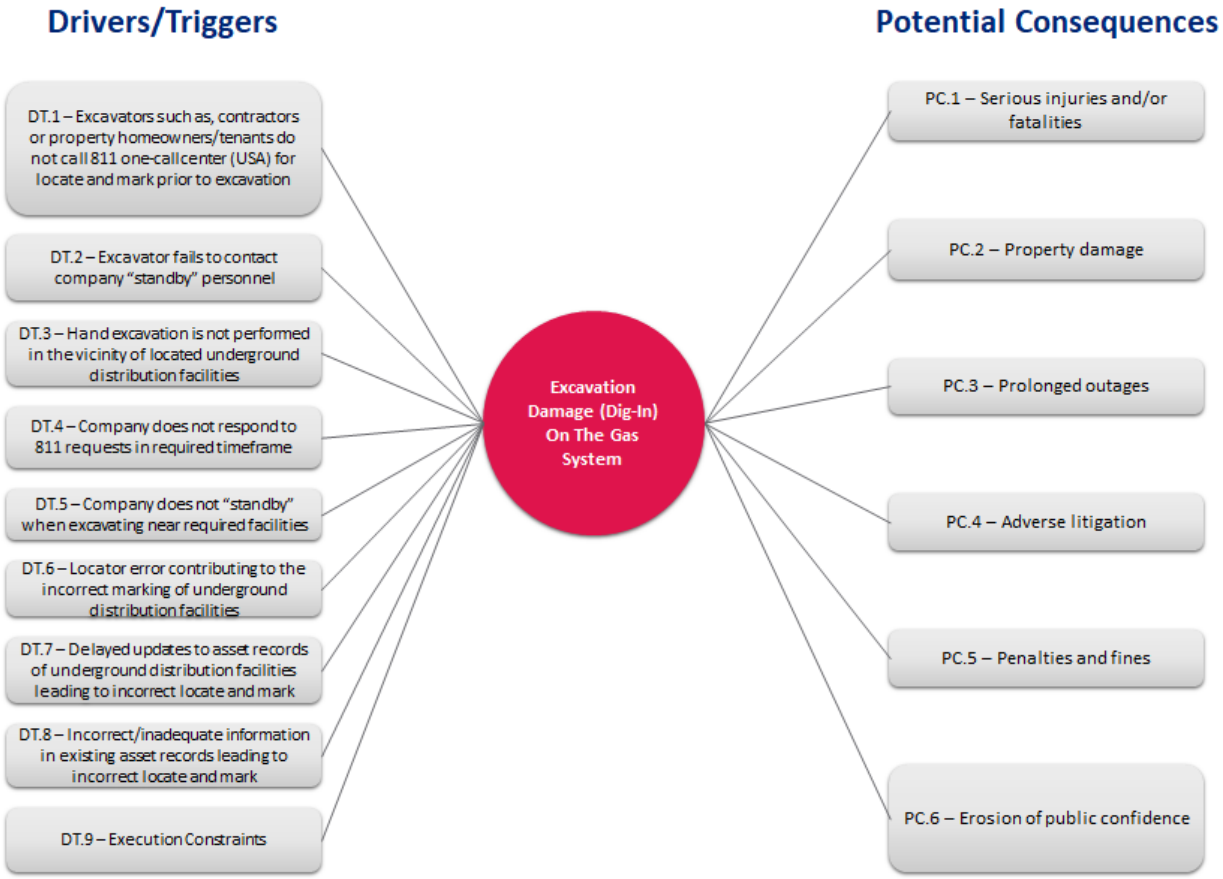


Figure 4: Risk Bow Tie -
Excavation Damage (Dig-In) High Pressure



B. Cross-Functional Factors (CFF)

The following cross-functional factors have programs and/or projects that affect one or more of the drivers and/or consequences of this risk: Emergency Preparedness and Response and Pandemic; Foundational Technology Systems; Safety Management Systems; and Workforce Planning / Quality Workforce. As an example, the training of SDG&E emergency response personnel and activation of SDG&E's emergency operations control center, as discussed in the Emergency Preparedness and Response, and Pandemic CFF address some of the potential consequences of this risk. Please review the narratives for the referenced CFF for additional information.

C. Potential Drivers/Triggers[10]

The Settlement Decision[11] instructs the utility to identify which element(s) of the associated risk bow tie each mitigation addresses. When performing the risk assessment for Dig-in on the System, SDG&E identified potential leading indicators, referred to as drivers or triggers. These include, but are not limited to:

- **DT.1 – Excavators such as contractors or property homeowners/tenants do not follow 811 One-Call Dig-Safe law requirements (USA) for locate and mark prior to excavation:** Despite the creation of Regional Notification Centers to inform and allow excavators to have underground infrastructure located and marked, and advertising campaigns alerting the excavator of the need to do so, incidents still occur where excavations are conducted without notifying 811 USA. In fact, third-party failure to contact the Regional Notification Center prior to excavating is the leading contributor of damages to Company pipelines. Third parties can damage or rupture underground pipelines and potentially cause property damage, injuries, or even death if gas lines are not properly marked before excavation activities begin. Without receiving an 811 USA ticket, the Company has no opportunity to mark its facility within the area of excavation. Furthermore, even when an 811 USA ticket is requested, excavators who are not knowledgeable with the details of the Dig Safe law may still damage underground facilities by performing some of the following practices:
  - Excavating prior to the valid start date/time;
  - Excavating after a valid ticket has expired;
  - Excavating under another excavator's USA ticket;
  - Improper job delineation and/or excavating beyond delineation marks
- **DT.2 – Excavator fails to contact company "standby" personnel:** An excavator may fail to contact the Utility's "standby" personnel to prevent damage to high pressure gas pipelines and other facilities when required, prior to

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

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

excavating within 24 inches of a high-pressure gas pipeline. This would increase the risk and likelihood that the excavator damages a high-pressure pipeline.

- **DT.3 – Hand excavation and other required excavation practices are not performed in the vicinity of located underground facilities:** Before using any power operated excavation equipment or boring equipment, the excavator is required to hand expose, using "Hand Tools,"[12] to verify the exact location and no conflict exist within 24 inches on either side of the gas pipeline. Excavators put themselves and others at risk for injuries when they do not exercise caution when digging near natural gas pipelines. However, even when proper hand excavation is performed, damages can still occur if an excavator fails to continue with unsafe excavation practices such as:
  - Maintaining proper clearance from the underground facilities;
  - Allowing the above ground locating marks to become faded or lost, rendering them ineffective;
  - Failure to provide adequate shoring, protection or support facilities; and
  - Utilizing improper backfill procedures.

  Excavators put themselves and others at risk when they do not exercise caution when digging near natural gas pipelines.
- **DT. 4 – Company does not respond to 811 requests in required timeframe:** The Company may fail to respond to 811 USA requests within the "legal excavation start date and time" [13] (within two working days of notification, excluding weekends and state holidays, not including the date of notification, or before the start of the excavation work, whichever is later, or at a time mutually agreeable to the operator and the excavator). This may happen because of human error, poor communication, or system failures. In these cases, the third party may not know that the locate and mark activity was not performed and may wrongly assume that not seeing any marking at their excavation site indicates there is no gas infrastructure nearby. Without the marked gas infrastructure, third parties

[12] "Hand Tools" is defined in Cal. Govt. Code § 4216(i).

[13] "Legal Excavation Start Date and Time" is defined in Cal. Govt. Code § 4216(l).

may damage or rupture the infrastructure if they are performing excavation activities near pipelines.

- **DT.5 - Company does not "standby" when requested near required facilities:** High Pressure pipelines (those that operate over 60 psig) and pipelines near required facilities pose a higher risk of hazard to life and property when damaged or ruptured, and additional precautions are not taken by the Company to observe excavation activities in the vicinity of these facilities. Qualified Company personnel are required to be present during excavation activities within 10 feet of any high-pressure gas line (commonly referred to as "stand-by"). The stand-by employee is onsite to monitor and communicate with the excavator, so safe excavation activities are followed (*e.g.*, not hand excavating near the pipeline).
- **DT.6 – Locator error contributing to the incorrect marking of underground facilities:** The Company, in some cases, inaccurately marks facilities due to incorrect operations, such as mapping/data inaccuracies, equipment signal interference, and human error. When this happens, third parties are not provided with accurate knowledge of underground pipelines in the vicinity of excavations, and the risk of damaging or rupturing gas pipelines increases.
- **DT. 7 – Delayed updates to asset records of underground facilities leading to incorrect locate and mark:** The Company may fail to update permanent mapping records necessary to meet federal, state, and local regulations, as well as corporate needs. This could result in underground infrastructure being incorrectly marked, which could lead to third-party damage if the excavator does not have the correct information on infrastructure location. In addition, inaccurate mapping data could delay repairs if a pipeline is damaged.
- **DT. 8 – Incorrect/inadequate information in existing asset records leading to incorrect locate and mark:** The use of inaccurate or incomplete information in asset records could result in the failure to meet federal, state, and local regulations, as well as corporate needs. This could result in underground infrastructure being incorrectly marked, which could lead to third-party damage if the excavator does not have the correct information on infrastructure location. In

addition, in the event in which a pipeline is damaged, inaccurate mapping data could delay repairs.

- **DT.9 - Execution Constraints:** Events (excluding those covered by outside force damages) that impact the Company's ability to perform as anticipated. Examples include but are not limited to materials and operational oversight, delays in response and awareness, resource constraints, and/or inefficiencies and reallocation of (human and material) resources, unexpected maintenance, or regulatory requirements.

D. Potential Consequences of Risk Event

Potential Consequences[14] are listed to the right side of the risk bow tie illustration provided above. If one or more of the drivers/triggers listed above were to result in an incident, the potential consequences, in a reasonable worst-case scenario, could include:

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

These potential consequences were used in the scoring of Dig-in on the System that occurred during the development of SDG&E's 2020 Enterprise Risk Registry.

E. Risk Score

The Settlement Decision requires a pre- and post-mitigation risk calculation.[15] Chapter SCG/SDG&E RAMP-C of this RAMP Application explains the Risk Quantitative Framework which underlies this chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

[14] D.18-12-014 at 16 and Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

[15] D.18-12-014 at Attachment A, A-11 ("Calculation of Risk").

Table 2: Pre-Mitigation Analysis Risk Quantification Scores[16]

	LoRE	CoRE	Risk Score
Dig-In on the High-Pressure System	0.19	4,235	815

	LoRE	CoRE	Risk Score
Dig-In on the Medium Pressure System	300.20	1	316

Pursuant to Step 2A of the Settlement Decision, the utility is instructed to use actual results, available and appropriate data (*e.g.*, Pipeline and Hazardous Materials Safety Administration data).[17]

Historical PHMSA data, internal damage database and emergency incident reporting were used to estimate the frequency of incidents.

III. 2020 CONTROLS

This section "[d]escribe[s] the controls or mitigations currently in place" as required by the Settlement Decision.[18] The activities in this section were in place as of December 31, 2020. Controls that will continue as part of the plan are addressed in Section IV.

As stated above, the excavation damage on the gas system is the risk of damage caused by an excavation event, which could result in serious injuries and/or fatalities. The risk mitigation plan includes both controls that are expected to continue and projected mitigations for the period of SDG&E's Test Year 2024 GRC cycle. The controls are those activities that were in place as of 2021, most of which are compliance driven and have been implemented over decades. These activities focus mainly on the essentials of damage prevention, including excavator's knowledge and use of the 811 one-call services and safe excavation practices, and the operator's responsibility to communicate the location of underground facilities through activities such as 811 one-call ticket responses and locate and mark activities.

---

16 The term "pre-mitigation analysis," in the language of the S-MAP Settlement Agreement Decision refers to required pre-activity analysis conducted prior to implementing control or mitigation activity. *See* D.18-12-014 at Attachment A, A-12 ("Determination of Pre-Mitigation LoRE by Tranche," "Determination of Pre-Mitigation CoRE," "Measurement of Pre-Mitigation Risk Score").

17 D.18-12-014 at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

18 D.18-12-014 at 33.

A. Locate and Mark Training

C1: MP; C2: HP

Locate and mark training provides employees who perform locating tasks with the necessary knowledge and operator qualification to locate and mark underground gas facilities. At SDG&E, in response to an 811-excavation request, the Distribution Locators are responsible for locating and marking Distribution Operations gas facilities, and the Transmission Locators are responsible for performing the L&M duties for Transmission Operations facilities. Gas Operations Training and Development provides each trainee with the initial locate and mark training upon being newly assigned to a position. Overall, training is approximately an eight-week course with hands-on locate and mark training comprising approximately one week. The employees are not certified to locate or mark gas facilities until they have successfully completed initial training and passed locate and mark operator qualification tasks. SDG&E's Gas Operations Training and Development includes training approximately 48 new locators. It is necessary to have a trained workforce to accurately locate and mark gas infrastructure and provide the necessary information to third-party excavators for safe excavation.

Marked facilities provide the excavator with approximate pipeline locations within the delineated work area. Awareness of underground gas facilities allows the excavator to either avoid the areas or carefully dig with hand tools to prevent damage while excavating. Since a vast majority of SDG&E's assets are buried below ground, it is imperative that proper action is taken to reduce the risk of accidental damage to these facilities by accurately communicating the locations to the excavators. Without a highly skilled and trained locate and mark workforce, excavators would have little knowledge and confidence of pipeline locations which could lead to third-party excavation damage. By improving knowledge and competency through training, locate and mark accuracy will increase, and the number of mismarks and third-party damages should reduce. Additionally, this training reinforces the requirements to accurately locate our pipelines, the importance of two-way communication with an excavator, the completeness and thoroughness of documentation, and the timeliness of locate and mark ticket completion.

B. Locate and Mark Activities

C3: MP; C4: HP

The purpose of the Locate and Mark Activities is to prevent damage to gas infrastructure caused by third-party excavators. Three primary locate and mark activities are listed below:

(1) locating and marking underground gas facilities before excavation occurs;

(2) observing (stand-by) pipeline excavation activities; and

(3) providing staff support for compliance and improvement.

The first of these activities, locating and marking, refers to the physical act of locating and marking underground facilities. SDG&E has been moving towards in-sourcing work related to locate and mark activities. In 2020, SDG&E responded to over l80,000 locate and mark ticket requests. By providing a visual indication of the location of underground facilities, the excavator has the necessary information to excavate safely.

The second locate and mark activity is pipeline observation, or "stand-by," which is a critical activity that requires a qualified Company representative to be present anytime excavation activities take place near high-priority pipelines. The purpose of this activity is to decrease the likelihood of damage occurring by having a dedicated employee present to maintain the integrity of the pipeline.

The third activity is providing daily damage prevention staff support to operations by interpreting policies, tracking compliance, evaluating tools, equipment, and new technologies, providing refresher training, and tracking and trending locate and mark data to proactively identify areas for improvement. This is a critical risk reduction activity that directly supports the field locator personnel in their daily activities and leads to more accurate and timely responses to locate and mark tickets and reduction in damages. This collection of Locate and Mark Activities ultimately provides the excavator with the necessary information to avoid hitting or damaging gas facilities.

C. Locate and Mark Annual Refresher Training and Competency Program C5: MP; C6: HP

All company personnel performing locate and mark activities must complete an annual re-training and refresh program. This program consists of local supervisors reviewing SDG&E Gas Standards with the locate and mark workforce. Employees are required to pass the refresher training in order to continue locate and mark activities. This refresher training involves all aspects of the Locate and Mark procedures to allow personnel to be able to successfully receive an 811 USA ticket and provide a proper positive response. Similar to the Locate and Mark training mentioned above, interactive electronic learning course modules are being developed for this refresher training with the addition of other training methods such as on-the-job training and

mentoring. This is a mandated activity in order to comply with regulations and code requirements and to provide employees with the basic knowledge to satisfactorily perform this critical task.

D. Locate and Mark Operator Qualification

C7: MP; C8: HP

Locate and Mark Operator Qualification (OQ) training requires employees to field-demonstrate their knowledge and competency to perform locate and mark tasks. This includes activities such as obtaining proper locating signals, interpreting the signals by placing accurate and proper markings on the ground to indicate the location of the pipe. This OQ training is in addition to Locate and Mark Training (C1), is required for employees every five years, and is administered by the Gas System Integrity - Operator Qualification department at SDG&E. In 2020, there were approximately 48 employees at SDG&E who participate in OQ training. OQ training is mandated by PHMSA.[19]

Maintaining resources that are trained and Operator Qualified to perform Locate and Mark functions promotes procedural knowledge and competency to perform the tasks. A prepared and qualified workforce allows SDG&E to meet its regulatory requirements, the demands of the excavator community, and helps provide for a safe excavation environment.

E. Locate and Mark Quality Assurance

C9: MP; C10: HP

The purpose of the Locate and Mark Quality Assurance (QA) Program is to validate that locators are following processes and procedures when performing locating tasks. The QA evaluators document each ticket assessment and identify opportunities for improvement. SDG&E's Safety Assurance, Quality, and Risk department administers the QA program and visits every operating district at least once per year. During these visits, they select a prescribed number of 811 USA tickets for each Locator, check the employee's Operator Qualification status, and evaluate the documentation on the ticket. Additionally, they will perform field visits, when possible, to evaluate in-field activities such as equipment setup and use, Company Gas Standard compliance, accuracy of locate and mark placement, proper documentation, and proper

[19] The Operator Qualification rule was adopted into the Code of Federal Regulations under Subpart N in 49 CFR Part 192 and Subpart G in 49 CFR Part 195.

use of the Korterra ticket management system, among other activities. Feedback on a quality assurance audit is provided to each local supervisor who is responsible for following up with employees and providing coaching or refresher training.

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

F. Damage Prevention Analysts

C11: MP; C12: HP

The Damage Prevention Analyst Program works to reduce the number of third-party damages to gas facilities by identifying at-risk excavating contractors and educating them on proper one-call and safe digging techniques. The Damage Prevention Analyst Program strives to reduce the number of third-party damages to gas facilities by identifying at-risk excavating contractors through data analysis. The benefit of the damage prevention analyst is threefold. First, it enables SDG&E to stop a job before an incident occurs if no underground markings are present or the excavator is not practicing safe digging techniques. Second, it provides an opportunity to educate contractors on the requirements before digging or when digging around gas facilities before damage is done. This education has far-reaching benefits as the contractor will perform future projects in other districts not currently part of the program, and the education can be applied to those future projects. Third, it creates a list of contractors who might be repeat offenders and/or prevalent site characteristics to improve prioritization of future construction site inspections.

The damage prevention analysts focus on districts with the greatest number of reported incidents by driving to and physically inspecting excavation projects with 811 USA ticket requests. The analysts stop at other construction projects to investigate if the excavator notified USA 811 and if safe excavating techniques are followed. At times, the analysts will stop the job

and educate the contractor about safe excavating practices and procedures. SDG&E expects to expand this program with additional analysts and broader system-wide coverage. SDG&E's damage prevention analysts have stopped many jobs since the program's inception in 2019 and have conducted over 684 contractor outreach and educational opportunities.

G. Locating Equipment

C13: MP; C14: HP

Providing hardware that is appropriate for the rugged outdoor environment and updated with the latest software to run efficiently and provide correct information to locate underground pipelines accurately. SDG&E utilizes Locate and Mark laptops and software to comply with the requirements of state and federal regulations. SDG&E provides locate and mark technicians rugged laptops called Mobile Data Terminals (MDTs) containing KorMobile© Ticket Management Software to respond to 811 USA tickets in real-time. Using obsolete technology increases wait times, contributes to data communication failure, and increases likelihood of not responding to an 811 USA request in the required timeframe.

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

Employees who perform locate and mark activities rely on laptops, 811 USA tickets, asset mapping, records data, software, and locating equipment. Using laptops in an outdoor setting, and often in construction areas, can reduce life expectancy due to the harsh environment. Therefore, employees have laptops designed to withstand a harsh environment. Additionally, as software and data are updated and become more sophisticated with new and more powerful features, new laptops with advanced capabilities are required to process the information. Approximately 70 laptops are replaced every five years.

Updated and ruggedized laptops provide longer battery life and can process software faster and more efficiently. Updated hardware and software increase the effectiveness of

performing locate and mark activities. The ruggedized laptops can also take pictures of the area near the excavation site to update and improve asset mapping information. New laptops provide enhanced features to reduce locator errors and reduce pipeline damage.

The purpose of the Locating Equipment Program is to utilize technology to standardize locating tools to locate and mark underground gas infrastructure accurately. The Locating Equipment program will provide employees with standardized locating devices. Employee locating equipment will be replaced as new technology becomes available. Reducing the potential for damage to underground facilities that is caused by excavation activities requires correct facility markings. Excavators use these markings to know when hand-digging and other safe digging practices should be followed. Finally, providing employees standardized equipment allows for consistent training and use of the equipment to improve locate accuracy.

H. Public Awareness Compliance

C15: MP; C16: HP

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

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

Title 49 Code of Federal Regulation section 192.616 requires utilities/natural gas providers to include efforts to educate the public, appropriate government organizations, and persons engaged in excavation-related activities. The four types of groups identified in section 192.616[20] are the affected public, emergency officials, local public officials, and excavators. The SDG&E-6-C8 – Public Awareness mitigation has been tranched to match the four groups identified in section 192.616.

Periodically SDG&E participates in Distribution Public Awareness Council (DPAC) Benchmark studies to collect and compare membership data related to the effectiveness of public

[20] 49 CFR § 192.616.

awareness and community safety outreach programs managed by gas utilities. There is a clear distinction between the general level of awareness between the affected public, emergency officials, local public officials, and excavators. In order to address this gap and reduce third-party damage, targeted messaging campaigns are performed for each subgroup to increase overall awareness and education. Emergency officials and local public officials are often met with in person to discuss municipal third-party damage trends. The public and excavators are informed of 811 USA notification and safe digging practices using bill inserts, media campaigns, SDG&E damage prevention analysts, radio advertising, internet advertising, billboard advertising, and safety meetings. A summary of SDG&E's 2019 public awareness activities is shown in the table below.

Table 3: Summary of SDG&E' 2019 Public Awareness Activities

	Mailers	**Email messages**	**Campaigns/ Presentations**	**811 Unique Page views (2019 data)**
Excavators	26k	5k	0	16,863
Local Public Officials	212	220	0	
Affected Public	753k customers; 175k live/work near HP	877k	4	
Emergency Officials	338	4	33	

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

1. Public Awareness - Affected Public

C15-T1: MP; C16-T1: HP

SDG&E continues to promote awareness of the Underground Service Alert (811, "call-before-you dig") system to the affected public by reaching out to contractors and the general public through meetings, mailers, bill inserts, hosting events, the Company website, marketing, and banners at locally broadcasted events and other methods, so pipelines are properly marked and located before excavation activities. Excavation activity includes excavating, blasting, boring, tunneling, backfilling, removing aboveground structures by explosive or mechanical means, and other earth-moving operations.

When residents or contractors dial 811 USA before any project that involves digging, SDG&E marks the locations of underground lines to prevent damage, which could cause injury or service outages. This outreach is performed in compliance compliant with Title 49 Code of Federal Regulations, section 192.616 (d) subsections 1-5.

2. Public Awareness - Emergency Officials

C15-T2: MP; C16-T2: HP

SDG&E has the responsibility to train its employees on emergency procedures and establish a liaison with first responders in accordance with Title 49 Code of Federal Regulations, section 192.615.[21] According to General Order (GO) 112-F, SDG&E, as an "Operator," must comply with the requirements of sections 192, 192.615, and 192.616(e). There are significant benefits to creating strategic partnerships and promoting awareness with emergency officials. Communication and coordination are improved when it matters most. SDG&E works to implement this requirement by establishing lines of communication between SDG&E and first responders, by learning about the responsibility and resources available to each party in the event of a gas pipeline emergency, and by educating each other on how to best respond to a gas system emergency.

Additionally, section 192.616, which governs GO 112-F, states that SDG&E is required to coordinate emergency exercises or drills with first responders. To commemorate "811" 8/11 Day SDG&E, The California Regional Common Ground Alliance (CARCGA), and Orange County Fire Authority (OCFA) hold a mock utility line strike to raise awareness about the

[21] 49 CFR § 192.615.

importance of contacting 811 USA at least two working days (not counting the day of notification) prior to the start of any project that involves digging. The event program includes the 811 USA process, emergency response demonstration, investigation by the Dig Safe Board, Speakers from Dig Safe Board, Orange County Fire Authority, plus exhibitor booths. Building relationships with emergency officials is imperative in creating awareness of safe digging practices and potential consequences if excavators are not safe.

3. Public Awareness - Local Public Officials

C15-T3: MP; C16-T3: HP

Working directly with city officials involved in construction activities within their jurisdictions helps to educate external personnel to support unsafe excavation practices that could result in damage to underground facilities. This interaction can involve several efforts. First, educating city personnel on the specific requirements of the California safe excavation laws. Second, helping officials understand their role in enforcing the laws by promoting the use of 811 USA for excavation tickets through their project review and permitting activities and through field inspections their employees perform. Third, to explain the city's potential cost savings from avoiding their emergency personnel from having to respond to a blowing gas emergency due to non-compliant excavation damage. City officials can avoid unnecessary emergency response if they promote safe excavation practices during their routine daily planning and permitting work. This outreach is performed to be compliant with Title 49 Code of Federal Regulations, section 192.616 (d) subsections 1-5.

4. Public Awareness – Excavators

C15-T4: MP; C16-T4: HP

Excavator awareness of 811 USA is essential. Nationwide statistics from the Common Ground Alliance indicate that when a locate request is made prior to an underground excavation, no damage will occur 99% of the time.[22] It is important for contractors and excavators to be informed of the potential safety issues that might arise when working around natural gas pipelines. Underground pipelines are in various locations, including under streets, sidewalks,

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

and private property – sometimes just inches below the surface. Hitting one of these pipelines while conducting routine work such as digging, planting, or demolition work can cause serious injury, property damage, and loss of utility service. The benefits of calling 811 USA are communicated through awareness campaigns, such as in person excavator outreach events, targeted mailings, and the Big Shovel display. Excavator outreach is performed to be compliant with Title 49 Code of Federal Regulations, section 192.616(d) subsections 1-5.

I. Increase Reporting of Unsafe Excavation

C17: MP; C18: HP

The purpose of Increased Reporting of Unsafe Excavation is to identify and report excavators who frequently utilize unsafe excavation practices and to report those contractors to the Dig Safe Board and/or State Licensing Board (CSLB). Reporting of unsafe excavation is applicable to the entire SDG&E territory.

SDG&E's purpose for Increased Reporting of Unsafe Excavation is to consolidate and formalize internal procedures for identifying excavators who frequently utilize unsafe excavation practices and reporting those contractors to the Dig Safe Board and/or (CSLB). This includes consolidating the efforts of the Damage Prevention Strategies Team with the Claims Recovery Team. Both internal groups engage in various degrees of excavator education and outreach efforts on safe digging practices. The consolidation of efforts includes a consistent methodology for identifying targeted excavators. Education and outreach efforts provide the excavators understanding of the implications of unsafe excavation practices. In 2020, SDG&E stopped several jobs for unsafe excavation and conducted over 442 outreach and educational opportunities.

By combining the outreach information, this program provides a more comprehensive and holistic effort to achieve the benefits of reducing third-party damage. First, it provides the names of unsafe excavators to the appropriate state boards to support the state's objectives. Second, it offers an opportunity for excavators to be educated and informed on their obligations, such as the contractor's requirement to call prior to any excavation activity and to perform hand excavation in the vicinity of gas pipelines. The outreach to the excavator and contractor community should reduce the number of excavation activities without location marks and reduce the number of incidents on our pipelines.

The costs for this activity are not planned to be incorporated into the next GRC, and therefore, these activities are not part of the risk mitigation plan.

J. Damage Prevention Policy Activities

C19: MP; C20: HP

SDG&E aims to secure greater education, compliance, and enforcement of safe excavation practices through legislation and work with other organizations. SDG&E actively participates in the California Underground Safe Excavation Board (Dig Safe Board) to provide input and education from the natural gas utility perspective. Similarly, the purpose of remaining active members of the California Regional Common Ground Alliance (CARGA) is to work with all members of the excavation community in achieving the Dig Safe Board's objectives of providing education and outreach, developing safe excavation practices, investigating violations, and supporting the Board's authority. Securing greater enforcement through legislation and working with the California State Digging Board applies to all third-party excavations. Therefore, no further tranching is required.

The purpose of this participation is to work with all members of the excavation community in achieving the Dig Safe Board's objectives of providing education and outreach, developing safe excavation practices, investigating violations, and supporting the Board's authority.

Through involvement in board meetings and workshops and collaborating to achieve common objectives related to damage prevention, SDG&E fosters a positive and more robust working relationship with all stakeholders. By playing an active role in developing, educating, and enforcing utility and contractor requirements, a collaborative and holistic environment can be achieved among all stakeholders. The Dig Safe Board provides a forum so that effective, safe excavation requirements can be cooperatively developed and disseminated to reduce third-party damage.

SDG&E is an active member of Dig Alert. Dig Alert's territory includes nine Southern California Counties: Imperial, Inyo, Los Angeles, Orange, San Bernardino, San Diego, Santa Barbara, Riverside, and Ventura. SDG&E is mandated by Title 49 Code of Federal Regulation, section 192.614 and California Government Code, section 4216 to remain an active member of the California One-Call Centers.

The California 811 USA One-Call Centers serve as the communication conduit between SDG&E and excavators to support safe digging practices. Excavators contact the 811 USA one-call centers with their intent to excavate in a specific location. This information is made available to the owners and operators of underground infrastructure to provide pipeline location information before excavation occurs. SDG&E is an active member of local one-call centers. In calendar year 2020, SDG&E responded to over 180,000 locate and mark requests on the system through the local one-call centers.

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

K. The Gold Shovel Standard Program

C21: MP; C22: HP

The Gold Shovel Standard (GSS) Program utilizes an external organization that certifies contractor's policies and procedures to protect underground facilities against an established Gold Shovel Standard. This program applies to all third-party contractors working for SDG&E. All third-party damage caused by contractors working for SDG&E poses the same safety risk. Therefore, no further tranching is required.

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

The GSS provides positive guidance to underground contractors, aligning their excavation practices against established safe digging practices and procedures. It helps to

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

L. Excess Flow Valve or Curb Valve Installation

C23: MP

Excess Flow Valves (EFV) are designed to prevent gas escape by automatically stopping the gas flow when a medium pressure service is damaged. Curb valves are used to quickly shut down damaged medium pressure service lines.

A medium pressure service line can be damaged by several driver/triggers such as the failure to follow the 811-notification process, a mismark by the locator, or the lack of caution during excavation. When a gas service line is severely damaged, the EFV immediately stops the flow of gas, eliminating the risk of prolonged gas release and migration. EFV and curb valves mitigate the consequences associated with a damaged medium pressure gas service line.

M. Pipeline Patrol and Pipeline Markers

C24: HP

Qualified employees patrol high-pressure pipelines, assessing the area over and around the pipeline for signs of excavation or potential excavation. Part of this patrol includes establishing and maintaining pipeline markers where required. Pipeline markers provide a visual warning to outside parties that a high-pressure gas pipeline is in the vicinity and contact must be made to 811 or SDG&E before any excavation occurs. Pipeline patrol and pipeline markers are important for preventing damage to the pipeline. During patrol, potential excavators without a USA ticket could be identified. The patrols help prevent excavators from digging without a USA ticket or without a SDG&E standby employee onsite when required. This mitigation is a proactive measure to alert excavators who are unaware of 811 laws and rules or standby requirements.

N. Company Excavator Training

C25: MP; C26: HP

A formal training program provides excavation training to employees who are required to excavate as part of their job duties. The training reinforces safe excavating procedures, so employees know how to avoid damaging company pipelines as well as other utilities' buried facilities. The training includes the use of a pneumatic clay spade around buried facilities and backhoe training. The training content is comprehensive, covering all operational aspects for the safe use of a particular piece of equipment, including the required personal protective equipment, manufacturers recommendations and instructions, as well as additional procedures, guidelines and limitations developed internally by SDG&E. Excavation equipment training is typically performed when an employee begins a new job position, as part of the job requirements. Once trained and qualified, employees continue to develop their safe operating skills in the field under direction of senior employees and supervision. Refresher training is available to employees on an as-needed basis.

Training employees to understand the applicable excavation regulations and safe excavating techniques around pipelines will mitigate the risk of employees damaging pipelines.

O. Warning Mesh

C27 MP; C28: HP

Warning mesh is a practice to help prevent excavators from not adhering to the 811 USA excavation safety notification requirement. Approximately 60% of Company damages are caused by excavators not contacting 811 USA before excavating. Warning mesh is installed over pipelines in open trench before backfilling. This program applies to all SDG&E open trench new pipeline installations or replacements.

The purpose of installing warning mesh over pipelines is to provide a visual warning to excavators to prevent damage. Warning mesh is installed over pipelines when an open-trench installation opportunity is available for new construction, repair, and replacements projects before backfilling. The warning mesh is a visual indicator that can be exposed before the excavator damages pipelines and can mitigate locate errors or unsafe excavation techniques. It reminds the excavator to exercise safe excavation techniques, corrects inaccurate surface locate markings, and warns the excavator that a pipeline is nearby.

P. Ticket Risk Assessment and Evaluating City Permit Data

C29: MP; C30: HP

Ticket Risk Assessment (TRA) technology uses complex modeling software to assign risk scores to every USA ticket received by the Company. The technology also provides additional identifiers on each USA ticket to quickly identify other facility properties, such as flags for high-pressure pipes or regulator stations intersecting the ticket's work scope. The tool also provides integration with public information such as city and county permit data, where available. This permit data is used to help determine areas with construction or building permits that may not have a USA ticket.

The TRA provides a new way to mitigate notification issues, location issues, and excavation issues that could lead to significant consequences. The higher risk tickets are visited by field employees who communicate with the excavator to assess if excavation rules are understood to prevent damage to pipelines. Field employees review and assess the USA ticket to verify it has been adequately addressed by locators and take appropriate follow-up action if required.

Q. Enhance Ticket Management Software

C31: MP; C32: HP

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

As part of continuous improvement, an assessment of the current state of the 811 USA one-call ticket routing and monitoring is underway. The primary focus of system improvements to the USA ticket routing and monitoring is to upgrade the ticket management system to provide increased abilities to monitor and manage locate and mark ticket requests and to evaluate and measure performance for meeting time commitments. In calendar year 2019, SDG&E fulfilled over 164,000 USA ticket requests from excavators.

SDG&E has a time requirement to fulfill locate and mark ticket requests. If time requirements are not met, contractors might excavate and assume no visible marks means no underground facilities conflict with their project. If this occurs, contractors could hit and damage

underground gas infrastructure due to the lack of surface markings. By providing enhanced capabilities to monitor and manage ticket request workload, SDG&E will have the ability to prioritize ticket requests, assign crews, and balance workload among the locate and mark crews. Additionally, the data capture and reporting enhancements can improve SDG&E's ability to monitor its processes and identify process improvements. These enhancements work toward improving SDG&E's performance in meeting the locate and mark timeframe, thereby reducing the potential of contractors digging without knowledge of underground gas infrastructure.

IV. 2022-2024 CONTROL & MITIGATION PLAN

This section contains a table identifying the controls and mitigations comprising the portfolio of mitigations for this risk.[23]

As reflected in the Table below, all of the activities discussed in Section III above are expected to continue during the TY 2024 GRC. For clarity, a current activity that is included in the Plan may be referred to as either a control and/or a mitigation. For purposes of this RAMP, a control that will continue as a mitigation will retain its Control ID unless the size and/or scope of that activity will be modified, in which case that activity's Control ID will be replaced with a Mitigation ID. The table below shows which activities are expected to continue.

Table 4: Control and Mitigation Plan Summary

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
1	C1	Locate & Mark Training (MP)	X	X
2	C2	Locate & Mark Training (HP)	X	X
3	C3	Locate & Mark Activities (MP)	X	X
4	C4	Locate & Mark Activities (HP)	X	X
5	C5	Locate and Mark Annual Refresher Training and Competency Program (MP)	X	X
6	C6	Locate and Mark Annual Refresher Training and Competency Program (HP)	X	X
7	C7	Locate and Mark Operator Qualification (MP)	X	X
8	C8	Locate and Mark Operator Qualification (HP)	X	X
9	C9	Locate and Mark Quality Assurance (MP)	X	X
10	C10	Locate and Mark Quality Assurance (HP)	X	X
11	C11	Damage Prevention Analyst Program (MP)	X	X

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

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
12	C12	Damage Prevention Analyst Program (HP)	X	X
13	C13	Locating Equipment (MP)	X	X
14	C14	Locating Equipment (HP)	X	X
15	C15 – T1	Public Awareness Compliance - The Affected Public (MP)	X	X
16	C15 – T2	Public Awareness Compliance - Emergency Officials (MP)	X	X
17	C15 – T3	Public Awareness Compliance - Local Public Officials (MP)	X	X
18	C15– T4	Public Awareness Compliance – Excavators (MP)	X	X
19	C16 – T1	Public Awareness Compliance - The Affected Public (HP)	X	X
20	C16 – T2	Public Awareness Compliance - Emergency Officials (MP)	X	X
21	C16 – T3	Public Awareness Compliance - Local Public Officials (HP)	X	X
22	C16 – T4	Public Awareness Compliance – Excavators (HP)	X	X
23	C17	Increase Reporting of Unsafe Excavation (MP)	X	No
24	C18	Increase Reporting of Unsafe Excavation (HP)	X	No
25	C19	Damage Prevention Policy Activities (MP)	X	X
26	C20	Damage Prevention Policy Activities (HP)	X	X
27	C21	Gold Shovel Standard Program (MP)	X	X
28	C22	Gold Shovel Standard Program (HP)	X	X
29	C23	Excess Flow Valve or Curb Valve Installation (MP)	X	X
30	C24	Pipeline Patrol and Pipeline Markers (HP)	X	X
31	C25	Company Excavator Training (MP)	X	X
32	C26	Company Excavator Training (HP)	X	X
33	C27	Warning Mesh (MP)	X	X
34	C28	Warning Mesh (HP)	X	X
35	C29	Ticket Risk Assessment and Evaluating City Permit Data (MP)	X	X
36	C30	Ticket Risk Assessment and Evaluating City Permit Data (HP)	X	X
37	C31	Enhance Ticket Management Software (MP)	X	X
38	C32	Enhance Ticket Management Software (HP)	X	X
37	M1	Automate Third Party Excavation Incident Reporting (MP)	-	X
38	M2	Automate Third Party Excavation Incident Reporting (HP)	-	X

Line No.	Control/ Mitigation ID	Control/Mitigation Description	2020 Controls	2022-2024 Plan
39	M3	Locate and Mark Photographs (MP)	-	X
40	M4	Locate and Mark Photographs (HP)	-	X
41	M5	Electronic Positive Response (MP)	-	X
42	M6	Electronic Positive Response (HP)	-	X
43	M7	Leverage Technology for Difficult Locates (MP)	-	No
44	M8	Leverage Technology for Difficult Locates (HP)	-	No
45	M9	Outreach for Latent 3rd Party Damages (MP)	-	X
46	M10	Outreach for Latent 3rd Party Damages (HP)	-	X
47	M11	Leverage Data Gathered by Locating Equipment (MP)	-	No
48	M12	Leverage Data Gathered by Locating Equipment (HP)	-	No
49	M13	Pipeline Monitoring Technologies (HP)	-	X

For activities SDG&E plans to perform that remain unchanged, please refer to the description in Section III. If changes to the various activities are anticipated, such modifications are further described in this section below.

A. Changes to 2020 Controls

SDG&E plans to continue each of the existing mitigations discussed above in Section III through the 2022 – 2024 period without any significant changes.

B. 2022 – 2024 Mitigations

1. Automate Third Party Excavation Incident Reporting

M1: MP; M2: HP

Automating Third Party Excavation incident reporting into one system will centralize the reporting and data analysis. This will assist with meeting compliance reporting obligations, develop a better understanding of the data collected in an investigation, simplify reporting, and enhance data analysis processes. Title 49 Code of Federal Regulation, section 192.614 and California Government Code, section 4216 require SDG&E to collect data on third-party excavation incidents.

Automating third-party excavation incident reporting is an effort to consolidate and simplify the data collection process involved in investigating a gas incident. Field supervisors complete the investigations of gas incidents. Currently, there are multiple systems and processes used to capture and report data, internally and externally, for a gas incident. All systems and

processes might not be updated simultaneously, thereby creating additional manual steps when using the data for internal analysis for process improvements or generate reports for internal or external stakeholders. SDG&E is undertaking an initiative to centralize these processes and systems into one record system to minimize data quality issues, simplify reporting, and standardize data collection with field supervisors.

Standardizing data collection into one system will centralize reporting and data analysis, assist with meeting compliance reporting obligations, develop a better understanding of data collected in an investigation, simplify reporting, and enhance data analysis processes. This will facilitate improvements in SDG&E's accuracy and timeliness in locating and marking its infrastructure.

2. Locate and Mark Photographs

M3: MP; M4: HP

Recording photographs for each locate and mark ticket visited by locators is planned for all SDG&E's above and belowground facilities in the service territory. These pictures will help audit the quality of locates and provide an opportunity to improve future locate and mark ticket request for previous locations.

The purpose of recording photographs of each locate and mark ticket is to improve the accuracy of the locating activity and to inform process improvements based on investigations of gas incidents and quality assurance audits. By having a record of the locate marks, SDG&E can perform root cause analyses of QA activities and investigations of gas incidents. Photographs could show incorrect markings or GIS mapping, which could be used to improve employee training and update GIS data. The benefits of this mitigation are to improve locate and mark accuracy and mitigate gas infrastructure damage.

3. Electronic Positive Response

M5: MP; M6: HP

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

SDG&E is required to locate and mark its underground infrastructure within two business days after receiving an 811 USA locate and mark ticket request. Implementing a positive response feature with the regional notification centers improves communication between SDG&E and excavating contractors. The system will inform the contractor that the utility has completed its task or inform the excavator there is no conflict with gas infrastructure in the excavation area. The system also provides a way to communicate stand-by requirements and notification if the locate task was incomplete due to weather or accessibility issues.

This program requires participation from contractors and SDG&E. It will mitigate potential damage to gas infrastructure due to miscommunication between the contractors and SDG&E. This is especially important in situations where the utility could not provide markings within the required timeframe and the contractor assumes no conflict with gas infrastructure because no marks are present. Without pipeline markings, the contractor may not exercise safe excavation techniques and damage gas infrastructure.

4. Leverage Technology for Difficult Locates

M7: MP; M8: HP

Vacuum excavation technology is an example of a hydro excavation tool that can be deployed to find the location of pipelines when it is difficult to locate the pipeline because of interference or other reasons. The technology is a safe alternative to hand tools to locate and prevent damage to unknown pipeline locations. Vacuum excavation is utilized on an as-needed, case-by-case basis during Locate and Mark activities or in a proactive way in areas that are historically known to be hard to locate. Vacuum excavation is applicable to areas in SDG&E's territory. All excavations utilizing vacuum excavation technology pose the same safety risk, and a single tranche is appropriate.

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

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

5. Outreach for Latent 3rd Party Damages

M9: MP; M10: HP

This mitigation encompasses the efforts to identify and communicate with excavators who may have damaged an SDG&E underground facility without complying with safe excavation laws and best practices.

Occasionally, during routine activities, SDG&E will expose a section of underground piping and, upon visual inspection, determine that previously unknown damage has occurred. SDG&E was likely unaware of the excavation activity and thus was not onsite to perform the required standby activities. To identify excavators who may have conducted the excavation, further investigation would be required to determine if any USA tickets or excavation/construction permits had been valid in the area over a given time period. This would include communication and information requests with the Regional Notification Center and any local jurisdiction that may have issued a permit. Follow-up communications would then be made to these excavators to remind them of the safe excavation law requirements and best practices, along with an offer to conduct a safe excavation training event at their facilities for their employees and management to attend. Additionally, information would be provided regarding the potential enforcement actions that can be taken by the Dig Safe Board Investigation department and the Contractor State Licensing Board.

The benefits of this activity would be to continue to educate the excavator community on the importance of following the laws and best practices in order to prevent unintended consequences that can be attributed to unsafe excavations.

6. Leverage Data Gathered by Locating Equipment

M11: MP; M12: HP

The current locating equipment has the capability of recording information from a locate site. This information could be used to assess the quality of each locate and the relative accuracy of pipe location in the GIS system. By having a quality measurement for each locate the company can further determine areas for improvement. The data gathered by leveraging locating equipment will be used to evaluate performance per Title 49 Code of Federal Regulation, section 192.614.

The purpose of the Leveraging Data Gathered by Locating Equipment Program is to utilize technology to improve how SDG&E mapping and asset records are updated and improve the accuracy of locate and mark activities. It provides locate and mark employees with tools and technology to update Company records by capturing location coordinates found in the field, which is used to validate existing company records and identify GIS or locating errors.

Correct and accurate pipeline locations will reduce the potential for damage to underground facilities caused by excavation. Excavators use markings to inform when to hand expose a pipeline or utilize other safe excavation techniques. Equipment with the latest technology provides an opportunity for more accurate pipeline location and the ability to provide latitude and longitude coordinates to update GIS records. Maintaining an accurate GIS database and records is essential to improve locate and mark quality and mitigate pipeline damage.

7. Pipeline Monitoring Technologies

M13: HP

The Control Center Modernization (CCM) organization will deploy new field pipeline monitoring technologies along existing high consequence areas, evacuation challenged areas, and new or replaced transmission pipelines. These field monitoring assets (*i.e.*, fiber, methane) will allow Gas Control to better monitor pipelines to more quickly identify and respond to abnormal operating or emergency conditions resulting from a dig-in incident.

These new field pipeline technologies will provide multiple safety and reliability benefits, including but not limited to:

- Faster response times to incidents and the reduction of severity of incidents due to the ability to monitor and respond to unfolding incidents in real-time.

- A centralized and modernized technology will increase operational efficiency and improve the speed and ability to manage incidents, directly translating to improvement in public and employee safety.

V. COST, UNITS, AND QUANTITATIVE SUMMARY TABLES

The tables in this section summarize the risk control and mitigation plan, including the associated costs, units, and the RSEs, by tranche. When an RSE could not be performed, an explanation is provided. SDG&E does not account for and track costs by activity or tranche; rather, SDG&E accounts for and tracks costs by cost center and capital budget code. The costs shown were estimated using assumptions provided by SMEs and available accounting data.

Table 7: Risk Control and Mitigation Plan - Recorded and Forecast Dollars Summary[24] (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[25]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	Locate & Mark Training (MP)	-	105	-	-	103	124
C2	Locate & Mark Training (HP)	-	14	-	-	15	18
C3	Locate & Mark Activities (MP)	-	4,946	-	-	5,135	6,215
C4	Locate & Mark Activities (HP)	-	1,435	-	-	1,458	1,765
C5	Locate and Mark Annual Refresher Training and Competency Program (MP)	-	8	-	-	4	5
C6	Locate and Mark Annual Refresher Training and Competency Program (HP)	-	1	-	-	1	1

[24] Recorded costs and forecast ranges are rounded. Additional cost-related information is provided in workpapers. Costs presented in the workpapers may differ from this table due to rounding. The figures provided are direct charges and do not include company loaders, with the exception of vacation and sick. The costs are also in 2020 dollar amounts and have not been escalated to 2021 amounts. The capital presented is the sum of the years 2022, 2023, and 2024, or a three-year total. Years 2022, 2023 and 2024 are the forecast years for SDG&E's Test Year 2024 GRC Application.

[25] Pursuant to D.14-12-025 and D.16-08-018, the Company provides the 2020 "baseline" capital costs associated with controls. The 2020 capital amounts are for illustrative purposes only. Because capital programs generally span several years, considering only one year of capital may not represent the entire activity.

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[25]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C7	Locate and Mark Operator Qualification (MP)	-	-	-	-	11	14
C8	Locate and Mark Operator Qualification (HP)	-	-	-	-	1	1
C9	Locate and Mark Quality Assurance (MP)	-	387	-	-	594	759
C10	Locate and Mark Quality Assurance (HP)	-	42	-	-	78	99
C11	Damage Prevention Analyst Program (MP)	-	97	-	-	235	301
C12	Damage Prevention Analyst Program (HP)	-	22	-	-	45	57
C13	Locating Equipment (MP)	411	-	602	769	-	-
C14	Locating Equipment (HP)	94	-	134	171	-	-
C15-T1	Public Awareness Compliance - The Affected Public (MP)	-	191	-	-	250	303
C16-T1	Public Awareness Compliance - The Affected Public (HP)	-	-	-	-	57	69
C15-T2	Public Awareness Compliance - Emergency Officials (MP)	-	0	-	-	3	3
C16-T2	Public Awareness Compliance - Emergency Officials (HP)	-	0	-	-	1	1
C15-T3	Public Awareness Compliance - Local Public Officials (MP)	-	0	-	-	16	20
C16-T3	Public Awareness Compliance - Local Public Officials (HP)	-	0	-	-	4	5
C15-T4	Public Awareness Compliance – Excavators (MP)	-	72	-	-	20	25
C16-T4	Public Awareness Compliance – Excavators (HP)	-	16	-	-	5	6
C19	Damage Prevention Policy Activities (MP)	-	0	-	-	0	0

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[25]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C20	Damage Prevention Policy Activities (HP)	-	0	-	-	0	0
C21	Gold Shovel Standard Program (MP)	-	2	-	-	2	3
C22	Gold Shovel Standard Program (HP)	-	0	-	-	0	1
C23	Excess Flow Valve or Curb Valve Installation (MP)	104	-	293	374	-	-
C24	Pipeline Patrol and Pipeline Markers (HP)	-	680	-	-	669	854
C25	Company Excavator Training (MP)	-	141	-	-	134	171
C26	Company Excavator Training (HP)	-	18	-	-	18	24
C27	Warning Mesh (MP)	76	-	226	273	-	-
C28	Warning Mesh (HP)	17	-	51	62	-	-
C29	Ticket Risk Assessment and Evaluating City Permit Data (MP)	-	60	-	-	35	45
C30	Ticket Risk Assessment and Evaluating City Permit Data (HP)		14	-	-	8	10
C31	Enhance Ticket Management Software (MP)	35	1	90	114	1	2
C32	Enhance Ticket Management Software (HP)	8	-	20	26	-	-
M1	Automate Third Party Excavation Incident Reporting (MP)	-	-	-	-	13	16
M2	Automate Third Party Excavation Incident Reporting (HP)	-	-	-	-	2	3
M3	Locate and Mark Photographs (MP)	-	-	-	-	69	88
M4	Locate and Mark Photographs (HP)	-	-	-	-	11	14
M5	Electronic Positive Response (MP)	Included with C31					
M6	Electronic Positive Response (HP)	Included with C32					

ID	Control/Mitigation Name	Recorded Dollars		Forecast Dollars			
		2020 Capital[25]	2020 O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
M9	Outreach for Latent 3rd Party Damages (MP)	-	-	-	-	3	4
M10	Outreach for Latent 3rd Party Damages (HP)	-	-	-	-	1	1
M13	Pipeline Monitoring Technologies (HP)	-	-	1,524	2,202	54	77

Table 8: Risk Control & Mitigation Plan – Units Summary

ID	Control/Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
C1	Locate & Mark Training (MP)	Training Hours		-	-	1,017	1,231
C2	Locate & Mark Training (HP)	Training Hours		-	-	163	197
C3	Locate & Mark Activities (MP)	Ticket Count		-	-	138,975	168,233
C4	Locate & Mark Activities (HP)	Ticket Count		-	-	31,675	38,344
C5	Locate and Mark Annual Refresher Training and Competency Program (MP)	Training Hours		-	-	31	37
C6	Locate and Mark Annual Refresher Training and Competency Program (HP)	Training Hours		-	-	7	9
C7	Locate and Mark Operator Qualification (MP)	Program		1	1	1	1
C8	Locate and Mark Operator Qualification (HP)	The units for this control are included in C7.					
C9	Locate and Mark Quality Assurance (MP)	FTE Headcount				3	3
C10	Locate and Mark Quality Assurance (HP)	The units for this control are included in C9.					
C11	Damage Prevention Analyst Program (MP)	FTE Headcount				3	3
C12	Damage Prevention Analyst Program (HP)	The units for this control are included in C11.					
C13	Locating Equipment (MP)	Number of Mobile Data Terminals (MDTs)		121	155	-	-
C14	Locating Equipment (HP)	Number of Mobile Data Terminals		38	49	-	-

ID	Control/Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
		(MDTs)					
C15-T1	Public Awareness Compliance - The Affected Public (MP)		Number of Communications Sent	-	-	1,510,739	1,828,789
C16-T1	Public Awareness Compliance - The Affected Public (HP)		Number of Communications Sent	-	-	344,329	416,819
C15-T2	Public Awareness Compliance - Emergency Officials (MP)		Number of Communications Sent	-	-	418	506
C16-T2	Public Awareness Compliance - Emergency Officials (HP)		Number of Communications Sent	-	-	95	115
C15-T3	Public Awareness Compliance - Local Public Officials (MP)		Number of Communications Sent	-	-	346	442
C16-T3	Public Awareness Compliance - Local Public Officials (HP)		Number of Communications Sent	-	-	79	101
C15-T4	Public Awareness Compliance – Excavators (MP)		Number of Communications Sent	-	-	44,384	53,728
C16-T4	Public Awareness Compliance – Excavators (HP)		Number of Communications Sent	-	-	10,116	12,246
C19	Damage Prevention Policy Activities (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
C20	Damage Prevention Policy Activities (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
C21	Gold Shovel Standard Program (MP)		Memberships	-	-	1	1
C22	Gold Shovel Standard Program (HP)	The units are included in C21					
C23	Excess Flow Valve or Curb Valve Installation (MP)		Number of Installations	12,645	15,307	-	-
C24	Pipeline Patrol and Pipeline Markers (HP)		Number of Items	-	-	28	34
C25	Company Excavator Training (MP)	The units are included in C26.					
C26	Company Excavator Training (HP)		Training Hours	-	-	207	251
C27	Warning Mesh (MP)		Number of Warning Mesh Rolls	2,872	3,477	-	
C28	Warning Mesh (HP)		Number of Warning Mesh Rolls	655	792	-	-
C29	Ticket Risk Assessment and Evaluating City Permit Data (MP)		FTE Headcount	-	-	1	1
C30	Ticket Risk Assessment and Evaluating City Permit Data (HP)	FTE Headcount (less than 1)					
C31	Enhance Ticket Management Software (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
C32	Enhance Ticket Management Software (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					

ID	Control/Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
M1	Automate Third Party Excavation Incident Reporting (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
M2	Automate Third Party Excavation Incident Reporting (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
M3	Locate and Mark Photographs (MP)		FTE Headcount	-	-	1	1
M4	Locate and Mark Photographs (HP)	The units for this mitigation are included with M3.					
M5	Electronic Positive Response (MP)	The units for this mitigation are included with C31.					
M6	Electronic Positive Response (HP)	The units for this mitigation are included with C32.					
M9	Outreach for Latent 3rd Party Damages (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
M10	Outreach for Latent 3rd Party Damages (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
M13	Pipeline Monitoring Technologies (HP)		Fiber	1	1	1	1

Table 9: Risk Control & Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C1	Locate & Mark Training (MP)	See Table 10			
C2	Locate & Mark Training (HP)	See Table 10			
C3	Locate & Mark Activities (MP)	3333	1.05	3504.2	590
C4	Locate & Mark Activities (HP)	0.17	4235.49	721.9	61
C5	Locate and Mark Annual Refresher Training and Competency Program (MP)	300	1.05	316	25
C6	Locate and Mark Annual Refresher Training and Competency Program (HP)	0.19	4235	815	317
C7	Locate and Mark Operator Qualification (MP)	See Table 10			
C8	Locate and Mark Operator Qualification (HP)	See Table 10			
C9	Locate and Mark Quality Assurance (MP)	300	1.05	315	1
C10	Locate and Mark Quality Assurance (HP)	0.19	4235	814	19
C11	Damage Prevention Analyst Program (MP)	290	1.05	305	40

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
C12	Damage Prevention Analyst Program (HP)	0.19	4235	814	19
C13	Locating Equipment (MP)	275	1.05	290	179
C14	Locating Equipment (HP)	0.19	4235	801.2	456
C15-T1	Public Awareness Compliance - The Affected Public (MP)	296	1.05	311	17
C16-T1	Public Awareness Compliance - The Affected Public (HP)	0.19	4235	813	38
C15-T2	Public Awareness Compliance - Emergency Officials (MP)	300	1.05	316	20
C16-T2	Public Awareness Compliance - Emergency Officials (HP)	0.19	4235	815	51
C15-T3	Public Awareness Compliance - Local Public Officials (MP)	300	1.05	315	14
C16-T3	Public Awareness Compliance - Local Public Officials (HP)	0.19	4235	815	39
C15-T4	Public Awareness Compliance – Excavators (MP)	298	1.05	313	124
C16-T4	Public Awareness Compliance – Excavators (HP)	0.19	4235	814	287
C19	Damage Prevention Policy Activities (MP)	See Table 10			
C20	Damage Prevention Policy Activities (HP)	See Table 10			
C21	Gold Shovel Standard Program (MP)	See Table 10			
C22	Gold Shovel Standard Program (HP)	See Table 10			
C23	Excess Flow Valve or Curb Valve Installation (MP)	299	1.05	315	83
C24	Pipeline Patrol and Pipeline Markers (HP)	0.19	4235	811	5.7
C25	Company Excavator Training (MP)	See Table 10			
C26	Company Excavator Training (HP)	See Table 10			
C27	Warning Mesh (MP)	300	1.05	315	26
C28	Warning Mesh (HP)	.19	4235	810	2702
C29	Ticket Risk Assessment and Evaluating City Permit Data (MP)	300	1.05	316	1
C30	Ticket Risk Assessment and Evaluating City Permit Data (HP)	.19	4235	815	8
C31	Enhance Ticket Management Software (MP)	300	1.05	315	17
C32	Enhance Ticket Management Software (HP)	.19	4235	815	39

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
M1	Automate Third Party Excavation Incident Reporting (MP)	300	1.05	316	17
M2	Automate Third Party Excavation Incident Reporting (HP)	0.19	4235	815	31
M3	Locate and Mark Photographs (MP)	See Table 10			
M4	Locate and Mark Photographs (HP)	See Table 10			
M5	Electronic Positive Response (MP)	See Table 10			
M6	Electronic Positive Response (HP)	See Table 10			
M9	Outreach for Latent 3rd Party Damages (MP)	See Table 10			
M10	Outreach for Latent 3rd Party Damages (HP)	See Table 10			
M13	Pipeline Monitoring Technologies (HP)	See Table l0			

Table 10: Risk Control & Mitigation Plan - Quantitative Analysis Summary for RSE Unavailability

ID	Control/Mitigation Name	RSE Unavailability
C1	Locate & Mark Training (MP)	Providing Locator training is standard practice across the industry. The need for in-depth knowledge of the use of proper tools and resources is paramount for the efficient and accurate application of L&M procedures. There are no known sources to find data associated with operators who do not have a training program and SMEs are unable to reliably speculate on the quantitative benefits of training.
C2	Locate & Mark Training (HP)	Providing Locator training is standard practice across the industry. The need for in-depth knowledge of the use of proper tools and resources is paramount for the efficient and accurate application of L&M procedures. There are no known sources to find data associated with operators who do not have a training program and SMEs are unable to reliably speculate on the quantitative benefits of training.
C7	Locate and Mark Operator Qualification (MP)	Locate & Mark activities are “covered tasks” as defined in 49 CFR 192.801. As such the Op

ID	Control/Mitigation Name	RSE Unavailability
		Qual program is required for all individuals performing the tasks. The program was mandated in 2004. Data representing the status of the L&M program before that time is not available to provide comparison to the pre-Op Qual environment, and SMEs are unable to reliably speculate on the quantitative benefits of this longstanding program.
C8	Locate and Mark Operator Qualification (HP)	Locate & Mark activities are "covered tasks" as defined in 49 CFR 192.801. As such the Op Qual program is required for all individuals performing the tasks. The program was mandated in 2004. Data representing the status of the L&M program before that time is not available to provide comparison to the pre-Op Qual environment, and SMEs are not able to speculate on the quantitative benefits of this longstanding program.
C19	Damage Prevention Policy Activities (MP)	This activity involves the proactive participation at meetings and workshops with the Dig Safe Board, Regional Common Ground Alliance (CARCGA), both California One-Call centers, and meetings with State Assembly and Senator staff to advocate from the Operator/Excavator perspective, for sensible and comprehensive enhancements to state laws and regulations. Participation provides the opportunity to make positive and beneficial changes. Choosing not to participate could lead to poor, costly, and ineffective regulations. The Damage Prevention Strategies group began this activity in 2018 and are not aware of meaningful data that would provide for an RSE calculation at this time. SMEs are unable to quantify the benefits of this activity.
C20	Damage Prevention Policy Activities (HP)	This activity involves the proactive participation at meetings and workshops with the Dig Safe Board, Regional Common Ground Alliance (CARCGA), both California One-Call centers, and meetings with State Assembly and Senator staff to advocate, from the Operator/Excavator perspective, for sensible and comprehensive enhancements to state laws and regulations.

ID	Control/Mitigation Name	RSE Unavailability
		Participation provides the opportunity to make positive and beneficial changes. Choosing not to participate could lead to poor, costly, and ineffective regulations. The Damage Prevention Strategies group began this activity in 2018 and are not aware of meaningful data that would provide for an RSE calculation at this time. SMEs are unable to quantify the benefits of this activity.
C21	Gold Shovel Standard Program (MP)	Participation in this program is one component of SDG&E's contractor performance management programs and applies to a small subset of the excavator community – those contractors who perform construction work on SDG&E's behalf. SDG&E has been working with the GSS program to develop useful metrics but is currently unaware of their availability. SMEs are unable to quantify the benefits of this program.
C22	Gold Shovel Standard Program (HP)	Participation in this program is one part of our contractor performance management programs and applies to a small subset of the excavator community – those contractors who perform construction work on SDG&E's behalf. SDG&E has been working with the GSS program to develop useful metrics but is currently unaware of their availability. SMEs are unable to quantify the benefits of this program.
C25	Company Excavator Training (MP)	Providing training is a common, necessary, and expected practice regardless of the industry. It is important to properly train employees on the safe use of excavation implements or machines. When working around a hazardous material such as natural gas, many safety practices and protocols have been developed internally and by institutions such as OSHA to promote safety and personal wellbeing. It is unknown where data can be found to represent an entity that does not provide adequate training, and SMEs cannot determine the quantitative effects of these activities.

ID	Control/Mitigation Name	RSE Unavailability
C26	Company Excavator Training (HP)	Providing training is a common, necessary, and expected practice regardless of the industry. It is important to properly train employees on the safe use of excavation implements or machines. When working around a hazardous material such as natural gas, many safety practices and protocols have been developed internally and by institutions such as OSHA to promote safety and personal wellbeing. It is unknown where data can be found to represent an entity that does not provide adequate training, and SMEs cannot determine the quantitative effects of these activities.
M3	Locate and Mark Photographs (MP)	Locate & Mark photographs mitigation is included with the C-3 Locate and Mark Activities (MP)
M4	Locate and Mark Photographs (HP)	Locate & Mark photographs mitigation is included with the C-4 Locate and Mark Activities (HP)
M5	Electronic Positive Response (MP)	Electronic Positive Response is included with C-33 Enhance Ticket Management Software (MP)
M6	Electronic Positive Response (HP)	Electronic Positive Response is included with C-34 Enhance Ticket Management Software (HP)
M9	Outreach for Latent 3rd Party Damages (MP)	This is a new mitigation with no historical data. SDG&E's intent is to attempt to identify an excavator who damaged a pipeline in the past (via historic permit or USA ticket information) to provide the opportunity for outreach and education to minimize or prevent a similar occurrence in the future. With no historical data to provide any indication for a potential success rate, calculation of an RSE is infeasible, as it would require SME speculation about this activity.
M10	Outreach for Latent 3rd Party Damages (HP)	This is a new mitigation with no historical data. SDG&E's intent is to attempt to identify an excavator who damaged a pipeline in the past (via historic permit or USA ticket information) to provide the opportunity for outreach and education to minimize or prevent a similar occurrence in the future. With no historical

ID	Control/Mitigation Name	RSE Unavailability
		data to provide any indication for a potential success rate, calculation of an RSE is infeasible, as it would require SME speculation about this activity.
M13	Pipeline Monitoring Technologies (HP)	Increasing the ability to monitor and control the natural gas system is a prudent safety and reliability measure for California's energy grid. The CCM will allow for the system to be controlled or isolated faster in the event of a system incident. Likewise, the CCM will allow for potential issues in the system to be identified sooner, as opposed to patrols or a system with fewer monitor points, and potentially resolved before becoming an incident. This can include dig-in detection and response, over/under pressure awareness and response as well as increased flexibility to respond to the varying demands on the system throughout the year. Increased remote control can also alleviate employee exposure while operating equipment prior to, during or after an incident. Overall, the CCM will decrease the consequences of system incidents through the opportunity for quicker identification, more timely response, and fewer human asset involvement in potentially hazardous conditions. Since the CCM is still in the design phase and not operational yet, there is no historical data available to develop an RSE for the risk mitigations of Dig-Ins, and SME input cannot fill the information gap.

VI. ALTERNATIVES

Pursuant to D.14-12-025 and D.16-08-018, SDG&E considered alternatives to the risk control and mitigation plan for the Dig-in on the System risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this plan also took into account modifications to the plan and constraints, such as budget and resources.

A. A1: MP; A2: HP Virtual Reality Training

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

B. A3: MP; A4: HP GPS Tracking of Excavation Equipment

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

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

The technology is not being pursued currently as the initial experience demonstrated false positives. Follow-up is needed to validate technology maturity.

Table 11: Alternate Mitigation Plan - Forecast Dollars Summary
(Direct After Allocations, In 2020 $000)

ID	Alternate Mitigation Name	Forecast Dollars			
		2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Virtual Reality Training (MP)	-	-	94	120
A2	Virtual Reality Training (HP)	-	-	94	120
A3	GPS Tracking of Excavation Equipment (MP)	-	-	306	391
A4	GPS Tracking of Excavation Equipment (HP)	-	-	306	391

Table 12: Risk Control & Mitigation Plan - Units Summary

ID	Control/Mitigation Name	Units Description		Forecast Units			
		Capital	O&M	2022-2024 Capital (Low)	2022-2024 Capital (High)	TY 2024 O&M (Low)	TY 2024 O&M (High)
A1	Virtual Reality Training (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
A2	Virtual Reality Training (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
A3	GPS Tracking of Excavation Equipment (MP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					
A4	GPS Tracking of Excavation Equipment (HP)	This mitigation contains numerous cost types. As a result, units cannot be calculated.					

Table 13: Alternate Mitigation Plan - Quantitative Analysis Summary (Direct After Allocations, In 2020 $000)

ID	Control/Mitigation Name	Forecast			
		LoRE	CoRE	Risk Score	RSE
A1	Virtual Reality Training (MP)	300	1.05	315.6	0.006
A2	Virtual Reality Training (HP)	0.19	4235	815.3	0.015
A3	GPS Tracking of Excavation Equipment (MP)	300	1.05	315.6	0.0002
A4	GPS Tracking of Excavation Equipment (HP)	0.19	4235	815.3	0.001

APPENDIX A: SUMMARY OF ELEMENTS OF THE RISK BOW TIE

Appendix A: Summary of Elements of the Risk Bow Tie
Dig-in on the System: Summary of Elements of the Risk Bow Tie

ID	Control/Mitigation Name	Elements of the Risk Bow Tie Addressed
C1	Locate & Mark Training (MP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C2	Locate & Mark Training (HP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C3	Locate & Mark Activities (MP)	DT.4, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C4	Locate & Mark Activities (HP)	DT.4, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C5	Locate and Mark Operator Qualification (MP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C6	Locate and Mark Operator Qualification (HP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C7	Locate and Mark Quality Assurance (MP)	DT.4, DT.5, DT.6, DT. 8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C8	Locate and Mark Quality Assurance (HP)	DT.4, DT.5, DT.6, DT. 8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C9	Damage Prevention Analyst Program (MP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C10	Damage Prevention Analyst Program (HP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C11	Locating Equipment and Supporting Computer Hardware/ Software (Purchase, Replace, Upgrades and Updates) (MP)	DT.4, DT.6, DT.7, DT.8, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C12	Locating Equipment and supporting computer Hardware/Software (Purchase, Replace, Upgrades and Updates) (HP)	DT.4, DT.6, DT.7, DT.8, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C13-T1	Public Awareness – Affected Public (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C14-T1	Public Awareness – Affected Public (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C13-T2	Public Awareness – Emergency Officials (MP)	DT.1, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C14-T2	Public Awareness – Emergency Officials (HP)	DT.1, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C13-T3	Public Awareness – Local Public Officials (MP)	DT.1, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C14-T3	Public Awareness – Local Public Officials (HP)	DT.1, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

C13-T4	Public Awareness – Excavators (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C14-T4	Public Awareness – Excavators (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C15	Increase Reporting of Unsafe Excavation (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C16	Increase Reporting of Unsafe Excavation (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C17	Damage Prevention Policy (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C18	Damage Prevention Policy (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C19	Gold Shovel Standard Program (MP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C20	Gold Shovel Standard Program (HP)	DT.1, DT.2, DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C21	Excess Flow Valve or Curb Valve Installation (MP)	DT.1, DT.3, DT.4, DT.6, DT.7, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C22	Pipeline Patrol and Pipeline Markers (MP)	DT.1, DT.2, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C23	Pipeline Patrol and Pipeline Markers (HP)	DT.1, DT.2, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C24	Company Excavator Training (MP)	PC.2, DT.3, PC.1, PC.3, PC.4, PC.5, PC.6
C25	Company Excavator Training (HP)	DT.3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C26	Locate and Mark Annual Refresher Training and Competency Program (MP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
C27	Locate and Mark Annual Refresher Training and Competency Program (HP)	DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M1	Automate Third Party Excavation Incident Reporting (MP)	DT.2, DT.4, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M2	Automate Third Party Excavation Incident Reporting (HP)	DT.2, DT.4, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M3	Locate and Mark Photographs (MP)	DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M4	Locate and Mark Photographs (HP)	DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M5	Electronic Positive Response (MP)	DT.2, DT.4, DT.5, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M6	Electronic Positive Response (HP)	DT.2, DT.4, DT.5, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M7	Leverage Technology for Difficult Locates (MP)	DT.5, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

M8	Leverage Technology for Difficult Locates (HP)	DT.5, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M9	Enhance Ticket Management Software (MP)	DT.2, DT.4, DT.5, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M10	Enhance Ticket Management Software (HP)	DT.2, DT.4, DT.5, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M11	Ticket Risk Assessment and Evaluating City Permit Data (MP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M12	Ticket Risk Assessment and Evaluating City Permit Data (HP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M13	Outreach for Latent 3rd Party Damages (MP)	DT.1, DT. 3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M14	Outreach for Latent 3rd Party Damages (HP)	DT.1, DT. 3, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M15	Leverage Data Gathered by Locating Equipment (MP)	DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M16	Leverage Data Gathered by Locating Equipment (HP)	DT.4, DT.6, DT.8, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M17	Warning Mesh (MP)	DT.1, DT.2, DT.3, DT.4, DT.7, DT.8, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M18	Warning Mesh (HP)	DT.1, DT.3, DT.4, DT.2, DT.7, DT.8, DT.9, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6
M19	Pipeline Monitoring Technologies (HP)	DT. 1, DT. 2, DT. 3, DT. 4, DT. 5, DT. 2, DT. 7, PC.1, PC.2, PC.3, PC.4, PC.5, PC.6

APPENDIX B: QUANTITATIVE ANALYSIS SOURCED DATA REFERENCES

Appendix B: Quantitative Analysis Sourced Data References

The SA Decision directs the utility to identify potential consequences of a risk event using available and appropriate data. The below provides a listing of the inputs utilized as part of this assessment.

Annual Report Mileage for Natural Gas Transmission & Gathering Systems
Agency: Pipeline and Hazardous Materials Safety Administration (PHMSA)
Link: *https://cms.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-natural-gas-*transmission-gathering-systems

Annual Report Mileage for Gas Distribution Systems
Agency: Pipeline and Hazardous Materials Safety Administration (PHMSA)
Link: *https://cms.phmsa.dot.gov/data-and-statistics/pipeline/annual-report-mileage-gas-distribution-systems*

Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data
Agency: Pipeline and Hazardous Materials Safety Administration (PHMSA)
Link: *https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data*

United States Census Bureau Quick Facts
Agency: United States Census Bureau
Link:*https://www.census.gov/quickfacts/fact/table/US/PST045219*

Real Estate Property Costs
Agency: National Association of Realtors
Link: *https://www.nar.realtor/research-and-statistics/housing-statistics/county-median-home-prices-and-monthly-mortgage-payment*

San Diego Gas & Electric high-pressure pipeline miles
Source: 2020 internal SME data

DIRT - Damage Information Reporting Tool
Source: Internal Incident Data

Warning Mesh Usage Information
Source: Internal Cost (Labor and Material) and Mileage Data

Excess Flow Valve (EFV) Installation Data
Source: Internal Cost (Labor and Material) and Scope Data