Risk Assessment Mitigation Phase

(Chapter SCG-1)

Medium Pressure Gas Pipeline Incident

(Excluding Dig-in)

November 27, 2019

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Risk: Medium Pressure Gas Pipeline Incident

I. INTRODUCTION

The purpose of this chapter is to present the Risk Mitigation Plan for Southern California Gas Company's (SoCalGas or Company) Medium Pressure Gas Pipeline Incident risk. Each chapter in this Risk Assessment Mitigation Phase (RAMP) Report contains the information and analysis that meets the requirements adopted in Decision (D.) 16-08-018 and D.18-12-014, and the Settlement Agreement included therein (the SA Decision).[1]

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

The purpose of RAMP is not to request funding. Any funding requests will be made in SoCalGas' General Rate Case (GRC). The costs presented in the 2019 RAMP Report are those costs for which SoCalGas anticipates requesting recovery in its Test Year (TY) 2022 GRC. SoCalGas' TY 2022 GRC presentation will integrate developed and updated funding requests from the 2019 RAMP Report, supported by witness testimony.[2] For the 2019 RAMP Report, the baseline costs are the costs incurred in 2018, as further discussed in Chapter RAMP-A. This 2019 RAMP Report presents capital costs as a sum of the years 2020, 2021 and 2022 as a three-year total; whereas, O&M costs are only presented for TY 2022.

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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 (SMAP) 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").

Costs for each activity that directly addresses each risk are provided where those costs are available and within the scope of the analysis required in this RAMP Report. Throughout the 2019 RAMP Report, activities are delineated between controls and mitigations, which is consistent with the definitions adopted in the SA 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 SoCalGas' Medium Pressure Gas Pipeline Incident risk; however, many of the activities presented herein also help mitigate other risk areas as outlined in Chapter RAMP-A.

As discussed in Chapter RAMP-D, Risk Spend Efficiency (RSE) Methodology, no RSE calculation is provided where costs are not available or not presented in this RAMP Report (including costs for activities that are outside of the GRC and certain internal labor costs). Additionally, SoCalGas did not perform RSE calculations on mandated activities. Mandated activities are defined as activities conducted in order to meet a mandate or law, such as a Code of Federal Regulation (CFR), Public Utilities Code (PUC) statute, or General Order (GO). Activities with no RSE score presented in this 2019 RAMP Report are identified in Section VI below.

SoCalGas 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 SoCalGas' mitigation activities. These distinctions are discussed in the applicable control/mitigation narratives in Section V. Similarly, a narrative discussion of certain "mitigation" activities and their associated

[3] *Id.* at 16.

[4] *Id.* at 17.

costs is provided for certain activities and programs that may indirectly address the risk at issue, even though the scope of the risk as defined in the RAMP Report may technically exclude the mitigation activity from the RAMP analysis. This additional qualitative information is provided in the interest of full transparency and understandability, consistent with guidance from Commission Staff and stakeholder discussions.

SoCalGas and San Diego Gas & Electric Company (SDG&E), collectively the "Companies," own and operate an integrated natural gas system. The Companies collaborate to develop policies and procedures that pertain to the engineering and operations management of the gas system operated in both the SoCalGas and SDG&E territory to maintain consistency. However, execution of such policies and procedures are the responsibility of the employees at respective geographically delineated operating unit headquarters. Accordingly, there are similar mitigation plans presented in the 2019 RAMP Report across the Companies' gas pipeline incident related chapters.[5]

A. Risk Definition

For purposes of this RAMP Report, the Medium Pressure Gas Pipeline Incident risk is the risk of damage, caused by a medium pressure pipeline[6] event, which results in serious injuries or fatalities. This risk concerns a gas public safety event on a medium-pressure distribution plastic or steel pipeline and/or its appurtenances (e.g., valves, meters, regulators, risers).

[5] The other gas pipeline incident related chapters in the 2019 RAMP Report include: SCG-5 – High Pressure Gas Pipeline Incident; SDG&E-6 – Medium Pressure Gas Pipeline Incident; and SDG&E-8 – High Pressure Gas Pipeline Incident.

[6] Maximum Allowable Operating Pressure (MAOP) at or lower than 60 psig.

B. Summary of Elements of the Risk Bow Tie

Pursuant to the SA Decision,[7] for each control and mitigation presented herein, SoCalGas has identified which element(s) of the Risk Bow Tie the mitigation addresses. Below is a summary of these elements.

Table 1: Summary of Risk Bow Tie Elements

ID	Description of Driver/Trigger & Potential Consequence
DT.1	Corrosion
DT.2	Natural forces (natural disasters, fires, earthquakes)
DT.3	Other outside force damage (excluding dig-in)
DT.4	Pipe, weld, or joint failure
DT.5	Equipment failure
DT.6	Incorrect operations
DT.7	Incorrect/inadequate asset records
PC.1	Serious injuries and/or fatalities
PC.2	Property damage
PC.3	Adverse litigation
PC.4	Penalties and Fines
PC.5	Erosion of public confidence

C. Summary of Risk Mitigation Plan

Pursuant to the SA Decision,[8] SoCalGas has performed a detailed pre- and post-mitigation analysis of controls and mitigations for the risks included in RAMP, as further

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

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

described below. SoCalGas' baseline controls for this risk consist of the following programs/activities:

Table 2: Summary of Controls

ID	Control Name
SCG-1-C1	Cathodic Protection (CP)
SCG-1-C2	Valve Inspections and Maintenance
SCG-1-C3	Meter and Regulator (M&R) Maintenance
SCG-1-C4	Meter Set Assembly (MSA) Inspection and Maintenance
SCG-1-C5	Pipeline Patrol
SCG-1-C6	Gas Infrastructure Protection Project (GIPP)
SCG-1-C7-T1	DREAMS: Vintage Integrity Plastic Plan (VIPP)
SCG-1-C7-T2	DREAMS: Bare Steel Replacement Program (BSRP)
SCG-1-C8	Sewer Lateral Inspection Project (SLIP)
SCG-1-C9	Distribution Riser Inspection Project (DRIP)
SCG-1-C10	Distribution Operations Control Center (DOCC)
SCG-1-C11	Leak Survey
SCG-1-C12	Bridge & Span Inspections
SCG-1-C13	Unstable Earth Inspection

The drivers/triggers identified for the Medium Pressure Gas Pipeline Incident risk are addressed through the 2018 baseline controls listed in the above table, and SoCalGas will continue said controls. Although SoCalGas has considered alternatives to these controls, no new mitigations are projected to be implemented. However, additional activities are being forecasted within the existing controls for Cathodic Protection and Regulator Stations, and SoCalGas is also forecasting to increase annual activity levels within existing controls.

Finally, pursuant to the SA Decision,[9] SoCalGas presents in Section VIII considered alternatives to the described mitigation plan for this risk and summarizes the reasons that the alternatives were not included in the mitigation plan in Section VII.

II. RISK OVERVIEW

Typically, medium-pressure distribution systems use a series of mains (pipes with larger diameter) to feed service lines, regulator stations, meters, and other appurtenance piping. Service lines are smaller diameter pipes which feed customer homes, businesses, and some commercial applications. Medium-pressure pipelines are made of steel or plastic material.

For safety and compliance, Title 49 of the Code of Federal Regulations (CFR) 192, General Order (GO) 58, and GO 112 are the leading sources of requirements for SoCalGas' medium-pressure pipelines (among other legal and regulatory provisions). 49 CFR 192 prescribes safety requirements for pipeline facilities and the transportation of gas at the federal level. GO 112 and GO 58 complement and enhance the requirements of 49 CFR 192 at a state level.

SoCalGas currently operates over 47,000 miles of medium pressure mains with over 22,000 miles being steel and approximately 25,000 made of plastic. These medium-pressure pipelines serve over 21.8 million SoCalGas consumers.

Table 3: Medium-Pressure Pipelines

Medium Pressure Pipelines	SoCalGas Mains	SoCalGas Services
Miles of Steel	22,785	31,694
Miles of Plastic	24,886	18,604
Total Miles Medium Pressure Pipelines	47,671	50,298

[9] *Id.* at 34.

Various causes and events can lead to medium pressure pipeline incidents. Drivers can range from natural forces (such as natural disasters, fires, earthquakes.), improper installation techniques, material defects, aging/environmental factors such as corrosion and material fatigue, improper operations, and inadequate maintenance of the pipeline infrastructure. For the purposes of this chapter, the Medium-Pressure Pipeline Incident risk focuses on risk events that result in serious injuries or fatalities.

SoCalGas notes that when the loss of gas cannot be resolved by lubing, tightening or adjusting, it is defined as a “leak.” A leak in and of itself may cause little-to-no risk of serious injury or fatality. Risk to the public and employees can increase when leaks are in close proximity to an ignition source and/or where there is a potential for gas to migrate into a confined space. The safety concern of the leak is addressed by SoCalGas’ leak indication prioritization and repair schedule procedures. In most cases, a pipe with a leak will continue to transport gas, and therefore is not considered a pipeline “failure” using the definition in American Society of Mechanical Engineering (ASME) B31.8S.[10]

Additionally, although not included in this RAMP filing, SoCalGas is currently in the very preliminary stages of organizing and modeling a Facilities Integrity Management Program (FIMP) based on principles developed by the Canadian Energy Pipeline Association (CEPA) and the Pipeline Research Council International (PRCI). The FIMP is not intended to duplicate any systems, processes, or information that may already exist, but rather to supplement the already existing programs to enhance the safety and integrity of the integrated gas pipeline

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10 American Society of Mechanical Engineering standard B31.8S: Managing System Integrity of Gas Pipelines. AMSE B31.8S is specifically designed to provide the operator with the information necessary to develop and implement an effective integrity management program utilizing proven industry practices and processes.

system.[11] FIMP will be a documented program, specific to the facilities portion of a pipeline system,[12] that identifies the practices used by the operator for purposes of "safe, environmentally responsible, and reliable service."[13] While SoCalGas is currently in the preliminary stages of organizing and modeling a FIMP approach based on the principles of CEPA, FIMP is anticipated to be included in the next GRC. Although this concept of an overarching program is still maturing in the industry, SoCalGas' intention of a FIMP is to better identify and reduce risks of facility assets, extend the life of assets, and achieve operational excellence, in alignment with both the principles of RAMP and the Company's existing Transmission, Distribution, and Storage Integrity Management Programs (TIMP, DIMP, and SIMP, respectively).[14] Consistent with the SA Decision, a supplemental analysis will be conducted in the GRC for FIMP if it ultimately meets the criteria for inclusion in that proceeding.

III. RISK ASSESSMENT

In accordance with the SA Decision,[15] this section describes the Risk Bow Tie, possible drivers, and potential consequences of the Medium Pressure Gas Pipeline Incident risk.

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11 SoCalGas notes that there are certain facilities management systems and processes in place, for example Pipeline Research Council International (PRCI) – Facility Integrity Management Program (FIMP) Guidelines – PRCI IM-2-1 Contract PR-186-113718.

12 "Pipeline system" is defined by Pipeline Research Council International (PRCI) - Facility Integrity Management Program (FIMP) Guidelines – PRCI IM-2-1 Contract PR-186-113718 as "*Pipeline System is comprised of pipelines, stations, and other facilities required for the measurement, processing, gathering, transportations, and distribution of oil or gas industry fluids*."

13 Canadian Energy Pipeline Association (CEPA), Facilities Integrity Management Program, Recommended Practice, 1st Edition (May 2013) at 7-8.

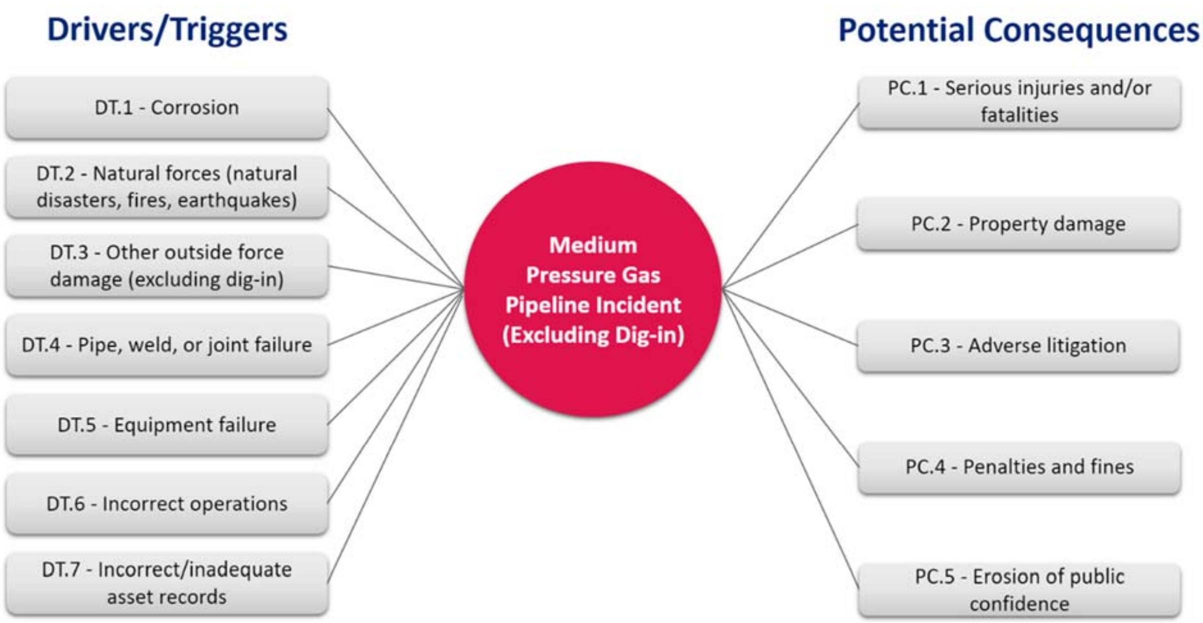
14 Based on industry definitions, there are a variety of types of facilities; facilities are highly complex; a variety of equipment/asset types exist within facilities; and in this context facilities are not considered building structures.

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

A. Risk Bow Tie

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

Figure 1: Risk Bow Tie



B. Asset Groups or Systems Subject to the Risk

The SA Decision[16] directs the utilities to endeavor to identify all asset groups or systems subject to the risk.

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16 D.18-12-014, Attachment A, Item No. 14 ("Definition of Risk Events and Tranches").

The Natural Gas Pipeline Distribution System consists of SoCalGas' medium and high-pressure distribution pipeline system is comprised of plastic and steel pipelines and its appurtenances (e.g., meters, regulators, risers). As discussed in RAMP-G, the tracking of costs by SoCalGas is not logically disaggregated by high/medium pressure, and therefore costs with some controls for high pressure assets are captured within this chapter.

SoCalGas' Medium Pressure Gas Pipeline Incident risk impacts all of SoCalGas' natural gas infrastructure and assets in the medium pressure pipeline system. The medium pressure pipeline system is comprised of approximately 100,000 miles of plastic and steel pipelines and its appurtenances (e.g., valves, meters, regulators, risers) operating at or less than 60 psig.[17] The large size of the system means a high volume of related appurtenances for example the system includes more than 5 million meters and approximately 2,000 regulator stations to distribute and regulate pressure.

C. Risk Event Associated with the Risk

The SA Decision[18] instructs the utility to include a Bow Tie illustration for each risk included in RAMP. As illustrated in the above Risk Bow Tie, the risk event (center of the bow tie) is a pipeline event that results in any of the Potential Consequences listed on the right. The Drivers/Triggers that may contribute to this risk event are further described in the section below.

D. Potential Drivers/Triggers[19]

The SA Decision[20] instructs the utility to identify which element(s) of the associated bow tie each mitigation addresses. When performing the risk assessment for High Pressure Gas

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[17] Due to cost tracking limitations, the cost reflects a small percentage of miles of high-pressure pipelines maintained by Distribution Operations.

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

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

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

Pipeline Incident, SoCalGas identified potential leading indicators, referred to as drivers. These include, but are not limited to:

- **D.T1 – Corrosion:** External corrosion is a naturally occurring phenomenon commonly defined as the deterioration of a material (usually a metal) that results from a chemical or electrochemical reaction with its environment.[21] External corrosion occurs to the outside of a pipe. Internal corrosion is the deterioration of metal that results from an electrochemical reaction. This reaction causes the iron in the steel pipe or other pipeline appurtenances to oxidize (rust). Internal corrosion results in metal loss in the inside of the pipe. The loss of material from corrosion can eventually result in "pinhole" leakage, or a crack, split, or rupture of the pipeline unless the corrosion is repaired, the affected pipe section is replaced, or the operating pressure of the pipeline is reduced.[22] Because corrosion can occur internally and/or externally, both potentially resulting in a pipeline incident, both will be referred to as "corrosion" for the remainder of this chapter, unless otherwise specified.
- **DT.2 – Natural forces (natural disasters, fires, earthquakes):** Attributable to causes not involving humans, but includes effects of climate change, such as earth movement, earthquakes, landslides, subsidence, heavy rains/floods, lightning, temperature, thermal stress, frozen components, wildfires and high winds.
- **DT.3 – Other outside force damage (excluding dig-in):** Attributable to outside force damage other than excavation damage or natural forces such as damage by car, truck, or motorized equipment not engaged in excavation.

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21 L.S. Van Delinder, *Corrosion Basics, An Introduction* (1984); *see also* U.S. Department of Transportation, *Fact Sheet: Internal Corrosion*, *available at* https://primis.phmsa.dot.gov/comm/FactSheets/FSInternalCorrosion.htm.

22 U.S. Department of Transportation, *Fact Sheet: Internal Corrosion*, *available at* https://primis.phmsa.dot.gov/comm/FactSheets/FSInternalCorrosion.htm.

- **DT.4 – Pipe, weld, or joint failure:** Attributable to material defect within the pipe, component or joint due to faulty manufacturing procedures, design defects, improper construction or fabrication, or in-service stresses such as vibration, fatigue and environmental cracking.
- **DT.5 – Equipment failure:** Similar to DT.4, but unrelated to pipe (main and services). These failures are attributable to the malfunction of a component including, but not limited to, regulators, valves, meters, flanges, gaskets, collars, and couples. This driver/trigger is specific to the material properties related to the manufacturing process or post installation of the equipment.
- **DT.6 – Incorrect operations**: May include a pipeline incident attributed to insufficient or incorrect operating procedures or the failure to follow a procedure.
- **DT.7 – Incorrect/inadequate asset records**: The use of inaccurate or incomplete information that could result in the failure to (1) construct, operate, and maintain SoCalGas' pipeline system safely and prudently, or, (2) to satisfy regulatory compliance requirements.

E. Potential Consequences

If one of the drivers 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 – Adverse litigation;
- PC.4 – Penalties and fines; and
- PC.5 – Erosion of public confidence.

These potential consequences were used in the scoring of the Medium Pressure Gas Pipeline Incident risk during the development of SoCalGas' 2018 Enterprise Risk Registry.

IV. RISK QUANTIFICATION FRAMEWORK

The SA Decision sets minimum requirements for risk and mitigation analysis in RAMP,[23] including enhancements to Interim Decision 16-08-018.[24] SoCalGas used the guidelines in the SA Decision as a basis for analyzing and quantifying risks, as shown below. Chapter RAMP-C of this RAMP Report explains the Risk Quantitative Framework which underlies this Chapter, including how the Pre-Mitigation Risk Score, Likelihood of Risk Event (LoRE), and Consequence of Risk Event (CoRE) are calculated.

Table 4: Pre-Mitigation Analysis Risk Quantification Scores[25]

Medium Pressure Gas Pipeline Incident (Excluding Dig-in)	Low Alternative	Single Point	High Alternative
Pre-Mitigation Risk Score	315	**1581**	3692
LoRE		**542**	
CoRE	1	**3**	7

A. Risk Scope & Methodology

The SA Decision requires a pre- and post-mitigation risk calculation.[26] The below section provides an overview of the scope and methodologies applied for the purpose of risk quantification.

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23 D.18-12-014 at Attachment A.

24 *Id.* at 2-3.

25 The term "pre-mitigation analysis," in the language of the SA Decision (Attachment A, A-12), refers to required pre-activity analysis conducted prior to implementing control or mitigation activity.

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

In Scope for purposes of risk quantification:	The risk of damage, caused by a medium pressure pipeline (maximum allowable operating pressure - MAOP at or lower than 60 psig) failure event, which results in consequences such as injuries or fatalities or outages.
Out of Scope for purposes of risk quantification:	The risk of damage caused by a non-medium-pressure pipeline failure event or third-party dig-ins which results in consequences such as injuries or fatalities or outages.

Pursuant to Step 2A of the SA Decision, the utility is instructed to use actual results, available and appropriate data (e.g., Pipeline and Hazardous Materials Safety Administration (PHMSA) data).[27]

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

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

[27] *Id.* at Attachment A, A-8 ("Identification of Potential Consequences of Risk Event").

B. Sources of Input

The SA Decision[28] 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
- SoCalGas medium-pressure pipeline miles
  - 2017 internal SME data
- Gas industry sales customers
  - Agency: AGA (2016Y)
  - Link: https://www.aga.org/contentassets/d2be4f7a33bd42ba9051bf5a1114bfd9/section8divider.pdf
- SoCalGas end user natural gas customers

[28] *Id*. at Attachment A, A-8 ("Identification of the Frequency of the Risk Event").

- Source: SNL (2016Y, from the FERC Form 2/2-F, 3/3-A or EIA 176)
- Link: https://platform.mi.spglobal.com/web/client?auth=inherit&newdomainredirect=1&#company/report?id=4057146&keypage=325311

V. RISK MITIGATION PLAN

The SA Decision requires a utility to "clearly and transparently explain its rationale for selecting mitigations for each risk and for its selection of its overall portfolio of mitigations."[29] This section describes SoCalGas' Risk Mitigation Plan by each selected control for this risk, including the rationale supporting each selected control.

As stated above, the Medium Pressure Gas Pipeline Incident risk is the risk of damage, caused by a medium pressure pipeline event, which results in serious injuries or fatalities. The Risk Mitigation Plan includes current controls that are expected to continue for the period of SoCalGas' TY 2022 GRC cycle. The controls are those activities that were in place as of 2018, most of which are compliance driven and have been implemented over decades plus the addition of the Distribution Integrity Management Programs (DIMP) that has been developed over recent years, to address this risk. SoCalGas' mitigation plan for this risk consists of controls based on 42 CFR Part 192, GO 58, GO 112-F and forecasted enhancements within existing controls. Overall the compliance requirements are set forth within the regulations (although considered minimum requirements.) The compliance requirements are robust in that they provide prescriptive preventative and maintenance guidance for the medium pressure assets. In addition, the DIMP regulations have allowed operators to identify risks specific to their system and address them through additional controls and mitigations.

For this RAMP chapter, the makeup of the portfolio of controls is a combination of compliance requirements and additional programs implemented by DIMP within the last 7 years. The DIMP is continually evaluating the system threats and risk to determine if additional

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[29] *Id.* at Attachment A, A-14 ("Mitigation Strategy Presentation in the RAMP and GRC").

mitigations are appropriate. The threat and risk evaluation leverages leak repair, incident data and SME input to evaluate and rank risk. As programs are developed, available data sets are leveraged to develop specific risk rankings for each, which allows higher priority remediations to be completed first. For example, the Distribution Risk Evaluation and Monitoring System (DREAMS) steel replacement programs utilize a relative risk model which includes leak rates, condition of the pipe, soil and other factors to prioritize medium pressure segments for replacement. An example is the introduction of the Damage Program Analyst specifically covered within the Third Party Dig-In on a Medium Pressure Pipeline Chapter SCG-6. The incremental request within existing controls for Cathodic Protection and Meter and Regulations[30] are the first steps to evaluating the need for larger programs and further analysis will aid in the overall prioritization given the size of the system.

Other programs and activities also mitigate the Medium Pressure Gas Pipeline Incident risk, but they are not included in this Risk Mitigation Plan. For example, the Mobilehome Park Utility Upgrade Program ("MHP") is converting master-metered/sub-metered natural gas and/or electric services to direct utility services in mobile home parks and manufactured housing communities to improve the safety and reliability of service for residents of mobile home parks currently served by master-metered gas systems. The MHP is not included in this mitigation plan because MHP costs are not anticipated to be forecasted in SoCalGas' next GRC.[31]

Another example is SoCalGas' methane emissions reduction activities in compliance with Senate Bill (SB) 1371 and the resulting Gas Leak Abatement OIR (R.15-01-008). In addition to the federally mandated leak survey requirements described in the Pipeline Monitoring Control (SCG-1-C5) below, SoCalGas proposed transitioning pre-1986 plastic to annual survey as part of the GRC and also bare steel to an annual survey per the SB 1371 proceeding. SB 1371

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30 Continued incremental request since because GRC requested funding to increase regulator replacement programs.

31 The Mobile Home Park Conversion Program is a pilot program authorized by and discussed in D.14-03-021 and Resolutions E-4878 (September 28, 2017) and E-4958 (March 14, 2019).

requires the adoption of rules and procedures to minimize natural gas leakage from Commission-regulated natural gas pipeline facilities consistent with Public Utilities Code section 961(d) and 49 CFR sections 192.703(c). SoCalGas has been an active participant in the rulemaking and has provided comments as well as met the reporting requirements set forth under SB 1371. SoCalGas' first Leak Abatement Compliance Plan and accompanying Advice Letter were approved in 2018 and the Plan is being implemented by the Emissions Strategy Project Management Organization to implement 26 Mandatory Best Practices. Although the focus of SB 1371 activities is to reduce methane emissions, the activities may result in collateral safety benefits as a reduction in the number of leaks reduces the potential opportunity for ignition. However, the risk reduction analysis and the costs tied to the implementation of SB 1371 are not reflected in the Mitigation Plan for this chapter because the intent of SB 1371 best management practice activities is to reduce methane emissions (and thus it is not primarily focused on addressing safety risk).

A. SCG-1-C1: Cathodic Protection

Corrosion is a natural process that can deteriorate steel assets and potentially lead to leaks or damage. If a leak migrates to a confined space and an ignition source is introduced, there is the potential for injuries. Although the SoCalGas operations groups immediately respond to these leak situations, they have the potential to lead to a pipeline incident. Cathodic Protection (CP), coating and monitoring can protect and extend the life of a steel asset by mitigating corrosion. The application of a Cathodic Protection current is necessary to overcome local corrosion currents along the pipeline, that left unabated would result in localized corrosion at anodic sites. Cathodic Protection can be achieved by the installation of sacrificial anodes or impressed current systems.[32]

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[32] SoCalGas utilizes both impressed current and magnesium anode (galvanic) systems to provide CP to existing pipelines. Impressed current systems utilize a rectifier for the generation of the direct current. Both systems utilize sacrificial anodes as a primary component in the system. Anodes are

The directives prescribed by 49 CFR 192 Subpart I, include the monitoring of CP areas, remediation of CP areas that are out of tolerance,[33] and preventative installations to avoid out of tolerance areas. The following summarizes the required intervals for completing these preventative measures as prescribed in 49 CFR § 192.465 External Corrosion Control (Monitoring):

- Each pipeline that is under cathodic protection must be tested at least once each calendar year, but with intervals not exceeding 15 months, to determine whether the cathodic protection meets the requirements of §192.463. However, if tests at those intervals are impractical for separately protected short sections of mains or transmission lines, not in excess of 100 feet (30 meters), or separately protected service lines, these pipelines may be surveyed on a sampling basis. At least 10 percent of these protected structures, distributed over the entire system must be surveyed each calendar year, with a different 10 percent checked each subsequent year, so that the entire system is tested in each 10-year period.

- Each cathodic protection rectifier or other impressed current power source must be inspected six times each calendar year, but with intervals not exceeding 2 1/2 months, to insure that it is operating.[34]

SoCalGas plans to continue with work according to this schedule.

In addition to meeting these federal and state requirements, based on feedback from the Commission's Safety and Enforcement Division (SED) during a 2018 Safety Audit, and upon further review, SoCalGas issued new guidelines requiring the re-evaluation of existing 100 mV

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installed in wells drilled into the surrounding soil by third-party drilling contractors. Each protected pipe segment requires multiple anodes, collectively referred to as an "anode bed." The number of anodes needed to achieve the desired level of protection and the average life of the anode bed can vary based on pipeline length, coating effectiveness, soil conditions and interference that may occur on the system.

[33] Out of tolerance areas are defined as areas where CP measures are not efficiently mitigating the effect of the corrosive environment on steel assets.

[34] 49 CFR § 192.465(a) and (b).

polarization shift areas[35] at least every 10 years to verify their effectiveness as a measurement for adequate Cathodic Protection of an area. A pipeline utilizing the 100 mV polarization shift criteria must achieve a minimum of 100 mV of polarization along its entirety through the application of Cathodic Protection. SoCalGas will re-evaluate 75 CP packages in 2018 and 175 CP packages annually starting in 2019. SoCalGas is forecasting to also expand this CP control by creating a sampling program of CP Areas that fall within the 10-year monitoring interval requirement to determine if a shorter interval would provide a benefit and reduce risk. This incremental work activity supports the safety and integrity of the system and mitigates risks defined in this RAMP chapter.

B. SCG-1-C2: Valve Inspections & Maintenance

Valve maintenance is a program that validates that the valves within the system operate at optimum effectiveness, enhancing public safety by providing SoCalGas with the ability to control the pressure and flow of gas in the system. The maintenance activities vary by type of valve, and may include flushing, lubrication, parts replacement, cleaning and testing of operability.

Valves are installed for control of pressure and flow of gas. Their location and purpose determine their criticality: fire valves at regulator stations isolate the high- and medium-pressure systems; emergency valves isolate segments of pipelines in case of pipe damage or for operational purposes; and isolation valves segment portions of the system in the event of a widespread emergency, such as an earthquake and reduce the impact of resulting pipeline damage. A valve that is operating at its optimum effectiveness means that, for example, in the case of an earthquake or fire where an area needs to be isolated to reduce the risk of incident, these valves will operate as intended and fully isolate the area. A second example, which happens more frequently, when third-party damage occurs, these valves can be operated to allow for a safe environment to complete the repairs and minimize the risk of furthering the incident.

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[35] 49 CFR Part 192, Appendix D (Criteria for Cathodic Protection and Determination of Measurements).

The following summarizes the requirements for completing these preventative measures as prescribed within the 49 CFR § 192.747:

> (a) Each valve, the use of which may be necessary for the safe operation of a distribution system, must be checked and serviced at intervals not exceeding 15 months, but at least once each calendar year.
>
> (b) Each operator must take prompt remedial action to correct any valve found inoperable, unless the operator designates an alternative valve.

C. SCG-1-C3: Meter & Regulator (M&R) Maintenance

Regulator stations reduce the pressure of gas entering the distribution system from high-pressure pipelines to provide a lower pressure to be used on the distribution pipeline system. A failure of a regulator station due to mechanical failure, corrosion, contamination or other cause could result in over-pressurization of the gas distribution system, which may compromise the integrity of medium-pressure pipelines and/or jeopardize public safety as evident by recent over-pressure events in the industry. The medium and large customers meter set assemblies (MSAs) require routine inspection/maintenance of the meters, regulators, and other components to meet customers' capacity requirements and to measure gas volume accurately.

Regulator stations are critical control elements in the gas distribution system. 49 CFR § 192.739 requires inspections/tests to be conducted done annually, not to exceed 15 months to maintain these devices in good mechanical condition. Functional tests of regulator stations are performed as part of inspections. The pressure checks are done to verify that the station's pressure protection devices perform as designed. If a station does not perform properly, internal maintenance and inspections are conducted. This consists of disassembling the regulator devices and inspecting the internal components for worn or damaged parts. The regulator is cleaned and inspected for corrosion and any faulty parts are replaced.

As regulator stations age, their parts and equipment can begin to wear, malfunction, and become harder to disassemble, increasing maintenance requirements. Modern regulator stations are beginning to be designed with dual-run feeds to maintain continued safe and reliable operation of the station in the event of a failure within either of the two runs. Annual maintenance and inspections are used to record the condition of each station and identify items that require immediate and long-term action. The overall inspection of the station is leveraged to prioritize future regulator station replacement projects. The assessment includes evaluation of the design, condition of the equipment, valves and vaults, and exposure to other outside forces including flooding and traffic conditions.

SoCalGas' operating and maintenance practices allow stations to exceed their useful lives. However, it is prudent to proactively replace regulator stations prior to the end of their design life in order to reduce the overall system risk. This risk reduction is achieved through improved station design of dual-run regulators which will reduce the risk of over-pressure and the stations location can be evaluated to reduce the risk of vehicular damage (outside force) or vandalism. SoCalGas operates and maintains approximately 1,357 regulator stations, of which, on average, 10 stations are replaced or added to the system each year. SoCalGas plans to expand this control by accelerating the rate at which it replaces regulator stations by replacing an incremental 8 in 2019 (0.6%) in addition to the base forecast. SoCalGas will prioritize the replacement of district regulator stations (DRS) across operating regions while continuing to enhance the prioritization methodology to validate the starting point of 10 regulator stations a year is enough or should be increased. SoCalGas relies heavily on SME input from the operating districts to determine prioritization of regulator station replacements. This combined with expanding datasets surrounding condition and performance of stations throughout the service territory will support the evolution of the prioritization methodology. This regulator station replacement program is an example of addressing SoCalGas' aging infrastructure and will be used as a model to review other facilities and equipment in a similar fashion. The following summarizes the requirements for completing these preventative measures as prescribed within the 49 CFR § 192.739 Pressure limiting and regulating stations: Inspection and testing:

(a) Each pressure limiting station, relief device (except rupture discs), and pressure regulating station and its equipment must be subjected at intervals not exceeding 15 months, but at least once each calendar year, to inspections and tests to determine that it is-

(1) In good mechanical condition;

(2) Adequate from the standpoint of capacity and reliability of operation for the service in which it is employed;

(3) Except as provided in paragraph (b) of this section, set to control or relieve at the correct pressure consistent with the pressure limits of §192.201(a); and

(4) Properly installed and protected from dirt, liquids, or other conditions that might prevent proper operation.

D. SCG-1-C4: Meter Set Assembly (MSA) Inspection and Maintenance

Meter and regulator activities include maintaining and operating approximately 102,000 medium and large customer MSAs in the SoCalGas service territory. The MSAs reduce the pressure of natural gas and measure the volume of natural gas delivered to the customer. General Order 58-A requires that meters, regulators, and other components be maintained, repaired, and tested periodically to meet customers' capacity requirements, measure gas volume accurately and deliver natural gas at an adequate pressure for the houseline and home appliances. Additionally, if MSAs are housed in vaults, the vaults must be inspected and repaired, if necessary, to protect the MSA. Should the regulators fail a household could potentially see a much higher pressure of natural gas and may lead to an incident. Scheduled inspections of meter set assemblies proactively target the risk of equipment failures, corrosion and outside force before operation and safety issues arise. In addition, as required by 49 CFR § 192.481, above ground piping facilities such as MSAs must be inspected for atmospheric corrosion no less than once every three calendar years and at intervals not to exceed 39 months.

E. SCG-1-C5/C11/C12/C13: Pipeline Monitoring (Pipeline Patrol, Leak Survey, Bridge & Span Inspection, Unstable Earth Inspection)

SoCalGas conducts pipeline monitoring and inspection activities to proactively target risk factors before operation and safety issues arise. These monitoring activities include pipeline patrols, leak surveys, bridge and span inspections, and unstable earth inspections. These inspections are critical since they are intended to observe assets over time to determine if abnormal conditions exist prior to becoming a concern. For example, a span that no longer is coated appropriately due to recent weather conditions can be identified for re-coating before corrosion begins that could lead to a leak. The leak survey monitoring identifies leaks that require repair.

The monitoring and inspections must follow certain prescribed processes included in the Code of Federal Regulations.[36]

F. SCG-1-C6: Gas Infrastructure Protection Project (GIPP)

The Gas Infrastructure Protection Project (GIPP) addresses prevention of potential third-party vehicular damage associated with above-ground pressurized natural gas facilities. An incident involving vehicular damage of a distribution facility can cause serious injuries or fatalities due the possibility of ignition. The GIPP is an additional control developed and managed as part of the DIMP. This program is responsive to PHMSA guidance indicating that operators should address low frequency, but potentially high consequence, events through the DIMP.[37] Although the DIMP guidelines do not prescribe what programs operators should implement the prescriptive sections results in the need to take action to reduce system risk.

GIPP identifies, evaluates, recommends, and implements damage prevention solutions for at risk above-ground pressurized gas facilities that are exposed to vehicular impacts. The

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36 49 CFR § 192.721.

37 https://www.phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Pipeline/DIMP_Enforcement_Guidance(1_29_2014).pdf.

solutions reduce the number of incidents to pressurized piping and/or reduce the potential consequences caused from escaping natural gas after vehicular collisions. Major actions include: investigating historical claims data and developing risk assessment algorithms, conducting record reviews and physical inspections of facilities, developing risk exposure categories, identifying and implementing mitigation measures, updating policies/practices/procedures, and developing performance measures and program tracking.

GIPP remediation measures include the construction of barriers between facilities and vehicular traffic (bollards or block wall), relocation of a facility, or installation of an excess flow valve. Barriers are intended to be a visual, not a structural deterrent. They are not intended or capable of stopping all vehicular traffic, particularly large vehicles. The installation of excess flow valves can aid in the reduction of unrestrained gas flows. The types of considerations for the relocation of a facility include the type of road nearby, the volume of traffic, and the type of area (e.g., commercial or residential). The prioritization of GIPP inspections and remediations is based on field assessments.

Among MSAs, which is the largest population facility type, the most vulnerable are high pressure residential first stage regulation meter sets and commercial and industrial MSAs. GIPP is focusing on these facilities, which account for 352,000 at SoCalGas. Since the development and implementation of the program in 2011, approximately 468,000 sites with above-ground distribution facilities have been inspected and over 38,000 sites have been remediated. The GIPP Program forecast for remediation is 5,000 sites a year.

G. SCG-1-C7: Distribution Risk Evaluation and Monitoring System (DREAMS)

The DREAMS program is an additional control developed and managed as part of the DIMP. Within DIMP, the DREAMS tool is used to prioritize risk mitigation on early vintage plastic and steel pipeline segments. The risk algorithm includes pipe attributes, operational conditions, and impact on population. The results of the analysis determine appropriate action to address risk for the segment and prioritize replacement investments based on a leakage root-cause analysis.

For 2019, SoCalGas is on target to replace 48 miles of mains and associated services for replacement above and beyond routine replacements in accordance with DIMP regulations for the replacement of vintage plastic. For 2019, SoCalGas is on target to replace 24 miles of mains and associated services and targeted replacement of 300 – 500 services for replacement above and beyond routine replacements in accordance with DIMP regulations for the replacement of vintage steel. As SoCalGas' infrastructure continues to age and more leak data is accumulated through annual inspections, SoCalGas anticipates continuing to increase the level of replacement over the next 6-8 years while monitoring performance to continually review the benefits and risk reduction accomplished through the replacement program through indicators such as leak repair and incident rates related to early vintage plastic as part of DIMP regulations. Although the initial outlook is for a continued increase in scope for DREAMS (as previously stated), program metrics will be monitored on a continual basis to determine increase or decrease levels in scope.

As RAMP continues to mature it is expected that the results will also influence scope and investment levels, as outlined later in this chapter the DREAMS steel and plastic programs have a positive RSE. In addition, when expanding the program, consideration will be given to resources and contractor availability so that contractors can adequately meet the increase scope while maintain safety at the forefront with qualified and experienced workers. The increased replacement rate is associated with the number of incidents related to Aldly-A in recent years. Since DIMP's inception in 2010, SoCalGas has continued to prioritize and adjust scope of the program as the inputs to the risk algorithms change annually. This anticipated increase in scope over the 6-8 years can be considered dynamic; however, is not considered a new mitigation activity, and it is still within the scope of a control activity that has been active for near a decade. DREAMS assessment proactively identifies the risk factors for remediation before operation and safety issues arise.

1. SCG-1-C7-T1: Vintage Integrity Plastic Plan (VIPP)

The Vintage Integrity Plastic Plan (VIPP) falls within the umbrella of DREAMS. Plastic pipe manufactured and used for gas service from the 1960s through the early 1980s (8,200 miles) exhibit brittle-like cracking characteristic that could cause a leak to grow and release additional natural gas than would normally be released, increasing the risk of natural gas gathering and igniting, causing injuries and/or fatalities. Given the potential for a higher release of gas, the leak survey frequency has been increased to yearly versus every five years for plastic pipelines within this vintage. The initial focus of the VIPP is early vintage plastic manufactured pre-1973. This vintage of plastic exhibits the brittle-like cracking characteristics discussed, but also exhibits a Low Ductile Inner Wall (LDIW) issue that further exacerbates the brittle-like cracking issues since it expedites crack initiation when external loads are applied. This issue in the manufacturing practice has been the focus of earlier notices as issued by the manufacturer DuPont and PHMSA. Therefore, the focus will be a wholesale replacement of pre-1973 plastic pipe with a priority given to poor performing segments by utilizing a relative risk model and dynamic segmentation. The secondary focus will be to leverage the same relative risk model and dynamic segmentation to continue to focus on the replacement of poor performing early vintage plastic for all pre-1986 plastic pipe.

As mentioned, for 2019 SoCalGas plans to target 50 miles of plastic mains and associated services for replacement above and beyond routine replacements. SoCalGas anticipates continuing to increase the level of replacement over the next 6-8 years while monitoring performance to continually review the benefits and risk reduction accomplished through VIPP through indicators such as leak repair and incident rates related to early vintage plastic. In the early 1970s and 1980s, SoCalGas proactively took this similar approach with replacing the cast iron pipe within the system, completing the removal in 1993. This contributed to California being one of 21 states that eliminated cast iron from the system.

2. SCG-1-C7-T2: Bare Steel Replacement Program (BSRP)

The Bare Steel Replacement Plan (BSRP) falls within the umbrella of DREAMS will continue to focus on the replacement of bare steel with highest leak rates. Starting in 2019, SoCalGas plans to target 21 miles of steel mains and associated services and targeted replacement of 300 – 500 services for replacement above and beyond routine replacements.

SoCalGas anticipates continuing to increase the level of replacement over the next 6-8 years, while monitoring performance to continually review the benefits and risk reduction accomplished through BSRP through indicators such as leak repair and incident rates related to bare steel. The lack of protective coating makes steel a high-risk family of pipe and has been identified by DOT and PHMSA as a family of pipe that should be evaluated for an accelerated replacement program.

H. SCG-1-C8: Sewer Lateral Inspection Project (SLIP)

The SLIP project is an additional control developed and managed as part of the DIMP. SLIP addresses the concerns PHMSA expressed under the DIMP regulations that require operators to address identified threats of low frequency, but potentially high consequence events concerning pipeline damage within sewer laterals. Threats to pipeline integrity can occur if the trenchless installation inadvertently crosses a sewer line (or "lateral") and penetrates, or bores, through the sewer line, creating what is referred to as a "cross bore." For instance, through the SLIP, SoCalGas is proactively inspecting gas services for points of intrusion into house sewer lines. Should an intrusion be found, the service is remediated, which mitigates the potential of an incident due to a homeowner or plumber attempting to clear a house sewer line when a clog is present. For example, a plumber or the property owner then unknowingly uses a cleanout technology, such as a sewer-line auger, to clean out what is seemingly normal sewer debris and blockage. Following this work, the sewer line appears to be unclogged, but in reality, the sewer-line auger has pierced the gas line. Depending on how extensive the damage caused by the sewer-line auger, the gas line, which has now been breached, will leak gas into the sewer line and elsewhere. This unwanted gas migration can pose significant risks of bodily injury and damage to property.

Since the start of the program in 2010, approximately 2 million services have been reviewed and over 240,000 services inspected in the field. The SLIP PAAR forecast for records review is another 2 million services; the services left to inspect are dependent on the findings of the records review and should be in the vicinity of another 300,000-350,000 services based on initial findings. At the current rate, the records research is anticipated to be completed by 2022.

I. SCG-1-C9: Distribution Riser Inspection Project (DRIP)

The Distribution Riser Inspection Project (DRIP) Programs and Activities to Address Risk (PAAR) addresses the threat of failure of anodeless risers due to corrosion. Anodeless risers (ALRs) are service line components that have shown a propensity to fail before the end of their useful lives. ALRs were first introduced in the 1970s as a new technology replacing steel risers to transition from the underground plastic pipe to the above ground steel meter set. When an ALR was originally installed, it was set at a height where the gas carrying portion of the ALR was above ground. However, as grade conditions change due to landscaping and hardscaping, this gas carrying portion may no longer be at the proper height above the ground. When the gas carrying portion of the ALR is buried or set too low it can potentially corrode due to contact with the soil. The consequence of this component failing can be significant in that risers are attached to the meter set assembly, which is usually located next to a residence.

In addition, SoCalGas has been involved in research to develop an effective means of mitigating above-ground and ground level corrosion on anodeless risers. This effort has led to the implementation of the epoxy composite wrap, which provides a protective barrier for the above-ground section of the riser under the environmental conditions that are typical of riser installations, in lieu of replacement of the riser.

J. SCG-1-C10: Distribution Operations Control Center (DOCC)

The DOCC and related system of field sensors and control assets will strengthen SoCalGas and SDG&E's ability to manage their distribution pipeline operations system in real-time by use of modern technology including remote and automated controls and the co-location of a constantly-staffed DOCC facility with Gas Control operations. The DOCC will allow integrated operation of the distribution and existing high-pressure transmission pipeline systems. A modernized DOCC will increase operational efficiency, swiftness of response and ability to manage unplanned pipeline incidents and associated emergencies on both high- and medium-pressure distribution pipeline systems. Moreover, the DOCC will allow the Company to shift toward real-time monitoring and control from our point-of-receipt for gas supplies through our transmission and distribution systems and, ultimately, to our 6.4 million metered customers. Additionally, the DOCC will allow for centralized change management for planned pipeline operations, including the central coordination of operational information. Some examples of the summary features of the DOCC and system of field monitoring and control assets include the following:

- Remote Control of over 200 distribution regulator stations
- Data connectivity with SoCalGas and SDG&E Emergency Operations Center
- At least one real-time pressure measurement and trending data station in each pressure district/zone trending data station in each pressure district/zone
- Monitoring over 2,500 additional system points using alarm-based notification DOCC
- Hourly consolidated flow information from up to 5,000 core and non-core metering sites

Once implemented the Distribution Operations Control Center will be responsible for the continuous electronic pressure monitoring and oversight of its gas distribution pipeline system into the Gas Control SCADA system. The DOCC will strengthen the ability to manage the distribution pipeline operations system in real-time by use of modern technology including remote and automated controls. This type of monitoring and control will facilitate faster response times to incidents that occur and reduction of severity of incidents that occur due to its ability to monitor and respond to unfolding incidents in real time.

VI. POST-MITIGATION ANALYSIS

As described in Chapter RAMP-D, SoCalGas has performed a Step 3 analysis where necessary pursuant to the terms of the SA Decision. Unless otherwise specified, all elements of the bow tie concerning Potential Consequences are assumed to be addressed by the below mentioned controls. SoCalGas has not calculated an RSE for activities beyond the requirements of the SA Decision but provides a qualitative description of the risk reduction benefits for each of these activities in the section below.

A. Mitigation Tranches and Groupings

The Step 3 analysis provided in the SA Decision[38] instructs the utility to subdivide the group of assets or the system associated with the risk into tranches. Risk reduction from mitigations and RSEs are determined at the tranche level. For purposes of the risk analysis, each tranche is considered to have homogeneous risk profiles (i.e., the same LoRE and CoRE). SoCalGas' rationale for the determination of tranches is presented below.

SoCalGas' comprehensive integrity and maintenance programs consist of policies, programs, and efforts designed to reduce the probability of a pipeline incident. The extensive activities SoCalGas performs to mitigate pipeline risks have been grouped into the controls presented herein based on the similarity of their risk profiles.

SoCalGas does differentiate some programs by asset type (e.g. steel vs plastic); however, as discussed in RAMP-G, costs are not tracked at a level of detail to allow for the logical disaggregation of assets or systems at a more granular level than the controls described in the mitigation plan.

Table 5: Summary of Tranches

ID	Control	Tranche	Tranche ID
SCG-1-C7	Distribution Risk Assessment and Monitoring Service (DREAMS)	DREAMS: Vintage Integrity Plastic Plan	SCG-1-C7-T1
		DREAMS: Bare Steel Replacement Program	SCG-1-C7-T2

[38] D.18-12-014 at Attachment A, A-11 ("Definition of Risk Events and Tranches").

B. Post-Mitigation/Control Analysis Results

As described in RAMP-D and Section 4 above, SoCalGas utilized both internal data/modeling as well as PHMSA data to build RSEs for the pipeline incident risk areas. In the determination of inputs for the RSE calculations, SMEs were heavily utilized to confirm and provide data to perform the RSE calculations. Such input included the effectiveness of each control. The effectiveness percentages shown below are the results of discussions with SMEs whose knowledge of the control heavily dictated the values selected.

The below sections detail the Risk Reduction Benefits of each control/mitigation as well as specifically outline the data used in conjunction with said SME input to develop the RSE values

1. SCG-1-C1: Cathodic Protection (CP)

a. Qualitative Description of Risk Reduction Benefits

A steel pipeline can corrode externally and experience a degradation process that can lead to a structural incident. Corrosion control activities, like Cathodic Protection (CP), should manage or arrest structural changes. CP is a method to mitigate external corrosion on steel pipelines thereby extending the life of a steel asset. The activities associated with CP include installation, monitoring, and remediation. SoCalGas has installed CP on 66% of its 22,785 miles of steel gas mains and 42% of its 17,593 miles of steel gas services. Given the mandated requirement to continuously monitor and evaluate the CP areas, the management of this control is cyclical in nature. Distribution Operations manages the implementation of the work associated with this control with engineering oversight from the Pipeline Integrity group.

CP will reduce safety risks by controlling pipeline corrosion rates thus reducing the frequency of corrosion-related incidents. Minimizing corrosion will have the additional benefits of reducing reconstruction costs from pipeline incidents, reducing risk to property, and the potential benefit of improved service reliability. SoCalGas exceeds the minimum safety requirements for CP prescribed by 49 CFR 192 Subpart I, which includes monitoring of CP areas, remediation of CP areas that are out of tolerance, and preventative installations to avoid areas out of tolerance.

b. Elements of the Bow Tie Addressed

CP addresses the following elements of the bow tie:

[DT.1] – Corrosion

[DT.4] – Pipe, weld, or joint failure

c. RSE Inputs and Basis

Scope	The cathodically protected distribution system running at a pressure of 60 psi or lower.
Effectiveness	Per internal SME assessment, we assume 95% effectiveness. Based on SME analysis, vintage steel segments replaced are 13.2 times more likely to have an incident occur than modern plastic pipe over a lifecycle. We assume a similar deterioration proportion were cathodic protection discontinued.
Risk Reduction	**Safety**: Based on an assessment of PHMSA data, 41 natural gas incidents occurred at SoCalGas and SDG&E starting in 2010. 1 out of the 41 SoCalGas and SDG&E incident samples were corrosion-related events (2%). Using these assumptions, this mitigation could improve safety risk by up to 30% of the current residual risk. **Reliability**: Using these assumptions, this control for this tranche can improve the SoCalGas Medium Pressure Gas Incident reliability risk by up to 30% of the current residual risk. **Financial**: Using these assumptions, this control for this tranche improve the SoCalGas Medium Pressure Gas Incident financial risk by up to 30% of the current residual risk.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		**542**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.53	**1581.09**	3692.04
Post-Mitigation	LoRE		**707.77**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	410.72	**2064.67**	4821.26
	RSE	1.01	**5.06**	11.81

2. SCG-1-C2: Valve Inspections and Maintenance

a. Qualitative Description of Risk Reduction Benefits

Valves provide the ability to control the pressure and flow of gas in SoCalGas' system. Valves are controlled locally or remotely from a central control system. Valve inspections and maintenance validate that the valves within the system operate at optimum effectiveness by detecting and addressing emerging equipment issues. Valve inspections and maintenance will continue to be conducted in accordance with 49 CFR 192 Subpart M, which require that each valve must be checked and serviced at intervals not exceeding 15 months, but at least once each calendar year. Given the mandated requirement to complete valve inspections and maintenance, the management of this control will continue in a cyclical nature. Distribution Operations will manage the implementation of the work associated with this control with engineering oversight from the Pipeline Integrity group.

Valves that are operating appropriately enhance public safety by providing SoCalGas with the ability to control the pressure and flow of gas in the system. Valve inspections and maintenance activities are preventative in nature and should reduce or eliminate conditions that might lead to an incident. Valve inspections and maintenance should increase public and employee safety by mitigating various risk sources, primarily corrosion and degradation. Minimizing safety threats has the additional benefits of reducing reconstruction costs from equipment failure, reducing risk to property, and the potential benefit of improved service reliability.

b. Elements of the Bow Tie Addressed

Valve Maintenance addresses the following elements of the bow tie:

[DT.1] – Corrosion

[DT.2] – Natural forces

[DT.3] – Outside forces

[DT.5] – Equipment failure

[DT.6] – Incorrect operations

3. SCG-1-C3: Meter and Regulator (M&R) Maintenance

a. Qualitative Description of Risk Reduction Benefits

Regulator stations will reduce the pressure of gas entering the distribution system from high-pressure pipelines to provide a lower pressure used on the distribution pipeline system. A failure of a regulator station due to mechanical failure, corrosion, contamination, or other cause could result in over-pressurization of the gas distribution system, which may compromise the integrity of medium-pressure pipelines and/or jeopardize public safety. Meter & Regulator (M&R) maintenance activities are cyclical in nature and are conducted in accordance with 49 CFR 192 Subpart M which require the annual inspection and maintenance of all of the approximately 1,357 regulator stations operated by SoCalGas in order to maintain these devices in good mechanical condition.

M&R maintenance activities are preventative in nature and should reduce or eliminate conditions that might lead to an incident by detecting and addressing emerging equipment issues. In addition to addressing emerging issues, M&R maintenance activities will provide an opportunity for SoCalGas to identify equipment that is at risk of deterioration in the future and procure equipment to address said equipment during the next inspection cycle. Distribution

Operations will manage the implementation of the work associated with this control with engineering oversight from the Pipeline Integrity group.

M&R maintenance will increase public and employee safety by mitigating various risk sources, including corrosion and degradation, for example. When a regulator station is replaced as part of M&R maintenance, there are additional safety benefits that improve safety and reliability. The design of new regulator stations includes dual-run feeds which provide redundancy. Modern regulator stations have more monitoring points that feed into the Distribution Operations Control Center (DOCC) which improves response time in the event of an incident. Additionally, there is a financial benefit with the installation of new regulator stations related to ease of maintenance compared to older model regulator stations and better availability of parts when maintenance is required. Minimizing safety threats has the additional benefits of reducing reconstruction costs from equipment failure, reducing risk to property, and the potential benefit of improved service reliability.

b. Elements of the Bow Tie Addressed

Meter & Regulator Maintenance addresses the following elements of the bow tie:

[DT.1] – Corrosion

[DT.2] – Natural forces

[DT.3] – Outside forces

[DT.5] – Equipment failure

[DT.6] – Incorrect operations

c. RSE Inputs and Basis

Scope	SoCalGas is replacing approximately 30 regulator stations out of 1,970 total regulator stations in the system (1.5%).
Effectiveness	Per internal SME assessment, replacing regulator stations could reduce safety, reliability, and financial risk associated with this asset type by up to 100%. Replacing stations with a potentially higher risk of incident,

	has a 5x risk reduction impact versus replacing the average regulator station in the system, per internal SME assessment.
Risk Reduction	**Safety**: Based on an assessment of PHMSA data, 26 out of 427 significant incident samples were attributed to regulator stations at the national level. This ratio (6%) is used as a proxy for the portion of SoCalGas Medium Pressure safety, financial, and reliability risk associated with this mitigation. Using these assumptions, this control for this tranche could improve the SoCalGas Medium Pressure Gas Incident safety risk by up to 0.5%. **Reliability**: Using these assumptions, this mitigation could improve the SoCalGas Medium Pressure Gas Incident reliability risk by up to 0.5%. **Financial**: Using these assumptions, this control for this tranche could improve the SoCalGas Medium Pressure Gas Incident financial risk by up to 0.5%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		**542**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.53	**1581.09**	3692.04
Post-Mitigation	LoRE		**544.52**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	315.99	**1588.44**	3709.19
	RSE	0.47	**2.35**	5.50

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4. SCG-1-C4: Meter Set Assembly (MSA) Inspection and Maintenance

a. Qualitative Description of Risk Reduction Benefits

Meter and regulator activities include maintaining and operating approximately 102,000 medium and large customer Meter Set Assemblies in the SoCalGas service territory. The medium and large customer MSAs require routine maintenance of the meters, regulators, and other components to meet customers' capacity requirements and to measure gas volume accurately. MSA inspection and maintenance activities are conducted in accordance with General Order 58-A which requires routine maintenance on medium and large MSAs. Given the mandated requirement to conduct MSA inspections and maintenance, the management of this control is cyclical in nature.

MSA inspection and maintenance activities are preventative in nature and should reduce or eliminate conditions that might lead to an incident by detecting and addressing emergent equipment issues. In addition to addressing emergent issues, MSA inspection and maintenance activities will provide an opportunity for SoCalGas to identify equipment that is at risk of deterioration in the future and procure equipment to remediate or replace that equipment during the next inspection cycle. Distribution Operations will manage the implementation of the work associated with this control with engineering oversight.

MSA inspection and maintenance activities will increase public and employee safety by mitigating various risk sources, including corrosion and degradation, for example. Minimizing safety threats has the additional benefits of reducing reconstruction costs from equipment failure, reducing risk to property, and the potential benefit of improved service reliability.

b. Elements of the Bow Tie Addressed

MSA Inspection and Maintenance addresses the following elements of the bow tie:

[DT.1] – Corrosion

[DT.2] – Natural forces

[DT.3] – Outside forces

[DT.5] – Equipment failure

[DT.6] – Incorrect operations

5. SCG-1-C5/C11/C12/C12: Pipeline Monitoring (Pipeline Patrol, Leak Survey, Bridge & Span Inspection, Unstable Earth Inspection)

a. Qualitative Description of Risk Reduction Benefits

SoCalGas conducts pipeline monitoring and inspection activities to proactively target risk factors before operation and safety issues arise. These monitoring activities include bridge and span inspections, unstable earth inspections, pipeline patrols, and leak surveys. These inspections are critical since they are intended to observe assets over time to determine if abnormal conditions exist prior to becoming a concern. For example, a span that no longer is coated appropriately due to recent weather conditions can be identified for re-coating before corrosion begins that could lead to a leak. The leak survey monitoring identifies leaks that require repair.

SoCalGas will conduct pipeline monitoring and inspections to proactively target risk factors before operational and safety issues arise. Pipeline monitoring activities include bridge and span inspections, unstable earth inspections, pipeline patrols, and leak surveys. Distribution pipeline spans, pipe supported on bridges, aboveground (or jacketed) pipelines, and all other exposed pipeline (as installed) are inspected for atmospheric corrosion or abnormal conditions: Onshore, at least once every 2 calendar years, but with intervals not exceeding 27 months. Offshore, at least once each calendar year, but with intervals not exceeding 15 months. SoCalGas will proactively survey its gas distribution system for leakage at frequencies determined based on the pipe material involved, the operating pressure, whether the pipe is under cathodic protection, and the proximity of the pipe to various population densities as prescribed within CFR § 192.723. Distribution Operations will manage the implementation of the work associated with this control with engineering oversight.

Pipeline monitoring activities are preventative in nature and should reduce or eliminate conditions that might lead to an incident by detecting and addressing emergent issues. Pipeline monitoring activities should increase public and employee safety by mitigating various risk sources, including corrosion and degradation, for example. Safety risks will be proactively reduced on a regular basis as result of the continual, ongoing nature of pipeline monitoring activities. Minimizing safety threats has the additional benefits of reducing reconstruction costs from equipment failure, reducing risk to property, and the potential benefit of improved service reliability.

b. Elements of the Bow Tie Addressed

Pipeline Monitoring addresses the following elements of the bow tie:

[DT.1] – Corrosion

[DT.2] – Natural forces

[DT.3] – Outside forces

[DT.5] – Equipment failure

6. SCG-1-C6: Gas Infrastructure Protection Project (GIPP)

a. Qualitative Description of Risk Reduction Benefits

The Gas Infrastructure Protection Project addresses prevention of potential third-party vehicular damage associated with above-ground pressurized natural gas facilities. An incident involving vehicular damage of a distribution facility can cause serious injuries or fatalities due to the possibility of ignition. Vehicular impacts have been one of the highest sources of significant incident risk due to the volume of incidents. The GIPP focuses on damage prevention with the following remediation measures: construction of barriers between the facility and vehicular traffic (bollards or block wall); relocation of the facility; or installation of an excess flow valve. The installation of various kinds of barriers can prevent some contacts from vehicular impacts, especially those done at low speed. The installation of excess flow valves can aid in the reduction of unrestrained gas flows.

GIPP activities will increase public safety by mitigating risk associated with above-ground distribution facilities located near vehicular traffic. GIPP remediation measures are preventative in nature and will reduce conditions that might lead to an incident.

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b. Elements of the Bow Tie Addressed

Gas Infrastructure Protection Project addresses the following elements of the bow tie:

[DT.3] – Outside forces

[PC.1] – Serious injuries and/or fatalities

[PC.2] – Property damage

[PC.5] – Erosion of public confidence

c. RSE Inputs and Basis

Scope	The GIPP involves the inspection and remediation (i.e., installing bollards, relocating meters, service alterations, and abandonments) of 22,275 of 27,600 total commercial and industrial locations on the SoCalGas medium pressure system (81%).
Effectiveness	Per internal SME assessment, this tranche can reduce safety, reliability, and financial risk associated with this asset type by up to 95%.
Risk Reduction	**Safety**: Based on an assessment of PHMSA data, 41 significant incidents occurred at SoCalGas and SDG&E since year 2010. Of these 41 incidents, 9 were attributed to "other outside force damage - car, truck, other vehicle." This ratio (22%) is used as the portion of SoCalGas Medium Pressure safety, financial, and reliability risk associated with this tranche. Using these assumptions, this control for this tranche could improve SoCalGas Medium Pressure Gas Incident safety risk by up to 17%. **Reliability**: Using these assumptions, this control for this tranche could improve the SoCalGas Medium Pressure Gas Incident reliability risk by up to 17%.

	Financial: Using these assumptions, this control for this tranche could improve the SoCalGas Medium Pressure Gas Incident financial risk by up to 17%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**542**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.53	**1581.09**	3692.04
Post-Mitigation	**LoRE**		**633.22**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	367.46	**1847.19**	4313.42
	RSE	63.58	**319.61**	746.34

7. SCG-1-C7: Distribution Risk Evaluating and Monitoring System (DREAMS)

a. Qualitative Description of Risk Reduction Benefits

The Distribution Risk Evaluating and Monitoring System tool, developed and managed as part of the DIMP, will prioritize risk mitigation on early vintage plastic and steel pipeline segments. SoCalGas will utilize a relative risk model in order to rank and prioritize the risk for both plastic and steel pipeline. As noted in Section 5.G., for 2019, SoCalGas is on target to replace 78 miles of mains and associated services for replacement above and beyond routine replacements in accordance with DIMP regulations for the replacement of vintage plastic as part of the Vintage Integrity Plastic Plan (VIPP). For 2019, SoCalGas is on target to replace 29 miles of mains and associated services and targeted replacement of 2,000 – 4,000 services for replacement above and beyond routine replacements in accordance with DIMP regulations for the replacement of vintage steel as part of the Bare Steel Replacement Plan (BSRP).

SoCalGas anticipates continuing to increase the level of replacement over the next 6-8 years while monitoring performance to continually review the benefits and risk reduction accomplished through the replacement program through indicators such as leak repair and incident rates related to early vintage plastic. DREAMS, inclusive of the VIPP and BSRP, are conducted in accordance with 49 CFR Part 192. Distribution Operations will manage the implementation of the work associated with this control with engineering oversight from the Pipeline Integrity group.

Significant reductions in safety risks will be achieved with the replacement of vintage plastic and steel pipeline with new plastic pipe. Newly installed plastic pipe has a very low leak rate and is not subject to corrosion. A newly installed pipeline has a lower residual risk level and its risk rises on a different path than that of vintage pipe. The difference in deterioration paths is the performance benefit derived from reconstruction. This directly translates into a decrease in safety risk. Minimizing safety threats has the additional benefits of reducing reconstruction costs from equipment failure, reducing risk to property, and the potential benefit of improved service reliability over time.

b. Elements of the Bow Tie Addressed

DREAMS, inclusive of VIPP and BSRP, addresses the following elements of the bow tie:

[DT.1] – Corrosion

[DT.2] – Natural forces

[DT.3] – Outside forces

[DT.4] – Pipe, weld or joint failure

[DT.5] – Equipment failure

[DT.7] – Incorrect/inadequate asset records

c. **RSE Inputs and Basis**

i. **SCG-1-C7-T1: Vintage Integrity Plastic Plan (VIPP)**

Scope	The VIPP involves replacing, mitigating, and remediating 560 miles of plastic pipe out of 8,680 identified miles (6.4%).
Effectiveness	Per internal SME assessment, we assume 100% effectiveness because failure rate of modern PE plastic pipe is very low. Based on SME analysis, replaced plastic segments are 12.5 times more likely for an incident to occur than modern plastic pipe over a lifecycle.
Risk Reduction	**Safety**: Based on an assessment of PHMSA data, 41 natural gas incidents occurred at SoCalGas and SDG&E starting in year 2010. 7 out of the 41 SoCalGas and SDG&E incident samples were plastic pipeline events (17%). Using these assumptions, this tranche could improve safety risk by up to 14%. **Reliability**: Using these assumptions, this control for this tranche could improve the SoCalGas Medium Pressure Gas Incident reliability risk by up to 14%. **Financial**: Using these assumptions, this control for this tranche could improve the SoCalGas Medium Pressure Gas Incident financial risk by up to 14%.

ii. **SCG-1-C7-T2: Bare Steel Replacement Program (BSRP)**

Scope	The BSRP involves replacing, mitigating, and remediating 114 miles of steel pipe out of 7,855 identified miles (1.5%).
Effectiveness	Per internal SME assessment, we assume 100% effectiveness because the failure rate of replacement PE steel pipe is very low. Based on SME

	analysis, steel segments that are being replaced are 13.2 times more likely for an incident to occur than the modern steel pipe over a lifecycle.
Risk Reduction	**Safety**: Based on an assessment of PHMSA data, 41 natural gas incidents occurred at SoCalGas and SDG&E starting in 2010. 3 out of the 41 SoCalGas and SDG&E incident samples were steel pipeline events (7%). Using these assumptions, this control for this tranche could improve safety risk by up to 1.4%. **Reliability**: Using these assumptions, this tranche could improve the SoCalGas Medium Pressure Gas Incident reliability risk by up to 1.4%. **Financial**: Using these assumptions, this control for this tranche could improve the SoCalGas Medium Pressure Gas Incident financial risk by up to 1.4%.

d. Summary of Results

i. SCG-1-C7-T1: Vintage Integrity Plastic Plan (VIPP)

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		**542**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.53	**1581.09**	3692.04
Post-Mitigation	LoRE		**616.57**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	357.80	**1798.63**	4200.02
	RSE	2.68	**13.45**	31.40

ii. SCG-1-C7-T2: Bare Steel Replacement Program (BSRP)

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		**542**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.53	**1581.09**	3692.04
Post-Mitigation	LoRE		**549.60**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	318.93	**1603.26**	3743.79
	RSE	0.64	**3.20**	7.48

8. SCG-1-C8: Sewer Lateral Inspection Project (SLIP)

a. Qualitative Description of Risk Reduction Benefits

SLIP addresses identified threats of low frequency, but potentially high consequence events related to pipeline damage within sewer laterals. The program should find instances in which a gas service has penetrated a sewer lateral upon installation thereby having the potential to cause incident from work such as auger or rooter operations in said lateral. It is a latent risk that exists in any gas system using directional boring technologies (boring through an existing sewer pipe creates a conflict which may lead to an incident). An inspection and the subsequent remediation, if necessary, eliminates the risk from a subject location. The potential migration of unwanted gas into a sewer line and elsewhere can pose significant risks of bodily injury and damage to property. The SLIP control will provide safety benefits by mitigating the risks to public safety and property damage.

b. Elements of the Bow Tie Addressed

SLIP addresses the following elements of the bow tie:

[DT.3] – Outside forces

[PC.1] – Serious injuries or fatalities

[PC.2] – Property damage

[PC.5] – Erosion of public confidence

c. RSE Inputs and Basis

Scope	165,000 locations out of 1,140,000 (14.5%) are scheduled for inspection as part of SLIP.
Effectiveness	Per internal SME assessment, inspection and remediation of these locations could reduce safety, reliability, and financial risk associated with this asset type by up to 100%.
Risk Reduction	Safety: Based on PHMSA information, 3 out of a 426 significant incident samples at the national level are due to sewer conflicts. Using these assumptions, this mitigation could improve safety risk by up to 0.1%. Reliability: Using these assumptions, this mitigation could improve the SoCalGas Medium Pressure Gas Incident reliability risk by up to 0.1%. Financial: Using these assumptions, this mitigation could improve SoCalGas Medium Pressure Gas Incident financial risk by up to 0.1%.

d. Summary of Results

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		**542**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.53	**1581.09**	3692.04
Post-Mitigation	LoRE		**542.55**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.85	**1582.70**	3695.80
	RSE	0.89	**4.46**	10.43

9. SCG-1-C9: Distribution Riser Inspection Project (DRIP)

a. Qualitative Description of Risk Reduction Benefits

The Distribution Riser Inspection Project (DRIP) PAAR will address the threat of failure of anodeless risers (ALRs) due to corrosion. ALRs are service line components that have shown a propensity to fail before the end of their useful lives. ALRs are located next to buildings or residences therefore the potential gas migration path is short and can present a safety risk. Where the threat of failure of an ALR is present, SoCalGas will remediate the issue by implementing an epoxy composite wrap, providing a protective barrier for the above-ground section of the ALR. The epoxy composite wrap is completed during all inspections Replacement of the equipment may be considered if the implementation of the epoxy composite wrap is not effective or possible. DRIP is conducted in accordance with 49 CFR Subpart P. Distribution Operations manages the implementation of the work associated with this control with engineering oversight from the Pipeline Integrity group. The DRIP PAAR will reduce the likelihood of failure of ALRs thus reducing risk to public safety and property.

b. Elements of the Bow Tie Addressed

DRIP addresses the following elements of the bow tie:

[DT.1] – Corrosion

[DT.2] – Natural forces

[DT.3] – Outside forces

[DT.5] – Equipment failure

c. RSE Inputs and Basis

Scope	570,000 out of 1,700,000 locations (33.5%) are identified to be inspected and remediated as part of DRIP.

Effectiveness	Per internal SME assessment, inspection of the remaining locations could reduce safety, reliability, and financial risk associated with this asset type by up to 100%.
Risk Reduction	**Safety**: Based on PHMSA information, 3 out of a 426 significant incident samples at the national level are due to riser issues. Using these assumptions, this mitigation could improve safety risk by up to 0.2%. **Reliability:** Using these assumptions, this control for this tranche could improve the SoCalGas Medium Pressure Gas Incident reliability risk by up to 0.2%. **Financial:** Using these assumptions, this control for this tranche could improve the SoCalGas Medium Pressure Gas Incident financial risk by up to 0.2%.

d. **Summary of Results**

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		**542**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.53	**1581.09**	3692.04
Post-Mitigation	LoRE		**543.28**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	315.27	**1584.83**	3700.75
	RSE	1.23	**6.21**	14.49

10. SCG-1-C10: Distribution Operations Control Center (DOCC)

a. Qualitative Description of Risk Reduction Benefits

The DOCC will continue to provide the ability to manage distribution pipeline operations system in real-time via the use of modern technology, including remote and automated controls and the co-location of a constantly-staffed DOCC facility with Gas Control operations. The DOCC allows for the integrated operation of the distribution and existing high-pressure transmission pipeline systems. The DOCC is managed by the Gas Control group in accordance with CFR 192.631 (Control Room Management). The DOCC is not mandated by state or federal regulations, but individual aspects of DOCC operations are regulated. The DOCC 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
- Increased operational awareness through the implementation of centralized management of change
- Improved technology that allows for more effective system controls and the ability to aggregate, streamline, and analyze inputs from multiple data sources

A centralized and modernized DSS will increase operational efficiency and improve the speed and ability to manage incidents which will directly translate to improvement in public and employee safety. The commission recognized the DOCC as an important mitigation to the Medium Pipeline Incident Risk and in authorizing SoCalGas' proposed capital expenditures in the TY 2019 GRC.[39]

b. Elements of the Bow Tie Addressed

Distribution Operation Control Center addresses the following elements of the bow tie:

[DT.1] – Corrosion

[DT.2] – Natural forces

[DT.3] – Outside forces

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[39] D.19-09-051 at 131 ("The system also supports mitigation of a key risk identified during the RAMP process and we find that the real time monitoring to be provided by the system supports our policy of reducing gas leaks more quickly.")

[DT.4] – Pipe, weld or joint failure

[DT.5] – Equipment failure

VII. SUMMARY OF RISK MITIGATION PLAN RESULTS

As discussed, the existing controls outlined within the Chapter will continue and certain controls will increase in scope or at an accelerated pace. However, as a diligent operator the controls will be monitored to determine if any adjustments are needed during the implementation period. The programs could be influenced as additional information is gathered or understanding of risk and controls relationship changes. Should controls need to change, consideration will be given to available technology, labor resources, planning and construction lead time, compliance requirements, and operational and execution considerations.

The table below provides a summary of the Risk Mitigation Plan, including controls, associated costs and the RSEs by tranche. SoCalGas does not account for and track costs by activity, but rather, by cost center and capital budget code. Thus, the costs shown in the table were estimated using assumptions provided by SMEs and available accounting data.

Table 6: Risk Mitigation Plan Overview[40]

(Direct 2018 $000)[41]

ID	Mitigation/Control	Tranche	2018 Baseline Capital[42]	2018 Baseline O&M	2020-2022 Capital[43]	2022 O&M	Total[44]	RSE[45]
SCG-1-C1	Cathodic Protection	T1	7,100	17,000	30,000 – 38,000	17,000 – 22,000	47,000 – 60,000	1.01 – 11.81
SCG-1-C2	Valve inspection & Maintenance	T1	0	900	0	900 – 1,100	900 – 1,100	--

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

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

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

43 The capital presented is the sum of the years 2020, 2021, and 2022 or a three-year total. Years 2020, 2021 and 2022 are the forecast years for SoCalGas' Test Year 2022 GRC Application.

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

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

ID	Mitigation/Control	Tranche	2018 Baseline Capital[42]	2018 Baseline O&M	2020-2022 Capital[43]	2022 O&M	Total[44]	RSE[45]
SCG-1-C3	Meter & Regulator (M&R) Maintenance	T1	5,800	15,000	7,500 – 9,600	21,000 – 27,000	30,000-37,000	0.47 – 5.50
SCG-1-C4	Meter Set Assembly (MSA) Inspection and Maintenance	T1	19,000	10,000	24,000 – 31,000	10,000 – 13,000	34,000 – 44,000	-
SCG-1-C5	Pipeline Patrol	T1	0	90	0	190 - 250	190-250	-
SCG-1-C6	Gas Infrastructure Protection Plan (GIPP)	T1	6,700	1,800	15,000 – 19,000	750 - 950	16,000 – 20,000	63.58 – 746.34
SCG-1-C7	DREAMS - Vintage Integrity Plastic Plan	T1	100,000	1,600	410,000 – 520,000	660 - 850	410,000 – 520,000	2.68 – 31.40
SCG-1-C7	DREAMS - Bare Steel	T2	44,000	680	170,000 – 220,000	280 - 360	170,000 – 220,000	0.64 – 7.48

ID	Mitigation/Control	Tranche	2018 Baseline Capital[42]	2018 Baseline O&M	2020-2022 Capital[43]	2022 O&M	Total[44]	RSE[45]
	Replacement Program							
SCG-1-C8	Sewer Lateral Inspection Plan (SLIP)	T1	0	9,600	0	9,100 – 12,000	9,100 – 12,000	0.89 – 10.43
SCG-1-C9	Distribution Riser Inspection Project (DRIP)	T1	0	15,000	0	15,000 – 19,000	15,000 – 19,000	1.23 – 14.49
SCG-1-C10	Distribution Operations Control Center (DOCC)	T1	720	0	65,000 – 83,000	0	65,000 – 83,000	-
SCG-1-C11	Leak Survey	T1	0	9,700	0	11,000 – 14,000	11,000 – 14,000	-
SCG-1-C12	Bridge & Span Inspections	T1	0	78	0	64 – 82	64 – 82	-

ID	Mitigation/Control	Tranche	2018 Baseline Capital[42]	2018 Baseline O&M	2020-2022 Capital[43]	2022 O&M	Total[44]	RSE[45]
SCG-1-C13	Unstable Earth Inspection	T1	0	8	0	9 – 12	9 – 12	-
		TOTAL COST	**180,000**	**81,000**	**720,000 – 920,000**	**86,000–110,000**	**810,000 – 1,000,000**	-

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

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

Table 7: Summary of RSE Exclusions

Control ID	Control Name	Reason for No RSE Calculation
SCG-1-C2	Valve Inspections and Maintenance	Mandated activity per 49 CFR 192 Subpart M § 192.7245 and § 192.747.
SCG-1-C4	Meter Set Assembly (MSA) Inspection and Maintenance	Mandated activity per 49 CFR 192 Subpart H
SCG-1-C5/C11/C12/C13	Pipeline Monitoring (Pipeline Patrol, Leak Survey, Bridge & Span Inspection, Unstable Earth Inspection)	Mandated activity per 49 CFR § 192.722, § 192.705, § 192.722, § 192.723 and § 192.935.
SCG-1-C10	Distribution Operations Control Center (DOCC)	The TY2019 SoCalGas/SDG&E GRC Decision recognized and approved the benefits of the DOCC, effectively establishing activities surrounding the DOCC as a control with funding approved from 2017 through 2019.[46]

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[46] D.19-09-051 at 128-130 ("The [DOCC] system is proposed to be built in phases from 2017 to 2021 with an estimated total capital cost of $108 million.…we find that the real time information and monitoring of gas distribution pipelines that will be provided by the system as described in Exhibit 50 showing the features and other capabilities of the DOCC, provide meaningful safety benefits.")

VIII. ALTERNATIVE MITIGATION PLAN ANALYSIS

Pursuant to D.14-12-025 and D.16-08-018, SoCalGas considered alternatives to the described mitigations for the Medium Pressure Gas Pipeline Incident risk. Typically, analysis of alternatives occurs when implementing activities to obtain the best result or product for the cost. The alternatives analysis for this Risk Mitigation Plan also took into account modifications to the plan and constraints, including but not limited to operational, compliance and resource constraints.

A. SCG-1-A1 – Assessment and Replacement of 10-year Cycle Cathodically Protected Services (CP10s)

SoCalGas considered replacing the 325,349 CP10 services rather than continuing to monitor, inspect and maintain them on ten-year cycle. CP10 services are separately protected service lines that are surveyed on a sampling basis where at least 10% of system inventory are sampled each year, so that the entire system is tested in a 10-year period. However, due to the number of CP10 services in the system, a program targeting complete replacement of CP10 services would exceed $2 Billion and likely take many decades to complete. As complete replacement is not feasible, further evaluation of CP10 services is required to evaluate and quantify the risk reduction benefits, and potentially develop a risk based targeted replacement program. In the interim CP10s will be replaced based on performance history and current protection levels.

Scope	Per SME input, scope is 0.9% or a replacement of 3,000 units out of 325,349.
Effectiveness	Per internal SME assessment, the effectiveness of this mitigation is 95%.
Risk Reduction	Based on historical information reported to PHMSA, risk addressed is 2%. Using these

	assumptions, this mitigation could improve storage safety, reliability, and financial risk by up to 0.02%.

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	LoRE		**542**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.53	**1581.09**	3692.04
Post-Mitigation	LoRE		**541.88**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.46	**1580.75**	3691.25
	RSE	0.06	**0.29**	0.67

B. SCG-1-A2 - Soil Sampling Program

SoCalGas considered expanding its collection of soil property information. SoCalGas collects soil properties (rocky, clay, sandy) during excavations and repairs along its pipelines. These soil properties are an element within the relative risk models used for prioritization process of the vintage replacement program for plastic. Expanding the collection of soil properties beyond leak repair excavations may allow SoCalGas to further refine its replacement efforts. The cost estimate of sampling the 54,479 miles of distribution pipe is $88.1 million; on average, 14 samples per day will be tested at intervals of 2 samples per mile. SoCalGas has not initiated an expanded soil sampling program since the potential benefit is related to the maturing of the risk assessment. As the risk assessment continues to mature for the corrosion threat the benefit of additional information can be better understood. In the interim SoCalGas will be researching available data sets and determining the benefit of additional soil property information.

Scope	Assuming 100% of soil would be sampled, as a one-time effort: once the soil is sampled, it does not need to be resampled.
Effectiveness	Per internal SME assessment, effectiveness of having additional data for making better pipe replacement decisions will be minimal, at 1%.[47]
Risk Reduction	Per SME guidance, risk addressed is 17%, same as plastic DREAMS program. Using these assumptions, this mitigation could improve storage safety, reliability, and financial risk by up to 0.2%.

		Low Alternative	Single Point	High Alternative
Pre-Mitigation	**LoRE**		**542**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	314.53	**1581.09**	3692.04
Post-Mitigation	**LoRE**		**541.07**	
	CoRE	0.58	**2.92**	6.81
	Risk Score	313.99	**1578.39**	3685.73
	RSE	0.01	**0.03**	0.07

47 Given the need for more mature data for this alternative, the RSEs calculated here are particularly speculative.

Table 8: Alternative Mitigation Summary

(Direct 2018 $000)[48]

ID	Mitigation	2020-2022 Capital[49]	2022 O&M	Total[50]	RSE[51]
SCG-1-A1	Assessment and Replacement of 10-year Cycle Cathodically Protected Services (CP10s)	30,000 – 38,000	0	30,000 – 38,000	0.06 – 0.67
SCG-1-A2	Soil Sampling Program	0	1,700 – 2,200	1,700 – 2,200	0.01 – 0.07

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

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

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

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

APPENDIX A: SUMMARY OF ELEMENTS OF RISK BOW TIE ADDRESSED

ID	Control Name	Drivers/Triggers/Potential Consequences Addressed
SCG-1-C1	Cathodic Protection (CP)	DT.1, DT.4
SCG-1-C2	Valve Inspections and Maintenance	DT.1, DT.2, DT.3, DT.5, DT.6
SCG-1-C3	Meter and Regulator (M&R) Maintenance	DT.1, DT.2, DT.3, DT.5, DT.6
SCG-1-C4	Meter Set Assembly (MSA) Inspection and Maintenance	DT.1, DT.2, DT.3, DT.5, DT.6
SCG-1-C5	Pipeline Patrol	DT.1, DT.2, DT.3, DT.5
SCG-1-C6	Gas Infrastructure Protection Project (GIPP)	DT.3; PC.1, PC.2, PC.5
SCG-1-C7-T1	DREAMS: Vintage Integrity Plastic Plan (VIPP)	DT.2, DT.3, DT.4, DT.5, DT.7
SCG-1-C7-T2	DREAMS: Bare Steel Replacement Program (BSRP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.7
SCG-1-C8	Sewer Lateral Inspection Project (SLIP)	DT.3; PC.1, PC.2, PC.5
SCG-1-C9	Distribution Riser Inspection Project (DRIP)	DT.1, DT.2, DT.3, DT.5
SCG-1-C10	Distribution Operations Control Center (DOCC)	DT.2, DT.3, DT.5
SCG-1-C11	Leak Survey	DT.1, DT.2, DT.3, DT.5
SCG-1-C12	Bridge & Span Inspections	DT.1, DT.2, DT.3, DT.5
SCG-1-C13	Unstable Earth Inspection	DT.1, DT.2, DT.3, DT.5