2025 Risk Assessment Mitigation Phase

(Chapter SCG-Risk-3)

Medium Pressure Gas System

May 15, 2025

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I. INTRODUCTION

The purpose of this chapter is to present Southern California Gas Company's (SoCalGas or Company) risk control and mitigation plan for SoCalGas's medium pressure gas system risk (MP System Risk). This chapter contains information and analysis for this risk that meet the requirements of the California Public Utilities Commission's (Commission or CPUC) Risk-Based Decision-Making Framework (RDF),[1] including the requirements adopted in Decision (D.) 22-12-027 (the Phase 2 Decision)[2] and D.24-05-064 (the Phase 3 Decision).[3] MP System Risk is included in the 2025 RAMP Report based on a safety risk assessment, further informed by its reliability and financial consequence attributes, consistent with RDF guidance. This risk chapter describes the basis for selection of MP System Risk, the controls and/or mitigations put forth to reduce the likelihood or consequence of this risk, a discussion of alternative mitigations considered but not selected, and a graphic to show historical progress. This chapter presents cost and unit forecasts for the risk mitigating activities, but it does not request funding. Any funding requests for this risk will be made through the Company's Test Year (TY) 2028 General Rate Case (GRC) application. Finally, this chapter describes the methods applied to estimate the risk's monetized, pre-mitigated risk, the estimated risk-reduction benefits of each included control and mitigation, and the calculation of Cost-Benefit Ratios (CBRs) for each control and mitigation consistent with the method and process prescribed in the RDF.

A. Risk Definition and Overview

1. Risk Definition

For the purposes of this RAMP Report, SoCalGas's MP System Risk is defined as "the risk of failure of a medium pressure[4] pipeline (including appurtenances to and at the meter) which results in serious injuries, fatalities, and/or damages to the infrastructure."

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1 As discussed in Volume 1, Chapter RAMP-1, the RDF Framework broadly refers to the recent modifications to the Commission's Rate Case Plan adopted in Rulemaking (R.) 13-11-006, Safety Model Assessment Proceeding A.15-05-002 et al. (cons.), and R.20-07-013 (the Risk OIR), including D.24-05-064, Appendix A.

2 D.22-12-027 is the "Phase II Decision Adopting Modifications to the Risk-Based Decision-Making Framework Adopted in Decision 18-12-014 and Directing Environmental and Social Justice Pilots" (December 21, 2022).

3 D.24-05-064 is the "Phase III Decision" (June 6, 2024).

4 "Medium pressure" pipelines are those for which the Maximum Allowable Operating Pressure (MAOP) is no greater than 60 pounds per square inch (psi).

Certain controls and mitigations presented in this chapter are subject to compliance mandates beyond RDF reporting requirements, including but not limited to General Order (GO) 112-F and subparts of Code of Federal Regulations (CFR) Rule 49. A list of compliance requirements applicable to MP System Risk is provided in Attachment A. Certain mitigation programs have value beyond the estimated risk reduction calculated under the RDF, such as enhancing operations and/or preparing for future capacity needs (such as driven by electrification or climate impacts).

2. Risk Overview

Medium pressure gas systems consist of an interconnected network of mostly underground mains that feed service lines. The system includes regulator stations, meters, and other appurtenances (such as couplings, joints, risers that connect service lines to meters, and meter set assemblies). Main lines are defined by PHMSA as distribution lines that serve as a common source of supply for more than one service line.[5] Service lines are smaller diameter pipes that feed customer homes, businesses, and some commercial applications, and end at the customer meter or at the connection to a customer's piping, whichever is further downstream (or at the connection to customer piping if there is no meter, which is where SoCalGas's responsibility ends).[6] Medium pressure pipelines are made of steel or plastic.

SoCalGas currently operates approximately 100,000 miles of medium pressure mains and services. This includes approximately 40,200 miles of steel mains and services and approximately 59,600 miles of plastic mains and services. These medium pressure pipelines serve over 21.1 million SoCalGas consumers. For safety and compliance, Title 49 of the CFR Part 192, GO 58, and GO 112 are the leading sources of requirements for SoCalGas's distribution pipelines (among other legal and regulatory provisions). Title 49 CFR Part 192 prescribes safety requirements for pipeline facilities and the transportation of gas at the federal level and is enforced by both the U.S. Department of Transportation's (DOT) Pipeline and Hazardous Material Safety Administration (PHMSA) and the CPUC. GO 58 and GO 112 complement and enhance the requirements of 49 CFR 192 at the state level and are enforced by the CPUC.

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5 49 C.F.R. § 192.3.

6 *Id.*

B. Risk Scope

SoCalGas's analysis considers risk events associated with failure of a medium pressure gas pipeline including appurtenances to and at the meter, which result in serious injuries, fatalities, and/or damages to the infrastructure.

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 present 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 and accumulate in a confined space. The safety concern caused by the leak is addressed by SoCalGas's leak indication prioritization and repair schedule procedures. In most cases, where leaks are non-hazardous, 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) Code section B31.8S.[7] However, SoCalGas actively monitors and prioritizes such leaks in accordance with 49 CFR 192.723, which requires leakage surveys to be conducted at least once annually in business districts and at least once every five years outside of business districts.

C. Data Sources Used to Quantify Risk Estimates[8]

SoCalGas utilized internal data sources to determine MP System Pre-Mitigation Risk Value and calculate risk reduction estimates for mitigation activities (which enables estimation of Post Mitigation Monetized Risk Values and Cost Benefit Ratios). Where internal data is deemed insufficient, supplemental industry or national data is used, as appropriate and adjusted to account for the risk characteristics associated with the Company's specific operating locations and service territory. For example, certain types of incident events have not occurred within the SoCalGas and SDG&E service territories. Expanding the quantitative data sources to include industry data where such incidents have been recorded is appropriate to establish a baseline of

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[7] 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.

[8] Copies and/or links to these data resources are provided in the workpapers served with this Report on May 15, 2025.

risk and risk addressed by mitigative activities. Attachment B provides additional information regarding these data resources.

The probability of failure component within the quantitative risk models for medium pressure gas distribution assets primarily relies on failure rates sourced from SoCalGas, SDG&E, and broader industry data, generally covering the period from approximately 2010 to the present. The exact date range varies by asset type according to data availability; thus, the resulting risk values represent average annual risks over these respective periods. For specific asset types and threats, time-dependent phenomena such as material degradation, have been accounted for using an exponential model to characterize changes in failure likelihood over time. However, this approach has not yet been comprehensively implemented across all asset types or threat categories, therefore, the absence of explicit time-dependent modeling should not be interpreted as indicating these assets are unaffected by time-dependent trends. The use of an exponential model is consistent with industry precedent for analyzing the time-dependent failure likelihood trends on buried infrastructure, including natural gas and water pipelines.

II. RISK ASSESSMENT

In accordance with Commission guidance, this section provides a qualitative description of the MP System Risk, including a risk Bow Tie which delineates potential Drivers/triggers and potential Consequences, followed by a description of the Tranches determined for this risk and the risk's Pre-Mitigated Risk Value.

A. Risk Selection

The MP System Risk was included as a Risk in SoCalGas's 2021 RAMP and was included in SoCalGas's 2022, 2023 and 2024 Enterprise Risk Registries (ERR).[9] The ERR evaluation and selection process is summarized in Chapter RAMP-2, Enterprise Risk Management Framework.

SoCalGas selected this risk in accordance with the RDF Row 9.[10] Specifically, SoCalGas assessed the top risks from the Company's 2024 Enterprise Risk Registry based on the

[9] In the 2021 RAMP Report this risk was called Incident Related to the Medium Pressure System (Excluding Dig-In). The risk definition and elements are unchanged.

[10] RDF Row 9 states that risks to be included in the RAMP Report, at minimum, are those identified in the Company's ERR comprising "the top 40% of ERR risks with a Safety Risk Value greater than zero dollars".

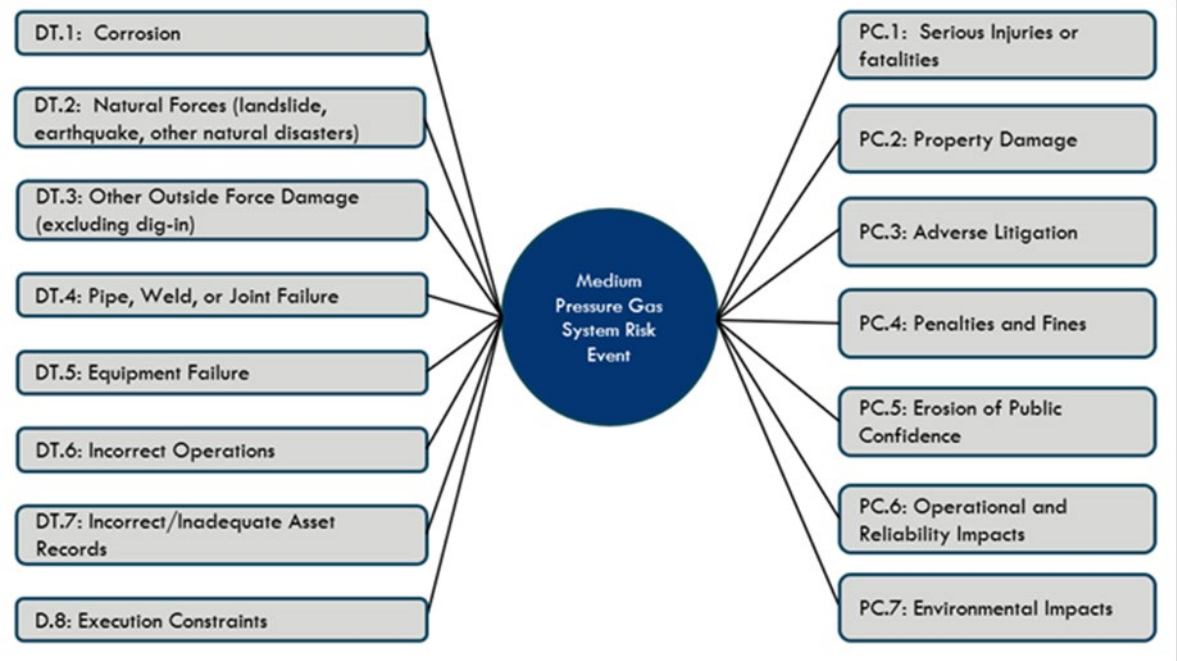
Consequence of a Risk Event (CoRE) Safety attribute. The MP System Risk was among the risks presented in SoCalGas's list of Preliminary 2025 RAMP Risks at the December 17, 2024, at a Pre-Filing Workshop. MP System Risk was selected based on the qualification of its Safety risk attribute, as required under the RDF. At the pre-filing workshop, no party expressed opposition to inclusion of this risk in SoCalGas's 2025 RAMP Report.

B. Risk Bow Tie

In accordance with Commission requirements, this section describes the Risk Bow Tie, possible Drivers, potential Consequences, and a mapping of the elements in the Bow Tie to the mitigation(s) that addresses it.[11] As illustrated in the Risk Bow Tie shown below in Figure 1, the Risk Event (center of the Bow Tie) is a MP System incident (*i.e.*, pipeline failure that leads to gas release causing fatalities and injuries to employees and/or the public), the left side of the Bow Tie illustrates Drivers/triggers that could lead to the MP System incident, and the right side shows the Potential Consequences of the MP System incident. SoCalGas applies this framework to identify and summarize the information provided in Figure 1. A mapping of each mitigation to the addressed elements of the Risk Bow Tie is provided in Attachment C.

Figure 1:

Medium Pressure Gas System: Risk Bow Tie



[11] D.24-05-064, RDF Row 15.

C. Potential Risk Event Drivers/Triggers[12]

When performing a risk assessment for the MP System Risk, SoCalGas identifies potential leading indicators, referred to as Drivers or Triggers, that reflect current and/or forecasted conditions and may include both external actions as well as characteristics inherent to the asset.[13] These Bow Tie Drivers/Triggers inform the Likelihood of a Risk Event (LoRE) component of the risk value. These include:

- **DT.1 Corrosion**: This Driver includes external corrosion, which 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. This Driver also includes internal corrosion which is the deterioration of the interior of an asset as a result of the environmental conditions on the inside of the pipeline.[14] In pipelines, corrosion can occur internally and/or externally, both potentially resulting in a pipeline incident; therefore, both internal and external corrosion are referred to as "corrosion" in the remainder of this chapter, unless otherwise indicated.
- **DT.2 Natural Forces (landslide, earthquake, other natural disasters)**: This Driver includes forces 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 excavation damage)**: This Driver includes effects attributable to outside damage other than excavation damage or natural forces, such as damage by car, truck, or motorized equipment not engaged in excavation.
- **DT.4 Pipe, Weld, or Joint failure**: This Driver includes materials defects within the pipe, component, or joint due to faulty manufacturing procedures, design

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

[13] D.24-05-064, RDF Row 10-11.

[14] ASME B31.8S, "Managing System Integrity of Gas Pipelines".

defects, improper construction or fabrication, or in-service stresses such as vibration, fatigue, and environmental cracking.

- **DT.5 Equipment Failure**: This Driver is 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 is specific to the material properties related to the manufacturing process or post installation of the equipment.
- **DT.6 Incorrect Operations**: This Driver includes a pipeline incident attributed to insufficient or incorrect operating procedures or the failure to follow a procedure.
- **DT.7 Incorrect/Inadequate Asset Records**: This Driver includes forces attributable to the use of inaccurate or incomplete information that can result in the failure to (1) construct, operate, and maintain SoCalGas's pipeline system safely and prudently, or (2) to satisfy regulatory compliance requirements.
- **DT.8 Execution Constraints**: This Driver includes constraints including third-party vendor issues, Quality Assurance/Quality Control issues related to materials and operational oversight, resource constraints (*e.g.*, workforce, material), re-allocation or unexpected maintenance or regulatory requirements or the inability to complete project initiatives or meet operational compliance.

D. Potential Consequences of Risk Event (CoRE)

Potential Consequences are listed to the right side of the risk Bow Tie. SoCalGas identifies the Potential Consequences of this Risk by analyzing internal data sources, where available, industry data, and subject matter expertise (SME).[15] These Bow Tie Consequences inform the CoRE component of the risk value. If one or more of the Drivers listed above were to result in an incident, the Potential Consequences, in a plausible worst-case scenario, can include:

- **PC.1: Serious Injuries or fatalities**
- **PC.2: Property Damage**
- **PC.3: Adverse Litigation**
- **PC.4: Penalties and Fines**

[15] D.24-05-064, RDF Row 10.

- **PC.5: Erosion of Public Confidence**
- **PC.6: Operational and Reliability Impacts**
- **PC.7: Environmental Impacts**

These potential consequences were used by SoCalGas in the scoring of the MP System Risk during the development of its ERR.

E. Evolution of Risk Drivers and Consequences

As specified in the Phase 3 Decision,[16] the following changes to the previous ERR and/or the 2021 RAMP include:

- The title of *Medium Pressure Gas System* was changed from *Incident Related to the Medium Pressure System (Excluding Dig-In)* to align with the 2024 ERR.
- The scope of *Medium Pressure Gas System* has been narrowed. In the 2021 RAMP, *Incident Related to the Medium Pressure System (Excluding Dig-In)* was a combination of two separate risks: (a) Incident Related to the Gas Distribution System (Excluding Dig-In), and (b) Customer and Public Safety. *Customer and Public Safety* has been renamed to *Beyond the Meter* and is a standalone risk in SoCalGas's 2024 ERR, which is not included in the 2025 RAMP due to not meeting the top 40% of safety risks threshold. SoCalGas has also made several updates to the Drivers and Potential Consequences to improve alignment with the terminology used in its policies and procedures.

1. Changes to Drivers/Triggers of the Risk Bow Tie

- DT.1 – "External corrosion" in the 2024 ERR was change to "Corrosion" for the 2025 RAMP.
- DT.2 – "Natural forces (natural disasters, fires, earthquakes)" in the 2021 RAMP was changed to Natural forces (landslides, fires, earthquakes) in the 2024 ERR, and "Natural Forces (landslide, earthquakes, other natural disasters)" for the 2025 RAMP.

[16] *Id.*, RDF Row 8.

- DT.3 – "Other Outside Force Damage (excluding dig-in)" in the 2024 ERR was changed to "Other Outside Force Damage (excluding excavation damage)" for the 2025 RAMP.

2. Changes to Potential Consequences of the Risk Bow Tie

The following change from the 2021 RAMP was made:

- PC.7 – Added "Environmental Impacts."

F. Summary of Tranches

To determine groups of assets or systems with similar risk profiles, or Tranches, and in accordance with Row 14 of the RDF, SoCalGas applied the Homogeneous Tranching Methodology (HTM) as outlined in Chapter RAMP - 3: Risk Quantification Framework. As a result, the following classes, LoRE-CoRE pairs, and resulting number of Tranches were determined:

Table 1: Medium Pressure Gas System Risk Tranche Identification

Class	Number of LoRE-CoRE Pairs	Number of Resulting Tranches
Aboveground	254	27
Belowground	3,073	40
TOTAL	**3,327**	**67**

Attachment D illustrates the derivation of the Tranches, as shown in Table 1 above, in accordance with the HTM. The classes were identified by SoCalGas as logical groups of assets and systems based on the Company's operations. These classes also align risk treatments with asset risk profiles reflective of SoCalGas's operations. More detailed Tranche information, including risk quantification by LoRE-CoRE pair, Tranche names, and mitigation associations (*i.e.*, cost mapping and risk reduction) to Tranches, are provided workpapers of this risk chapter.

III. PRE MITIGATION RISK VALUE

In accordance with the RDF Row 19 below provides the pre-mitigation risk values for the MP System Risk. For further details, including pre-mitigation risk values by Tranche, please refer to the workpapers. Explanations of the risk quantification methodology and other higher-level assumptions are provided in Chapter RAMP-3 Risk Quantification Framework.

Table 2: Medium Pressure Gas System Risk
Monetized Risk Values
(Direct, in 2024 $ millions)

LoRE	CoRE [Risk-Adjusted Attribute Values]			Total CoRE	Total Risk [LoRE x Total CoRE]
	Safety	Reliability	Financial		
58,846.77	$0.00014	$0.00012	$0.00171	$0.00197	$115.90

A. Risk Value Methodology

SoCalGas's risk modeling for the MP System risk follows RDF guidance[17] for implementing a Cost Benefit Approach, as described below:

1. **Cost Benefit Approach Principle 1 – Attribute Hierarchy (RDF Row 2):** MP System Risk is quantified in a combined attribute hierarchy as shown in the table above, such that Safety, Reliability, and Financial are presented based on available, observable, and measurable data.
2. **Cost Benefit Approach Principle 2 – Measured Observations (RDF Row 3):** MP System Risk used observable and measurable data in the estimation of CoRE values. SoCalGas utilized a combination of internal and external data to estimate consequences in terms of natural units, (*e.g.* fatalities, serious injuries, and meters out) that can occur as the result of a risk event on the MP System.
3. **Cost Benefit Approach Principle 3-Comparison (RDF Row 4):** The MP System Risk quantification did not include any attributes that are not directly measurable, so proxy data, as described in the RDF, was not necessary.
4. **Cost Benefit Approach Principle 4-Risk Assessment (RDF Row 5):** The data sources used for MP System Risk – as described in the preceding paragraphs – were sufficient to model probability distributions for use in estimating risk values.
5. **Cost Benefit Approach Principle 5-Monetized Levels of Attributes (RDF Row 6):** In accordance with D.22-12-027 and D.24-05-064, RDF Row 6, SoCalGas and SDG&E used a California-adjusted Department of Transportation monetized equivalent to calculate the Safety CoRE attribute at a monetized

[17] D.24-05-064, RDF Rows 2-7.

equivalent of $16.2 million per fatality, and $4.1 million per serious injury;[18] the Gas Reliability CoRE attribute is valued at a monetized equivalent of $3,868 per gas meter outage; and the Financial CoRE attribute is valued at $1 per dollar.[19] Further information regarding SoCalGas's quantitative risk analyses, including raw data, calculations, technical references, are provided in workpapers.

6. Cost Benefit Approach Principle 6 - Adjusted Attribute Level (RDF Row 7):

Table 3: Medium Pressure Gas System Risk
Risk Scaled vs Unscaled Value by CoRE Attribute
(Direct, in 2024 $ millions)

	Safety	Reliability	Financial	Total
Unscaled Risk Value	$6.4	$7.0	$100.0	$113.3
Scaled Risk Value	$8.4	$7.0	$100.5	$115.9

The values in the table above are the result of SoCalGas applying the risk scaling methodology described in Chapter RAMP-3 to the CORE attributes for the MP System Risk. The MP System does not feature a significant risk aversion scaling impact because a relatively small proportion of the observed events rise to the level at which scaling is applicable, and the magnitudes of the consequences are not as high (*e.g.*, multiple-fatality event) as can occur with other risks.

For further information regarding the risk scaling function, including the risk scaling factor and the loss threshold at which the risk scaling factor begins to apply, is provided in Chapter-RAMP-3.

IV. 2024-2031 CONTROL & MITIGATION PLAN

This section identifies and describes the controls and mitigations comprising the portfolio of mitigations for MP System Risk and reflects changes to the portfolio expected to occur from the last year of recorded costs at the time of filing this RAMP Report (2024) through the 2028 GRC cycle (2031). For clarity, a current activity that is included in the plan may be referred to as either a control and/or a mitigation. Table 4 below shows which control activities are in place

[18] D.22-12-027 at 35 ("We adopt Staff's recommendation to require a dollar valuation of the Safety Attribute in the Cost-Benefit Approach in the RDF using the DOT VSL as the standard value.").

[19] *See* Chapter RAMP-3: Risk Quantification Framework, Section II.

in 2024 and which are expected to be on-going, completed, or new during the 2025-2031 time periods. Because the TY 2024 GRC proceeding established rates through 2027,[20] information through 2027 is calculated as part of the baseline risk, in accordance with D.21-11-009.[21] For the TY 2028 GRC, SoCalGas calculated CBRs beginning with TY 2028 and for each Post-Test Year 2029, 2030, and 2031.[22]

Table 4: Medium Pressure Gas System Risk
2024-2031 Control and Mitigation Plan Summary

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C103	Cathodic Protection Base Activities	X	Ongoing
C106	Cathodic Protection-CP10 Activities	X	Ongoing
C116	M&R Station and EPM Inspection and Maintenance	X	Ongoing
C120	Distribution Riser Inspection Program (DRIP)	X	Ongoing
C121	Gas Infrastructure Protection Program (GIPP)	X	Ongoing
C122	Sewer Lateral Inspection Program (SLIP)	X	Ongoing
C123	Regulator Station Replacement	X	Ongoing
C124	Regulator Station Installation Replacement & Enhancement	X	Ongoing
C129	Cathodic Protection System Improvement	X	Ongoing
C130	MSA Inspection and Maintenance	X	Ongoing
C134	Pipeline Monitoring	X	Ongoing
C135	EPM Installations & Replacements	X	Ongoing
C159	Quality Assurance Gas Distribution Assets	X	Ongoing
C170	CP Install/Replace Impressed Current Systems	X	Ongoing
C174	Service Replacements – Leakage Abnormal Op. Conditions CP Related	X	Ongoing
C175	Residential Meter Protection	X	Ongoing
C177	Main Replacements – Leakage Abnormal Op. Conditions CP Related	X	Ongoing
C178	Distribution Leak Survey	X	Ongoing
C179	Distribution Main and Service Leak Repair	X	Ongoing

[20] D.24-12-074.

[21] D.21-11-009 at 136 (Conclusion of Law (COL) 7) (providing a definition for "baselines" and "baseline risk").

[22] In the TY 2028 GRC, the last year of recorded costs, or base year, will be 2025. SoCalGas and SDG&E will forecast information for 2026 through 2031, in accordance with the Rate Case Plan.

ID	Control/Mitigation Description	2024 Control	2025-2031 Plan
C182	Distribution Risk Evaluation & Monitoring System (DREAMS)	X	Ongoing

A. Control Programs

In accordance with Commission guidance, this section "[d]escribe[s] the controls or mitigations currently in place,"[23] (*i.e.,* activities in this section were in place as of December 31, 2024). Controls that will continue as part of the risk mitigation plan are identified in Table 4 above.

- **C103: Cathodic Protection Base Activities:** Corrosion is a natural process that can deteriorate steel assets and potentially lead to leaks or failure of such assets. If the gas released from a leak was to migrate and accumulate in a confined space and an potential ignition source is present or introduced, there is also the potential for injuries and/or fatalities. Although SoCalGas operations groups endeavor to respond quickly to leaks when notified, such conditions have the potential to lead to an incident within a short amount of time.

  To mitigate the risk of corrosion and associated leaks and failures, SoCalGas uses Cathodic Protection (CP), coating, and monitoring to protect and extend the life of a steel asset. The application of a CP 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.[24] 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

[23] D.18-12-014 at 33.

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

months, to assess that it is functioning.[25] SoCalGas plans to continue this schedule for these cathodic protection base activities.

The directives prescribed by 49 CFR 192 Subpart I and followed by SoCalGas include the monitoring of CP areas, remediation of CP areas that are out of tolerance,[26] and preventative installations to avoid out of tolerance areas.

- **C106: Cathodic Protection-CP10 Activities:** SoCalGas also tests each pipeline that is under cathodic protection as prescribed by 49 CFR § 192.465. The following summarizes the required intervals for completing preventative measures, like CP10, as prescribed in 49 CFR § 192.465 External Corrosion Control (Monitoring).

  Each pipeline that has 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 49 CFR § 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 ten percent of these protected structures, distributed over the entire system must be surveyed each calendar year, with a different ten percent checked each subsequent year, so that the entire system is tested in each ten-year period. SoCalGas plans to continue these CP10 activities according to this schedule.
- **C116: Meter & Regulator (M&R) Station and Electronic Pressure Monitors (EPM) Inspection and Maintenance:** Regulator stations reduce the pressure of gas entering the medium-pressure (distribution) system from higher-pressure pipelines to lower pressure to within the MAOP limits of 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

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[25] 49 C.F.R. § 192.465(a) and (b).

[26] "Out of tolerance" areas are defined as areas where CP reads are outside of pre-determined read tolerances, and if left unaddressed, CP measures may not effectively mitigate the effect of the corrosive environment on steel assets.

pipelines and/or jeopardize public safety resulting from potential over-pressure events.

49 CFR § 192.739 requires inspections/tests of regulator stations to be conducted annually, not to exceed 15 months to maintain these stations and EPMs in good mechanical condition. Functional tests of regulation and monitoring equipment are performed as part of the annual inspections. If a device does not perform properly, internal maintenance and inspections are conducted. This consists of disassembling, inspecting, and cleaning the internal components of the regulator. Worn, corroded, or damaged components are repaired/replaced, and the regulator is reassembled and verified to be in working order prior to being placed back into service.

As regulator stations age, their parts and equipment can begin to wear and become harder to disassemble, increasing maintenance requirements. Regulator stations are designed to maintain continued safe and reliable operation of the station in the event of a failure within either of the station's two "runs."[27] Annual maintenance and inspections are used to record the condition of each station and EPM and identify items that require immediate and long-term action. The overall inspection of the station includes evaluation of the design, condition of the equipment, valves, vaults and EPMs, and exposure to other outside forces including flooding and traffic conditions.

The following summarizes the requirements, which are followed by SoCalGas, for completing these preventative measures as prescribed within 49 CFR § 192.739 Pressure Limiting and Regulating Stations: Inspection and testing:

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

1) In good mechanical condition;

[27] "Runs" refer to the parallel paths within a regulator station that allow gas to flow through one path while the other is shut off for maintenance or in case of failure. This redundant design is intended for continuous operation and pressure control.

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[28], set to control or relieve at the correct pressure consistent with the pressure limits of § 192.201(a);

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

- **C120: Distribution Riser Inspection Program (DRIP):** The Distribution Riser Inspection Program (DRIP) is one of SoCalGas's programs/projects developed and managed under the DIMP in response to requirements in 49 CFR Part 192, Subpart P. This program addresses the threat of failure associated with anodeless risers (ALRs) as a result of corrosion. 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 used to connect underground plastic pipe to above ground steel meter sets. 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 or other conditions, 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. Since ALRs are attached to meter set assemblies that are usually located next to residences, the consequence addressed by this program is that of an ALR failing and the failure resulting in an unintentional release of gas which if met with an ignition source, could result in serious injuries or fatalities.

  SoCalGas's research-based efforts to develop an effective means of mitigating above-ground and ground-level corrosion on anodeless risers has led to the implementation of using an epoxy composite wrap in lieu of ALR replacements. The epoxy composite wrap provides a protective barrier for the above-ground section of the riser to mitigate the effects of the environmental

[28] For more details, *see* 49 C.F.R. § 192.739(b), *available at:* https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-D/part-192/subpart-M/section-192.739#p-192.739(b).

conditions that are typical of riser installations. Through the DRIP, SoCalGas inspects ALRs and where the threat of corrosion-driven failure is present, SoCalGas will remediate the issue by implementing an epoxy composite wrap to provide a protective barrier for the above-ground section of the ALR.

- **C121: Gas Infrastructure Protection Program (GIPP):** The Gas Infrastructure Protection Program (GIPP) is a DIMP program developed and managed in response to requirements in 49 CFR Part 192, Subpart P and addresses the risk of third-party vehicular damage to above-ground pressurized natural gas facilities. An incident involving vehicular damage of a distribution facility can cause serious injuries or fatalities if an unintentional release of gas meets a source of ignition. GIPP was also developed in response to PHMSA guidance that indicated operators should consider low frequency but potentially high consequence events under the DIMP.[29]

  Through the GIPP, SoCalGas identifies, evaluates, recommends, and implements damage prevention solutions for at-risk above-ground pressurized gas facilities that are exposed to possible vehicular impacts. The current solutions have been effective at reducing the number of incidents on pressurized piping and/or reducing the potential consequences after vehicular collisions. Activities include: investigating historical claims data; developing risk assessment algorithms; conducting record reviews and physical inspections of facilities; developing risk exposure categories; identifying and implementing mitigation measures; updating policies, practices, and procedures; and developing performance measures. The prioritization of GIPP inspections and remediations is based on field assessments.

  GIPP remediation measures include the installation of barriers between facilities and vehicular traffic (*e.g.*, bollards or block wall), relocation of a facility, or installation of an excess flow valve. Barriers are intended to be a

[29] U.S. Department of Transportation PHMSA, *Gas Distribution Pipeline Integrity Management Enforcement Guidance – 49 CFR Part 192 – Subpart P* (December 7, 2015), *available at:* https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/DIMP_Enforcement_Guidance_12_7_2015.pdf.

visual rather than structural deterrent since they are not able to stop vehicular impacts, particularly those of large vehicles. The installation of excess flow valves can aid in the reduction of unrestrained gas flow should a gas release occur after impact. 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 GIPP has been scoped to focus on high pressure residential first stage regulators and commercial and industrial (C&I) MSAs. Overall, there are approximately 372,000 C&I and HP residential first stage regulation customer sites in the system, of which – approximately 47,600 are estimated to require some type of mitigation.

The GIPP control includes both capital and O&M expenditures associated with this activity, which is measured by the number of capital mitigations completed per year. O&M activities and costs include an allocation of DIMP management such as data management, program/project evaluation and development, and reporting, which cannot be unitized.

- **C122: Sewer Lateral Inspection Program (SLIP):** The Sewer Lateral Inspection Program (SLIP) is a DIMP program developed and managed in response to requirements in 49 CFR Part 192, Subpart P and addresses the low frequency but high consequence risk of pipeline damage that occurs as a result of a sewer lateral crossing. Where gas pipe inadvertently crosses a sewer line (or "lateral") due to trenchless installation and penetrates, or bores, through the sewer line, a "cross bore" is created and exposes the gas pipeline to potential integrity risks. For example, a plumber or property owner may use a cleanout technology – such as a sewer line auger – to clean out what is seemingly normal sewer debris and blockage but unknowingly pierce a gas pipeline crossing the sewer line. Depending on how extensive the damage is, the gas pipeline may then release gas into and around the sewer line, enabling the migration of gas towards and into a residence or other type of property. If this migration of gas is then met with an ignition source, serious injuries or fatalities could occur.

Through the SLIP, SoCalGas inspects gas services for points of intrusion into residential sewer lines. Should an intrusion be found, the issue is remediated, which mitigates the potential of an incident. Since the start of the program in 2010, over 630,000 services have been inspected in the field. The forecast for the number of remaining services to be inspected is driven by the findings of SoCalGas's SLIP records review, but is currently estimated to be an additional 300,000 services. At the present rate, SoCalGas expects to complete SLIP records research by the end of 2025.

- **C123: Regulator Station Replacement:** SoCalGas's operating and maintenance practices allow the useful lives of regulator stations to be extended. SoCalGas proactively replaces regulator stations prior to the end of their useful life to reduce overall system risk. SoCalGas developed a district regulator station (DRS) relative risk assessment to inform the prioritization of enhancements and replacements of stations. SoCalGas plans to apply the results of the risk assessment by increasing the number of regulator station replacements to reduce safety risks. Risk reduction is achieved when addressing either or both equipment failure probability (LoRE) and consequences (CoRE). Industry practices and philosophies have evolved to modernize antiquated station designs to essentially reduce over/under pressure and outside force risks. While stations have been replaced in the past to address safety concerns, this risk assessment-based approach enables the prioritization and focus of this activity to be driven by safety risk and will inform this multi-year program.
- **C124: Regulator Station Installation Replacement & Enhancement:** SoCalGas's Control Center Modernization (CCM) organization is deploying remote control and real-time monitoring at distribution regulator stations, which will provide Gas Control visibility into the dynamic pressures and flows across the gas distribution system. This work includes the installation of remote real-time automated control valves, pressure sensing equipment, flow measurement, and communication devices. These enhancements will provide Gas Control personnel with comprehensive operational awareness by receiving information

from the regulator stations through a centralized data management system to the Gas Control Room.

With these enhancements, Gas Control personnel will have improved visibility and control over assets within the distribution system, enabling them to more quickly identify, respond, and remediate abnormal operating pressures. This is intended to help prevent overpressure situations by providing earlier awareness that, in turn, facilitates more timely response.

- **C129: Cathodic Protection System Improvement:** The Cathodic Protection System Improvement Plan (SIP), and its associated activities, was developed to address the threat of corrosion on SoCalGas's Non-State-of-the-Art (NSOTA) steel medium-pressure pipelines, which are also referred to as NSOTA steel pipelines. The SIP is a DIMP program developed and managed in response to requirements in 49 CFR Part 192, Subpart P.

  Through field examinations, SoCalGas has determined that the presence of Southern Counties number 7 and number 9 coal tar coating on installed pipe is conducive to cathodic protection. SoCalGas conducted an analysis of its Geographical Information System (GIS) distribution data and identified 23 operating districts in its service territory with pre-1971 pipelines categorized as bare steel that are coated with these specific coating types. To reduce the risk of corrosion on pipe that may not be prioritized for accelerated replacement under C182 (DREAMS) and/or decrease the amount of pipe that requires accelerated replacement, SoCalGas plans to convert these NSOTA pipelines to cathodically protected pipelines with impressed current systems.

  SIP consists of both capital and O&M activities and costs, which are primarily driven by the number of feet replaced. O&M activities and costs include an allocation of DIMP management such as data management, program/project evaluation and development, and reporting, which cannot be unitized.

  Through both the SIP and the replacement of higher risk NSOTA pipe under C182 (DREAMS), SoCalGas comprehensively mitigates the risk of corrosion-driven failure on NSOTA steel pipelines.

- **C130: Meter Set Assembly (MSA) Inspection and Maintenance:** Meter and regulator activities include maintaining, inspecting, or replacing approximately 18 percent of the total 105,000 medium and large M&R MSAs in the SoCalGas service territory annually. 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 which could 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 and complete necessary remediation no less than once every three calendar years and at intervals not to exceed 39 months.
- **C134: Pipeline Monitoring:** SoCalGas conducts comprehensive pipeline monitoring and inspection activities to proactively address risk factors that can lead to operational and safety issues. The monitoring activities performed by the Gas Distribution Department on Medium Pressure pipelines includes bridge and span inspections, unstable earth inspections, and valve inspections and maintenance.

  Bridge and Span inspections involve Distribution pipeline spans, pipe supported on bridges, above ground (or jacketed) pipelines, and other exposed pipelines (as installed). In accordance with regulatory requirements, 49 CFR § 192.481, each pipeline or portion of pipeline that is exposed to the atmosphere must be inspected for evidence of atmospheric corrosion. During inspections employees performing the inspection must give particular attention to pipe at soil-to-air interfaces.

Company employees performing the pipeline inspections on bridges and spans, and above ground pipelines will investigate and report on the following:

- Indications of gas leakage
- Corrosion damage to pipe
- Stress on the pipe
- Deterioration of protective coatings
- Pipe supports
- Soil Erosion
- Condition of pipeline markers and stenciling
- Condition of fencing and personnel barriers
- Damage to the pipe
- Any other condition which might affect the operation or safety of the pipe

Unstable Earth inspections are performed where physical movement or external loading that could cause failure or leakage is anticipated. Additional special patrols for transmission pipelines and distribution mains are conducted as necessary immediately after events that could cause pipeline movement or loading conditions to change. These events may include earthquakes, heavy rain, flooding, sinkholes, landslides, or indications of earth movement, surface subsidence or cracking, that would result in "unstable earth" conditions.

Conditions that must be reported as part of unstable earth inspections, as required by 49 CFR § 192.613, include the following:

- Landslides or indications of earth movement, such as cracks or slumping
- Flooding or unusual erosion of roads, banks, rights of way, etc.
- Surface subsidence or cracking of land and paved surfaces
- Evidence of gas leakage
- Needed repairs on adjacent foreign structures that might endanger the pipeline
- Needed maintenance of Company facilities, *e.g.*, gates, fences, patrol roads, weed or brush removal, etc.

Valve inspections are performed to ensure the proper operation of valves within the distribution system, which enhances public safety by enabling

SoCalGas to control the pressure and flow of gas in the system. Valves operating at optimum effectiveness provide that, in the event of an earthquake or fire, areas are capable of being fully isolated to reduce the risk of incident. More frequently, when excavation damage occurs, these valves can be operated to create a safe environment to complete repairs and minimize the risk of further incidents. The following summarizes the requirements for completing these preventative measures as prescribed within the 49 CFR § 192.747 and followed by SoCalGas:

1. 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.
2. Each operator must take prompt remedial action to correct any valve found inoperable, unless the operator designates an alternative valve.

- **C135: Electronic Pressure Monitor (EPM) Installations & Replacements:** The purpose of EPM is to monitor and record system operating pressures, and generate alarms when pressures exceed or drop below alarm set points, monitoring for maximum allowable operating pressure (MAOP) exceedance or under-pressure conditions as required by 49 CFR 192.741, 192.201(a), 192.739(a)(2) and GO 112F 122.2. Pressure alarms are maintained and evaluated and the appropriate corrective actions such as new installs and replacements are administered. The pressure zones and pressure districts are monitored and reported as part of GO 112-F requirements for Over-MAOP and Under-Pressure events. EPMs are required to indicate the gas pressure in each distribution system supplied by more than one district pressure regulating station. In addition, for distribution systems supplied by a single district pressure regulating station, the operator determines the necessity of installing an EPM. EPM installations and replacements are ongoing activities.
- **C159: Quality Assurance Gas Distribution Assets:** The Gas Compliance Quality Management Team (GQCM) conducts annual quality assessments on a random selection of completed leak survey orders. Specifically, the GQCM team reviews the required documentation (equipment logs), performs leakage equipment tests, and conducts field assessments using GIS maps. During the field

assessments, the GQCM team reviews the meter and meter set assembly, checks for missed leaks, and assesses the pipe structure for integrity.

- **C170: Cathodic Protection (CP) Install/Replace Impressed Current Systems:** Buried steel pipelines revert back to their natural state as an iron oxide without anti-corrosion intervention. Corrosion of pipelines increases the risk for leaks and may reduce the useful life of pipelines. In addition to the application of coating and electrical isolation, CP is a method for mitigating external corrosion on steel pipelines. CP combats corrosion by imposing an electric current flow toward the surface of the pipeline, which keeps the pipeline negatively charged (cathodic) with respect to the surrounding soil, in turn resulting in reduced corrosion on the pipeline system. 49 C.F.R. § 192, Subpart I, and GO 112-F set forth the regulatory standards for pipeline corrosion control. SoCalGas utilizes impressed current systems to provide CP to existing pipelines. Impressed current systems utilize a rectifier for the generation of the direct current and sacrificial anodes as primary components in the system. Anodes are 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 rectifiers and 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. Impressed current cathodic protection system maintenance, installation, and replacement are all ongoing activities.
- **C174: Service Replacements – Leakage Abnormal Op. Conditions CP Related:** Service replacements are conducted for various reasons, including the occurrence of large leaks or a disproportionate frequency of past leaks. Steel services in particular are replaced when active corrosion is detected or when a leak is found on a non-cathodically protected steel service. During maintenance activities, it is possible to encounter services containing obsolete materials such as cellulose acetate butyrate (CAB) or polyvinyl chloride which prompts the service to be replaced. Services may also be replaced on an accelerated basis when the makeup of the service contains Aldyl-A material. Whereas pipeline replacements

performed under the DIMP through C182 (Distribution Risk Evaluation & Monitoring System) in SDG&E-Risk-3 are informed by a quantitative risk model and are prioritized based on likelihood and consequence of failure, replacement activities under C174 are executed in response to real-time field findings related to leaks and abnormal operating conditions.

Service replacements in this category are specific to the replacement of existing service lines to maintain system reliability and to safely deliver gas to the customer, thus mitigating the risks associated with loss of service and public safety. Services are replaced by two construction methods, "insertion" and "direct bury". With the insertion method, a new plastic replacement service pipe is inserted into the to-be abandoned steel service pipe such that the steel service becomes casing for the plastic pipe. The direct bury technique specifies to the construction crews that the installation of new pipe does not need casing, and any installation method can be utilized such as boring or open trench. Service replacements are an important part of operational reliability and public safety.

- **C175: Residential Meter Protection:** The Residential Meter Protection Project (RMPP) addresses the prevention of potential vehicular damage associated with above-ground distribution facilities at residential properties. This control minimizes the potential for vehicular damage for above ground gas equipment (*e.g.*, the meter set assembly, or MSA) by placing various forms of physical devices or barriers to mitigate damage in case of a potential collision. Barriers are intended to be a visual, not structural, deterrent and are not intended to or capable of stopping all vehicular traffic, particularly large vehicles. Where adequate mitigation cannot be achieved, gas equipment can be relocated or removed. In certain instances a meter guard can provide protection during incidents like earthquakes, landslides, and floods by providing the meter with protection from debris that would otherwise directly strike the meter.
- **C177: Main Replacements – Leakage Abnormal Operating Conditions CP Related:** Activities under Main Replacements include installation of new mains to replace existing ones, main replacements in advance of public infrastructure

projects, and service line replacements, existing service line tie-overs, and meter set rebuilds in connection with newly installed replacement mains.

Leakage is often the driving factor for pipeline replacements; however, there are other considerations. Other criteria taken into consideration include whether the steel pipe meets cathodic protection mandates, or the main is found to have active corrosion. In addition, other criteria include whether the pipeline may be deemed unsafe or unfit for service under pressure due to manufacturing or other defects. Leak history and pending leaks on individual segments are the primary factors in identifying the majority of SoCalGas's main replacements. These replacements are critical to sustain operational reliability and public safety.

- **C178: Leak Survey:** SoCalGas performs leak survey monitoring activities by conducting a thorough search for gas leak indications in an assigned area and reporting detectable leaks using an approved survey method. The leak survey process can be separated into routine leak survey and special leak survey.

  The monitoring and inspections must follow certain prescribed processes included in 49 CFR Part § 192.723 and incorporated into SoCalGas's Gas Standards.

  Special leak surveys are one-time, additional surveys to the routine scheduled surveys that are driven by a specific circumstance. Special leak surveys are performed:

  - Upon discovery that the MAOP of a pipeline is exceeded by 10% or more at any time during the life of the pipeline;
  - After the occurrence of any incident (*e.g.*, train derailment, explosion, earthquake, flooding, landslides, etc.) over or adjacent to high pressure pipelines or related facilities;
  - When there is the danger of public exposure to leaking gas; the special survey is performed using the appropriate leak detection method;
  - When increasing the MAOP of a pipeline;
  - When the routine scheduled survey frequency is not considered adequate because of pipe condition, limited opportunity for gas to vent safely, or other reasons;

- There is a need to monitor pipe condition for special situations, such as: material evaluations, proposed street improvement projects, as a mitigated measure for the Integrity Management Program; and
- In conjunction with major underground construction projects.

- **C179: Main & Service Leak Repair:** Following the identification of leaks through the comprehensive leak survey process, the Main and Service Leak Repair control provides for detected leaks to be promptly assessed and repaired to maintain the safety and integrity of the gas pipeline system and public safety. This activity establishes guidelines and requirements for assessing the degree of hazard and coding of leaks or leak indications found on the Company's below ground piping system, and actions required to provide for public safety and repair of the leak as required by SoCalGas's Gas Standards, which comply with 49 CFR Subpart M. Leak indications on Company facilities are classified by trained and qualified employees according to location, spread, concentration of gas, possibility for accumulation of gas, possible sources of ignition, potential migration, and imminence of hazard to people or property. Classifications of leaks or leak indications are based on the relative degree of hazard. The judgment of the qualified person evaluating the leak or leak indication, after consideration of all factors involved, is the primary criterion for classification and mitigation. Hazardous indications of leaks are reported, and action is taken according to the applicable Gas Standard until the hazard has been eliminated and the leak has been either temporarily or permanently repaired; or until it is determined that the leak is from a source other than the Company piping system.

  Each segment of pipeline that is assessed as unsafe must be repaired, altered, or removed from service. Each imperfection or damage that would impair the serviceability of PE pipe or fittings must be repaired or removed. Appropriate temporary repairs such as plugging, or clamping shall be made if permanent repairs are not possible at the time of discovery.

- **C182: Distribution Risk Evaluation & Monitoring System (DREAMS):** The DREAMS was developed to manage the replacement of NSOTA pipes with State-Of-The-Art (SOTA) pipes, which SoCalGas has undertaken to comply with the

DIMP requirements mandated by 49 CFR Part 192, Subpart P, to reduce the risk of serious incidents and enhance the overall safety and reliability of the natural gas distribution system. The NSOTA pipe population consists of vintage Aldyl-A and bare steel pipe, which have been recognized by federal and state regulators as high-risk pipes that necessitate action by pipeline operators.[30] Specific to Aldyl-A, slow crack growth fundamentally poses a higher level of risk due to the nature of leaks created by this mode of failure.[31] Leak surveys do not completely mitigate the risk as leaks can occur suddenly and result in risk events.[32]

SoCalGas mitigates the risk associated with both vintage Aldyl-A pipe and bare steel pipe through the execution of pipe placement projects informed by the DREAMS model. The DREAMS model, which was previously a relative risk model, was recently updated with the use of a segment-specific quantitative risk assessment (QRA) algorithm that combines internal datasets and external publicly available data sources, and includes pipe attributes, operational conditions, and potential impact of an incident on the general population, to estimate the safety risk of NSOTA main pipelines. This model and its results are used to determine appropriate actions to address risk for each segment and inform the prioritization of replacement investments. In the absence of an established safety risk threshold from PHMSA and other regulatory bodies, SoCalGas has established a threshold of an annual probability greater than 6×10^{-6} of a serious incident for medium pressure distribution main locations. NSOTA medium pressure distribution mains with QRA results that exceed this threshold are targeted for replacement under the DREAMS program.

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30 CPUC, *Hazard Analysis and Mitigation Report: Aldyl A Polyethylene Gas Pipelines* (June 11, 2014) at 11, *available at:* https://www.cpuc.ca.gov/regulatory-services/safety/gas-safety-and-reliability-branch/pipeline-documents, and the Pipeline Safety: Safety of Gas Distribution Pipelines and Other Pipeline Safety Initiatives, 88 Fed. Reg. 172,61751 (September 7, 2023) (to be codified at 49 C.F.R. Parts 191, 192, and 198), *available at:* https://www.govinfo.gov/content/pkg/FR-2023-09-07/pdf/2023-18585.pdf.

31 CPUC, *Hazard Analysis and Mitigation Report: Aldyl A Polyethylene Gas Pipelines* (June 11, 2014) at 25, *available at:* https://www.cpuc.ca.gov/regulatory-services/safety/gas-safety-and-reliability-branch/pipeline-documents.

32 *Id.* at 26

As more data is accumulated through inspections and other pipeline activities, SoCalGas expects continuous improvement in its risk evaluations, including consideration of the current state of risk in the system as well as the projected long-term risks such as environmental changes to the material and impacts from construction activity since threats affecting these vintage materials are time-dependent (*e.g.*, corrosion) and the associated risks can escalate at different rates (*e.g.*, corrosion vs. material degradation). SoCalGas monitors the performance of DREAMS pipeline replacements by reviewing benefits and risk reduction achieved through indicators such as leak repair and incident rates related to vintage pipe. Program metrics are monitored on a continual basis and SoCalGas will increase or decrease replacement rates based on findings.

SoCalGas's DREAMS consists of both capital and O&M activities and costs, which are primarily driven by the number of miles replaced through this control. While Capital activities are measured by miles replaced, O&M activities and costs cannot be measured by a singular unit due to the variety of work included, such as data management, risk analysis, reporting, training, and an allocation of general DIMP management activities including the evaluation and development of prospective risk programs/projects.

B. Changes from 2024 Controls

SoCalGas plans to continue each of the existing controls, discussed above and reflected in Table 1, through the 2025-2031 period without any significant changes, with the exception of C121 (GIPP) which is currently projected to be completed by 2030.

C. Mitigation Programs

SoCalGas does not currently foresee implementing new mitigations not described above during the 2025-2031 period.

D. Climate Change Adaptation

Pursuant to Commission decisions[33] in the Climate Adaptation OIR (R.18-04-019), SoCalGas performed a Climate Adaptation Vulnerability Assessment (CAVA) focused on years 2030, 2050, and 2070, with the aim of identifying asset and operational vulnerabilities to climate

[33] D.19-10-054; D.20-08-046.

hazards across the SoCalGas system. SoCalGas recognizes the need to address climate vulnerabilities to promoting safety and reliability of its services to its customers and mitigate the increasing climate-related hazards through innovative and community-centric approaches. Some of the climate hazards that will have short- and long-term ramifications in the Southern California region include extreme temperatures, snowstorms, wildfire, inland flooding, coastal flooding and erosion, and landslides. Climate change is recognized as a factor that can drive, trigger, or exacerbate multiple RAMP risks. Implementing climate change adaptation measures and integrating climate vulnerability considerations into RAMP controls and mitigations can enhance system infrastructure longevity and reduce the severity of long-term negative climate impacts. The controls and mitigations described in further detail in this chapter, as shown below, align with the goal of increasing SoCalGas's physical and operational resilience to the increasing frequency and intensity of climate hazards. Additional information on the CAVA and a list of climate-relevant controls and mitigations included in RAMP, are provided in Chapter RAMP-5: Climate Change Adaptation.

Table 5: Medium Pressure Gas System Risk
Controls and Mitigations that Align with Increasing Resilience to Climate Hazards

Relevant ID	Relevant Control/Mitigation	Potential Climate Hazard(s)
C120	DIMP - Distribution Riser Inspection Program (DRIP)	Inland Flooding and Landslides
C124	Regulator Station Installation Replacement & Enhancement	Inland Flooding, Landslides, and Wildfires
C134	Pipeline Monitoring	Inland Flooding and Landslides
C135	EPM Installations & Replacements	Inland Flooding, Landslides, and Extreme Temperatures
C174	Service Replacements - Leakage Abnormal Operating Conditions CP Related	Inland Flooding and Landslides
C175	Residential Meter Protection	Inland Flooding and Landslides
C177	Main Replacements - Leakage Abnormal Operating Conditions CP Related	Inland Flooding and Landslides
C178	Distribution Leak Survey	Inland Flooding and Landslides
C179	Distribution Main & Service Leak Repair	Inland Flooding and Landslides
C182	DIMP - Distribution Risk Evaluation & Monitoring System (DREAMS)	Inland Flooding and Landslides

E. Foundational Programs

Foundational Programs are "[i]nitiatives that support or enable two or more Mitigation programs or two or more Risks but do not directly reduce the Consequences or reduce the Likelihood of safety Risk Events."[34]

The C178 Distribution Leak Survey is a foundational program that supports distribution main and service repair activities. These surveys, mandated by federal and state regulations (PHMSA/DOT Regulation 49 CFR 192, Subpart M, § 192.723) involve comprehensive monitoring and inspections to detect gas leaks in designated areas. Upon identification, these leaks are promptly assessed and repaired to seek the safety and integrity of the gas pipeline system.

Below in Table 6 are the Foundational Programs that are applicable to the MP System Risk and the mitigation activities that they support.

Table 6: Medium Pressure Gas System
Foundational Activities
(Direct, in 2024 $ millions)

ID	Foundational Activity Name	Enabled Control/Mitigation	2025 O&M Costs	2025-2031 Capital Costs
C178	Distribution Leak Survey	C179 Distribution Main and Service Repair	7.88	0

F. Estimates of Costs, Units, and Cost-Benefit Ratios (CBRs)

The tables in this section provide a quantitative summary of the risk control and mitigation plan for MP System Risk, including the associated costs, units, and CBRs. Additional information by Tranche is provided in workpapers. The costs shown are estimated using assumptions provided by SMEs and available data. In compliance with the Phase 3 Decision,[35] for each enterprise risk, SoCalGas uses actual results and industry data and when that is not available, supplements the data with SME input. Additional details regarding the data and expertise relied upon in developing these estimates are provided in Attachment B.

[34] D.24-05-064, Appendix A at A-4.

[35] D.24-05-064, RDF Row 10.

Table 7: Medium Pressure Gas System
Control and Mitigation Plan – Recorded and Forecast Costs Summary
(Direct, in 2024 $ thousands)

Control/Mitigation		Recorded Costs		Forecast Costs			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C103	Cathodic Protection Base Activities	0	12,102	12,102	0	0	36,306
C106	Cathodic Protection-CP10 Activities	0	1,328	1,665	0	0	4,995
C116	M&R Station and EPM Inspection and Maintenance	0	3,988	3,855	0	0	11,565
C120	Distribution Riser Inspection Program (DRIP)	0	20,468	26,056	0	0	76,628
C121	Gas Infrastructure Protection Program (GIPP)	13,510	1,471	1,522	48,599	11,747	1,514
C122	Sewer Lateral Inspection Program (SLIP)	0	13,260	21,113	0	0	63,224
C123	Regulator Station Replacement	4,479	0	0	17,916	13,437	0
C124	Regulator Station Installation Replacement & Enhancement	25,630	0	0	112,075	87,170	0
C129	Cathodic Protection System Improvement	7,057	235	537	19,917	15,568	1,652
C130	MSA Inspection and Maintenance	0	1,618	1,618	0	0	4,854
C134	Pipeline Monitoring	0	868	868	0	0	2,604
C135	EPM Installations & Replacements	320	0	0	1,632	1,224	0
C159	Quality Assurance Gas Distribution Assets	0	0	331	0	0	993

Control/Mitigation		Recorded Costs		Forecast Costs			
ID	Name	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C170	CP Install/Replace Impressed Current Systems	11,041	0	0	44,164	33,123	0
C174	Service Replacements-Leakage Abnormal Op. Conditions CP Related	32,903	0	0	144,441	137,196	0
C175	Residential Meter Protection	10,649	0	0	12,572	9,429	0
C177	Main Replacements-Leakage Abnormal Op. Conditions CP Related	10,975	0	0	57,761	74,508	0
C178	Distribution Leak Survey	0	7,880	16,393	0	0	49,179
C179	Distribution Main & Service Leak Repair	0	20,364	60,528	0	0	181,584
C182	Distribution Risk Evaluation & Monitoring System (DREAMS)	157,688	4,963	3,877	620,101	458,427	11,718
Total		**274,252**	**88,545**	**150,465**	**1,079,178**	**841,829**	**446,816**

Table 8: Medium Pressure Gas System Risk Control & Mitigation Plan – Units Summary

Control/Mitigation		Recorded Units		Forecast Unit				
ID	Name	Unit of Measure	2024 Capital	2024 O&M	2028 O&M	2025-2028 Capital	PTY Capital	PTY O&M
C103	Cathodic Protection Base Activities	Work orders	0	38,403	38,403	0	0	115,209
C106	Cathodic Protection-CP10 Activities	CP and follow-up reads	0	34,651	35,525	0	0	106,575
C116	M&R Station and EPM Inspection and Maintenance	Work orders	0	6,437	5,913	0	0	17,739
C120	Distribution Riser	Inspections	0	197,953	237,953	0	0	628,859

Control/Mitigation		Recorded Units		Forecast Unit				
ID	**Name**	**Unit of Measure**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
	Inspection Program (DRIP)							
C121	Gas Infrastructure Protection Program (GIPP)	Mitigations	4,278	0	0	5,050	3,250	0
C122	Sewer Lateral Inspection Program (SLIP)	Inspections	0	53,249	86,249	0	0	258,747
C123	Regulator Station Replacement	Work orders	32	0	0	128	96	0
C124	Regulator Station Installation Replacement & Enhancement	SCADA Enhanced Sites	8	0	0	90	70	0
C129	Cathodic Protection System Improvement	Feet	405,181	0	0	2.112*	1.584*	0
C130	MSA Inspection and Maintenance	Work orders	0	6,316	6,316	0	0	18,948
C134	Pipeline Monitoring	Work orders	0	5,081	5,081	0	0	15,243
C135	EPM Installations & Replacements	Installations or Replacements	110	0	0	476	357	0
C159	Quality Assurance Gas Distribution Assets	FTEs	0	0	3	0	0	9
C170	CP Install/Replace Impressed Current Systems	Work orders	596	0	0	2,384	1,788	0

Control/Mitigation		Recorded Units		Forecast Unit				
ID	**Name**	**Unit of Measure**	**2024 Capital**	**2024 O&M**	**2028 O&M**	**2025-2028 Capital**	**PTY Capital**	**PTY O&M**
C174	Service Replacements- Leakage Abnormal Op. Conditions CP Related	Replacements	3,956	0	0	16,367	13,497	0
C175	Residential Meter Protection	Repairs – meter protection sites mitigated	11,341	0	0	13,388	10,041	0
C177	Main Replacements- Leakage Abnormal Op. Conditions CP Related	Feet – main replacements	38,535	0	0	157,296	125,073	0
C178	Distribution Leak Survey	Feet	0	123.569*	143.474*	0	0	430.422*
C179	Distribution Main & Service Leak Repair	Leaks Repaired	0	6,162	12,672	0	0	38,016
C182	Distribution Risk Evaluation & Monitoring System (DREAMS)	Miles	143	0	413	333		0

*This unit is in millions

In Table 9 below, CBRs are presented in summary at the mitigation or control level for the Test Year 2028 GRC cycle. CBRs are calculated based on scaled, expected values unless otherwise noted and calculated for each of the three required discount rates[36] in each year of the GRC cycle and for the post-test years in aggregate (2029-2031). Costs and CBRs for each year of the GRC cycle and the aggregated years are provided in workpapers.

[36] *See* Chapter RAMP-3: for definitions of discount rates, as ordered in the Phase 3 Decision.

Table 9: Medium Pressure Gas System Risk
Cost Benefit Ratio Results Summary (2028-2031)
(Direct, in 2024 $ millions)

ID	Control/Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C103	**Cathodic Protection Base Activities**	0	48.4	6.64	6.65	6.61
C106	**Cathodic Protection-CP10 Activities**	0	6.7	0.80	0.80	0.80
C116	**M&R Station and EPM Inspection and Maintenance**	0	15.4	1.40	1.42	1.40
C120	**Distribution Riser Inspection Program (DRIP)**	0	102.7	0.11	0.02	0.01
C121	**Gas Infrastructure Protection Program (GIPP)**	23.6	3	0.01	0.01	0.01
C122	**Sewer Lateral Inspection Program (SLIP)**	0	84.3	0.01	0.01	0.01
C123	**Regulator Station Replacement**	17.9	0	0.15	0.06	0.05
C124	Regulator Station Installation Replacement & Enhancement	118.3	0	0.10	0.04	0.04
C129	**Cathodic Protection System Improvement**	20.8	2.2	0.28	0.22	0.22
C130	**MSA Inspection and Maintenance**	0	6.5	0.15	0.15	0.15
C134	**Pipeline Monitoring**	0	3.5	1.94	1.95	1.94
C135	**EPM Installations & Replacements**	1.6	0	8.68	8.72	8.66
C159	**Quality Assurance Gas Distribution Assets**	0	1.3	0.22	0.22	0.22
C170	**CP Install/Replace Impressed Current Systems**	44.2	0	7.28	7.28	7.25

ID	Control/Mitigation Name	Capital (2028 – 2031)	O&M (2028 – 2031)	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
C174	**Service Replacements – Leakage Abnormal Op. Conditions CP Related**	182.9	0	12.48	1.37	1.31
C175	**Residential Meter Protection**	12.6	0	0.02	0.01	0.01
C177	**Main Replacements – Leakage Abnormal Op. Conditions CP Related**	99.3	0	8.33	0.86	0.81
C179	**Distribution Main and Service Leak Repair**	0	242.1	0.50	0.51	0.50
C182	**Distribution Risk Evaluation & Monitoring System (DREAMS)**	611.9	15.6	2.28	0.23	0.22

Bold *indicates a mandated program*

Tranche-level CBRs by year and in aggregate for each mitigation are provided in workpapers.

V. ALTERNATIVE MITIGATIONS

Pursuant to D.14-12-025 and D.16-08-018,[37] SoCalGas considered two alternatives to the Risk Mitigation Plan for the MP System Risk. The alternatives analysis for this plan considered changes in risk reduction, cost, reasonableness, current conditions, modifications to the plan and constraints, such as budget and resources.

[37] *See, e.g.,* D.18-12-014 at 33-35.

Table 10: Medium Pressure Gas System Risk
Alternative Mitigation Plan – Forecast Costs Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Forecast Costs			
		2025-2028 Capital	PTY Capital	2025-2028 O&M	PTY O&M
A009	Comprehensive Replacement of Bare Steel Pipelines	312.928	234.696	0	0
A106	CP10 Service Replacement	603.436	452.577	0	0

Table 11: Medium Pressure Gas System Risk
Alternative Mitigation Cost Benefit Ratio Results Summary
(Direct, in 2024 $ millions)

ID	Alternative Mitigation Name	Capital TY 2028	O&M TY 2028	CBR (Societal)	CBR (Hybrid)	CBR (WACC)
A009	Comprehensive Replacement of Bare Steel Pipelines	78.232	0	1.48	0.14	0.14
A106	CP10 Service Replacement	150.859	0	1.46	0.15	0.14

A. Alternative 1: Replacement of 10-year Cycle Cathodically Protected Services (CP10s)

SoCalGas considered replacing all of its 301,718 CP10 services rather than continuing to monitor, inspect and maintain them on a 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 $4.5 billion and likely take decades to complete. As complete replacement is not currently 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 continue to be replaced based on performance history and current protection levels.

B. Alternative 2: Comprehensive Replacement of Bare Steel Pipelines

SoCalGas continues to evaluate whether replacing all NSOTA bare steel pipelines is more effective at reducing risk associated with this specific category of medium pressure pipe, as

an alternative to the CP SIP control (C129) and the current QRA-driven replacements of NSOTA bare steel under the DREAMS (C182). In this alternative, SoCalGas would target all NSOTA bare steel pipelines (mains and services) for replacement, prioritizing segments to maximize cost-efficiency and expediency.

SoCalGas developed a cost estimate of $78 million per year that assumes the level of activity authorized in D.24-12-074[38] for the DREAMS Bare Steel Replacement Program (BSRP) and would plan to increase the replacement rate over time to remove as much of this NSOTA pipe population as possible. For this alternative, SoCalGas assumed that the cost of replacing bare steel pipe would align with the average cost per mile forecasted for the BSRP, though there would be measures taken to maximize cost efficiency, such as prioritizing work in the same geographical areas. SoCalGas also assumed that the increased prioritization on efficiency would result in a more randomized risk reduction as compared to the targeted risk reduction that would result from prioritizing work based on SoCalGas's QRA results that are currently driving DREAMS replacements.

SoCalGas is not currently pursuing wholesale replacement of bare steel pipelines, which is estimated to exceed $27 billion over the life of such a program, but is instead leveraging the QRA-driven replacement program to prioritize higher-risk pipeline segments. The planned combination of QRA-driven replacement of bare steel under the DREAMs and the application of cathodic protection on select pipeline segments under the CP SIP ultimately balances risk reduction with long-term impact to ratepayers.

VI. HISTORICAL GRAPHICS

As directed by the Commission in Phase 2 Decision, this section illustrates the accomplishments in safety work and the progress in mitigating safety risks over the two immediately preceding RAMP cycles. A bar chart graphic is employed to depict historical progress. This graphic uses a key DIMP metric that aligns with Company safety goals to illustrate trends in historical progress and identify remaining tasks necessary to continue mitigating this risk.

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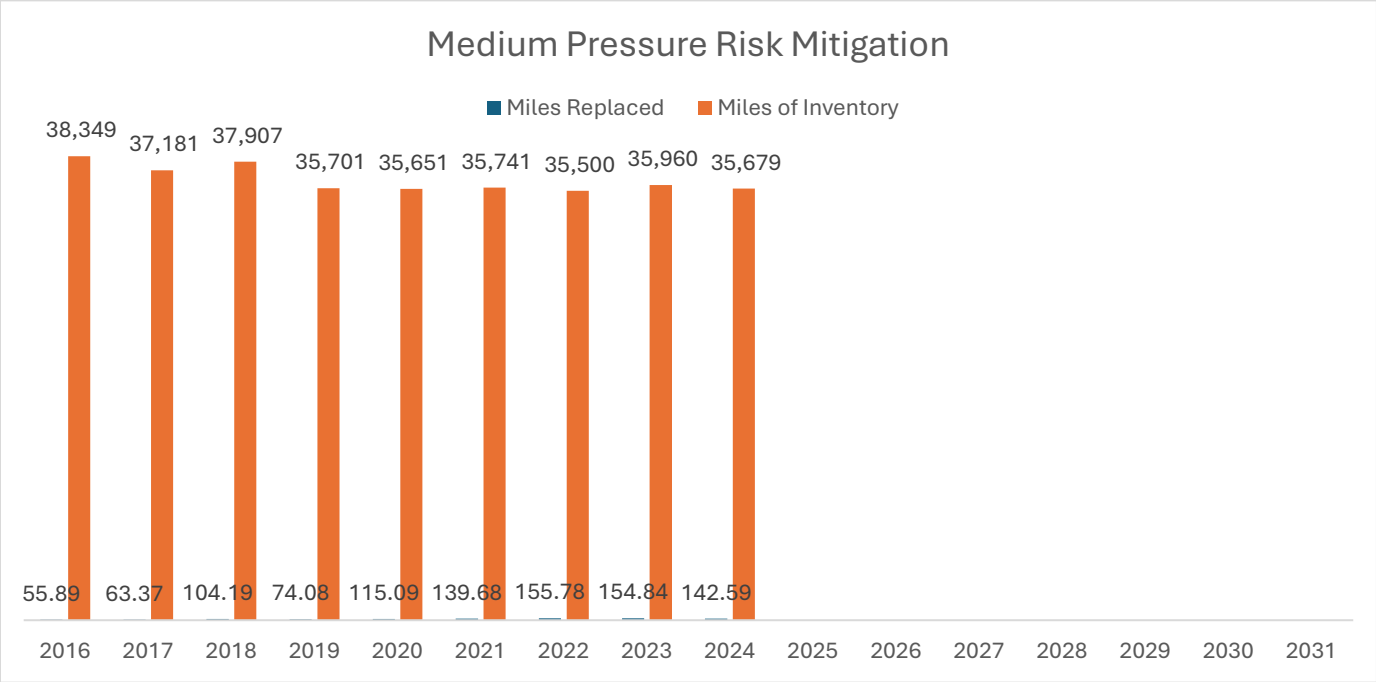
[38] *See* D.24-12-074, 13.1.2.3 SoCalGas DIMP Capital; "For BSRP, the Commission adopts a forecast of $86.578 million, $63.005 million, and $79.737 million for the years 2022, 2023, and 2024, respectively."

Figure 2

Medium Pressure Gas System: Safety Progress 2016-2024



As described in Section III.A, the DREAMS is a risk program developed by SoCalGas to replace NSOTA pipes with SOTA pipes. The recently updated DREAMS model uses a QRA algorithm that integrates various data sources to estimate the safety risks associated with vintage plastic and bare steel pipelines. Prioritizing pipeline replacements using this model, SoCalGas aims to enhance the safety and reliability of the natural gas distribution system.

From 2016 to 2024, SoCalGas successfully completed pipeline replacements, improved data tracking, and advanced risk evaluations through the DREAMS. The scope of DREAMS has evolved over time with improvements made in data tracking and management, as well as the execution of pipeline work across the company. With these efforts, combined with improvements to the DREAMS model, SoCalGas is enhancing the accuracy of risk assessments, allowing for more precise prioritization of pipeline replacement projects based on identified threats and risks.

From 2025 to 2031, SoCalGas plans to continue replacements of vintage plastic and bare steel pipelines to mitigate safety risks.

ATTACHMENTS

ATTACHMENT A

CONTROLS AND MITIGATIONS WITH REQUIRED COMPLIANCE DRIVERS

The table below indicates the compliance drivers which underpin identified controls and mitigations.

ID	Control/Mitigation Name	Compliance Driver
C103	Cathodic Protection Base Activities	49 CFR Subpart I, CPUC GO 112-F
C106	Cathodic Protection-CP10 Activities	49 CFR Subpart I, CPUC GO 112-F
C116	M&R Station and EPM Inspection and Maintenance	49 CFR Subpart M, CPUC GO 112-F
C120	Distribution Riser Inspection Program (DRIP)	49 CFR Subpart P
C121	Gas Infrastructure Protection Program (GIPP)	49 CFR Subpart P
C122	Sewer Lateral Inspection Program (SLIP)	49 CFR Subpart P
C123	Regulator Station Replacement	49 CFR Subpart L
C129	Cathodic Protection System Improvement	49 CFR Subpart P
C130	MSA Inspection and Maintenance	49 CFR Subpart I, CPUC GO 112-F
C134	Pipeline Monitoring	49 CFR § 192
C135	EPM Installations & Replacements	49 CFR § 192, CPUC GO 112-F
C159	Quality Assurance Transmission Assets	49 CFR 192.605
C170	CP Install/Replace Impressed Current Systems	49 CFR Subpart I, CPUC GO 112-F
C174	Service Replacements – Leakage Abnormal Op. Conditions CP Related	49 CFR Subpart L, CPUC GO 112-F
C175	Residential Meter Protection	49 CFR Subpart H
C177	Main Replacements – Leakage Abnormal Op. Conditions CP Related	49 CFR Subpart L
C178	Distribution Leak Survey	49 CFR Subpart M

ID	Control/Mitigation Name	Compliance Driver
C179	Distribution Main & Service Leak Repair	49 CFR Subpart M
C182	Distribution Risk Evaluation & Monitoring System (DREAMS)	49 CFR § 192

ATTACHMENT B

MEDIUM PRESSURE GAS SYSTEM - REFERENCE MATERIAL FOR QUANTITATIVE ANALYSES

The Phase 3 Decision at RDF Row 10 and Row 29 directs each utility to identify Potential Consequences of a Risk Event using available and appropriate data.[39] Appropriate data may include Company specific data or industry data supplemented by the judgment of subject matter experts. Provided below is a listing of the inputs utilized as part of this assessment and the description of the data.

Risk Data	Source Type	Source Information
Likelihood of failure and probability failure results in safety consequence	Internal Model results	Source: Internal DIMP models Description: Integrity Management Department Internal model that uses internal and industry data
Business District Location Type	External Data	Source: Google maps Description: Used to determine if national medium pressure incidents occurred in a business district or not to inform consequence modelling
Population Density	External	Agency: US Census Bureau Link: https://www.census.gov/programs-surveys/decennial-census/decade/2020/2020-census-results.html Description: Used to determine population density in SoCalGas and SDG&E's service territories and locations where national incidents were reported to PHMSA to inform consequence modelling

[39] D.24-05-064, RDF Rows 10 and Row 29.

Risk Data	Source Type	Source Information
National Pipeline Incidents (2010-2024)	External Data	Agency: PHMSA Link: https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data Description: Due to lack of internal data, national data was used to model the number of fatalities and serious injuries from an incident on the medium pressure system.
Meter Outages	Internal Data	Source: GO 112-F quarterly reports and internal database. Description: Historical data for SoCalGas was used to model likelihood and number o9f outages as a result of an incident on the medium pressure system.
National Medium Pressure Incident Cost data	External Data	Agency: PHMSA Link: https://www.phmsa.dot.gov/data-and-statistics/pipeline/pipeline-incident-flagged-files Description: National data was used to estimate costs such as property damage in current year (2024) dollars because internal data was not available
Leak Repair Costs	Internal Data	Source: Distribution Department and SoCalGas SB 1371 filing Link: https://www.socalgas.com/sites/default/files/2022-SoCalGas-SB-1371-Compliance-Plan.pdf Description: Internal data for leak repair on aboveground assets was available however costs associated with main and service repair were not readily available so previous analysis from SB 1371 Filing was used.

Risk Data	Source Type	Source Information
Average cost of a fatality	External Data	Agency: National Safety Council (NSC) Link: https://injuryfacts.nsc.org/work/costs/work-injury-costs/ Description: Costs include wage losses, medical expenses, administrative expenses and employer costs, which are not included in the PHMSA costs.
Average Cost of a serious injury	External Data	Agency: CDC Link: WISQARS Cost Of Injury Description: Wage loss and medical costs associated with non-fatal injuries that require hospitalization that are not included in PHMSA costs.

ATTACHMENT C

MEDIUM PRESSURE GAS SYSTEM - SUMMARY OF ELEMENTS OF BOW TIE

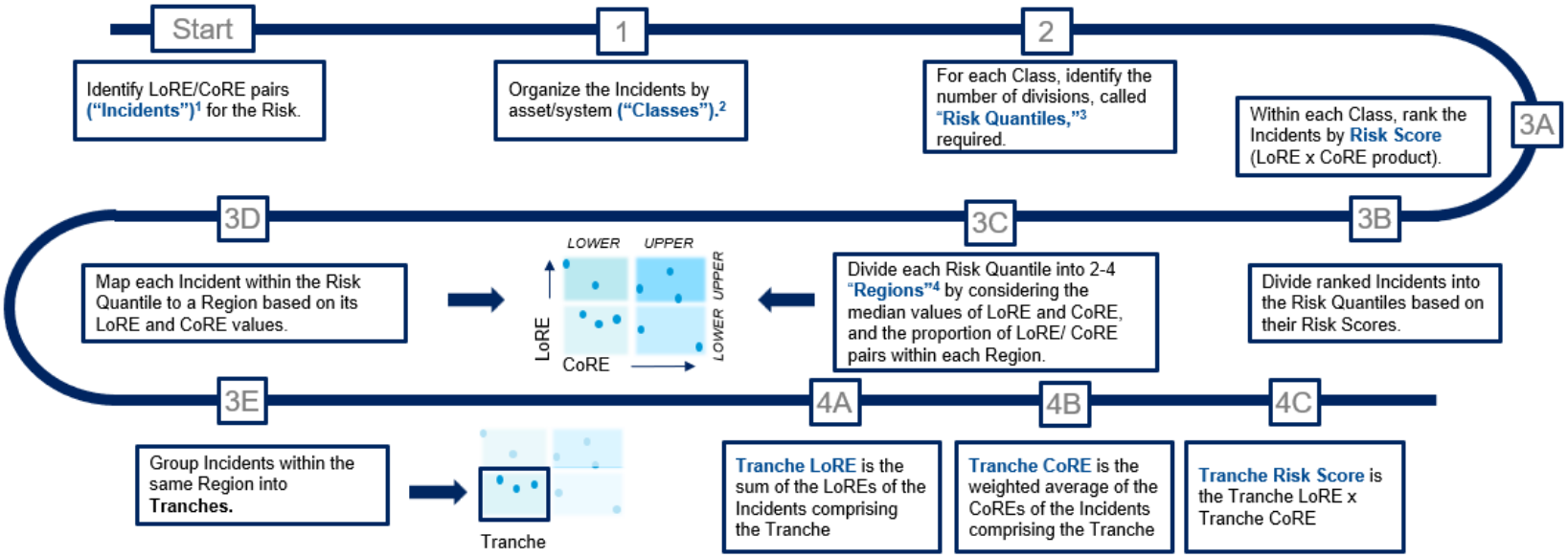
SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
C103	Cathodic Protection Base Activities	DT.1	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C106	Cathodic Protection-CP10 Activities	DT.1	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C116	M&R Station and EPM Inspection and Maintenance	DT.1, DT.4, DT.5, DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C120	Distribution Riser Inspection Program (DRIP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C121	Gas Infrastructure Protection Program (GIPP)	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C122	Sewer Lateral Inspection Program (SLIP)	DT.3, DT.6, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C123	Regulator Station Replacement	DT.1, DT.4, DT.5, DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C124	Regulator Station Installation Replacement & Enhancement	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6	PC.1, PC.2, PC.4, PC.5, PC.6, PC.7
C129	Cathodic Protection System Improvement	DT.1, DT.5	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C130	MSA Inspection and Maintenance	DT.1, DT.4, DT.5, DT.6,	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7

SUMMARY OF ELEMENTS OF BOW TIE			
ID	**Control/Mitigation Name**	**Drivers Addressed**	**Consequences Addressed**
C134	Pipeline Monitoring	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C135	EPM Installations & Replacements	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C159	Quality Assurance Gas Distribution Assets	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C170	CP Install/Replace Impressed Current Systems	DT.1	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C174	Service Replacements – Leakage Abnormal Op. Conditions CP Related	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C175	Residential Meter Protection	DT.2, DT.3	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C177	Main Replacements – Leakage Abnormal Op. Conditions CP Related	DT.1, DT.2, DT.3, DT.4, DT.5, DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C178	Distribution Leak Survey	DT.1, DT.2, DT.4, DT.5, DT.6	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C179	Distribution Main & Service Leak Repair	DT.1, DT.2, DT.4, DT.5, DT.6,	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7
C182	Distribution Risk Evaluation & Monitoring System (DREAMS)	DT.1, DT.2, DT.4, DT.6, DT.7	PC.1, PC.2, PC.3, PC.4, PC.5, PC.6, PC.7

ATTACHMENT D

APPLICATION OF TRANCHING METHODOLOGY

A sample walkthrough of the Homogeneous Tranching Methodology (HTM) as outlined in Volume 1, Chapter RAMP - 3: Risk Quantification Framework is provided.



NOTES

[1]*For example, **Incidents (or "Risk Incidents")** for Medium Pressure are generally modes of failure of medium pressure assets in various environments such as low or high population densities.*

[2]*For example, **Classes (or "Asset Classes")** for Medium Pressure include Above-Ground and Below-Ground.*

[3]***Quantiles** are divisions of equal numbers of incidents (quartiles have 4 divisions, quintiles have 5, etc.) The number of incidents dictates the number of quantiles needed.*

[4]*The four **Regions** are: 1. Lower LoRE-Lower CoRE (LL-LC), 2. Lower LoRE-Upper CoRE (LL-UC), 3. Upper LoRE-Lower CoRE (UL-LC), and 4. Upper LoRE-Upper CoRE (UL-UC).*

Start

1

2

Identify LoRE/CoRE pairs ("Incidents")[1] for the Risk.

Organize the Incidents by asset/system ("Classes").[2]

For each Class, identify the number of divisions, called "Risk Quantiles,"[3] required.

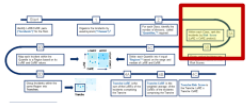
Class	LORE / CORE PAIRS	TOTAL # PAIRS
Above Ground	Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Corrosion	254
	Riser in ORC Outside Business District in High Population Density Caused by Corrosion	
	…and 252 more pairs	
Below Ground	Non-State-of-the-Art Plastic Main in NOR Outside Business District in Low Density Population	3,073
	State-of-the-Art Plastic Service in PAC in Business District in Low Density Population	
	…and 3,071 more pairs	

$$\min\left(\frac{N}{8}-1.9\right) < K \leq \min\left(\frac{N}{8},10\right)$$

10

Step 3 for *Above Ground*

10



Within each Class, rank the Incidents by **Risk Score** (LoRE x CoRE product). 3A

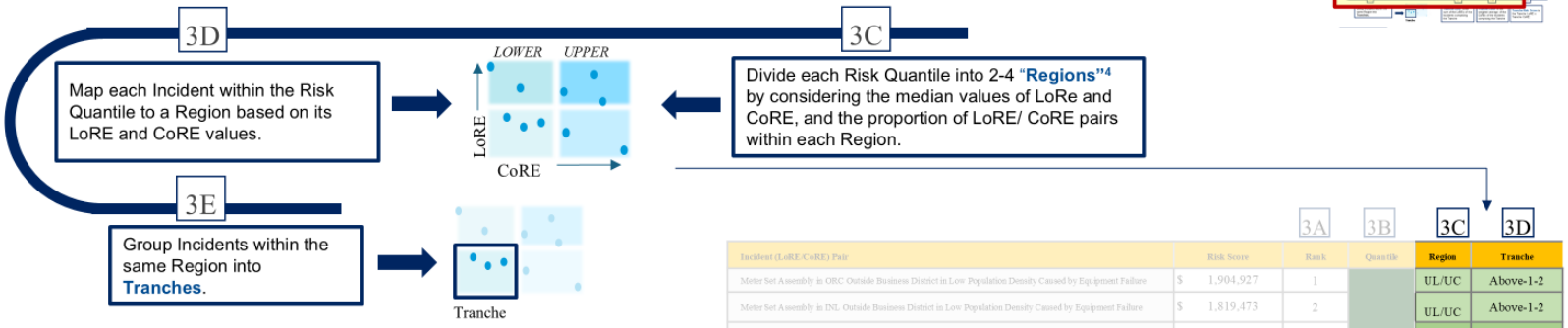
3B

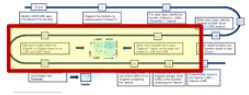
Divide ranked Incidents into the Risk Quantiles based on their Risk Scores.

From Step 2 for *Above Ground*

3A 3B

Incident (LoRE/CoRE) Pair	Risk Score	Rank	Quantile
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Equipment Failure	$ 1,904,927	1	
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Equipment Failure	$ 1,819,473	2	
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Equipment Failure	$ 1,533,156	3	
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Other Outside Force Damage	$ 655,635	4	
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Incorrect Operations	$ 591,969	5	
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Incorrect Operations	$ 591,047	6	
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Incorrect Operations	$ 562,632	7	
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Other Outside Force Damage	$ 553,798	8	
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Other Cause	$ 516,754	9	
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Other Cause	$ 495,104	10	#1
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Other Outside Force Damage	$ 491,243	11	
Meter Set Assembly in PAC Outside Business District in Low Population Density Caused by Equipment Failure	$ 469,194	12	
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Corrosion	$ 465,075	13	
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Other Cause	$ 419,926	14	
Meter Set Assembly in ORC Inside Business District in Low Population Density Caused by Equipment Failure	$ 405,061	15	
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Corrosion	$ 389,184	16	
Meter Set Assembly in ORC Outside Business District in High Population Density Caused by Equipment Failure	$ 382,087	17	
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Pipe, Weld, or Joint Failure	$ 378,174.8	18	
...	...	19-25	





		3A	3B	3C	3D
Incident (LoRE/CoRE) Pair	Risk Score	Rank	Quantile	Region	Tranche
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Equipment Failure	$ 1,904,927	1		UL/UC	Above-1-2
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Equipment Failure	$ 1,819,473	2		UL/UC	Above-1-2
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Equipment Failure	$ 1,533,156	3		UL/LC	Above-1-1
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Other Outside Force Damage	$ 655,635	4		LL/UC	Above-1-3
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Incorrect Operations	$ 591,969	5		UL/LC	Above-1-1
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Incorrect Operations	$ 591,047	6		UL/LC	Above-1-1
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Incorrect Operations	$ 562,632	7		UL/LC	Above-1-1
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Other Outside Force Damage	$ 553,798	8		LL/UC	Above-1-3
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Other Cause	$ 516,754	9		UL/LC	Above-1-1
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Other Cause	$ 495,104	10	#1	UL/LC	Above-1-1
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Other Outside Force Damage	$ 491,243	11		LL/UC	Above-1-3
Meter Set Assembly in PAC Outside Business District in Low Population Density Caused by Equipment Failure	$ 469,194	12		UL/UC	Above-1-2
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Corrosion	$ 465,075	13		UL/UC	Above-1-2
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Other Cause	$ 419,926	14		UL/LC	Above-1-1
Meter Set Assembly in ORC Inside Business District in Low Population Density Caused by Equipment Failure	$ 405,061	15		UL/LC	Above-1-1
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Corrosion	$ 389,184	16		LL/UC	Above-1-3
Meter Set Assembly in ORC Outside Business District in High Population Density Caused by Equipment Failure	$ 382,087	17		UL/LC	Above-1-1
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Pipe, Weld, or Joint Failure	$ 378,174.8	18		UL/LC	Above-1-1
…	…	19-25		…	…

4A

Tranche LoRE is the sum of the LoREs of the Incidents comprising the Tranche

4B

Tranche CoRE is the weighted average of the CoREs of the Incidents comprising the Tranche

4C

Tranche Risk Score is the Tranche LoRE x Tranche CoRE

		4A	4B	4C
Incident (LoRE/CoRE) Pair	**Tranche**	**Tranche LoRE**	**Tranche CoRE**	**Tranche Risk Score**
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Equipment Failure	Above-1-1	15,362.59	382	5,875,911
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Incorrect Operations	Above-1-1			
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Incorrect Operations	Above-1-1			
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Incorrect Operations	Above-1-1			
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Other Cause	Above-1-1			
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Other Cause	Above-1-1			
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Other Cause	Above-1-1			
Meter Set Assembly in ORC Inside Business District in Low Population Density Caused by Equipment Failure	Above-1-1			
Meter Set Assembly in ORC Outside Business District in High Population Density Caused by Equipment Failure	Above-1-1			
Meter Set Assembly in PAC Outside Business District in Low Population Density Caused by Pipe, Weld, or Joint Failure	Above-1-1			
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Pipe, Weld, or Joint Failure	Above-1-1			
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Equipment Failure	Above-1-2	11,148.14	418	4,658,668
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Equipment Failure	Above-1-2			
Meter Set Assembly in PAC Outside Business District in Low Population Density Caused by Equipment Failure	Above-1-2			
Meter Set Assembly in ORC Outside Business District in Low Population Density Caused by Corrosion	Above-1-2			
Meter Set Assembly in INL Outside Business District in Low Population Density Caused by Other Outside Force Damage	Above-1-3	6,676.00	676	4,511,205
Meter Set Assembly in NOR Outside Business District in Low Population Density Caused by Other Outside Force Damage	Above-1-3			
...	Above-1-3			
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