

GP-1102 - Gas Distribution Mains and Services Asset Management Plan

Gas Plan

Document Number: GP-1102

August 1, 2016

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1. Executive Summary

This asset management plan provides an assessment of condition and risk of the Distribution Mains and Services (DMS) asset family and includes a plan detailing risk mitigations, strategic objectives and asset maintenance for the life cycle of the assets.

The plan is developed with a 5-year planning horizon to align with the Gas Operations 5-year financial outlook and will be updated annually. It describes the physical assets included in this asset family, an assessment of the current and desired future state of the assets, the key risks associated with the assets and the investments planned or in progress to mitigate and reduce these risks.

1.1 Asset Overview

The DMS asset family is comprised of over 42,400¹ miles of pipeline that connects the gas measurement and control family on the upstream side and transports natural gas to customers throughout the service area. It also includes approximately 3.4 million service lines that deliver gas from the distribution mains to the assets in the Customer Connection Equipment (CCE) family on the downstream side. Figure 2 illustrates the role the Distribution Mains and Services asset family plays in delivering natural gas to customers.

Table 1 summarizes the primary asset types in the gas distribution asset family and the quantity of assets.

Table 1 - Primary Gas Distribution Assets

Physical Asset	Quantity
Distribution Mains (miles)	42,400
Services	3,400,000
Valves	6,250

1.2 Strategic Objectives

Gas Operations sets annual corporate Line of Sight (LoS) goals that cascade throughout the organization. Asset Family objectives are created using these LoS goals as a framework and developed both from a bottom-up and top-down approach. After analyzing asset risk and condition within the LoS framework, the 2016 DMS strategic asset objectives are as follows:

Safe

1. Reduce 3rd party dig-ins to first quartile by 2016
2. Reduce major over-pressurization events to 0 by 2018

¹ 2015 PGE Dist Annual Report. Submitted 3-15-2016



3. Identify all potential cross bores and remediate by 2023
4. Reduce the size of emergency shutdown zones in areas that have significant exposure to external hazards by 2023

Safe and Reliable

5. Achieve a replacement rate that limits asset age to 100 years by 2030
6. Replace all pipelines that cannot be cathodically protected within 5 years of determination
7. Limit the use of mechanical fitting use to emergency response by 2023.

Compliance & Risk

8. Document all Abnormal Operating Conditions (AOCs) in the SAP Work Management (WM) system by 2020
9. Improve completeness and accuracy of digital data to support a data driven risk management process by 2020.

Reliable

10. Evaluate cathodic protection on steel distribution mains and services by 2021
11. Maintain annual open leak backlog at less than 100 Grade 2 leaks

Reliable and Customer

12. Achieve 100% SCADA visibility by 2020

1.3 Asset and Data Condition

The data availability for this asset family has improved significantly with the implementation of GD GIS and the digitization of Gas Service Records. Digitization of Job Files will continue to improve data accessibility. Processes are being developed to collect data if data is determined to be missing. Performance indicators and metrics for trending and predicting asset performance and health, particularly leading indicators, are relatively immature.

1.4 Key Risks

This asset management plan takes a risk-based approach to managing the assets to reduce risk. Proposed programs of work are risk scored with a process for prioritization across all asset families in an effort to implement programs that optimize risk reduction and asset health.

Gas Operations identifies risks for each asset family. For each threat risk drivers and risks are identified for each asset family based on available data and SME input. The result of this process is a set of Gas Operations risks as shown in Figure 1. For this effort, risk is defined as the potential for an adverse event that can impact company's ability to achieve its objectives. Risk drivers are defined as factor(s) that could cause risk to occur.

PG&E also defines risks at the enterprise level. The enterprise level assessment ensures that all lines of business have risks defined at a consistent basis for enterprise level decision-making. For the



enterprise assessment, the Gas Operations risks are consolidated or rolled-up to provide a higher level of risk definition consistent with all PG&E lines of business. The development of the Gas Operations enterprise risks is performed by treating the Gas Operations risks as “risk drivers” to develop higher level enterprise risks. Therefore, the enterprise risks incorporate many of the “risk drivers” (or risks from the Gas Operations histogram). The enterprise risks are addressed in the Asset Management Strategy and Objectives.

This asset management plan is based on the risks developed for Gas Operations. The enterprise risk for this asset family is shown in Table 2 for information only:

Table 2 - Enterprise Risk for Distribution Mains and Services Asset Family

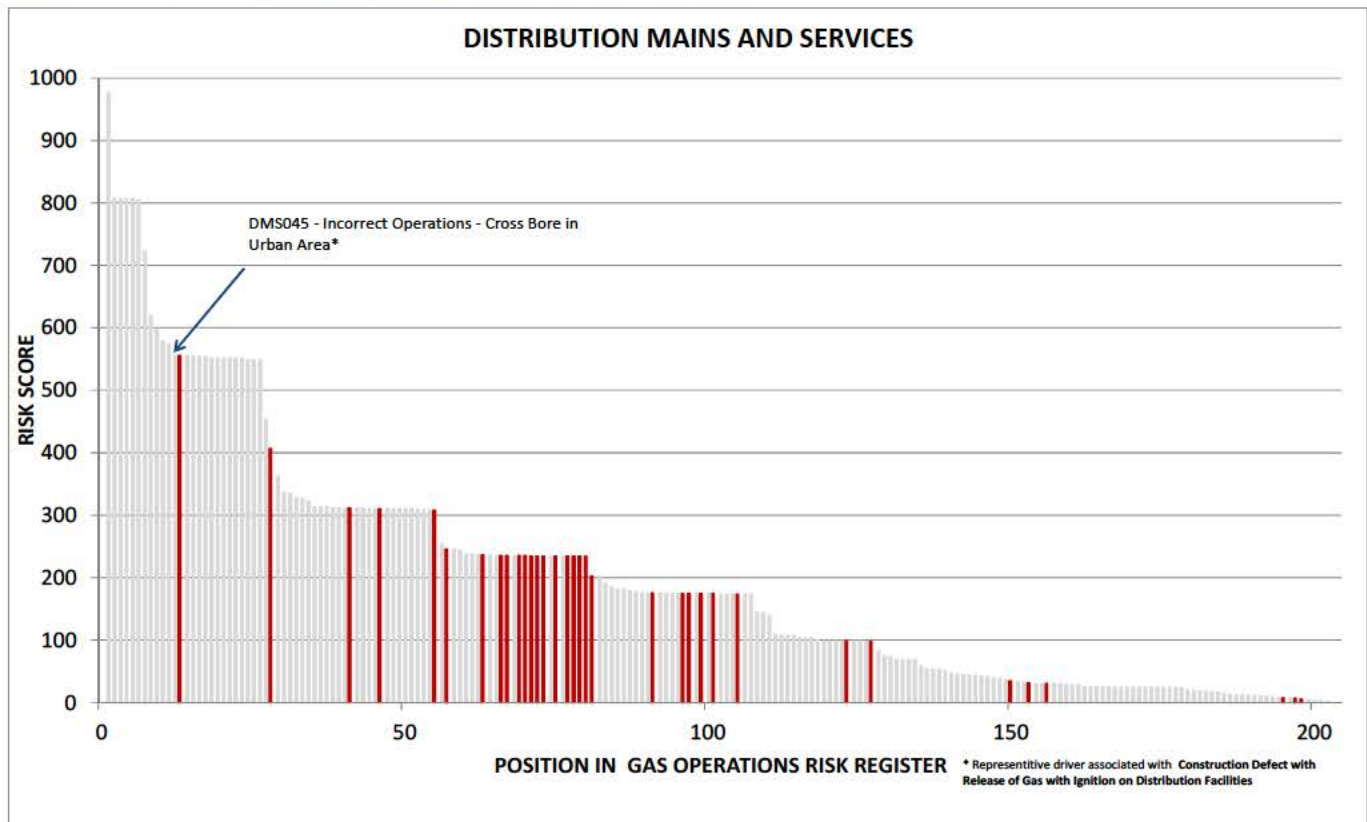
Enterprise Risk	Risk Drivers
Catastrophic Failure – Distribution Mains and Services	DMS045 – Incorrect Operations – Cross Bore in Urban Area



Figure 1 displays the position of the Distribution Mains and Services risks (red) within the Gas Operations Risk Register. Of the 204 Gas Operations Risks, the top Distribution Mains and Services risk (DMS45) is ranked 13th.



Figure 1 - Distribution Mains and Services Risk Profile



1.5 High Level Program Overview

The asset management plan focuses on managing and reducing risk in the most efficient and effective manner possible. As the plan matures, focus on optimizing risks, performance and costs will continue to be strengthened. Proposed programs involve both capital and expense funding and in some cases address more than one area of risk. Detailed description of the scope of each program is found in Section 4. The work scope, pace, and trajectory for these programs are in alignment with the General Rate Case for Distribution Mains and Services assets.

The key identified Distribution and Main Services risks, briefly described in Table 3, are derived based on a risk score that considers the likelihood and consequence of failure. These risk drivers highlighted below are the highest among multiple risks that have been identified across the Distribution Mains and Services assets. The full extent of the risks identified is addressed in detail in Appendix C.



Table 3 - Key DMS Threats and Risks

Threat	Risk ID	Risk Description	Primary Mitigation	Mitigation Metrics
Incorrect Operations	DMS45	A gas cross bore exists which may be damaged by a third party during sewer clearing resulting in damage to distribution pipeline, loss of containment, migration of gas with ignition leading to significant property damage or public safety issues. (Multiple homes or buildings - e.g. downtown San Francisco)	Cross Bore Sewer Program	Percent inspections completed Percent repairs completed within 90 days of identification
Excavation Damage	DMS39	Damage to gas distribution facilities from a third party (Non At-Fault) may result in loss of containment leading to significant property damage or public or employee injury or fatality.	Damage Prevention DIRT Team Gas Distribution Emergency Response	Number of gas 3 rd party dig-ins per 1,000 USA tickets Locate and Mark requests completed on time
Incorrect Operations	DMS42	Failure of fusion connections may result in loss of containment, with migration and ignition leading to safety impact	Employee Qualifications; Improved fusion pipe preparation procedures	Quarterly monitoring for 2 or more fusion failures
Incorrect Operations	DMS8	Third party sewer clearing may result in damage to distribution pipeline, loss of containment, migration of gas with ignition leading to significant property damage or public safety issues. (Isolated incident – single residence)	Cross Bore Sewer Program	Percent inspections completed Percent repairs completed within 90 days of identification
Excavation Damage	DMS01	Damage to gas distribution facilities from a third party (At-Fault) may result in loss of containment leading to significant property damage or public or employee injury or fatality.	Damage Prevention DIRT Team Gas Distribution Emergency Response	Dig-in Rate due to PG&E At-Fault

2. Asset Inventory and Condition Overview

2.1 Asset Overview

Table 4 describes physical assets within the Distribution Mains and Services asset family includes distribution mains, services, risers, pits and vaults, multiple types of valves and ancillary systems such as cathodic protection and SCADA.

Table 4 - Distribution Mains and Services Overview

Asset Type	Description
Distribution Mains	Distribution mains transport gas downstream of a Distribution Center. Distribution pipes carry gas to customers who purchased it for consumption (as opposed to resale).
Service Lines	Gas lines operating at less than or equal to 60 pounds per square inch gauge (psig) connecting the main to customer connecting equipment. Service lines include single customer services as well as branch services.
Pits and Vaults	Below grade areas that house, protect and allow access to distribution equipment.
Valves	<p>Restrict flow of natural gas through distribution mains and services. Types of valves include:</p> <ul style="list-style-type: none"> • Excess flow valves • Curb valves • Blow-down valves • Curtailment valves • BTU Zone valves • Emergency Zone valves • Maximum Allowable Operating Pressure (MAOP) valves • Other Mainline valves
Riser	Connects underground service line to the above ground meter set. Typically this is a metal pipe to support the meter set.
Fittings	<p>Connectors between pipe segments including elbows, tees, reducers, caps, etc. Types of fittings include:</p> <ul style="list-style-type: none"> • Mechanical fittings • Socket fusion fittings • Electrofusion fittings • Welded fittings
Casings	Larger diameter pipe into which smaller diameter pipe is inserted for additional protection. For example, used when carrying a pipe on a bridge or under railroad tracks.



Asset Type	Description
Cathodic Protection Equipment	Equipment used to protect metallic pipe from corrosion. Examples include rectifiers, anode beds, electrolysis test stations (ETS), and anodes.
SCADA Systems	Supervisory Control and Data Acquisition (SCADA) monitoring pressures at various locations in the system. Typically installed at low pressure points and used to validate system planning as well as monitoring operations.

Distribution mains were installed starting in the 1900s and continue to be installed as new customers are served and existing customers demand additional gas capacity. Currently there is approximately 42,400² miles of distribution main with diameters ranging from 1 ¼" to over 16". The system is comprised of three key materials:

- Steel: 20,100 miles (47%)³
- Plastic: 22,400 miles (53%)⁴
 - Aldyl-A Plastic Pipe: 5,400 miles⁵
 - Pre-1973 Aldyl-A Pipe: 800 miles⁶
- Cast Iron: 0 miles (In December 2014, the last known cast iron pipe in the system was removed; 0.4 miles of reconditioned cast iron are in the system)

There are approximately 3,400,000 service lines that total approximately 35,000 miles⁷ of pipe. These lines are comprised of three materials:

- Steel: 1,200,000 services (35.2%)
- Plastic: 2,200,000 services (64.7%)
- Copper: 4,900 services (0.1%)

There are 6,250 active mainline valves on the system⁸. A summary of valves by type are listed below.

- Blow-down valves = 20
- BTU zone valves = 55
- Curtailment valve = 50
- Emergency zone valves = 6,040
- MAOP valves = 50
- Other valve types = 30

² 2015 PGE Distribution Annual Report. March 15, 2016.

³ See footnote 2.

⁴ See footnote 2.

⁵ Aldyl A end forecast.xlsx. DIMP staff, May 2016

⁶ Aldyl A export.xlsx. DIMP staff, May 2016

⁷ See footnote 2.

⁸ Summary of Distribution Mainline Valves (IH08_G_Valves_GD.Valves.Emer.XLSX). DIMP staff, May 2016.



There are approximately 3,200 Cathodic Protection Areas defined in PG&E's service territory. There are approximately 3,950 rectifiers and 86,000 Cathodic Protection read points in these areas⁹.

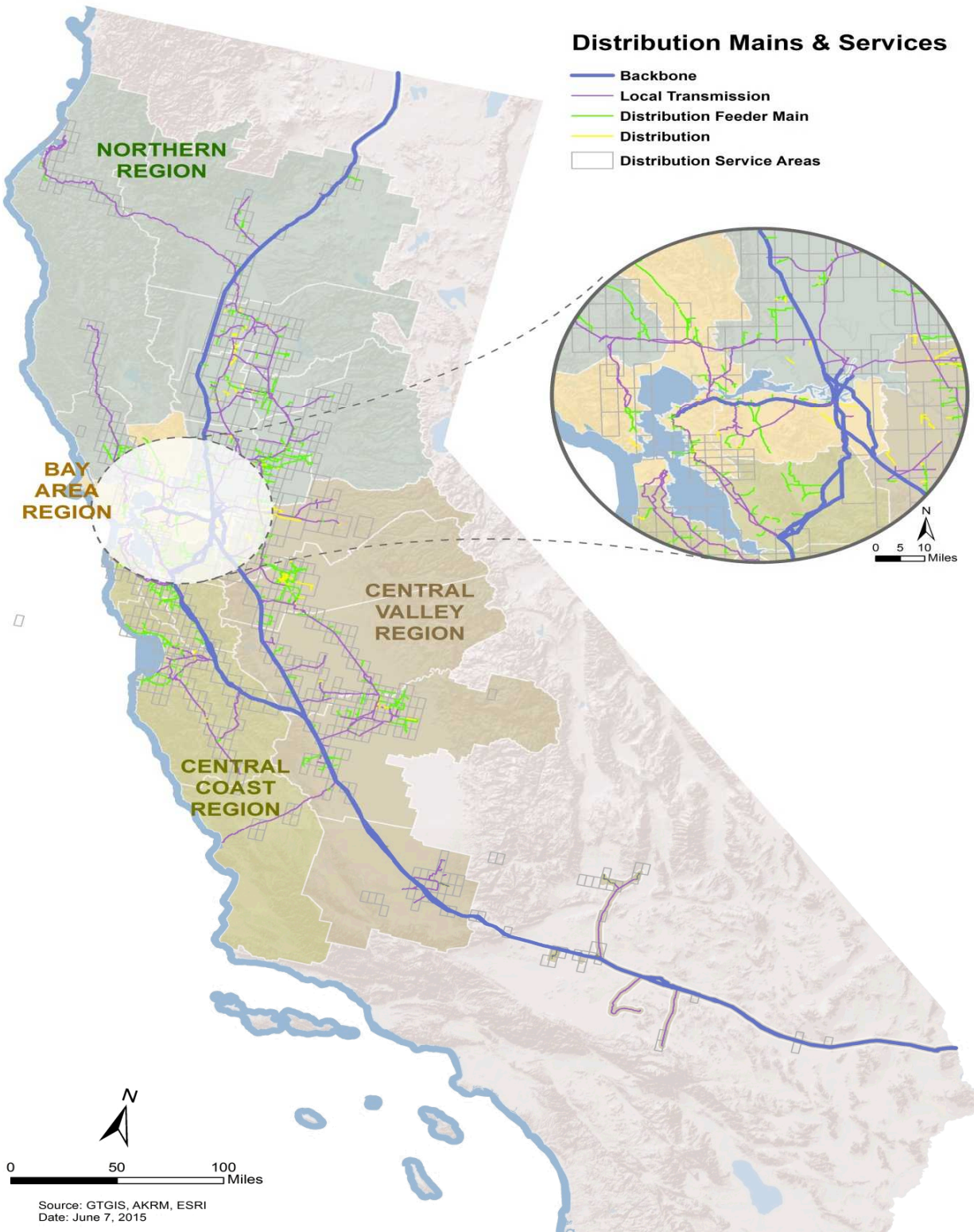
PG&E has achieved 36% visibility of the gas distribution system through SCADA as of the end of 2015 with 1,030 locations currently monitored within the distribution network. Approximately 53% of these locations are on mains, the other 47% are located at regulator stations, which are covered in the Measurement and Control Asset Family.¹⁰ All of these locations monitor gas pressures affecting the distribution main and distribution services asset families. The regulator station monitoring points are part of the Measurement and Control Station asset family.

The gas distribution system canvases PG&E's service territory from Bakersfield to the Oregon border. Figure 2 shows where distribution facilities exist in PG&E's service territory.

⁹ 2016_CPA_Rectifiers_ReadPoints.xlsx. Gas Asset Maintenance staff, May 17, 2016.

¹⁰ SCADA information provided by Gas Control Operations Engineering staff via email dated May 11, 2016.

Figure 2 – Map of PG&E's Gas Distribution System





2.2 Asset Inventory and Condition

Data available to support distribution mains and services asset management is generally fair in its completeness and quality. The majority of records are in paper format contained at local headquarter mapping offices.

PG&E's Gas Distribution GIS system (GD GIS) was fully deployed in August 2015 and serves as one of the primary data sources to support asset management. Additionally, the Distribution Integrity Management Program is deploying Riskfinder for the first time in 2016, which calculates relative risk scores for individual features in four asset types: mains, services, metersets and regulator stations. These risk score calculations incorporate the Likelihood of Failure (LoF) and the Consequence of Failure (CoF), along with any identified risk reduction factors (e.g. excess flow valves). The LoF is calculated at the sub-threat level and allows better identification of distinct risk drivers and failure mechanisms within each of the eight threat categories. LoF calculations also consider data such as the proximity of an asset to seismic hazards, FEMA flood zones, regions of unstable soil, and observations from field reviews. The CoF portion of the risk score estimates the human life potentially impacted by a failure and uses up to four factors (Severity, Gas Migration, Population Density and Pressure) to gauge the potential magnitude and migration of a leak. This analysis will be used by the Distribution Integrity Management team to drive risk decisions and identify appropriate mitigations at various levels of detail, ranging from the entire system to regional level, and by asset type, threat and subthreat.

2.2.1 Asset Age and Characteristics

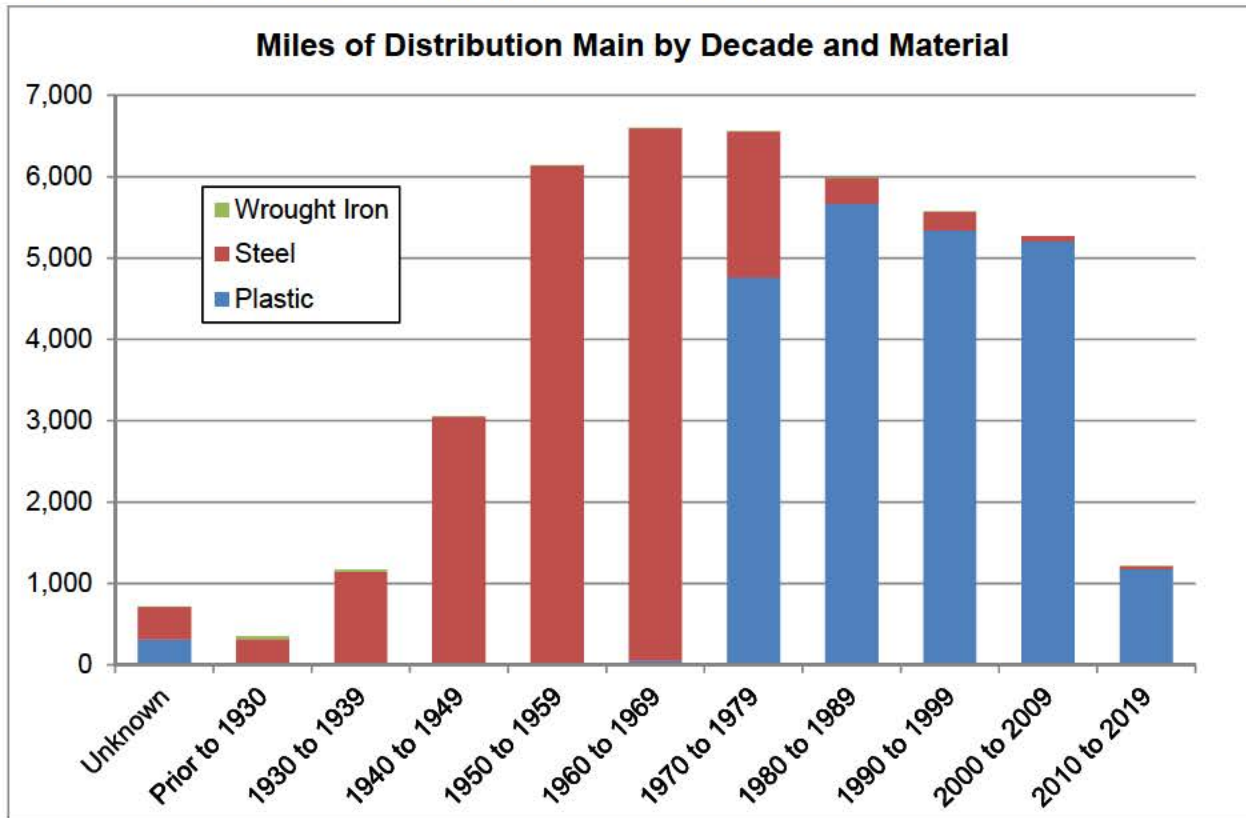
The gas distribution system is comprised of both distribution mains and distribution services. Characteristics of each group of assets are described in this section.

Distribution Mains

There are approximately 42,400 miles of distribution mains in PG&E's Gas Distribution system. The average age of gas distribution mains is approximately 39 years. When PG&E was incorporated in 1905, its gas distribution main system was made up of cast iron and steel pipe. PG&E stopped installing cast iron in the early 1930's and installed only steel pipe until the mid-1960s, when plastic pipe began being used. At this point, PG&E began installing DuPont Aldyl-A in addition to steel. Over the next several decades, PG&E installed multiple resins of plastic pipe and reduced the amount of new steel pipe installed in the system. Today, almost all new pipe installed on the distribution system is plastic. Figure 3 illustrates the miles of gas distribution mains by material type and decade of installation.



Figure 3 – Miles of Distribution Main by Decade and Material



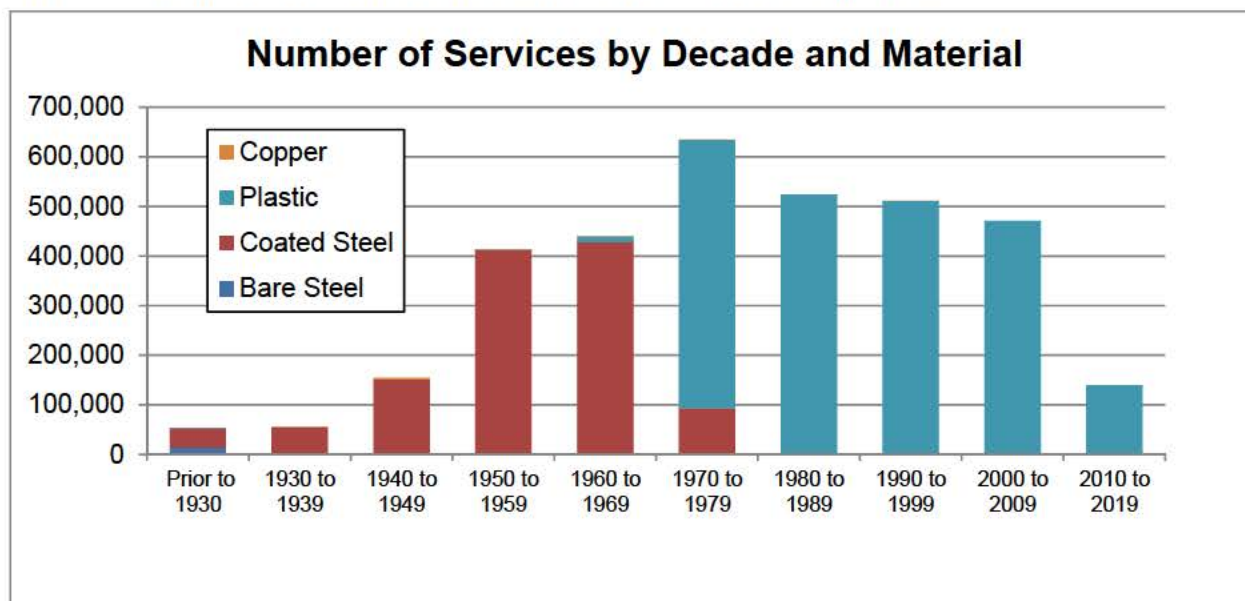
Source: StdDistMain.xlsx

Distribution Services

There are approximately 3.4 million gas services comprising approximately 34,700 miles of pipe.¹¹ The average age of PG&E's gas distribution services is approximately 39 years. When PG&E was incorporated in 1905, its gas distribution services were primarily steel pipe. PG&E installed copper services from the 1930s through the 1960s and also began installing plastic pipe (DuPont Aldyl-A) in the mid-1960s. Over the next several decades, PG&E installed multiple resins of plastic pipe and reduced the amount of new steel pipe installed in the system. Almost all new services installed on the distribution system are plastic.

¹¹ 2015 PHMSA Annual Report (2015 Dist Annual PGE - submitted 2016-03-15)

Figure 4 – Number of Distribution Services by Decade and Material



Source: TPL Cumulative 2015.xlsx

2.2.2 Asset Condition

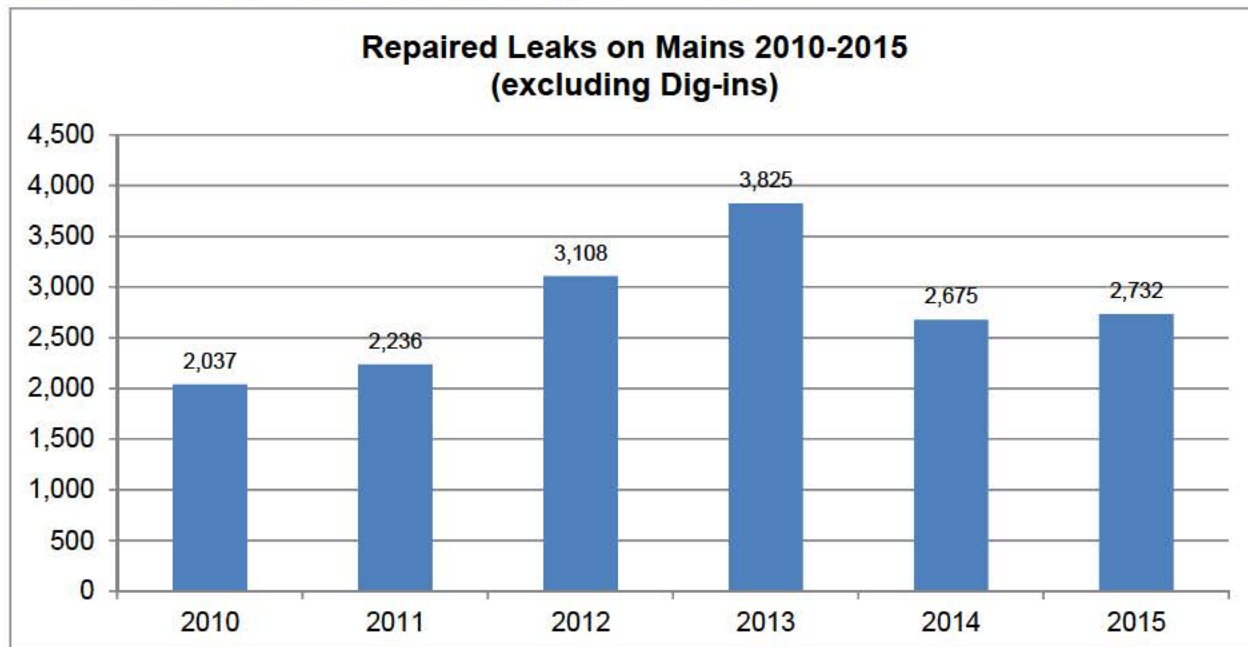
Gas leaks are the primary indicator of asset condition in a gas distribution network. Surveys are conducted regularly to detect leaks and to monitor existing leaks. Leaks are graded by severity and decisions related to repair, replace or monitor are made based on the leak grade. This section describes the condition of assets through a discussion of leaks and excavation damage.

2.2.3 Leak History – Mains

PG&E uses leak history as the primary indicator of the health of its distribution main assets. Figure 5 below shows the leak trend on distribution mains for the last 6 years. The rise in leak repair data in 2013 may be attributed to an effort to eliminate the backlog of leak repairs that year. Year to year variability is not necessarily an indicator of system health.



Figure 5 - Leak History for Distribution Mains – 2010-2015



Source: LeakjoinLeakScrub2010_2016.xls

Table 5 below shows the leak data for distribution mains by leak cause. Hazardous leaks are broken out separately as they pose more risk to public safety due to the size of the leak or its proximity to structures. These leak causes align with the known threats described in Section 3.

Table 5 - 2015 Leaks by Cause for Distribution Mains

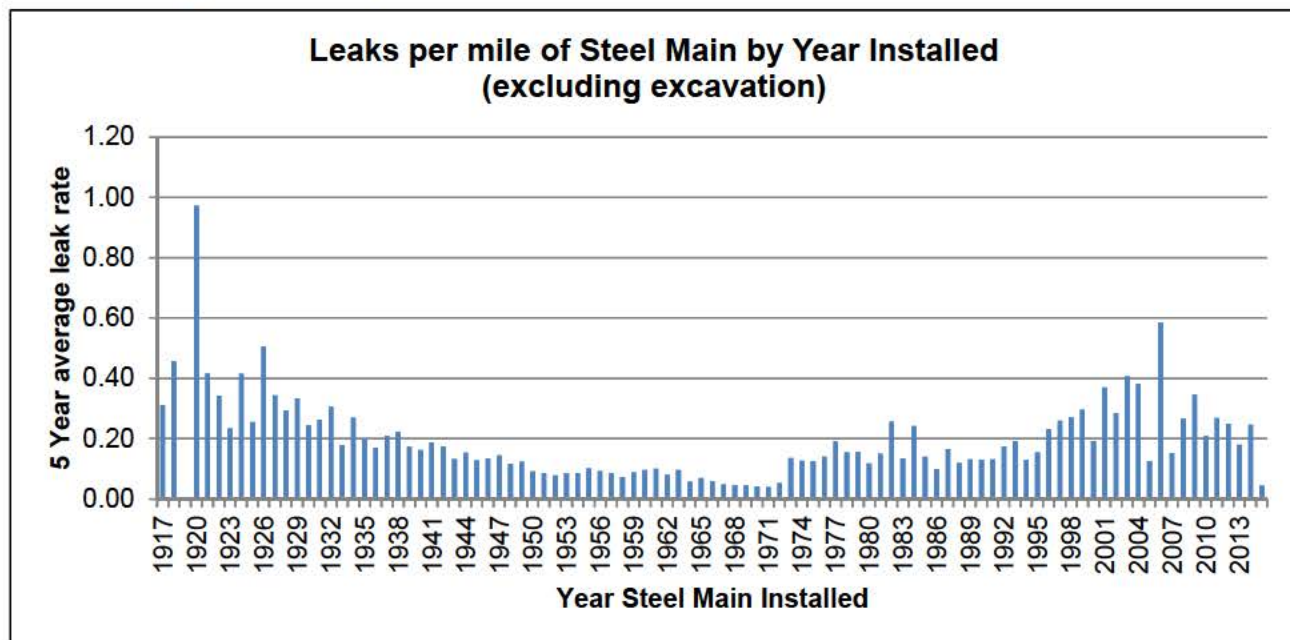
	Hazardous Leaks	% Total Hazardous Leaks	Total Repaired Leaks	% Total Repaired Leaks
Corrosion	416	33.7%	1,197	47.7%
Natural Forces	50	4.1%	71	2.8%
Excavation Damage	261	21.1%	273	10.9%
Other Outside Force Damage	6	0.5%	8	0.3%
Material or Welds	295	23.9%	589	23.4%
Equipment	3	0.2%	10	0.4%
Incorrect Operations	9	0.7%	16	0.6%
Other	195	15.8%	348	13.9%
Total	1,235	100%	2,512	100%

Source: 2015 PHMSA Annual Report (2015 Dist Annual PGE - subm 2016-03-15.pdf)



In addition to leaks by cause, PG&E evaluates leaks by age and material. Figure 6 shows the average annual leak rate on steel mains, based on leak data from 2010-2015 and mileage of main per install year. Figure 7 shows the average annual leak rate on plastic mains similar to Figure 6. PG&E observes a downward trend by installation year for the leak repair rate on plastic mains by mile, but data shows a slight increase on the rate of steel main leak repairs by mile from 1974 to the present year. This trend could be attributed to the sensitivity of the rate calculated for the very low miles of steel main installed during these years. CAP# 7031579 has been established to further investigate the increase in leak rates on distribution steel mains after 1974. PG&E is actively replacing vintage steel and plastic mains that show signs of higher leak rates through the Gas Pipe Replacement and Plastic Main Replacement programs.

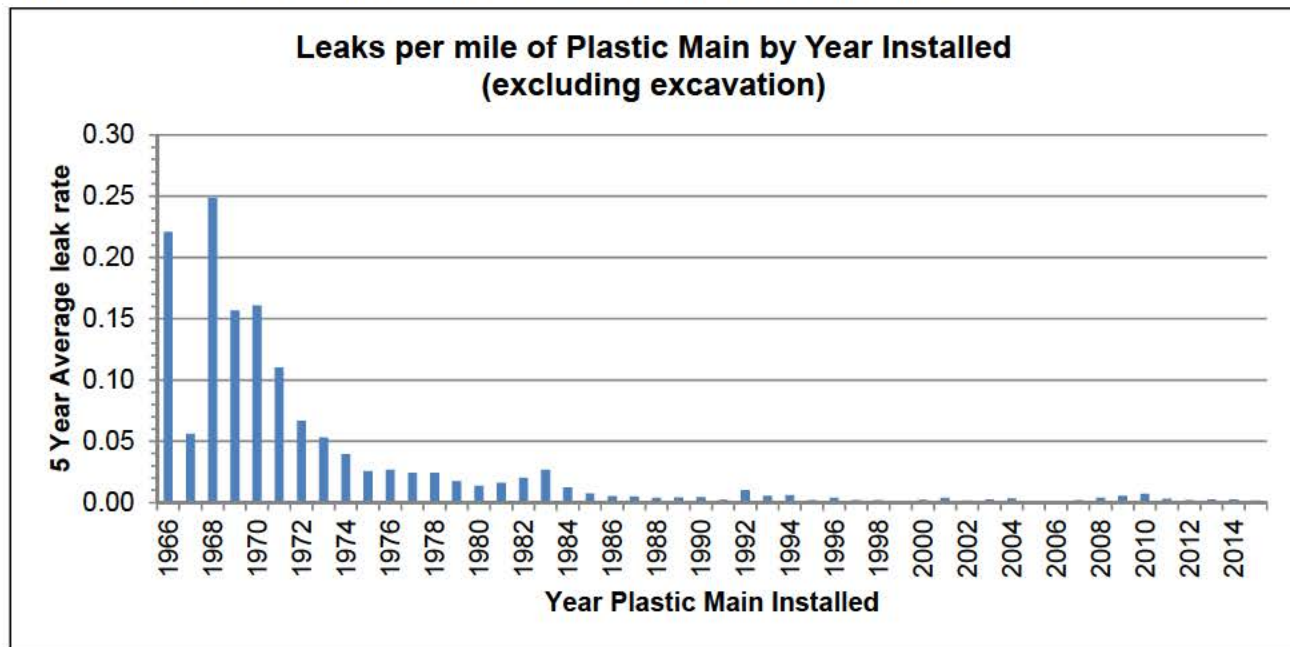
Figure 6 - Repaired Leaks per Mile of Steel Main by Year Installed



Source: *leaksperyearsteel.xls*, RiskFinder data for mains



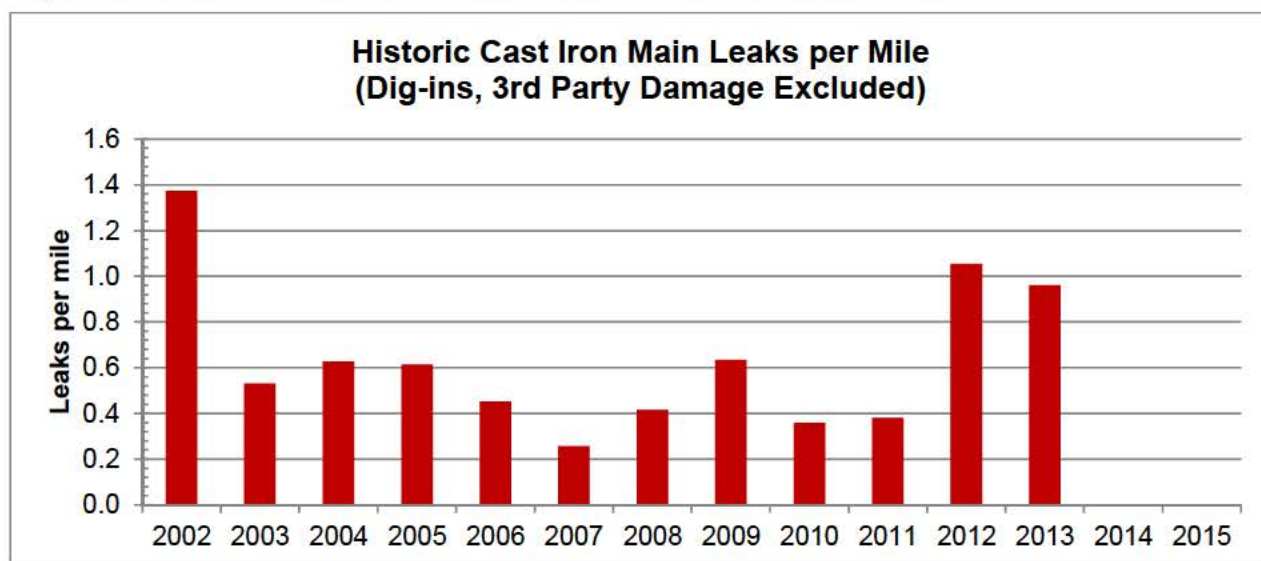
Figure 7 – Repaired Leaks per Mile of Plastic Main by Year Installed



Source: leakspereyearplastic.xls, RiskFinder data for mains

Figure 8 below shows the historic leak trend on cast iron mains from 2002 through 2013, based on number of leaks and remaining miles of cast iron main in the distribution system by year. By the end of 2014, there was no known cast iron in the system, so there are no leaks on cast iron for 2014 and beyond.

Figure 8 – Historic Cast Iron Distribution Main Leaks per Mile– 2002-2015



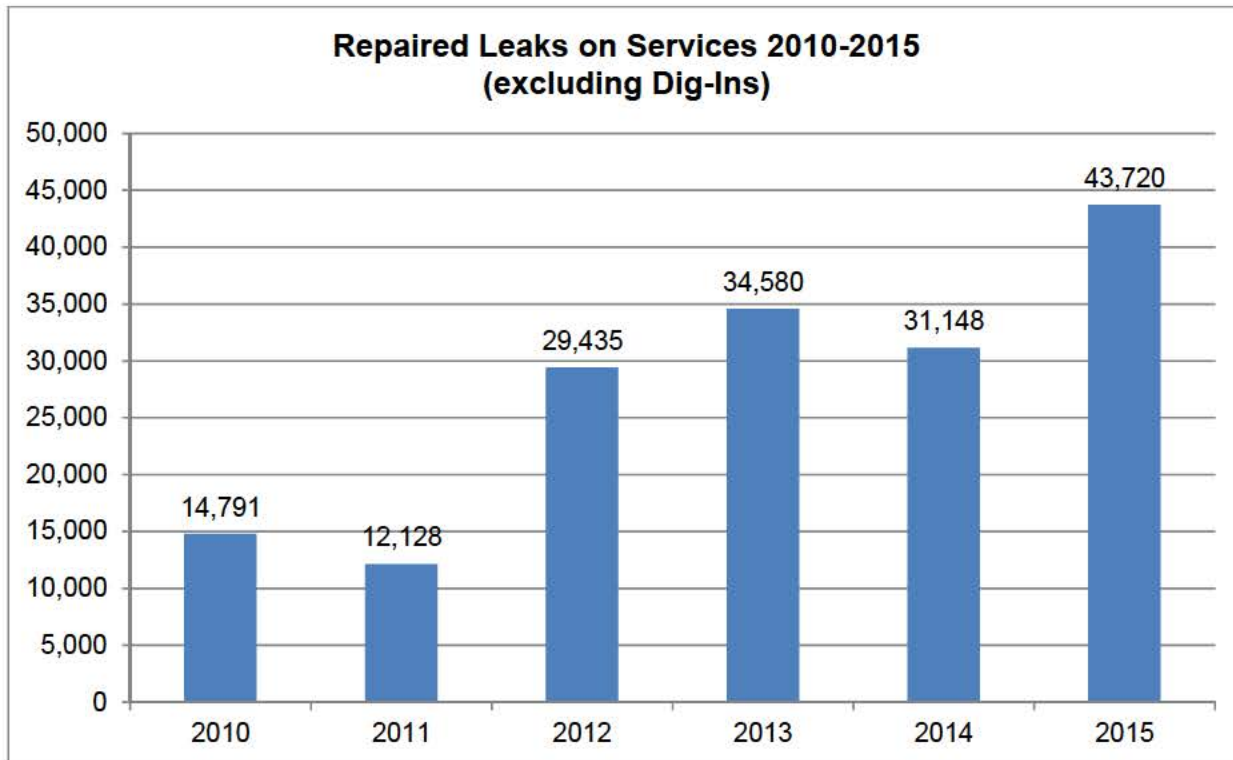
Source: LeakjoinLeakScrub2010_2016.xls



2.2.4 Leak History - Services

PG&E examines leak history as one indicator of the health of its distribution services. Figure 9 below shows the leak trend on distribution services for the last 6 years.

Figure 9 - Leak History for Distribution Services – 2010-2015



Source: LeakjoinLeakScrub2010_2016.xls

Table 6 below shows the leak data for distribution services by leak cause. Hazardous leaks are broken out separately as they pose more risk to public safety due to the size of the leak or its proximity to structures. These leak causes align with the known threats described in Section 3 below.



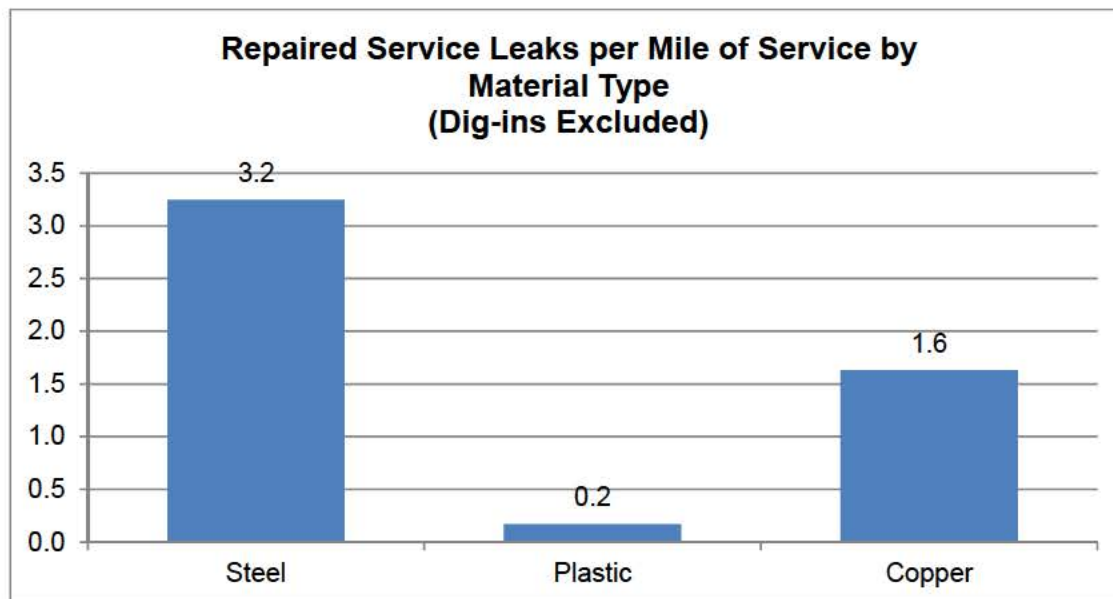
Table 6 - 2015 Leaks by Cause for Distribution Services

Leak Cause	Hazardous Leaks	% Total Hazardous Leaks	Total Repaired Leaks	% Total Repaired Leaks
Corrosion	1,247	20.1%	2,468	10.9%
Natural Forces	94	1.5%	138	0.6%
Excavation Damage	1,561	25.2%	1,579	6.9%
Other Outside Force Damage	206	3.3%	221	1.0%
Material or Welds	1,695	27.4%	3,133	13.8%
Equipment	63	1.0%	167	0.7%
Incorrect Operations	192	3.1%	284	1.3%
Other	1,139	18.4%	14,736	64.8%
Total	6,197	100%	22,726	100%

Source: 2015 PHMSA Annual Report (2015 Dist Annual PGE - subm 2016-03-15.pdf)

In addition to leaks by cause, PG&E evaluates leaks by material, as shown in Figure 10 below. PG&E is actively replacing materials that show signs of higher leak rates.

Figure 10 - Service Leaks per Miles by Material for leaks repaired in 2015



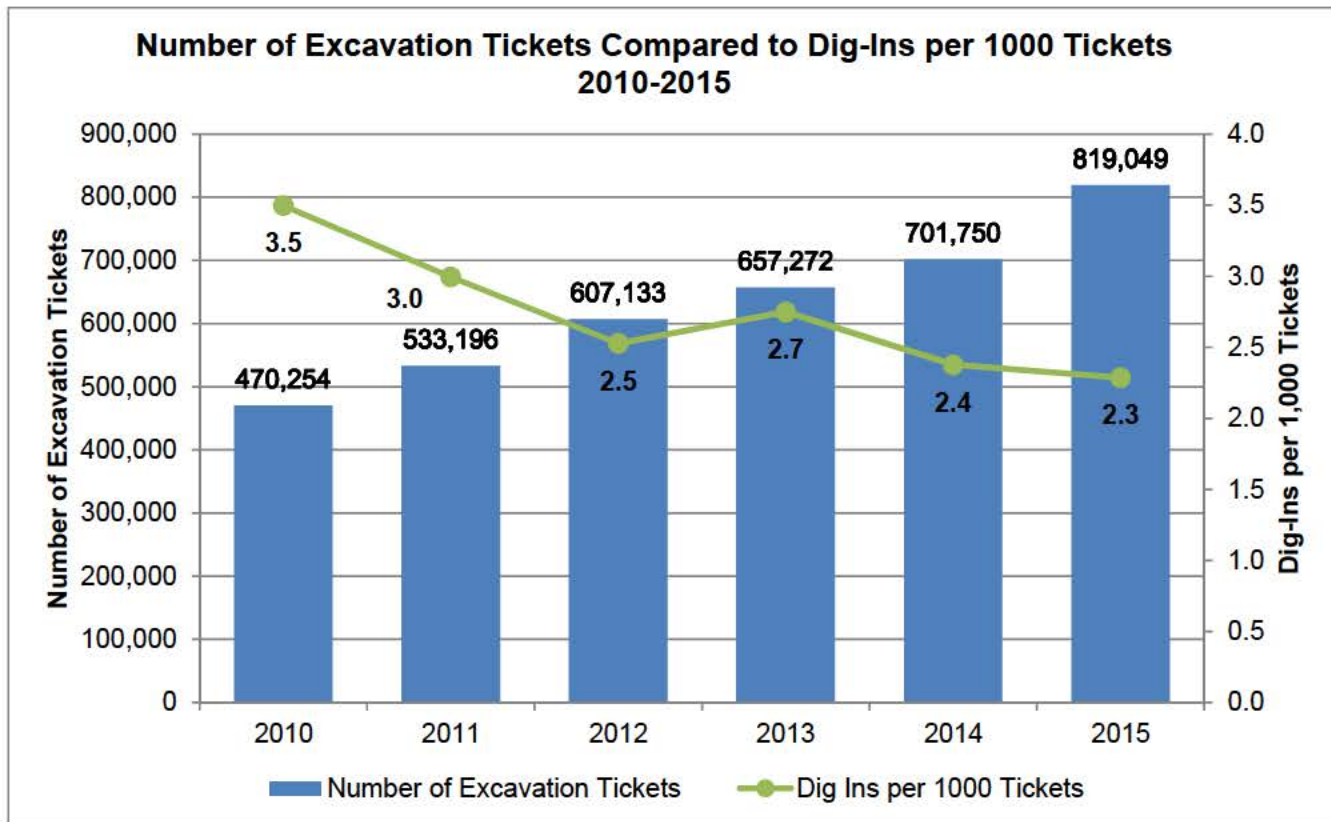
Source: TPL Cumulative 2015.xlsx, LeakjoinLeakScrub2010_2016.xls



Other Maintenance/Inspection Indicators

In addition to leak history, PG&E considers other leading and lagging indicators to better understand the health of the distribution main asset family. One key metric for understanding risk of distribution assets is excavation activity. PG&E tracks the number of calls to Underground Service Alert (USA) to understand the construction activity around our pipelines. Figure 11 below shows the increasing trend for excavation tickets for 2010 through 2015, combined with the decreasing rate of Dig-ins per 1,000 tickets. The dig-in rate continues to decrease from 2010, with the exception of 2013.

Figure 11 - Number of Excavation Tickets Compared to Dig-Ins per 1,000 tickets for 2010-2015



Source: 2015 PHMSA Annual Report (2015 Dist Annual PGE - subm 2016-03-15.pdf)



3. Threats and Risks

Risks are tracked in an enterprise-wide risk register, a central repository where risk names, descriptions and scores (as determined by utilization of Enterprise and Operational Risk Management's (EORM) risk criteria) along with other pertinent information are documented. The risk register is updated and refined as additional information is obtained and evaluated.

The risk management framework is fully integrated into PG&E's Integrated Planning Process (IPP). This framework complements risk assessment processes already in place via integrity management programs. Additional information about the integrated planning process can be found in the Strategic Asset Management Plan, GP-1100.

3.1 Threat and Risk Identification

To identify the Gas Distribution Mains and Services risks, the Asset Family Owner (AFO) works with their team and other Subject Matter Experts (SMEs) to identify asset threats. The Distribution Mains and Services AFO relies on the 49 Code of Federal Regulations (CFR) Part 192, subpart P, section 192.1007 (gas distribution pipeline). The threat categories are shown in Table 7.

The integrity management program is documented in Risk Management Procedure (RMP) 15. This procedure outlines the methodology used to assess and identify the relative risk within the distribution system.



Table 7 - Distribution Mains and Services Threat Categories

Threat Category	Description	Specific Threats
Time-Dependant	Potentially increase over time	<ul style="list-style-type: none">• External Corrosion• Internal Corrosion• Material or Weld (Plastic)
Stable or "Resident"	Present, or potentially inherent in the pipeline, but do not grow over time or pose a threat unless influenced by another condition or failure mechanism	<ul style="list-style-type: none">• Material or Weld (Metallic Pipe)• Equipment failure
Time-Independent	Not influenced by time	<ul style="list-style-type: none">• Excavation Damage• Incorrect Operation• Natural Forces• Other

Each AFO identifies the full range of potential threats to the Asset Family, including how the threats interact with each other.

After identifying various applicable threats, available data sources and Subject Matter Experts (SMEs) are consulted to determine the relative risk, including impact and frequency levels, associated with each threat. Distribution Mains and Services risks are calibrated across Gas Operations as well as the enterprise.

3.1.1 Primary Threats and Mitigations

The threat matrix in Appendix B lists the primary threats that have been identified for the Distribution Mains and Services asset family. These threats guide the identification of the risks contained in the Distribution Mains and Services Risk Register.

3.1.2 Key Gas Distribution Mains and Services Risks

Using the identified threats from the threat matrix risk have identified and annually updated for the distribution mains and services asset family, and prioritized for both Gas Operations (addressing risks across asset families) and within the asset family (as part of the risk and compliance process). The Distribution Mains and Services asset family identified 34 risks in 2016. The top DMS risk (DMS45) ranked 13th among the 204 risks in Gas Operations.

The key risks for the Distribution Mains and Services asset family are detailed in Table 8.



Table 8 - Key Distribution Mains and Services Risks

Risk ID	Threat	Risk Description
DMS45	Incorrect Operations	Third party sewer clearing may result in damage to distribution pipeline, loss of containment, migration of gas with ignition leading to significant property damage or public safety issues. (Multiple homes or buildings - e.g. downtown San Francisco)
DMS39	Excavation Damage, Third Party - Rupture Non At Fault	Damage to gas distribution facilities from a third party (Non At-Fault) may result in loss of containment leading to significant property damage or public or employee injury or fatality.
DMS42	Incorrect Operations	Failure of fusion connections may result in loss of containment, with migration and ignition leading to safety impact
DMS8	Incorrect Operations	Third party sewer clearing may result in damage to distribution pipeline, loss of containment, migration of gas with ignition leading to significant property damage or public safety issues. (Isolated incident - single residence)
DMS1	Excavation Damage, Third-Party - Rupture At-Fault due to mismarking by PG&E	Damage to gas distribution facilities from a third party (At-Fault) may result in loss of containment leading to significant property damage or public or employee injury or fatality.

**For all Distribution Mains and Services risks see Appendix C

3.2 Integrity Management Programs

PG&E's Distribution Integrity Management Program, based on the federal regulation (49 Code of Federal Regulations (DFR) 192, subpart P), evaluates and ranks the risks to the gas distribution system and proposes mitigations to address those risks. The risk process for this program gathers, reviews and integrates data to calculate risk, identifies mitigative measures, and monitors for effectiveness. For additional information about the DIMP, see Procedure RMP-15 (Risk Management Procedure - Gas Distribution Integrity Management Program).

As part of the DIMP, PG&E identifies relative risk through subject matter expertise of its staff and industry experience, historical performance of the system as indicated by leak history, the application of various threats to pipeline assets using its risk algorithm, and field personnel review meetings conducted by DIMP staff. Mitigating actions such as inspection, repair, and replacement are considered to address each high priority asset risk. Several programs have been established in response to risks identified through the DIMP process and these are described in Section 4.

4. Desired State, Strategic Objectives, Programs and Risk Mitigations

The DMS asset family's strategic objectives are developed to maintain and improve asset condition and mitigate risks and threats. These strategic objectives support PG&E's Line of Sight (LoS) goals.

Using these inputs, a long-term plan has been defined to meet the DMS asset management and corporate objectives.

The long term plan is to limit the age of the distribution main to 100 years to reduce risks associated with older pipe and to prioritize asset replacement based on risk insights. The approach of setting overall pipeline replacement rates includes four elements:

- Completion of all GPRP priority pipe and non-cathodically protected bare steel replacement by 2020
- Continue to increase the replacement rate of the Aldyl-A plastic pipe year over year in recognition of the ~5,450 miles of known inventory
- Complete all identified reliability main replacement projects

4.1 Strategic Objectives, Programs and Mitigations Alignment

The DMS strategic asset objectives and associated metrics as they correspond to Gas Operations' LoS goals are detailed in Table 9 below:

Table 9 - Strategic Objectives Mapped to Gas Operations Line of Sight (LoS) Goals

Corporate Objective	DMS Strategic Objective	Metric
Compliance	Improve completeness and accuracy of digital data to support a data driven risk management process by 2020	Percent complete - Data driven risk management process
Compliance	Document all Abnormal Operating Conditions (AOCs) in the Work Management (WM) system by 2020	Percent of AOCs documented in the Work Management (WM) system
Safe	Identify all potential cross bores and remediate by 2023	Percent inspections complete Percent repairs completed within 90 days of identification
Safe	Reduce the size of emergency shutdown zones in areas that have significant exposure to external hazards by 2023	Number of Emergency shutdown zones reduced
Safe	Reduce 3 rd party dig-ins to first quartile by 2016	Number of 3rd party dig-ins per 1,000 USA tickets
Safe	Reduce major over-pressurization events to 0 by 2018	Number of distribution overpressure events
Reliable	Evaluate cathodic protection systems on steel distribution mains and services by 2018	Percent of systems evaluated



Corporate Objective	DMS Strategic Objective	Metric
Reliable	Maintain annual open leak backlog at less than 100 Grade 2 leaks	Number of Grade 2 leaks backlog
Safe and Reliable	Replace pipelines that cannot be cathodically protected within 5 years of identification	Miles of main replaced
Safe and Reliable	Achieve a replacement rate that limits asset age to 100 years by 2030	Miles of main replaced
Reliable and Customer	Achieve 100% SCADA visibility by 2020	Execution of distribution SCADA visibility improvements (% complete)



PG&E has developed the following programs listed in Table 10 to meet these strategic objectives; the timeframes for the following programs and mitigations are based on the proposed rate case targets as of the publish date of this Asset Management Plan.

Table 10 - Programs, Mitigations and Strategic Objectives

Programs and Mitigations	Asset Family Strategic Objectives										
	Improve completeness and accuracy of digital data to support data driven risk identification and scoring by 2020	Identify all potential cross bores for remediation by 2023	Reduce the size of ESZs in areas that have significant exposure to external hazards by 2023	Reduce 3 rd party dig-ins to first quartile by 2016	Reduce major OP events to 0 by 2018	Achieve a replacement rate that limits asset age to 100 years by 2030	Evaluate cathodic protection on steel distribution mains and services by 2021	Maintain annual open leak backlog at less than 100 Grade 2 leaks	Replace all pipelines that cannot be cathodically protected within 5 years of identification	All AOCs are documented in the Work Management system by 2020	Achieve 100% SCADA visibility by 2020
Plastic Pipeline Replacement Program						X					
Gas Pipeline Replacement Program						X			X		
Leak Survey and Repair								X		X	
Cross Bore Sewer Program		X									
Corrosion Program							X		X		



Programs and Mitigations	Asset Family Strategic Objectives										
	Improve completeness and accuracy of digital data to support data driven risk identification and scoring by 2020	Identify all potential cross bores for remediation by 2023	Reduce the size of ESZs in areas that have significant exposure to external hazards by 2023	Reduce 3 rd party dig-ins to first quartile by 2016	Reduce major OP events to 0 by 2018	Achieve a replacement rate that limits asset age to 100 years by 2030	Evaluate cathodic protection on steel distribution mains and services by 2021	Maintain annual open leak backlog at less than 100 Grade 2 leaks	Replace all pipelines that cannot be cathodically protected within 5 years of identification	All AOCs are documented in the Work Management system by 2020	Achieve 100% SCADA visibility by 2020
Damage Prevention				X							
Tee Cap Replacement Program								X			
Curb Valve Replacement								X			
GD ARC	X										
RiskFinder	X										
Valve Replacement Program			X								
Gas Distribution Control Center - SCADA											X



Programs and Mitigations	Asset Family Strategic Objectives										
	Improve completeness and accuracy of digital data to support data driven risk identification and scoring by 2020	Identify all potential cross bores for remediation by 2023	Reduce the size of ESZs in areas that have significant exposure to external hazards by 2023	Reduce 3 rd party dig-ins to first quartile by 2016	Reduce major OP events to 0 by 2018	Achieve a replacement rate that limits asset age to 100 years by 2030	Evaluate cathodic protection on steel distribution mains and services by 2021	Maintain annual open leak backlog at less than 100 Grade 2 leaks	Replace all pipelines that cannot be cathodically protected within 5 years of identification	All AOCs are documented in the Work Management system by 2020	Achieve 100% SCADA visibility by 2020
Service Replacement Criteria						X			X		



4.2 Programs and Mitigations Overview

Table 11 – Program Summary – Distribution Mains and Services

Program:	Gas Distribution As Built Record Collection (GD ARC)
Scope:	This program will scan and centrally archive the historical gas distribution as-built records into the enterprise document management system. It will provide company-wide access to gas distribution as built records through GD GIS viewer.
Desired State:	Provide electronic as built records of gas distribution system
Risk Addressed:	Records and Information Management (Enterprise Shared Risk)
Timeframe:	December 2017
Responsible Organization:	Technology, Strategy and Solutions
Mitigation:	N/A
Metrics:	N/A
Program:	RiskFinder
Scope:	This program provides tools to automate the gathering of additional data streams. The tool uses Uptime software to performs GIS-based risk analysis.
Desired State:	Provide data to be used to drive risk decisions and identify appropriate mitigations.
Risk Addressed:	N/A
Timeframe:	On-going
Responsible Organization:	Technology, Strategy and Solutions
Mitigation:	N/A
Metrics:	N/A
Program:	Aldyl-A Plastic Pipeline Replacement Program
Scope:	This program specifically focuses on the replacement of Aldyl-A plastic pipe using risk based insights. Replacement of this type of pipe has two strategic benefits; 1) Decrease the risk associated with this pipe and 2) improves the leak performance for this pipe type towards the system average.
Desired State:	Replacement of all Aldyl-A plastic pipe



Risk Addressed:	DMS-5, DMS-22, DMS-6
Timeframe:	On-going
Responsible Organization:	Gas Distribution Projects and Programs
Mitigation:	Plastic Pipeline Replacement Program – Mains and Services (Aldyl-A)
Metrics:	Miles of main replaced
Program:	Gas Pipeline Replacement Program
Scope:	This program focuses on the removal and replacement of pre-1931 steel gas main and pre-1940 steel which poses higher risk. The primary goal of this program are to reduce risk to public safety associated with the highest risk steel pipe.
Desired State:	Remove and replace high risk steel pipe.
Risk Addressed:	DMS-15, DMS-23, DMS-17, DMS-3
Timeframe:	On-going
Responsible Organization:	Gas Distribution Projects and Programs
Mitigation:	Gas Pipeline Replacement Program (GPRP)
Metrics:	Miles of main replaced
Program:	Service Replacement Criteria
Scope:	Steel, Copper and Pre-1985 Plastic Services
Desired State:	Replacement of targeted material service lines during leak repair.
Risk Addressed:	Corrosion, Equipment Failure, DMS5, DMS15, DMS23, DMS3
Timeframe:	On-going
Responsible Organization:	Maintenance and Construction - Leak Repair
Mitigation:	Asset Replacement
Metrics:	None
Program:	Leak Survey and Repair



Scope:	As part of the pipeline safety regulations PG&E is required to conduct periodic or routine leak surveys on the distribution system to find gas leaks. The frequency of the surveys depends on several factors, such as: material; cathodic protection and proximity to the public. Approximately 94 percent ¹² of the distribution system is currently surveyed on a five-year cycle. Leak repair is part of the Corrective Maintenance program. The need for replacement of a damaged or failed facility is identified during leak repair activities.
Desired State:	Reduce the number of leaks on the distribution system
Risk Addressed:	DMS-5, DMS-22, DMS-23, DMS-15, DMS-6, DMS-7, DMS-17, DSM-12, DMS-25
Timeframe:	On-going
Responsible Organization:	Leak Process Optimization
Mitigation:	Leak Repair
Metrics:	Grade 2 and 2+ leak backlog
Program:	Corrosion Program
Scope:	The corrosion program is designed to protect steel mains and services from corrosion. Through periodic monitoring and maintenance, the cathodic protection systems are kept operational thus reducing the likelihood of leaks resulting from corrosion. Atmospheric corrosion inspections are also performed on exposed sections of main and services to ensure pipe coatings are effectively mitigating atmospheric corrosion.
Desired State:	Reduce the corrosion threats to PG&E's distribution assets
Risk Addressed:	DMS-15, DMS-17
Timeframe:	On-going
Responsible Organization:	Corrosion Engineering Gas Distribution
Mitigation:	Improve Cathodic Protection system reliability and maintain integrity of underground steel distribution system.
Metrics:	Not yet developed
Program:	Cross Bore Inspection Program
Scope:	The cross bore inspection program inspect waste water systems to identify and remediate cross bores on the gas distribution system that were installed using

¹² Accounting Field Handbook



	trenchless technology.
Desired State:	Remediation of all identified cross bores
Risk Addressed:	DMS-8, DMS-45
Timeframe:	2023
Responsible Organization:	Gas Distribution Projects and Programs
Mitigation:	Cross Bore Inspection Program
Metrics:	Percent inspections completed; percent repairs completed within 90 days of identification
Program:	Damage Prevention
Scope:	The damage prevention program manages the risks associated with excavation around PG&E facilities. This program focuses on educating third parties as well as the public in the "Call before you dig" or 811 program and monitors contractor performance via the repeat offender program.
Desired State:	Reduce third party dig-ins
Risk Addressed:	DMS-1, DMS-2, DMS-39
Timeframe:	On-going
Responsible Organization:	Gas T & D Compliance Programs
Mitigation:	Mark and Locate requests complete on time; Damage Prevention Program
Metrics:	Number of 3rd party dig-ins per 1,000 USA tickets
Program:	Tee Cap Replacement Program
Scope:	The plastic tee cap replacement program is focused on proactively replacing tee caps on projects with a history of tee cap leaks
Desired State:	To reduce risk associated with tee cap leaks by systematically replacing tee caps in area of high risk and poor leak performance.
Risk Addressed:	DMS-6
Timeframe:	On-going
Responsible Organization:	Gas Distribution Projects and Programs



Mitigation:	Leak reduction on the gas distribution system.
Metrics:	Number of tee caps replaced vs. plan
Program:	Curb Valve Replacement
Scope:	This program is focused on the inspection and replacement of Kerotest Valves located in San Francisco Division. These valves have shown a high frequency of repeated leaks. PG&E is proactively replacing these valves to prevent future leaks.
Desired State:	Leak reduction on the distribution system
Risk Addressed:	DMS-25
Timeframe:	On-going
Responsible Organization:	Distribution Integrity Management Program
Mitigation:	Reducing leaks on curb valves
Metrics:	Number of valves replaced vs. plan
Program:	Emergency Zone Valve Program
Scope:	Replace existing or install new gas distribution zone valves. Valves are replaced when they are leaking or can no longer be operated. New valves are installed to improve emergency response to major external events.
Desired State:	To improve ability to isolate and restore portions of the gas system by utilizing Emergency Shutdown Zones.
Risk Addressed:	DMS-49, DMS-14
Timeframe:	2022
Responsible Organization:	Gas Distribution Engineering and Design
Mitigation:	Repair or replace non-functioning valves. Install valves in zones identified having higher risk due to exposure to external hazards such as seismic, flood and fire.
Metrics:	Not yet determined
Program:	Gas Distribution Control Center - SCADA
Scope:	Install distribution system field monitoring and control points



Desired State:	Will proactively and predictively detect developing abnormal conditions and emergency events, mitigate the associated risks in real-time, and provide a more integrated response to developing events.
Risk Addressed:	DMS-49
Timeframe:	2020
Responsible Organization:	Gas Control Strategy and Support
Mitigation:	Fully implemented SCADA system on the gas distribution system
Metrics:	Bringing visibility within the gas distribution system up to 26% in 2015. (Overall metric – 100 percent SCADA on the distribution system by 2020)

For the latest program investment plan information contact the Gas Operations Investment Planning organization.



5. Areas for Continuous Improvement

There are some areas in the asset management plans that have not been fully built out at this stage; these are highlighted in Table 12 below. These are areas that will continue to evolve and improve as more thorough data sets and understanding of asset condition are developed over time.

Table 12 - Areas for Continuous Improvement

Areas for Continuous Improvements	
Risk Process	<ul style="list-style-type: none">• Incorporate the use of benchmarking data into the risk register refresh process and mitigation strategies• Use data from Distribution Integrity Management (DIMP) Cause Analyses (CA) for incorporation into the risk register
Data	<ul style="list-style-type: none">• Continue to improve the gas distribution GIS to address data completeness and quality gaps• Developing measures for quantifying risk reduction through implementation of RiskFinder.
Asset Management Plan	<ul style="list-style-type: none">• Continue to work with other asset families to maintain consistency in plan content• Improve criteria for identifying mitigation program status, including benchmarking criteria, program effectiveness metrics, and funding fulfilment
Personnel Implications	<ul style="list-style-type: none">• Continue developing technical skills and expertise of the DIMP Subject Matter Experts, Asset Management Principal and Asset Family Owner



APPENDICES

A. Related Documents

The following table lists documents associated with this asset management plan.

Table 13 - Related Documents

Related Document	Document Number / Description	Link
Risk Register	The risk register captures all risks outlined in this plan at the data of publish	http://gasrisk/
Asset family investment planning forecast	Retained by investment planning for S1 and S2 planning purposes.	
Enterprise and Operational Risk Management Standard and Procedures	RISK-5001S, RISK-5001P-01, RISK-5001P-02, RISK-5001P-03	http://pgeatwork/Guidance/RiskCompliance/Pages/default.aspx
Gas Asset Management Policy	TD-01	TD-01
Gas Operations Asset Management System Risk Management Standard and Procedure	TD-4011S, TD-4011P-01	TD-4011S and TD-4011P-01
Gas Operations Risk and Compliance Committee Charter	GOV-1021S	http://pgeatwork/Guidance/Governance/Pages/default.aspx
Strategic Asset Management Plan	GP-1100	Gas Safety Plans / Asset Management
Transmission Pipe Asset Management Plan	GP-1101	
Distribution Mains and Services Asset Management Plan	GP-1102	
Customer Connected Equipment Asset Management Plan	GP-1103	
Measurement and Control Asset Management Plan	GP-1104	
Compression and Processing Asset Management Plan	GP-1105	
LNG/CNG Portable Supplies Asset Management Plan	GP-1106	
CNG Station Asset Management Plan	GP-1107	
Gas Storage Asset Management Plan	GP-1108	



B. Threat Matrix & Key Threats

The threat matrix below display threats, drivers, and mitigations associated with this asset family. The threats are outlined with a red, amber, or green status denoting the current availability and quality of asset data. The mitigations are color coded with white, red, amber, or green status to display how it currently compares to industry best practices as well as the strength of the controls.

Figure 12 - DMS Asset Threat Matrix

PG&E Approved Revision: 10/20/2015

Threat Matrix (Distribution Mains and Services)

		Primary Causes of Failures	Primary Prevention Measures (highest impact on risk reduction - from left to right)				
Time Dependent Threats	External Corrosion DMS15,DMS17,DMS12,DMS3	Inadequate coating Inadequate Cathodic protection Atmospheric conditions	Cathodic Protection	Leak Survey	Asset Replacement		
	Internal Corrosion DMS4	Sulfur Water intrusion	Leak Survey	Leak Repair	Asset Replacement		
	Material or Weld – Plastic DMS3,DMS22,DMS6	Poor resin quality Rock impingement/ stress on pipe	Material Specifications	Inspection during Manufacturing	Leak Survey	Asset Replacement	
Stable Threats	Material or Weld – Metallic Pipe DMS23,DMS7,DMS12	Poor quality manufacture Inadequate specifications	Material Specifications	Inspection during Manufacturing	Leak Survey	Asset Replacement	Process* Safety
	Equipment Related DMS25	Age, Obsolescence Incorrect sizing/design	Preventive maintenance	Work Procedures	Training	Asset Replacement	
Time Independent Threats	Excavation Damage DMS9,DMS1,DMS33,DMS2	1 st , 2 nd , 3 rd Party Excavation Damage	Quality Control	Locating and Marking	One Call System	Public Awareness	Excavation Monitoring
	Incorrect Operations DMS10,DMS11	Inadequate Procedures Human Error Cross Bores Applicant Installed Fusion Joints	Operator Qualifications	Quality Control	Training	Quality Assurance Audits	Inspection during construction Records Process Safety
	Natural Forces DMS7,DMS14	Lightning; Flooding Seismic events; Land movement	Slope Monitoring and Stabilization	Emergency Preparedness Procedures			
	Other DMS33,DMS37	Vandalism Vehicular damage Overbuilds	Design	Physical Barrier to Asset	Asset Relocation or Replacement		
Loss of Supply	Failure to meet customer demand	Inadequate Capacity Improper Clearances	Long term Investment Planning	Clearance Process and Tools			
Emergency Response	Major Emergency or Disaster	Inadequate First Responder Response Inadequate Dispatch response Inadequate EOC Response Inadequate training	Odor Response	Emergency Response	Shut-in Time	Emergency Shutdown Zones	

availability and the quality of the asset data

complete partial weak

Mitigation Color Key

Green = Meets or exceeds industry best practices AND controls are adequate

Amber = Partially meets industry best practices OR controls are being strengthened

Red = Does not meet industry best practices AND controls are not adequate

White = Pending evaluation

*Not yet implemented

1



Key Threats

In order to identify key threats to the Distribution and Main Services asset family, national and PG&E data was evaluated. Following are summaries of incidents in US gas distribution mains and services as well as PG&E's distribution system from the past ten years, organized by primary cause.

Table 14 – Industry and PG&E Reported Significant Incidents by Cause, Natural Gas Distribution, Mains, Services and Risers (2010 - 2016)

Incident Cause	2010-May 2016 Industry Incidents	Percent Total Industry Incidents	2010-May 2016 PG&E Incidents	Percent Total PG&E Incidents
CORROSION FAILURE	10	4%	1	7%
EQUIPMENT FAILURE	6	2%	0	0%
EXCAVATION DAMAGE	109	40%	7	50%
INCORRECT OPERATION	20	7%	1	7%
MATERIAL FAILURE OF PIPE OR WELD	22	8%	2	14%
NATURAL FORCE DAMAGE	21	8%	1	7%
OTHER INCIDENT CAUSE	34	12%	0	0%
OTHER OUTSIDE FORCE DAMAGE	53	19%	2	14%
Total	275	100%	14	100%

Source: PHMSA Natural Gas Distribution Incident Data *through May 31, 2016*

C. Asset Family Risks

The 34 DMS asset family risks below are sorted below by risk score.

Table 15 - DMS Risks and Interdependencies

Threat	Risk ID	Risk Description
Incorrect Operations - Cross Bore in Urban Area	DMS045	Third party sewer clearing may result in damage to distribution pipeline, loss of containment, migration of gas with ignition leading to significant property damage or public safety issues. (Multiple homes or buildings - e.g. downtown San Francisco)
Excavation Damage, Third-Party - Rupture Non At-Fault	DMS039	Damage to gas distribution facilities from a third party (Non At-Fault) may result in loss of containment leading to significant property damage or public or employee injury or fatality.
Incorrect Operations - Electrofusion Failure	DMS042	Failure of fusion connections may result in loss of containment, with migration and ignition leading to safety impact
Incorrect Operations - Cross Bore in Suburban Area	DMS008	Third party sewer clearing may result in damage to distribution pipeline, loss of containment, migration of gas with ignition leading to significant property damage or public safety issues. (Isolated incident - single residence)
Excavation Damage, Third-Party - Rupture At-Fault due to mismarking by PG&E	DMS001	Damage to gas distribution facilities from a third party (At-Fault) may result in loss of containment leading to significant property damage or public or employee injury or fatality.
Natural Forces	DMS014	Natural disaster (flood, earthquake) may result in extensive damage to the distribution system due to a fault crossing or breakage of service lines from soft structure failures resulting in loss of containment and ignition leading to property damage and public safety issues. Earth movement in conjunction with flooding may contribute to water / contaminant infiltration into the distribution network disrupting service throughout the system.
MAOP Valve failure or Incorrect Operation	DMS049	MAOP Isolation valve failures or incorrect operation between high pressure distribution to low pressure distribution systems may result in an over-pressurization event causing fire or explosion with public safety impact.
Material or Weld - Plastic (System Safety)	DMS005	Aldyl-A pipe material failure may result in loss of containment (body of pipe crack), gas migration and ignition leading to significant property damage or public safety issue.



Threat	Risk ID	Risk Description
Incorrect Operations (Workmanship Traceability)	DMS053	Inability to identify workmanship in the field when qualification or competency issues arise which results in not being able to identify who completed the work or where the person has previously performed work which may lead to a loss of containment and public or employees safety issues
Other Outside Forces - Aging Infrastructure	DMS058	The risk of aging mains and services, trending toward a 400+ year life cycle, may result in increased leaks, migration and ignition of gas, leading to safety impact and property damage.
Incorrect Operations - Third-Party Pipe Bursting Activity	DMS066	Pipe bursting activities on a sewer line cause damage to gas distribution piping resulting in a gas leak which migrates into the open sewer system with into adjacent buildings with the potential for fire or explosion and public safety consequence.
External Corrosion - Steel Pipe	DMS015	External corrosion of steel pipe may result in loss of containment leading to migration and ignition.
Material and Weld - Composite Risers	DMS022	Internal failure of composite risers (Green Perfection and Powell kit) may result in loss of containment, gas migration and ignition leading to public safety issue.
Material and Weld - Steel Installed Through the 1950's	DMS023	Thin wall steel pipe installed through the 1950s is more susceptible to external corrosion may result in loss of containment, gas migration and ignition leading to public safety issue.
Internal Corrosion	DMS004	Copper service insert in steel or, copper connected to steel, corrodes which may result in loss of containment with gas migration and ignition leading to property damage and public safety impacts.
Outside Force - Land Movement Due to Erosion or Subsidence	DMS043	Land movement due to hillside erosion or sliding may result in pipe overstress, failure and loss of containment with gas migration and ignition leading to safety impact
Incorrect Operations - Applicant Installed Facilities	DMS046	Applicant installed facilities not meeting company requirements may result in loss of containment leading to gas migration leading to public safety issues.
Other Outside Force - Grounding	DMS055	Electric distribution grounding in the vicinity of distribution piping may result in a potential ignition of gas during maintenance activities leading to employee safety impact
External Forces - Water main failure	DMS064	Water main rupture may result in water intrusion into the gas facility disrupting service, extinguishing pilot light, leading to gas accumulation and safety impact
Other Outside Forces - Inaccessible Equipment	DMS054	Installation of roof-top mains and or services may result in inaccessibility issues leading to inadequate



Threat	Risk ID	Risk Description
		maintenance resulting in loss of containment, gas migration into the building and public safety impact
Material Traceability	DMS052	Lack of material traceability may result in an inability to locate and recall defective material being left in the field resulting in loss of containment which leads to a public or employee safety issue
Overbuilds	DMS037	Overbuilds may result in loss of containment, gas migration into overbuild structure leading to public safety issue.
Outside Force - Land Movement Due to Creep	DMS038	Land movement due to creep along seismic fault line may result in pipe over-stress, failure and loss of containment with gas migration and ignition leading public safety issue.
Co-location of gas and electric facilities	DMS051	Failure of distribution pipe located at or near electric substations due to operations and incidents at electric substations may result in unsafe work environment (electrified pipe) or loss of containment that can lead to impact on public and employee safety, outages, property damage
Incorrect Operations - Construction Quality	DMS065	The risk of increasing the asset replacement rate may result in poor construction quality associated with increased contract work, leading to safety impact.
External Corrosion - Reverse polarity	DMS059	The risk of reversing the polarity on a CP rectifier would cause the steel pipe to become an anode with rapid metal loss in multiple locations and may result in loss of containment, migration and ignition, leading to safety impact.
Material / Weld - Odor Fade	DMS063	Pipe absorption of odorant leaving gas odorless may result in an inability to smell gas and take proper steps to notify the utility or emergency response personnel leading to safety impact
Natural Forces - Lightning Strike	DMS056	Lightning strike causing damage to the distribution pipe with release of gas and ignition may lead to public and employee safety impact, outages and property damage.
Other Outside Forces - Tree Root Damage to Plastic Pipe	DMS047	Tree Root damage of plastic distribution mains and services may result in loss of containment leading migration and possible public safety impact.
Military facilities	DMS050	Acquired military facilities that have no records and substandard installations may result in health and safety impacts or loss of containment.
Excavation Damage - Unlocatable Stubs	DMS044	Unlocatable stubs may result in at-fault dig in leading to loss of containment and a public safety impact



Threat	Risk ID	Risk Description
Internal Corrosion - Mainline Drips	DMS048	Mainline drips not maintained may result in internal corrosion creating loss of containment and possible migration
Other Outside Forces - Lined Pipe	DMS061	The lack of proper maintenance on pipe with a Paltem liner may result in pipe damage, release of gas, migration and ignition leading to safety impact.
Natural Forces - Wind or Winter Storm	DMS062	Wind or winter storm may result in trees uprooting and causing pipe damage, rupture with loss of containment, leading to safety impact.



D. Stakeholder Roles and Responsibilities Matrix

The key contacts are stakeholders who are involved in each phase of the asset life cycle, managing and operating the assets to operate as planned.

Table 16 - Stakeholder Roles and Responsibility Matrix

Stakeholder Group	Primary Contact	Creation / Enhancement				Utilization	Maintenance	Decommission/ Dispose
		Conception	Design	Procedure	Construct/ Start-up			
Compliance	Director	X	X	X	X	X	X	X
Distribution Engineering & Design	Director	X	X	X	X			X
Gas Distribution Project Management	Director	X	X	X	X			X
Gas Distribution Control Center	Manager	X			X	X	X	X
Gas Control Strategy & Support	Director	X	X					X
General Construction	Senior Director				X			X
M&C Construction	M&C North and South Directors						X	X
Field Operations	Field Services North and South Directors						X	X
Codes and Standards	Director		X		X	X	X	X

E. Glossary of Acronyms and Abbreviations

The following is a glossary of acronyms and abbreviations used in this asset management plan and related documents.

Table 17 - Acronyms and Abbreviations

Acronym	Meaning
AC	Alternating Current
AC	Atmospheric Corrosion
AF	Asset Family
AFO	Asset Family Owner
AHS	Asset Health Scorecard
AMP	Asset Management Plan
AMR	Automated Meter Reading
ANSI	American National Standards Institute
APD	Abnormal Peak Day
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
Bcf	Billion cubic feet
BHP	Brake Horsepower
BTU	British Thermal Unit
C&P	Compression & Processing
CAP	Corrective Action Program
CC&B	Customer Care and Billing
CCE	Customer-Connected Equipment
CCR	California Code of Regulations
CDD	Critical Document Database
CFH	Cubic Feet per Hour
CFR	Code of Federal Regulations
CIS	Close Interval Survey
CM	Corrective Maintenance
CNG	Compressed Natural Gas
CNL	Compensated Neutron Log

Acronym	Meaning
CoF	Consequence of Failure
CP	Cathodic Protection
CPP	Casing Potential Profile
CPUC	California Public Utilities Commission
CSRP	Copper Service Replacement Program
CWD	Cold Winter Day
DC	Direct Current
DCVG	Direct Current Voltage Gradient
DHSV	Downhole Safety Valve
DIMP	Distribution Integrity Management Program
DOGGR	Division of Oil, Gas and Geothermal Resources
DOT	Department of Transportation
ECA	Engineering Critical Assessment
ECDA	External Corrosion Direct Assessment
EORM	Enterprise and Operational Risk Management
ERM	Enterprise Risk Management
ERW	Electric Resistance Welded
ESD	Emergency Shut Down
ESZ	Emergency Shut-down Zone
ETS	Electrolysis Test Station
FIMP	Facility Integrity Management Program
FM	Facility Maintenance
FPI	Future Performance Indicator
GC	Gas Chromatograph



Acronym	Meaning
GDCC	Gas Distribution Control Center
GGE	Gas Gallon Equivalents
GHG	Greenhouse Gas
GIS	Geographic Information System
GMPCP	Gas Meter Performance Control Program
GPRP	Gas Pipeline Replacement Program
GRC	General Rate Case
GRN	Gamma Ray Neutron
GSDB	Gas Storage Database
GSE	Gas Safety Excellence
GSR	Gas Service Representative
GT	Gas Transmission
GTI	Gas Technology Institute
GT&S	Gas Transmission and Storage
HAZOP	Hazard and Operability
HCA	High Consequence Area
HP	High Pressure
HP	Horsepower
HPR	High Pressure Regulator
I/O	Input/Output
I/W	Injection/Withdrawal
IA	Information Assurance
IC	Internal Corrosion
ICDA	Internal Corrosion Direct Assessment
IGIS	Integrated Gas Information System
IJ	Injection
ILI	In-Line Inspection
IM	Integrity Management
IMLAP	Internal Metal Loss Action Plan
INGAA	Interstate Natural Gas Association of America
I&R	Instrument & Regulation

Acronym	Meaning
IRV	Internal Relief Valve
KPI	Key Performance Indicator
LUAF	Lost and Unaccounted For
LNG	Liquefied Natural Gas
LOB	Line of Business
LoF	Likelihood of Failure
LP	Low Pressure
LRCV	Line Rupture Control Valve
M&C	Measurement and Control
M&O	Maintenance and Operations
MAME	Meter Asset Management and Engineering
MAOP	Maximum Allowable Operating Pressure
MASCP	Maximum Allowable Surface Casing Pressure
MAT	Major Activity Type
MCC	Motor Control Center
Mcf	Thousand cubic feet
MFL	Magnetic Flux Leakage
MMcf	Million cubic feet
MIC	Microbiologically Induced Corrosion
MIT	Mechanical Integrity Test
ML	Microlog
MMCFD	Millions of Cubic Feet per Day
MOP	Maximum Operating Pressure
MPP	Meter Protection Program
MPR	Material Problem Reporting
MSA	Meter Set Assembly
MTTF	Mean Time to Failure
MTTR	Mean Time to Repair
MTU	Meter Transmitting Units
MWC	Major Work Category
NDE	Non-Destructive Examination



Acronym	Meaning
NFPA	National Fire Protection Association
NOV	Notice of Violation
NOx	Nitrogen Oxides
OBS	Observation
OEM	Original Equipment Manufacturer
OPF	Over-Pressure Frequency
OPP	Over-Pressure Protection
OSHA	Occupational Safety and Health Administration
PAP	Public Awareness Plan
PCC	Provider Cost Center
PCM	Pipeline Current Mapper
PG&E	Pacific Gas and Electric
PHA	Process Hazard Analysis
PHMSA	Pipeline and Hazardous Materials Safety Administration
PIR	Potential Impact Radius
PLC	Programmable Logic Controller
PLM	Pipeline Maintenance
PM	Preventive Maintenance
PMC	Periodic Meter Change
PRCI	Pipeline Research Council International
PS	Portable Supply
psig	Pounds per Square Inch Gauge
PSRS	Project Status Reporting System
PSSR	Pre-Startup Safety Review
QRA	Quantitative Risk Assessment
RCC	Risk and Compliance Committee
RCV	Remote Control Valves
RIM	Records Integrity Management
RMP	Risk Management Procedure
RTU	Remote Terminal Unit
SAP	Systems, Applications, Products

Acronym	Meaning
SCADA	Supervisory Control and Data Acquisition
SCC	Stress Corrosion Cracking
SCCDA	Stress Corrosion Cracking Direct Assessment
SLA	Service Level Agreement
SMC	Statistical Meter Control
SME	Subject Matter Expert
SMYS	Specified Minimum Yield Strength
SP	Spontaneous Potential
STPR	Strength Test Pressure Report
SWD	Salt Water Disposal
SWGR	Switchgear
T&R	Transmission & Regulation
TCS	Turner Cut Station
TIMP	Transmission Integrity Management Program
TOX	Thermal Oxidizers
TPL	Tangible Property List
TSA	Transportation Security Administration
UPSV	Uphole Safety Valve
USA	Underground Service Alert
USGS	United States Geological Survey
UVIR	UltraViolet InfraRed
VAC	Volts Alternating Current
VFD	Variable Frequency Drives
VIDED	Vehicular Improvised Explosive Device
WD	Withdrawal
WELL	Well Integrity Management Program
WRO	Work Requested by Others
WSS	Whiskey Slough Station



F. Change Log

Table 18 summarizes revisions to the publication of the GP-1102: DMS Asset Management Plan.

Table 18 - Asset Management Plan Change Log

Date	Section	Change	Reason for Change	Implication of Change
2/11/15	Entire Asset Management Plan	Reformatted structure and streamlined content	Address feedback from internal and external plan stakeholders	
7/01/16	Entire document	Updated charts and tables with 2015 data	Updated with current data	
7/01/16	1.1	Removal of distribution main mileage that was reclassified as transmission mileage	PG&E is including this pipe under TIMP	
7/01/16	Appendix C	Revised Asset Family Risks	Risk scores and risk ranking updated for 2016	