

Southern California Gas Company

Natural Gas Leakage Abatement Report

In partial fulfillment of

Rulemaking (R.) 15-01-008 to Adopt Rules and Procedures Governing
Commission Regulated Natural Gas Pipelines and Facilities to Reduce
Natural Gas Leaks Consistent with Senate Bill 1371, Leno.

And In Response to Data Request
Southern California Gas Company R.15-01-008
2016 Annual Report

By: Southern California Gas Company

Date: 6/17/16

Revision Submitted: 12/09/16

Introduction

The following data¹ have been prepared to comply with Senate Bill 1371 (Leno, 2014), Section 2, Article 3, Order Instituting Rulemaking (OIR) 15-01-008, and to provide our responses to Data Requests Southern California Gas Company (SoCalGas) R.15-01-008 2016 Annual Report.

Pursuant to SB 1371, Leno - Natural gas: leakage abatement, the California Public Utilities Commission (CPUC) requests that the following information be transmitted to the CPUC and the State Air Resources Board (ARB):

- (1) A summary of changes to utility leak and emission management practices from January 1st, 2015 to December 31st, 2015. The report must include a detailed summary of changes, including the reasoning behind each change and an explanation of how each change will reduce methane leaks and emissions.

Response:

See Attachment Q1.

- (2) A list of new graded and ungraded gas leaks discovered, tracked by geographic location in a Geographic Information System (GIS) or best equivalent, by grade, component or equipment, pipe size, schedule and material, pressure, age, date discovered and annual volume of gas leaked for each, by month, from January 1st, 2015 through December 31st, 2015.

Response:

See Appendices

¹ As described in Data Request SoCalGas R15-01-008 2016 Annual Report.

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- (3) A list of graded and ungraded gas leaks repaired, tracked by geographic location in a Geographic Information System (GIS) or best equivalent, by month, from January 1st, 2015 through December 31st, 2015. Include the grade, component or equipment, pipe size, schedule and material, pressure, age, date discovered, date of repair, annual volume of gas leaked for each and the number of days from the time the leak was discovered until the date of repair.

Response:

See Appendices

- (4) A list of ALL open graded and ungraded leaks, regardless of when they were found, tracked by geographic location in a Geographic Information System (GIS) or best equivalent that are being monitored, or are scheduled to be repaired, by month, from January 1st, 2015 through December 31st, 2015. Include the grade, component or equipment, pipe size, schedule and material, pressure, age, date discovered, scheduled date of repair, and annual volume of gas leaked for each.

Response:

See Appendices

- (5) System-wide gas leak and emission rate data, along with any data and computer models used in making that calculation, for the 12 months ending December 31st, of the reporting year.

Response:

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Per the Administrative Law Judge’s (ALJ) Ruling Issuing a Staff Data Request Regarding 2016 Annual Reporting Requirements and Directing Responses by June 17, 2016 (Ruling), the system wide leak rate has been deleted.² However, the leak rate for purposes of this data request can be found in Appendix 8 on the “Total Leaks & Emissions” tab.

- (6) Calculable or estimated emissions and non-graded gas leaks, as defined in Data Request SoCalGas R.15-01-008 2016 Annual Report for the 12 months ending December 31st, 2015.

Response:

See Appendices

- (7) An annual report on measures that will be taken in the following year to reduce gas leaks and emissions to achieve the goals of SB 1371. The report must include a detailed summary of changes, including the reasoning behind each change and an explanation of how each change will reduce methane leaks and emissions.

Response:

See Attachment Q7.a and Q7.b.

² See Ruling, Attachment 1, at 2.

SoCalGas
Attachment Q1

A summary of changes to utility leak and emission management practices from January 1st, 2015 to December 31st, 2015. The report must include a detailed summary of changes, including the reasoning behind each change and an explanation of how each change will reduce methane leaks and emissions.

Emission Source	Summary of Change in Practice and Reasoning	How Does this Change Reduce Methane Leaks and Emissions?
<p>1. Customer Meters (customer side of the meter)</p>	<p>Advanced Meter Analytics authorized through the Advanced Meter Project in the Advanced Meter Infrastructure (AMI) Decision (D.) 10-04-027</p> <p>In areas where the AMI communications network is fully deployed, SoCalGas is leveraging Advanced Meter-enabled data analytics and technology by integrating data to develop algorithms that would support early leak detection and indicate premises where leaks are reoccurring at customer facilities. The Advanced Meter team assesses unusual consumption patterns on closed accounts using a Per Day Average and in some cases will look at the hourly reads to conduct further research.</p>	<p>Although this practice is still in the exploratory phase, some additional customer and safety benefits enabled by these advanced analytics include quicker detection of higher-than-usual gas usage to enable earlier investigation of possible problems, as well as improved monitoring of gas pressure throughout the gas system. Leveraging the Advanced Meter network could result in faster identification of abnormally high gas usage, which enables SoCalGas to identify, investigate, and respond to potential safety situations quicker. By discovering abnormally high gas usage and notifying customers, SoCalGas can reduce methane leaks and emissions, while also reducing the financial burden on customers from higher usage, saving energy, and improving air quality. Leveraging Advanced Meter consumption analytics is a component of a more comprehensive set of processes and inspections aimed at ensuring public safety.</p> <p><i>See SoCalGas Advanced Meter Semi-Annual Report, available at: https://www.socalgas.com/regulatory/documents/a-08-09-023/SoCalGas_Advanced_Meter_Semi_Annual_Report_FEB2016.pdf</i></p>
<p>2. Distribution Pipeline</p>	<p>Increased Annual Mileage of Distribution Leak Surveys and Special Surveys</p> <p>SoCalGas improved its ability to identify business districts which require annual leak surveys by using algorithms and outside land development data in its enterprise Geographic Information System (eGIS). This system enhancement has resulted in the increased distribution</p>	<p>With the increased frequency of surveys a spike will occur in the number of leaks found but this will decline over a few cycles as the same mileage surveyed each year gets repaired or replaced. The amount of emission reduction as a result in the increased annual survey is estimated to be approximately 4,000 Mcf per year</p>

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	<p>mileage that is surveyed annually; now approximately 36% of the 100,000+ miles of Distribution Main and Service pipelines are surveyed annually or bi-annually with the remaining 64% scheduled at 3- or 5-year intervals.</p> <p>The portion of the system scheduled for annual leak survey is a function of the type of development and activities of the population in the vicinity, such as schools, hospitals, child care centers, business, and commercial centers. These areas are independent of the pipeline materials and vintage (or age) of the piping system, providing a snapshot of system performance each year. Leakage trends from year to year are known to provide a good measure of system performance during years when there are no policy or procedure changes or other uncommon events that externally influence the trend (such as a large earthquake).</p> <p>In addition to routine leak survey activities, special leak surveys are conducted for various business reasons, such as city street improvements projects, areas with unusual leakage trends, areas in the vicinity of a recent earthquake, etc.</p>	
<p>3. Transmission Compressor Stations and Storage</p>	<p>Compressor Knowledge Community</p> <p>In 2015, SoCalGas started a Compressor Station Community that helps share best maintenance practices and other knowledge transfer ideas. Through this</p>	<p>This effort is difficult to quantify an emission reduction but will support the efficient and optimal operation of the equipment that ultimately results in emission reductions.</p>

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Attachment Q1

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Emission Source	Summary of Change in Practice and Reasoning	How Does this Change Reduce Methane Leaks and Emissions?
Facilities	community, SoCalGas fosters open dialogue between Engineering, Transmission and Storage to share ideas and opportunities for areas of improvement.	

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Emission Source	Summary of Change in Practice and Reasoning	How Does this Change Reduce Methane Leaks and Emissions?
<p>4. All Emission Sources</p>	<p>SoCalGas has funded research to develop or assess Mobile Leak Quantification technologies in projects with Picarro, Washington State University, Colorado State University, and PSI/Heath through NYSEARCH research and development (R&D) collaborative projects. Investing in the latest studies supports improved quantification and emission reduction efforts in the long term.</p>	<p>As stated in previous comments, the ability to quickly quantify the size of a potential leak would be helpful to identify the “super-emitters” that statistically make up 50% of the methane emissions from leaks on the buried pipeline portion of the systems. Unfortunately, the ability to quickly derive the flux rate of known system leaks through the use of algorithms, models, and various novel techniques of measuring methane concentrations in air plus various other variables has yet to be validated in actual field conditions.</p> <p>In all of these studies the results have demonstrated that, while the technologies hold promise they are still being developed. Cost-effectiveness still needs to be determined for specific applications.</p> <p>These technologies will likely be useful initially for niche applications to assess emissions from certain types of facilities, such as Storage Fields, Transmission Compressor Stations, Pressure Limiting Stations and Measurement & Regulation facilities.</p> <p>Leakage flux rate estimates still have too much variation to be useful for estimating all leaks from the Distribution piping system. The target application should be to identify large leaks for prioritization of leak repair in order to reduce methane emissions.</p>
<p>5. Compressor Engines</p>	<p>Voluntary EPA Gas STAR Rod Packing Replacement to reduce methane leakage from rod packings</p> <p>SoCalGas has replaced compressor rod packings at its Storage Facilities and Transmission Compressor Stations</p>	<p>This practice continued in 2015 with the replacement of 29 rod packings across SoCalGas’ compressor stations for a total methane reduction of 25,085 Mcf (26,405 Mcf natural gas).</p>

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	since the early 1990s due to its voluntary participation in the EPA Natural Gas STAR program. The company adopted this voluntary best practice in order to improve gas savings from its transmission and storage operations. Replacing worn rod packings is a critical part of equipment maintenance with routine replacement based on satisfactory performance. The added benefit of timely replacement also accomplishes the environmental objective of achieving methane emission reductions.	

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6. Compressor Stations	<p>Voluntary Simulated Emergency Shutdown (ESD) to avoid release of methane from preparedness for ESD systems</p> <p>SoCalGas documents gas savings from ESD activities on an annual basis. These methane emissions savings are voluntarily reported annually to the EPA as part of its Natural Gas STAR program. The simulation allows the compressor station to prepare its system for an emergency blowdown event without having to actually blow a large volume of gas to the atmosphere. Estimates of gas savings are accomplished by conducting engineering calculations given requirement size and gas composition.</p>	<p>This prevention of gas being released to the atmosphere in 2015 accounted for a methane savings of 3,460 Mcf (3,832 Mcf natural gas) at SoCalGas' compressor stations.</p>
7. Transmission Pipelines	<p>Lower pipeline pressure before venting lines to atmosphere to reduce potential for methane release</p> <p>SoCalGas Transmission Pipelines routinely require maintenance and/or repair to maintain system integrity and safety. Maintenance activities on high pressure pipelines are inherently dangerous due to the high pressure gas in the line. The gas must be evacuated from the pipelines to a safe level in advance of any repair work to be completed. As a best practice in 2015, SoCalGas lowered the pipeline pressure where feasible to reduce to potential volume of gas that could be blown to atmosphere, and thus reduce methane emissions to the atmosphere.</p>	<p>During 2015, this practice led to methane emissions savings of 37,777 Mcf (39,965 Mcf natural gas) in SoCalGas territory.</p>
8. Distribution	<p>Replacement of Distribution Mains & Services to avoid methane release due to leaking Mains and Services</p>	<p>In 2015, the emissions savings (Mcf Natural Gas) from all removed, abandoned and replaced non-state of the art distribution pipe is 1379</p>

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Pipelines	SoCalGas targeted to replace or abandon 175 miles of non-state of the art main and service pipe that includes all work categories.	Mcf. This includes 688 Mcf natural gas from 190 miles of mains and services from an accelerated pipe replacement program as well as installation of 148 miles of new pipe.

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An annual report on measures that will be taken in the following year to reduce gas leaks and emissions to achieve the goals of SB 1371. The report must include a detailed summary of changes, including the reasoning behind each change and an explanation of how each change will reduce methane leaks and emissions.

Emission Source	Description of Leak Management Practice	Synergistic with Safety or IM?	Incremental Funding Needed?	Anticipated Timeframe to Implement	Estimated Emissions Reduction Benefit (Mcf to be avoided) and Estimated Direct Costs To Implement (capital and O&M costs)	Reasoning Behind Strategy
SoCalGas' Top Three Strategies to Pursue Starting in 2016						
1. Various sources (e.g. Customer Meters and Meter and Regulator (M&R) stations etc.)	Refinement of Emission Factors (EFs) through Research and Development (R&D) studies to improve quantification of leaks and emissions. Facility EFs are currently being used for Customer Meter Set Assemblies, Direct Sale Meter Sets, T-D Regulator Stations, and Farm Taps. There are currently no EFs for some other pipeline facilities such as Pressure Limiting	Yes	Yes. SoCalGas needs incremental funding to support any studies or any further research that CPUC/CARB wants to pursue in lieu of accepting updated factors recently adopted by the Environmental Protection Agency (EPA) for their mandatory greenhouse gas reporting program.	2016-2017	Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.	Many of the required EFs used for this annual report are not based on the latest science that was recently accepted by EPA in their updates to the federal inventory. As a result, the emissions from last year compared to greenhouse gas reports under state and federal mandatory reporting will not be an apples-to-apples comparison. Also, the currently required Annual Facility EFs do not provide a means for the System Operator to demonstrate emissions reduction. Leak surveys are routinely conducted at all facilities, and system maintenance and repair activities address the majority of system leaks (i.e. Above Ground (AG)-Non-Hazardous- Minor leak category). Often the maintenance activities conducted

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	Stations, Producer Receipt Points, In-Line Transmission Valves, and Launcher/Receiver facilities. Investing in studies for EFs will improve quantification efforts and identify the leakiest components for targeting for reduction opportunities.		Once the scope and framework for these projects are determined by CPUC/CARB, appropriate funding can be determined.			<p>to eliminate the emissions are quick fixes (such as lubricating valves, tightening bolts and fittings, adjusting equipment). As a result, current policies do not require minor leak repairs to be documented due to the administrative burden.</p> <p>If the goal is to capture all minor leak information from each component, then developing component leak rates to replace annual facility-based factors will better support emissions reduction accounting because it will be estimating emissions based on actual leak data and component counts. Identifying the most leak-prone components will also improve system knowledge and may provide opportunity for component redesigns to improve emission performance. Improved estimates of methane emissions</p>

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						<p>will help provide a more realistic assessment on magnitude of emission source for prioritizing resources.</p> <p>In addition, SoCalGas is willing to participate with CARB in state-wide studies to measure emissions from these types of facilities and develop component-level EFs. These factors will facilitate emission estimates from actual leak data that is currently available, and identify any additional data that will need to be collected to support this approach. Changes in data collection requirements will require changes to certain procedures, forms, and enterprise systems to manage the new information and data collection effort. Once understood cost estimates can be provided and funding will be needed to fund the necessary system</p>

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						changes and any incremental labor to collect, QC, monitor, and report the data.
2. Distribution Pipeline Leaks	Reduction of Non-Hazardous Leak Inventory	Yes	SoCalGas is currently awaiting a final decision in its Test Year 2016 General Rate Case [A.14-11-004]. The CPUC will approve, deny, or modify a portfolio of settlements reached on the Test Year revenue requirement, post-	The current anticipated timeframe, which is likewise subject to the factors described in the left-hand column, is approximately a three-year	Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.	Reduce emissions by mitigating non-hazardous leaks sooner.

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			<p>test year mechanism, and several terms and conditions, which will provide the basis of an operating budget to perform the work forecasted and contemplated in the GRC.</p> <p>Leak detection and repair is an ongoing and dynamic process, and the expectation is to perform those activities to the best of our ability and with the resources</p>	<p>period from the date the GRC decision is finalized and Test Year rates are implemented , to undertake an aggressive leak repair program that strives to reduce and manage the dynamic leak backlog, in furtherance</p>		

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			<p>authorized during the GRC cycle (2016-2018).</p> <p>The need for incremental funding will depend on a number of factors, such as changing operational needs; new laws, rules or regulatory requirements; need for flexibility to devote resources to areas demanding increasing priority; and the emergence of unforeseen circumstances.</p>	<p>of our operational focus of providing safe and reliable service to customers.</p>		

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			<p>This is combined with the ability of SoCalGas to seek incremental funding through available regulatory avenues.</p> <p>If the CPUC adopts the submitted GRC settlements without modification, one of the settlements discusses the New Environmental Regulatory Balancing Account (NERBA), a 2-way balancing account, as one such regulatory avenue.</p>			

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			Per the Settlement Agreement reached with Environmental Defense Fund, "To the extent costs associated with compliance with SB 1371 exceed the forecasted costs for Leak Detection and Repair (LDAR) during the GRC cycle, . . . , Parties support, and will seek any additional regulatory authority to clarify that the recovery of those costs is permissible using			

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			the adopted NERBA for the duration of the GRC cycle.			
3. Distribution and Transmission Pipeline damages	Excavation Damage Prevention Effective March 30, 2016, SoCalGas committed to participate in the EPA Methane Challenge Program and implement the options for the Excavation Damages Best Management Practice	Yes	Yes. Incremental funding is needed that should be tracked and recorded in SoCalGas' NERBA by authorizing in the SB 1371 OIR Phase 1 Decision.	2016-ongoing	Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.	Although SoCalGas currently conducts damage prevention programs that address the nine damage prevention elements found within the PIPES Act listed in legislation, Title 49 U.S.C. (United States Code) §60134(b), more can be done to reduce this emission source. Reduction of damages to the system can support public safety, integrity of the system as well as environmental methane reduction goals. Annual damages per 1,000 Underground Service Alert (USA) tickets (also known as the damage rate) are tracked,

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	(BMP). SoCalGas is also implementing the Gold Shovel program.					which is the industry metric. During 2015, the SoCalGas damage rate was 3.75. In addition to excavation damage prevention, SoCalGas also promotes other damage prevention measures such as protection of gas facilities from outside force damage, monitoring of certain third party excavation activities and proactive monitoring of Company facilities.
Other Strategies SoCalGas is Pursuing						
4. Distribution Pipelines	Mobile Methane Mapping Assessment of Methane Emissions from Pipelines	Yes	No, funded via RD&D and DIMP.	2016-2017	Estimated emissions reduction benefit	This practice supports methane reduction as well as the DIMP. As beta-test models of mobile leak quantification technologies

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	<p>Identified by Distribution Integrity Management Program (DIMP) for Replacement Prioritization.</p> <p>SoCalGas plans to evaluate the feasibility of using existing mobile methane mapping technologies to model atmospheric methane levels in the vicinity of pipeline Main segments or Services identified through the DIMP risk model for replacement</p>				<p>and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.</p>	<p>become available these areas may also provide good locations for field trials.</p> <p>This information will be evaluated against known system leaks in the area and then compared against atmospheric methane levels after replacement of the targeted pipelines to compare the emissions before and after replacement and observe the emissions reduction.</p> <p>In addition, the confirmation of any additional leakage prior to pipeline replacement through this work would result in a change of segment leak history and would affect the risk profiles of the segments. This additional information may also result in a re-prioritizing of some segments scheduled for replacement, thereby</p>

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						reducing emissions.
5. Transmission and Storage Compressors	<p>Increase Compressor Rod Packing replacements every 26,000 hours of engine operation</p> <p>(Since implementing this practice requires the shutdown of compressors, reliability concerns may override and impact targeted goals for the year)</p>	No	<p>Yes. Incremental funding is needed for the increase in rod packing replacements. Costs can be tracked and recorded in SoCalGas' NERBA by authorizing in the SB 1371 OIR Phase 1 Decision. Any on-going and recurring costs would be rolled into future General Rate Case filings.</p>	2016-ongoing	<p>Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.</p>	<p>Increasing the frequency of rod packing replacements reduces methane emissions that may occur due to worn or damaged rod packings that allow excessive amounts of natural gas to escape while compressors are in operation. SoCalGas operates a combination of 10 Transmission Compressor Stations and 4 Underground Storage Facilities in California over 4 different local Air Districts. These units are used to either to compress gas along the pipeline or store natural gas for anticipated peak demand seasons. Though some of these facilities utilize centrifugal compressors, the vast majority of the compression is handled by</p>

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						<p>reciprocating internal combustion engines (RICE). SoCalGas has voluntarily replaced compressor rod packing units as part of its commitment to the EPA Natural Gas STAR program since 1994. Over that period of time, approximately <u>488,000 Mcf</u> of methane emissions have been reduced from rod packing replacements alone.</p>

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6. High Bleed Pneumatics	<p>Reduce Methane Emissions by Replacing High Bleed Pneumatic Devices with Technology that Vents less Natural Gas</p> <p>Pneumatic devices use the energy stored in compressed natural gas to operate actuators and control devices with the need for an external power source. These devices have been used in the gas industry for decades and legacy equipment can be cost effectively</p>	No	No. Funded via GRC Capital Replacement.	2016-2017	Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.	<p>Previous projects have replaced most high-bleed pneumatic devices installed in the system. Through research conducted for SB-1371 data gathering for system reporting of all types of Natural Gas facilities a possible 32 locations were found that indicate a high-bleed pneumatic devices may still exist.</p> <p>This project will require a field site visits to each location to review the facility design and condition and confirm the devices qualify as high bleed pneumatics. Once verified a replacement project will be initiated and the component will be replaced with a device that qualifies as no-bleed, low bleed or intermittent bleed.</p>

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An annual report on measures that will be taken in the following year to reduce gas leaks and emissions to achieve the goals of SB 1371. The report must include a detailed summary of changes, including the reasoning behind each change and an explanation of how each change will reduce methane leaks and emissions.

Emission Source	Description of Leak Management Practice	Synergistic with Safety or IM?	Incremental Funding Needed?	Anticipated Timeframe to Implement	Estimated Emissions Reduction Benefit (Mcf to be avoided) and Estimated Direct Costs To Implement (capital and O&M costs)	Reasoning Behind Strategy
	replaced with newer, lower emitting models at a relatively low cost. Often the savings from the cost of the gas lost over the service life of the asset can be used to demonstrate a positive cost-benefit in replacing this type of equipment.					
7. Transmission Pipeline Blowdowns	Improve data collection of activities that support emission reduction. Implement efforts to examine current practices in order to identify how forms can be	Yes	Depending on the solution, this may be part of an IT capital project to electronically capture data needed for reporting and other	2016-2019	Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC	SoCalGas acknowledges that there is limited information available on blowdown activities. In order to identify key constraints and institute effective blowdown strategies, it is necessary to evaluate current practices and improve data collection practices, and employee training.

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	streamlined to electronically capture the data to improve the ability to quickly calculate and record emission reductions New data collection practices and tools will require associated training that can be implemented to improve on collection and documentation practices.		analytics. Since the intent of the evaluation is to put more rigor into the process, SoCalGas may require additional resources which are not accounted for in the GRC. If incremental funding is needed, it should be tracked and recorded in SoCalGas' NERBA by authorizing in the SB 1371 OIR Phase 1 Decision.		cost-effectiveness methodology.	

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8. Transmission and Distribution Pipelines - Leak Survey	Adopt technologies that will allow the electronic tracking of verified gas leaks and show the routes surveyed by SoCalGas' qualified technicians.	Yes	No, funding for replacing equipment and training is pending GRC decision and current pilot is under RD&D.	In 2016, finish pilot and in 2017, begin training and replacing equipment.	Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.	This will allow replacement of paper Leakage Survey Maps with electronic GPS "Bread-Crumb" records. Future system capability will also facilitate integrating methane readings from the leak detection instruments. The first step in the process is to purchase and deploy leak detection equipment that is Bluetooth enabled so that leak levels can be recorded via software placed on a smart device and matched with the GPS location. The Bluetooth enabled leak detection equipment is currently being rolled out at SoCalGas.
9. Storage Wells	SoCalGas is implementing an expanded Storage Integrity Management Program ("SIMP" and	Yes	On May 19, 2016, a Proposed Decision was issue A.14-11-004 that proposes approval of the	2016-consistent with GRC filing	Estimated emissions reduction benefit and estimated direct costs should	Prior to SIMP, most major O&M and capital funded activities conducted on storage wells were typically reactive-type work, in response to corrosion or other problems identified through routine pressure

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Emission Source	Description of Leak Management Practice	Synergistic with Safety or IM?	Incremental Funding Needed?	Anticipated Timeframe to Implement	Estimated Emissions Reduction Benefit (Mcf to be avoided) and Estimated Direct Costs To Implement (capital and O&M costs)	Reasoning Behind Strategy
	<p>“Program”) to proactively identify and mitigate potential storage well safety and/or integrity issues in addition to SoCalGas’ existing maintenance and prevention program.</p> <p>Storage Operations, as they exist today, focus on safety, integrity and effective operations of the natural gas storage system. Storage provides a reliable and economic supply of natural gas to</p>		<p>SIMP and two way refundable balancing account treatments for the SIMP. If approved by the California Public Utilities Commission, the SIMP would extend for 6-years at an estimated cost of approximately \$30 million per year. After the six-year baseline assessment period of the SIMP, it is expected that well assessments performed on a regular frequency</p>		<p>be re-calculated according to adopted CPUC cost-effectiveness methodology.</p>	<p>surveillance and temperature surveys.</p> <p>The SIMP proactively inspects the wells within the Storage Fields with state of the art technology prior to leaks or integrity issues being detected. Detailed baseline assessments on the wells and associated surface facilities will be complete, verifiable, and traceable to a much greater degree than it has done in the past. This risk management approach will enhance the proactive assessment, management, planning, repair, and replacement of below-ground facilities to eliminate situations that could potentially expose the public or employees to uncontrolled well-related situations.</p> <p>SIMP, as proposed, will include the</p>

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Emission Source	Description of Leak Management Practice	Synergistic with Safety or IM?	Incremental Funding Needed?	Anticipated Timeframe to Implement	Estimated Emissions Reduction Benefit (Mcf to be avoided) and Estimated Direct Costs To Implement (capital and O&M costs)	Reasoning Behind Strategy
	customers throughout our service territory while achieving compliance with operating and environmental regulations. The proposed SIMP program goes above and beyond our existing protective operation using state-of-the-art inspection technologies to address well integrity issues.		would become part of routine operations.			expanded use of contract workover rigs to evaluate downhole casing and tubing conditions. Surface equipment such as valves, wellheads, and well laterals will also be evaluated using enhanced methods.

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Emission Source	Description of Leak Management Practice	Synergistic with Safety or IM?	Incremental Funding Needed?	Anticipated Timeframe to Implement	Estimated Emissions Reduction Benefit (Mcf to be avoided) and Estimated Direct Costs To Implement (capital and O&M costs)	Reasoning Behind Strategy
10. Distribution Pipelines	Post-Construction Leakage Survey	Yes	No. Funded through DIMP.	2016	Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.	<p>New pipeline construction projects in residential areas are scheduled for leakage survey every 5 years. Leaks can occur on newly constructed pipelines due to construction or material defects, and if the leak is small it may not be detected by odor until the first scheduled routine leak survey 5 years later.</p> <p>Detection of such leaks earlier in the life cycle of a pipeline is advantageous for many reasons, in addition to emissions reduction. The knowledge gained can lead to better inform decisions; for example it may lead to the identification of a defective material, pipeline component, or installer error that could exist elsewhere in the system. This initiative will support construction quality objectives by providing more timely</p>

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Emission Source	Description of Leak Management Practice	Synergistic with Safety or IM?	Incremental Funding Needed?	Anticipated Timeframe to Implement	Estimated Emissions Reduction Benefit (Mcf to be avoided) and Estimated Direct Costs To Implement (capital and O&M costs)	Reasoning Behind Strategy
						<p>feedback to construction personnel and potentially identify where additional training may be needed to help identify and prevent systemic construction problems. This practice may also improve cost recovery of construction defects from contractors.</p> <ul style="list-style-type: none"> • 2015 miles of Main installed and scheduled for 5 year leak survey: <ul style="list-style-type: none"> ○ SCG: 94mi = \$17,400 <p>(Note: Leak Survey \$35/1k ft)</p>

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Emission Source	Description of Leak Management Practice	Synergistic with Safety or IM?	Incremental Funding Needed?	Anticipated Timeframe to Implement	Estimated Emissions Reduction Benefit (Mcf to be avoided) and Estimated Direct Costs To Implement (capital and O&M costs)	Reasoning Behind Strategy
11. Distribution and Transmission Pipeline Leaks	<p>Synergies with Pipeline Safety Enhancement Plan (PSEP) Technology Plan</p> <p>Methane Sensors Linked to Advanced Meter Network- Recently, both Utilities have requested funding under the Utilities’ PSEP Technology plan, to install approximately 200 methane sensors that link to the Advanced Meter network. Theses sensors support early warning of a leak for schools, hospitals or hard to evacuate</p>	Yes	<p>Yes. If funding is supported, SoCalGas proposes as a best practice to further expand this methane sensing network beyond the PSEP proposal to support early warning of a leak and identification of potential “super-emitters.” SoCalGas currently is pursuing research to dramatically decrease the cost of the methane sensors that can link to the advance</p>	<p>Depends on funding. If installed costs are dramatically reduced, this potentially can increase implementation on system-wide.</p>	<p>Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.</p>	<p>To support the PSEP and if expansion funded under SB1371, support system-wide natural gas early leak detection and reduction.</p>

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Emission Source	Description of Leak Management Practice	Synergistic with Safety or IM?	Incremental Funding Needed?	Anticipated Timeframe to Implement	Estimated Emissions Reduction Benefit (Mcf to be avoided) and Estimated Direct Costs To Implement (capital and O&M costs)	Reasoning Behind Strategy
	<p>facilities (e.g. nursing homes). So far the Utilities have installed about a dozen in each Utility to pilot the sensors and ensure integration with the network, back office systems and associated processes. If this program is funded, the Utilities would like to expand the program beyond pilot, install the full 200 methane sensors in the original plan and go beyond this as a best practice under SB1371.</p>		<p>meter network. If the methane sensor technology cost can be greatly reduced along with the detection levels, this will enable larger scale implementation beyond the PSEP proposal.</p>			

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Emission Source	Description of Leak Management Practice	Synergistic with Safety or IM?	Incremental Funding Needed?	Anticipated Timeframe to Implement	Estimated Emissions Reduction Benefit (Mcf to be avoided) and Estimated Direct Costs To Implement (capital and O&M costs)	Reasoning Behind Strategy
	<p>Both Utilities recommended under their PSEP Technology Plan to begin installing fiber optics above high pressure lines that can sense leaks and potential encroachments near the pipeline. SoCalGas just installed as a pilot and for training a fiber optic line in their Situation Training facility at Pico Rivera. To further this effort, the Utilities changed their</p>					

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	procedures to require any pipeline projects 12" or greater in diameter for a mile or longer to install a fiber optic sensing line.					
12. Various	Conduct various research projects to advance the science and tools available to detect and quickly quantify leaks.	Y	No, currently being funded under RD&D.	2016-2018 (depending on research success – some may move into commercialization by	Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness	Supports improved leak detection to find leak earlier and potential means to quickly quantify emissions to target resources to optimally reduce natural gas emissions. Methane Emissions Detection: Pipeline Research Council International (PRCI)/JPL fast accurate low detection level portable handheld instrument Leak Detection Device, Leak Survey Tracking, Small Unmanned

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				2017).	methodology.	<p>Aerial Systems (sUAS) Technology Assessment, JPL Aerial Leak Survey System, Multi-Technology Aerial Leak Survey</p> <p>Field Measurement of Leak Flow Rate: Develop an inexpensive and repeatable device that can provide a course measurement of the gas leakage rate in the field while investigating leaks on distribution piping. Utilities will use this information to prioritize the repair of non-hazardous leaks by their leak rates and can also use this information in prioritizing segments for main replacement programs.</p>

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13. Distribution Pipelines	Leverage eGIS to enhanced prioritization and optimization of non-state-of-the-art pipeline replacement programs by identifying leak clusters.	Yes	No, DIMP funded	2016	Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.	Leveraging eGIS to more efficiently address the leakiest portions of the system increases the effectiveness of modernization programs and supports greater natural gas reductions.

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Alternative Best Practices Considered

Accelerated Leak Survey from 5 to 3 Years

Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.

Distribution Mobile Leak Quantification)

Leakage flux rate estimates using mobile leak quantification techniques still have too much variation to be cost effective for estimating emissions from the Distribution piping system. The target application should be to measure only known large leaks or emission sources for prioritization of efforts to reduce methane emissions.

- Mobile Leak Quantification Systems are not yet commercially available.
- The ability to quickly derive the flux rate of known system leaks through the use algorithms, models, and various novel techniques of measuring methane concentrations in air (plus various other variables) has yet to be successfully validated in actual field conditions.
- Under controlled conditions, varying degrees of success in measure leakage flux rates have been achieved that show these techniques are feasible within a limited scope of application and provided enough data is gathered. However, these technologies are still being refined and need to be proven to be cost effective over currently available options using commercially available equipment.
- SoCalGas has funded research to develop or assess Mobile Leak Quantification technologies in projects with Picarro*, EDF**, Washington State University, Colorado State University, and PSI/Heath through NYSEARCH research and development (R&D) collaborative projects.
 - In all of these projects, the results have demonstrated that while the technologies hold promise, they are still being developed, and cost-effectiveness still needs to be determined for specific applications (such as measuring emissions from Pressure Limiting Stations and Measurement & Regulation facilities).

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Alternative Best Practices Considered

The following is the “Statement of Result of NYSEARCH/Picarro M2014-003 Project”:

NYSEARCH Collaborative project with PICARRO (Funder Group 12/18/15): The project verified technical feasibility of quantifying near-ground methane emissions utilizing a prototype mobile flux-plane technology (developed by Picarro) in a variety of release simulations. Simulations included field measurements of known discharges of methane from point and distributed sources under controlled conditions. System performance was tested on leakage flow rates in the range of 4–42scfh. The study included tests in varying wind conditions from 2–11 mph and considered barriers and obstacles that are encountered in typical application environments (representing parked vehicles and low walls etc.).

Using a designed protocol, accuracy was achieved to within a nominal methane emissions ratio of 1.10 meaning that the average leak rate measured by the system was within 10% of the actual leak rate across the entire dataset. The precision of the nominal methane emissions ratios, when applying a 1 sigma standard deviation (67% confidence interval), ranged from 0.65 to 1.56, and when applying a 2 sigma standard deviation (95% confidence interval) ranged from 0.42 to 2.42.

In summary, this research & development project also provided an opportunity to demonstrate practical application of prototype emissions quantification technology. This technology has application in quantifying methane emissions within the range of confidence intervals established in similar applications. For future applications, the site specific conditions and associated critical variables would need to be evaluated to achieve accurate measurements consistent with this study.

The following summarizes the findings of the collaboration with EDF and Colorado State University (CSU) to conduct mobile methane mapping of 4 cities within the SoCalGas service territory, which included leak quantification by CSU for each location:

SoCalGas has collaborated with EDF and Colorado State University (CSU) to conduct mobile methane mapping of 4 cities within the SoCalGas service territory, which included leak quantification by CSU for each location. In the collaboration with EDF and Colorado State University (CSU) to conduct mobile methane mapping, the effort included leak quantification for each location where CSU thought a leak existed, and slotted the emission into “Low,” “Medium,” and “High” flux rate categories, with defined ranges of 0+ to 13, 13 to 85, and over 85 CFH (Note: these estimates were derived by proprietary CSU algorithms). In one instance where CSU estimated the leak flux rate to be in the “High” category, EDF contacted SoCalGas and said it was the largest leak they had ever seen and estimate the flux rate to be on the order of 800 cubic feet per hour. SoCalGas located the leak and determined it was from a mechanical fitting. The fitting and section of piping was extracted without disturbing the leaking connection for laboratory testing to determine the root cause of the leak and measure the flow

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Alternative Best Practices Considered

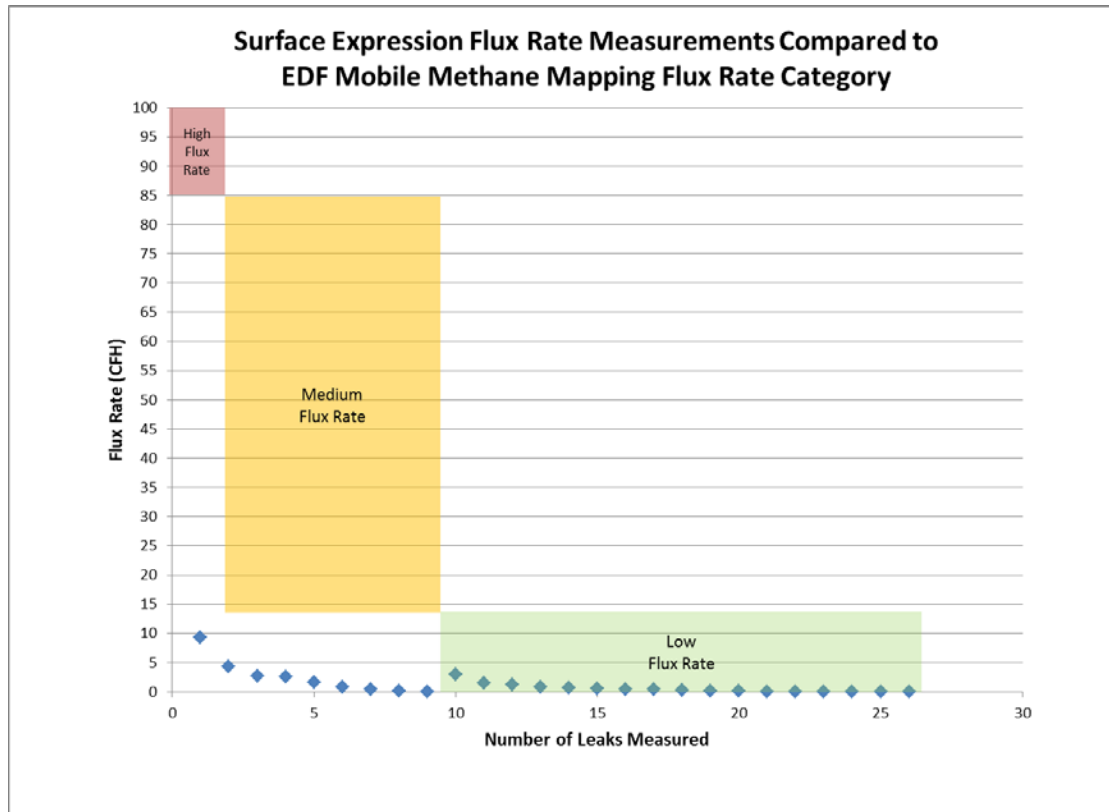
rate. Laboratory testing determined the leak to be from a displaced saddle o-ring on a mechanical tapping tee. The flow testing was by direct measurement and yielded a flow rate of 153 cubic feet per hour.

After this finding, SoCalGas contracted with Conestoga-Rovers & Associates (CRA-now GHD Services) to perform surface expression measurements on a sampling of EDF locations where SoCalGas confirmed the emissions were from a buried system leak.

When compared to the actual leak rates determined by using the same technique as in the study with EDF and Washington State University (WSU) for assessing methane emissions from the distribution sector, there was a very poor correlation to the emissions size buckets by EDF/CSU. If the CSU estimates were to be used to estimate the emissions from the system, the resulting emissions would be over 13 times greater than the results from the direct measurements (assuming EDF were to use the middle of the CSU category range to calculate the Low and Medium categories and 85 CFH for the High category) and applied to the original total number of leaks. When corrected for the actual number of confirmed system leaks found after investigation by SoCalGas, that overstatement of the methane emissions estimate increases significantly to more than 21 times the methane emissions than obtained by the direct surface expression measurement method.

The shaded area of the chart below shows the range of the High/Medium/Low categories and the diamonds are the results of surface expression measurement of confirmed leaks from buried pipelines within these categories.

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Alternative Best Practices Considered



The chart shows that all the leak rates were actually in the Low bucket, but the mapping study erroneously indicated one was in EDF/CSU’s High bucket and eight in their Medium bucket. In the peer reviewed study by WSU on Distribution system leakage recently published by Dr. Lamb, the results suggest 98% of all system leaks should statistically land in the Low Flux Rate category as defined by CSU. For the SoCalGas system, based on this valuable work, this model seems to be holding true. Direct measurement of buried leaks on the distribution system is not a cost-effective activity since by doing nothing we can assume 98% of the system leaks are in the Low category (as defined by CSU). Current efforts are being conducted by SoCalGas on developing a means of identifying the very few large leaks that occasionally develop. SoCalGas recommends the technologies being developed to quantify leaks be targeted in scope for the quantification of leaks or emission sources that fall into the large emission category. Hence, at this point the technology and practice should not be implemented.

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Alternative Best Practices Considered

Mobile Methane Mapping for Leak Survey

SoCalGas started evaluating a mobile methane mapping technology in January 2012 as a research, development, and demonstration project. After conducting two studies (in-house and NYSEARCH collaboration projects), it was concluded that the mobile methane mapping technology and approach studied could not be used to replace the current technologies and approaches used to conduct leak survey of Distribution Mains and Services. Subsequent experience gained with another system resulted in similar results. While mobile methane mapping technologies may be useful in other applications, they cannot replace the current leak survey technologies and approaches used in an urban environment for the following reasons:

- The systems provide a general estimate of where a methane emission source might be located in proximity to the vehicle location.
 - Many methane emissions from activities of the general population are transient or short-lived in nature. The systems cannot effectively differentiate piping system gas from other sources of methane emissions.* 40-50% of the methane indications obtained from this technology ends up being from sources other than utility-owned facilities.
*Note: sources such as sewer gas, leaks on customer-owned facilities, and emissions from equipment starts, vehicles, abandoned wells, and naturally occurring methane.
 - The systems cannot pin-point leak locations, or provide an assessment of probable source of the methane indications
- The systems do not provide the information necessary for assessing public safety and to grade system leaks, such as:
 - Determining whether the leak is on an above ground facility, or a below ground leak indication, or from yard piping owned by the customer.
 - Whether methane readings exist inside enclosures that could provide a source of ignition, such as electrical boxes on structures or enclosures and vaults owned by other utilities.
- The systems cannot provide the information needed to assess the likelihood of leak migration into structures in order to grade below ground leak indications, such as:
 - The spread and ground level concentrations of the methane readings;
 - The proximity of the spread to buildings and structures; and
 - The type and extent of paving.
- The systems cannot assess for abnormal operating conditions, such as:
 - Construction that violates safe operation of the Meter Set Assembly and other company-owned facilities;

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Alternative Best Practices Considered

- Proximity of system components designed to provide over-pressure protection to sources of ignition;
- Unsafe alterations on visible customer piping;
- Signs of tempering and theft;
- Damage to above ground facilities and pipeline coatings; and
- Exposed buried piping.
- The systems measure in parts per billion and hand-held technologies have not been commercially available (some are in development or just entering the market) to trace the methane readings from the vehicle to the source of the emissions.
 - For most system leaks that are very small, since it is impossible to validate this relationship, leaks can be missed.
 - The area of coverage (Field of View) from the vehicle is highly variable and often extends a long way from the vehicle location, sometimes blocks away. There is no practical way to validate the area coverage claimed by the system developers. Even if it is valid, such area coverage is a drawback for leak survey applications because of the variability of the system and impracticality of investigating the given area for leaks without performing a walking survey of all facilities.

For these reasons, walking surveys must be conducted in addition to the use of this technology; therefore, any benefit gained from this technology must be considered incremental to existing leak survey practices.

Estimated emissions reduction benefit and estimated direct costs should be re-calculated according to adopted CPUC cost-effectiveness methodology.