

# PG&E Gas Curb Valve Box Leak Analysis

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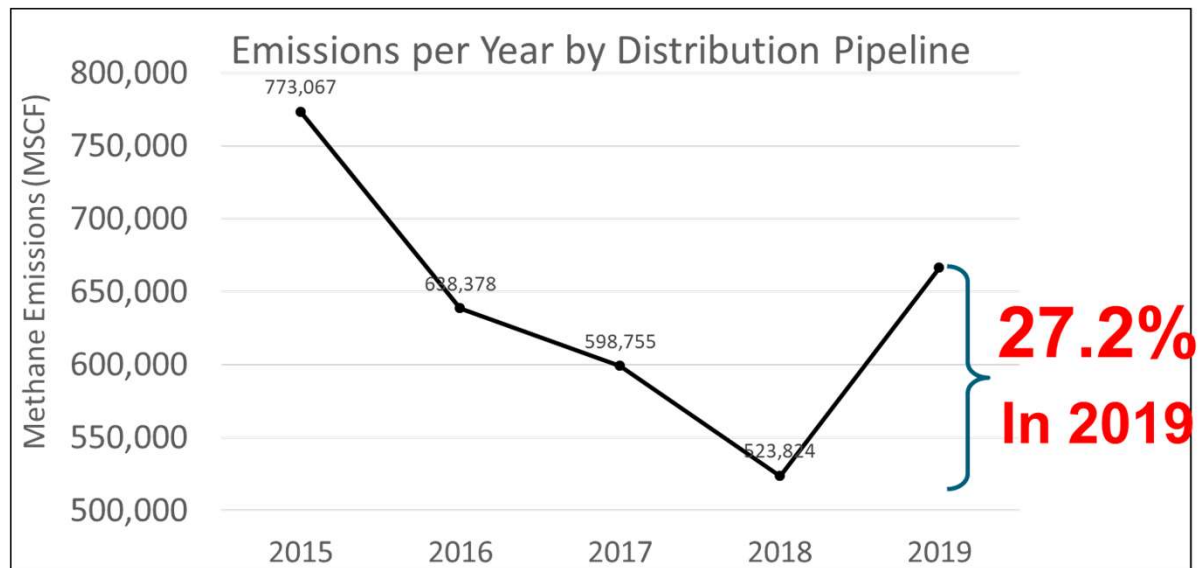


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# Background

- 2019 saw an increase in methane emissions from PG&E distribution pipelines
- The 27.2% increase in methane emissions raised questions
- Overall trend for yearly emissions indicated that 2019 would further reduce methane emissions
- PG&E R&D and Innovation team investigated the increase in distribution emissions



# Ghost Leaks





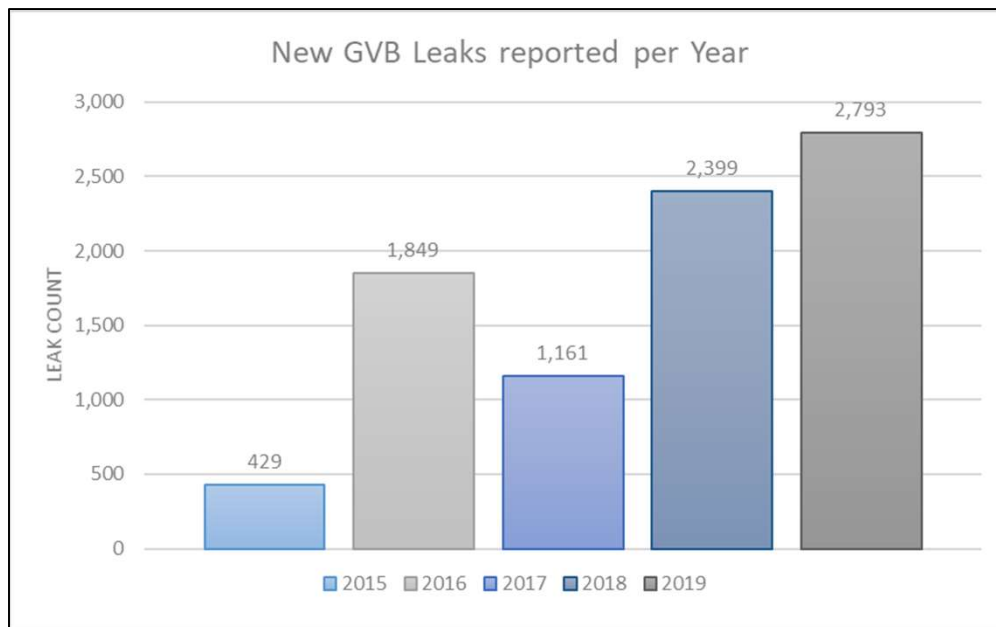
# Ghost Leaks

- Discovered through traditional leak survey not predicted by Picarro/RBS Model
- Typically found in a substructure (Ex: Gas valve box)
- Small concentration (Ex: <1,000 ppm or .1% gas)
- With low concentrations, we evaluated how ghost leaks would appear between survey years
- Between 2015-2019, a select number of BG distribution leaks would be opened and closed through out the 5-year leak survey window



# PG&E Gas Curb Valve Boxes

- Of the ghost leaks found between 2015-2019, there were a sizeable number of leaks reported at PG&E gas curb valve boxes (GVB)
- Leaks reported at GVBs were low in concentration (<0.1% gas) and were reported as a grade 3
- The distribution of the leaks is reported below:



Row Labels	Count of Division
San Francisco	2128
East Bay	158
Peninsula	98
Sacramento	93
Kern	52
San Jose	52
Fresno	38
Yosemite	36
Mission	32
Diablo	16
De Anza	15
Central Coast	14
North Valley	14
Sierra	14
Stockton	12
Sonoma	10
North Bay	8
Humboldt	3
<b>Grand Total</b>	<b>2793</b>



## PG&E Gas Curb Valve Boxes cont.

- In 2019, **13,000 new distribution pipeline** leaks were reported, **2,800** of those leaks were reported at GVBs
  - GVB leaks make up approximately **21%** of the total distribution pipeline leak count
- The Picarro/RBS model did not predict these leaks, so understanding why these leaks appeared was a challenge
- However, considering that the majority of GVB leaks reported a gas concentration less than 0.1%, then the emissions should be minor.
- We conducted field testing on GVB leaks reported in annually surveyed plats to improve our understanding



# GVB Emission Analysis

- PG&E R&D took initiative in analyzing the GVB ghost leaks
  - 1st step was to determine the emission rate of leaks reported at the GVB
  - 2nd step was to understand why gas accumulates in the curb valve boxes
- In October of 2020, we conducted field testing to evaluate emission rates at reported GVB leaks in the San Francisco service territory
  - Measured GVB leaks over various ranges of reported concentration data
- Evaluated the emissions at GVBs over a two-day period in order to understand how gas accumulates in the box
- Utilized DP-IR, Hi-Flow Sampler, and OPLS RKI





# October Field Testing Key Findings

- We evaluated **31** leaks reported at GVBs
- With the lid closed, we measured the surface concentration and AG emission rates using the DP-IR, RKI, and Hi-Flow Sampler
- We then opened the lid, allowed the box to vent for 30 seconds, and then recorded the gas concentration and BG flow rate
- The measured gas concentration during field testing was much less than the what was originally reported by leak survey
- GVBs with a measured surface gas concentration less than **1000 ppm**, produced an **AG emission rate** between  **$10^{-2}$  -  $10^{-4}$  SCFH**
- GVBs with a measured surface concentration less than **1000 ppm**, produced a **BG leak rate** between  **$10^{-2}$  -  $10^{-5}$  SCFH**
- The surface concentration recorded with the RKI showed considerable change between test dates, where the recorded gas concentration was **lower in Day 2**





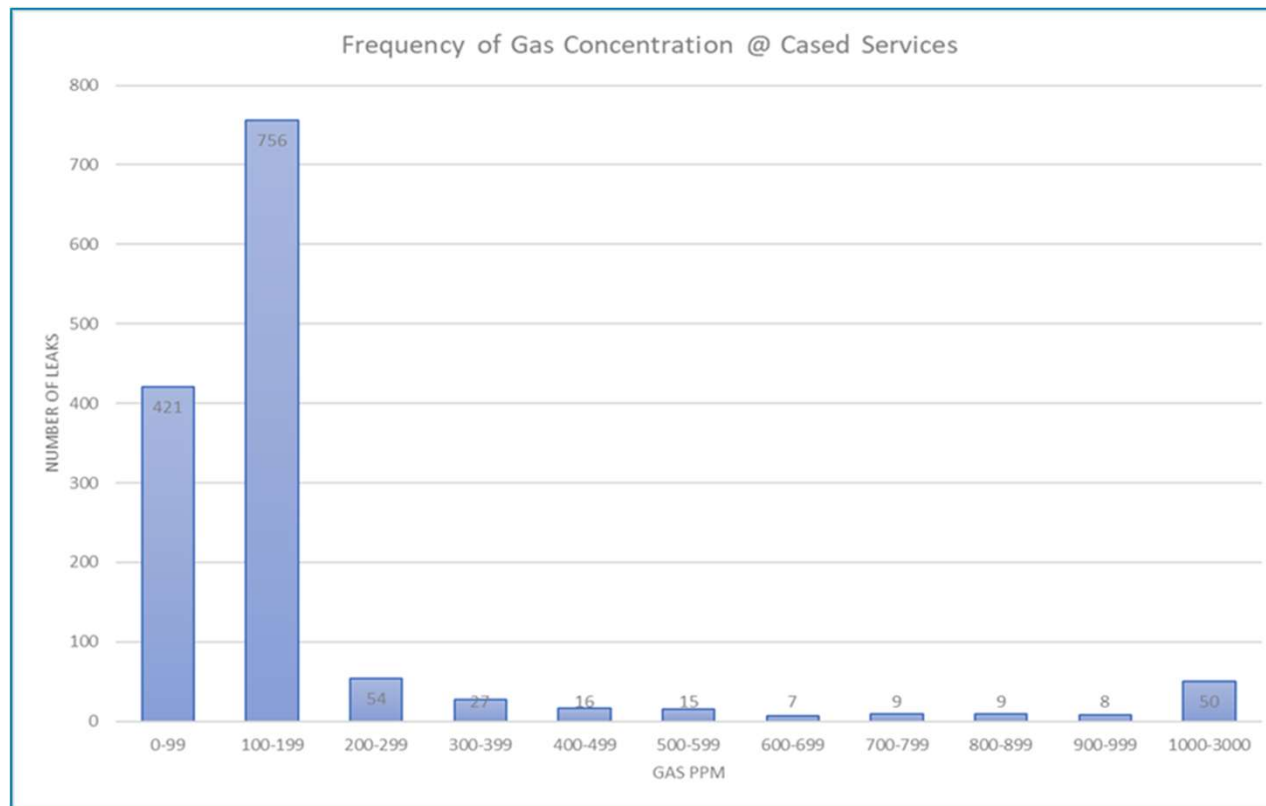
# Service Line Analysis

- The testing demonstrated that the AG emission rates are very low, thus the GVB may not have a leak
- During the testing, we noticed that most of the GVB leaks evaluated were connected to a **service line in a casing**.
- The majority of San Francisco services line are installed via insertion using the old line as a casing to facilitate construction
- With San Francisco reporting both the greatest number GVB leaks and most service lines in casings, there may be a connection between the two construction types
- We analyzed the GVB corresponding service line installation type by pulling data from **GD GIS**
- A service line is in a casing if the **installation method** pulled from GIS is listed via **Insertion**



## Service Line Analysis Cont.

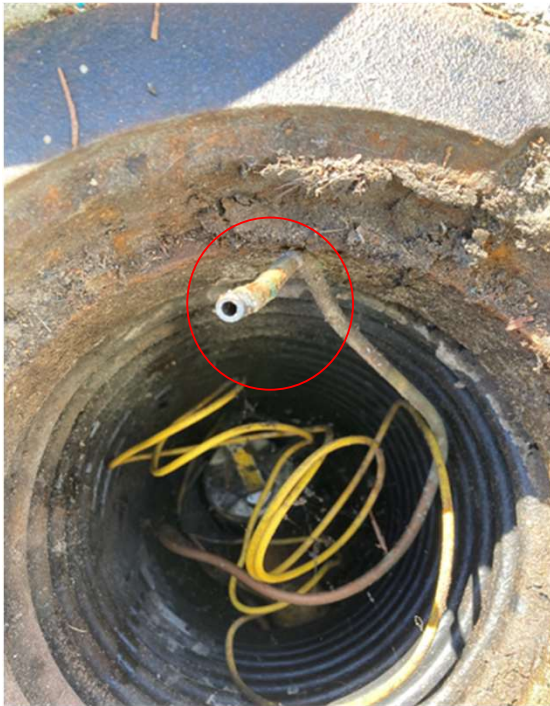
- Submitted **1700** GVB leaks to GIS, **1400** were connected to an incased service line
- Depicted below is the number of leaks at a GVB with an incased service line versus the reported gas concentration





# A.90 Standard

- There appeared to be a correlation between reported low concentration leaks at a GVB having a corresponding service installed in a casing
- A potential source for gas to accumulate in the curve valve box could be a **copper tubing** that **vents methane** from the **service casing** per the **A.90 Standard**



## Plastic Main and Service Installation

A-90

3. Use 1/4" copper tubing (Code 012037) or stainless steel tubing as the vent pipe. The vent pipe shall be inserted approximately 6" into the annulus between the casing pipe and plastic pipe. The tubing may be slightly ovalled to fit into the annulus. Care must be used to avoid restricting the carrying capacity of the tubing. Insulate the tubing from the steel casing by wrapping the tubing with tape. Drill a 3/8" hole into the plastic extension of the curb valve box and insert tubing with slight goose neck to prevent dirt from clogging the vent.

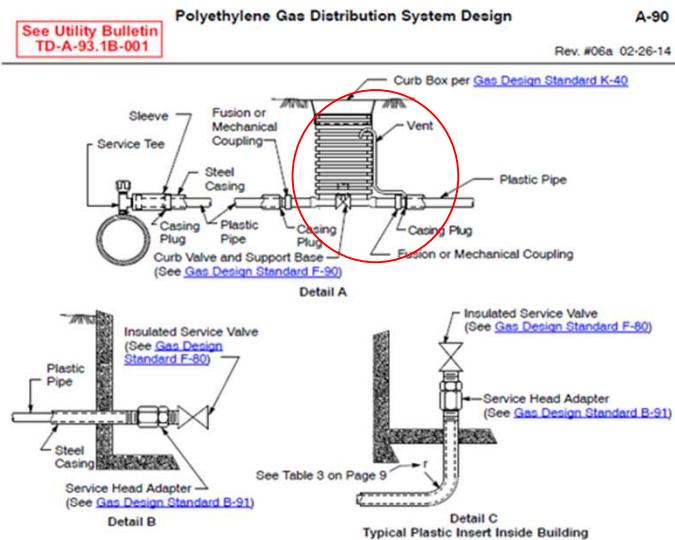
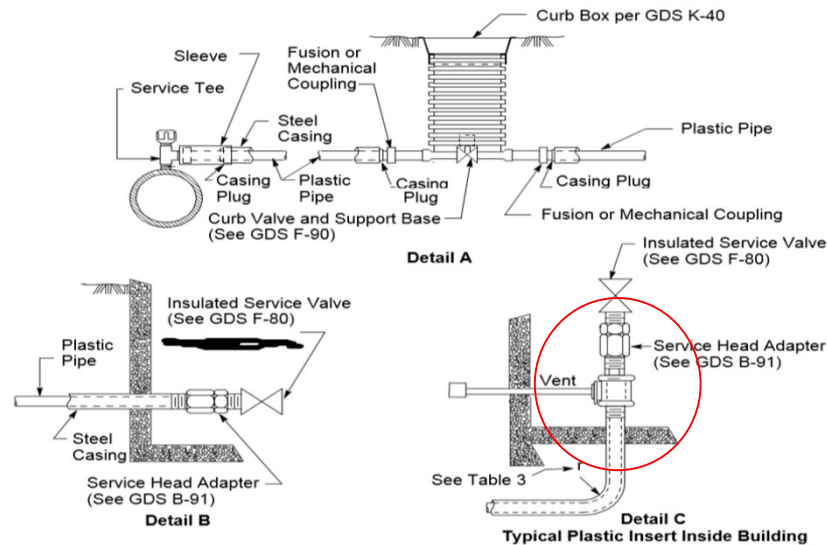


Figure 7  
Typical Plastic Insert Into Basement or Meter Box

# A.90 Standard cont.

- The A.90 standard allows for **gas to vent from the service casing into the valve box**, however in **2018** the standard was changed and demanded that service casing vent gas at the **service head adapter**
- The A.90 standard was in effect between **1973-2017**; based on that window we calculated the number of GVB boxes that had service casing installed per the original A.90 standard
- Of the **1400 GVBs** with **an incased service line**, **1370** were installed per the original standard



*New A.90 standard where the vent from the casing is to be installed at the service head adapter and no longer at the GVB*



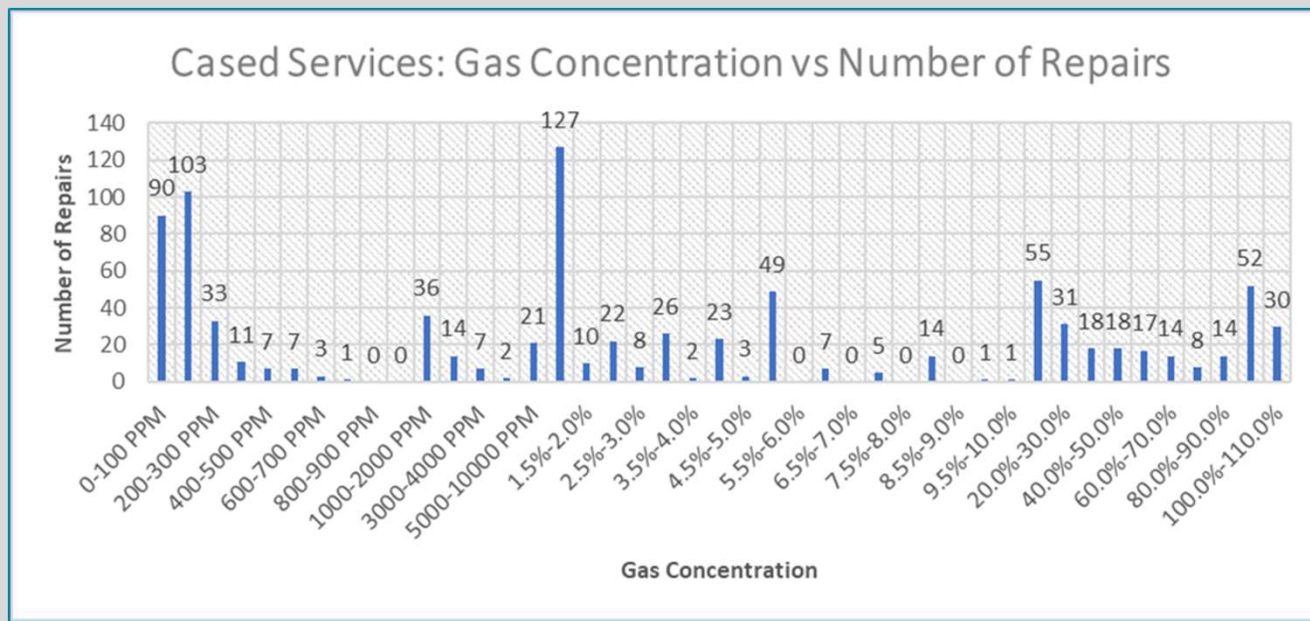
# Construction Analysis

- The hardest part of this analysis was to pinpoint the leak source at the gas valve box. While leak survey marks the GVB at the source, where is the gas coming from? The potential sources are listed below:
  1. Gas Curb Valve Leak
  2. Leak from the service line or main
  3. Gas migration from service casing that travels out the venting tube
  4. Gas diffusing through the soil
- R&D interviewed PG&E M&C to understand what kind of repairs are completed on leaks reported at GVBs
- M&C procedure involves determining the leak source by measuring gas migration at the valve, service line and main line
- If there is no gas migration at those point sources, they look to see if there is an issue with the riser
- M&C stated that most of their repairs at GVB leaks involve working with the service riser rather than the components related to the valve box



# Construction Analysis cont.

- Based on the interview with M&C, we evaluated service construction data for GVB leak repairs between **2015-2019**
- The construction data did not list service installation type, thus we needed to filter the data to determine if the repair was completed at a service with a vent casing:
  - **IF** the year of the service installation was between **1973-2017**, the service material is **plastic** AND the service is **<= 1.5” diameter**, **THEN** the service was assumed to be incased with a vent
- **1400 total repairs** were evaluated, **900** of the repairs had an **incased service line**





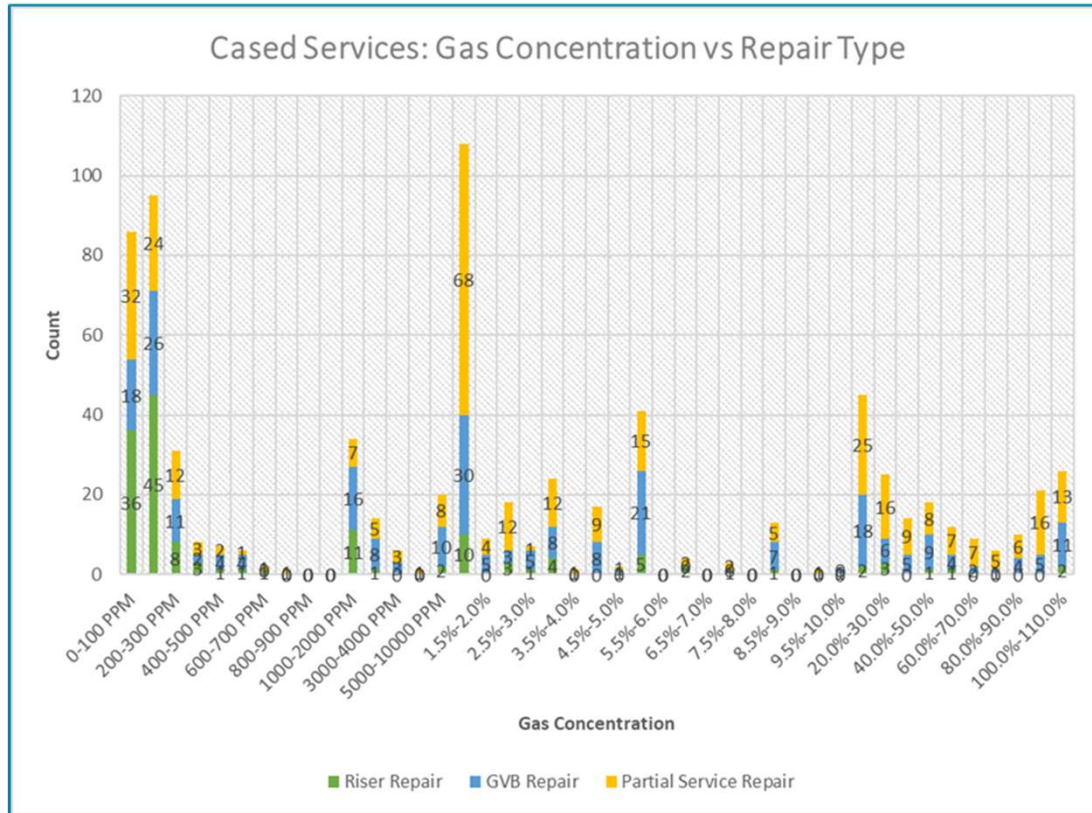
# Construction Type Analysis

- Diving further into the analysis, we evaluated the type of repairs completed at these concentration levels
  - Filtered the construction information by looking at the remarks left by construction crews
- If the remark had the criteria listed below in containing those keywords, they were assigned to that repair in the count

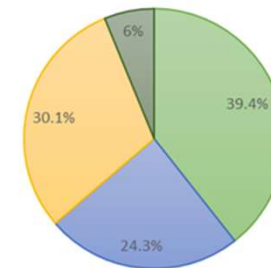
Types of Repairs listed		
Partial Service	Riser Repair	GVB Repair
Replaced Partial Service	Insert Riser Kit	Repair GVB
Deactivate Partial Service	Riser Cut down	Curve valve repair
Install Partial service	Service Head Adapter	Valve Repair
-	Powell Kit	Tighten Valve



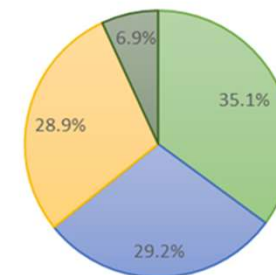
# Construction Type Analysis cont.



Repairs (cased) 0 - 300 PPM

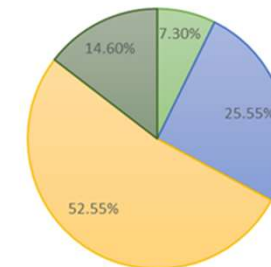


Repairs (Cased) 0 - 3000 ppm



- Riser
- GVB
- Partial Service
- Other

Repairs (cased) 0.5 - 1.5 % Gas

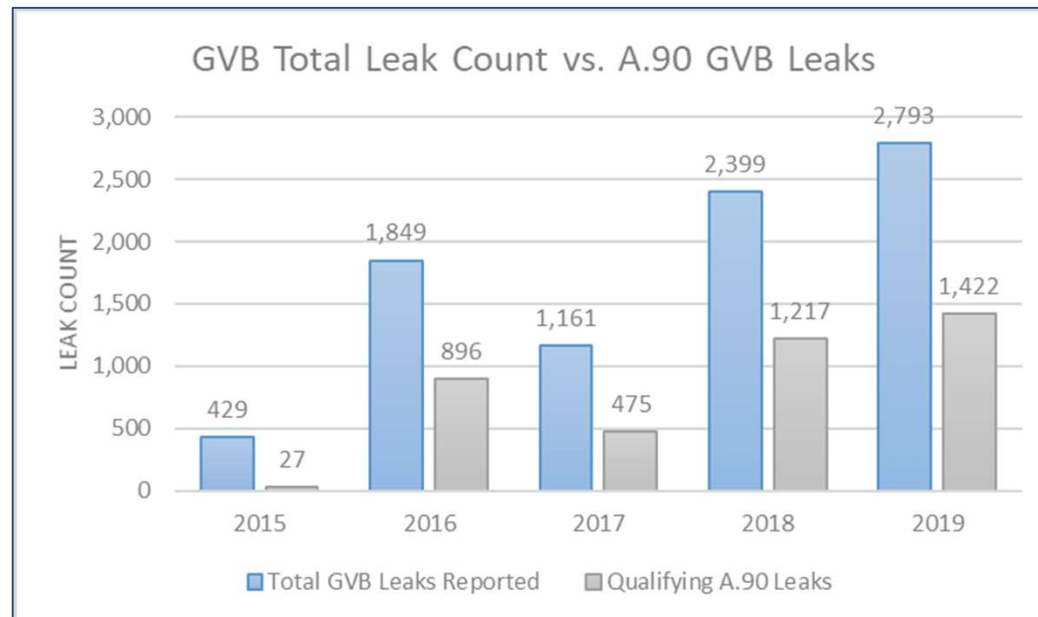






# Final Criteria

- Based on the construction data, we developed the following criteria:
- **IF** a leak is reported at a GVB:
  - **AND** has a reported gas concentration **less than 3000 PPM**
  - **AND** was installed to an **incased service line**
  - **AND** was installed between **1973-2017**, thus following the original **A.90 Standard**
  - **THEN** the curve valve box **does not have a leak** as the leak reading is **gas accumulating** from the **vent demanded by the original standard**
- Counted the number of GVB leaks that fit that criteria using the LS and GIS data





# Adjusted Leak Count & Emissions

- PG&E can confidently remove **1,420** new GVB leaks from the **2019 leak survey year**
- Considering that the number of leaks removed counts only **new known leaks**, we must account for the unknown leak portion that falls under the same A.90 standard
- The *number of known leaks is equal to the number of unknown leaks*, thus the total new leak population to be removed in 2019 is: **1,420 x 2 = 2,840**
- The 2019 emissions calculations count backlogged leaks as part of the total leak count, summing the known GVB leaks that are **unrepaired** in 2019 from 2015-2018 produces **2,600 backlogged** leaks that fall under the A.90 standard
- Using the emission factor of **1.29 SCFH**, the emission reduction is calculated below:

Year	New Leaks	New Unknown Leaks	Backlog	Total Leaks	Emission Reduction (MSCF)
2019	1,422	1,422	2,615	5,459	61,689



# Total Emission Reduction & Application

- Removing the number of known GVB leaks changes the overall methane emissions from distribution pipelines in 2019:

Year	Distribution Emissions (MSCF)	Reduction using GVB Removal (MSCF)	Final Emissions (MSCF)	% Reduced
2019	666,304	61,689	604,615	9.26%

- We are approaching the GVB removal analysis conservatively, we believe that the entire GVB leak population should be removed
- We are planning to introduce this study to LS and to update their standards
  - Potentially having LS open the box before recording gas concentration
- We are working with OTD (7.21.h) in developing a methodology to detect leaks and estimate leak rate of utility boxes, applying the GVB analysis will help facilitate the projects understanding on targeting utility box leaks
- We plan on deploying new leak survey technology that increases the accuracy of leak detection
  - The OPLS RKI will evaluate leaks differently and will produce concentration readings that are connected to the emission rate of the component

# Thank you!

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