

Lessons learned from the first year of the Super Emitter Program

François Rongere

Natural Gas STAR & Methane Challenge Workshop
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Together, Building
a Better California

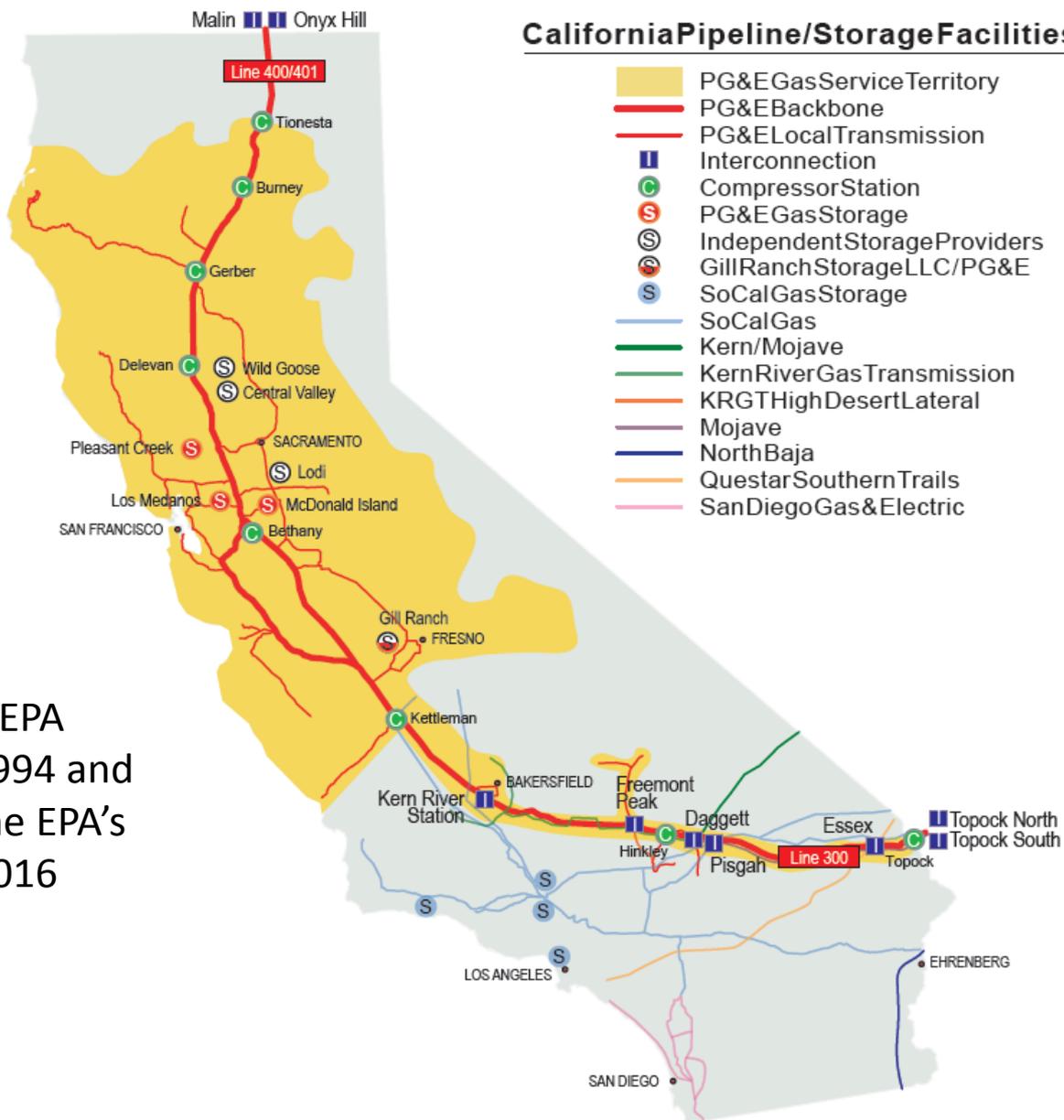


PG&E System

Key Statistics

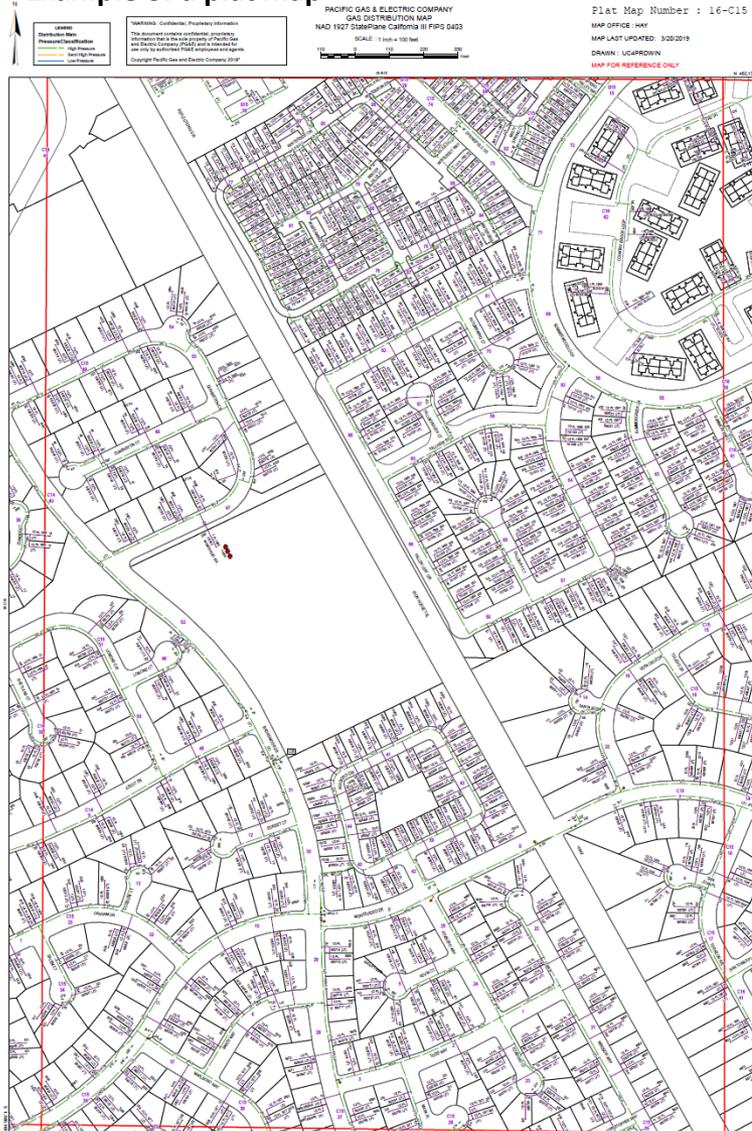
- 6,600 miles of gas transmission pipeline
- 42,800 miles of gas distribution main
- 4.3 million natural gas customer accounts.
- Throughput of 839 BCF in 2018

PG&E has been a member of the EPA Natural Gas Star program since 1994 and became a founding member of the EPA's Methane Challenge Program in 2016

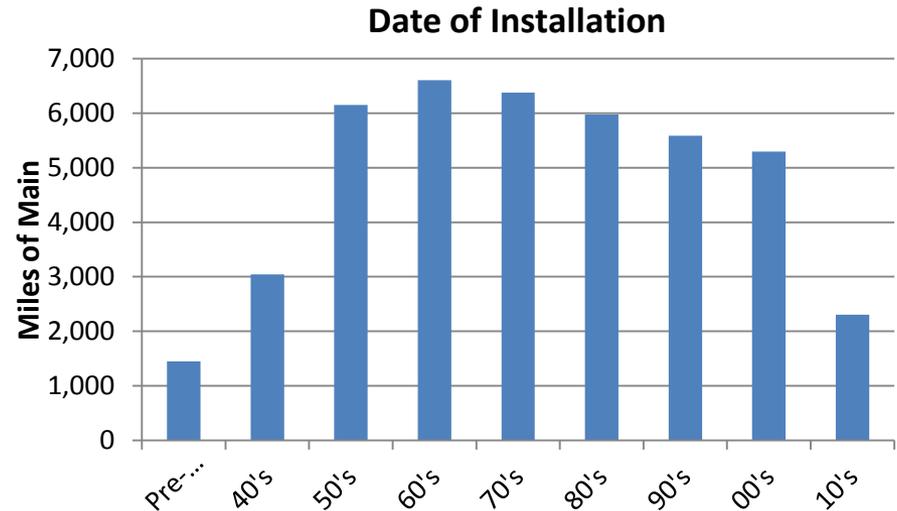


The Distribution System at PG&E

Example of a plat map

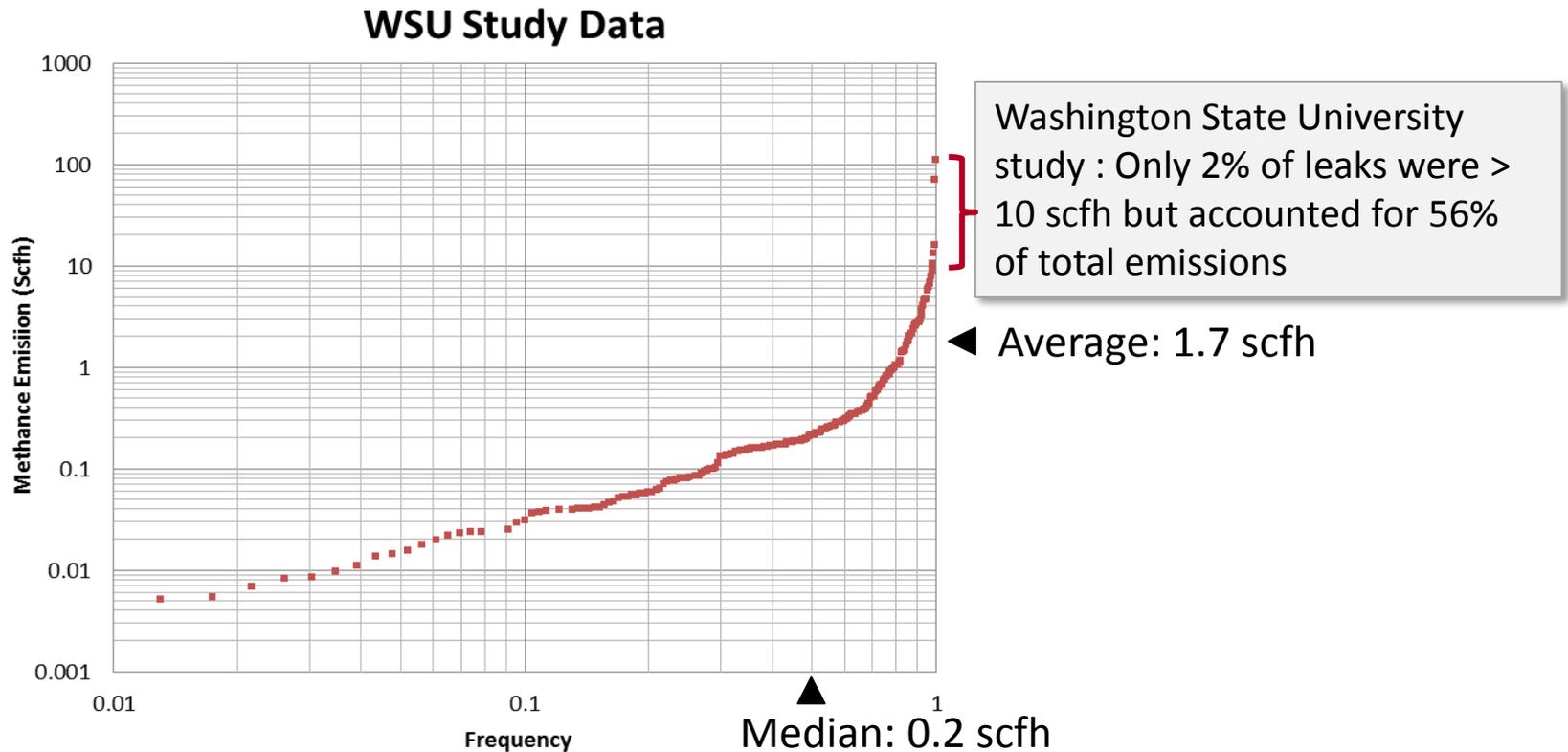


Material	Main (Miles)	Services (Miles)
Plastic	22,926	22,543
Steel	18,077	10,881
Copper	-	6



The concept of Super Emitters

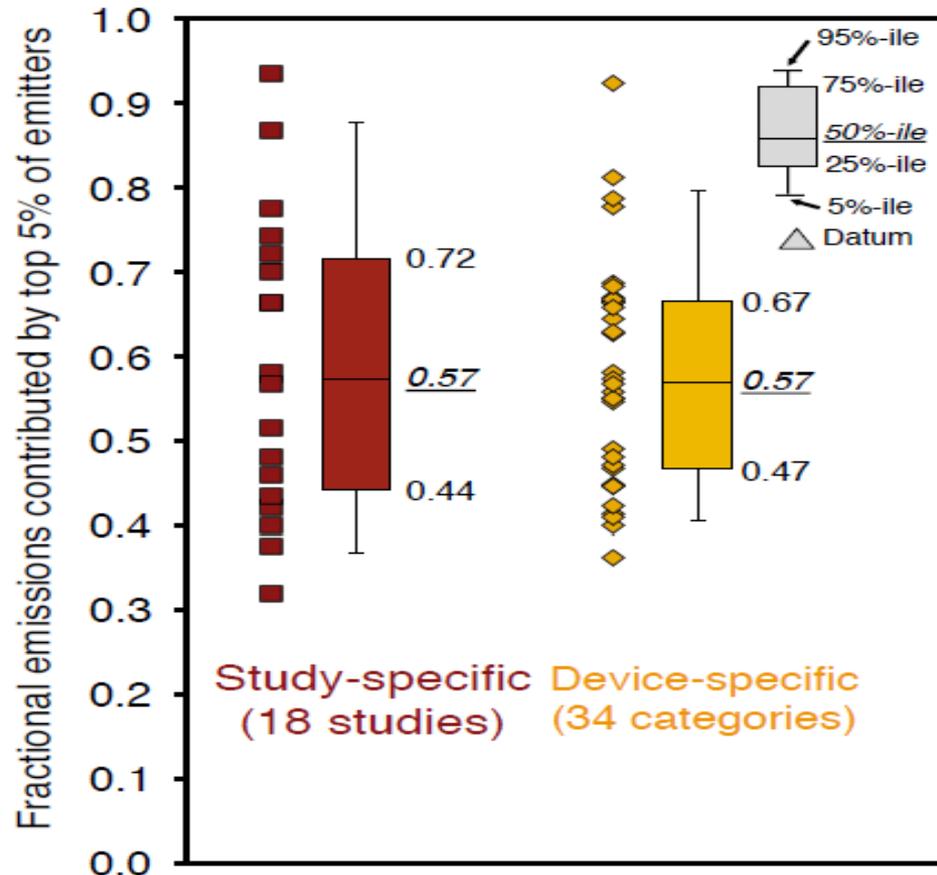
- Methane emissions in distribution systems are driven by a small number of larger leaks named Super Emitters.



- Opportunity for substantially reducing methane emissions by accelerating detection and repair of the larger leaks.

Super Emitters beyond Distribution Systems

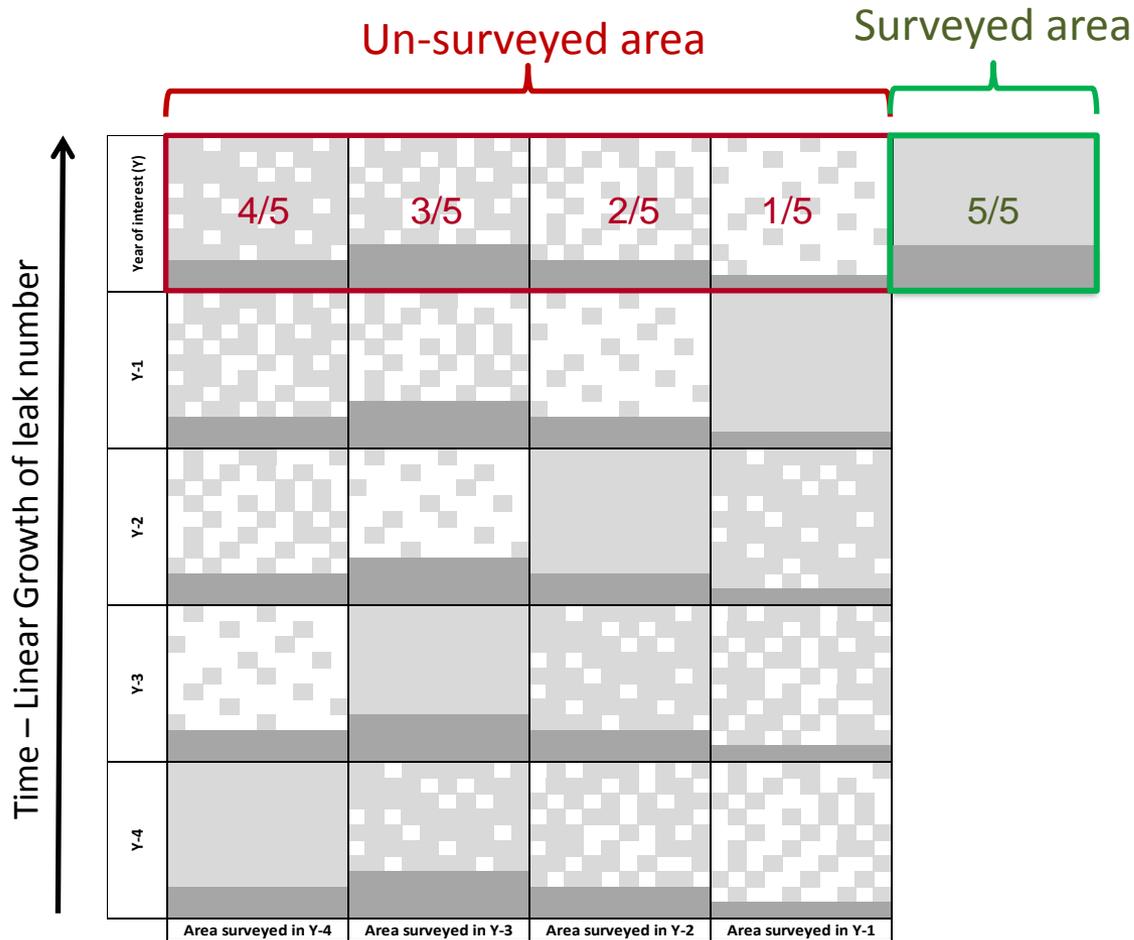
- A. Brandt et al. have observed that for a broad range of assets and devices, the contribution of top 5% of emitters account for more than 50% of emissions.





Compliance surveys

- For compliance, gas distribution systems must be surveyed every five years. In that case more than 2/3 of emissions are due to non-surveyed areas.



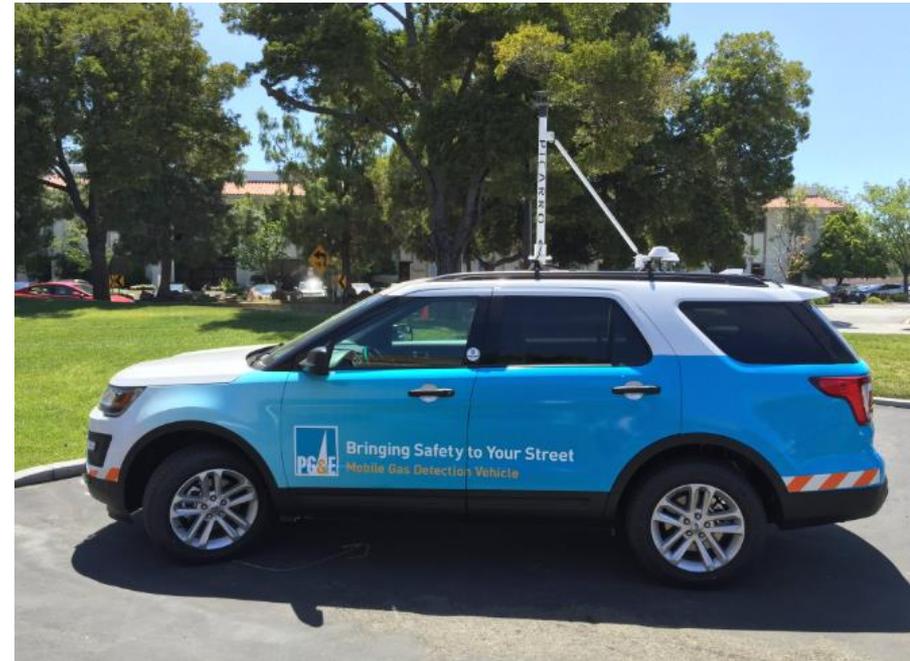
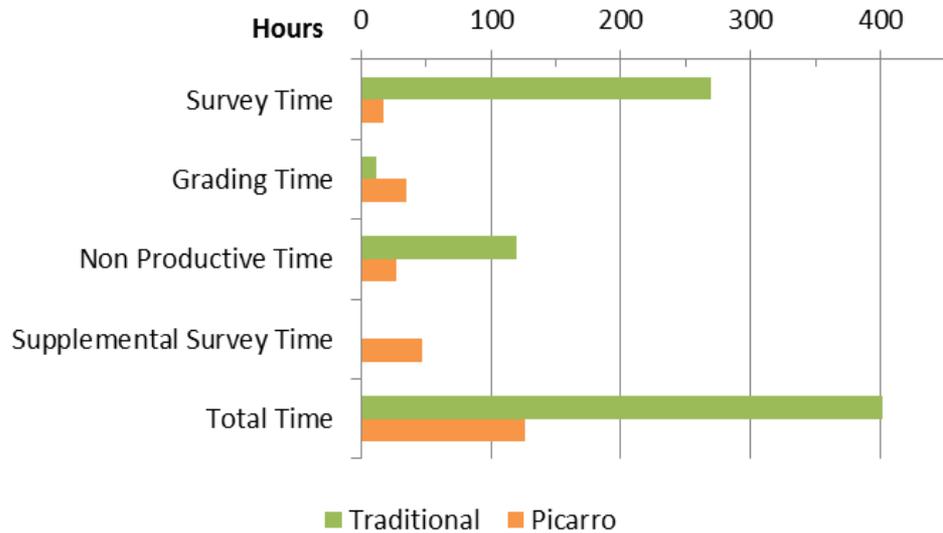
- Detecting and repairing large leaks faster is very effective to reduce emissions



Mobile Leak Detection System

- PG&E introduced Picarro's mobile detection system for its compliance survey in 2014

Normalized time for 100 Leaks



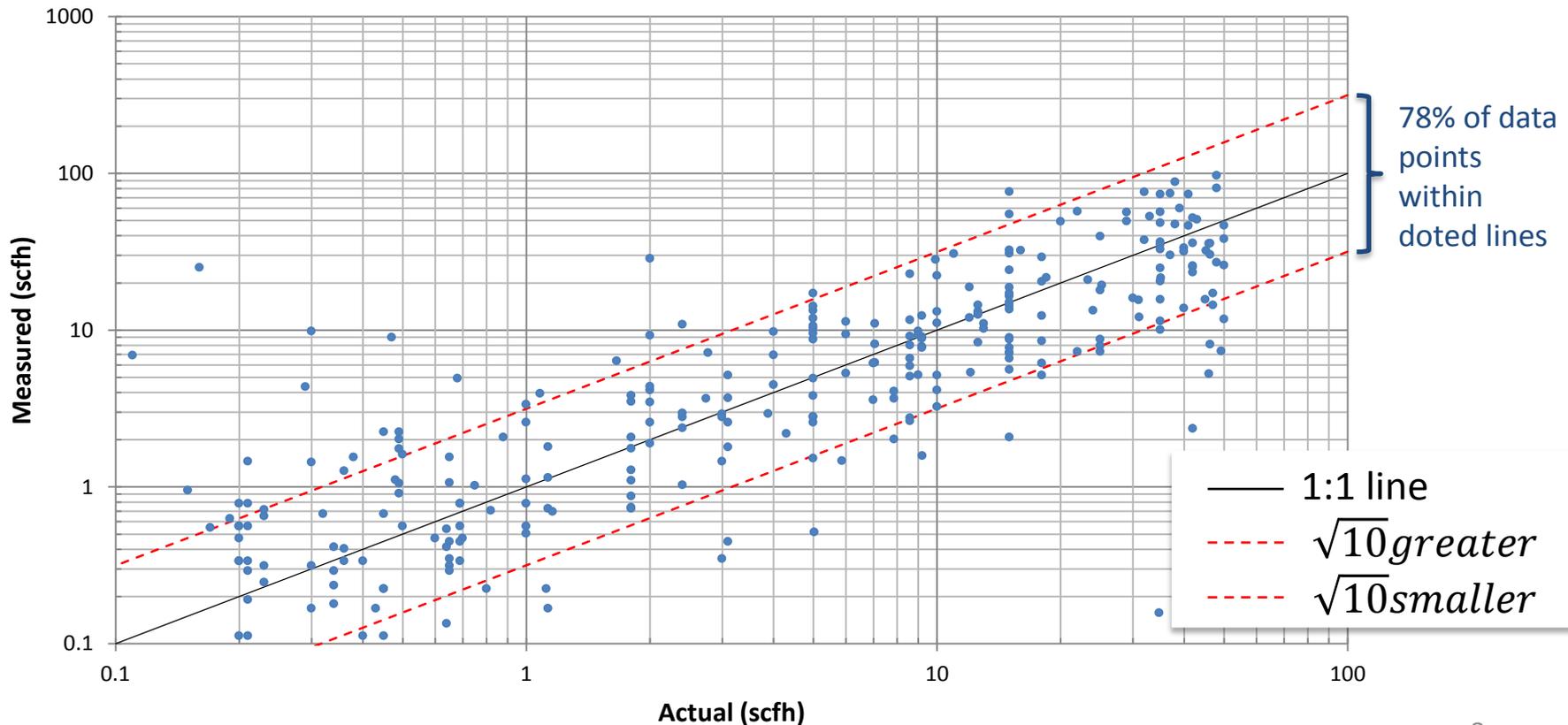
- Mobile only surveys are typically 10 times faster than walking surveys



The opportunity

- Large leaks are **easy to detect** with mobile surveys (Picarro).
- Leak flow rate quantification is still challenging with mobile devices but:
 - Solid data coming from a NYSEARCH study is now available

NYSEARCH Tests Unity Plot

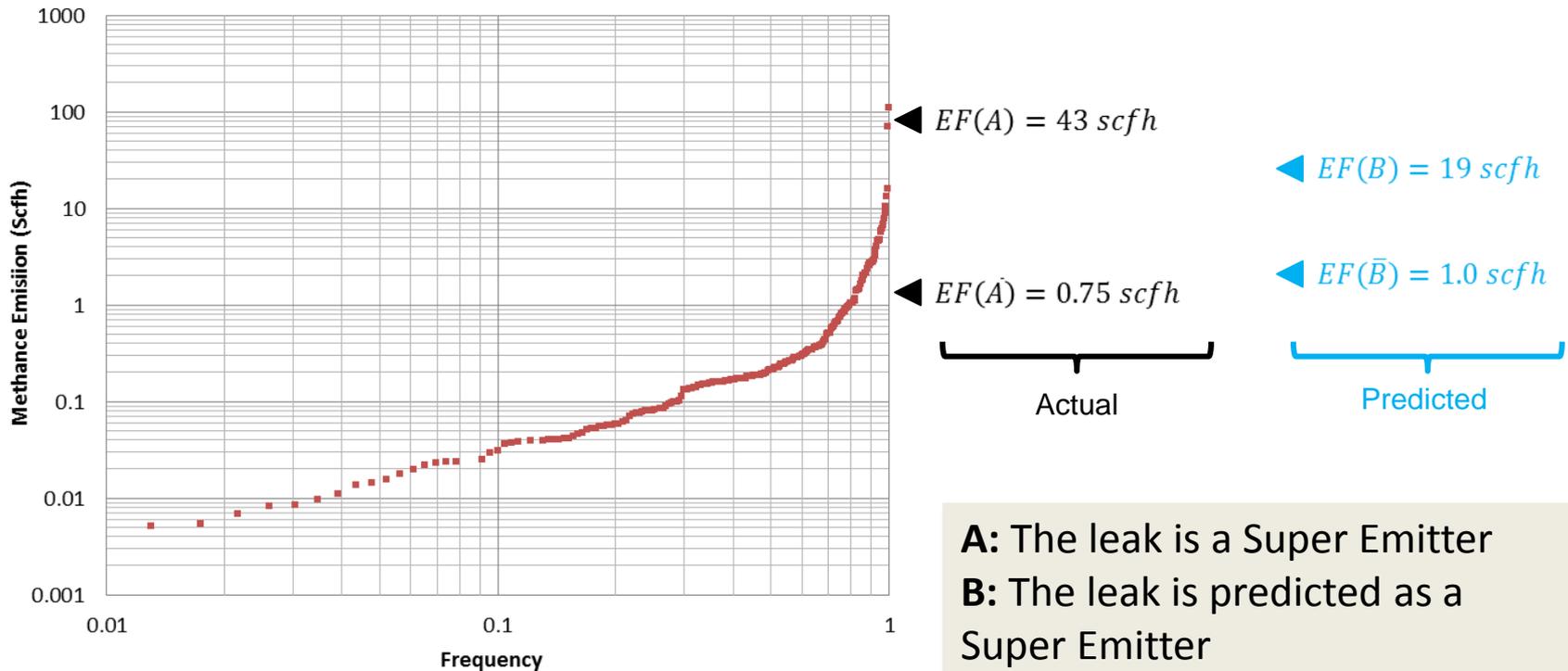




Accounting for uncertainties

- By binning validation data and merging them with leak size distribution using Bayesian conditional probability, we adjusted emission factors to include uncertainties in Super Emitter quantification using NYSEARCH results

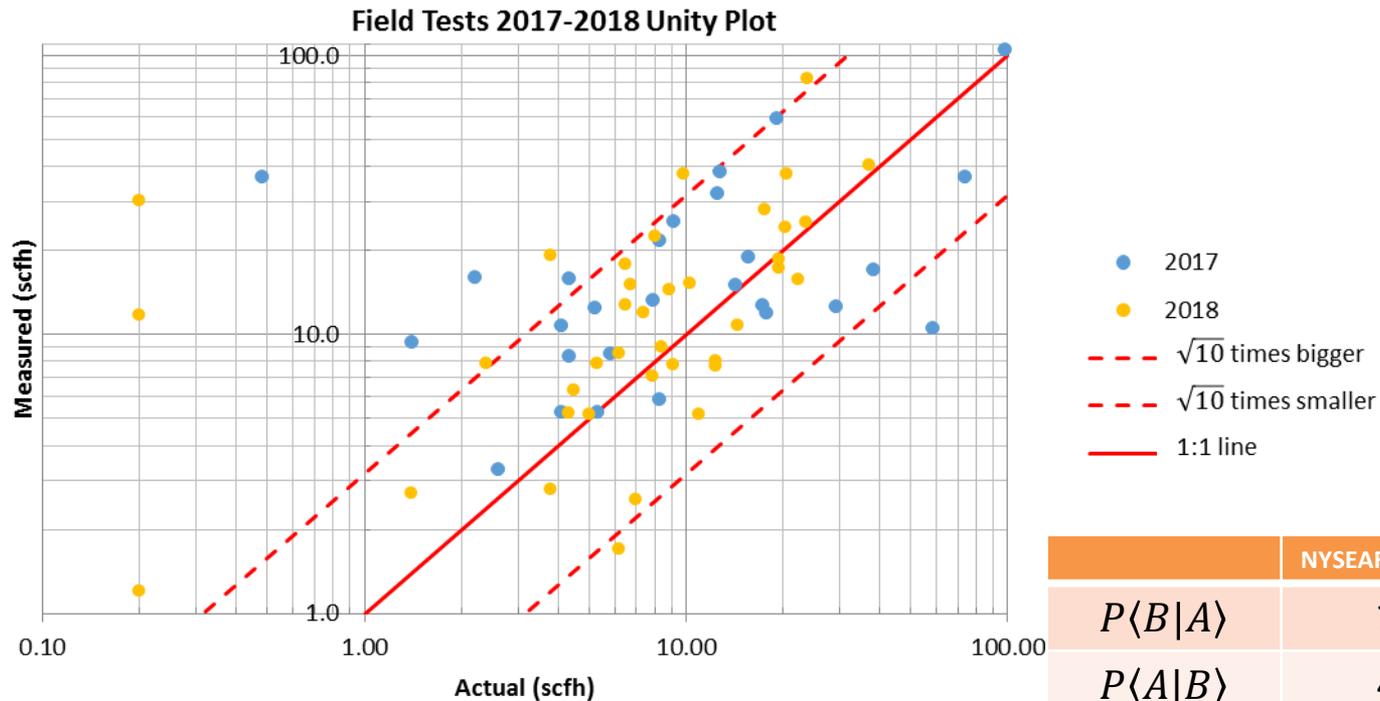
$$P\langle A|B \rangle = 42\%, \quad P\langle A|\bar{B} \rangle = 0.55\%$$





Validation

- Tested the approach in the field by directly measuring flow rate of 58 large leaks related to large detection by Picarro system (>10 scfh)



	NYSEARCH	Validation
$P\langle B A \rangle$	76%	77%
$P\langle A B \rangle$	42%	56%
Within order of magnitude	78%	80%

1. Drive Picarro car in the areas not surveyed through Compliance Survey
2. Filter out any indications <10 scfh (Picarro's algorithm)
3. Investigate and repair leaks associated with large indications (>10 scfh)
4. Savings from two sources:
 - a) Accelerated detection and repair of "Super Emitters"
 - b) Reduction of Emission Factors for other leaks
5. Add the Super Emitters detected through the Compliance Survey



Results

Super Emitters through Compliance Survey

Coverage:

23,862 miles of mains and services

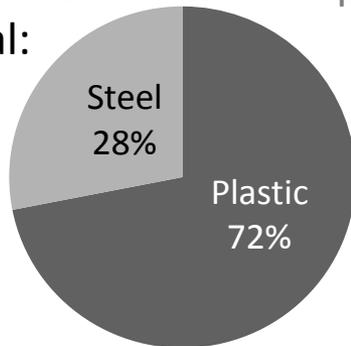
Findings:

130 Super Emitters

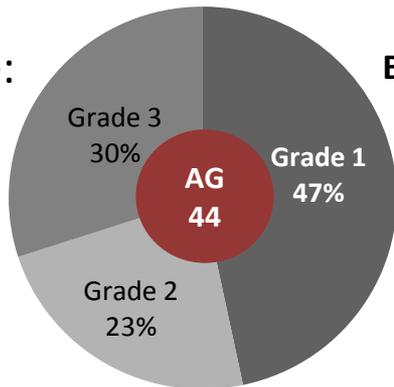
19 No leak found

27 indications with multiple leaks

Material:



Grade:



BG: 86

Super Emitter Survey

Coverage:

41,533 miles of mains and services

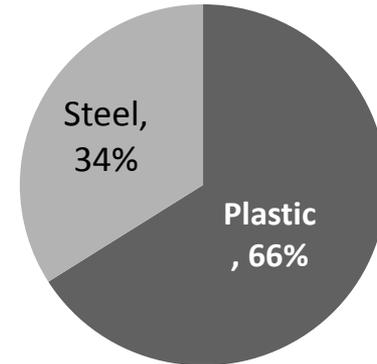
Findings:

169 Super Emitters

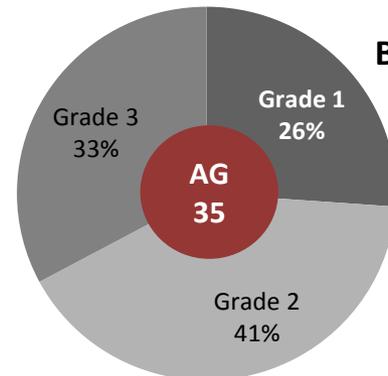
57 No leak found

20 indications with multiple leaks

Material:



Grade:



BG: 134

Thank you

François Rongere
fxrg@pge.com



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