Methane Emissions from Distribution M&R stations

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Together, Building a Better California

2018 Annual Leak Report

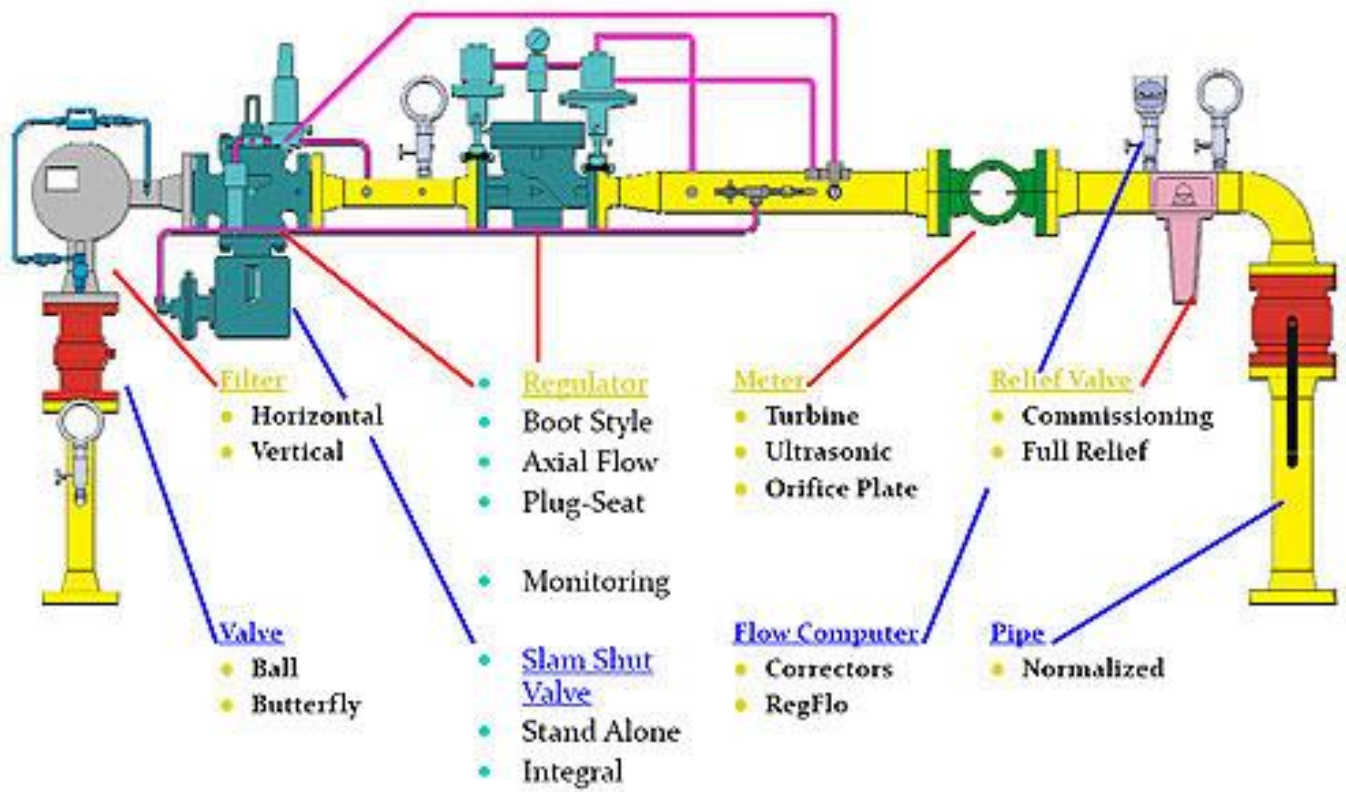
- Distribution M&R stations account for 20% of PG&E's overall emissions.
- Population-based emission factors used are old (GRI 1996), new emission factors are available (WSU 2014)
- Population-based emission factors does not show leak abatement efforts.

Station Classification	Number of Stations	Annual Emissions (Mscf)	GRI Emission Factor (Scfh)	WSU Emission Factor (Scfh)
A1: Above Ground < 100 psi	9	365	4.6	-
A2: Above Ground [100-300] psi	**92**	**82,478**	**102.3**	**5.9**
A3: Above Ground >300 psi	**376**	**633,372**	**192.3**	**12.8**
B1: Below Ground < 100 psi	322	310	0.11	0.1
B2: Below Ground [100-300] psi	696	1,281	0.21	0.1
B3: Below Ground >300 psi	900	10,958	1.4	0.1
	Total (Mscf)	**728,765**		

Emissions are driven by two categories of regulation stations (A2 and A3) that are assigned very high emission factors

Source: R15-01-008 2018 June Report

Distribution Regulation Stations



Source: E. Zarei et al. "Dynamic Safety assessment of natural gas stations using Bayesian network" Journal of Hazardous Materials Vol. 321, January 2017, pp 830-840

- Distribution Regulation Stations do not include bleeding pneumatic devices such as controllers and actuators.
- Except for the Relief Valve, all emissions are related to unintentional leaks.

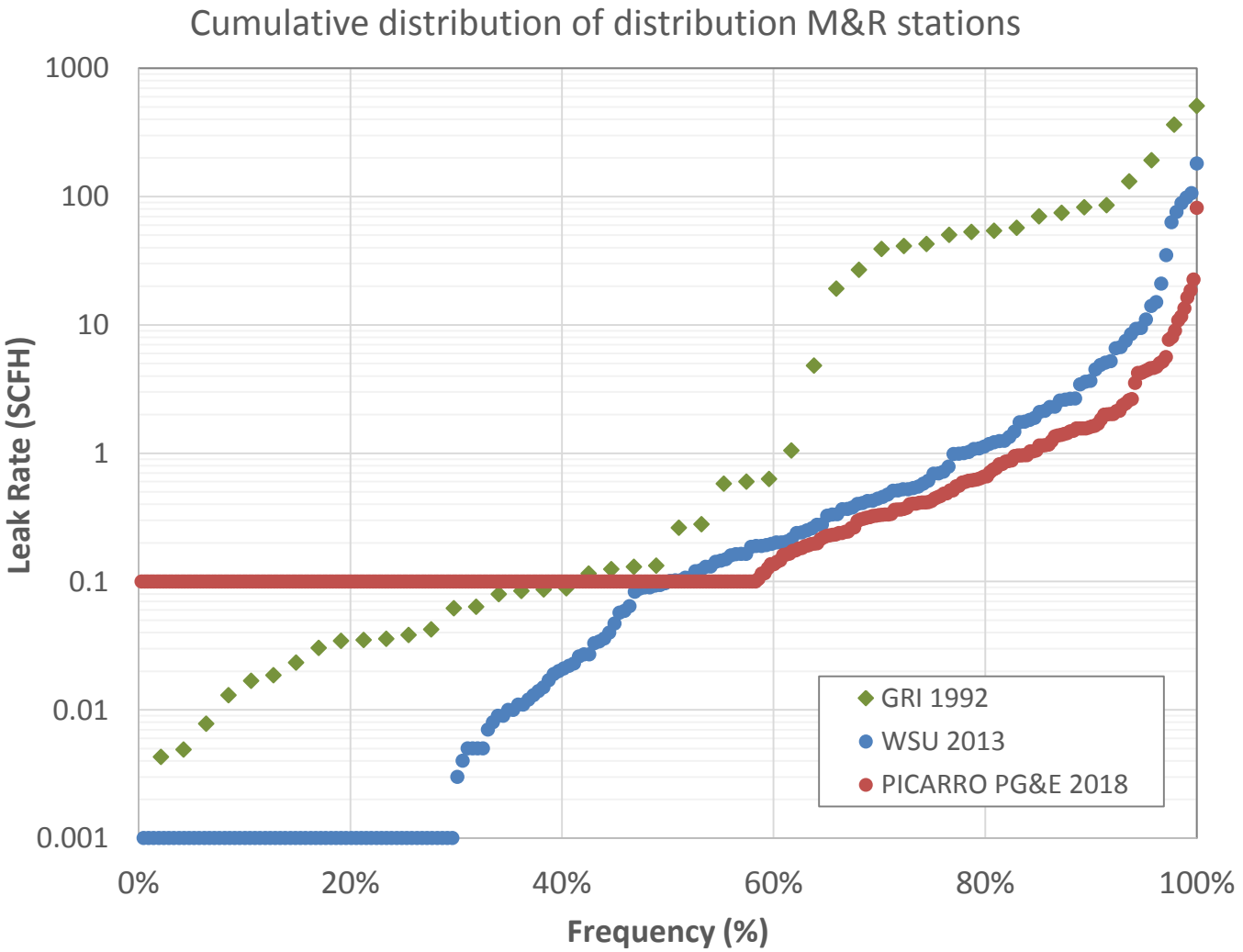
Distribution Regulation Stations

Transmission Regulation Stations

Harkins Rd. Regulator Station (Salinas)

Distribution Reg. Station Emissions

- Picarro analyzed emissions data from regulating stations within the car's field of view from the last three years. The average emissions per station is plotted below.



Distribution Reg. Station Emissions

Data Source	GRI (1992)*	WSU (2013)*	Picarro PG&E (2016-2018)
Sample size	55	249	343
Average emission (scfh)	38.4	5.27	1.06
Largest emitter (scfh)	509	181	82
Median emitter (scfh)	0.12	0.11	0.10

- Accounting for uncertainty in Picarro's measurements, PG&E's average emissions data is in the same ballpark as WSU's.
- In line with WSU's observation, a small number of super-emitters dominate the emissions from this asset category

*Source: Page S90 of Supporting Information for Brian Lamb et. al. 2015 study Direct Measurements Show Decreasing Methane Emissions from Natural Gas Local Distribution Systems in the United States.

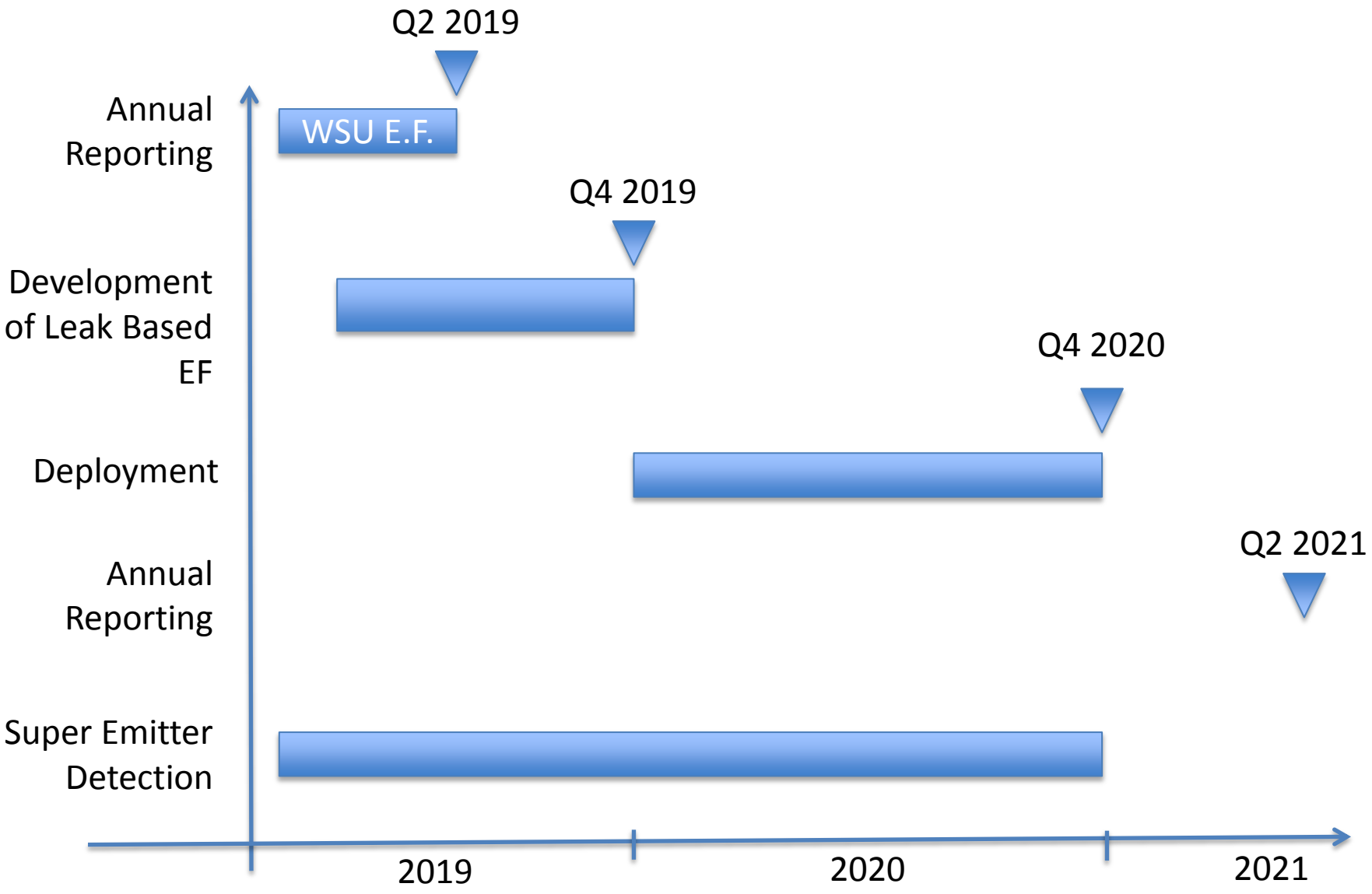
Recommendation

1. Use WSU Emission Factors when available:

Station Classification	GRI Emission Factor (Scfh)	WSU Emission Factor (Scfh)	Proposed Emission Factor (Scfh)
A1: Above Ground < 100 psi	4.6	-	4.6
A2: Above Ground [100-300] psi	102.3	5.9	5.9
A3: Above Ground >300 psi	192.3	12.8	12.8
B1: Below Ground < 100 psi	0.11	0.1	0.11
B2: Below Ground [100-300] psi	0.21	0.1	0.21
B3: Below Ground >300 psi	1.4	0.1	1.4

2. Develop a method to develop leak based emission factors
3. Explore Super Emitter approach to rapidly detect and eliminate large leaks

Proposed timeline



Thank you!

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