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Supplement of

A quantitative comparison of methods used to measure smaller methane emissions typically observed from superannuated oil and gas infrastructure

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Supplementary Material Section 1 – Pasquill-Gifford Stability Class look up table

Estimating the stability class from wind speed and sunlight conditions (Pasquill, 1975; Seinfeld and Pandis, 2016).

Table S1 Estimating the stability class from wind speed and sunlight conditions (Pasquill, 1975; Seinfeld and Pandis, 2016).

Stability Class	Day			Night	
Wind Speed (m $s^{-1)}$	Strong	Mod	Light	Overcast	Clear
2	a	a	b		
3	b	b	c	e	f
4	b	c	c	d	e
5	c	c	d	d	d
6	c	d	d	d	d

Supplementary Material Section 2 – Single measurement data

Table S2 Accuracy (%) of single measurements using each of the measurement methodologies

Method	Theoretical accuracy (%)	Volume (m^3)	Accuracy, small source ~40 g CH_4 h^{-1} (%)	Accuracy, medium source ~100 g CH_4 h^{-1} (%)	Accuracy, large source ~200 g CH_4 h^{-1} (%)
Dynamic chamber	± 7[#]	0.1	-21	-15	-11
HiFlow	± 10[†]	-	-15	-14	-16
Gaussian Plume	± 30[‡]	-	56	104	33
bLs model	± 24[§]	-	-4	-21	-11

[#] (Riddick et al., 2019a)

[†] (Pekney et al., 2018)

[‡] (Edie et al., 2020; Riddick et al., 2019b)

[§] (Flesch et al., 1995; Riddick et al., 2017)

Supplementary Material Section 3 – Repeat measurement data

SM3.1 Dynamic chamber

Table S3 Chamber volume (*V*, m^3), known CH_4 release rate (*Rate*, g hr^{-1}), average steady state (SS) CH_4 concentrations in the chamber at the end of each experiment and the average of the emission as calculated in each experiment.

V (m^3)	*Rate* (g hr^{-1})	Average SS chamber conc (mg m^{-3})	Av Q (g hr^{-1})	Av A (%)
0.12	47.7	10,155	40.8	-14.4
0.12	47.7	10,600	42.6	-10.6
0.12	47.7	11,202	45.0	-5.5
0.12	94.9	22,521	90.5	-4.6
0.12	94.9	19,386	77.9	-17.9
0.12	65.6	16,310	65.6	-0.5
0.12	183.3	38,308	153.9	-7.9
0.12	146.9	37,052	148.9	1.4
0.12	146.9	33,038	132.8	-9.6

SM3.2 GP model & bLS Model

Table S4 Data used to derive emission estimates for the Gaussian plume and bLS approach for the three known emission rates from a point source.

Em (g hr^{-1})	WS (ms^{-1})	PGSC	$[CH_4]_b$ (mg m^{-3})	x (m)	z (m)	$\overline{[CH_4]}_m$ (mg m^{-3})	GP Em (g hr^{-1})	bLS Em (g hr^{-1})
31	1.46	C	1.32	5	1.5	1.49	46.9	28.7
36	1.84	C	1.25	5	1.5	1.47	75.3	34.7
38	1.87	C	1.25	5	1.5	1.46	73.4	47.9
101	1.94	C	1.32	5	1.5	1.40	204.1	78.4
114	1.76	C	1.25	5	1.5	1.45	146.9	98.9
114	1.48	C	1.25	5	1.5	1.50	155.7	133.6
181	2.74	D	1.25	5	1.5	1.59	207.8	197.3
181	1.99	C	1.25	5	1.5	1.35	250.9	148.1
198	4.28	D	1.32	5	1.5	1.66	267.4	178.2

Supplementary Material Section 4 – Dates/times of experiments

Experiment	Date	Time	Target Flow Rate (g/hr)	Chamber size (m^3)
Static Chamber	7/8/2020	9:00	40	0.12
Static Chamber	7/8/2020	9:00	200	0.5
Static Chamber	7/8/2020	9:30	40	0.12
Static Chamber	7/8/2020	9:30	200	0.5
Static Chamber	7/8/2020	10:00	200	0.5
Static Chamber	7/8/2020	10:00	40	0.12
Static Chamber	7/8/2020	10:30	100	0.12
Static Chamber	7/8/2020	11:00	100	0.12
Static Chamber	7/8/2020	11:30	100	0.12
Static Chamber	7/8/2020	12:00	200	0.12
Static Chamber	7/8/2020	13:00	200	0.12
Static Chamber	7/8/2020	13:30	200	0.12
Dynamic Chamber	7/9/2020	9:00	40	0.12
Dynamic Chamber	7/9/2020	10:30	40	0.12
Dynamic Chamber	7/9/2020	11:00	40	0.12
Dynamic Chamber	7/9/2020	14:00	100	0.12
Dynamic Chamber	7/9/2020	14:30	100	0.12
Dynamic Chamber	7/9/2020	15:00	100	0.12
Dynamic Chamber	7/9/2020	16:00	200	0.12
Dynamic Chamber	7/10/2020	9:00	200	0.12
Dynamic Chamber	7/10/2020	10:30	200	0.12
Static Chamber	7/22/2020	12:00	40	0.5
Static Chamber	7/22/2020	12:30	40	0.5
Static Chamber	7/22/2020	13:00	40	0.5
Static Chamber	7/22/2020	13:30	100	0.5
Static Chamber	7/22/2020	14:00	100	0.5
Static Chamber	7/22/2020	14:30	100	0.5
Downwind measurements	7/30/2020	9:34	40	
Downwind measurements	7/30/2020	10:00	100	
Downwind measurements	7/30/2020	10:24	200	
Hi-Flow	8/3/2020	9:00	100	
Hi-Flow	8/3/2020	9:10	200	
Hi-Flow	8/3/2020	9:20	40	
Hi-Flow	8/3/2020	9:30	100	
Hi-Flow	8/3/2020	9:50	40	
Hi-Flow	8/3/2020	10:00	100	
Hi-Flow	8/3/2020	10:20	40	
Hi-Flow	8/3/2020	10:30	200	
Hi-Flow	8/3/2020	10:40	200	

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