

## 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	
	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 <sup>3</sup> )	Accuracy, small source ~40 g CH <sub>4</sub> h <sup>-1</sup> (%)	Accuracy, medium source ~100 g CH <sub>4</sub> h <sup>-1</sup> (%)	Accuracy, large source ~200 g CH <sub>4</sub> h <sup>-1</sup> (%)
Dynamic chamber	± 7 <sup>#</sup>	0.1	-21	-15	-11
HiFlow	± 10 <sup>†</sup>	-	-15	-14	-16
Gaussian Plume	± 30 <sup>‡</sup>	-	56	104	33
bLs model	± 24 <sup>§</sup>	-	-4	-21	-11

<sup>#</sup> (Riddick et al., 2019a)

10 <sup>†</sup> (Pekney et al., 2018)

<sup>‡</sup> (Edie et al., 2020; Riddick et al., 2019b)

<sup>§</sup> (Flesch et al., 1995; Riddick et al., 2017)

## 15 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 chamber conc ( $mg\ m^{-3}$ )	SS	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 &amp; bLS Model

20 **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)	y	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	0	1.5	1.49	46.9	28.7
36	1.84	C	1.25	5	0	1.5	1.47	75.3	34.7
38	1.87	C	1.25	5	0	1.5	1.46	73.4	47.9
101	1.94	C	1.32	5	1.5	1.5	1.40	204.1	78.4
114	1.76	C	1.25	5	1	1.5	1.45	146.9	98.9
114	1.48	C	1.25	5	1	1.5	1.50	155.7	133.6
181	2.74	D	1.25	5	0	1.5	1.59	207.8	197.3
181	1.99	C	1.25	5	1.5	1.5	1.35	250.9	148.1
198	4.28	D	1.32	5	0	1.5	1.66	267.4	178.2

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