**1.0 Effects of chamber seal**

We performed an additional single controlled release test of the static chamber method in June 2019 to investigate the impacts of a chamber seal on measurement accuracy. One controlled release was performed outdoors of the MacDonald Engineering Building at McGill University (Canada) using the rectangular 2,265 L chamber with fans present in the interior. The chamber was installed over soft ground for this experiment. One single controlled release of methane (2.5% methane with a balance of air) at a rate of 160 mg/hour of methane. The controlled release test lasted 20 minutes in total. For the first 10 minutes, the chamber was sealed to the ground using metal collars to press the chamber material to the ground. For the second 10 minutes of the release, the metal collars were removed and the chamber material was allowed to rest over the ground. Wind speeds were low (i.e., <5 kph) for this experiment. The measured methane flowrate during the first 5 minutes of the experiment was 133 mg/hour (R2 = 0.9758), and for the second 5 minutes the measured flowrate was 91 mg/hour (R2 = 0.9587), meaning that the change in the chamber seal led to a decrease in accuracy from -17% for the proper chamber seal to -43% from the improper chamber seal.

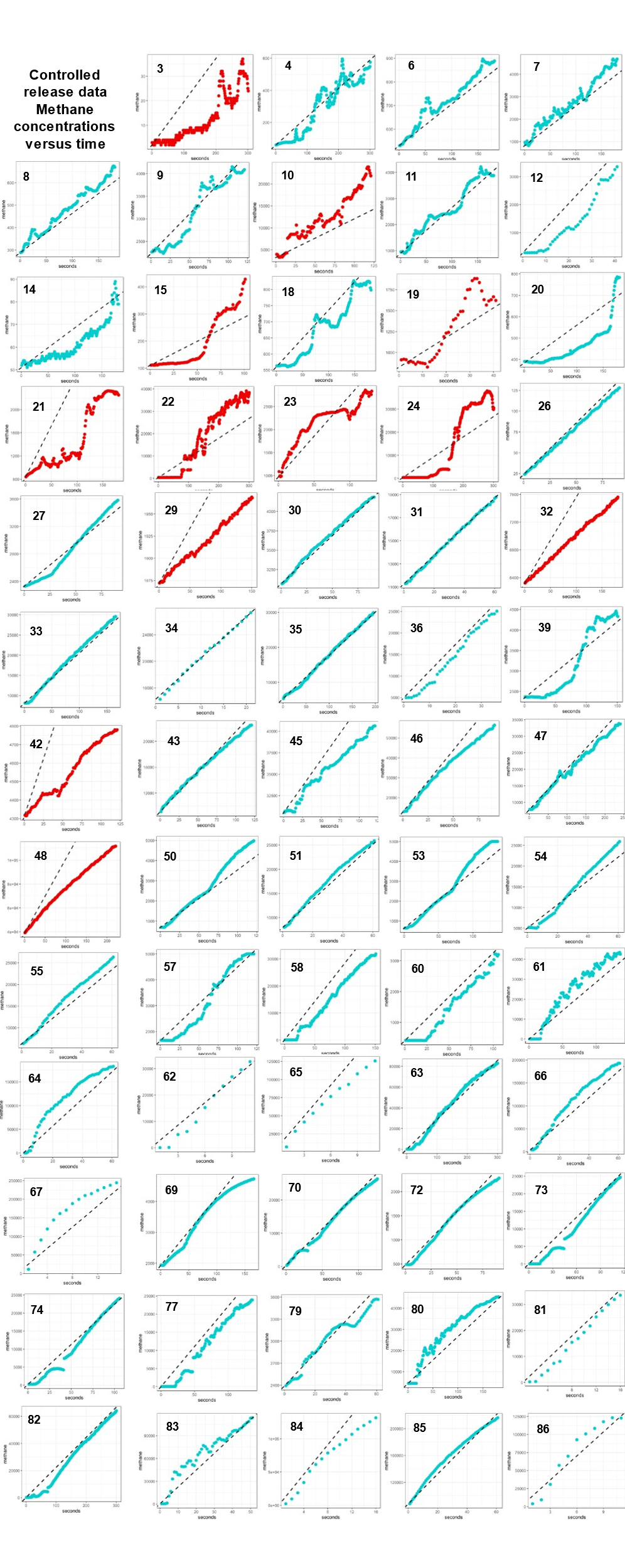
**Table S1: IPCC Emission factor database – summary of assumptions used for component level methane emission factor calculations.**

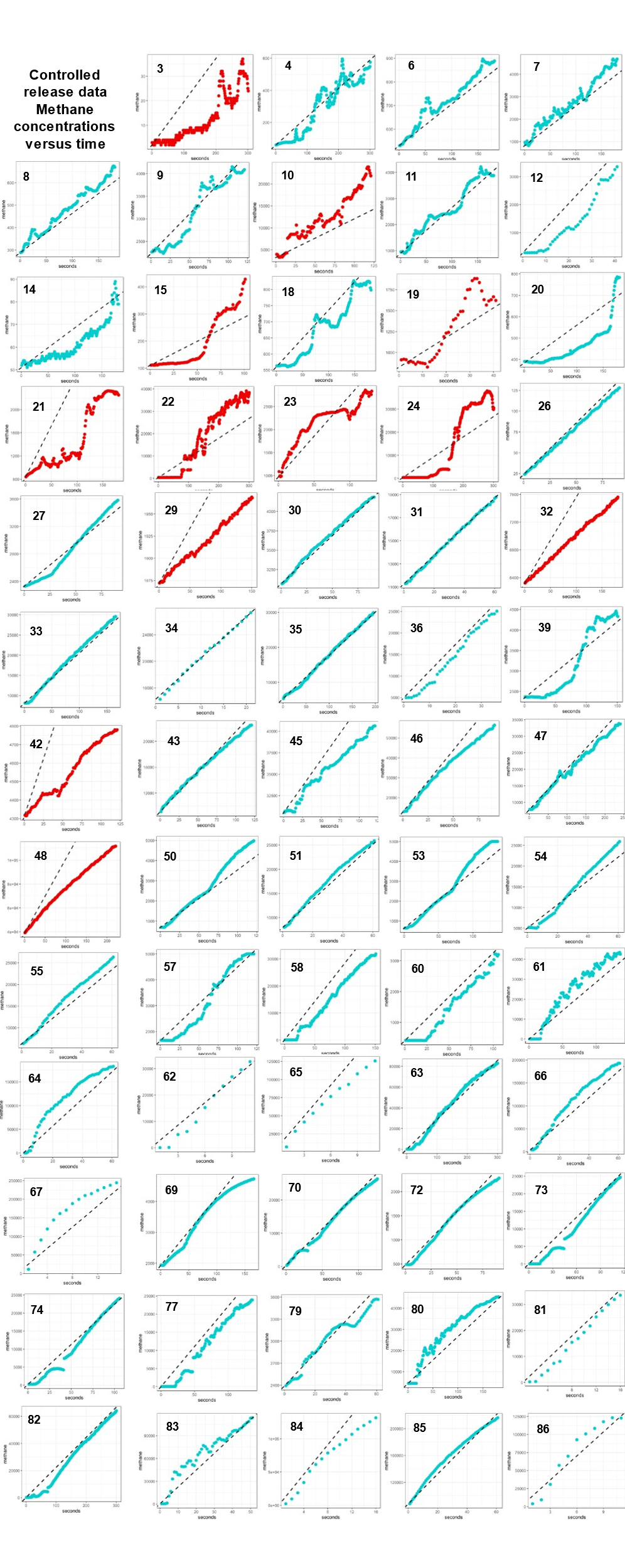
|  |  |  |
| --- | --- | --- |
| Category | Assumption | Reasoning (if applicable) |
| Waste | Component level = 1 person |  |
| Waste | 5.12 L of wastewater per capita per hour | - 8,000,000,000 people globally  - 359,000,000,000 m3/yr wastewater generation globally[1] |
| Waste | 0.019 kg of waste per capita per hour | - 8,000,000,000 people globally  - 1,300,000,000 tons/yr solid waste generation globally[2] |
| Energy | 1.12 hours per liquid unloading | - Average duration of liquid manual unloading[3] |
| Energy | 9301 km driven per year per capita | -Population based average from 12 countries[4] |
| Energy | 19.1 g of methane per ft3 |  |
| Energy | 80.5 hours | - Average flowback duration[3] |
| AFOLU | Component level = 1 head of cattle |  |
| Other | 16.04 grams per mol of methane |  |
| Other | GWP of methane = 24 |  |

**Table S2: Physical chamber factors and leak properties of all 64 controlled release tests.**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Leak ID** | **Mass flowrate (g/hour)** | **Methane percentage of leak (%)** | **Volumetric flowrate of leak (slpm)** | **Volume (L)** | **Shape\*** | **Fans present** |
| 3 | 1.02 | 5 | 0.476 | 2,265 | Rec. | Yes |
| 4 | 10.2 | 5 | 4.76 | 2,265 | Rec. | Yes |
| 6 | 10.2 | 10 | 2.38 | 2,265 | Rec. | Yes |
| 7 | 102 | 10 | 23.8 | 2,265 | Rec. | Yes |
| 8 | 10.2 | 50 | 0.476 | 2,265 | Rec. | Yes |
| 9 | 102 | 50 | 4.76 | 2,265 | Rec. | Yes |
| 10 | 512 | 50 | 23.8 | 2,265 | Rec. | Yes |
| 11 | 102 | 100 | 2.38 | 2,265 | Rec. | Yes |
| 12 | 512 | 100 | 11.9 | 2,265 | Rec. | Yes |
| 14 | 1.02 | 5 | 0.476 | 2,265 | Rec. | No |
| 15 | 10.2 | 5 | 4.76 | 2,265 | Rec. | No |
| 18 | 10.2 | 10 | 2.38 | 2,265 | Rec. | No |
| 19 | 102 | 10 | 23.8 | 2,265 | Rec. | No |
| 20 | 10.2 | 50 | 0.476 | 2,265 | Rec. | No |
| 21 | 102 | 50 | 4.76 | 2,265 | Rec. | No |
| 22 | 512 | 50 | 23.8 | 2,265 | Rec. | No |
| 23 | 102 | 100 | 2.38 | 2,265 | Rec. | No |
| 24 | 512 | 100 | 11.9 | 2,265 | Rec. | No |
| 26 | 1.02 | 5 | 0.476 | 322 | Cyl. | Yes |
| 27 | 10.2 | 5 | 4.76 | 322 | Cyl. | Yes |
| 29 | 1.02 | 10 | 0.238 | 322 | Cyl. | Yes |
| 30 | 10.2 | 10 | 2.38 | 322 | Cyl. | Yes |
| 31 | 102 | 10 | 23.8 | 322 | Cyl. | Yes |
| 32 | 10.2 | 50 | 0.476 | 322 | Cyl. | Yes |
| 33 | 102 | 50 | 4.76 | 322 | Cyl. | Yes |
| 34 | 512 | 50 | 23.8 | 322 | Cyl. | Yes |
| 35 | 102 | 100 | 2.38 | 322 | Cyl. | Yes |
| 36 | 512 | 100 | 11.9 | 322 | Cyl. | Yes |
| 39 | 10.2 | 5 | 4.76 | 322 | Cyl. | No |
| 42 | 10.2 | 10 | 2.38 | 322 | Cyl. | No |
| 43 | 102 | 10 | 23.8 | 322 | Cyl. | No |
| 45 | 102 | 50 | 4.76 | 322 | Cyl. | No |
| 46 | 512 | 50 | 23.8 | 322 | Cyl. | No |
| 47 | 102 | 100 | 2.38 | 322 | Cyl. | No |
| 48 | 512 | 100 | 11.9 | 322 | Cyl. | No |
| 50 | 1.02 | 5 | 0.476 | 14 | Rec. | Yes |
| 51 | 10.2 | 5 | 4.76 | 14 | Rec. | Yes |
| 53 | 1.02 | 10 | 0.238 | 14 | Rec. | Yes |
| 54 | 10.2 | 10 | 2.38 | 14 | Rec. | Yes |
| 55 | 10.2 | 50 | 0.476 | 14 | Rec. | Yes |
| 57 | 1.02 | 5 | 0.476 | 14 | Rec. | No |
| 58 | 10.2 | 5 | 4.76 | 14 | Rec. | No |
| 60 | 1.02 | 10 | 0.238 | 14 | Rec. | No |
| 61 | 10.2 | 10 | 2.38 | 14 | Rec. | No |
| 62 | 102 | 10 | 23.8 | 14 | Rec. | No |
| 63 | 10.2 | 50 | 0.476 | 14 | Rec. | No |
| 64 | 102 | 50 | 4.76 | 14 | Rec. | No |
| 65 | 512 | 50 | 23.8 | 14 | Rec. | No |
| 66 | 102 | 100 | 2.38 | 14 | Rec. | No |
| 67 | 512 | 100 | 11.9 | 14 | Rec. | No |
| 69 | 1.02 | 5 | 0.476 | 18 | Cyl. | Yes |
| 70 | 10.2 | 5 | 4.76 | 18 | Cyl. | Yes |
| 72 | 1.02 | 10 | 0.238 | 18 | Cyl. | Yes |
| 73 | 10.2 | 10 | 2.38 | 18 | Cyl. | Yes |
| 74 | 10.2 | 50 | 0.476 | 18 | Cyl. | Yes |
| 77 | 10.2 | 5 | 4.76 | 18 | Cyl. | No |
| 79 | 1.02 | 10 | 0.238 | 18 | Cyl. | No |
| 80 | 10.2 | 10 | 2.38 | 18 | Cyl. | No |
| 81 | 102 | 10 | 23.8 | 18 | Cyl. | No |
| 82 | 10.2 | 50 | 0.476 | 18 | Cyl. | No |
| 83 | 102 | 50 | 4.76 | 18 | Cyl. | No |
| 84 | 512 | 50 | 23.8 | 18 | Cyl. | No |
| 85 | 102 | 100 | 2.38 | 18 | Cyl. | No |
| 86 | 512 | 100 | 11.9 | 18 | Cyl. | No |

\*Rec. = Rectangular chamber shape, Cyl. = Cylindrical chamber shape





**Figure S1: Scatter-plots of methane concentration over time for all 64 controlled release tests. Points coloured blue indicate a measurement accuracy of 40% or better. Points coloured red indicate a measurement accuracy of 40% or worse.**

References

1 Jones, Edward R., et al. "Country-level and gridded estimates of wastewater production, collection, treatment and reuse." *Earth System Science Data* 13.2 (2021): 237-254.

2 Kawai, Kosuke, and Tomohiro Tasaki. "Revisiting estimates of municipal solid waste generation per capita and their reliability." *Journal of Material Cycles and Waste Management* 18.1 (2016): 1-13.

3Allen, David T., et al. "Measurements of methane emissions at natural gas production sites in the United States." Proceedings of the National Academy of Sciences 110.44 (2013): 17768-17773.

4Internation Comparisons – Transportation. Accessed: 2023-02-09. Available: https://internationalcomparisons.org/environmental/transportation/