

Importance of Super-emitter Natural Gas Well Pads in the Marcellus Shale

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A large-scale study of methane emissions from well pads was conducted in the Marcellus shale (PA), the largest producing natural gas shale play in the U.S., to better identify the prevalence and characteristics of super-emitters. Roughly 2100 measurements were taken from 673 unique unconventional well pads corresponding to ~18% of the total population of active sites and ~32% of the total statewide unconventional natural gas production. A lognormal distribution with a geometric mean of 2.0 kg hr⁻¹ and arithmetic mean of 5.5 kg hr⁻¹ was observed, which agrees with other independent observations in this region. The geometric standard deviation (4.4 kg hr⁻¹) compared well to other studies in the region, but the top 10% of emitters observed in this study contributed 77% of the total emissions, indicating an extremely skewed distribution. The distribution of emissions is shown in Figure 1. The integrated proportional loss of this representative sample is equal to 0.53% with a 95% confidence interval of 0.45–0.64% of the total production of the sites, which is greater than the EPA inventory estimate (0.29%), but in the lower range of other mobile observations (0.09–3.3%). These results emphasize the need for a sufficiently large sample size when characterizing emissions distributions that contain super-emitters.

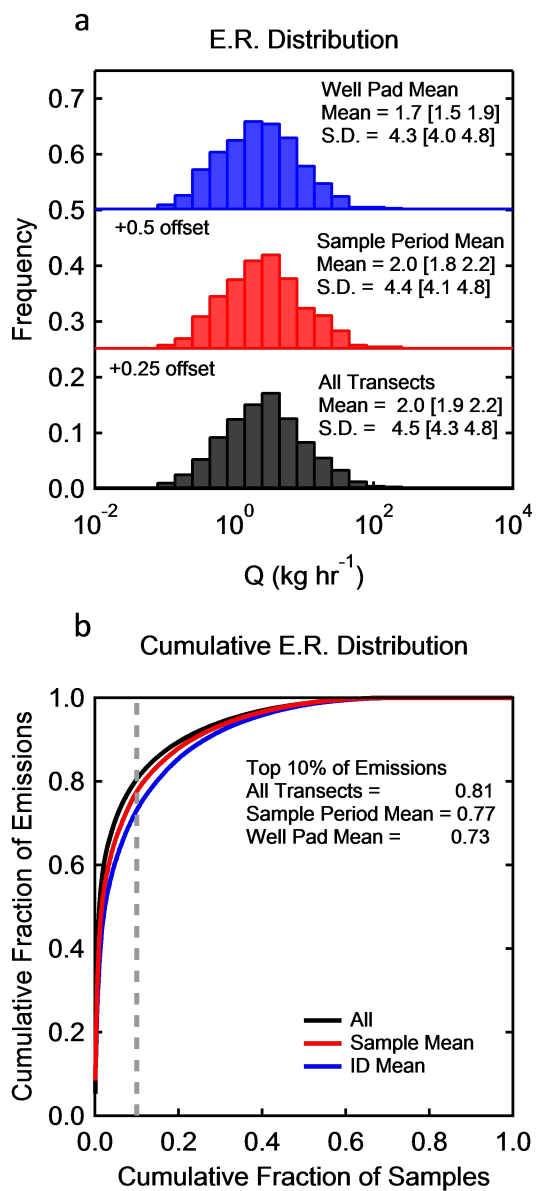


Figure 1. Figure 1. (a) Distribution of emissions for three scenarios: all transects, transects averaged to unique sample periods and transects averaged to unique well pads, excluding sites with no emissions. (b) Cumulative emissions for the same three scenarios, including sites with no emissions.