Measuring Methane Emissions from Oil and Natural Gas Well Pads in the Barnett Shale Using the Mobile Flux Plane Technique

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As part of the Barnett Coordinated Campaign, we present a study of methane emissions from oil and gas producing well pad facilities in the Barnett Shale region of Texas, measured using an innovative mobile flux plane (MFP) measurement system. The MFP method consists of a) deploying a mast with 4 – 6 gas inlet ports on a vehicle, and b) connecting each of these inlet points to long tubes (AirCores) that can store approximately 50 seconds of gas, c) driving the vehicle through the downwind plume, thus tracing out a surface defined by the mast and the path of the vehicle, d) measuring the gas stored in the tubes sequentially with a single high-accuracy methane analyzer based on Cavity Ring Down Spectroscopy (CRDS), and e) combining the concentration data with measured position of the vehicle to retrieve the concentration map on the surface. This concentration map, combined with the measured local wind, can be used to compute the flux of methane through the downwind surface, from which the emission rate of the source can be inferred. The precision and accuracy of the method has been quantified from validation experiments in which the release rate of methane is known. Using only public roads, we measured the emissions from nearly 200 well pads over two weeks in October 2013. The population of measured well pads is highly skewed. Including the population of non-emitting well pads, we find that the arithmetic mean of the well pads sampled in this study is 1.1 kg / hr. This distribution implies that 50% of the well pad emissions is due to the 6.6% highest emitting well pads, and 80% of the emissions is from the 22% highest emitting well pads.

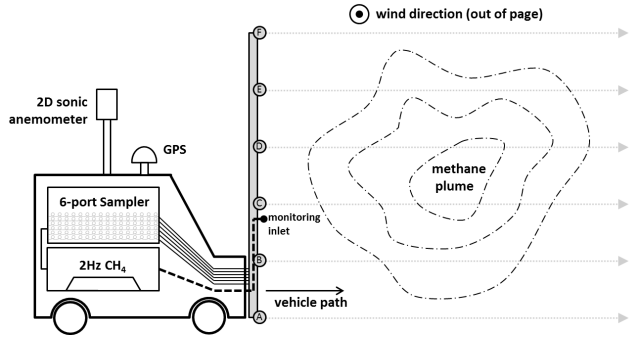

Figure 1. Schematic of the vehicle with forward sampling pole with 6 inlet ports, a 6 port sampler with 50 second gas storage time, and a 2 Hz methane analyzer. [figure reproduced from DOI: 10.1021/acs.est.5b00099]

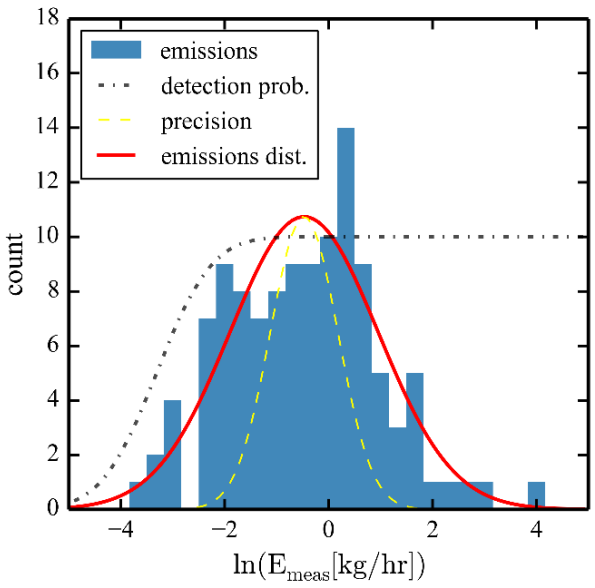

Figure 2. Histogram of the natural logarithm of the measured emission rate in kg / hr. The red curve is the modeled log-normal distribution; the precision of the measurement (yellow) as derived from the validation experiments. We also show the system detection probability (gray dot-dashed line), scaled by a factor of 10. [figure reproduced from DOI: 10.1021/acs.est.5b00099]