Assessment of Air Emissions from Oil and Natural Gas Well Pads Using Mobile Remote and Onsite Direct Measurements

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Sustainable oil and gas development requires an improved understanding of air emissions from oil and gas production and an enhanced ability to efficiently detect large maintenance related emissions. To achieve these goals a new remote inspection method, Other Test Method (OTM) 33A, was developed and utilized to quantify short-term methane (CH_4), volatile organic compound (VOC), and hazardous air pollutant (HAP), emissions from oil and natural gas production pads. OTM 33A was employed in eight two-week field studies from 2010 to 2013 resulting in 287 CH_4 and 132 speciated emissions estimates from production pads in the Barnett, Denver-Julesburg (DJ), and Pinedale Basins. Emissions were log-normally distributed with geometric means and 95% confidence intervals (CIs) of 0.33 (0.23, 0.49), 0.14 (0.11, 0.19), and 0.59 (0.47, 0.72) g CH_4/s, and 0.05 (0.03, 0.09), 0.12 (0.06, 0.20), 0.25 (0.18, 0.36) g VOC/s in the Barnett, Denver-Julesburg, and Pinedale basins, respectively. Methane emissions were found to be very weakly correlated with gas production, with only 10% of the variation in emissions explained by variation in production levels. To inform the speciated remote measurements, an onsite direct measurement study of 23 pads was conducted in the DJ basin using a commercial high volume sample (HVS). Geometric mean VOC emission rates did not differ significantly from those measured remotely in the DJ, 0.19 (0.09, 0.35) g VOC/s but did differ significantly from the results of the study conducted by ERG [1] using the same direct measurement method in the Barnett. Results from the onsite study indicate that emissions from condensate storage tanks are highly variable and can be a measureable source of VOCs and HAPs, even when control measures are in place. Comparison of the measured condensate tank emissions with potentially emitted concentrations modeled using E&P tanks suggested that some of the tanks were effectively controlled (emissions less than 95% of potential) while others were not. The results from these studies support the idea that maintenance-related stochastic variables and design of production and control equipment are factors determining emissions and highlight the need for more efficient inspection techniques and repair programs.

1. ERG, *City of Fort Worth Natural Gas Air Quality Study Final Report*, E.R. Group, Editor. 2011, City of Fort Worth: Fort Worth.