Atmospheric Gas Concentrations in the Pre- and Post- Production Phases of an Unconventional Oil and Gas Recovery Operation at the MSEEL Test Site, West Virginia

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ABSTRACT

The Marcellus Shale Energy and Environment Laboratory (MSEEL) in West Virginia provides a unique opportunity in the field of unconventional energy research. By studying near-surface atmospheric chemistry over several phases of a hydraulic fracturing event, the project will help evaluate the impact of current practices, as well as new techniques and mitigation technologies. A total of 10 mobile surveys were conducted around the MSEEL site that contains 3 test wells (1 science well and 2 natural gas producing wells) and over several miles of nearby regional routes. Our surveying technique involved using a vehicle-mounted Los Gatos Research Ultraportable Methane/Acetylene Analyzer that provided geo-located measurements of methane (CH4) and carbon dioxide (CO2). The ratios of super-ambient concentrations of CO2 and CH4 were used to separate drilling- and fracturing-related observations from the natural background concentrations over the various well pad developmental stages. We found that regional background methane concentrations were elevated in all surveys, with a mean concentration of 2.699ppm (n = 98369), which simply reflected the mix of anthropogenic and natural CH4 sources in this riverine urban location. Over time and through successive stages of well development, we noted a progressive rise in the occurrence of enriched methane in the vicinity of the developed wells. While there was a moderate degree of variability over time, we did observe a higher occurrence of CH4-enriched observations during and after production began at the test site (~25% of measurements within 500 meters of the test wells) compared to the baseline surveys (>10% of measurements). This change was expected, as we anticipated some level of increased emissions from the well pads as production began. However, we did not expect the rise to be so noticeable. The results of this study show that there is a statistically significant increase in the occurrence of enriched methane values in the vicinity of the well locations when we compare pre-production to post-production surveys, and that pre-existing methane sources in the immediate vicinity must be accounted for when assessing environmental impacts.