Quantifying the Relative Contribution of Natural Gas Fugitive Emissions to Total Methane Emissions in Colorado, Utah and Texas Using Mobile $\delta^{13}CH_4$ Analysis

C.W. Rella[1], E. Crosson[1], A. Karion[2], G. Petron[2] and C. Sweeney[2]

[1]Picarro Inc, 3105 Patrick Henry Drive, Santa Clara, CA 94054; 408-962-3941, E-mail: rella@picarro.com
[2]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309

Fugitive emissions of methane into the atmosphere are a major concern facing the natural gas production industry. Because methane is more energy-rich than coal per kg of CO_2 emitted into the atmosphere, it represents an attractive alternative to coal for electricity generation, provided that the fugitive emissions of methane are kept under control. A key step in assessing these emissions is partitioning the observed methane emissions between natural gas fugitive emissions and other sources of methane, such as from landfills or agricultural activities. One effective method for assessing the contribution of these different sources is stable isotope analysis, using the $\delta^{13}CH_4$ signature to distinguish between natural gas and landfills or ruminants. We present measurements of mobile field $\delta^{13}CH_4$ using a spectroscopic stable isotope analyzer based on cavity ringdown spectroscopy, in three intense natural gas producing regions of the United States: the Denver-Julesburg basin in Colorado, the Uintah basin in Utah, and the Barnett Shale in Texas. Mobile isotope measurements of individual sources and in the nocturnal boundary layer have been combined to establish the fraction of the observed methane emissions that can be attributed to natural gas activities. The fraction of total methane emissions in the Denver-Julesburg basin attributed to natural gas emissions is 78 +/- 13%. In the Uinta basin, which has no other significant sources of methane, the fraction is 96% +/- 15%. In addition, preliminary results in the Barnett shale, which includes a major urban center (Dallas), are presented.

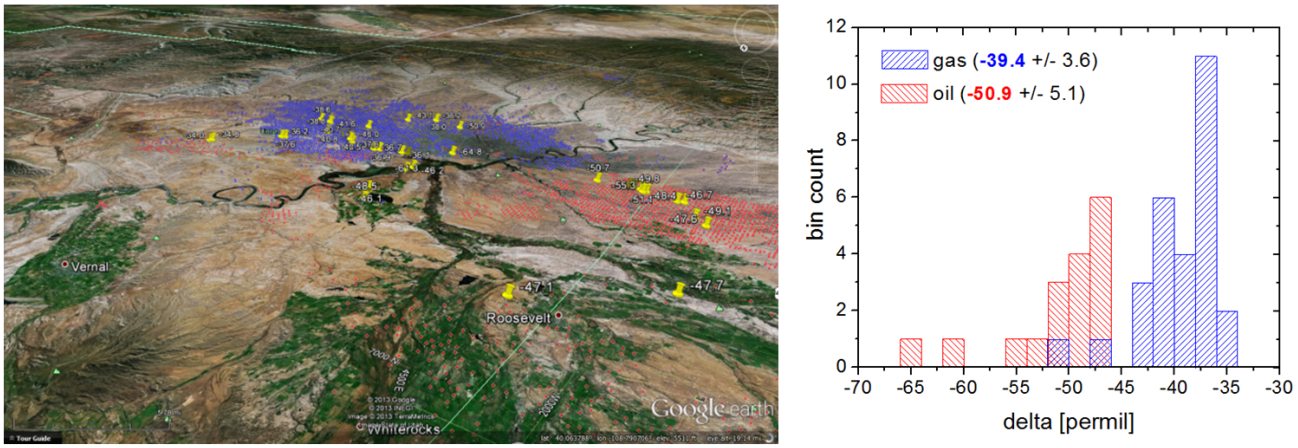

Figure 1. (left panel) Individual source isotope measurements in the Uintah Basin in gas (blue) and oil (red) producing regions. (right panel) Histogram of isotopic source signatures, showing distinct signatures for the two well types.