Measuring VOCs and Other Pollutants Near an Active Oil and Gas Drilling Site in Broomfield, Colorado

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We know that propane is strongly associated with oil and gas, but how well other key VOCs are correlated with propane during each of the phases of drilling?

Background

- ❖ The oil and gas industry is one of the largest sources of air pollution in Colorado, increasingly putting public health and welfare at serious risk
- ❖ Volatile Organic Compounds are gasses that are emitted into the air from products or processes.
- ❖ The six criteria pollutants are carbon monoxide, lead, ozone, particulate matter, nitrogen dioxide, and sulfur dioxide .
- ❖ The Colorado Department of Health and Environment placed the Colorado Air Monitoring Mobile Laboratory (CAMML) near an active drilling site in Broomfield Colorado over the course of 18 months from Nov 2018-May 2020
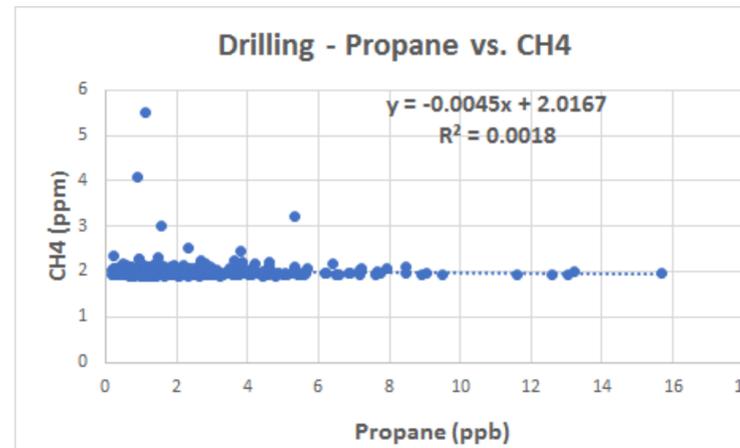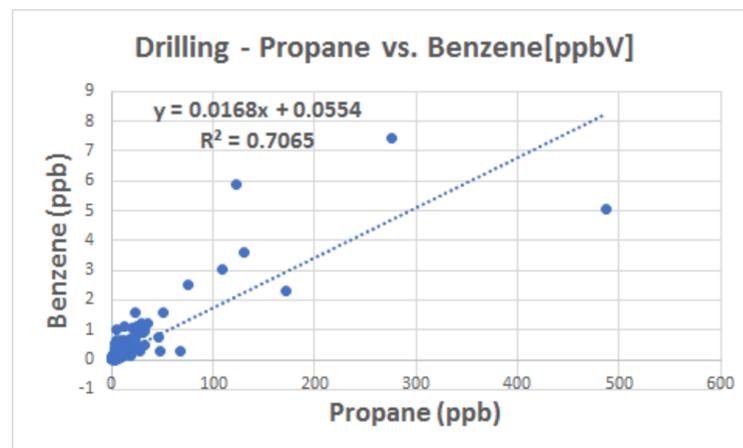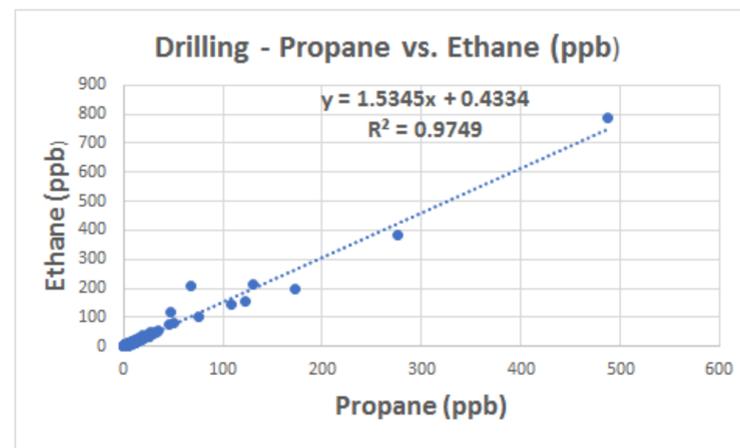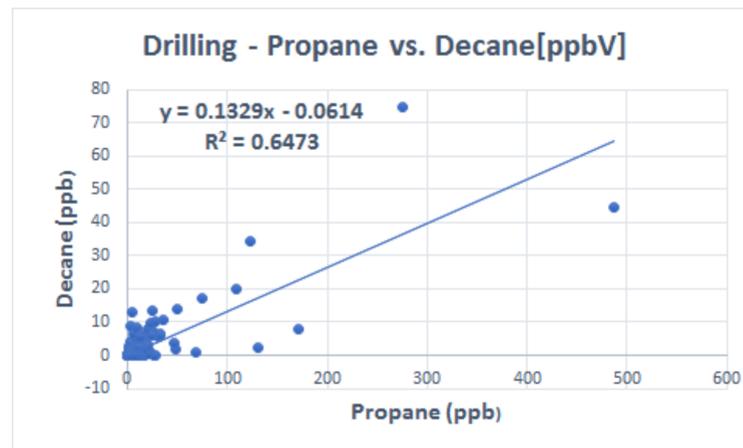

Method

- ❖ The data was collected using a (**GC-FID**) instrument, which is a chromatography (GC) with Flame-Ionization Detection.
- ❖ To compare the data of VOCs and other criteria pollutants we took each VOC and plotted it with propane for comparison and to perceive a correlation between them.

Results

Drilling - Propane vs. Decane[ppbV]
$y = 0.1329x - 0.0614$
$R^2 = 0.6473$

Drilling - Propane vs. Ethane (ppb)
$y = 1.5345x + 0.4334$
$R^2 = 0.9749$

Drilling - Propane vs. Benzene[ppbV]
$y = 0.0168x + 0.0554$
$R^2 = 0.7065$

Drilling - Propane vs. CH4
$y = -0.0045x + 2.0167$
$R^2 = 0.0018$

Phase	Propane vs Ethane (R^2)	Propane vs Ethane (Slope)	Propane vs Decane (R^2)	Propane vs Decane (Slope)	Propane vs Methane (R^2)	Propane vs Methane (Slope)	Propane vs Benzene (R^2)	Propane vs Benzene (Slope)
Baseline	0.92	0.66	0.31	0.007	0.665	0.021	0.24	0.013
Drilling	0.975	1.53	0.647	0.133	0.002	-0.005	0.71	0.017
Flow back Production	0.964	1.46	0.141	0.002	0.003	-0.003	0.76	0.013

Discussion

- ❖ Propane is the most reliable indicator of oil and gas and is something that exclusively comes from oil and gas.
- ❖ Anything that is linear in a straight line with propane, it means that it likely came from oil and gas.
- ❖ We compared ethane, benzene, methane, and decane with propane to perceive a correlation between them.
- ❖ The correlation between propane and ethane is higher. Ethane is linear in ta straight line with propane, which means ethane came from oil and gas.
- ❖ Ethane only comes from wells.
- ❖ Methane comes from many different sources such as landfills, cattle, waste water treatments and including wells.
- ❖ Benzene mostly comes from oil and gas.
- ❖ Decane is only added at the drilling phase, so we should not see a large amount of it in any other phases such as baseline, hydraulic fracturing, mill-out, and flowback production.

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