

# Evaluating a Bottom-up Inventory of Anthropogenic VOC Emissions with Field Measurements in New York City

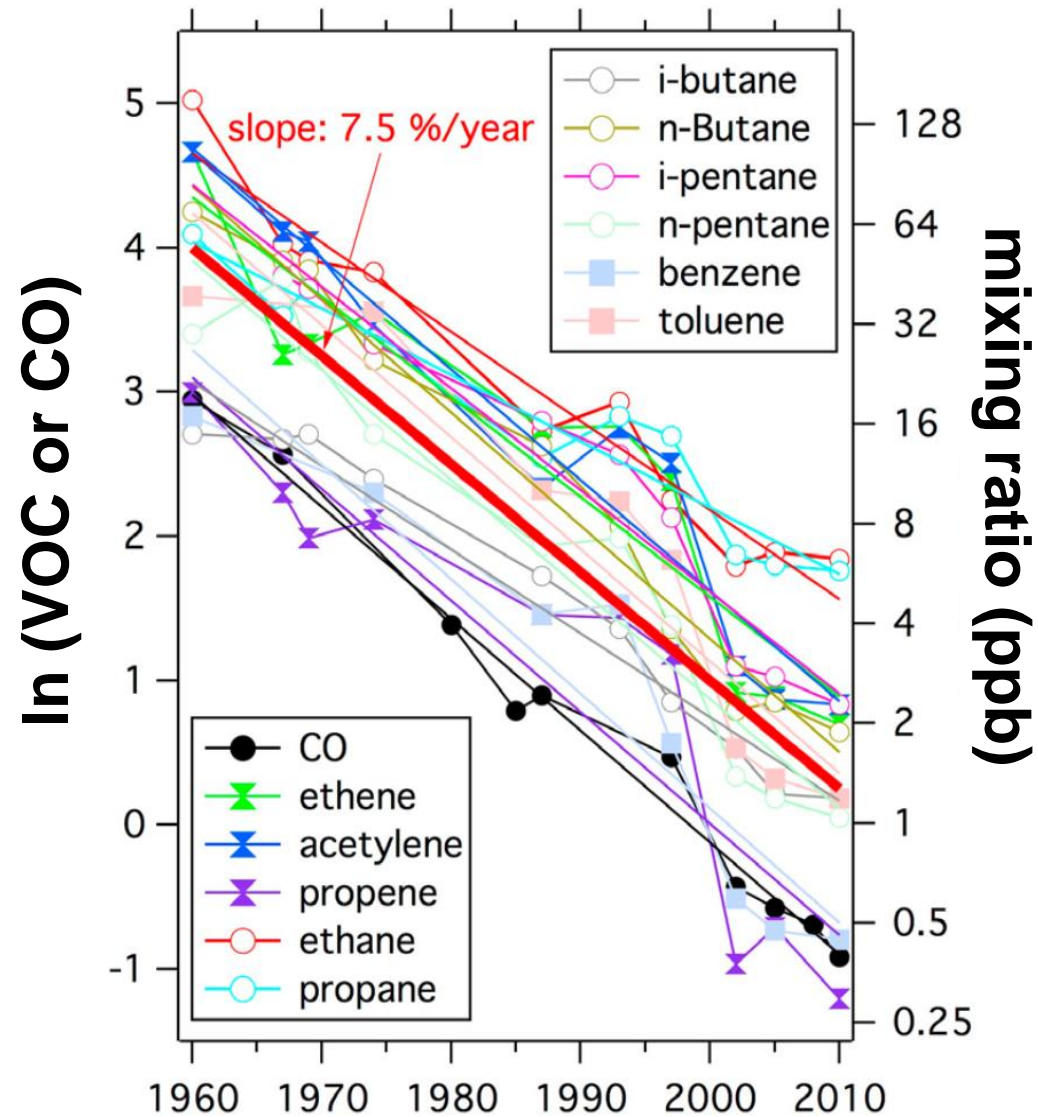


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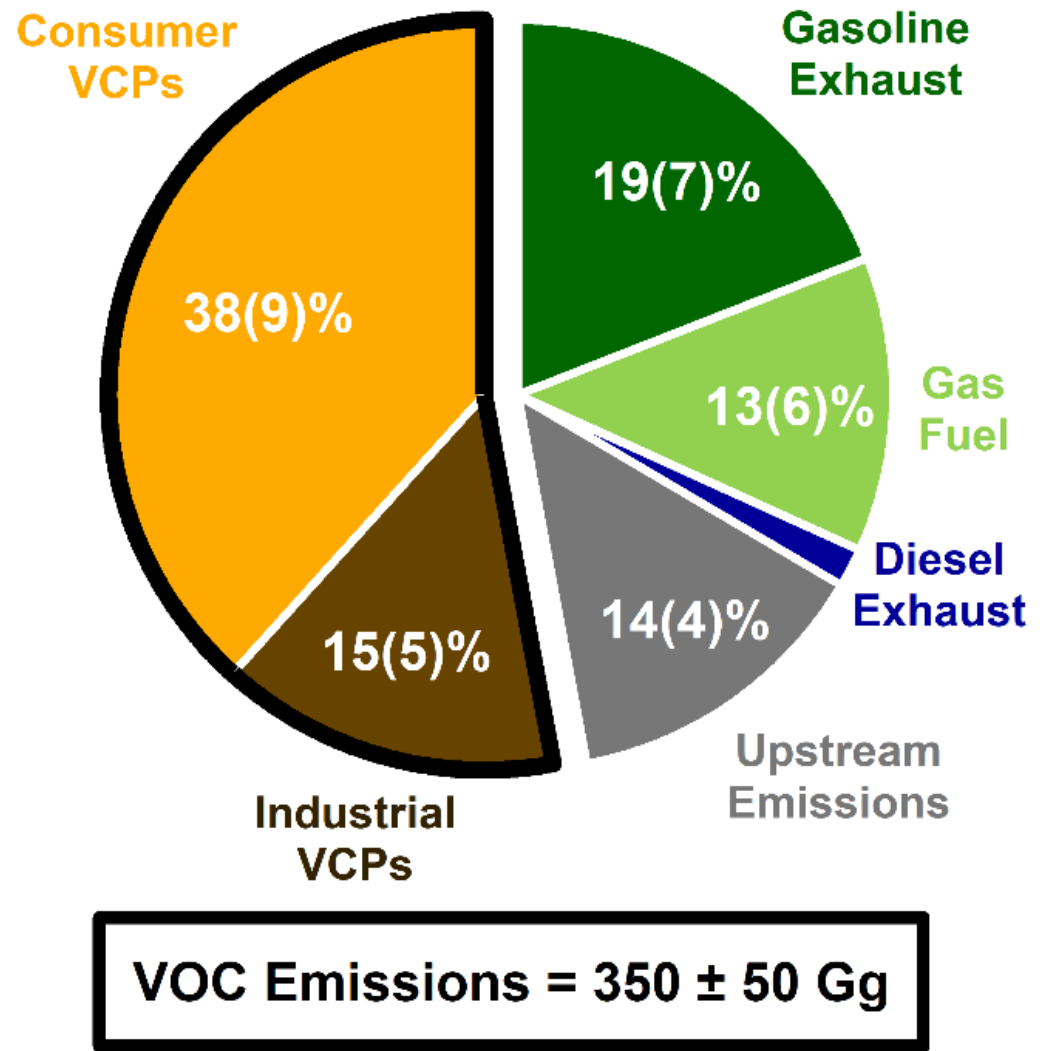
1. NOAA ESRL, Boulder, CO, USA
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# Long-Term Decreases in Motor Vehicle Emissions of VOCs



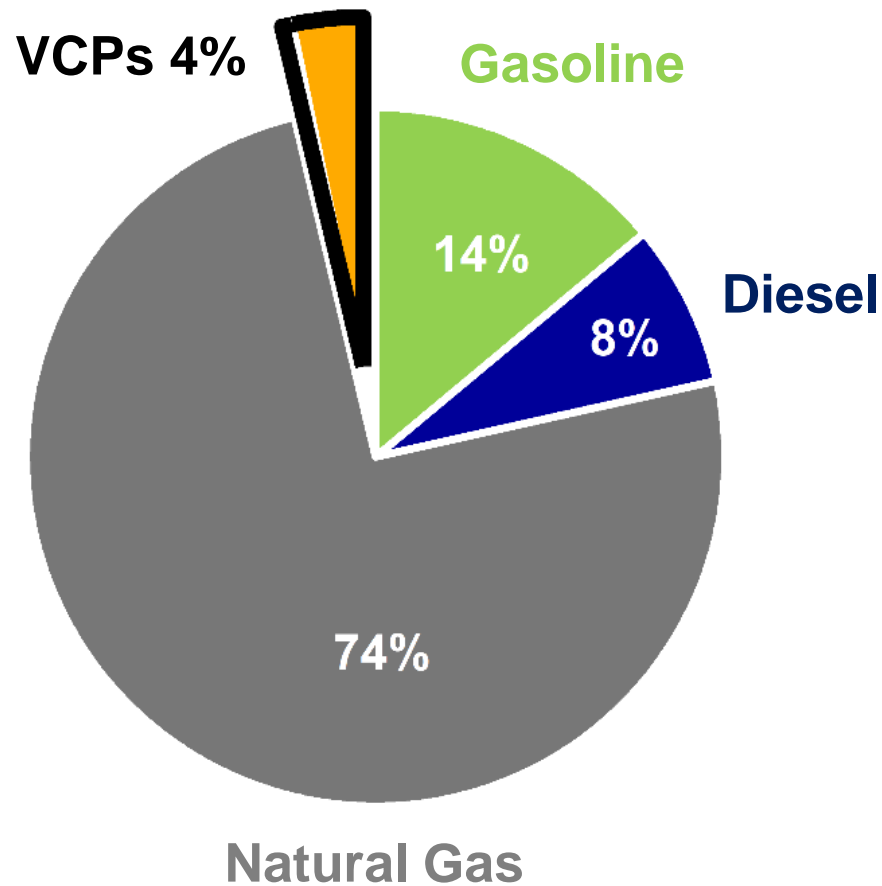
Warneke et al. (*J. Geophys. Res.* 2018)



McDonald et al. (*Science* 2018)

# Quantifying Fossil Fuel and Chemical Product Use in NYC

## Manhattan (Winter 2018)



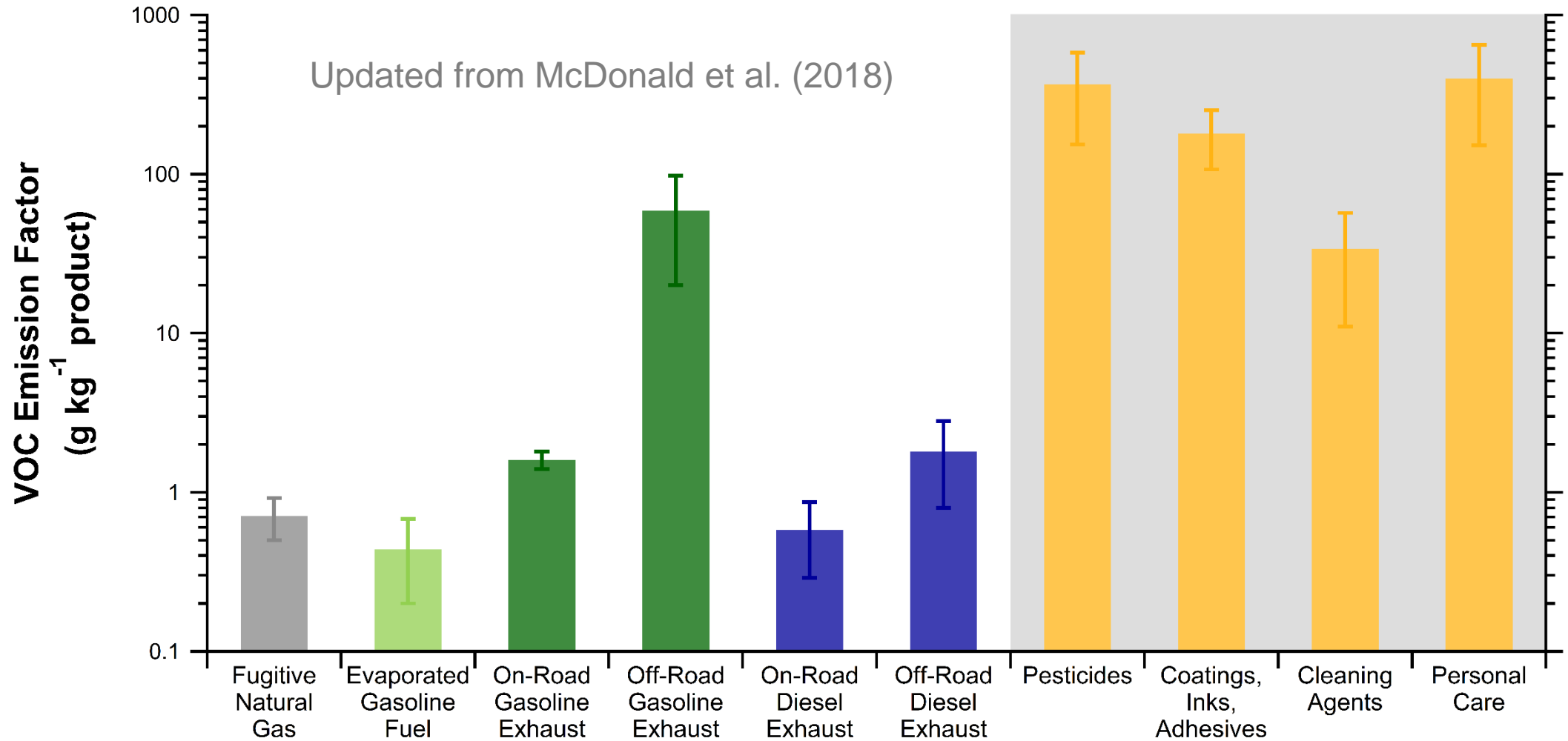
Product Use = 6.6 kg/person/d

- State-level **on-road gasoline** and **diesel** fuel sales allocated to NYC using traffic data [McDonald et al., *ES&T* 2018]
- State-level **off-road gasoline** and **diesel** fuel sales allocated to NYC by population [FHWA, EIA]
- State-level **natural gas** fuel sales by month allocated to NYC by population [EIA]
- Per capita **VCP** use allocated to NYC by population [McDonald et al., *Science* 2018]

# Fossil Fuel vs. VCP VOC Emission Factors (NYC 2018)

## Fossil Fuels

## Chemical Products

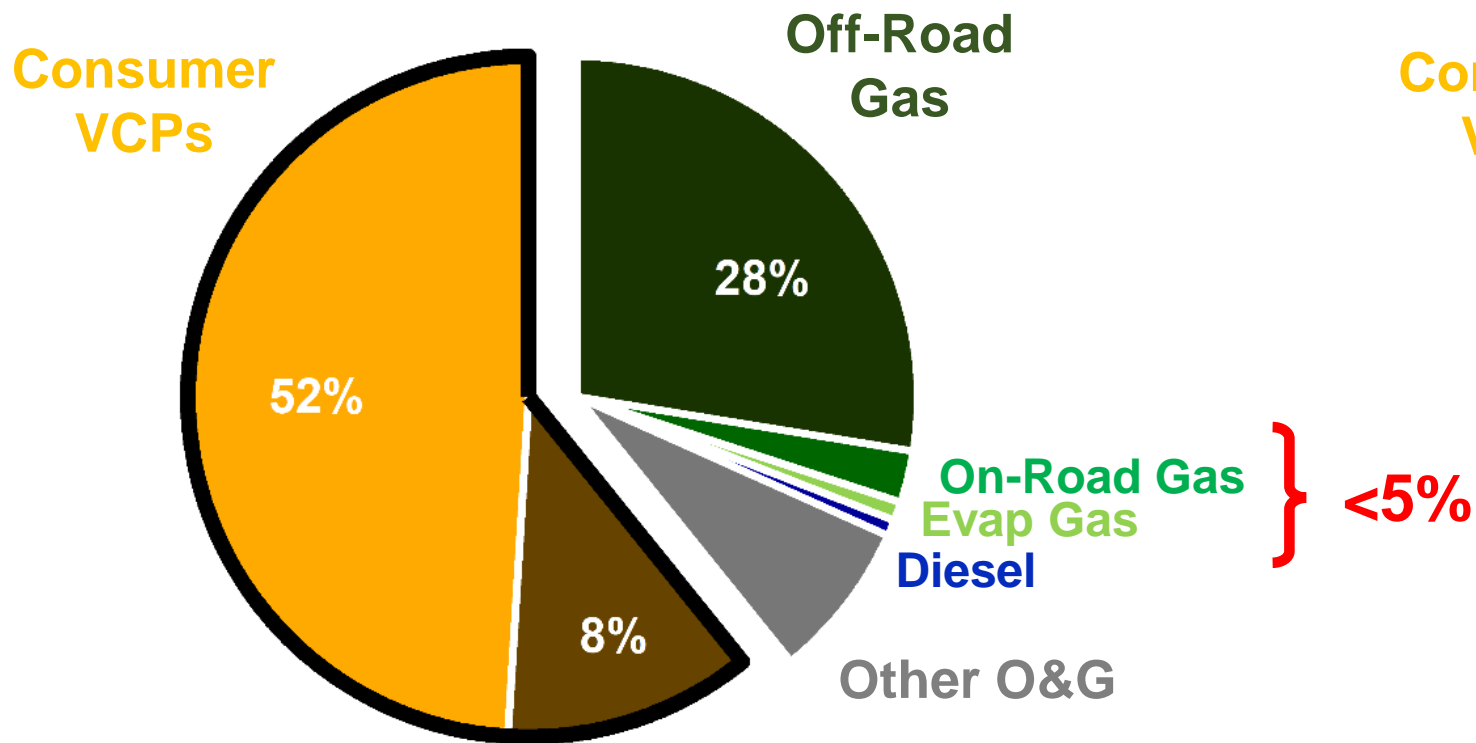


**Manhattan Sales**  
(g/person/d)

4920	920	700	220	430	70	4.3	56	160	28
(±250)	(±60)	(±50)	(±110)	(±40)	(±10)	(±2.0)	(±8)	(±40)	(±7)

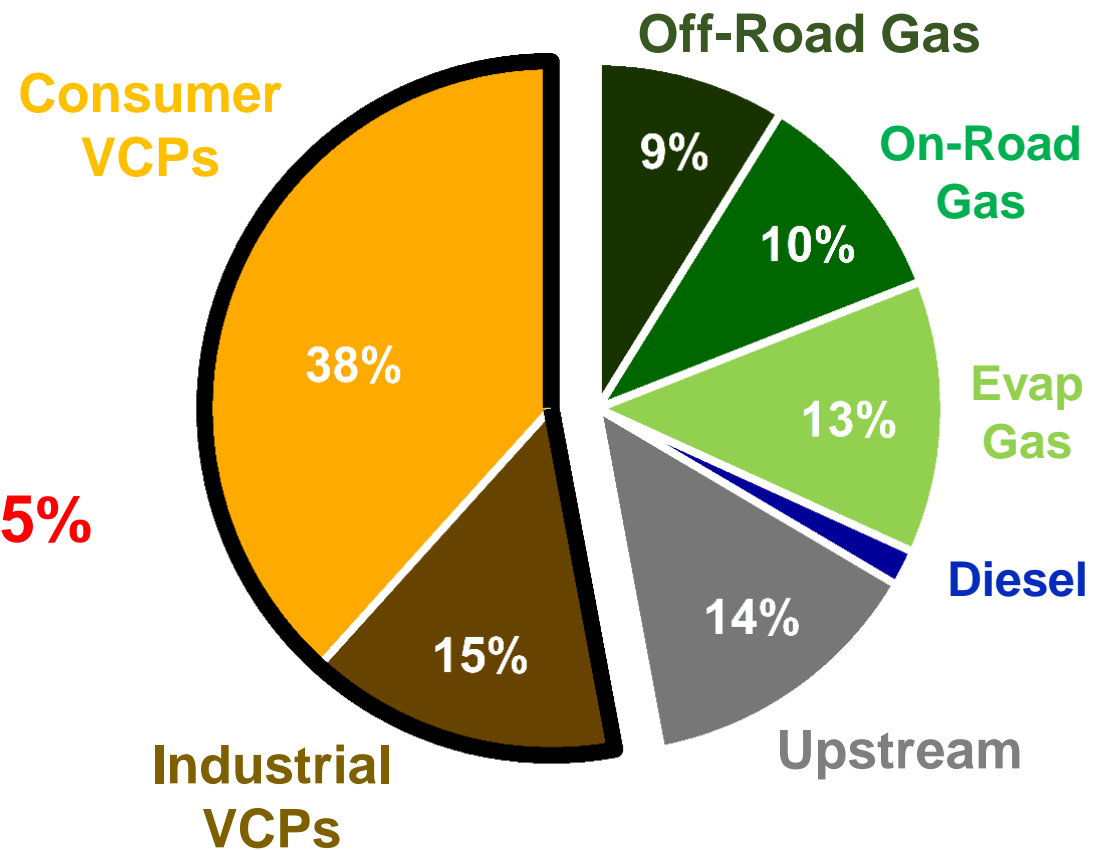
# Distribution of Petrochemical VOC Emissions

## Manhattan (Winter 2018)



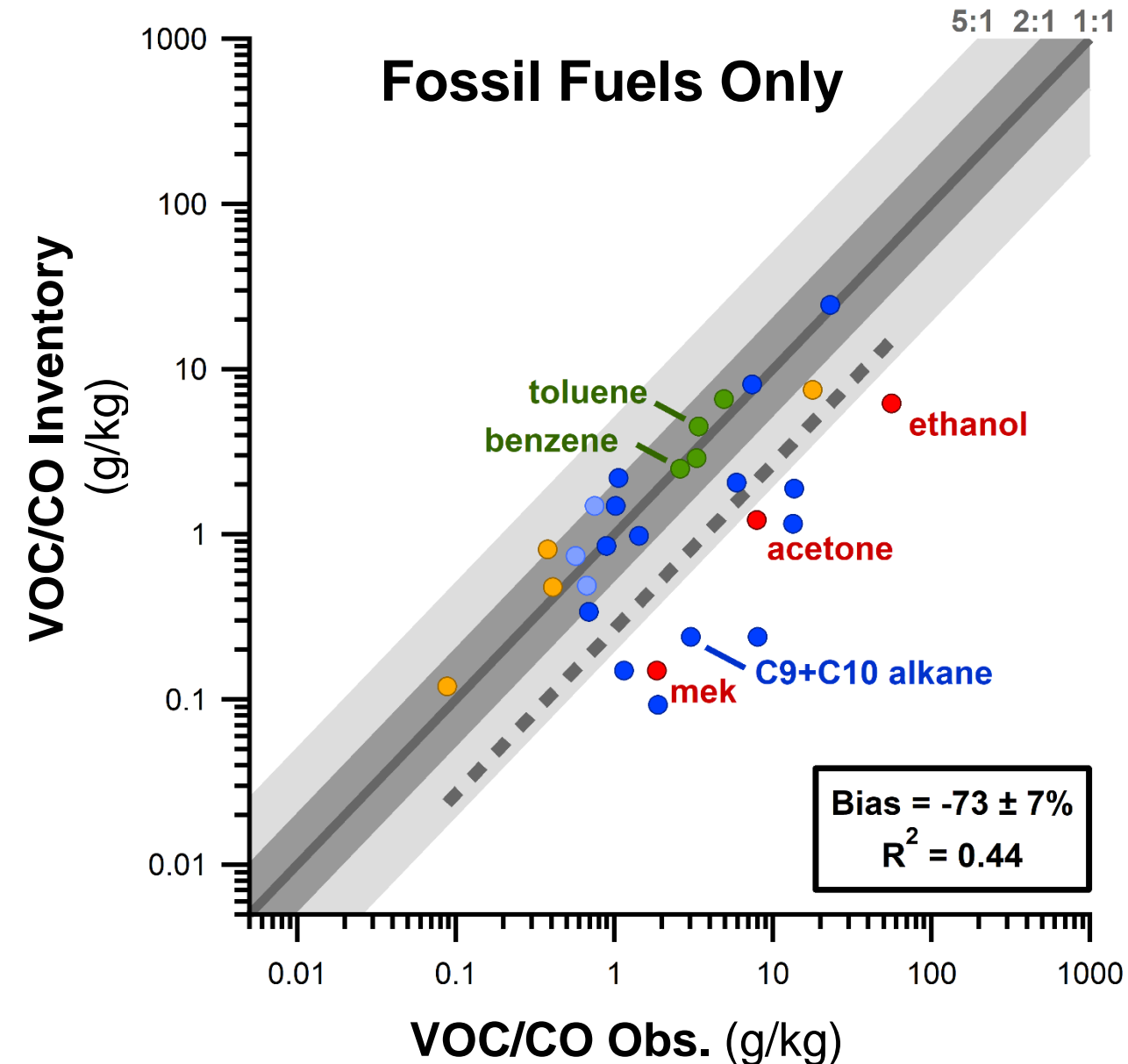
VOC Emissions =  $46 \pm 12$  g/person/d

## Los Angeles (Summer 2010)



VOC Emissions =  $61 \pm 9$  g/person/d

# Fossil Fuels Alone Cannot Explain Ambient VOC Levels in Manhattan

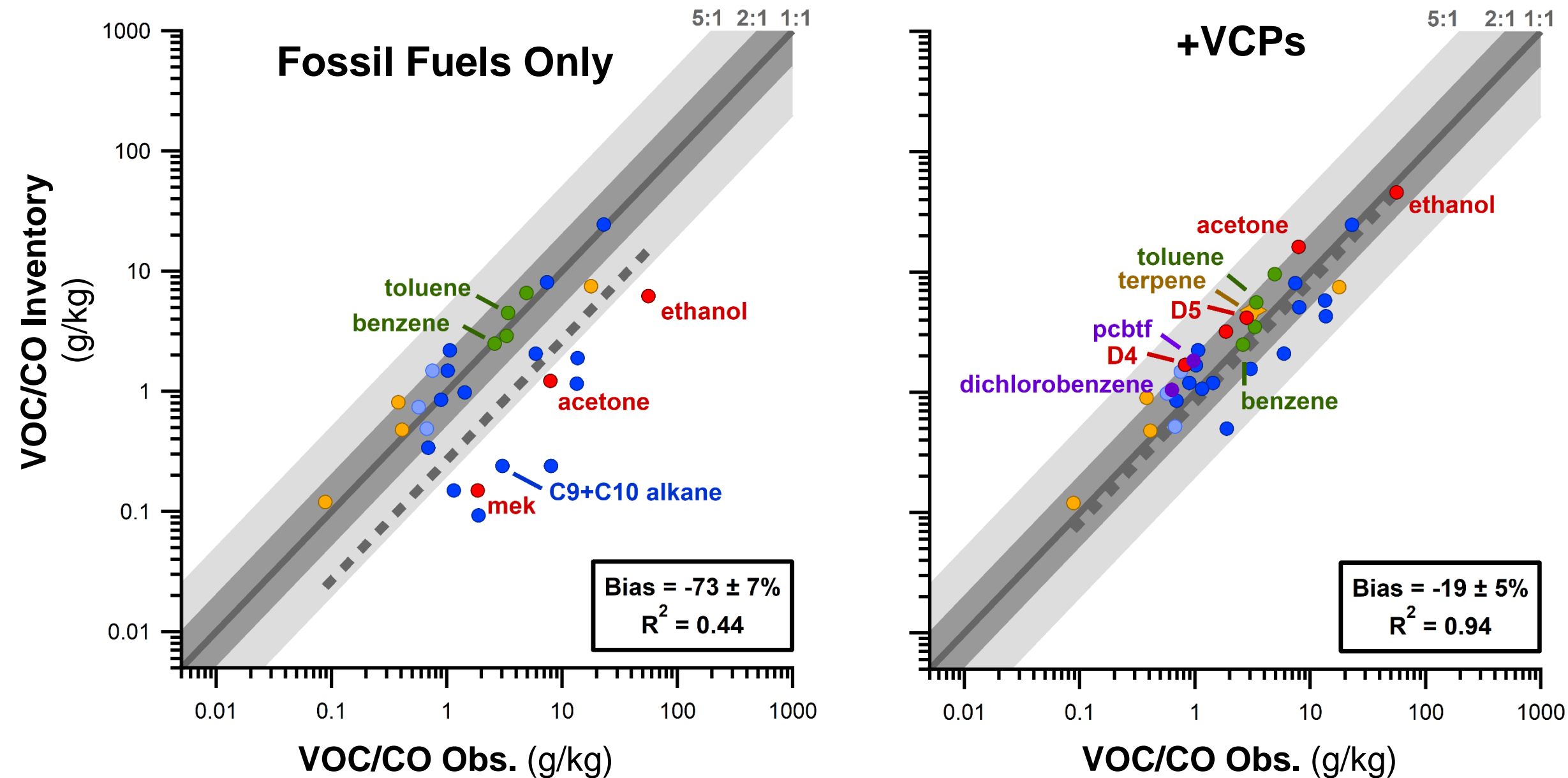


30+ VOCs measured by...

GC-MS analysis of iWAS canisters  
(alkanes, cycloalkanes, alkenes, aromatics)

In-situ PTR-ToF-MS  
(oxygenates, terpenes, select halocarbons)

# Need VCP Emissions to Explain Ambient VOC Levels in Manhattan



# Preliminary Findings

- (1) Quantified petrochemical VOC emissions for NYC similar to Los Angeles
  - VCPs account for **over half** of the petrochemical VOC emissions in NYC (greater fraction of total than for LA)
- (2) Evaluated bottom-up VOC inventory with ambient VOC measurements
  - VCP emissions needed to explain ambient VOC measurements ( **$R^2 \sim 0.94$** )

**Next Step:** Develop VOC inventory for chemical transport modeling.