Deciphering Denver’s Ozone Problem: What’s the Role of Oil & Gas Development?

The Issue for Denver: Ozone Nonattainment

- The Denver urban area is often out of compliance with the National Ambient Air Quality Standards (NAAQS) for ozone ($O_3$) in the summer.
- At least a fifth of Denver’s ozone is produced locally from the region’s emissions of nitrogen oxides ($NO_x$) and volatile organic compounds (VOCs).
- Quantifying the most important regional sources of $NO_x$ and VOCs is key to Denver’s efforts to comply with federal ozone standards.

Ozone Basics

- Regulated pollutant that is harmful to human health, ecosystems, and crops
- Formed in the atmosphere from other starting ingredients: nitrogen oxides ($NO_x$) reacting with volatile organic compounds (VOCs)
- $NO_x$ and VOCs come from human activities such as the use of fossil fuels (motor vehicles, power plants) and from natural sources

What’s Unique about Denver’s Ozone?

- Denver’s locally produced ozone is fueled by large sources of $NO_x$ and VOC pollution that are in close proximity:
  - $NO_x$ from urban activity (fossil fuel combustion)
  - VOCs from oil and natural gas (O&NG) activity, urban activity, agriculture
- Natural emissions of $NO_x$ and VOCs are low in the region

NOAA Findings: How Do Local Emissions Influence Denver’s Ozone Pollution?

- At current levels of $NO_x$, oil and natural gas (O&NG) VOC emissions contribute to ~19% (~3 ppb) of the ozone produced in the north Denver metro region (see red bracket)
- For any given level of $NO_x$, increases in O&NG emissions will increase ozone (compare black curve to green curve), but:
  - The ozone increase would be larger if $NO_x$ increases from its current level
  - The ozone increase would be smaller if $NO_x$ decreases from its current level

Payoffs of this Research

- Quantifies the roles of the Denver region’s major emission sources in producing ozone pollution
- Provides the scientific basis for air quality approaches that could bring the region into compliance with NAAQS