

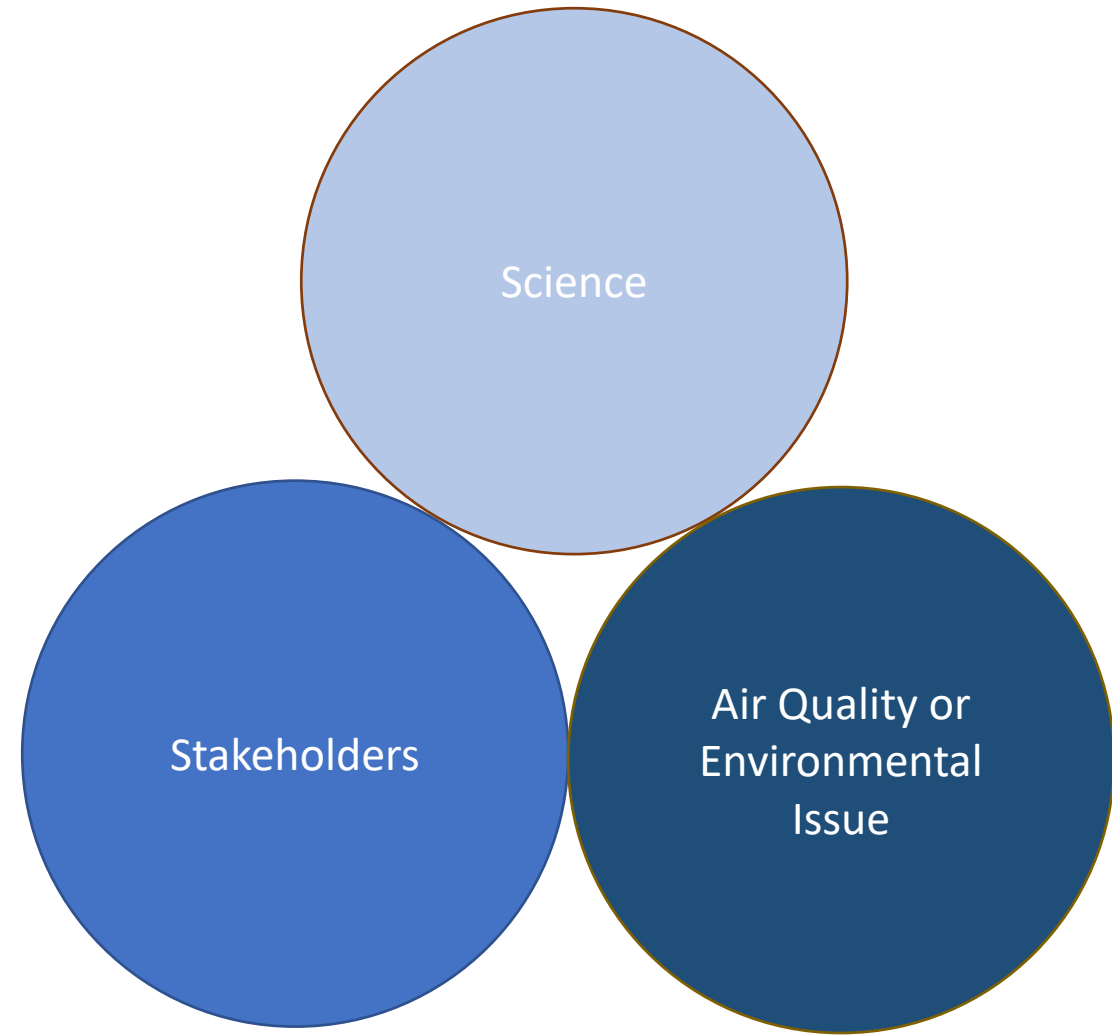


# Environmental Monitoring Panel

Katie Benedict

# In my experience, stakeholder interests in air quality measurements are motivated by different objectives

- Regulatory requirement
- To fulfill stewardship land management objectives.
  - Often a partner in research question development and often multiple issues are of interest.
- To be seen as a cooperating partner.
  - Often from industries contributing to an identified issue
  - May or may not need to be educated about the issues and science
- To gather evidence to meet a set of objectives
  - May be competing objectives particularly if the public is involved.



# My Experience

- Elevated nitrogen deposition in Rocky Mountain National Park
  - Engagement with National Park Service, State Agencies, Agricultural Producers
  - Measurements of aerosol and gas phase compounds of interest.
  - Working with all parties to design sampling strategies
- Impacts of oil and natural gas extraction in local and regional air quality
  - Carlsbad Caverns National Park (ozone exceedances)
  - Broomfield, Colorado
  - Oil and Gas Companies



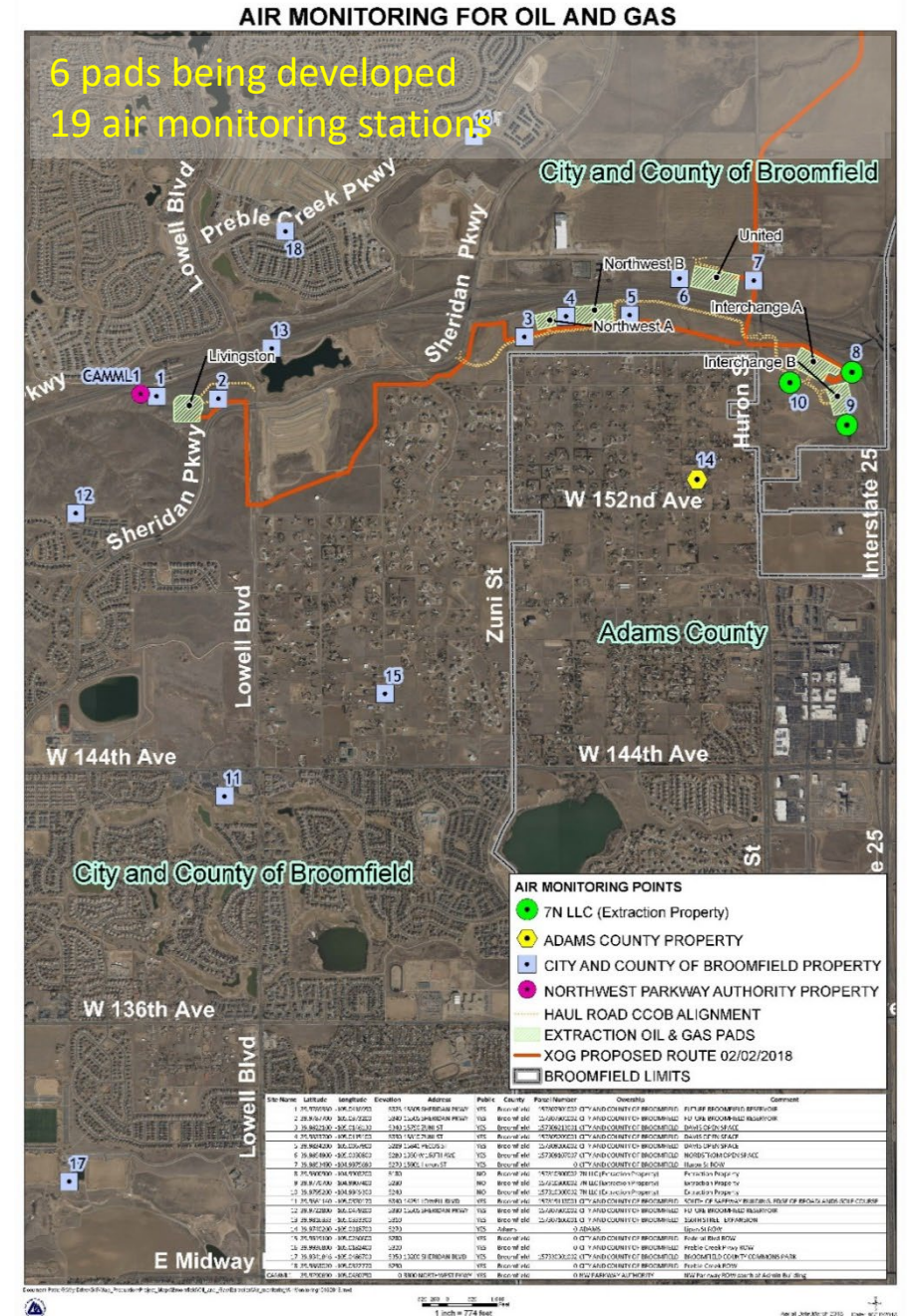
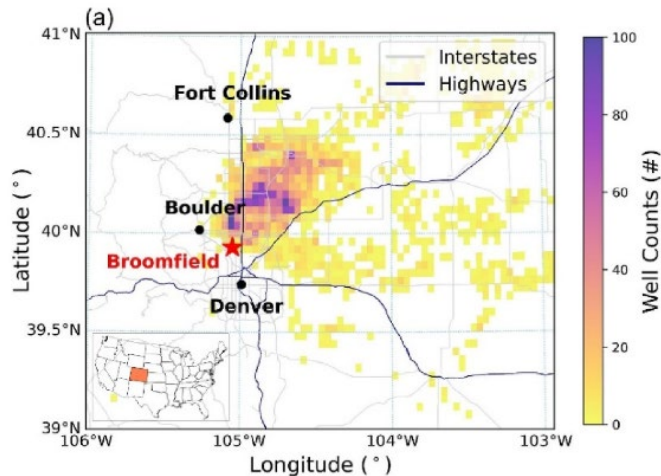
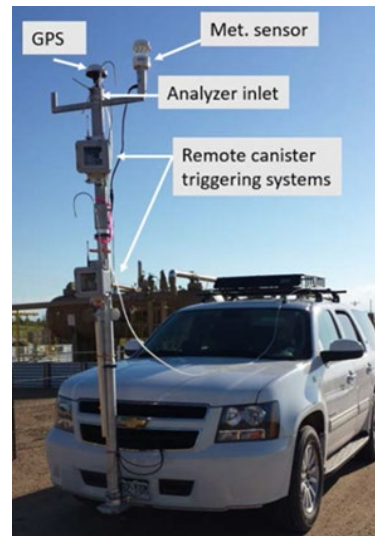
# Stakeholder Concerns

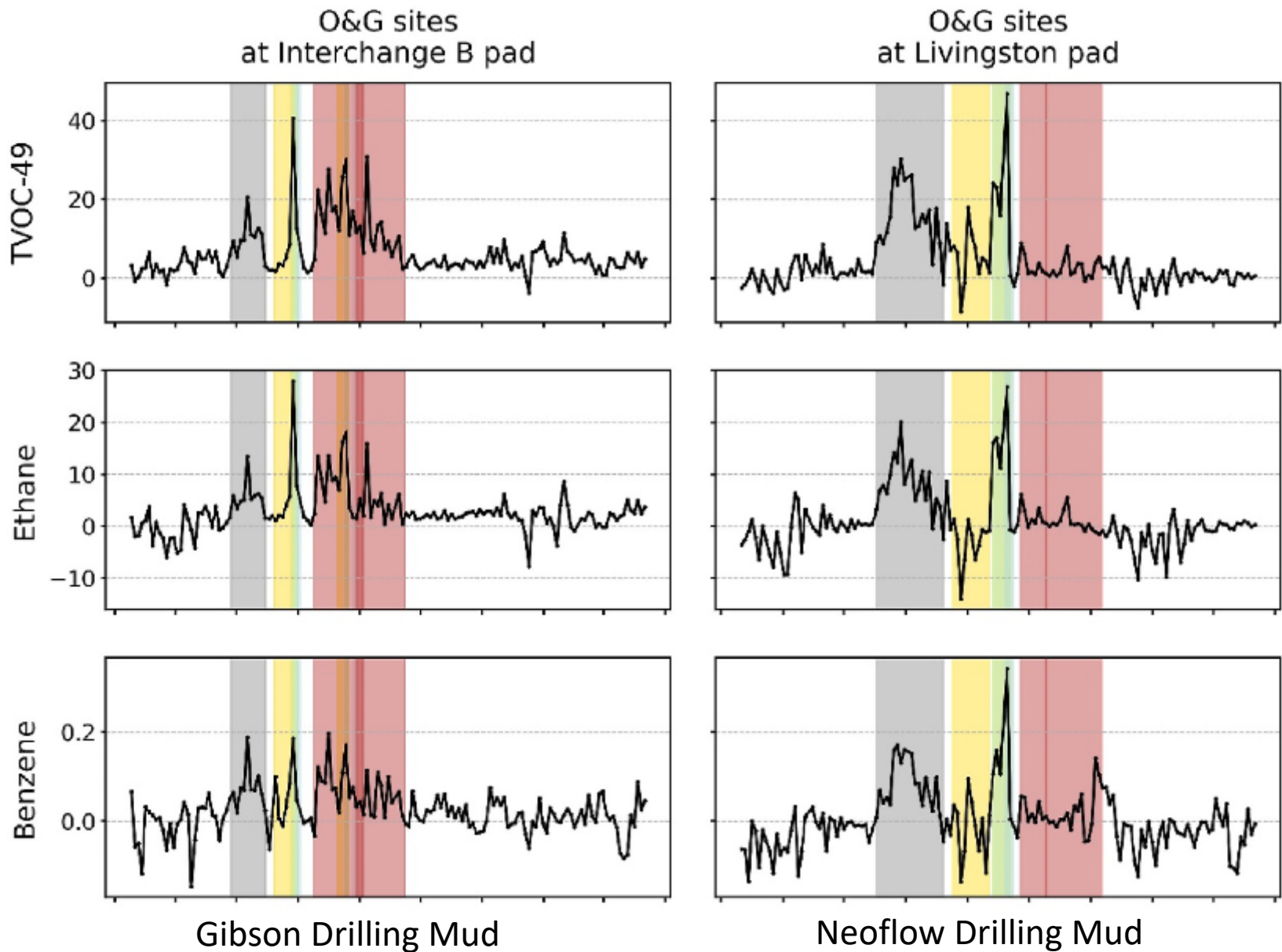
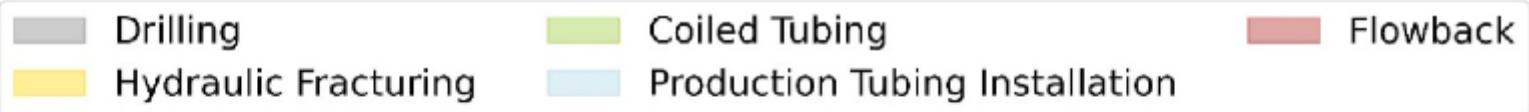
- City and County Council
  - Address citizens concerns about impacts (quality of life, noise, health)
  - Elections in 2019 put some of the most vocal anti-fracking citizens on the council.
- Broomfield Staff
  - People on the ground interacting with all parties and fulfilling the wishes of Council.
- Companies Developing Wells
  - Agreed to cooperate as condition of operating.
- Citizens
  - Health impacts of air toxics – chronic exposure
  - Change with time to be more concerned with acute impacts

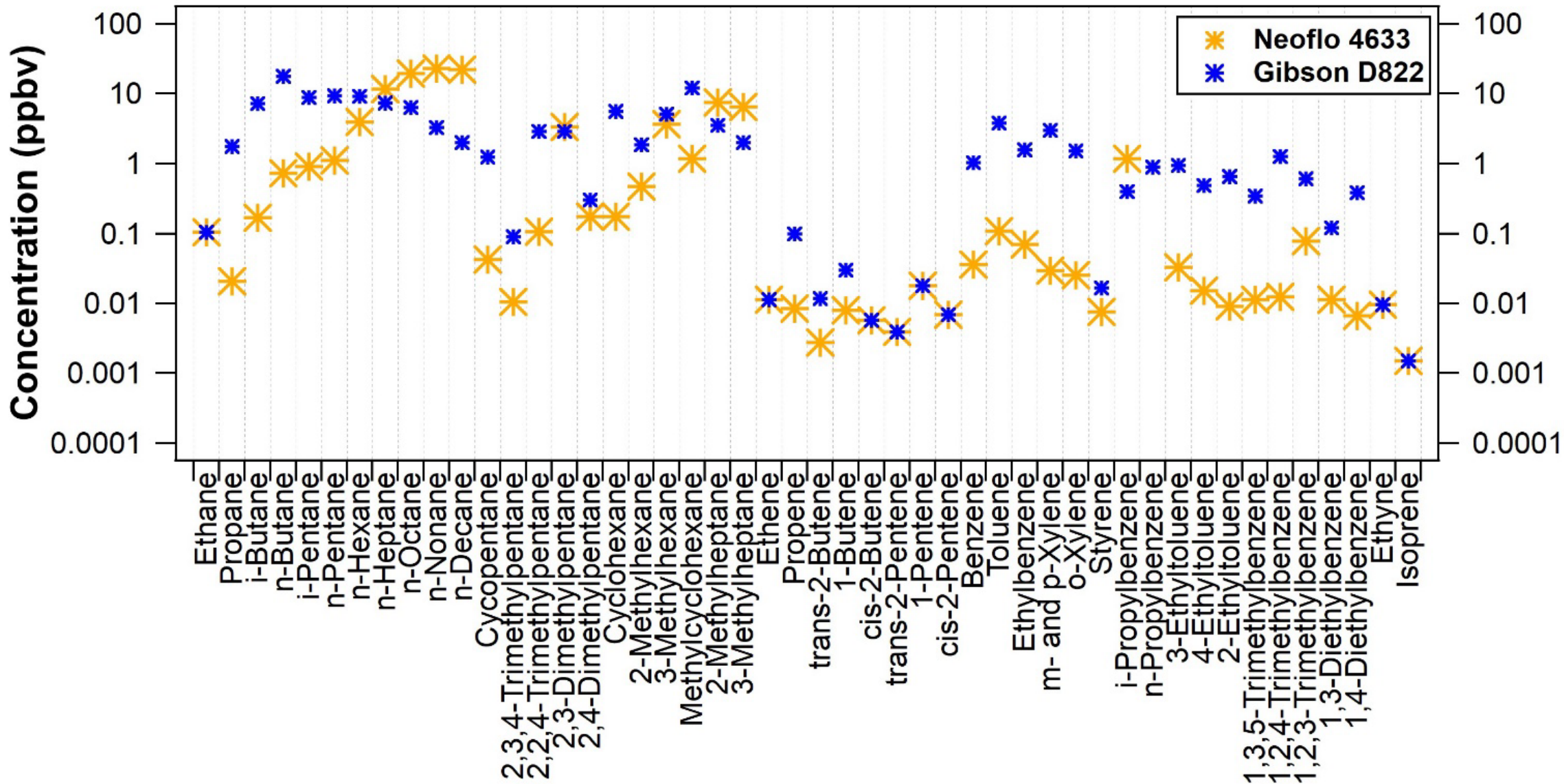


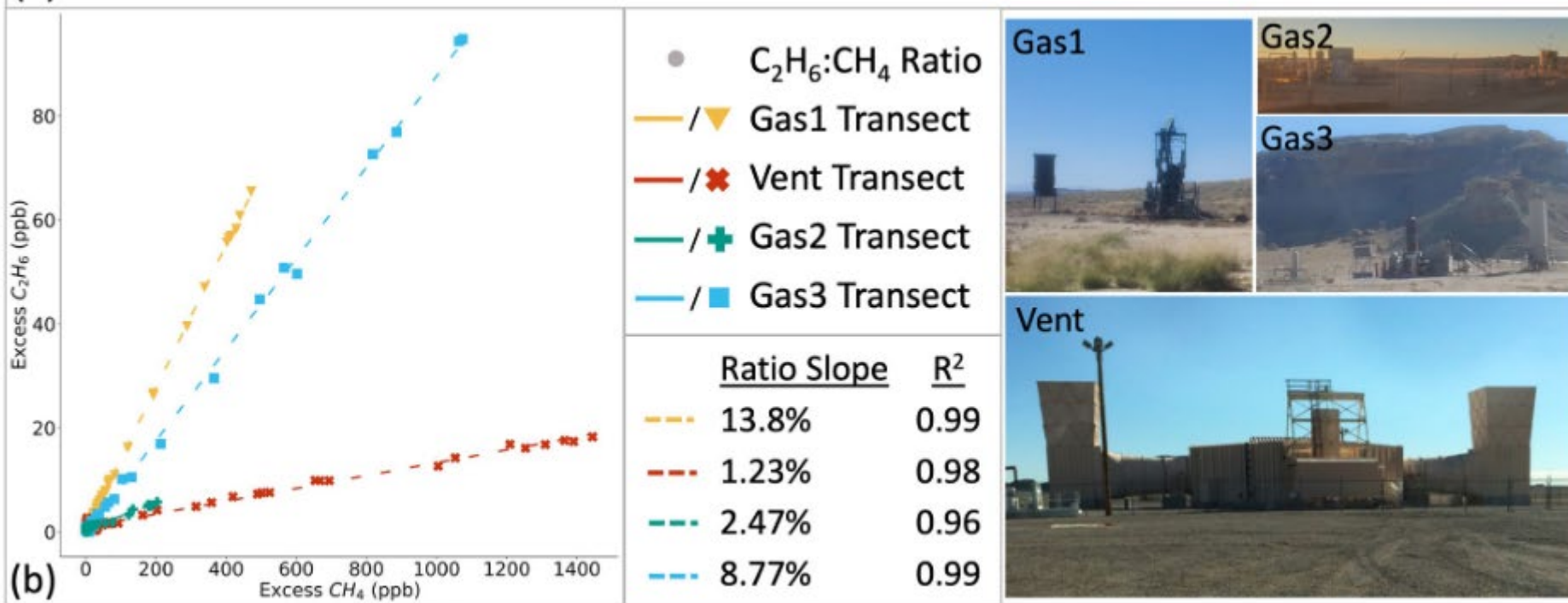
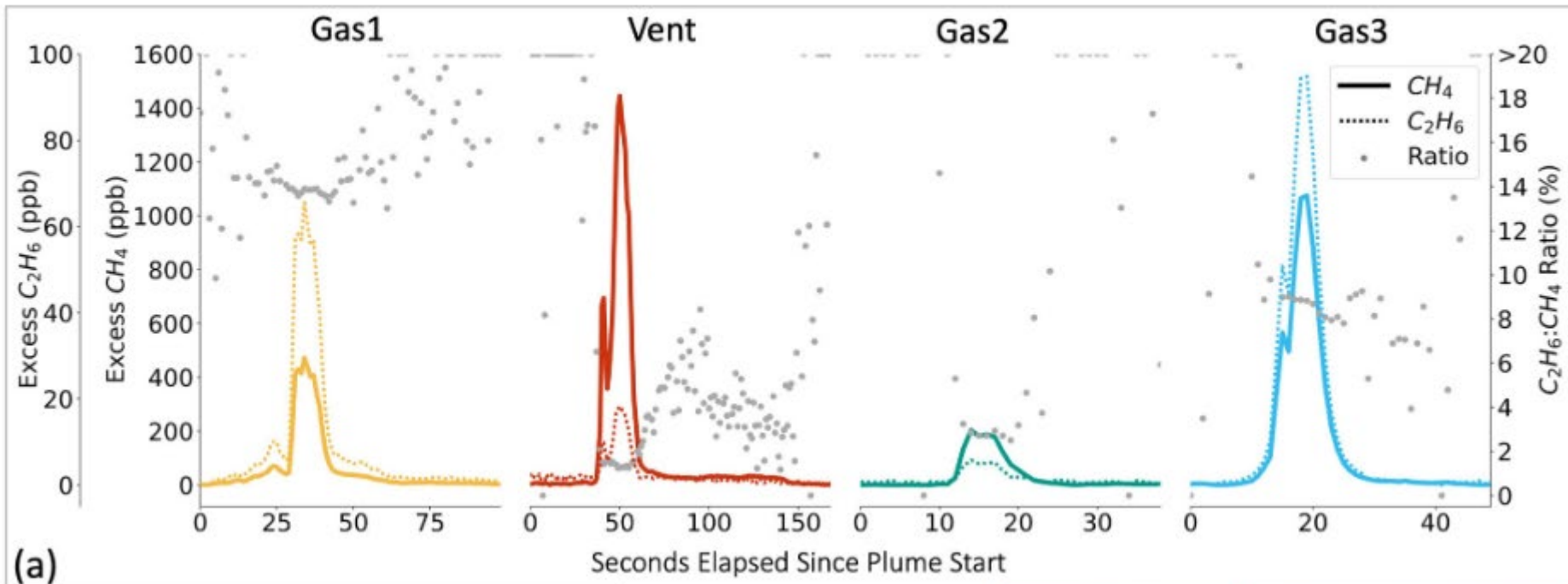
# Broomfield air monitoring study (2018-2019)

- Weekly canisters (methane + speciated VOCs)
  - Sub-chronic (14 day) and chronic (annual) exposure potential
  - “Fingerprint” source contributions
- CSU Mobile plume tracker
  - Find plumes and document peak VOC concentrations
- Small sensors using Ajax Analytics











# Related Publications

- Ku, I.-T., Zhou, Y., Hecobian, A., Benedict, K., Buck, B., Lachenmayer, E., Terry, B., Frazier, M., Zhang, J., Pan, D., Low, L., Sullivan, A., Collett, J.L., 2024. Air quality impacts from the development of unconventional oil and gas well pads: Air toxics and other volatile organic compounds. *Atmospheric Environment* 317, 120187. <https://doi.org/10.1016/j.atmosenv.2023.120187>
- Meyer, A.G., Lindenmaier, R., Heerah, S., Benedict, K.B., Kort, E.A., Peischl, J., Dubey, M.K., 2022. Using Multiscale Ethane/Methane Observations to Attribute Coal Mine Vent Emissions in the San Juan Basin From 2013 to 2021. *Journal of Geophysical Research: Atmospheres* 127, e2022JD037092. <https://doi.org/10.1029/2022JD037092>
- Pan, D., Pollack, I.B., Sive, B.C., Marsavin, A., Naimie, L.E., Benedict, K.B., Zhou, Y., Sullivan, A.P., Prenni, A.J., Cope, E.J., Juncosa Calahorrano, J.F., Fischer, E.V., Schichtel, B.A., Collett Jr., J.L., 2023. Source characterization of volatile organic compounds at Carlsbad Caverns National Park. *Journal of the Air & Waste Management Association* 73, 914–929. <https://doi.org/10.1080/10962247.2023.2266696>
- Pollack, I.B., Pan, D., Marsavin, A., Cope, E.J., Juncosa Calahorrano, J., Naimie, L., Benedict, K.B., Sullivan, A.P., Zhou, Y., Sive, B.C., Prenni, A.J., Schichtel, B.A., Collett, J., Fischer, E.V., 2023. Observations of ozone, acyl peroxy nitrates, and their precursors during summer 2019 at Carlsbad Caverns National Park, New Mexico. *Journal of the Air & Waste Management Association* 73, 951–968. <https://doi.org/10.1080/10962247.2023.2271436>
- Benedict, K.B., Prenni, A.J., El-Sayed, M.M.H., Hecobian, A., Zhou, Y., Gebhart, K.A., Sive, B.C., Schichtel, B.A., Collett, J.L., 2020. Volatile organic compounds and ozone at four national parks in the southwestern United States. *Atmospheric Environment* 239, 117783. <https://doi.org/10.1016/j.atmosenv.2020.117783>
- Benedict, K.B., Prenni, A.J., Sullivan, A.P., Evanski-Cole, A.R., Fischer, E.V., Callahan, S., Sive, B.C., Zhou, Y., Schichtel, B.A., Jr, J.L.C., 2018. Impact of Front Range sources on reactive nitrogen concentrations and deposition in Rocky Mountain National Park. *PeerJ* 6, e4759. <https://doi.org/10.7717/peerj.4759>
- Thompson, T.M., Rodriguez, M.A., Barna, M.G., Gebhart, K.A., Hand, J.L., Day, D.E., Malm, W.C., Benedict, K.B., Collett, J.L., Schichtel, B.A., 2015. Rocky Mountain National Park reduced nitrogen source apportionment. *Journal of Geophysical Research: Atmospheres* 120, 4370–4384. <https://doi.org/10.1002/2014jd022675>