

Could O&G Wastewater Be a Significant Source of Air Toxics in the Northern Colorado Front Range?

R. Edie¹, A.M. Robertson¹, S. Murphy¹, G. Petron^{2,3}, M. Madronich^{2,3}, and B.H. Vaughn⁴

¹University of Wyoming, Laramie, WY 82071; 719-244-6364, E-mail: redie@uwyo.edu

²Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309

³NOAA Earth System Research Laboratory, Global Monitoring Division (GMD), Boulder, CO 80305

⁴Institute of Arctic and Alpine Research (INSTAAR), University of Colorado, Boulder, CO 80309

Upstream oil and natural gas (O&G) operations in the Northern Colorado Front Range (NCFR) ozone non-attainment area have come under scrutiny as sources of ozone precursor emissions and hazardous air pollutants such as benzene, toluene, ethylbenzene, and xylenes (BTEX). Additionally, drilling operations in close proximity to residential areas have increased the public's concern about possible health impacts. An often-overlooked byproduct of oil and gas extraction—produced water—is another area of concern for potential air quality and health impacts in the region.

Emission plumes from produced water disposal facilities were investigated with the University of Wyoming mobile laboratory, which houses an Ionicon Proton Transfer Reaction Time of Flight Mass Spectrometer (measuring BTEX), Picarro CH₄/CO₂/CO analyzer, meteorological instrumentation, and GPS. BTEX enhancements observed at these facilities were three to four orders of magnitude above background in some instances. These real-time measurements of BTEX mixing ratios downwind of disposal wells reveal seasonal and day-to-day variations in emission composition profiles. Additionally, the relative abundance of BTEX species is not reflected in the inventory (Figure 1). Most striking is the complete absence of benzene in the State inventory for some facilities.

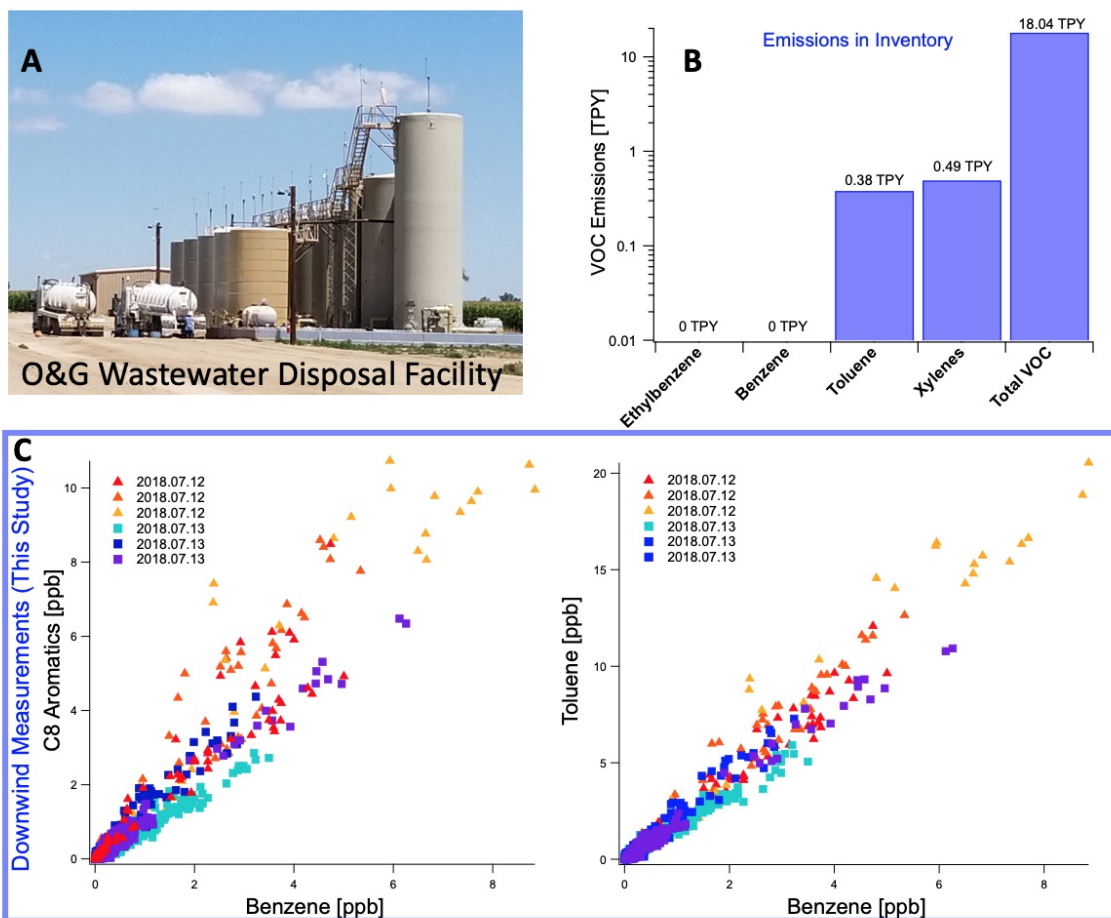


Figure 1. Oil and gas wastewater disposal facility (A) with associated emissions from the State inventory (B). Emissions measured in this study (C) indicate benzene is missing from the inventory.