RISK MANAGEMENT

O&G Development:

Potential community health implications

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Ramboll Risk Management

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Credentials

- PhD, SM in Toxicology
- Fellow Academy of Toxicological Sciences

Experience

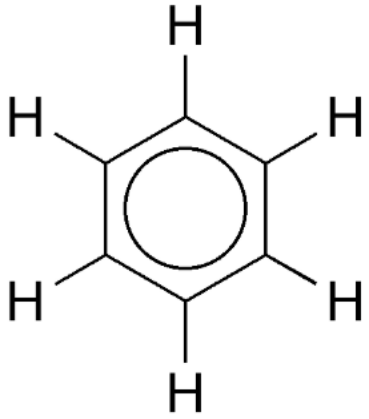
- > 40 years as a toxicologist, including assessing potential health risks from inhaled pollutants

Publications

- >3 dozen peer-reviewed scientific papers, book chapters, or reports
- Editor, 2 scientific books

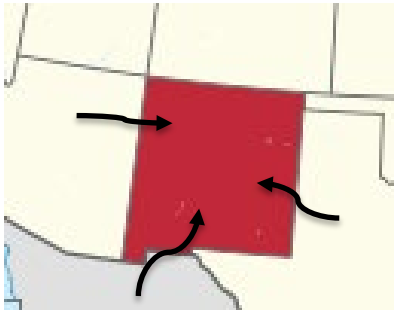
A Tale of Two Pollutants: Ozone and Benzene

- Ozone (O_3) is a criteria pollutant, regulated under NAAQS
- Benzene is a Hazardous Air Pollutant (HAP), aka Air Toxic
- Handout



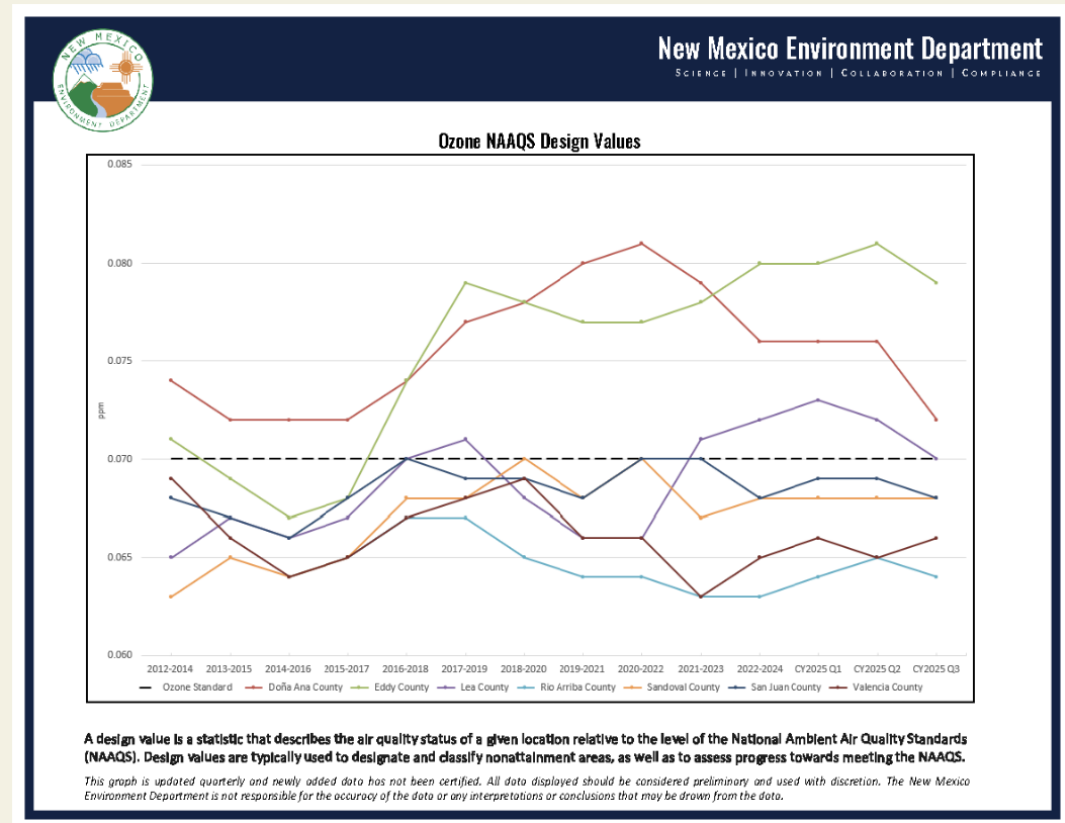
Sources: Ozone and Benzene

Ozone



Benzene

A Tale of Two Pollutants: Ozone

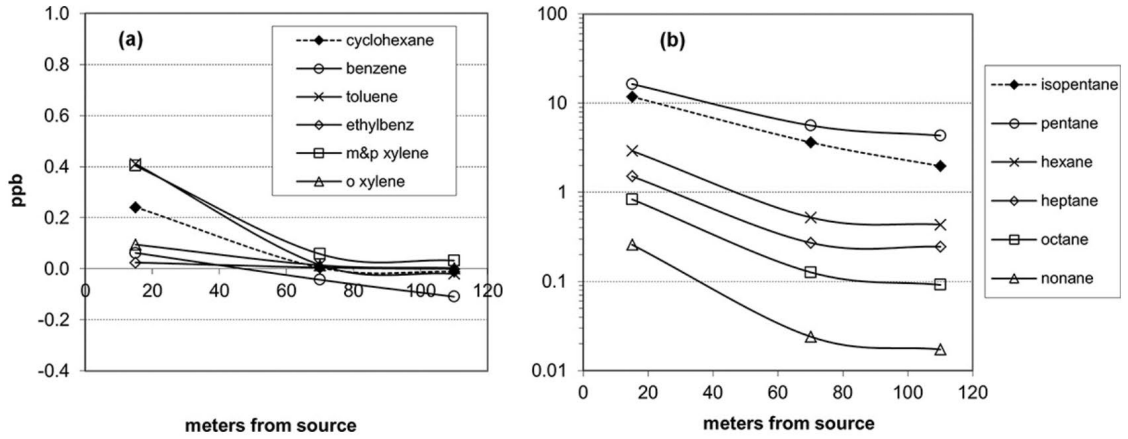


- Formed in atmosphere
- NOx is often rate-limiting
- Regional transport
- Concentration varies with year, season, location
- Averaging time is important with respect to comparisons with health effects

A Tale of Two Pollutants: Benzene

- Benzene emissions dissipate with distance from sources

Figure 5. VOC gradient downwind of a well with condensate tank emissions. (a) Aromatics and cycloalkanes (linear scale); (b) aliphatic hydrocarbons (log scale). Concentrations are background subtracted 7-day averages for the week of May 13, 2010.

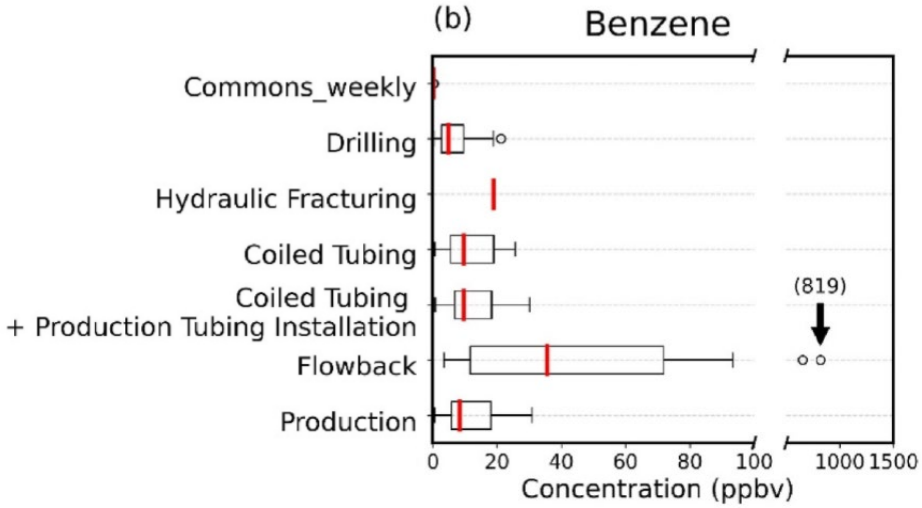


From Zielinska et al., 2014. *JAWMA* 64 (12): 1369–83. https://doi.org/10.1080/10962247.2014.954735.

relative to alkanes. In addition, 1,3-butadiene does not show an appreciable

Oil and Gas Development Sites

- Different development phases
  - Preproduction phases usually last weeks-to-months; production phase can last 30 years, dominate lifetime exposures
  - Emissions decrease further during production
- Emissions have decreased in more contemporary wells



From Ku et al., 2024. *Atmospheric Environment* 317 (January): 120187.

Health Effects Considerations

- Concentration matters! Exposure duration matters!
- Health benchmark values (IRIS, ATSDR, etc.) are **very conservative**. Exposure above these concentrations does not necessarily mean health effects are likely to occur.

Ozone	Benzene
NAAQS (Primary and secondary): 0.07 ppm (~143 µg/m^3) as the annual fourth-highest daily maximum 8 hour average concentration, averaged over 3 years.	HAPs values:
	Chronic cancer: 2.2 x 10^{-6} to 7.8 x 10^{-6} per µg/m^3 (EPA IRIS)
	Chronic noncancer: 30 µg/m^3 (EPA IRIS RfC) 6 µg/m^3 (ATSDR MRL)
	Intermediate noncancer: 20 µg/m^3 (ATSDR MRL)
	Acute noncancer: 30 µg/m^3 (ATSDR MRL)

Evaluating Community Impacts: Epidemiological Studies

- **Observational studies** in human populations where exposure happens in an environment (e.g., people living near O&G sites, people working at O&G sites)
- Exact exposure is not always known
  - Sometimes must be estimated using surrogate measures
  - Other exposures, social factors sometimes but not always accounted for

Conclusion: Study limitations of O&G studies to date prevent concluding that exposures originating directly from O&G sites contribute to health outcomes.

Evaluating community impacts: Risk Assessment Studies

- **Exposure estimates** at different distances away from well sites, using measured or conservatively modelled concentrations
- Compare exposure estimates to **conservative estimates of risks** set by authoritative bodies (USEPA, ATSDR)
  - If Hazard Quotient (HQ) $\leq$1.0, then no significant risks anticipated
  - For cancer, excess risk range of 1- to 100-in-a-million acceptable
- Studies examined chronic (cancer and noncancer) and acute exposures; multiple HAPs.

Conclusion: Most studies only examined distances >½ mile from O&G sites → No significant risks.

Conclusions

- Ozone is a regional pollutant; substantial fraction in NM comes from out-of-state
- Benzene and other VOCs from O&G well sites dissipate with distance from site
- Duration of exposure is important In evaluating potential health impacts
- Study limitations of O&G studies to date prevent concluding that exposures originating directly from O&G sites contribute to health outcomes
- Most studies estimating exposure from O&G sites only examined distances >½ mile away → Conclude no significant risks

RHP RISK MANAGEMENT

Thank you!

Questions?

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