

Why worry about air pollution near natural gas operations?

- Volatile organic compounds (VOCs) are released at all stages of natural gas production. Sources of air pollution include the following.
 - raw natural gas contains many toxic non-methane hydrocarbons (NMHCs) that surface with the methane and are released during venting and in fugitive emissions at all stages of natural gas production and delivery
 - mobile and stationary equipment release VOCs, NO_x, CO and particulate matter through exhaust and evaporative emissions
 - pit fluids are a source of VOCs, including break-down products and combinations of chemicals that cannot be predicted
 - volatile chemicals are used during cleaning and maintenance of well pads and equipment
 - volatile chemicals injected underground during drilling and hydraulic fracturing (fracking) could eventually surface
- Many of the VOCs cause adverse health effects and/or are ozone precursors.

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Implications of *An Exploratory Study of Air Quality Near Natural Gas Operations*¹

- **FINDING:** In this closed-loop system, the number and concentrations of chemicals detected was highest during the early stage of drilling, and fracking events did not substantially alter the number or concentration of chemicals present.
 - **IMPLICATION:** This study demonstrates the need to focus on a new suite of toxic volatile chemicals, the NMHCs released during drilling, that heretofore have received little attention.
- **FINDING:** There can be large variations from week to week in the types and numbers of volatile chemicals detected.
 - **IMPLICATION:** Grab samples reveal what is in the air at a particular moment and cannot accurately represent the different chemicals that can be released during

all stages of well development and production, or the range of their concentrations. Under-sampling could lead to false negative results.

- **IMPLICATION:** To better interpret the results from systematic sampling, weather patterns and seasonal changes need to be measured (e.g. using wind roses). Sampling during seasons of low temperature and low wind velocity is particularly important in areas that are prone to inversions.
- **FINDING:** Chemical concentrations were below federal exposure limits, but above concentrations found to have health effects in scientific studies.
 - **IMPLICATION:** Government standards do not take into account low-level, chronic exposure experienced by the increasing numbers of people in close proximity to gas operations. Some VOCs are endocrine disrupting chemicals, which can cause adverse effects at low-concentrations, even in parts per trillion, for which there are no government standards yet.
- **FINDING:** Polycyclic aromatic hydrocarbons (PAHs), detected in parts per trillion, were at greater concentrations than were reported in urban studies of prenatal exposure, in which adverse effects on fetal growth and childhood cognitive development were demonstrated.
 - **IMPLICATION:** Concentrations of PAHs should be investigated in rural neighborhoods with and without natural gas activity.
- **FINDING:** Methylene chloride was detected in 73% of the samples, sometimes at extremely high concentrations, but was not listed as an ingredient in any of the products reported in two lists of several hundred products used by the natural gas industry^{2,3}.
 - **IMPLICATION:** This suggests that it is time to require full disclosure for all toxic chemicals used during natural gas operations, including those that might only be used above ground.

¹ Colborn, T.; Schultz, K.; Herrick, L.; and Kwiatkowski, C..2014. An exploratory study of air quality near natural gas operations. *Hum Ecol Risk Assess* 20(1):86-105, doi: 10.1080/10807039.2012.749447.

² Colborn, T.; Kwiatkowski, C.; Schultz, K., and Bachran, M. 2011. Natural gas operations from a public health perspective. *Hum Ecol Risk Assess* 17(5):1039-1056, doi: 10.1080/10807039.2011.605662.

³ US House of Representatives Committee on Energy and Commerce Minority Staff. 2011. Hydraulic Fracturing Report.