

# The Health Effects Associated with Air Pollution from Hydraulic Fracturing

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# Assaults to Air Quality

## (A non-comprehensive list)

- Dust/Silica
- Volatile Organics from:
  - Condensate Tanks
  - Compressors Stations
  - Gas Lines
  - Rogue gas (escaping gas)
  - Evaporative pits/flowback
- Diesel fumes from:
  - Drilling Engines
  - Large Fracking Pumps
  - Truck traffic (~1000 trucks per leg/inc w longer legs)<sup>1,2</sup>



### Air Contamination from fires and explosions

Note1: Each truck comes to the site and goes from the site - effectively doubling traffic.

Note2: No adverse situations to this point, all as planned

# Reference

McKenzie LM, et al, Human health risk assessment of air emissions from development of unconventional natural gas resources, *Sci Total Environ* (2012), doi: [10.1016/j.scitotenv.2012.02.018](https://doi.org/10.1016/j.scitotenv.2012.02.018)

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McKenzie et al. **Assessment of the chemicals found**

- **78 chemicals were detected** in the air in this study. **45** of those chemicals had previously established toxicity values.
- These chemicals were detected by actual **direct measurement**. They are not “theoretical”.
- **Flowback** : was shown to be the **most dangerous time** for human health

**Residents living  $\leq \frac{1}{2}$  mile from wells are at greater risk for negative health effects** than are residents living further away.

# Hazard Indexes

- “McKenzie used standard United States Environmental Protection Agency (EPA) methodology to estimate non-cancer Hazard Indexes and excess lifetime cancer risks for exposures to hydrocarbons”
- **Primary Limitation of EPA Risk Methodology** – “safe” levels are **outdated-science has advanced.**

Human health risk assessment of air emissions from development  
of unconventional natural gas resources  
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- Several factors may have lead to an **underestimation of risk** in our study results:
  - air pollutants **directly** associated with the NGD process via emissions from wells or equipment used to develop wells, including formaldehyde, acetaldehyde, and particulate matter, **were not measured**.
  - **We did not include ozone** or other potentially relevant exposure pathways such as **ingestion of water** and **inhalation of dust** in this risk assessment because of a lack of available data.

# Limitations

- To calculate the hazards indexes: the study results were compared to **industrial samples** where **people** were **exposed only 40 hours/wk** to chemicals. With 128 hours/wk to detoxify and allow their bodies to recover.
- Horizontal fracking exposes those who live or work adjacent to a frack pad to chemicals **168 hours/ week**. This is **4 times more exposure!** Happening each week.
- with NO exposure-free time to recuperate.

# Limitations

Occupational/industrial database did not include babies, toddlers, children, teens or the elderly. It included few pregnant women and no babies in utero. That database and toxicologists in general assumed that only if an exposure exceeded a certain threshold or “toxic” level was it harmful. It was thought that it was all dose related. Our scientific knowledge now has shown that low level exposures can cause problems and disease if those exposures are chronic or recurring.

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# Multiple Chemical Exposures

Simultaneously increase risk

- In general chemical toxicity studies have been on one isolated chemical, **not multiple chemical exposures at once.**
- The levels needed to cause bad effects are lower with exposure to multiple simultaneous chemicals .
- There have been some studies on exposure to 3 chemicals at a time. The lethal dose of each chemical is much lower when an animal (or human) is exposed to 3 chemicals at a time.

# Problems with clearing multiple chemicals at the same time

- The bulk of the clearing is done in the liver by enzymes known as the **cytochrome P<sub>450</sub>** system
- There are over 50 Cytochromes.
- Unfortunately for us, only 3 of these Cytochrome systems can clear hydrocarbon compounds such as the ones measured in the McKenzie study. **Toll booths!**
- **Exposing people to 78 hydrocarbons in the air simultaneously will overload the cytochromes.**
- The buildup of toxic substances unable to be cleared can cause sickness, symptoms and disease.

# Other Problems

- **The Lungs as a special problem:** they are vulnerable to toxic effects of the gases given off in unconventional natural gas drilling. Oxygen & carbon dioxide aren't the only gasses to cross into the lungs.
- **Any gas in the air can and will cross!**
- Just as nicotine in cigarette smoke crosses into the lungs and into the blood stream almost instantaneously causing constriction of blood vessels,
- chemicals such as benzene & xylene cross into the lungs and are almost instantaneously absorbed into the blood and are then coursing through our blood vessels to every cell in our body.

# Other serious issues related to health

- **Pregnant women:** the **placenta has no barrier** to keep inhaled gases in the mother's blood stream from getting to the baby.
- **Pregnant women:** if an endocrine disruptor gets in during organ development or brain development it can change development causing a permanent problem that medicine can't reverse or "fix" later.
- **Toddlers and children:** 1) immature systems for clearing substances 2) smaller bodies less places to store toxins. Same amount of a toxin can have larger effects.

# Teens and the Elderly

- **Teens:** Puberty is a particularly bad time to experience chemical exposures. Seems to pre dispose to chemical sensitivity.
- **Elderly:** the detoxification systems like other systems have less capacity as we age. The “weaker” systems may be more sensitive to a chemical insult.

# parting questions:

- Is it fair that Oil and Gas exploration companies (unlike all other US companies) be allowed to introduce an industrial process into our neighborhoods with **no provision for enforcement** of the safety standards that all other US companies have to operate within?
- Do we as a country **have the RIGHT to say** that **peoples' health is not important** enough to merit **regulation** of an industry that is **measurably contaminating the air** around their homes, schools, and food supply?