

Air quality and unconventional oil and gas sites

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Research suggesting air pollutants released by unconventional oil and gas production are well over recommended levels in the US is published today in the open access journal *Environmental Health*. High levels of benzene, hydrogen sulfide and formaldehyde were found. The study is the first to be based on community sampling by people who live near production sites and could be used to supplement official air-quality monitoring programs.

Unconventional oil and gas come from reserves that do not readily flow to the surface. This is because they are either distributed throughout rocks with low permeability or, as in the case of shale gas, trapped by the sedimentary rock shale. They are usually extracted using techniques such as vertical or horizontal drilling and hydraulic fracturing.

Previous studies have focused on contamination of ground and surface water, with very few looking at air pollution or [air quality](#). Work on air quality has either focused on regional sources of air pollutants or gathered data from one or a limited number of production sites averaged over a long period of time.

In this research, residents were trained to take 'grab air' samples and collected 35 samples at 11 sites across five states in the US: Wyoming, Arkansas, Pennsylvania, Colorado and Ohio. They were asked to take samples during periods of heavy industrial activity on site or when feeling acute health symptoms such as headache, nausea or dizziness. In addition, 41 passive tests were set up to monitor for formaldehyde near

production facilities or compressor sites. All collected samples were logged and sent to a lab for analysis.

Lead researcher, David O. Carpenter from the University at Albany in New York, said: "We explored air quality at a previously neglected scale: near a range of unconventional oil and gas development and production sites that are the focus of community concern. Residents conducted sampling in response to operational conditions, odor events, and a history of the onset of acute symptoms."

A total of 16 of the 35 grab sample sites and 14 of 41 passive formaldehyde tests exceeded minimal risk levels set out by the US Agency for Toxic Substances and Disease Registry and the US Environmental Protection Agency Integrated Risk Information System. The three chemicals most commonly found to exceed recommended levels and which are linked to increased risk of diseases were benzene, hydrogen sulfide and formaldehyde.

The air samples that exceeded recommended levels of benzene were found to range from 35 to 770,000 times higher than background levels. The concentrations were up to 33 times the benzene concentration one gets when pumping gasoline into your car. The exposure one would get in five minutes at one Wyoming site is equivalent to that you would get living in Los Angeles for two years or Beijing for eight and half months. For the samples with higher than recommended levels of [hydrogen sulfide](#), the results ranged from 90 to 60,000 times higher than background levels, all above the odor threshold (smell of rotten eggs), according to the US Occupational Safety and Health Administration (OSHA). OSHA reports that these concentrations would cause eye and respiratory tract irritation after 1 hour of exposure, accompanied by fatigue, loss of appetite, headache, irritability, poor memory and dizziness. Formaldehyde levels in the 14 samples that were outside federal guidelines were 30-240 times higher than background levels.

This is more than twice the formaldehyde concentration that occurs in rooms where medical students are dissecting human cadavers, and where most students report respiratory irritation. Both benzene and formaldehyde cause cancer, but cancer takes a long time to develop and won't appear for years.

The study is limited by the number of samples taken in each state and the fact that samples were taken at only a very few of the thousands of unconventional oil and gas sites. They also reflect sampling at one point in time for all measurements but for [formaldehyde](#). So these results are more a worst-case concentration than an average over long periods of time.

David Carpenter said: "Community-based monitoring near unconventional oil and gas operations has found dangerous elevations in concentration of hazardous [air pollutants](#) under a range of circumstances. In this study we have shown that community-based research can improve air-quality data while adhering to established methods. Our findings can be used to inform and calibrate state monitoring and research programs."

More information: Air concentrations of volatile compounds near oil and gas production: A community-based exploratory study , Gregg P. Macey, Ruth Breech, Mark Chernaik, Caroline Cox, Denny Larson, Deb Thomas and David O. Carpenter , *Environmental Health* 2014, 13:82. www.ehjournal.net/content/13/1/82/abstract

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