

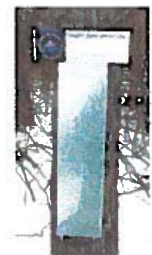


Air Quality in Ohio: Impacts of Unconventional Natural Gas Drilling (UNGD)

Dear Keith,

Thank you for participating in this air quality study being conducted by the University of Cincinnati and Oregon State University in Carroll County. The purpose of this study is to analyze air quality before, during and after unconventional natural gas drilling. In the first phase of the study, our research team placed twenty-five passive air samplers on twenty-three properties from February 17-20, 2014 in Carroll County. After three weeks, all samples were returned to Oregon State University by trained landowners to be analyzed and provide environmental passive sampling results.

The passive air sampling material used can collect thousands of different chemicals, including semi-volatile organic compounds which can impact human health. This includes PAHs (polycyclic aromatic hydrocarbons) which may be related to drilling activities. We have analyzed the samples for PAHs. Our analytical methods can measure 62 different PAHs at extremely low concentrations.



Air sampler

This report contains the environmental passive sampling results collected in Carroll County. The results are first shown with all results from the study averaged together, then results from your property are provided. Below, you will find basic information about PAHs. Detailed explanations accompany the results in the following pages.

What are PAHs?

Polycyclic aromatic hydrocarbons (PAHs) are environmental pollutants of concern. PAHs are a class of more than 100 chemicals composed of two or more rings. People are typically exposed to mixtures of PAHs, not to just a single PAH.

Where are PAHs found? PAHs can be found in the air, water and soil. The majority of PAHs come from incomplete combustion events. PAHs can be produced from natural (forest fires, volcanoes, oil seeps) and man-made (industrial emissions, traffic exhaust, chemical spills) sources. PAHs are considered semi-volatile organic compounds, meaning that they may be in the gas phase which can be breathed in.

Do PAHs affect human health? PAHs are a human health concern. The level of concern depends on how you are exposed as well as the concentration and PAHs present. A number of studies have linked PAH exposure to certain cancers, such as lung and skin cancer, particularly in occupational settings. Some PAHs have been shown to have respiratory effects and are related to chronic obstructive pulmonary disease (COPD).

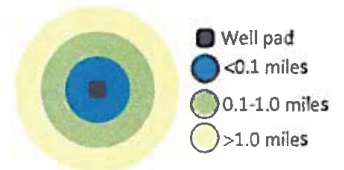
Thank you for participating in this research study!

It was a pleasure working with you! We hope you find these results easy to understand. Please contact us with any questions or feedback:
Diana Rohlman, PhD | diana.rohlman@oregonstate.edu | 541-737-4374

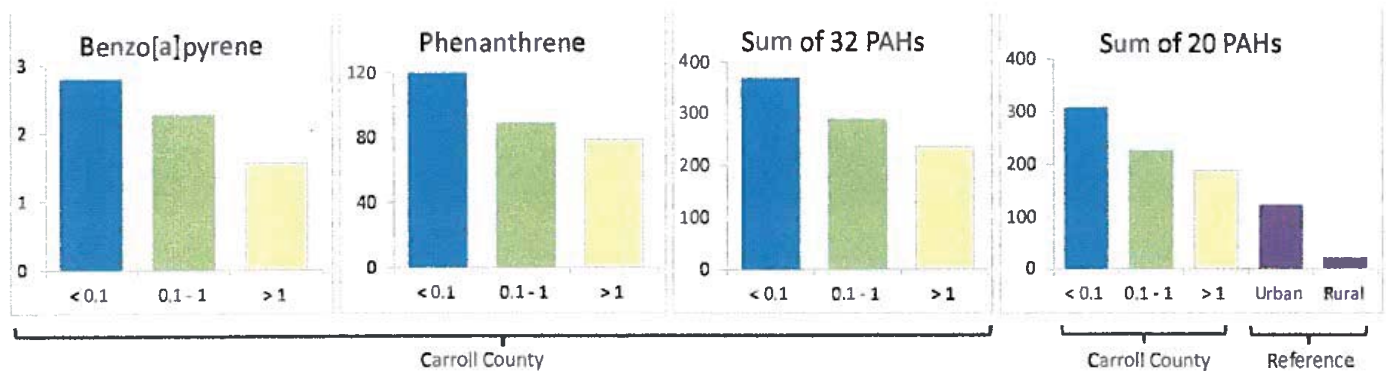
For more information about this study, please visit: <http://ehsc.oregonstate.edu/air/ohio>.

1 Summary of All Results Averaged Together

We are interested in the effect that Unconventional Natural Gas Drilling (UNGD) may have on air quality. These graphs show results grouped by distance in miles from the sampler to the closest active well. We have also compared our data to data from other reference locations.



These graphs contain the average concentrations of all 25 samples measured in Carroll County. The results show air concentrations measured in nanograms per meter cubed (ng/m^3), which is the amount of the chemical in a cubic meter of air.



Graph Explanations

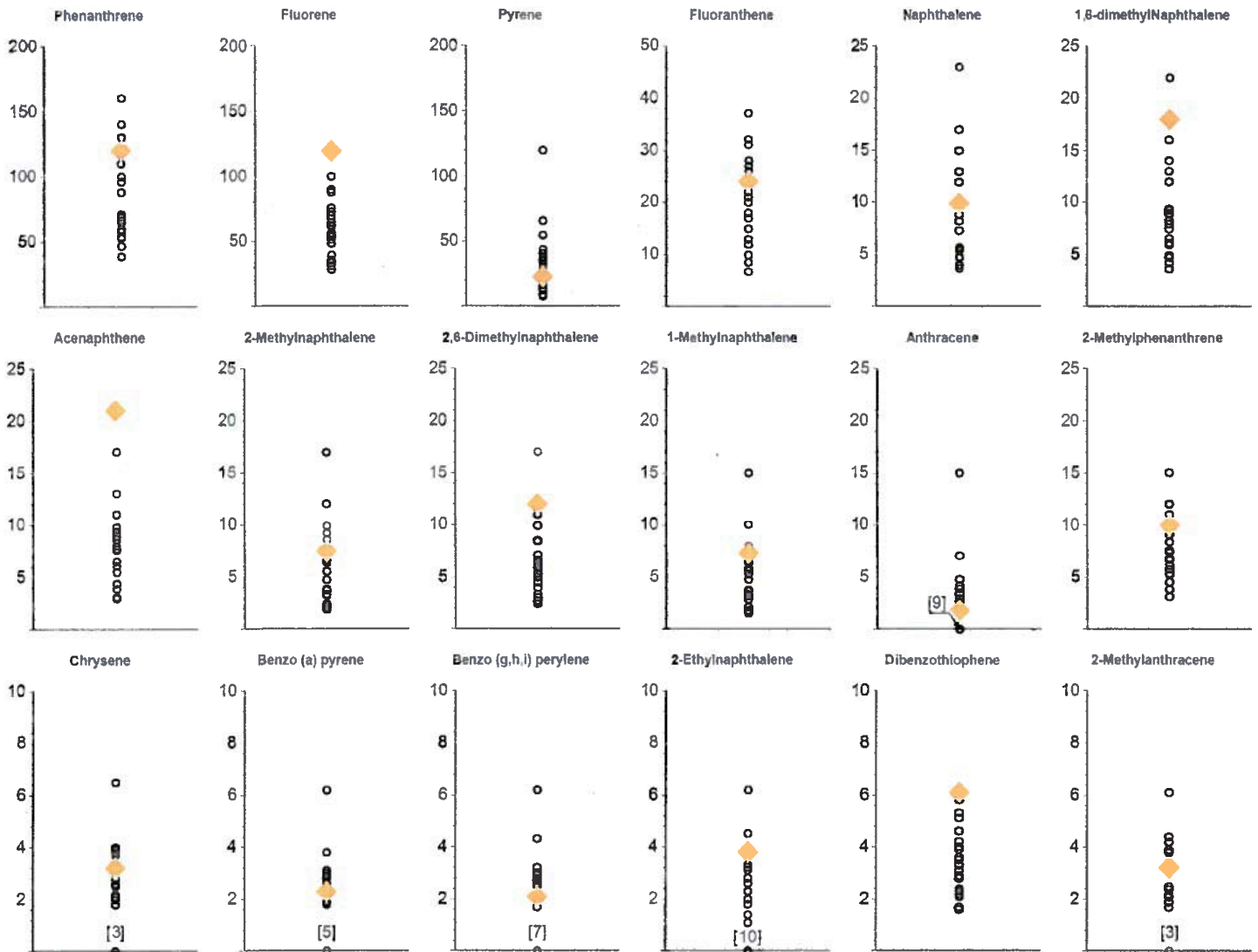
A total of 62 PAHs were analyzed in the passive air samples from Carroll County resulting in 32 of the 62 PAHs being detected at measurable concentrations. Above, we show the following graphs from left to right:

Benzo[a]pyrene - One of the PAHs that studies have shown to be associated with cancer risk.

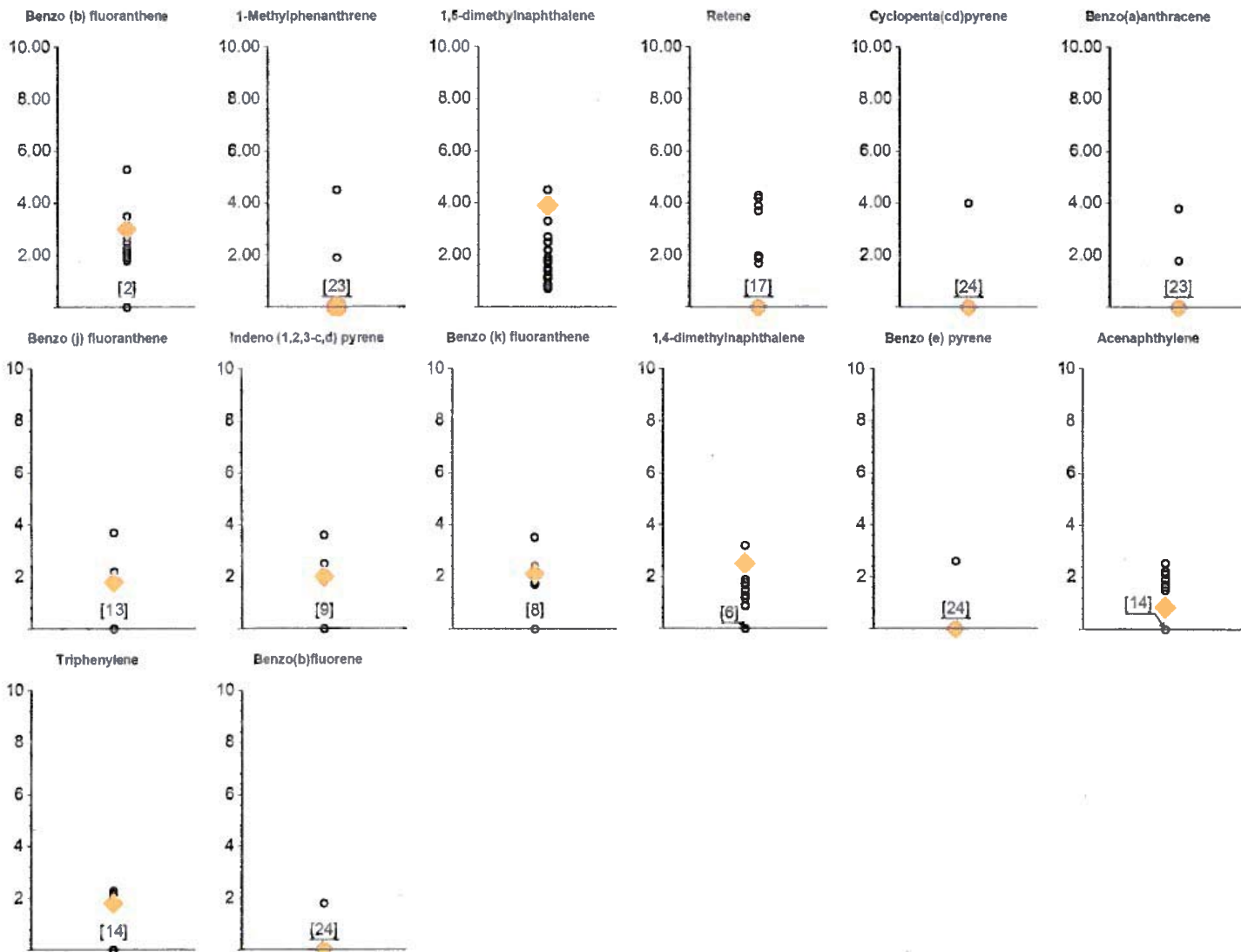
Phenanthrene - One of the PAHs that studies have shown to be associated with diminished lung function.

Sum of 32 PAHs - The concentration of all of the measured PAHs added together.

Sum of 20 PAHs - A previous study (1997) looked at 20 PAHs in urban (downtown Chicago) and rural (east of South Haven, Michigan) locations. For comparison, this graph shows the sum of the 20 PAHs measured in that study (shown in purple) alongside the sum of the same 20 PAHs measured in Carroll County.



Name: Williams



Name: Williams

2 Results From Your Property

Graph Explanation

In the following pages, we show your individual results within the context of all 25 samples analyzed. There are a series of graphs showing each PAH that we measured—a total of 32 PAHs were measurable in Carroll County. The PAHs are presented in the order from the highest concentration measured to the lowest. If a PAH is not presented in the graphs, none of the samplers in Carroll County detected the chemical at measurable levels. For a full list of the 62 PAHs we analyzed, please visit <http://ehsc.oregonstate.edu/air/ohio>.

This sample graph explains how the data is presented:

