Methane levels have increased in Marcellus Shale region despite dip in well installation

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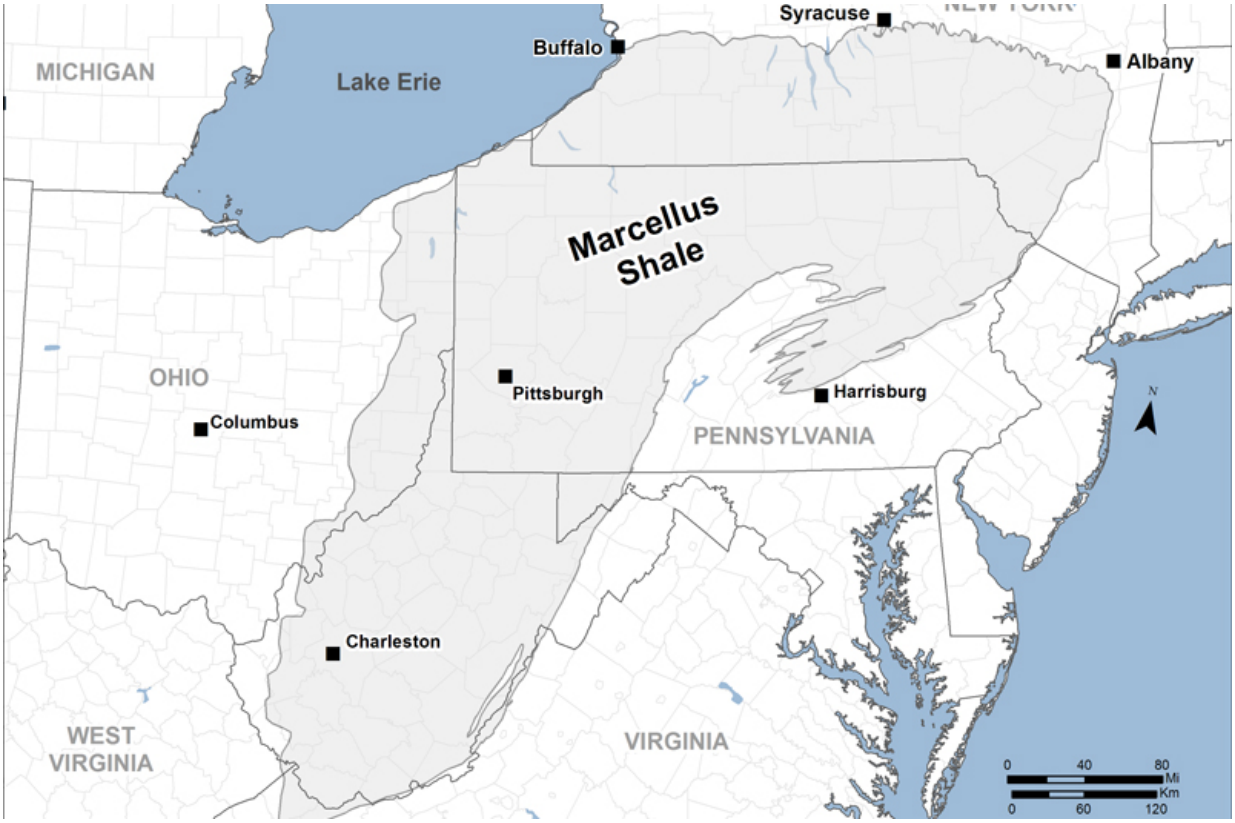

Drexel researchers have been studying air pollution in the Marcellus Shale regions of Pennsylvania for several years. Credit: Drexel University

Despite a slow down in the number of new natural gas wells in the Marcellus Shale region of Northeast Pennsylvania, new research led by

Drexel University finds that atmospheric methane levels in the area are still increasing. Measurements of methane and other air pollutants taken three years apart in the rural areas of Pennsylvania that have been the target of natural gas development over the last decade, revealed a substantial increase from 2012 to 2015.

"Methane is increasing globally, but the rate of increase for this region is much more rapid than global increases," said Peter DeCarlo, PhD, an assistant professor who studies atmospheric chemistry in Drexel's College of Engineering and College of Arts and Sciences, who led the study. "The rapid increase in methane is likely due to the increased production of natural gas from the region which has increased significantly over the 2012 to 2015 period. With the increased background levels of methane, the relative climate benefit of natural gas over coal for power production is reduced."

Since the first shale gas wells were drilled in the Marcellus Shale Basin, a region that diagonally bisects the state from the northeast to the southwest, there have been concerns about what unlocking the new stores of fossil fuel by an unconventional method, called hydraulic fracturing, could mean for the environment. Nearly a decade later, researchers are still working to understand just how the chemicals released and the chemicals used to release them are lingering in the water and air.

This study, which was published in the journal *Elementa: Science of the Anthropocene*, is the latest in a series conducted by DeCarlo and the Drexel Air Resources Research Lab, indicates that levels of atmospheric methane in the region are likely linked to increased natural gas production, rather than the number of new wells drilled in the area. The researchers did not observe this increase for other pollutants, such as carbon monoxide. This suggests that different gas extraction activities—drilling versus production—produce different chemical

emissions, according to DeCarlo.

Data from this study was compared to the team's 2012 findings in the same area, which was the first effort to measure background levels of various atmospheric pollutants associated with shale gas extraction in the Marcellus Shale region of Pennsylvania. The team traversed the area using Drexel's Mobile Laboratory, a Ford cargo van equipped with all the equipment necessary for measuring concentrations of chemicals and particles in the air at 1-10 second intervals while driving.

This sort of ground-level monitoring is a useful way to collect data because the sample air is the same that residents of the area are exposed to. The team covered a large portion of the northeast region of Pennsylvania that included parts of Bradford, Clinton, Columbia, Luzerne, Lycoming, Potter, Susquehanna and Tioga counties and northeast and north central Pennsylvania.

"Our 2015 field study covered a larger spatial area and was funded to focus on pipeline and pipeline technology," DeCarlo said. "But we also overlapped with the 2012 study area and were able to cross check the background concentrations of several pollutants and found the methane levels were higher while the carbon monoxide levels were lower in the overlap regions."

Initial measurements in 2012 showed methane levels at 1960 parts per billion—roughly 50 parts per billion higher than would be expected in a rural area without natural gas development. Three years later that concentration jumped another 100 parts per billion. Atmospheric concentrations without natural gas development rose at 6 parts per billion, so this increase is quite substantial compared to the global increase, according to DeCarlo.

Overall natural gas production from the Marcellus Shale region has

climbed to 16 billion cubic feet per day, which is twice as much as any other unconventional natural gas resource in the country, according to the researchers. Over the last three years alone, production of natural gas from the region more than doubled, despite the fact that there were about half as many new wells drilled in 2015 as there were in 2012, according to Pennsylvania Department of Environmental Protection figures cited in the paper.

"Though the rate at which new wells are being drilled and completed has slowed down, the overall infrastructure, and production has increased," DeCarlo said. "That means that the volume of gas moving through pipelines, compressor stations and processing plants is increasing. If the leakage rate of methane is constant per cubic foot of gas, it would not be surprising that the background methane has increased as much as it has while other pollutants like carbon monoxide, which is more associated with drilling and trucking, are showing a decline."

This finding could also suggest that measures taken by natural gas producers to decrease leakage from well completions, while still necessary, are not sufficient to reduce methane leakage in the Marcellus Shale region. And with the bulk of environmental protection regulations from the PADEP focusing on ground water contamination, it is possible that atmospheric emissions from the natural gas infrastructure could persist until research can more clearly identify the source of the leaks and identify the impact of specific emissions on public health.

The team also used the methodology developed for this study to analyze data from other studies such as the SENEX campaign, undertaken by NOAA researchers from a research aircraft in 2013. The new methodology lays out a roadmap for analysis that can be applied to datasets from other groups and will allow researchers to monitor the background levels of various pollutants in the region as natural gas extraction continues.

"This study is a snapshot from three years development in the Marcellus Shale region," DeCarlo said. "While it has clearly demonstrated trends in various pollutant emissions and subsequent atmospheric background levels, continued monitoring in these regions in Pennsylvania are required to track the continued impact of natural gas development and production infrastructure on sparsely monitored areas of the state."

More information: J. Douglas Goetz et al, Analysis of local-scale background concentrations of methane and othergas-phase species in the Marcellus Shale, *Elem Sci Anth* (2017). DOI: 10.1525/elementa.182

Provided by Drexel University