# Determining Tropospheric Ozone Trends in Pennsylvania



## from 2007 to 2012



**RESULTS CONTINUED** 

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#### ABSTRACT

There has been little research conducted and published on hydraulic fracturing's effect on air quality, specifically on the six NAAQS Criteria Pollutants. This preliminary study attempts to assess current air quality monitoring systems and utilize tropospheric ozone data to determine whether or not there is a significance in variation among three sites in Pennsylvania from 2007 to 2012. It also looks at the possible trend between tropospheric ozone levels and the number of active well sites within the state during the same time period. Although consistent, agreeable, and easily accessible data is difficult to come by a 2-Way ANOVA shows significance in variation based on location and time. Furthermore, Pearson's Correlation Coefficient depicts some positive relationship between tropospheric ozone levels and the number of active fracking well sites. A completely comprehensive air quality study would take into account all aspects of the fracking process, not just wells.

### **BACKGROUND & FOCUS QUESTIONS**

The State of Pennsylvania is among the leading producers of natural gas via conventional and unconventional hydraulic fracturing mechanisms, "Fracking" is a highly controversial alternative fuel extraction process with little scientific data published in regards to its effects on general air quality.

Under the 1970 Clean Air Act (CAA), Congress granted the Environmental Protection Agency (EPA) authorization to regulate air quality and emissions. The National Ambient Air Quality Standards (NAAQS) provides national thresholds and monitoring systems for harmful and/or hazardous air pollutants.



Fracking is thought to be associated with an increase in various pollutants, including ozone. Many ozone precursors, such as volatile organic carbons (VOCs), are believed to be emitted throughout the fracking process. Thus, the following questions have been posed in order to attempt a better understanding of air quality, taking particular interest in ozone, in a state heavy with fracking activity:

- 1) Does there seem to be sufficient air quality data available to assess trend patterns in the State of Pennsylvania for a specific time frame?
- 2) If there is not sufficient data, what steps could be taken to improve availability within the state?
- 3) Utilizing available ozone data, is there a significance in ozone patterns from 2007 to 2012 among the testing sites: Scranton, Reading, and Erie?
- 4) Is there a trend in tropospheric ozone levels in association with fracking well sites?

METHODS

Using maximum 8-hour daily values from the EPA Air Quality System (AQS), tropospheric ozone data was downloaded and input into Excel for Scranton, Reading, and Erie, Pennsylvania. The three sites are controlled by the Pennsylvania Department of Environmental Protection, providing daily ozone readings from 2007 to 2012. The testing period within each year is from April 1st to October 31st, leaving out winter and spring months when solar activity is low which results in minute photochemical ozone production. The selection of the research sites was largely in part to eliminate variability in interannual weather conditions. Furthermore, when considering Pennsylvanian wind patterns, Erie should typically be upwind, while Scranton tends to be downwind. In regards to fracking, all have different proximities to active wells, with Scranton being directly in the hydraulic fracturing belt along the Marcellus Shale Beds and Reading lying in the lower portion of the state, farthest from fracking activities



#### Figure 5: Hydraulic fracturing well



With the maximum 8-hour daily ozone values, the sites having multiple air quality monitoring stations were averaged across the board for each day. Maximum values within each month of data were also taken. Normalized data was used to conduct a two-way ANOVA statistical analysis to determine if there is a significance in variation among the three sites over the years. Maximums and averages were graphed by month/year/site to evaluate any abnormalities and/or trends. Lastly, ozone levels were graphed in relation to the number of active fracking wells (both conventional and unconventional) on an annual basis to depict any patterns over the years of increased methane production. The well numbers were acquired from the DEP Office of Oil and Gas Management SPUD Data.





- How to improve: More sites in rural areas and those closer to fracking activities would give a better picture of air quality in relationship to natural gas extraction.
- 3) Significant ozone: Location and time interval both play roles in tropospheric ozone variation Ozone trends tend to follow national patterns.
- 4) Association with fracking: Active wells do seem to play some part in O3 trends. The entire process of hydraulic fracturing needs to be assessed and included in further studies to determine if fracking as an entity leads to higher tropospheric ozone levels. Wells alone do not account for all patterns.

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