Effects of COVID-19 on Kentucky Air Pollutant Levels

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Introduction

COVID-19 has proven to be a deadly disease with nearly 28.1 million cases and 496,000 deaths in the US as of February 20th, 2021. One unexpected result of the pandemic has been an apparent improvement in air quality levels due to reduced travel at the global, national, and regional levels. One air quality study found that nitrogen dioxide (NO_2) and particulate matter (PM) levels decreased from before to after the beginning of the pandemic. On a smaller scale, another study examined the effects of air quality in the cities of Barcelona and Madrid (Spain). This study focused on the time period after the pandemic occurred and assessed the NO_2 data for each hour. The study observed a decrease in air pollutant levels, but the results were not significant between the years studied. Sulfur Dioxide (SO_2) is used as an indicator for a larger group of gaseous sulfur oxides.[11] The largest source of SO_2 pollution is fossil fuel combustion at power plants and other industrial facilities. Nitrogen dioxide is a part of a group of highly reactive gasses and used as an indicator for the larger group of nitrogen oxides in the atmosphere. The most likely source of this type of pollution is from the burning of fuel from cars, trucks, buses, power plants and off-road equipment. Each has devastating complications regarding health if high levels are inhaled.

Methods

The purpose of this study is to determine whether there is a difference in the emission rates of two of the six criteria pollutants in Kentucky along with overall air quality in the 5-month period of January 1st - June 1st of 2016-2020. This will be used to evaluate the environmental impact of COVID-19 and contrast air quality before and after the start of the pandemic. The hourly data analyzed was obtained from the US Environmental Protection Agency (EPA) and an Analysis of Variance (ANOVA) test was performed to analyze each year (2016-2020) and its significance.

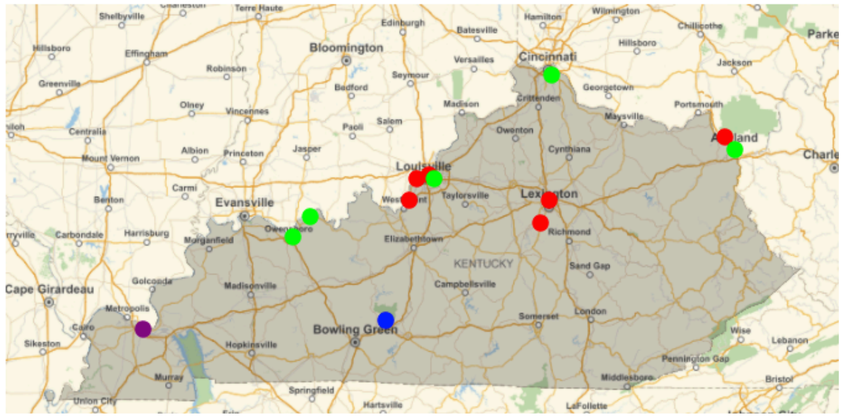

Figure 1 Map of Kentucky, Site locations indicated with dots at each given location. Red indicated a SO_2 monitoring location, Green indicates a NO_2 monitoring location, and Purple and blue represent Sites 1024 and 501, respectively.

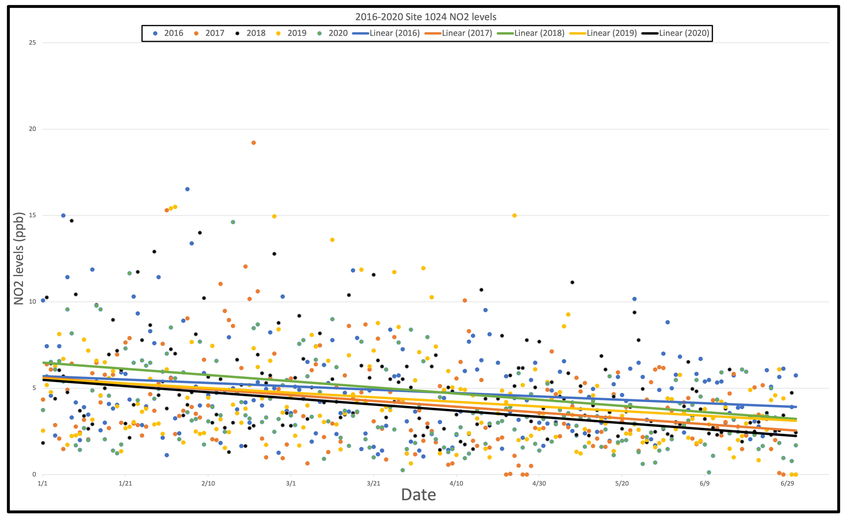

Figure 2 Graph with 5 trend lines demonstrating 2016-2020 NO_2 levels.

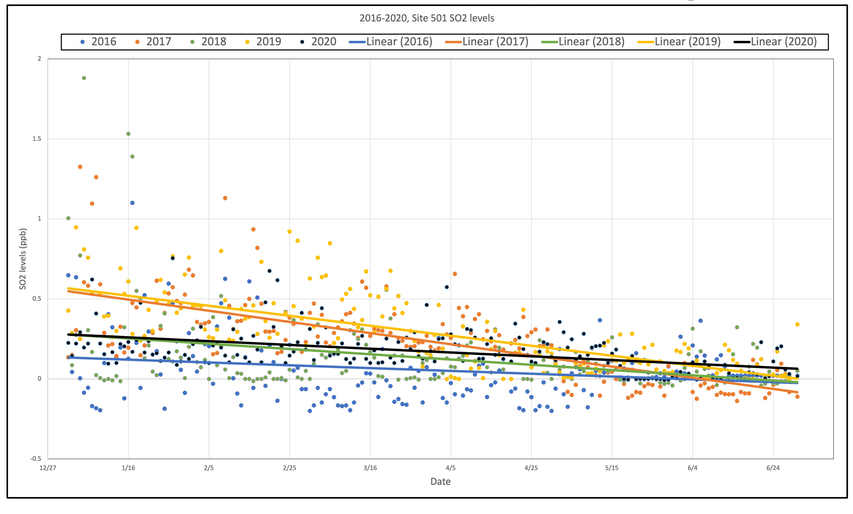

Figure 3 Graph with 5 trend lines demonstrating 2016-2020 SO_2 levels.

Methods cont.

6 sites around KY were chosen for analysis of NO_2 and 11 sites were chosen for analysis of SO_2. These were chosen based off data availability and accuracy. Though each was analyzed, only 2 will be presented here. Figure 1 shows each monitoring site, NO_2 in green and SO_2 in red. The two presented are site 1024 for NO_2 analysis located in McCracken County, Kentucky and site 501 for SO_2 located in Edmonson County, Kentucky at Mammoth Cave National Park. Site 1024 is indicated in Figure 1 with a purple dot, and site 501 is indicated with a blue dot.

Results

Though site 1024 and 501 were the only sites presented here, it is important to note that these were chosen because they were representative of the nature of the results for the rest of the sites. The results were consistently significant in SO_2 analysis, with all p values < .05. Site 501 resulted in a p-value of 0.02068. Results were also consistently significant in v analysis, with all p values < .05. Site 1024 resulted in a p-value of 0.019027219. Figure 2 and 3 demonstrate trend lines seen throughout each respective year, with 2020 in black. Each trendline was created with a linear fit model in mind. This is clearly shown in each figure.

Discussion

COVID-19 has had many effects on our current lives, though this study aimed to analyze the environmental health impact of COVID-19. The results from this small study indicate that there is a significant difference between each year (2016-2020) in both SO_2 and NO_2 Figures 2 and 3 accurately show this. This implies that COVID-19 had an effect on SO_2 and NO_2 levels at 2 Kentucky air monitoring sites. More testing is needed to grasp the extent of which COVID-19 has impacted air quality. Some outstanding considerations include the location of each site chosen, as some are in rural parts of the state and some in suburban parts. To continue this study, an analysis within 2020's months, specifically from January-March and March-June will be necessary to determine any significant differences between before moving into quarantine and after.