Experimentation Results

### Comparison of temperature and wind speeds on pollution levels

**NO2**

To get this data, SQL queries were put to the database to check for values with values of wind and temperature and then averaging the pollution values for NO2 using all values for the previous month. These averages are given in the table below. The first column is for one specific site. This does not tell us much as the sample size is low. However we can see a slight correlation between wind speed and pollution, where low wind means higher pollution.

To further test, we used all sites’ values to ensure a large sample size. With this we found a further correlation between wind speed and pollution levels, but also found a small correlation between high temperatures and high pollution, which goes completely against our initial research. We then realised levels would be higher during the day when traffic is more prominent, and realised high temperatures would more likely occur during the day and low temperatures at night. As a result we only took daytime values and found there was no correlation between temperature and pollution, but a large correlation between wind speed and NO2 levels.

|  |  |  |  |
| --- | --- | --- | --- |
|  | At site ‘BL0’ only | At all sites | All sites, 6am-8pm |
| Low Wind/Low Temp | 56.5 | 55.6 | 62.1 |
| Low Wind/High Temp | 63.3 | 63.4 | 66.6 |
| High Wind/Low Temp | 51.6 | 45.7 | 52.1 |
| High Wind/High Temp | 49.6 | 50.7 | 52.4 |

**PM2.5**

A similar search was conducted on PM2.5, but this time only for all sites between 6am and 8pm, as these are the best for fair results. By doing this we were able to establish a correlation with higher wind and lower pollution as well as higher temperature resulting in higher PM2.5 levels.

|  |  |
| --- | --- |
|  | All sites, 6am-8pm |
| Low Wind/Low Temp | 15.9 |
| Low Wind/High Temp | 17.0 |
| High Wind/Low Temp | 14.5 |
| High Wind/High Temp | 16.0 |

**PM10**

When conducting the same research for PM10, we found that there was not really any correlation between wind or temperature and pollution. However, after further testing by changing the wind to be more extreme (rather than just above or below 10 KM/H) it was determined that there is a correlation between wind speed and PM10 levels. This is detailed in the next section.

|  |  |
| --- | --- |
|  | All sites, 6am-8pm |
| Low Wind/Low Temp | 27.9 |
| Low Wind/High Temp | 26.5 |
| High Wind/Low Temp | 25.9 |
| High Wind/High Temp | 27.4 |

**Wind Speeds**

It was found that the wind speeds were the thing which affected all kinds of pollution the most. By taking only daytime values and values with a temperature above 10C, we tested the average values for low and high wind for each of the three pollutants. With all three you can see a significant reduction following high winds.

|  |  |  |
| --- | --- | --- |
| Pollutant | Low Wind | High Wind |
| NO2 | 72.3 | 48.0 |
| PM2.5 | 21.3 | 15.5 |
| PM10 | 31.1 | 26.1 |

Comparison of daytime to nighttime pollution values

From the research into daytime and nighttime, we found that NO2 levels are reduced at night. This is probably due to lower exhaust emissions from traffic. However we also found that particulate matter levels are actually much higher at night than during the day. After some research we found that this is a normal phenomenon[[1]](#footnote-0) caused by more stable air at night, meaning the particulate matter is not moved away. This research paper explores the causes of a divide in particulate matter levels between daytime and nighttime in an urban area in Italy, however these results would still apply for London.

|  |  |  |
| --- | --- | --- |
| Pollutant | Daytime | Nighttime |
| NO2 | 56.5 | 51.2 |
| PM2.5 | 18.8 | 32.9 |
| PM10 | 31.3 | 40.1 |

Comparison of precipitation to pollution levels

From the research done into precipitation levels and various pollutants, it is clear to see that higher levels of precipitation leads to a significant reduction in pollution levels for all of the three pollutants. This is because particulate matter is washed away, and NO2 is diluted and also washed away. This clear evidence shows how precipitation is the key to being able to predict pollution levels for the next day.

|  |  |  |
| --- | --- | --- |
| Pollutant | Precipitation under 2mm | Precipitation over 2mm |
| NO2 | 60.4 | 57.3 |
| PM2.5 | 17.4 | 13.6 |
| PM10 | 29.3 | 19.9 |

Comparison of pollution values at different times

It is expected that pollution levels will peak at certain times in the day. Such times are usually the ‘rush hour’, where congestion and traffic are at their highest as commuters move to and from work. Below is a table recording how the pollution changes across different ranges of times. The data certainly corresponds with this expectation, though not very significantly. The most clear changes appear to be in levels of NO2, showing that this is likely responsible for most of the change.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | 7:00 to 9:00 (first rush hour) | 9:00 to 17:00 | 17:00 to 19:00 (second rush hour) | After 19:00 |
| Overall pollution levels | 40.57 | 37.78 | 40.34 | 35.5 |
| NO2 | 61.97 | 56.78 | 63.7 | 52.73 |
| PM2.5 | 14.46 | 14.59 | 16.02 | 17.13 |
| PM10 | 27.13 | 26.2 | 25.34 | 24.6 |

1. http://www.ge.infn.it/~prati/Fisica%20Nucleare%20Applicata/articoli/valli,%20vecchi.pdf [↑](#footnote-ref-0)