

# Air Quality Changes During COVID-19 Conditions

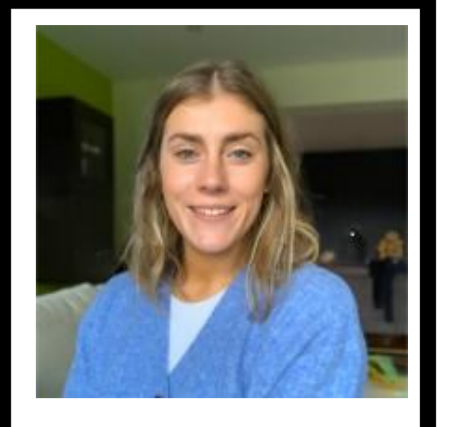
B.Sc. (Honours) in Environmental Science & Sustainable Technology



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## Background Research & Motivation

### Air Quality

The quality of air is based on the Air Quality Index.

Bands of air quality:

- 1-3 **Good**
- 4-6 **Fair**
- 7-9 **Poor**
- 10 **Very Poor**

Cork has Good air quality- this award is based on the following limit values.

### Air Pollutants

The pollutants with the strongest evidence of causing health effects are:

- Particulate Matter (PM)
- Ozone (O3)
- Nitrogen Dioxide (NO2)
- Sulphur Dioxide (SO2)

Sources: domestic heating, vehicles & industry.

Dangers: strokes, heart disease, lung cancer and acute and chronic respiratory diseases.

### What Factors Effect Air Quality ?

- Humans Activity
- Wind Direction & Rain
- Temperature

### Air Quality Instrumentation

- Ultraviolet Fluorescence SO2 Analyser
- Chemiluminescence NOx analyser
- Gravimetric PM analyser
- Ultraviolet Photometry

### Motivation & Goal

Quantify the changes which occurred to Cork's Air Quality due to the COVID-19 Lockdowns.

Why? Ambient air pollution leads to approx. **4.2 million deaths** per year worldwide [1] & **1,300 premature deaths** in Ireland every year. [2]

If changes in the air quality are sustainable and beneficial for reducing health implications, then perhaps cleaner air is the 'new normal'.

Monitoring Station location	Index	Ozone (8-hr mean) ug/m3	Nitrogen Dioxide (1-hr mean) ug/m3	Sulphur Dioxide (1-hr mean) (ug/m3)	PM2.5 (24-hr mean) (ug/m3)	PM10 (24-hr mean) (ug/m3)
MTU & Heatherton Park	1. <b>Good</b>	0-33	0-67	0-29	0-11	0-16
UCC & South Link Road	2. <b>Good</b>	34-65	68-134	30-59	12-23	17-33



## Data Sources



### European Environmental Agency (EEA)

European database which provides pollutants concentrations for the following locations in Cork:

- PM2.5 & PM10 - Ballinlough Heatherton Park
- NO2- South Link Road Landfill
- SO2 & O3- MTU

### Transport Infrastructure Ireland Traffic Count Data

All classes of vehicles are recorded every hour of 365 days of 2017, 2018, 2019 & 2020

Bishopstown & South Ring Road counter locations used during this investigation

### Environmental Protection Agency (EPA)

Body responsible for protecting and monitoring the environment in Ireland.

SAFER-Data is the EPA database for previous years pollutant concentrations &

AirQuality.ie is source for the current year data.

- PM2.5- UCC
- PM10- South Link Road
- SO2 & O3- MTU

### PurpleAir

PMSX003 Laser Particle counters (Different sensors to regulatory ones)

- PM10 & PM2.5- South Mall

### COVID-19 Lockdowns in Ireland

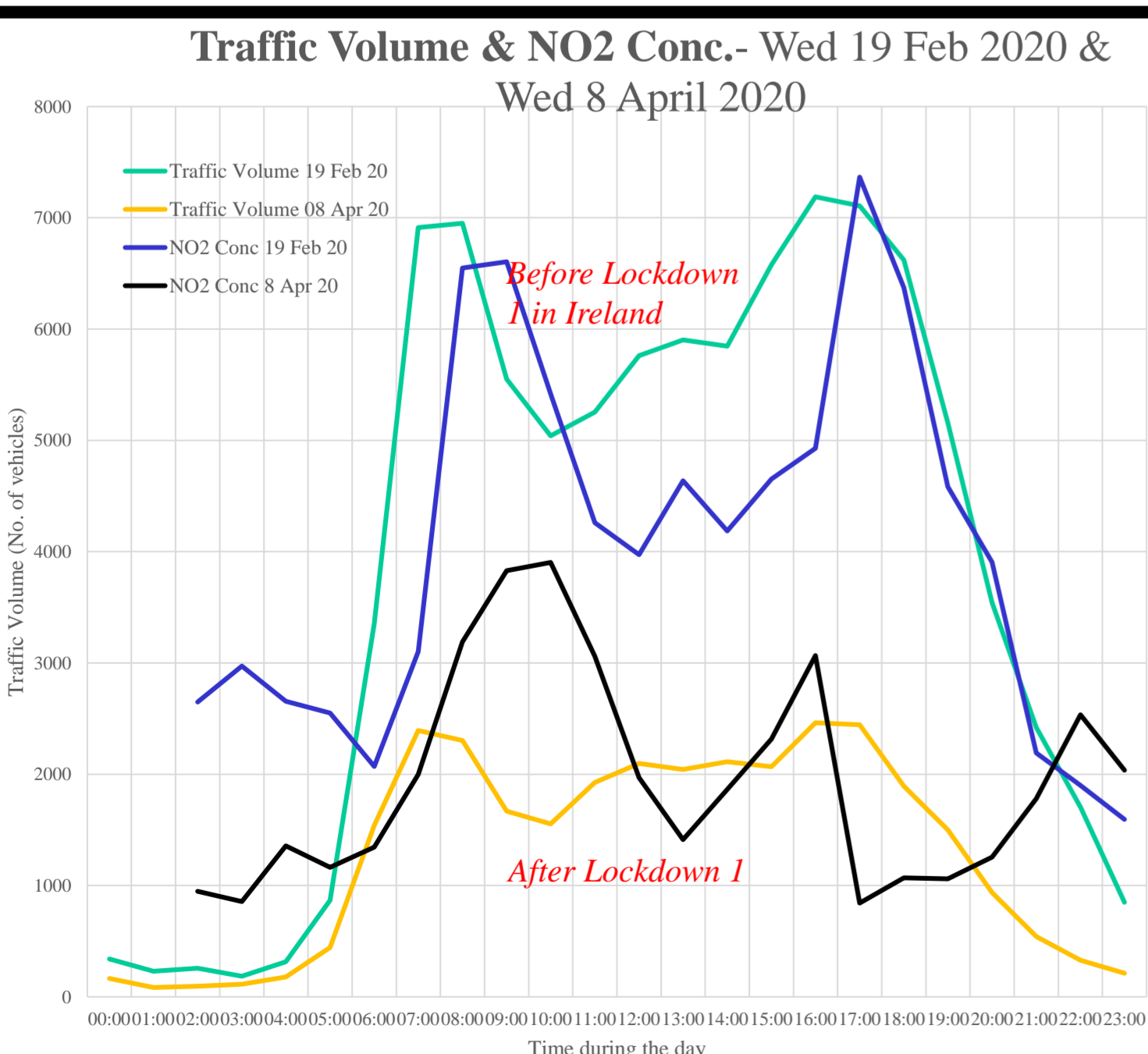
Start Date	End Date	Level/ Comment
12 <sup>th</sup> Mar '20		Schools & Colleges closed
27 <sup>th</sup> Mar '20	18 <sup>th</sup> May '20	Level 5
19 <sup>th</sup> Oct '20	1 <sup>st</sup> Dec '20	Level 5
24 <sup>th</sup> Dec '20	12 <sup>th</sup> Apr '20	Level 5

### Met Éireann Weather Data

Measurements from the synoptic station based at Cork Airport for 2018, 2019, 2020. Factors focused on in this investigation:

- Air Temperature (°C)
- Sunshine duration (hours)
- Relative Humidity (%)
- Mean Wind Speed (kt)
- Precipitation Amount (mm)

## Results & Conclusions



### NO2 & Road Traffic

- 36% decrease in NO2** conc. levels during 2020 Vs. 2019
- 23% decrease in traffic volume Vs 2019 records

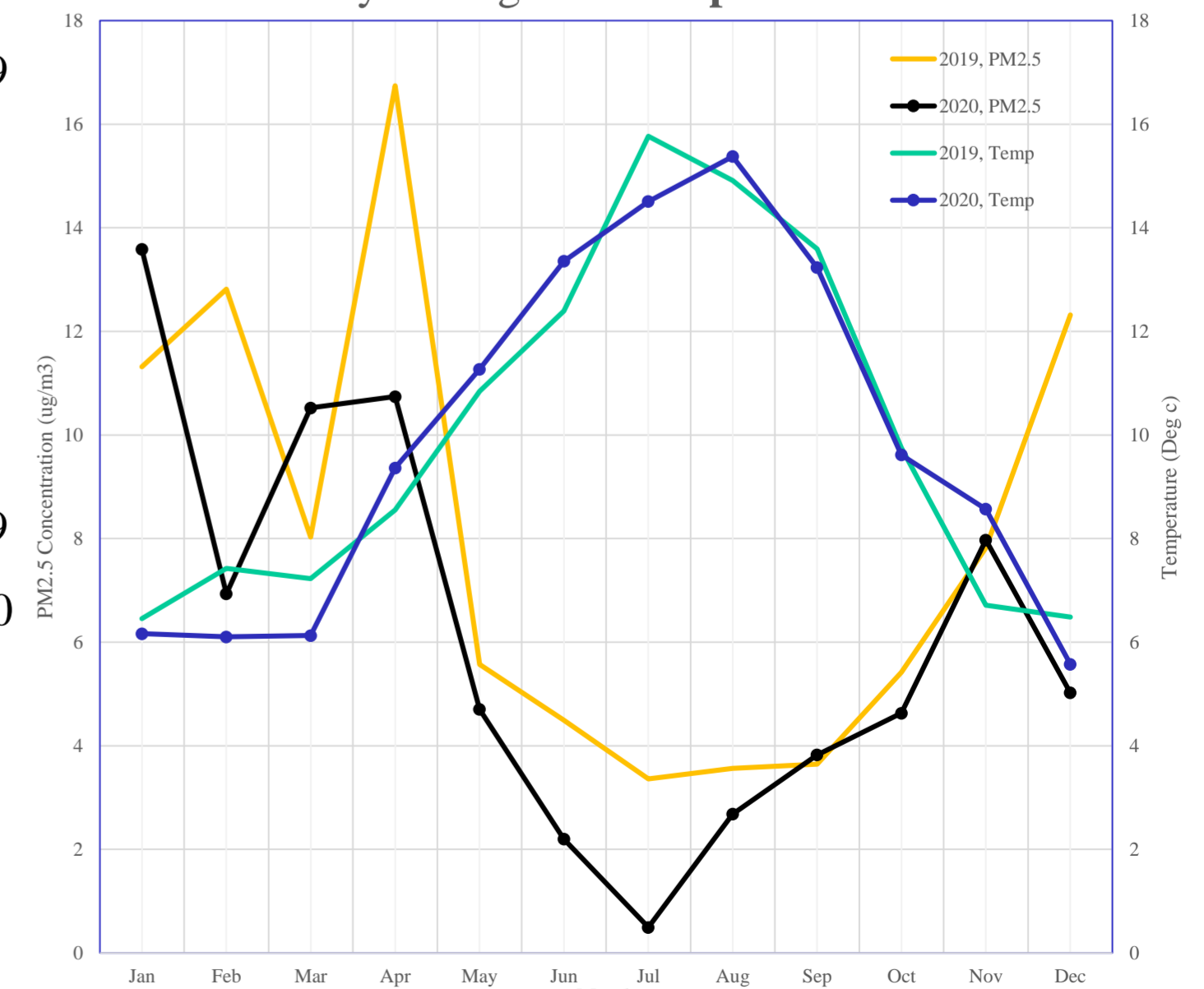
### PM & Domestic Heating

- 22.91% decrease in PM2.5** conc. levels during 2020 Vs. 2019
- 9% decrease in PM10** conc. levels during 2020 Vs. 2019
- 0.72% difference in average annual temperature for 2020 Vs. 2019

### O3 & Sunshine hours

Reduce O3 levels by reducing NO2 levels  
 $NO_2 + VOC + Sunlight \rightarrow O_3$

### Monthly Average PM2.5 Conc. for 2019 & 2020 Vs. Monthly Average Air Temp. for 2019 & 2020



## References

[1] "Air pollution", *Who.int*, 2021. [Online]. Available: [https://www.who.int/health-topics/air-pollution#tab=tab\\_2](https://www.who.int/health-topics/air-pollution#tab=tab_2). [Accessed: 25- Apr- 2021]

[2] "Air Quality in Ireland 2019", *EPA*, 2020. [Online]. Available: <https://www.epa.ie/pubs/reports/air/quality/epairqualityreport2019.html>. [Accessed: 26-04-2021]