Traffic Zones & NO_2 Air Pollution

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Introduction

Nitrogen dioxide (NO_2) is primarily a pollutant generated by traffic, especially diesel engines, and breathing it can irritate the airways and aggravate respiratory and cardiovascular diseases. Research is important in meeting targets for the reduction of Nitrogen oxides (NOx) emissions from the transport sector in Ireland, Europe and around the world. The continued gathering of atmospheric data is an important tool in monitoring the possible causes of climate change as well as the potential negative impacts on human and environmental health. This has significant implications for current and future governments to sustain quality of life and living as laid down in the 22 UN Sustainable Development Goals.

Larkin Community College Is situated in the center of Dublin city. It is a mixed school with 450 students and 45 staff. The school community Is committed to raising awareness about environmental issues and in particular the modelling of a sustainable way of life. Larkin is currently preparing for its fifth Green Flag in Biodiversity and is partnering with Belvedere College for a program to install and manage an aquaponics system as an long-term sustained educational tool.

As part of the GLOBE Air Quality Campaign NO2 diffusion tubes were placed in different locations around the school campus to record the levels of this air pollutant over a period of one month. Weather data for air temperature and precipitation was also recorded and uploaded to the NASA GLOBE site.

Research Question

Air Quality Campaign Aims

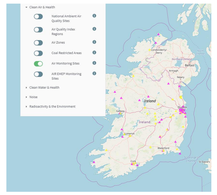
1. To compare NO_2 levels recorded at the 3 zones within the college campus and to relate this to the air temperature and precipitation data recorded and uploaded to NASA GLOBE.
2. To compare Larkin Community College data to the other 35 schools in the survey to search for patterns of interest in the NO_2 levels between the different types of zones (urban versus rural, sheltered area versus moving traffic).
3. To promote awareness in the college about the concerns and health implications related to NO_2 and other air pollutants through a campaign on Green Day with a video and transport survey during tutor time.
4. To extend the campaign further linking with local primary schools and assisting students to implement an awareness campaign and conduct their own traffic survey within their own school.
5. To links to Trinity College Dublin where a presentation and a site visit to the laboratories to allow students to find out about a new project funded by the Environmental Protection Agency (EPA) to examine the impacts of NO_2 on health and quality of life.

Research Methods

NO_2 data was recorded over a one month period using 3 diffusion tubes that filtered NO_2 from the atmosphere. These tubes were analyses by a laboratory and the data presented in micrograms per cubic meter (ug/m^3).

Air temperature (^oC) levels were recorded with a maximum/minimum thermometer daily. This data was loaded to NASA GLOBE data.

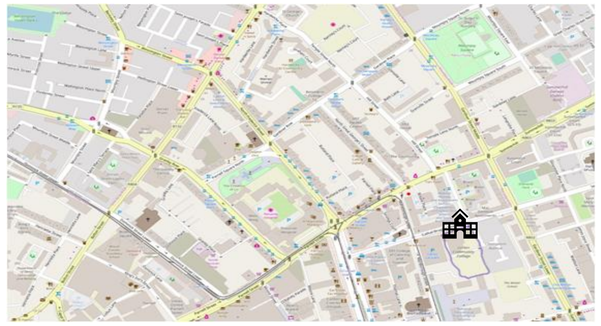
Precipitation levels (mm) were recorded with a rain gauge daily and pH recorded using universal pH paper when possible. This data was loaded to NASA GLOBE data.



EPA Air Monitoring Sites

Colour Code Description	
NO2 concentration (µg/m3)	Description
50 +	Extremely bad
45 - 50	Very bad
40 to 45	Bad
35 - 40	Substandard
30 - 35	Mediocre
25 - 30	Average
20 - 25	Pretty good
15 to 20	Good
10 to 15	Very good
0-10	Excellent

Curieuzen Neuzen Scale



Larkin Community College Dublin 1

Sheltered Area

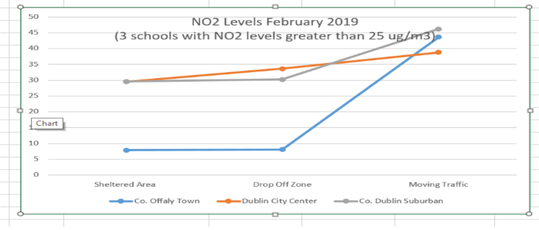
Drop-off Zone

Moving Traffic

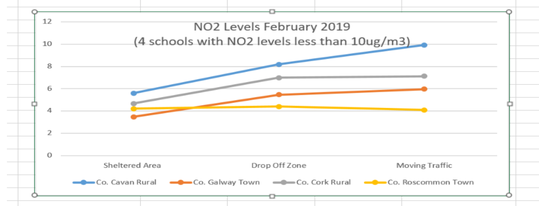
Diffusion Tube Locations

Results

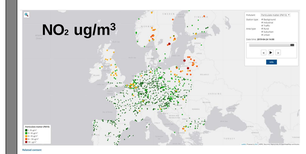
School Location	Co. Offaly Town	Dublin City Center	Co. Dublin Suburban
Sheltered Area	7.85	29.52	29.59
Drop Off Zone	8.06	33.64	30.26
Moving Traffic	43.61	38.76	46.17

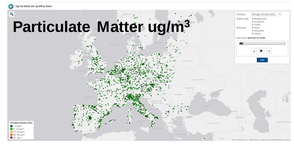


School Location	Co. Cavan Rural	Co. Galway Town	Co. Cork Rural	Co. Roscommon Town
Sheltered Area	5.59	3.46	4.67	4.2
Drop Off Zone	8.19	5.46	6.98	4.4
Moving Traffic	9.93	5.96	7.13	4.09

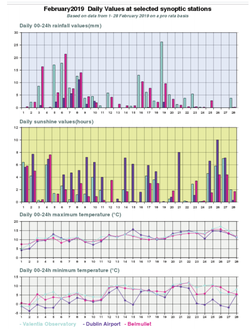


Air Quality Campaign NO_2 Data February 2019



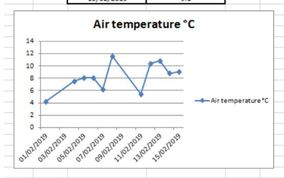


EEA Air Pollution Data February 2019



MET EIREANN

Date	Air temperature °C
01/02/2019	4.2
04/02/2019	7.5
05/02/2019	8.1
06/02/2019	8.1
07/02/2019	6.2
08/02/2019	11.6
11/02/2019	5.4
12/02/2019	10.4
13/02/2019	10.8
14/02/2019	8.8
15/02/2019	9.1



NASA GLOBE

Weather Data February 2019

Discussion

At Larkin Community College the NO_2 data was recorded as 29.52, 33.64 & 38.76ug/m^3 for the sheltered (furthest back corner away from traffic), drop-off (front gate on Champions' Avenue) and moving traffic (Cathal Brugha Street) zones respectively. This data shows an steady increase in NO_2 levels recorded between the zones and are described as **average, mediocre** & **substandard** in accordance with the Curieuzen Neuzen scale.

A second school In Dublin showed a similar profile in their 3 zones but exceeded Larkin College data by 7.41ug/m^3 moving from a **substandard** to **very bad** category at their drop-off zone, where traffic may be heaviest due to transport of students to and from school but also due to busy non-school traffic as is the case at Larkin College's moving traffic zone on Cathal Brugha Street..

Of the 36 schools surveyed, 4 school drop-off zones showed a significant peak in NO_2 levels compared with the sheltered zone data. Of these 4 school, 3 are based in Dublin and 1 in Offaly town. NO_2 levels increased by 9.24, 5.93, 16.58 & 35.76ug/m^3 respectively indicating that the traffic at the drop-off or moving traffic zone.

Urban and rural schools around the country largely ranged in the 0-25ug/m^3 being described as **excellent** to **pretty good** indicating that the level of diesel engine traffic and other sources of NOx emissions are not excessive enough to cause a sustained spike in levels over a period of one month.

The WHO state that 'air pollution is the single biggest health risk" and the EPA in Ireland state that "premature deaths attributed by air pollution in Ireland is estimates at 1510 per annum". Further complications such as and an increase in drier sunnier warmer weather can lead to secondary pollution such as "SMOG that can cause respiratory ailments from chest pains to deadly cancer and that overall one third of deaths from stroke, lung cancer and heart disease are due to air pollution".

Conclusions

Overall the results indicate that increased levels of traffic caused an increase in levels of NO_2 recorded over the month of February 2019. There was an incremental rise in NO_2 levels from the sheltered to drop-off to moving traffic zones. This pattern was more pronounced for rural schools than for urban schools (as shown in the results). Increased traffic in bigger towns and cities may become a significant cause for concern and have serious implications for public health with particular concern for vulnerable groups such as the young and old or people with health issues such as asthma, COPD or other respiratory and cardiovascular conditions. This impacts on the transport and town planning sectors.

Nearly all rainfall totals were below their Long-Term Average (LTA) for the month (Met Eireann weather statements) causing less of an opportunity to wash pollutants to the ground and out of the atmosphere where they can have negative health impacts. Wet deposition of air pollutants occurs when pollution dissolves in rain or snow. Precipitation cleans most of the pollution from the air (Clean Air Hamilton factsheets).

To extend this research a travel survey could also be conducted from a cross section of the student and staff community to investigate how people travel to school or work. This information could help inform the Green Schools committee how best to continue raising awareness about how our choices impact on the environment. Traffic surveys recording the volume of traffic during set times to see when the roads are busiest might help people to decide how to plan the future design of the city. Students could do a project planning the design of their ideal community.

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Air quality Campaign Ireland 2019

epa Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

An Taisce
The National Trust for Ireland