



THE GLOBE PROGRAM

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# Air Quality Campaign

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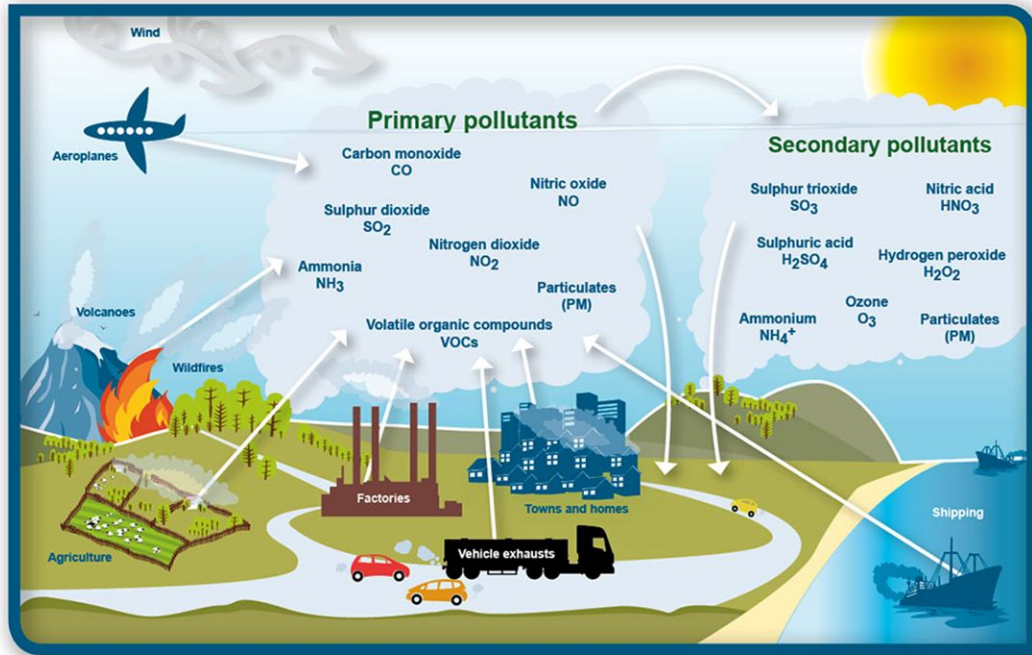
18th October 2023

Riga, Latvia

# Agenda

- Who is here today? Introductions
- What is air pollution?
- What is NO<sub>2</sub>
- Introduction to the Nitrogen Dioxide Campaign, why measure?
- How do we measure NO<sub>2</sub>
- Activity 1 – Map School
- Campaign methodology (Part 1)
- Activity 2 – Discuss GLOBE Protocols
- Results – Data Analysis
- GLOBE Stories and Projects
- Activity 3 – Brainstorm Task
- Collaboration Opportunities

# Air Pollution



Air pollution - any harmful substance in air

GLOBE Countries  
measuring:

Nitrogen Dioxide (Gas)

Particulate Matter/

Aerosols

# What is Nitrogen Dioxide?

NO<sub>2</sub> is a traffic-related air pollutant.



- **Nitrogen Dioxide is emitted from exhausts:**
- **It is a Gas**
- **Has a Foul Smell**

# Aims of the Air Quality Campaign

GLOBE students are invited to measure nitrogen dioxide (NO<sub>2</sub>) - a principal pollutant from car exhaust emissions.

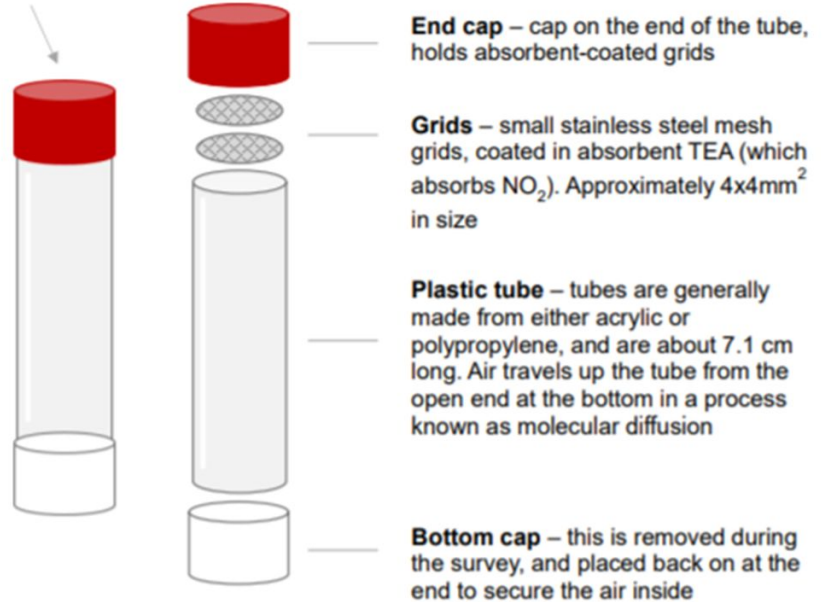
The main purposes of the campaign are to:

- raise awareness about air pollution through a practical investigation.
- engage students in meaningful local environmental observations
- collect accurate data that can be used in students' research projects.
- share knowledge with school communities and wider communities.

# Equipment - Diffusion Tube



Diffusion Tube



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# Talk and Share

Where would be the best place in  
your school to put up the diffusion  
tube?

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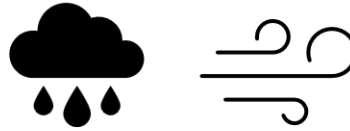
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# Nitrogen Dioxide Monitoring

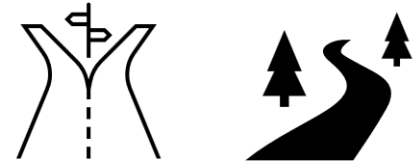
NO<sub>2</sub> is a traffic-related air pollutant.



**Traffic.** The amount of traffic in the area is the most important factor controlling the level of NO<sub>2</sub>.



**Weather.** Different weather can affect the levels of pollution.



**Ventilation.** A narrow street can record higher levels of pollution than a wide street as there is less space for air to move around.





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# Discussion Round

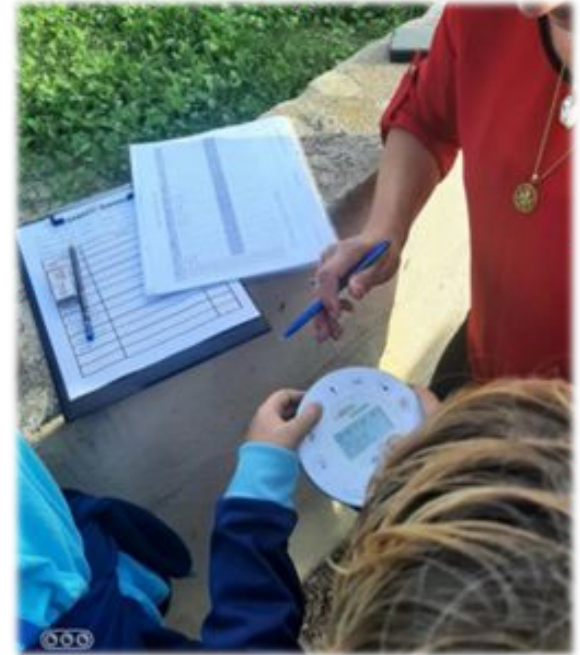
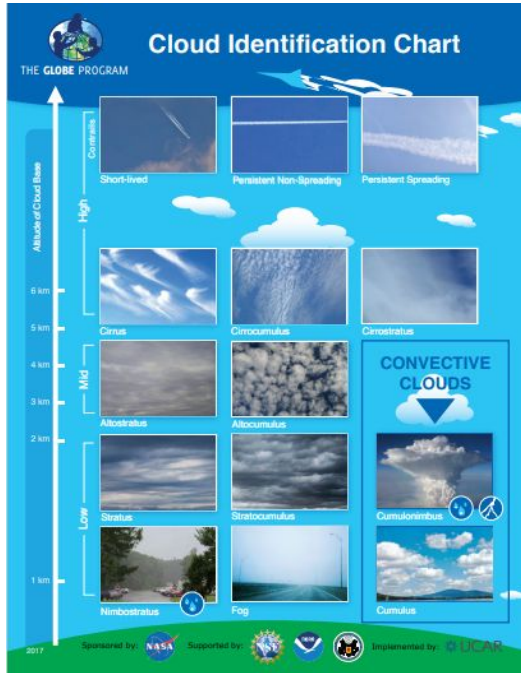
Can you think of other GLOBE observations  
students can conduct throughout the  
four-week monitoring period?

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# Air Quality Campaign Methods

## Part 2 - Links with GLOBE Protocols



# Monitoring Traffic - Survey



# Interpreting results and working with data

$\mu\text{g}/\text{m}^3$	Colour Code	NO <sub>2</sub> Pollutant Level
>40	Red	High
30-40	Orange	Medium to High
20-30	Yellow	Medium
10-20	Green	Low to Medium
0-10	Blue	Low

NO<sub>2</sub> is measured in micrograms ( $\mu\text{g}$ ) per cubic metre ( $\text{m}^3$ )

Your result shows an **average** of how much NO<sub>2</sub> was in the air around the tube **over the 4 weeks** they were up.

The **red** colours, or over 40, shows a high amount of NO<sub>2</sub>. The EU recommends that air pollution should not go above 40  $\mu\text{g}/\text{m}^3$  per year.

The World Health Organisation recommends that the amount of NO<sub>2</sub> in the air should not be more than 10  $\mu\text{g}/\text{m}^3$  per year.



# GLOBE Projects



## Air Quality (NO<sub>2</sub>) Monitoring Campaign Autumn 2022 Rockford Manor Secondary School

Aleena Jose, Imane Belkhen and Aziza Rezaie - Transition Year



### Abstract

During Autumn 2022, our Transition Year students continued to participate in a citizen science project to monitor the air quality of our outdoor school environment. Students from other schools in Ireland have also measured the NO<sub>2</sub> levels around their school grounds. Diffusion tubes were placed at three different locations to measure NO<sub>2</sub> concentrations. We compared the results to our previous results and to the Nitrogen Dioxide Scale, which indicates that the average Nitrogen Dioxide levels around Rockford Manor are in the low-medium range.

### Research questions

1. What is Nitrogen Dioxide and how much NO<sub>2</sub> is there in different parts of our outdoor school environment?
2. Is our school air quality within the recommended level of healthy NO<sub>2</sub> exposure?
3. Do weather conditions affect our air quality?
4. How do these results compare to our previous data?

### Introduction

Rockford Manor is a Presentation Secondary School located on Stradbroke Road, Blackrock, Co. Dublin. The school is situated next to a main road and a busy roundabout, as shown in our site map.<sup>1</sup> The school is in a suburban area, which has mixed, commercial and residential use. Due to the location of the school, we think that there could possibly be higher NO<sub>2</sub> levels in the air at the front of the school grounds and lower NO<sub>2</sub> levels in the green space to the rear of our school building as it is sheltered from traffic.

NO<sub>2</sub> (Nitrogen Dioxide) is a red-brown gas that is produced when fuel is burned in the engines of vehicles such as cars, trucks and buses. Elevated levels of NO<sub>2</sub> can lead to damage to the human respiratory tract and an increase in the risk of asthma and respiratory infections. NO<sub>2</sub> can also react with other chemicals in the air to form particulate matter and ozone which are harmful when inhaled.<sup>24</sup>

We conducted an analysis of the levels of NO<sub>2</sub> in our school using specialized diffusion tubes which we obtained from An Taisce and The Globe Program. During our air monitoring campaign, we also recorded local daily weather conditions and conducted a traffic survey to gain insight into the factors that may affect our air quality.

### Research Methods

We placed three diffusion tubes at different locations to measure the NO<sub>2</sub> levels in the air around our school grounds. The first tube was secured to the traffic light at the front of our school on the main road, a location that is exposed to a lot of traffic. The second was placed at the basketball court which is in an elevated position, a short distance from traffic. The remaining tube was placed behind the school hall in a green space which is sheltered from the traffic. The tubes were put up on the 29th of September and taken down four weeks later on the 26th of October 2022. They were then sent to a laboratory for analysis.



During this time, we recorded daily local weather conditions, temperatures, rainfall, wind speed and direction. We think wind speed and direction may influence the concentrations of nitrogen dioxide lingering around the school. We also conducted traffic surveys on the roundabout and the two roads adjacent to our school to gain insight into the levels of traffic in our area.



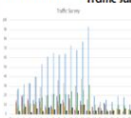
### Results<sup>4,5</sup>

Diffusion tube results - average NO<sub>2</sub> concentration

Area	Autumn 2022	Spring 2022	Autumn 2021
Green Space-behind hall	13.36	13.3	13.13
Basketball court	13.49	21.86	16.12
Main Rd-Traffic light	18.29	22.15	18.29

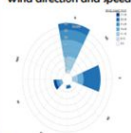
As expected, the tube by the road and exposed to the most traffic (tube 1) had the greatest concentration of NO<sub>2</sub>. The tube that was placed in the basketball court (tube 2) had less NO<sub>2</sub> as it was further away from the road. This tube shows the greatest variability in NO<sub>2</sub> levels over the three monitoring campaigns. It will be interesting to measure the result at this location this Spring (2023). Perhaps the elevation of this site and weather conditions influence air quality here. The tube that contained the least NO<sub>2</sub> was the one placed in the green open space behind our school hall (tube 3). It was the furthest from the road and was in the most remote and isolated area of the school. It should also be noted that the results are average values over a four-week period. Nitrogen dioxide concentrations fluctuate depending on the amount of traffic in the area at any given time.

#### Traffic survey results



There is quite a lot of traffic passing our school. The levels of traffic vary greatly over a 24-hour period with the greatest amounts during morning and evening rush hours. The graph shows sample traffic levels in the area at midmorning.

#### Wind direction and speed



Wind direction and speed data collected during the monitoring period show that the prevailing winds came from northerly and easterly directions. Traffic pollution from New Road may have been blown away from our basketball courts. The green space to the rear of our school building was most likely shielded from traffic pollution from the roads adjacent to the school by these winds also.

### Discussion

The EU and World Health Organization (WHO) have created the nitrogen dioxide scale for good health.<sup>6</sup> The EU has set an annual mean limit of 40 µg/m<sup>3</sup> NO<sub>2</sub> and the WHO has set an annual mean limit of 10 µg/m<sup>3</sup> NO<sub>2</sub> for good health. Our results indicate that the air quality around Rockford Manor is in the low-medium category on the scale (10-20 µg/m<sup>3</sup>). This is safe for our health according to the EU Annual standards but exceeds the limit set by the WHO. This means that the NO<sub>2</sub> levels may be too high, and requires action. If the NO<sub>2</sub> levels keep increasing in the area due to exhaust fumes and human activity around the school, it could have a serious long-term effect on our respiratory health.

#### Nitrogen dioxide scale<sup>3,7</sup>



### Conclusions

In conclusion, we found that the levels of NO<sub>2</sub> in the school were moderately low. There was an average of 15.04 µg/m<sup>3</sup> over all three diffusion tests. We noticed that there were higher NO<sub>2</sub> levels at the front of the school since this location is next to a busy road. It would also seem that weather and in particular wind conditions play an important role in our air quality. Based on these results we have recommended that our students should hang out in the green space behind our school and not to the front of the school in the carpark area. We would like to conduct further studies into the air quality around our school and plan to repeat our diffusion tube monitoring campaign in Spring 2023 to compare these results.

### Bibliography

1. GOOGLE maps
2. The Globe Program health and Environment impacts
3. The Globe Program Air Quality Model
4. Rockford Manor Students Traffic Survey
5. Rockford Manor Weather Analysis Report
6. EPA Website <https://www.epa.gov/no2-pollution-basic-information-about-no2>
7. <https://www.eea.europa.eu/data-and-maps/figures/nitrogen-dioxide-annual-limit-values-for-the-protection-of-human-health>

# Community engaging and solution-based actions





# Community engaging and solution-based actions





# Community engaging and solution-based actions



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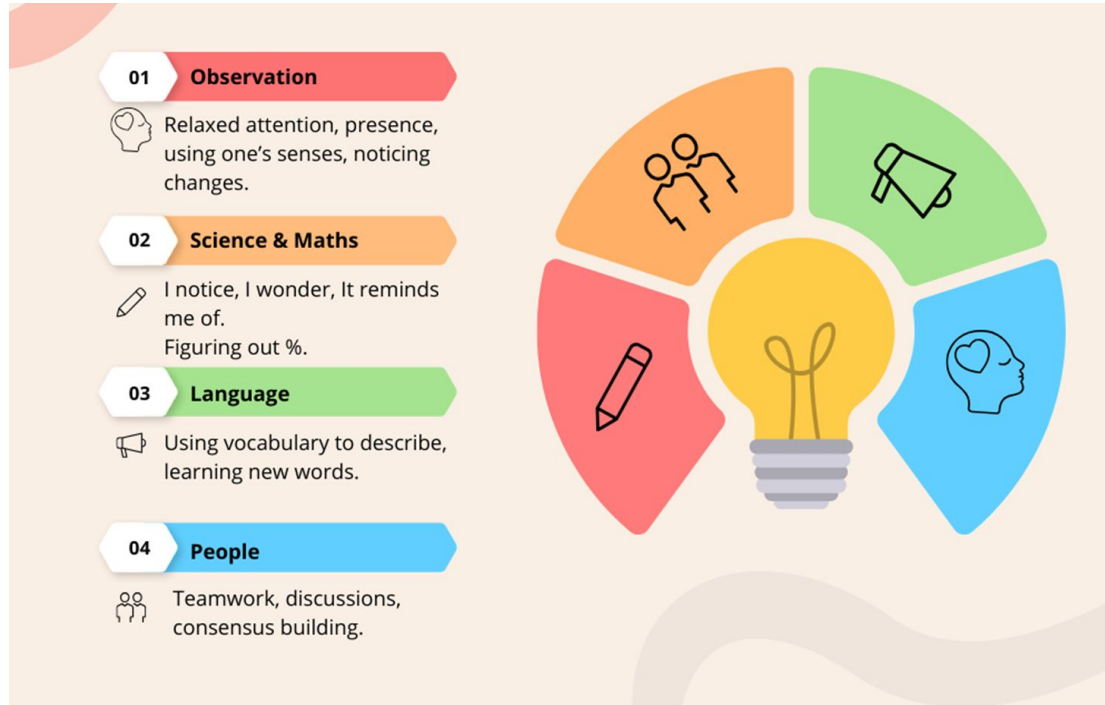
# Time to Brainstorm

How can the Air Quality Campaign be linked with other subjects at schools?

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# Links to School Curriculum



# Collaboration Opportunities



GLOBE Investigation

**Title: An international comparative study of nitrogen dioxide levels recorded at schools in Malta and Ireland**

**Organization: GLOBE Ireland & GLOBE Malta**

