Clean Air Matters: A Study on the State of our Atmosphere

GLOBE Team

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Summary

Air quality and the level of air pollution are important factors and have significant impacts on the health and wellbeing of humans. It is now considered that any level of air pollution is not acceptable and poses a risk. Nitrogen dioxide (NO_2) is a pollutant commonly found in the air and is produced by burning fossil fuels such as coal, oil, and gas. There are often wide variations in local air quality that go undetected and so we started to investigate the quality of the air around our school. This was done using a specialised monitoring device, a diffusion tube, to detect the concentration of NO_2 in the air. The data collected from the diffusion tube was analysed to determine the average levels of NO_2 in front of our school. The NO_2 level was compared with other localities in Gozo and with a school in Ireland. Ireland and Malta are two countries that have different levels of NO_2 and air quality, based on several factors such as population density, industrial activity, transportation, and energy production. Through this investigation, some strategies have been developed to reduce nitrogen dioxide emissions and improve air quality.

Research Questions

- What are the levels of nitrogen dioxide in front of the school?
- How do nitrogen dioxide levels in our school area compare with those of other schools in Gozo and one in Ireland?
- How has the level of nitrogen dioxide changed over time and what are the primary causes of these changes?
- What measures can be taken to reduce the levels of nitrogen dioxide in the air and improve air quality?

Introduction

The aim of the study is to find out the extent of the levels of nitrogen dioxide present in the area around the school. In this study we used the experimental method, where a diffusion tube was carefully set up in the main school areas facing the street that is frequented by students and staff daily. Temperature and atmospheric conditions were taken on a regular basis during every school day between 17th October, and 14th November 2022. Finally, the diffusion tube was taken down and sent to Gradko Environmental Laboratory for analysis. This study contributes significantly to the importance of reducing NO_2 emissions for the well-being of citizens and for the environment in general both on a local and on a global level. Gozo College Middle School (GCMS) is situated on the smaller island of Gozo which is part of the Maltese Islands. There is usually relatively less traffic in Gozo but there still is a substantial number of cars per capita. GCMS is in the farther end (north-east side) of the main town of Rabat or Victoria, in Europe Street which is parallel to the main road. The school has its frontage overlooking a secondary road which is being increasingly used by traffic to avoid the main road. Air quality in the Maltese Islands is considered to be between good to moderate.

Map of the Maltese Islands.

Research Methods

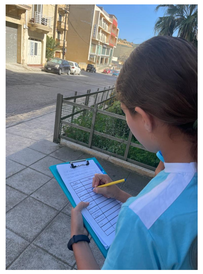
GLOBE students decided to test the school area for nitrogen dioxide emissions and compare it to tests carried out last year at the same time of year and at the same entry point. It is an ideal area as Gozo College Middle School, this year is situated in Europe Street, Rabat or Victoria, the main town of the Island of Gozo, which is the second island in size of the Maltese Archipelago. Also, such an analysis would provide an opportunity for the students to take effective action since they are part of the area and are the commuters to the school.

One diffusion tube was fixed at the entrance of the Gozo College Middle School where students arrive into both the Middle and Secondary school in the morning and leave in the afternoon. The diffusion tube was placed to measure nitrogen dioxide levels in the air. It was set up on Monday, 17th October, 2022.

Atmospheric and temperature readings were also taken over a four-week period to support the results of the average nitrogen dioxide levels. These were taken from the same site. Students made cloud observations using the GLOBE Observer App, measured air pressure, air temperature, humidity and surface temperature and took a traffic count tally on a regular basis. The last day of observation and data collection was 14th November 2022. Then, the diffusion tube was taken down and sent to Gradko Environmental Laboratory in the UK, for analysis. In the meantime, we communicated with Mercy College in Sligo, Ireland and introduced ourselves and our intended investigations.

Aerial view of school complex with the two main roads.

Putting up the diffusion tube at the school entrance on 14th October 2022.



GLOBE students measuring weather parameters using a data logger and doing traffic count.

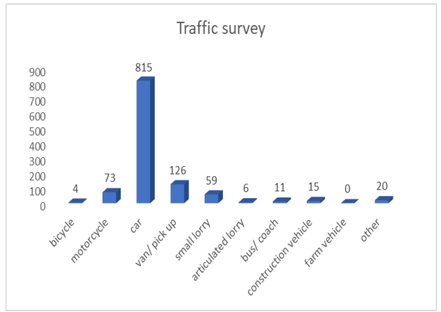
Results

The levels of nitrogen dioxide (NO_2) can vary between settlements in Gozo, Malta, depending on several factors such as population density, transportation, industrial activity, and energy production. In general, urban areas, particularly those with high levels of transportation and industrial activity, tend to have higher levels of nitrogen dioxide. For example, settlements with a higher concentration of vehicles, such as Victoria, may have higher levels of nitrogen dioxide compared to settlements with fewer vehicles and lower population densities, such as Xewkija as seen in the results by Gradko (Fig. 19). However, it is important to note that nitrogen dioxide levels can also be influenced by other factors such as weather patterns, topography, and local emissions sources. Therefore, it is difficult to make generalisations about nitrogen dioxide levels between settlements in Gozo without conducting specific monitoring and analysis of local conditions. To understand and address the specific challenges with air quality in Gozo, it is important to regularly monitor and analyse nitrogen dioxide levels, as well as other pollutants, in each settlement, and take action to reduce emissions and improve air quality.

NO2 results from Gradko Laboratories

Location	Sample Number	Exposure Data Date On*	Date Off*	Time* (hr.)	µg/m³ *	ppb *	µg NO_2 on tube
Gozo College Middle School, Europe Street, Victoria, Gozo	2096424	17/10/2022	14/11/2022	671.87	30.70	16.02	1.50
St. Francis Primary School, Main Gate Street, Victoria, Gozo	2096425	17/10/2022	14/11/2022	672.00	36.90	19.26	1.80
Gozo College Rabat Primary School, Triq Vajringa, Victoria, Gozo	2096426	17/10/2022	14/11/2022	668.88	39.62	20.68	1.93
Gozo College Xewkija Primary School, Triq Tal-Hamrija, Xewkija	2096427	17/10/2022	14/11/2022	671.83	3.79	1.98	0.19
Gozo College Sannat Special Unit School, Sannat Road, Sannat	2096428	17/10/2022	14/11/2022	672.00	20.74	10.83	1.01
Gozo College Zebbug Primary School, St. Andrew Street, Zebbug	2096429	17/10/2022	14/11/2022	669.58	6.53	3.41	0.32
Sir M.A. Refalo Sixth Form, Fortunato Mizzi Street, Victoria	2096430	17/10/2022	14/11/2022	672.25	43.10	22.50	2.11
Sacred Heart Minor Seminary, Enrico Mizzi Street, Victoria	2096431	14/10/2022	14/11/2022	739.17	33.56	17.52	1.80
Laura Vicuna Primary School, Ghasri Square, Ghasri	2096432	17/10/2022	14/11/2022	671.80	5.61	2.93	0.27
Gozo College Qala Primary School, Triq it-Tempju, Qala	2096433	17/10/2022	14/11/2022	671.75	28.82	15.04	1.41
Gozo College Gharb Primary School, Triq il-Vizitazzjoni, Gharb	2096434	17/10/2022	14/11/2022	672.50	9.96	5.20	0.49

Traffic count



Discussion

Following the reading of results and their comparison with the results taken last year at the same time of year and from the same site, we were shocked to discover that emissions had gone up from 19.20 µg/m² to 30.70µg/m². Reasons for this change were discussed and the plausible explanations students came up with were:

1. the increase in the amount of construction on the island generally and in the next-door area where a public gym and two schools are under construction and
2. the use of this street, which is parallel to the main road, by an increasing number of vehicles to avoid getting caught up in traffic jams on the main road.

Malta, like many other densely populated areas, faces air quality challenges due to emissions from transportation and industrial activities. The island has a high density of vehicles and a relatively high level of air pollution, particularly in urban areas. In recent years, the Maltese government has taken steps to improve air quality, including the implementation of stricter emissions standards for vehicles, the promotion of alternative modes of transportation, and the development of renewable energy sources. However, there is still work to be done to improve air quality in Malta and address the health impacts of air pollution.

After analysing data and results the students concluded that planting more trees would help to mitigate pollution in front of the school. Three trees were bought and planted, namely an olive, a fig and a kumquat tree. Students also planted several crops for the same purpose and to decrease the carbon footprint and packaging. On the next school outing, the school decided to go to the event place on foot as a whole school to instil a sense of responsibility towards air quality.

Bibliography

WHO - WHO Global Air Quality Guidance 2021 9789240034228-eng.pdf (who.int) (Accessed February 2023).

EPA US Environmental Protection Agency - Basic Information about NO_2 https://www.epa.gov/no2-pollution/basic-information-about-no2 (Accessed January 2023).

GLOBE Observer https://observer.globe.gov/ (Accessed October 2022).

GLOBE teacher guide https://www.globe.gov/ (Accessed October 2022).

IQAir Gozo Air Quality Index (AQI) and Malta Air Pollution | AirVisual (iqair.com) (Accessed February 2023).

Queensland Government - Nitrogen Oxides https://www.qld.gov.au/environment/pollution/monitoring/air/air-pollution/pollutants/nitrogen-oxides (Accessed November 2022).

Wikipedia 2023 https://en.wikipedia.org/wiki/Gozo (Accessed February 2023).