

A central photograph showing several pairs of hands cupping a small globe of the Earth. A butterfly is perched on top of the globe. The background is a soft, out-of-focus green. The text 'What do we breathe?' and '(project GLOBE)' is overlaid on the image.

What do we breathe? (project GLOBE)

Primary school A.
Sládkoviča Sliač
SLOVAKIA

This school year, our research team decided to join the activities of the Globe project. This time, we were interested in the opportunity to obtain portable air pollution meters ATMOTUBE PRO for a certain period of time. Why are we interested in the quality of the air we breathe?

Some facts:

Each person inhales approximately 14 kg of air per day, while drinking only 2 kg of water and consuming 1.5 kg of food. This fact alone makes it clear that air quality is one of the factors that significantly affects human health. In addition, it also significantly affects the state of ecosystems. Air quality is assessed using the concentrations of selected pollutants in the air. Research shows that adverse health effects are caused not only by short-term heavy exposure to pollutants in the environment, but also by long-term exposure of humans to poor air quality. Like many other processes in the atmosphere, air quality is highly variable in time and space.



What all reduces air quality?

Clean air is a fundamental component of a healthy environment. It is air that does not cause any unpleasant or harmful effects on flora, fauna and humans in the short or long term.

During the development of our Earth, there was no completely clean air. In addition to the basic components, the air always contained some pollutants from cosmic dust, volcanic activity, terrestrial dust, substances originating from the decomposition of plants and animals, forest fires, etc. This natural pollution in the past was negligible worldwide, it was usually local and limited in time. The new situation has arisen in recent decades as a result of strong and often reckless human industrial activity associated mainly with the growing consumption of all types of fossil energy (mainly coal) and the production of a large number of various emissions and waste. Worldwide, the land is polluted daily by a huge number (estimated at over 800 million) of various sources producing substances harmful to living and non-living nature.



Sources of air pollution

01

ENERGY

- power plants, heating plants, boiler houses

02

TRANSPORT

-automobile, air, rail and water

03

WASTE DISPOSAL

- municipal and industrial waste incinerators, landfills, composting plants, wastewater treatment plants, sludge fields, veterinary sanitation facilities and crematoriums

04

AGRICULTURE AND FORESTRY

Pollutants we monitored:

- 01 PM10
- 02 PM2,5
- 03 PM1
- 04 AQS



PM10

| 01 |

These are particles with a diameter of less than or equal to 10 microns. They are about 30 times smaller than the thickness of a human hair and are small enough to bypass our defensive hairs in the nose and enter the lungs. Sources of PM10 particles include the grinding and abrasion of various things, dust stirred up by vehicles, pollen, mold, and plant and insect particles are also considered PM10.



PM2,5

| 02 |

These are fine particles, 2.5 micrometers or less in diameter. Fine particles are created by all types of combustion, including motor vehicles, power plants, domestic wood burning, wildfires, agricultural combustion and some industrial processes. While PM10 ends up in the lungs, PM2.5 is more dangerous because it can travel from the lungs into the bloodstream. From the bloodstream, it can travel anywhere in the body, making it an “invisible killer.”



PM1

| 03 |

These are solid particles less than 1 micron in diameter - they are the main subgroup of PM2.5. These are extremely fine particles that are even more likely to reach deeper into the respiratory system than PM2.5. PM1 particles are a by-product of industry, construction activities and road dust and car driving. They do not disperse and remain suspended in the air you breathe.



AQS-Air Quality Score

| 04 |

It can give us an immediate idea of the air quality in the area. The AQS ranges from 0 (very polluted air) to 100 (very clean) points.

The AQS is automatically displayed in the application that you download to your mobile or tablet. There is an LED on the front of the sensor. The color of the LED represents the current AQS air quality score. (Red - highly polluted, orange - very polluted, yellow - polluted, green - moderately polluted, blue - good).



On 26.11.2024, we started our measurements. We received 4 ATMOTUBE PRO air quality meters. Each meter recorded the values of pollutants for three weeks in different locations. The locations were as follows: Očová (village), Sliach (town), Kováčová (village), Vysoké Tatry (national park), Lúčky (small town). We were interested in the extent to which the method of heating households, the size of the location, the number of cars, the phase of the day and human activity in general have an impact on air pollution. We measured and recorded the values of AQS, PM1, PM2.5, PM10.



Our research questions



Question n. 1

Is there a significant difference in the air quality around our school in the morning and at noon?



Question n. 2

Is there a significant difference in air quality in the countryside and in the city?



Question n. 3

Is there a significant difference in air quality between inhabited areas and the wild nature in the national park?

Our hypotheses

1

We assume that in the morning the air quality around the school will be strongly affected by the large number of cars in front of the school.

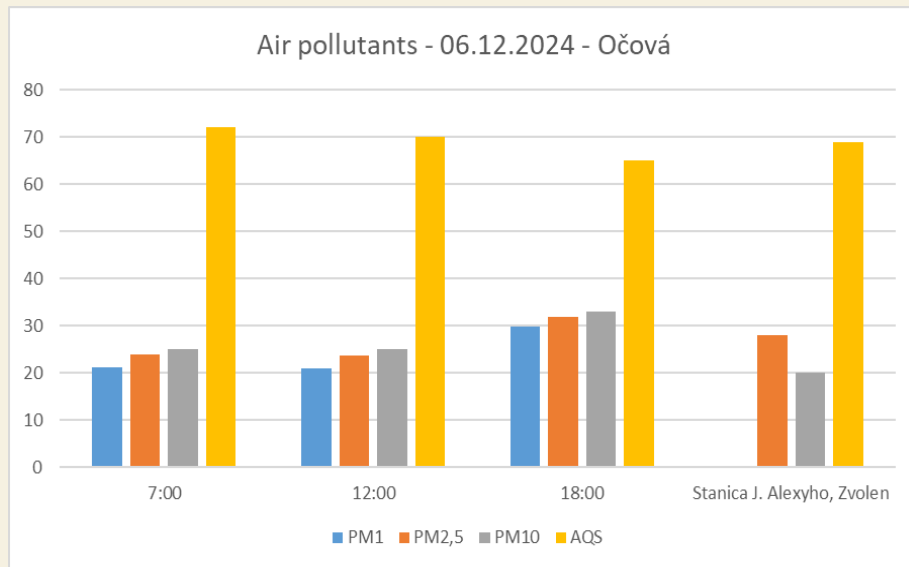
2

We assume that the air quality in the village will be worse in winter than in the city, as many residents in the village heat their homes with solid fuel.

3

The national park is a legally protected area where almost all human activity is prohibited, and therefore we expect the air quality here to be at a high level.

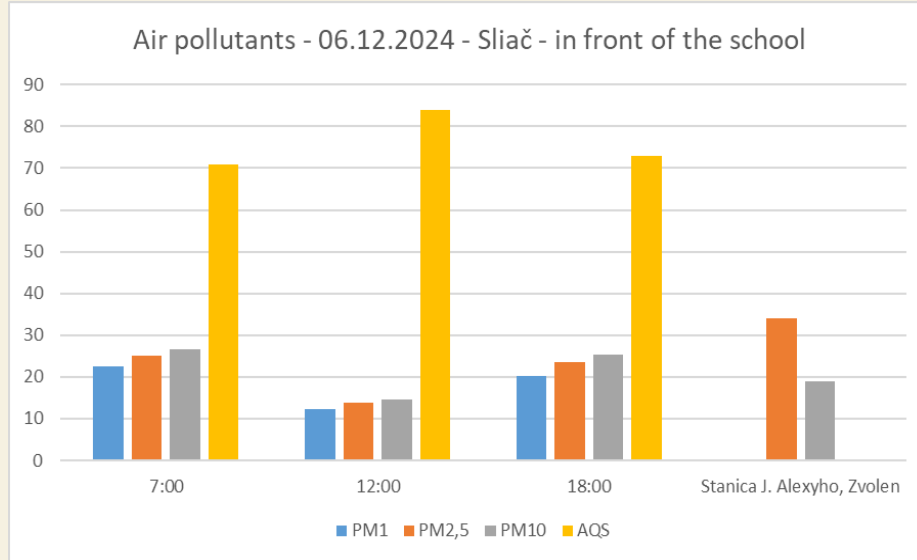
MEASURED RESULTS



Locality OČOVÁ - village

From the graph we can see that the worst situation in the village is in the evening, around 6:00 PM, when residents begin to intensively heat their homes. In the village of Očová, a large percentage of family houses are heated with solid fuels, i.e. wood, coal, but there is also one serious factor that significantly worsens the air quality in the winter months. This is still the insufficient knowledge of some citizens about what is and what is not permissible to burn. Many burn plastics and various other waste, as they do not consider it necessary to sort and hand over the sorted waste.

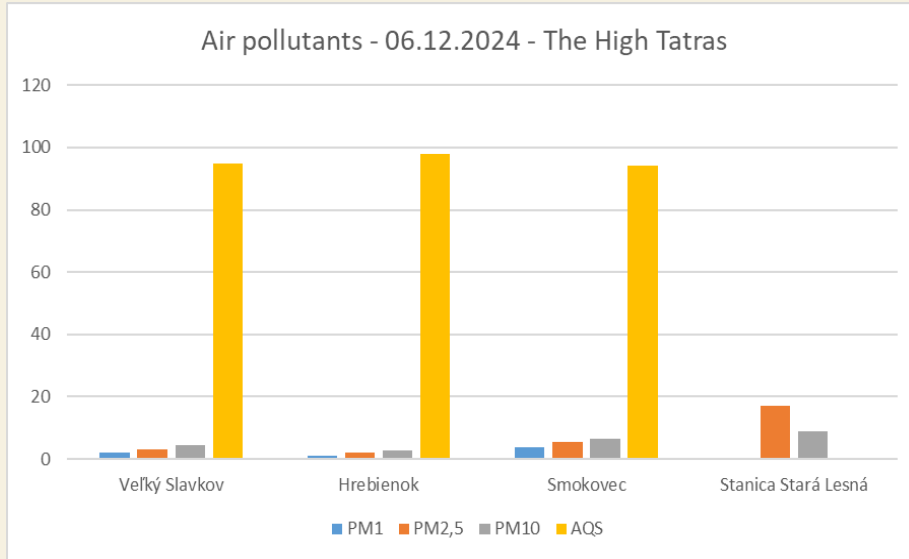
MEASURED RESULTS



Location SLIAČ - town

From the graph we can see that the worst situation is in the vicinity of our school primarily in the morning, between 7:00 and 7:30, when students arrive at school and there is a large concentration of cars with their engines running. The situation improves around lunchtime, as the concentration of cars near the school is low, and worsens again in the evening, when people come home from work. There are also 2 factors that cause the deterioration, namely the increased number of cars on the roads and the intensification of heating of residential areas of the city's residents. Comparing 18:00 in Očová and in Sliač, it is evident that the situation is worse in Očová, as many people heat their homes with solid fuel.

MEASURED RESULTS



From the graph we can see that pollution in the three areas of the Tatra National Park is very low. As we expected, the impact of human activity is minimal here and therefore the air is almost ideal for humans. That is why it is very beneficial for humans to spend at least a few days a year in such an environment.

Location HIGH TATRAS – national park




Conclusion:

When expressing the conclusions of our measurements, we must emphasize again that we carried out the measurements in the winter, i.e. the heating season, when air quality is significantly affected by the fact that residents heat their homes. In the non-heating season, the measurement results would be different. This was particularly noticeable in the village, where many residents heat with solid fuel. And it was this factor that was most pronounced in our research. The air quality in the city in the winter is somewhat better, precisely because many households heat with natural gas, which is generally considered an ecological fuel, or heat with electricity. Also, the situation in traffic jams is significantly worse than in empty streets. And of course, the air quality in the high-mountain environment is very favorable, as we expected.

Impact of poor air quality on human populations:

Air pollution continues to pose a risk to human health and the environment. Air pollution levels in many European cities still exceed EU legal limits. The tragic consequence is that around 400,000 Europeans die prematurely every year due to poor air quality, according to EEA estimates. In terms of environmental factors, air pollution is the leading cause of premature death in Europe, and it also has a significant impact on the economy. It increases healthcare costs and reduces economic productivity through poor worker health. Air pollution also has a detrimental effect on soil, crops, forests, lakes and rivers. Pollutants even damage our homes, bridges and other built infrastructure.





What next? – What are we planning to do?

- **Based on our findings from the research, we decided to take some steps that would contribute to improving the situation in our city and in the areas where we spend most of our time.**
- **1.** Raising awareness of the importance of air quality among students and the general public – we will prepare leaflets with important information and instructions for improving the condition and deliver them to every household in our place of residence. In the leaflet, we want to inform about: the importance of proper ecological heating of households – using high-quality dry fuel, natural gas, or other ecological fuel. The advantages of using bicycles, walking, and using public transport. The importance of the impact of greenery on air quality – planting young trees as much as possible, caring for already growing trees.
- **2.** Planting young trees in front of the school, if possible in the area of the roundabout.
- **3.** Calling in an expert to treat the already growing trees on the school grounds.
- **4.** Promoting the use of bicycles for transportation to school instead of driving in cars, even for short distances.
- **5.** Implementing a program to improve air quality in school subjects through peer learning.



Thank You for Your attention

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