



Air quality in the Tri-City: sources of air pollution, measurements and changes in concentration levels.

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Szkoła Podstawowa nr 19
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ul. Emilii Hoene 6,
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*Diseases caused
by air pollution*



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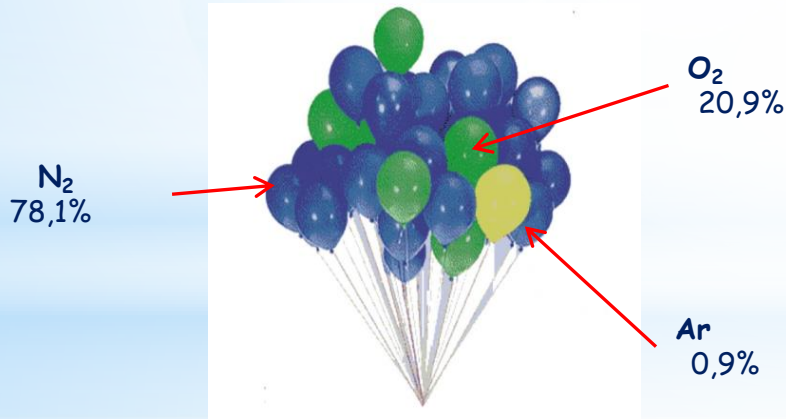
Atmospheric air

The Earth's atmosphere is a layer of gas that surrounds the Earth's surface. It consists of a mixture of gases and aerosols called air.



Atmosphere

Atmospheric air consists mainly of nitrogen (N_2), oxygen (O_2), small amounts of noble gases (argon (Ar), neon (Ne), helium (He), carbon dioxide (CO_2) and other compounds. Air also contains water vapor ($H_2O(g)$) in an amount depending on climate and weather.



With such air, a person can breathe freely and perform all activities related to exercise without side effects for the body.



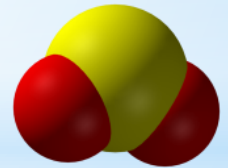
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What is air pollution ?

*Air pollutants are all substances (gases, liquids, solids) that are present in the atmospheric air, but **are not its natural components**. Air pollution also **includes substances that are its natural components, but present in significantly increased amounts.***



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Sources of air pollution

- ❑ **Air pollution** results from car traffic, fuel combustion, production processes.

- ❑ **Basic air pollutants:** Sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter (PM_{10}), ozone (O_3), carbon monoxide (CO), carbon dioxide (CO_2), etc.

- ❑ What are the sources of each pollutant?

- ❑ **There are two basic groups of pollutants:**
 - 1) natural and 2) anthropogenic (related to human activity)



Main sources of air pollution sources:



Fires of forests, savannas and steppes



Erosion of soil and rocks



Volcanic eruptions



Lightning discharges



Dust storms



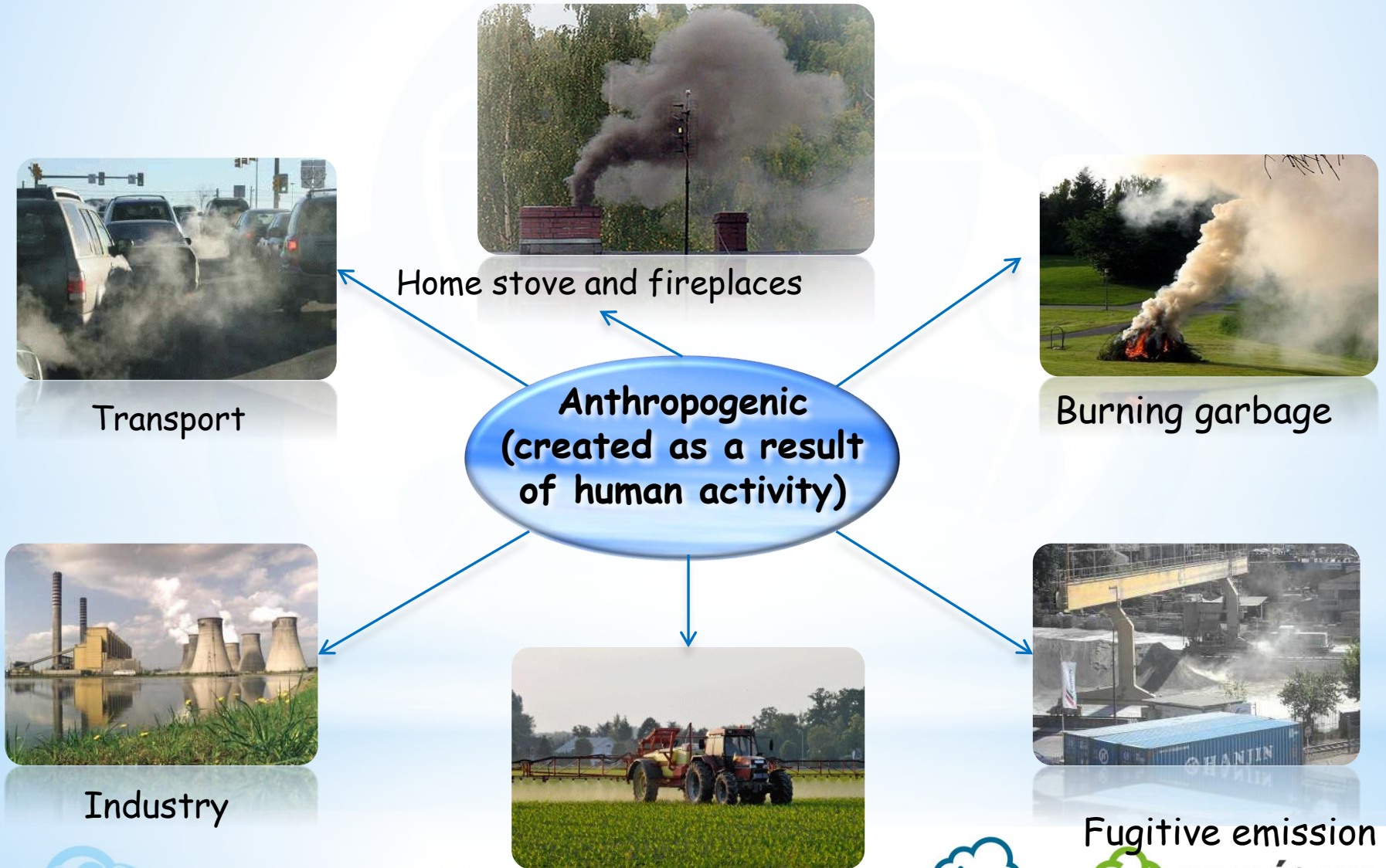
Swamps



Green areas from which plant pollen originates



Main sources of air pollution sources:



Air pollution

CARBON MONOXIDE (CO)

Colorless, odorless, flammable gas. Highly toxic. Causes severe poisoning (suffocation). It is formed during the combustion of coal, crude oil or other carbon fuels, it is present in car exhaust.



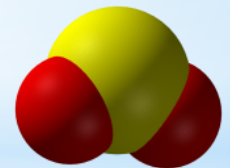
CARBON DIOXIDE (CO₂)

Colorless, odorless, non-flammable gas. In small concentrations it is not poisonous, in higher concentrations carbon dioxide is harmful to health. It is formed in the combustion of coal and oil, as well as in the respiration of living organisms.



SULFUR DIOXIDE (SO₂)

A colorless gas with a pungent, acrid and suffocating odor, strongly irritating to the respiratory tract. It is poisonous to animals and harmful to plants. It is created as a result of burning solid and liquid fuels contaminated with sulfur.



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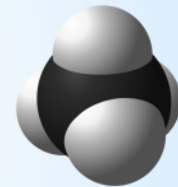
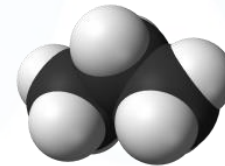
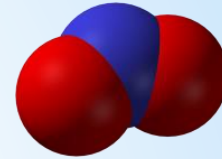


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Air pollution

NITROGEN OXIDES (NO, NO₂, NOX)

NO - colorless, toxic gas. NO₂ – brown, highly toxic gas with a pungent odor. Nitrogen oxides are irritating to the eyes and respiratory tract. They are precursors of carcinogenic and mutagenic compounds formed in the soil. They are formed during the combustion of fossil fuels and during the operation of internal combustion engines of cars.

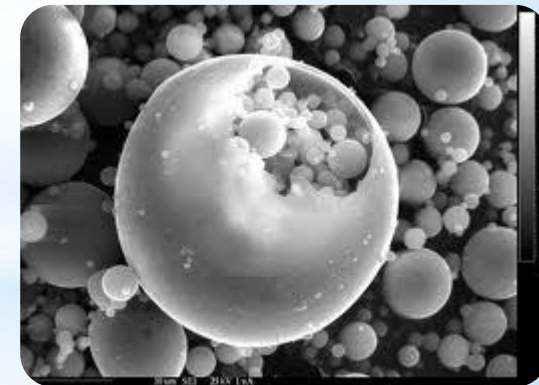


HYDROCARBONS

Many hydrocarbons are gases or liquids that are quite volatile. They appear in the air as a result of evaporation and combustion of fuels, mainly coal, crude oil and petroleum substances, as well as burning waste and tobacco.

PARTICULATE MATTER (PM) : PM₁₀, PM_{2,5}

Particulate matter is a mixture of fine particles of various sizes and chemical composition. It is harmful to health. It is produced mainly during the combustion of coal in household furnaces and boiler rooms, And also as a result of road transport.



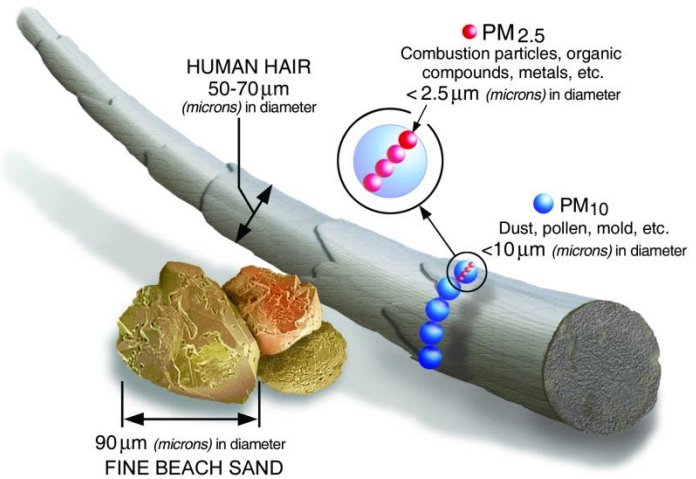
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Air pollution

Division of aerosols due to particle size



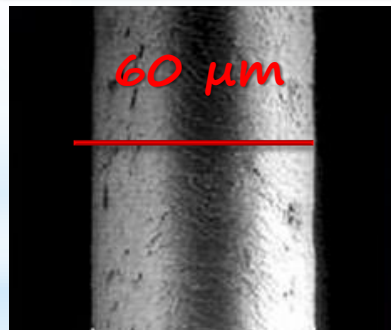
Aerosols

TSP
(0,1-30) μm

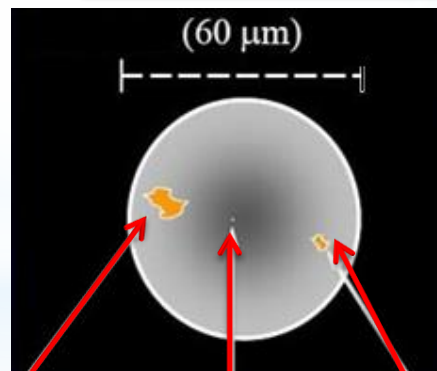
PM₁₀
10 μm

PM_{2,5}
2,5 μm

PM₁
1 μm



PM₁₀



PM₁

PM_{2,5}



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Low emission

Among the listed anthropogenic sources of air pollution, the most important in Poland is **LOW EMISSION**.

Low emissions include pollutants emitted from sources at an altitude of less than 40 m. This is the *emission of dust and harmful gases from road transport and local coal-fired boiler houses and home heating furnaces, in which low-quality coal and household waste are burned in an inefficient way.*

Transport is one of the sources of low emission. Car exhaust fumes are very harmful because they spread in high concentrations at low altitudes in the immediate vicinity of people. Motor vehicles pollute the environment by burdening it with over 15,000 chemical compounds.



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Effects of air pollution

- serious health problems, including cancer;
- corrosion of furnaces,
- inflammation of the chimney and even fire;
- smog;
- acid rain;
- ozone hole;
- the greenhouse effect;
- climate change: droughts, floods, hurricanes.



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Smokes

The smoke coming out of the chimneys of houses can look very different. Depending on what is burned in home stoves, the smoke takes on different colors.



White smoke is safe - it is produced by burning wood, gas, oil and coal of good quality.



Dark gray smoke - is produced by burning solid fuels, such as coal or damp wood of inferior quality, biomass.



Black smoke - it is produced as a result of burning poor quality coal or wet wood of poor quality. It causes a high content of dust and soot in the air.



Smoke of uneven color, pale orange / dull - is produced as a result of burning waste of various origins, it is a sign that plastics, cans, peelings, old clothes are thrown into the furnace. We burn everything we can get - old tires, used diapers and ordinary garbage. It is very dangerous for our health



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Effects of air pollution

- SMOG

Smog is polluted air containing high concentrations of dust and toxic gases, the source of which is mainly cars and industry. This word originated in the from the combination of two words, **namely the word "smoke" (smoke) and the word "fog" (fog).**

It is a phenomenon characteristic of large cities. It causes irritation of the respiratory tract and eyes, respiratory failure or paralysis of the circulatory system. It can trigger asthma and its attacks, and increases the incidence of cancer. Causes damage to coniferous trees, decomposition of sandstone and rubber materials.



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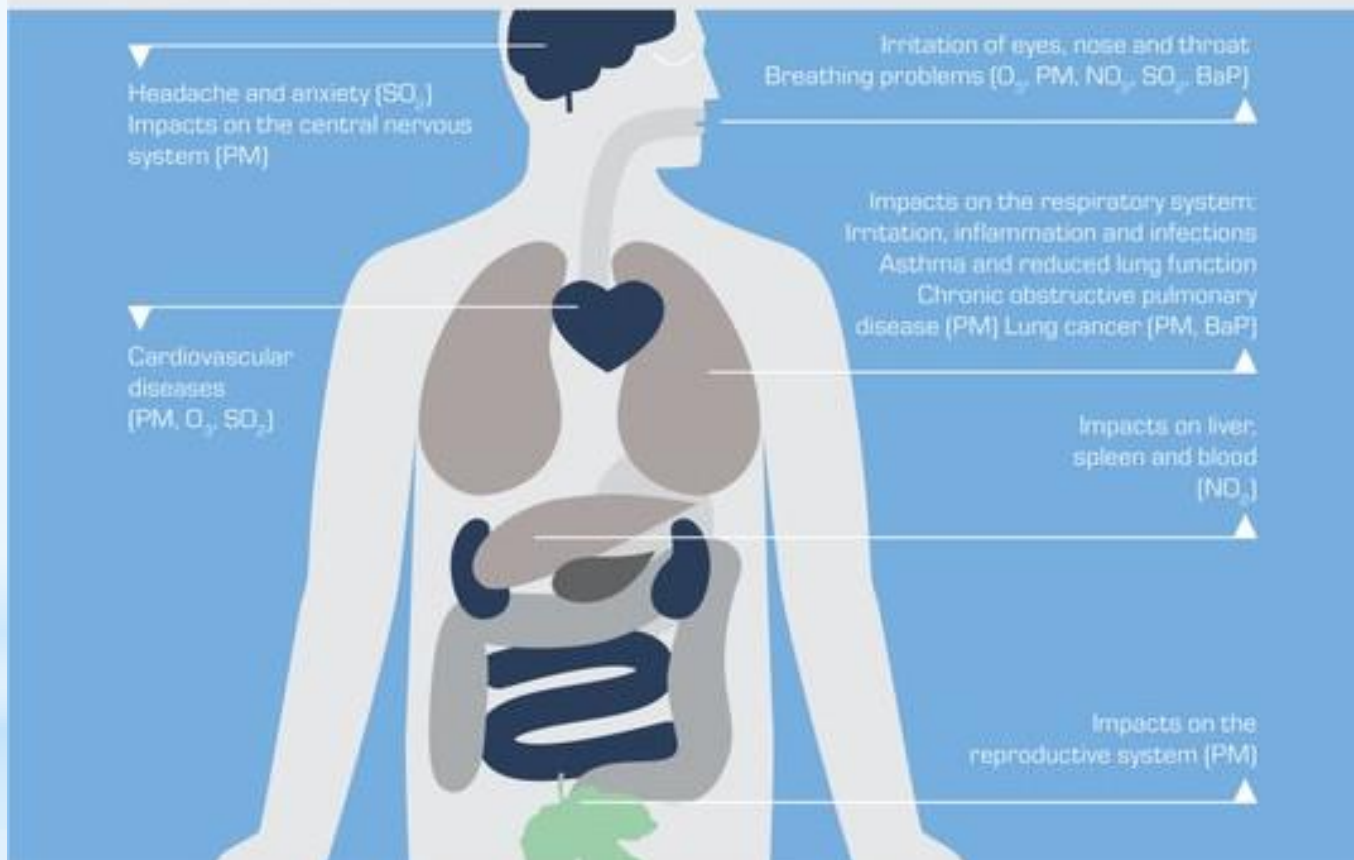
Effects of air pollution - impact on health

European Environment Agency



Health impacts of air pollution

Air pollutants can have a serious impact on human health. Children and the elderly are especially vulnerable.



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Effects of air pollution

The main effect of the greenhouse effect is the increase in temperature on Earth, which results in alarming climate changes.



The effects of climate change caused by the greenhouse effect are:

- weather cataclysms (hurricane winds, downpours, snowstorms, frosts, thick fogs)
 - melting glaciers,
 - rising sea levels,
 - prolonged droughts,
- shortage of drinking water,
 - fires,
 - floods.



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Air protection - examples!

We all have an impact on the environment in which we live. By making the right choices in our daily activities, we can contribute to reducing the emission of pollutants into the atmosphere, and thus limiting dangerous climate changes!



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Air protection – examples !

- **Save energy!** (turn off the light, use energy-saving lighting, Do not leave the TV, computer and other electrical equipment in stand-by mode),
 - **Travel smart and together!** (use public transport, covers short distances on foot or by bike, travel together -If you have a common goal (to get to school, to extracurricular activities), use one car,
 - If you are buying or your parents are **buying a new electrical appliance, such as a fridge or washing machine, buy energy efficient appliances**
 - **Plant a tree at school, in the garden or in your neighborhood!**
- Five trees absorb about 1 ton of carbon dioxide during their lifetime.
- **Don't burn garbage! Use good fuel in your stove.**
 - **Switch to zero-emission heating !**



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Air monitoring

The air is constantly monitored. Monitoring *provides the necessary information on the state of air quality, allows you to identify types of pollution, as well as the place and causes of their formation.*

There are 16 stations for automatic air monitoring in the Pomeranian Voivodeship, including 8 stations in the Tri-City (Foundation ARMAG).



Institutions that measure air pollution and monitor its quality in the Pomeranian Voivodeship are:



Foundation of the Regional
Atmosphere Monitoring
Agency Gdańsk-Sopot-Gdynia
(Foundation ARMAG)



Chief Inspectorate of
Environmental
Protection

Information on air quality in the Pomeranian Voivodeship is available at: www.armaag.gda.pl/ and <http://airpomerania.pl/> and <https://powietrze.gios.gov.pl/pjp/current>



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Communication station - AM7 Gdańsk ul. Słowackiego



EQUIPMENT:

- nitrogen oxides analyzer,
- carbon monoxide analyzer,
- PM10, PM2.5 and PM1 dust analyzer
- calibration system (calibrator with GPZ and compressor),
- sampling system (manifold)
- data collection and communication system (datalogger with instrumentation),
- meteorological station (temperature, humidity, wind speed and direction, atmospheric pressure, precipitation).

Atmoludek

The state of air quality is presented using the graphic form of **ATMOLUDEK**. Atmoludek takes on different colors depending on the state of the air at a given moment.

very good



Blue and **dark blue** indicate: it's very good, you can enjoy the "fresh" air without restrictions

Bardzo dobry

Green color informs: sensitive people (children, the elderly) should limit their physical activity near busy communication routes.

satisfactory



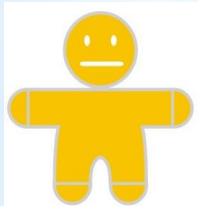
Zadowolający

good



Dobry

sufficient

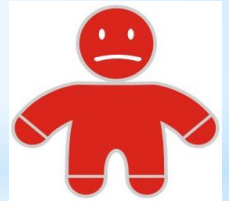


Dostateczny

Yellow advises: take a walk away from high-traffic streets and coal-fired residential areas.

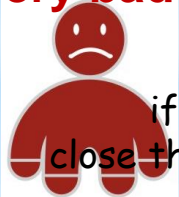
Orange color warns: outdoor physical activity recommended only for healthy people, leave the car at home.

bad



Zły

Very bad



Bardzo zły

if you have health problems, stay at home, contact your doctor in case of ailments, close the windows. If you are healthy, leave the car at home, use public transport or a bicycle.

Red color alerts:

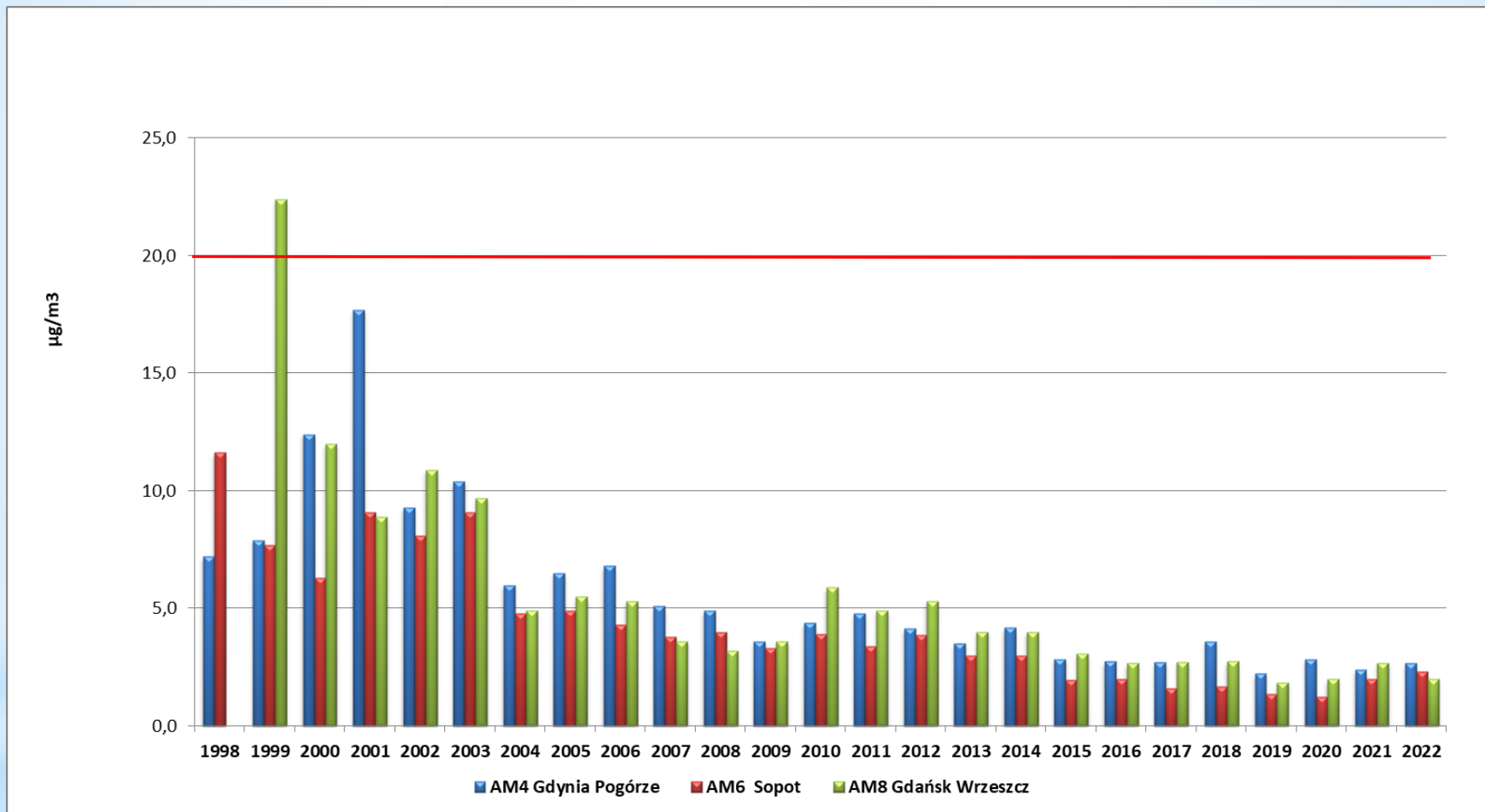


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Average annual concentrations of SO₂ 1998 -2022 at selected stations in the Tri-City

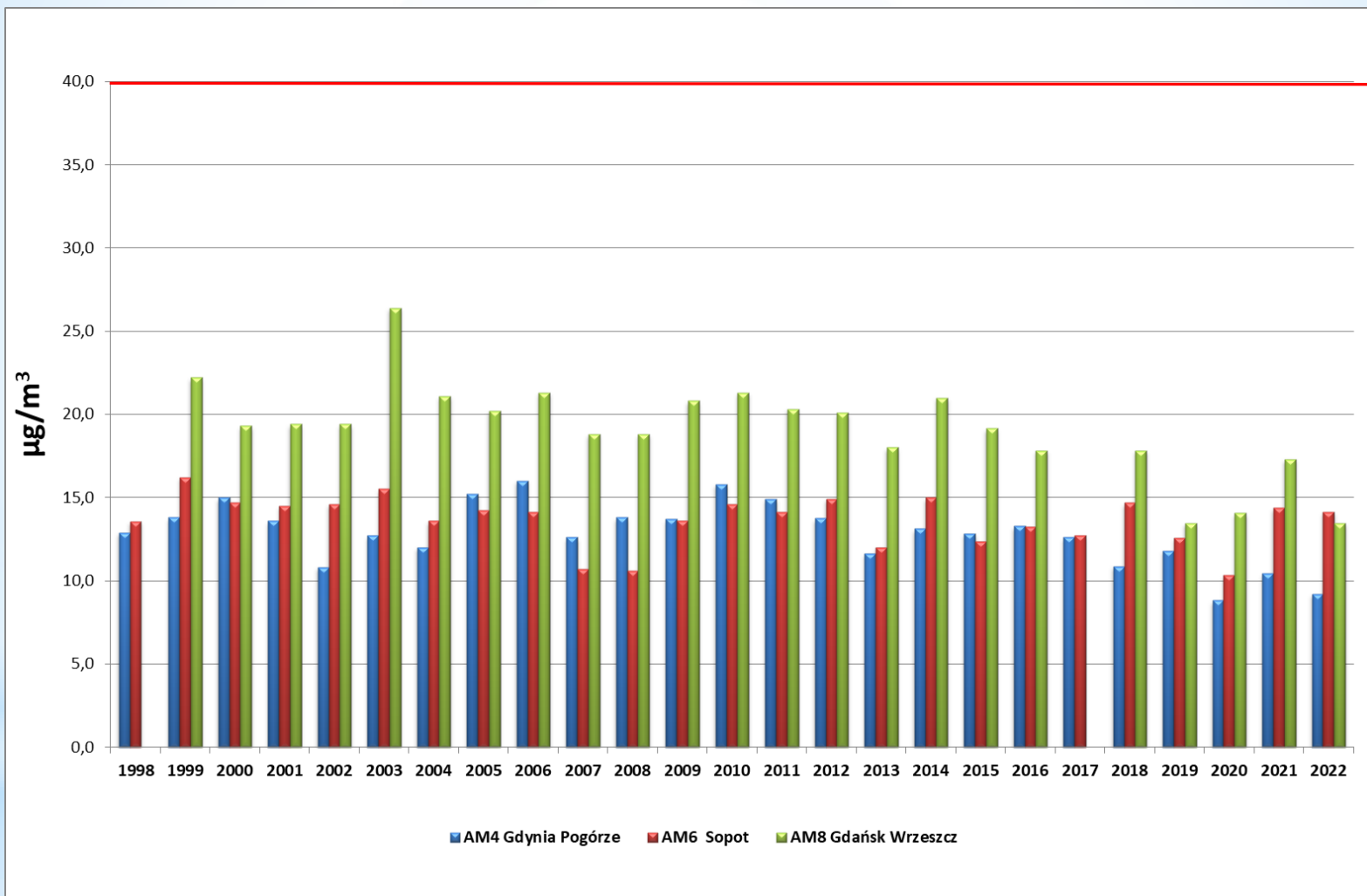


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Average annual concentrations of NO₂ 1998 -2022 at selected stations in Tricity

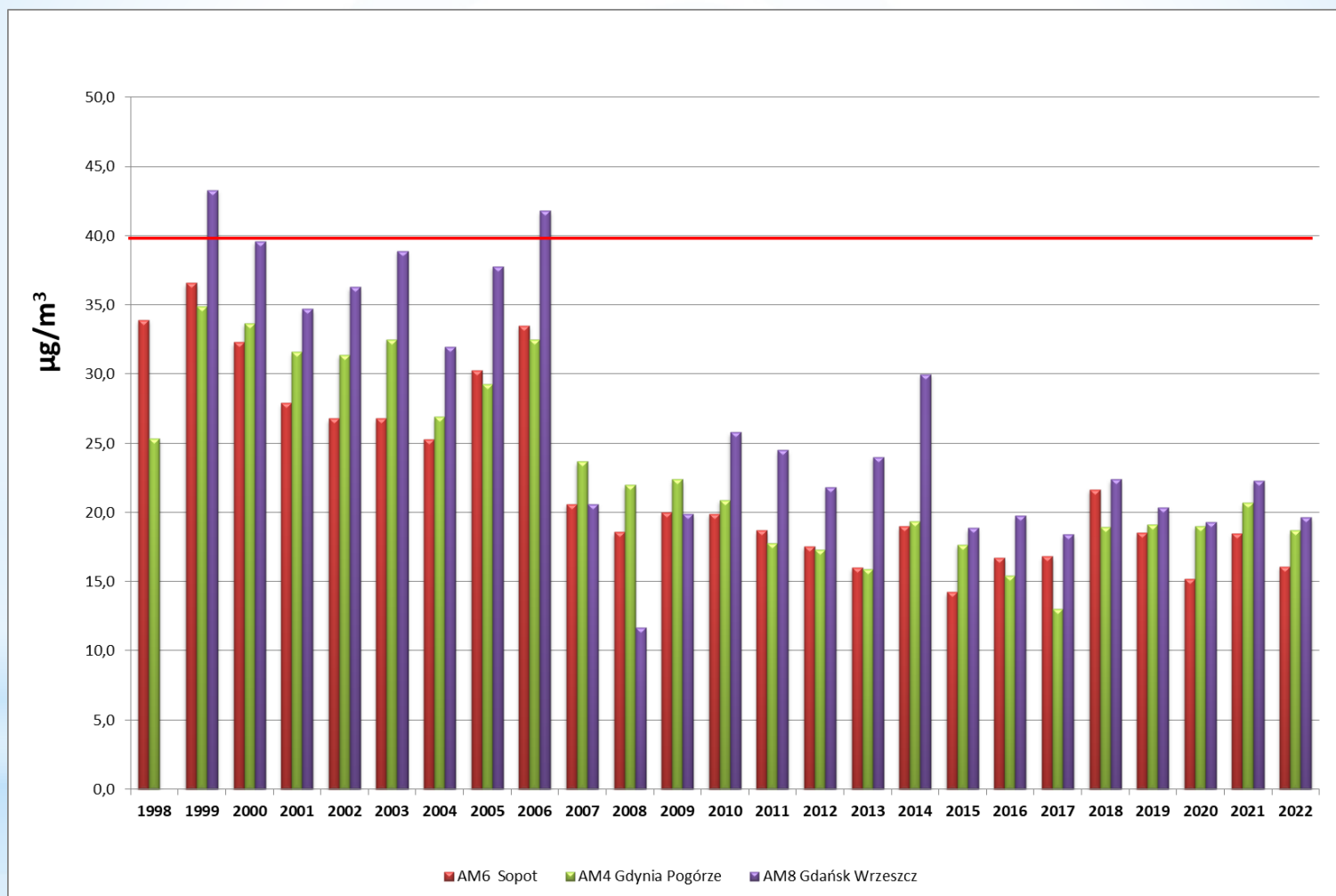


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Average annual concentrations of PM10 1998 -2022 at selected stations in the Tri-City

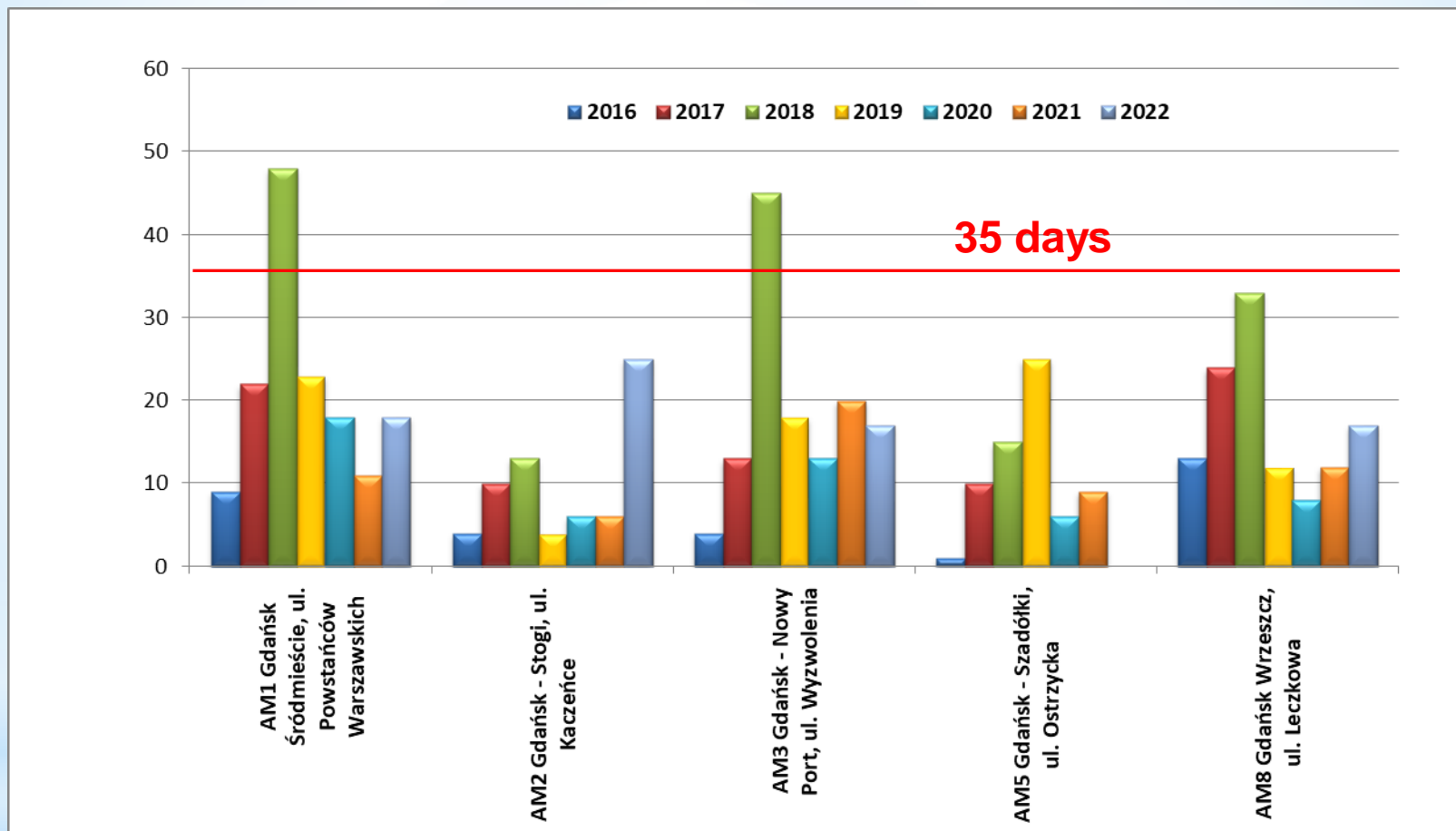


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Number of exceedances of the permissible level of average daily PM10

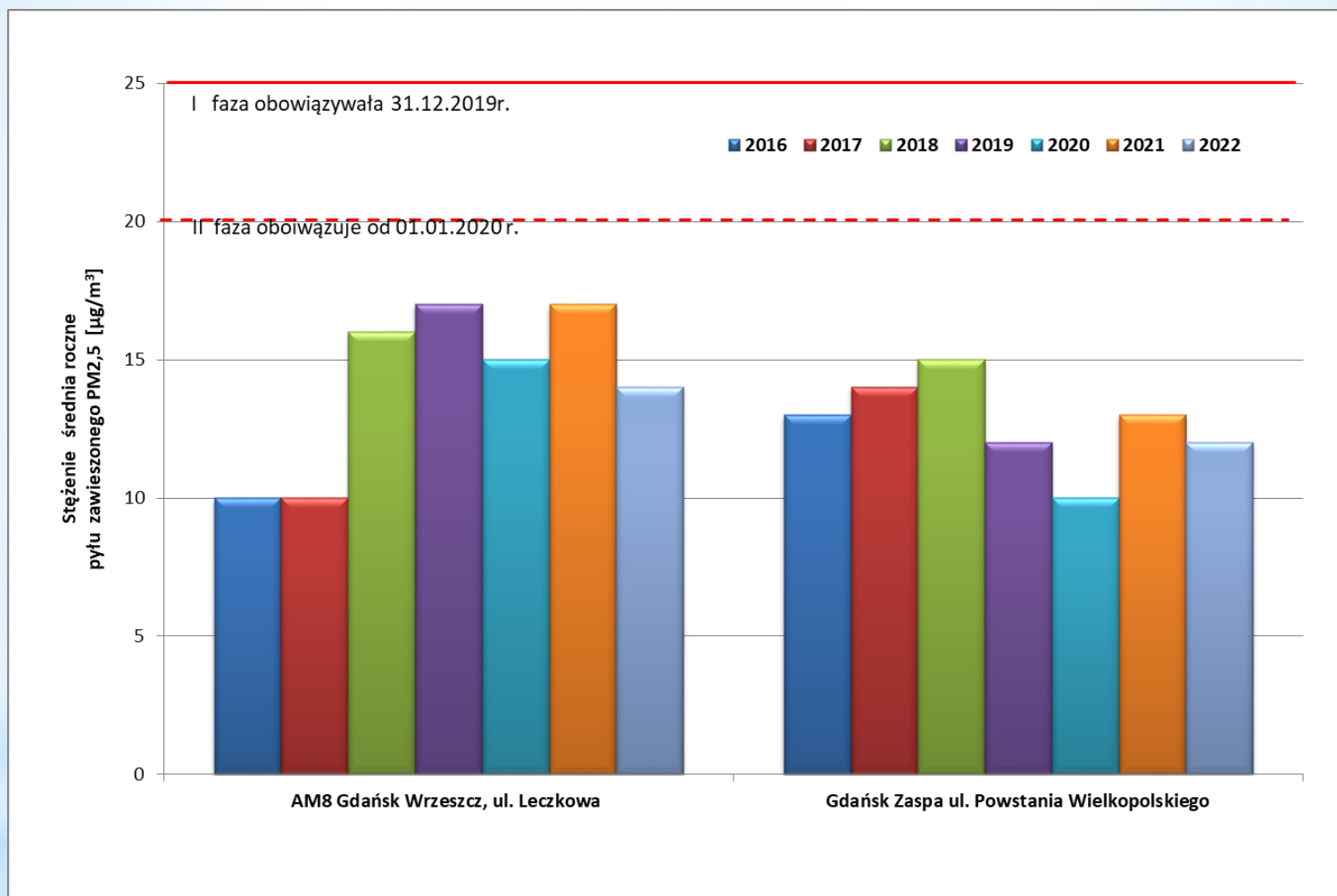


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Average annual concentration of particulate matter PM2.5 [$\mu\text{g}/\text{m}^3$]

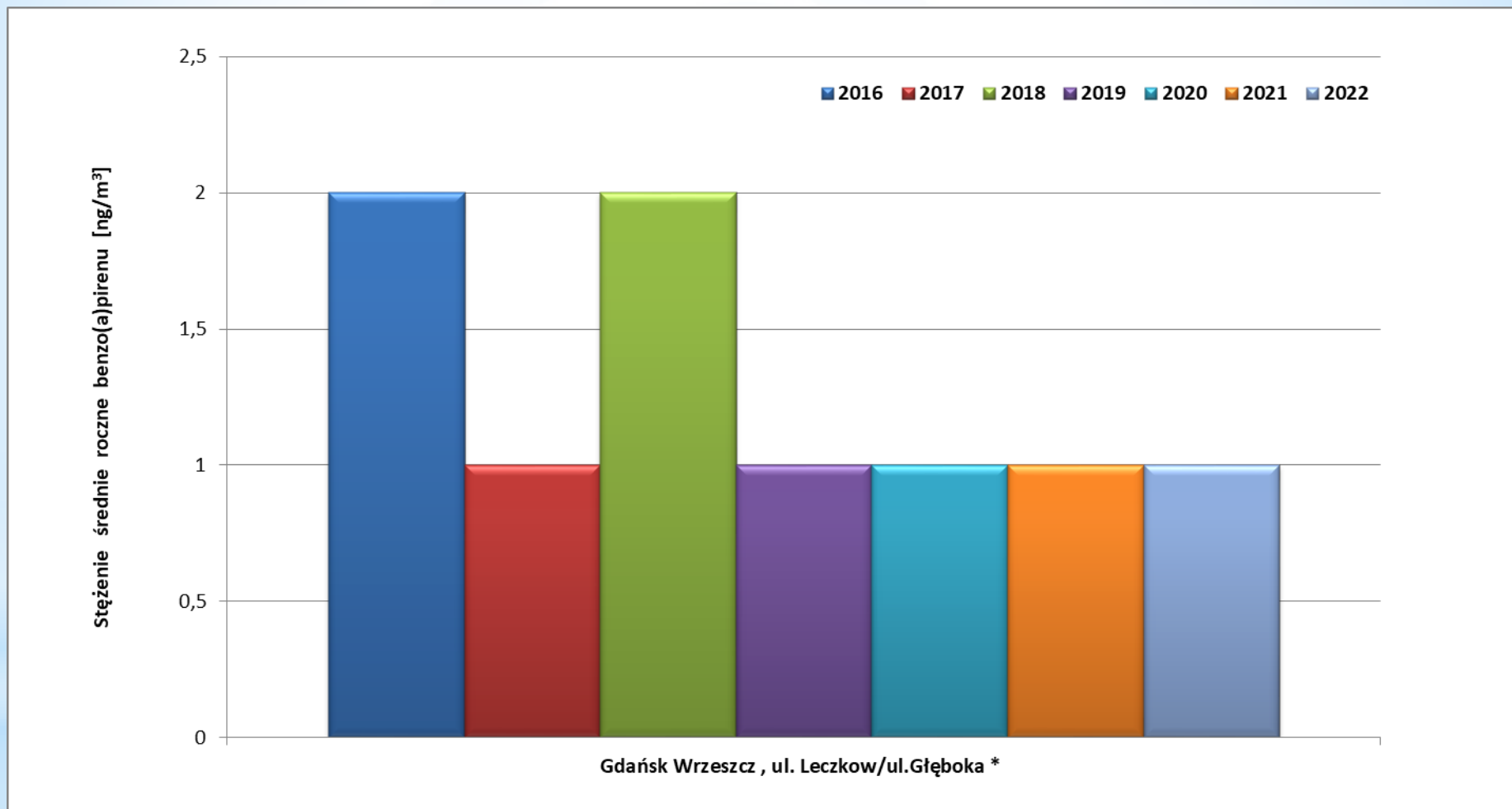


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Annual average benzo(a)pyrene - B(a)P [ng/m³]



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Summary

- The greatest decrease in the concentration of sulfur dioxide,
- Further slow decrease in concentration levels for PM10 and PM2.5 dust,
- In the case of nitrogen oxides, maintaining at a similar level and a slight increase in the longer term.
- Tightening of PM standards by the EU in the near future, the problem with meeting air quality standards with regard to PM2.5 and PM10 dust in the perspective of several years.



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Thank you very much for your attention !



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