Czech hydrometeorological institute
Brno regional office
Air quality department

Czech
Hydrometeorological
Institute

Air quality monitoring

Air quality monitoring at the Brno regional office is being performed since 1970. The department activity stems from the 201/2012 law regarding air quality.

Measurements include monitoring of concentrations of PM_{10}, $PM_{2,5}$, SO_2, NO, NO_2, NO_x, CO, O_3, heavy metals (lead, arsenic, nickel, cadmium), benzene, polycyclic aromatic hydrocarbons.

The ambient air quality monitoring is accredited based on ISO/IEC 17025:2017.

Air quality monitoring at CHMI

Air quality monitoring

- projects
- stationary and mobile measurements
- long-term and short-term measurements
- data verification
- expert evaluation

Locations

CHMI Brno

Jihomoravský kraj

- 11 stanic ČHMÚ
- 5 stanic Město Brno
- 2 stanice ZÚ Ostrava
- 2 stanice Českomoravský cement

Zlínský kraj

- 6 stanic ČHMÚ
- 1 stanice Město Otrokovice
- 1 stanice Město Zlín

Kraj Vysočina

- 5 stanic ČHMÚ
- 3 stanice ZÚ Ostrava
- 1 stanice CzechGlobe
- 1 stanice Ústav chem. procesů

NATIONAL AMBIENT AIR QUALITY STATION NETWORK

- approximately 200 stations in the Czech Republic
- approximately two thirds owned by CHMI
- some stations maintained by other Organization, CHMI guarantees quality
- data sent to Air quality information systém (ISKO)

Automatic station – station equipped with analyzers monitoring air quality in real time. Data are sent to the central computer and available online, usually in hourly interval. These stations monitor suspended particles, nitrogen oxides, sulfur dioxide, carbon monoxide and ozone.

Manual station – a sampler sampling suspended particles on a filter, which is subsequently weighed (gravimetric analysis) and it is also possible to further determine concentrations of heavy metals and polycyclic aromatic hydrocarbons. Measurements are usually done in 24h interval.

Each station can be classified by various criteria:

Classification based on station type:

- **traffic station**
- **background station**
- **industrial station**
- **hot spot**

Classification based on zone type:

- **urban**
- **suburban**
- **rural**

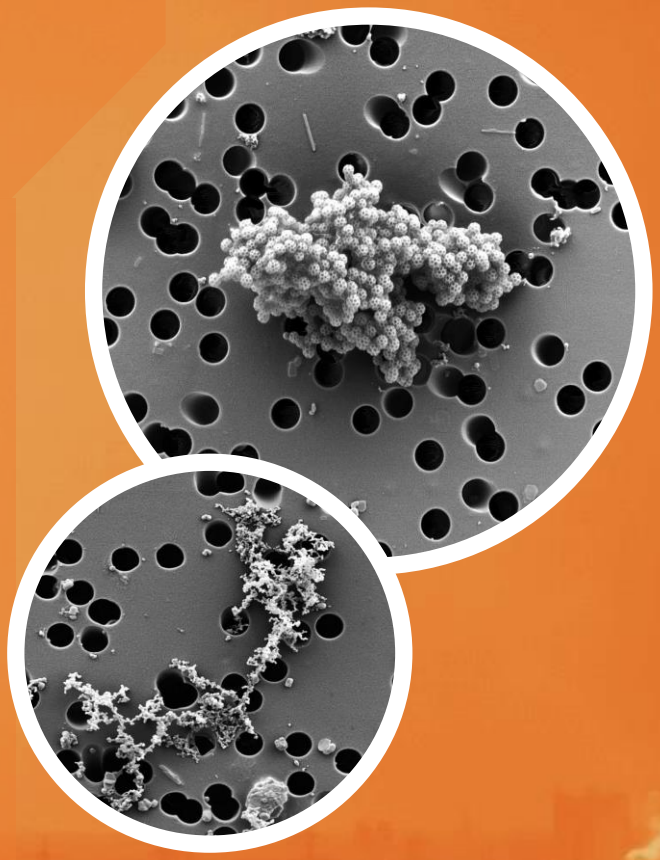
Region characterization:

- **residential, commercial, industrial, agricultural, natural or combinations**

Suspended particles

Suspended particles (particulate matter, PM) represent a heterogenous mixture of organic and inorganic liquid or solid particles of vraious sizes and chemical composition and of various origins. Such particles present a significant health risk factor with various effects on human health.

Short-term increase in daily PM concentrations can cause increase in disease prevalence, causing especially cardiovascular diseases, increasing infant death rate, causing irritation, cough, shortness of breath and presents a problem especially for sensitive individuals – asthma patients, elderly, children, patients with chronic diseases of respiratory or cardiovascular system.



Right: PM sampler (sampling on filters with subsequent gravimetric analysis)

PM_{10}

PM_{10} are particles with aerodynamic diameter of up to 10 µm. They often originate mechanically, for example by wind erosion, resuspension, and in the Czech Republic mostly by local domestic heating (60 %).

$PM_{2,5}$

Smaller particles with aerodynamic diameter up to 2.5 µm. Main source is by far local domestic heating (75 %).

PM_1

Very small particles with aerodynamic diameter up to 1 µm. Potentially very dangerous for human health. Currently no limit for this fraction exists in the legislation.

Aerodynamic diameter – diameter of a circular particle with a density of 1 g/cm^3, which has same falling velocity as the observed particle

The effect of particles depends on their size, shape and chemical composition. Particle size is crucial for the penetration level into the respiratory tract. Larger particles get trapped in the upper airways, smaller particles penetrate deeper and the smallest even directly into the blood stream.

Nitrogen oxides (NO_x)

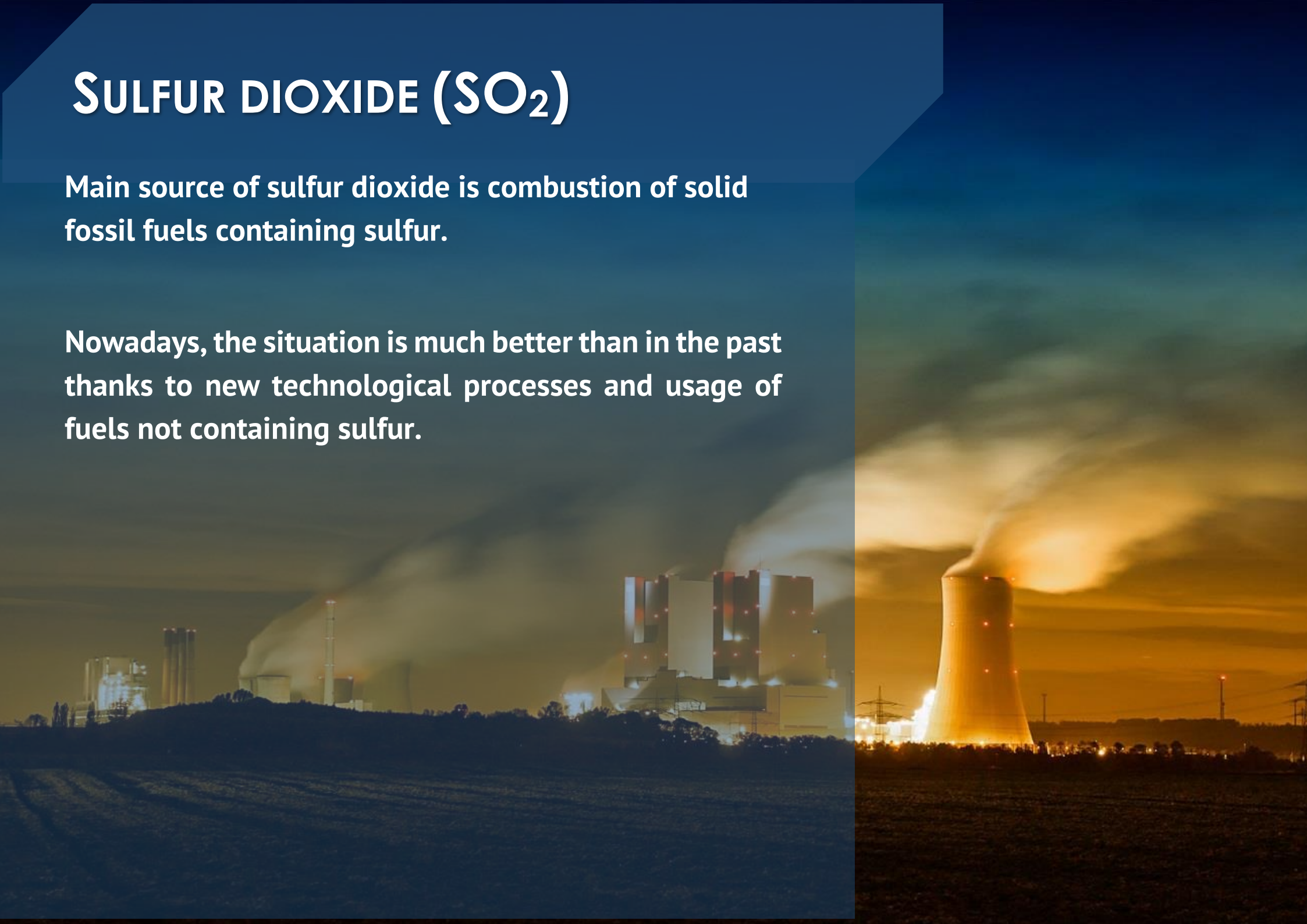
In terms of air quality, nitrogen oxides mean nitrogen dioxide (NO_2) and nitrogen monoxide (NO). Nitrogen oxides form during burning of fuels depending on the combustion temperature, nitrogen content in the fuel and excess air during the combustion proces. They also form during some chemical-technological processes (synthesis of acids, ammonia, fertilizers etc.).

Main source of NOx is traffic.

Sulfur dioxide (SO_2)

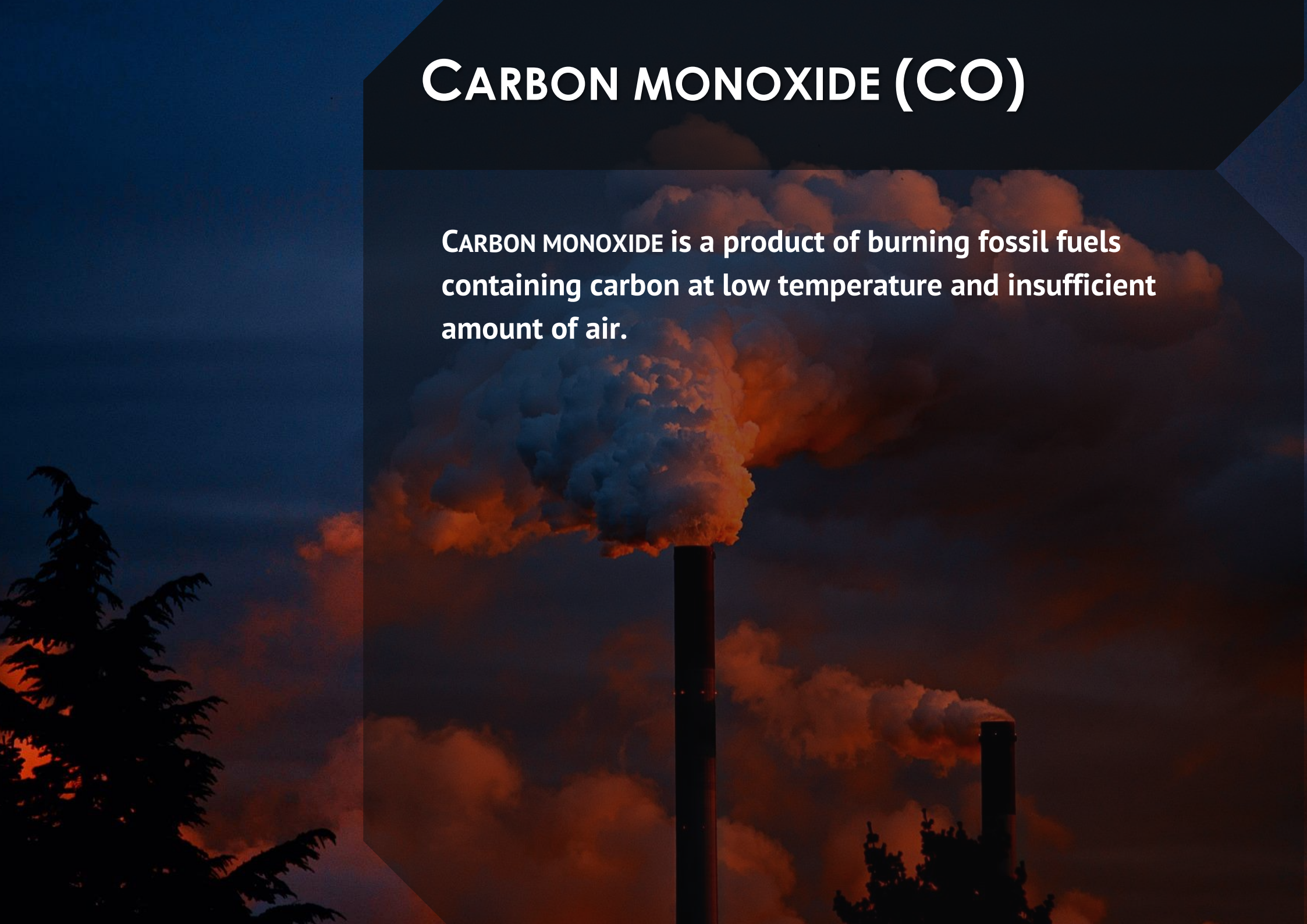
Main source of sulfur dioxide is combustion of solid fossil fuels containing sulfur.

Nowadays, the situation is much better than in the past thanks to new technological processes and usage of fuels not containing sulfur.



Carbon monoxide (CO)

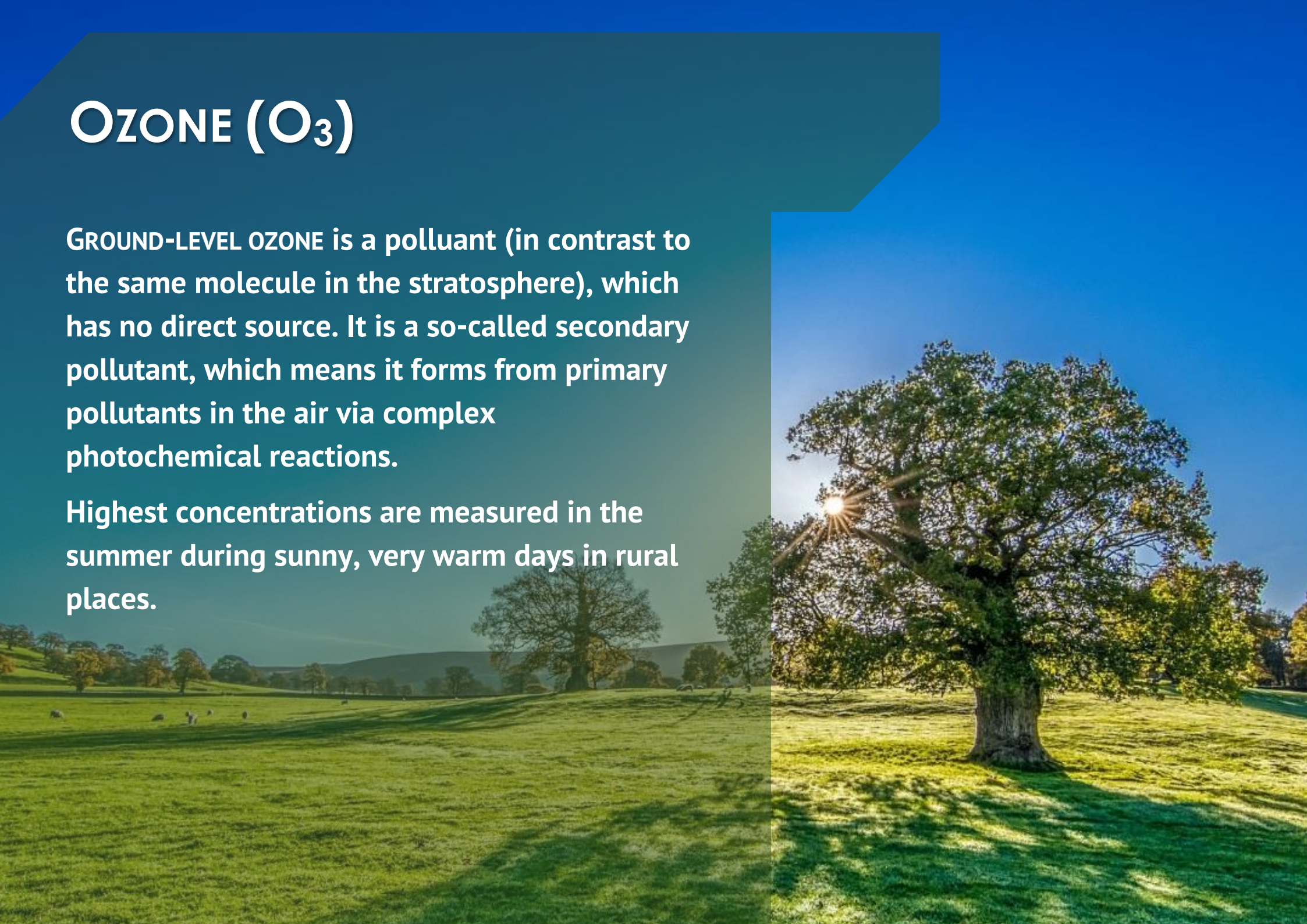
Carbon monoxide is a product of burning fossil fuels containing carbon at low temperature and insufficient amount of air.



Ozone (O_3)

Ground-level ozone is a polluant (in contrast to the same molecule in the stratosphere), which has no direct source. It is a so-called secondary pollutant, which means it forms from primary pollutants in the air via complex photochemical reactions.

Highest concentrations are measured in the summer during sunny, very warm days in rural places.



Heavy metals

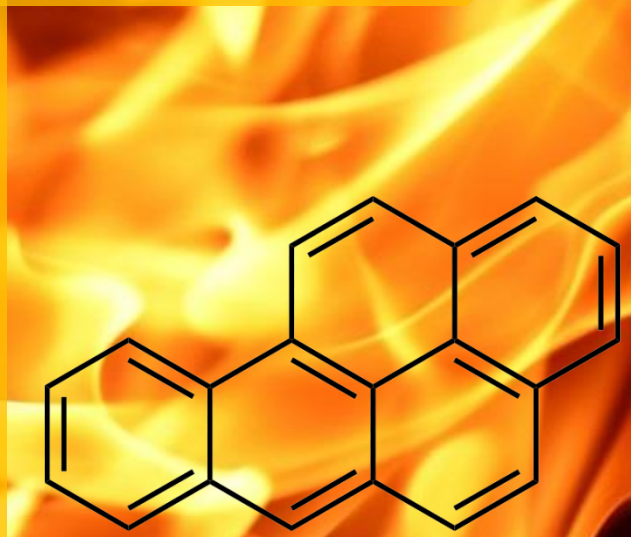
Heavy metals are metals with a specific density of more than 4,5 g/cm^3 and their compounds.

Sources of heavy metals include burning of fossil fuels (emission amount depends on fuel type, type of combustion device and combustion temperature, which affects the volatility of metals). Emissions also arise from some technological processes such as synthesis of iron ore, glass etc.

POLYCYCLIC AROMATIC HYDROCARBONS (PAH)

POLYCYLIC AROMATIC HYDROCARBONS are aromatic hydrocarbons made up of at least two benzene rings. The reference PAH is benzo[*a*]pyrene, which is produced almost exclusively by domestic heating during combustion processes with insufficient oxidation of organic compounds.

Benzo[*a*]pyrene is a product of incomplete combustion at temperatures between 300 and 600 °C.

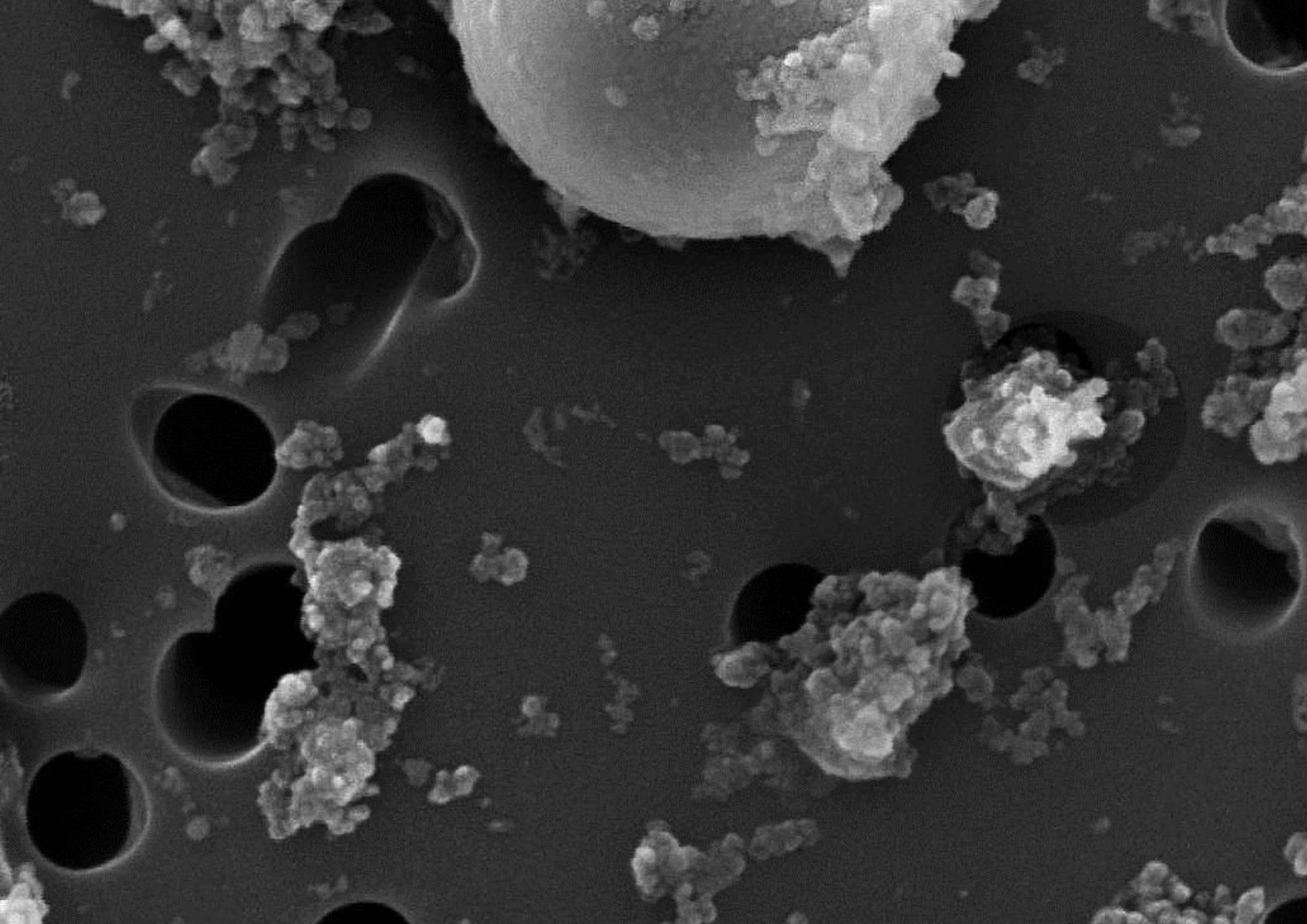


benzo[*a*]pyren

Particle analysis

Scanning electron microscopy allows us to look at the individual particles and determine not just their chemical composition, but also their morphology. Main goal of using SEM is to perform source apportionment, i.e. identify the pollution sources.

scanning electron microscope Tescan MIRA3



Meteorological conditions

Air quality is to a large extent affected by meteorological and dispersion conditions, therefore concentrations of pollutants highly depend not just on the actual emission sources, but also current weather conditions. This includes air temperature and humidity, wind speed and direction, precipitation amount, temperature inversions etc.

Smog warning and regulation system (SVRS)

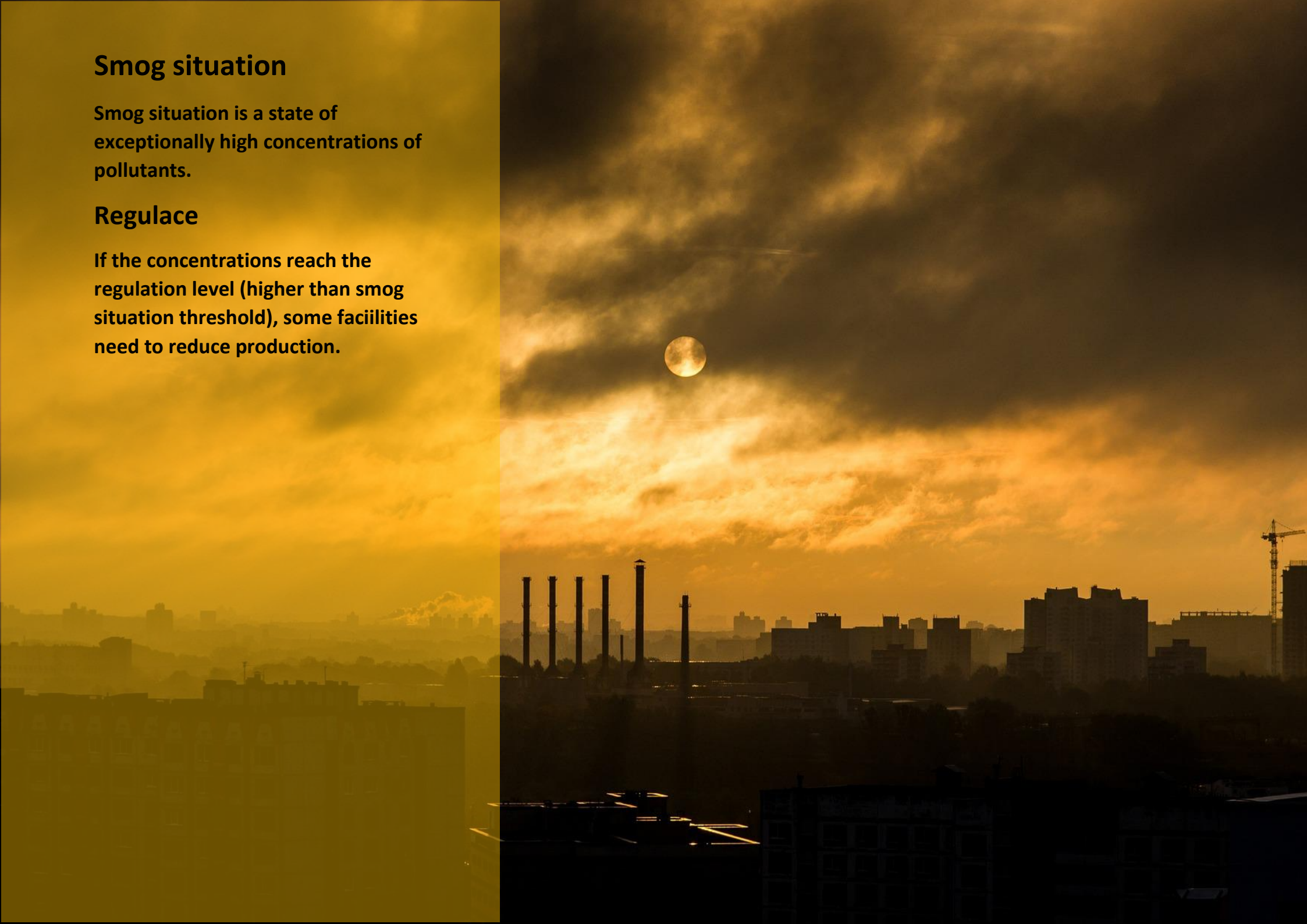
Information from SVRS is used for exceptional states of pollution (smog situations) and also regulations. Monitored pollutants include PM_{10}, SO_2, NO_2 and O_3.

Smog situation

Smog situation is a state of exceptionally high concentrations of pollutants.

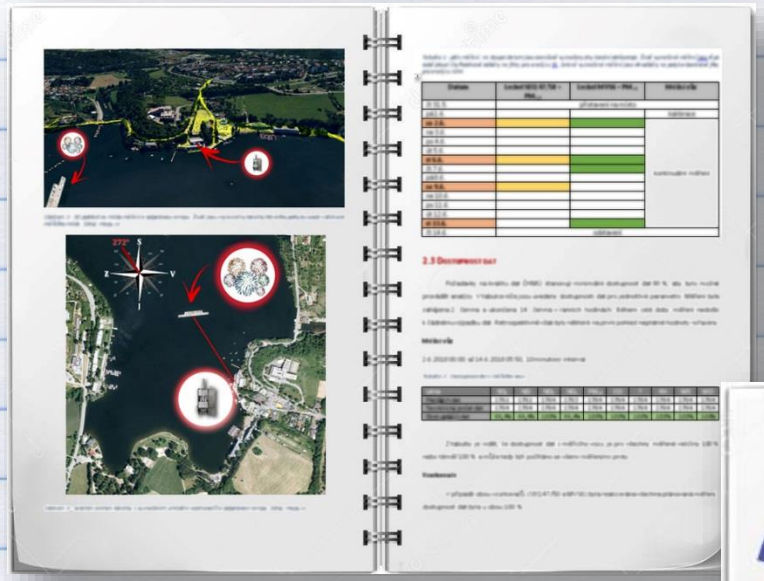
Regulace

If the concentrations reach the regulation level (higher than smog situation threshold), some faciilities need to reduce production.



Expert evaluation

Air quality assessment is quite complex, requires knowledge of pollution sources, meteorological and dispersion conditions, location, distant transport, habits etc.

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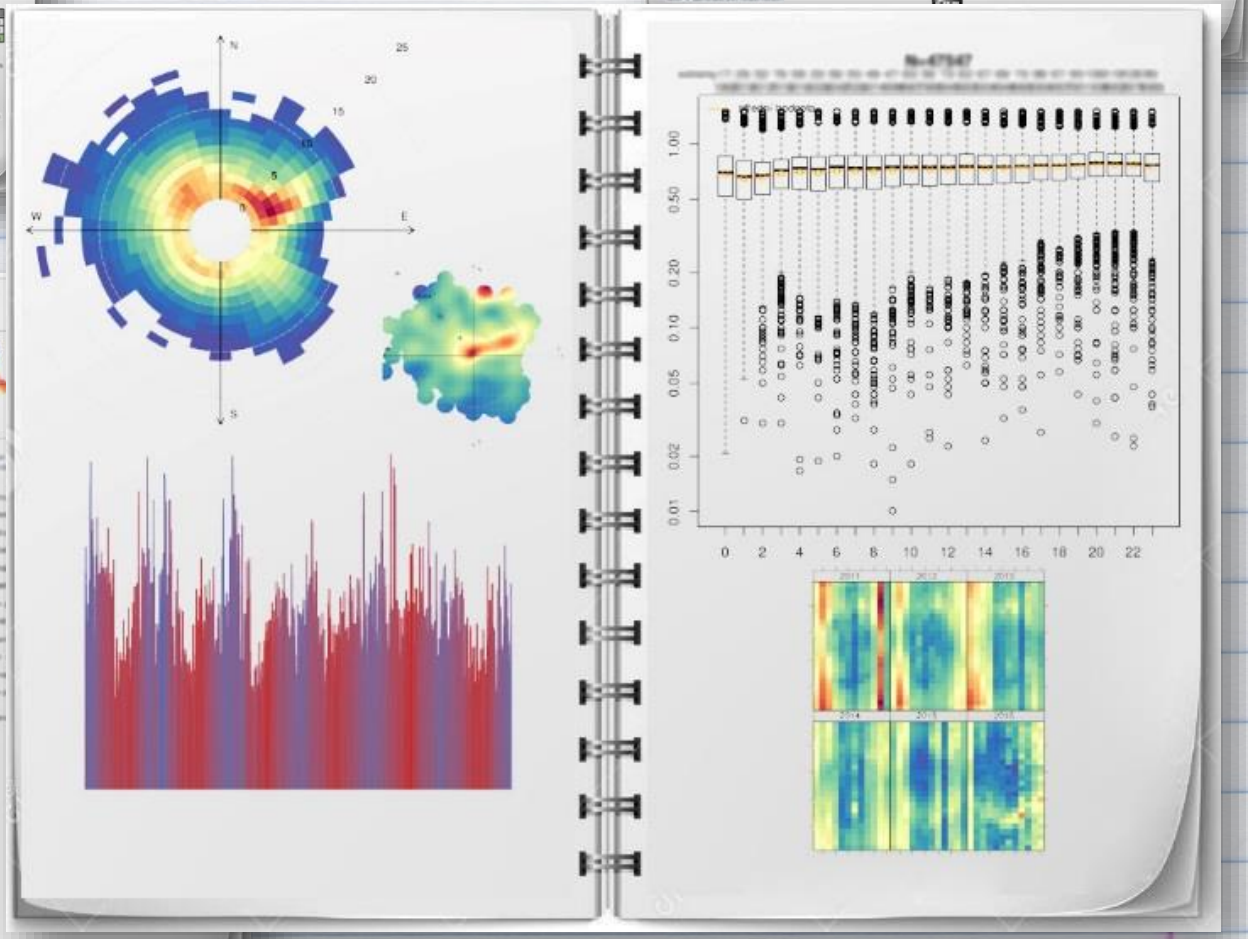
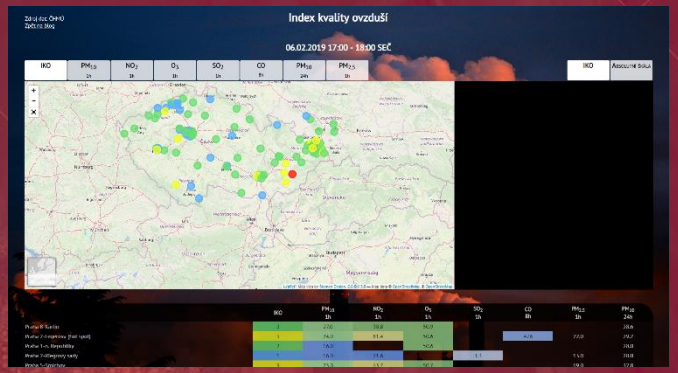
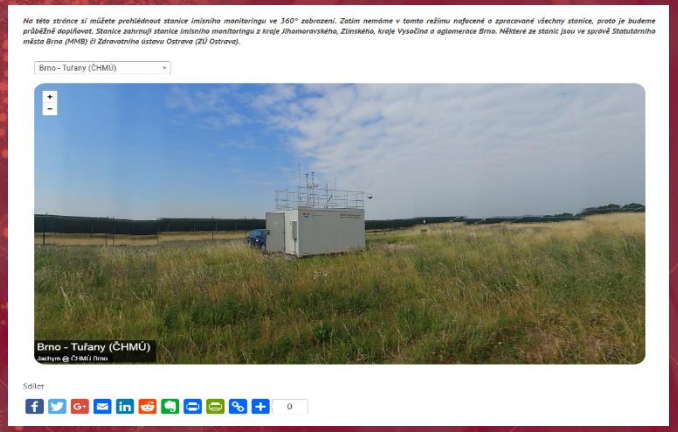


CHMI - WEB

http://www.chmi.cz, https://www.chmibrno.org

- news
- information
- trivia
- quizzes
- interviews
- articles
- interactive pollution map
- 360° station views
- useful tools



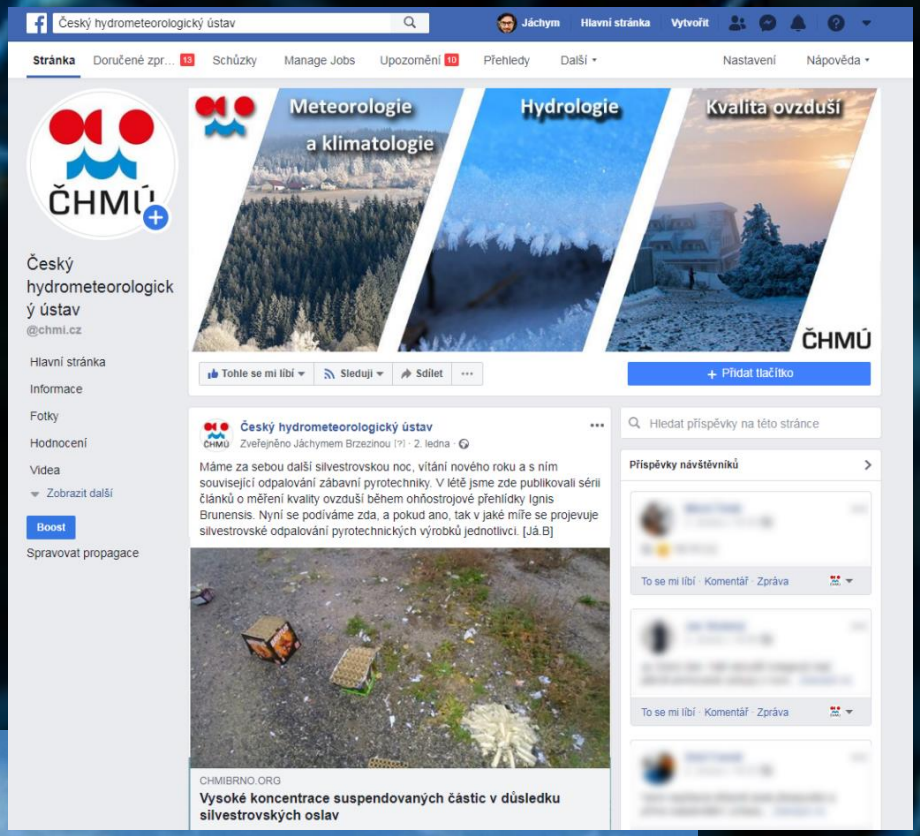


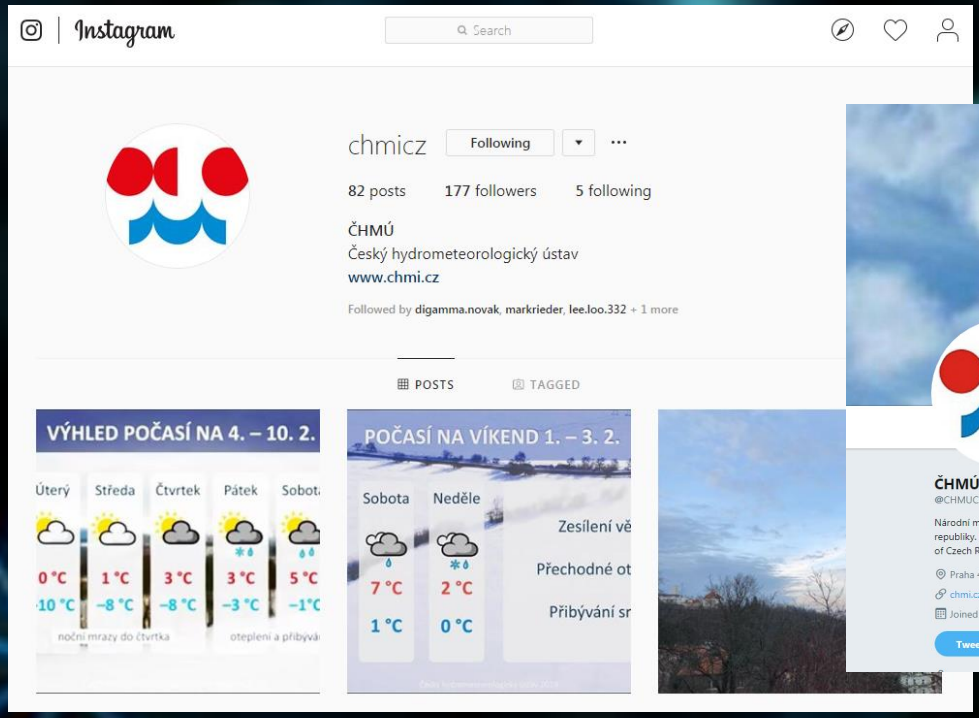
CHMI – SOCIAL NETWORKS

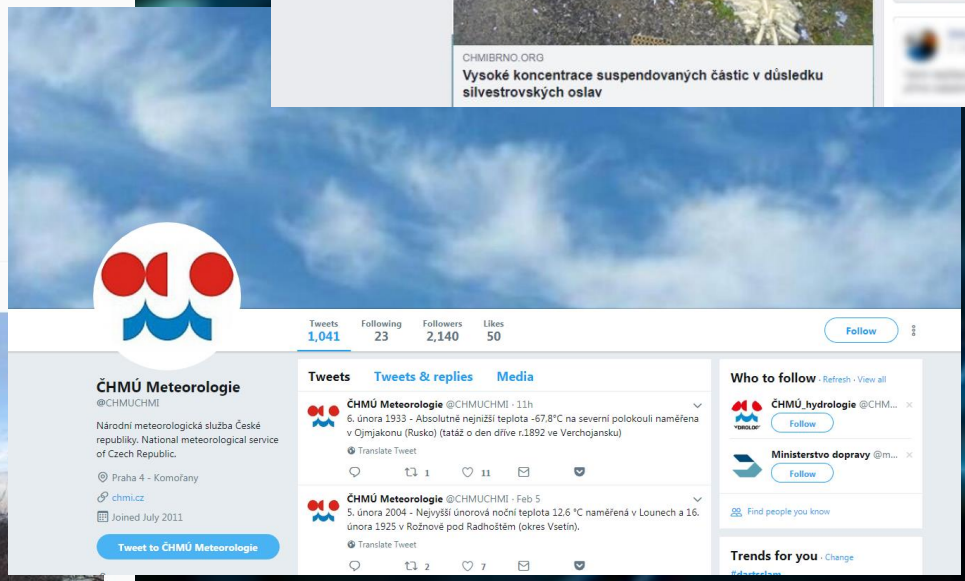
facebook.com/**chmi.cz**

twitter.com/**chmuchmi**

instagram.com/**chmi.cz**





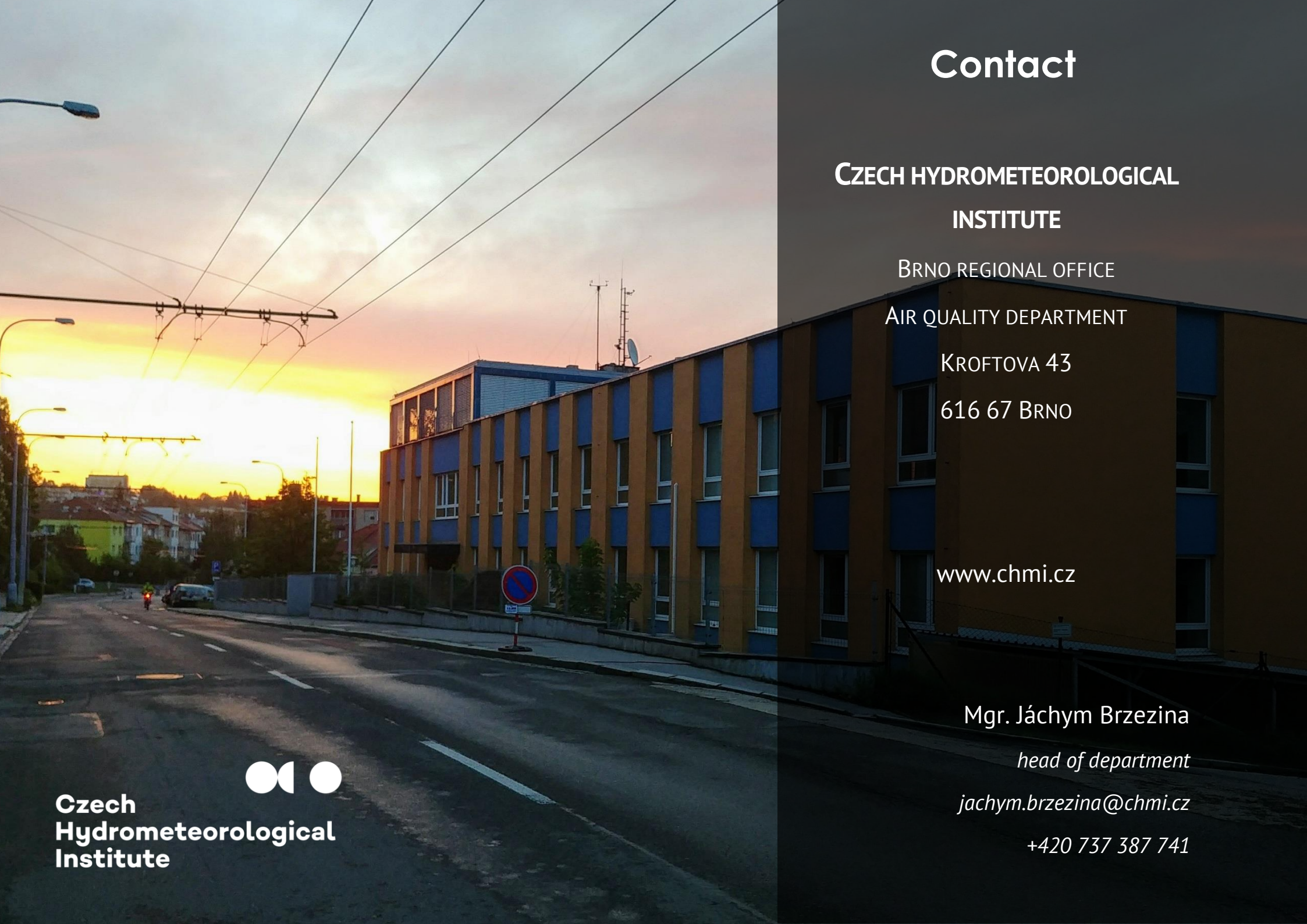


CHMI - MOBILE APP

ČHMÚ weather, forecasts, radar images etc.

ČHMÚ+ air quality, hydrology


Měření kvality ovzduší
Státní síť imisního monitoringu
Český hydrometeorologický ústav



Czech Hydrometeorological Institute

Contact

CZECH HYDROMETEOROLOGICAL INSTITUTE

BRNO REGIONAL OFFICE

AIR QUALITY DEPARTMENT

KROFTOVA 43

616 67 BRNO

www.chmi.cz

Mgr. Jáchym Brzezina

head of department

jachym.brzezina@chmi.cz

+420 737 387 741