

# AIR QUALITY REPORT OF THE SLOVAK REPUBLIC

## 2025

### ANNEX

### AIR QUALITY ASSESSMENT IN THE ZONE

### TRNAVA REGION

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## 1 DESCRIPTION OF THE TERRITORY OF TRNAVA REGION IN TERMS OF AIR QUALITY

The Trnava Region is predominantly characterised by lowland and hilly terrain. Its two major lowland areas, the Danubian Lowland and the Záhorie Lowland, are separated by the Little Carpathians, which have a significant influence on air circulation patterns. In the north-western part of the region, the foothills of the Považský Inovec Mountains extend into the regional territory. The highest point in the region is Záruby Peak in the Little Carpathians, at an elevation of 768 m above sea level; however, the majority of the region lies below 200 m above sea level. There are no large enclosed basins within the Trnava Region.

According to data from the Statistical Office of the Slovak Republic, the average population density in the Trnava Region is 137 inhabitants per km<sup>2</sup>. The highest population density is recorded in the Trnava District, with 179 inhabitants per km<sup>2</sup>, while the Senica District has the lowest population density in the region, with 86 inhabitants per km<sup>2</sup>.

For the purposes of air quality assessment, the entire Trnava Region constitutes a single air quality zone for sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), benzene, polycyclic aromatic hydrocarbons (PAHs), and carbon monoxide (CO) in ambient air.

### Air pollution sources in Trnava Region

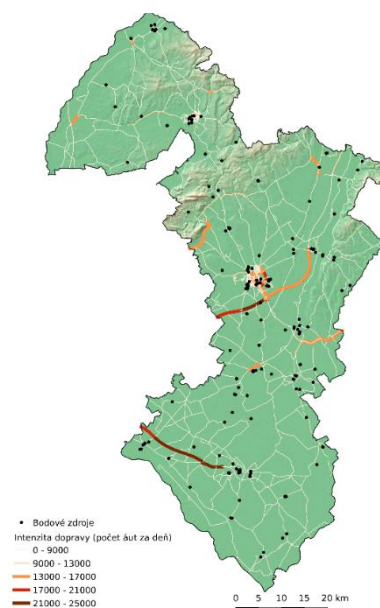
According to data from the latest Population and Housing Census (2021), natural gas is the primary fuel used for household heating in this air quality zone. The share of solid fuels is among the lowest compared with other regions of Slovakia, although the consumption of firewood is slightly higher in the more mountainous areas of the Little Carpathians.

Industrial sources of air pollution are of relatively minor importance in this zone with regard to their contribution to local concentrations of the principal air pollutants. Road transport contributes to air pollution in the Trnava Region in proportion to traffic intensity. **Tab. 1.1** presents traffic volumes on the region's major roads based on the national traffic census conducted in 2022 and 2023. **Fig. 1.1** shows point sources and sections of busier roads processed by the Transport Research Centre for 2024.

**Tab. 1.1** Number of vehicles per day on the busiest roads in the Trnava Region (vehicles/day)

| District        | Motorway / road | Number of vehicles | Heavy goods vehicles | Passenger cars |
|-----------------|-----------------|--------------------|----------------------|----------------|
| Skalica         | n. 426          | 13 220             | 1 473                | 11 626         |
| Senica          | D2 Kúty         | 13 153             | 1 246                | 11 843         |
|                 | č. 51           | 16 868             | 2 797                | 13 994         |
| Piešťany        | D1              | 49 185             | 10 734               | 38 336         |
| Trnava          | n. 61           | 14 847             | 2 002                | 12 740         |
|                 | n. 51           | 27 040             | 5 692                | 21 268         |
| Sereď           | R1              | 51 031             | 11 864               | 39 084         |
|                 | n. 62           | 14 405             | 1 000                | 13 374         |
| Galanta         | 561             | 12 141             | 2 009                | 10 013         |
|                 | 507             | 15 909             | 1 388                | 14 396         |
| Hlohovec        | 507             | 15 810             | 1 573                | 14 180         |
| Senica          | 51              | 16 868             | 2 797                | 13 994         |
|                 | 63              | 17 678             | 3 310                | 14 294         |
|                 | R7              | 12 622             | 2 048                | 10 535         |
|                 | 572             | 18 849             | 975                  | 17 776         |
| Dunajská Streda | n. 61           | 26 567             | 2 641                | 23 819         |

**Fig. 1.1** Road traffic intensity in the Trnava Region. Source: CDV.



## 2 AIR QUALITY MONITORING STATIONS IN TRNAVA REGION

Air quality in the Trnava Region is monitored at four locations. The urban traffic air monitoring station is located in **Trnava** on a busy road (Kollárova Street), close to both the railway and bus stations. Another traffic monitoring station is situated in the north-western part of the region, in the district town of **Senica**. The air quality monitoring station in **Sereď** is located within a residential area with prefabricated apartment buildings and represents the urban background environment. In the cadastral area of the municipality of **Topoľníky**, near the Klátovské rameno water channel, the lowest-altitude regional/rural background station is located. It measures air pollution in a rural environment and is part of the EMEP network. The station records the influence of long-range transport of air pollution, similarly to other air quality monitoring stations included in the EMEP monitoring network (see Chapter 2 of the \*Air Quality Report in the Slovak Republic 2025\*).

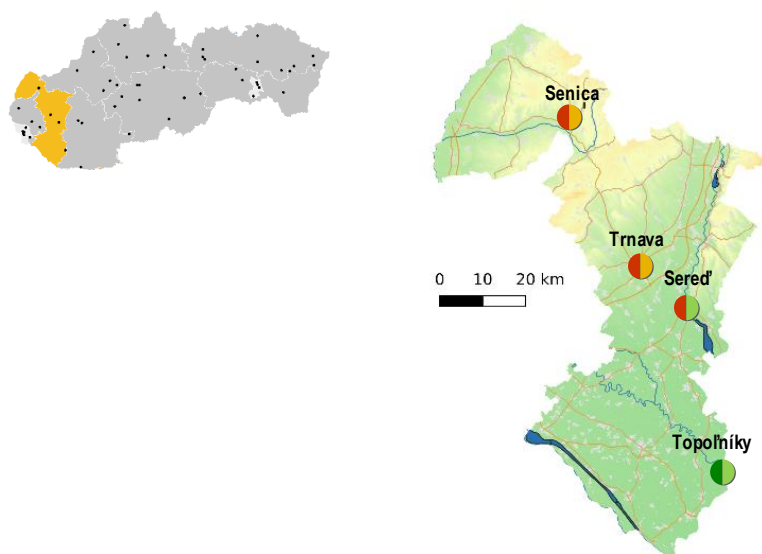
**Tab 2.1** contains information on air quality monitoring stations in the Trnava Region zone:

- international EOI code, station classification according to the dominant sources of air pollution (traffic, background, industrial), the type of area monitored by the station (urban, suburban, rural/regional), and geographical coordinate;
- monitoring programme. Automatic continuous monitoring instruments provide hourly average concentrations of PM<sub>10</sub>, PM<sub>2,5</sub>, nitrogen oxides, sulphur dioxide, ozone, carbon monoxide, benzene, and mercury. The SHMÚ testing laboratory performs manual monitoring and analyses heavy metals and polycyclic aromatic hydrocarbons. The results are expressed as average 24-hour values. An exception is the EMEP station in Topoľníky, where the monitoring programme is described in **Tab. 2.2**.

**Tab. 2.1** Air quality monitoring programme in the Trnava Region zone.

| Trnava Region zone |          |                        |       |          |              |           |              | Monitoring programme |                   |                 |                 |                |    |         |    |                |       |
|--------------------|----------|------------------------|-------|----------|--------------|-----------|--------------|----------------------|-------------------|-----------------|-----------------|----------------|----|---------|----|----------------|-------|
| District           | Eol code | Station name           | Type  |          | Geographical |           | Altitude [m] | Continuous           |                   |                 |                 |                |    |         |    |                |       |
|                    |          |                        | areas | stations | length       | width     |              | PM <sub>10</sub>     | PM <sub>2,5</sub> | NO <sub>x</sub> | SO <sub>2</sub> | O <sub>3</sub> | CO | Benzene | Hg | As, Cd, Ni, Pb | B(a)P |
| Dunajská Streda    | SK0007R  | Topoľníky, Aszód, EMEP | R     | B        | 17°51'37"    | 47°57'34" | 113          |                      |                   |                 |                 |                |    |         |    | *              |       |
| Senica             | SK0021A  | Senica, Hviezdoslavova | U     | T        | 17°21'47"    | 48°40'51" | 212          |                      |                   |                 |                 |                |    |         |    |                |       |
| Trnava             | SK0045A  | Trnava, Kollárova      | U     | T        | 17°35'06"    | 48°22'17" | 152          |                      |                   |                 |                 |                |    |         |    |                |       |
| Sereď              | SK0063A  | Sereď, Vinárska        | U     | B        | 17°44'07"    | 48°17'01" | 130          |                      |                   |                 |                 |                |    |         |    |                |       |
| Total              |          |                        |       |          |              |           |              | 4                    | 4                 | 3               | 2               | 1              | 1  | 1       | 1  | 2              | 1     |

\* Heavy metal monitoring at the Topoľníky station is carried out according to the EMEP monitoring programme (**Tab. 2.2**)



**Area type:**  
 U – urban  
 S – semi-urban  
 R – rural (regional)

**Station type:**  
 T – traffic  
 B – background  
 I – industrial

The Topoľníky monitoring station is included in the EMEP monitoring programme. An extended monitoring programme for heavy metals ([Tab. 2.2](#)) and sampling of atmospheric precipitation ([Tab. 2.3](#)) are carried out at the AMS. Heavy metals in ambient air are analysed from three-day samples of atmospheric aerosol (with a sampling interval of 3 days).

**Tab. 2.2** *Atmospheric aerosol monitoring programme at the EMEP station in Topoľníky*

|           | PM <sub>10</sub> | Pb | As | Cd | Ni | Cr | Cu | Zn |
|-----------|------------------|----|----|----|----|----|----|----|
| Topoľníky | x                | x  | x  | x  | x  | x  | x  | x  |

Precipitation samples are analysed at a sampling interval of one week for basic precipitation parameters and on a monthly basis for heavy metals ([Tab. 2.3](#)). A “wet-only” precipitation sampler is used for precipitation collection; it captures only precipitation (and remains closed during periods without precipitation). Based on the analysis of these collected samples, the wet deposition of the monitored substances is assessed.

**Tab. 2.3** *Precipitation monitoring programme at the EMEP station in Topoľníky.*

|           | pH | Conductivity | SO <sub>4</sub> <sup>2-</sup> | NO <sub>3</sub> <sup>-</sup> | Cl <sup>-</sup> | NH <sub>4</sub> <sup>+</sup> | Alkaline ions<br>K <sup>+</sup> , Na <sup>+</sup> , Ca <sup>2+</sup> ,<br>Mg <sup>2+</sup> | Pb | As | Cd | Ni | Cr | Cu | Zn |
|-----------|----|--------------|-------------------------------|------------------------------|-----------------|------------------------------|--------------------------------------------------------------------------------------------|----|----|----|----|----|----|----|
| Topoľníky | x  | x            | x                             | x                            | x               | x                            | x                                                                                          | x  | x  | x  | x  | x  | x  | x  |

### 3 ASSESSMENT OF AIR QUALITY IN TRNAVA REGION

This chapter presents an assessment of air quality in the Trnava Region zone based on monitoring results, supplemented by the results of mathematical modelling for PM<sub>10</sub>, PM<sub>2.5</sub>, benzo(a)pyrene, and benzene for the year 2025.

**Tab. 3.1** Assessment of air pollution according to limit values for the protection of human health and the smog warning system for PM<sub>10</sub> in the Trnava Region zone – 2025.

| Pollutant                         | Type             | Human health protection |                       |                       |         |                       |         |                   |                   |                   | IT <sup>2)</sup> | AT <sup>2)</sup>          |                           |
|-----------------------------------|------------------|-------------------------|-----------------------|-----------------------|---------|-----------------------|---------|-------------------|-------------------|-------------------|------------------|---------------------------|---------------------------|
|                                   |                  | SO <sub>2</sub>         |                       | NO <sub>2</sub>       |         | PM <sub>10</sub>      |         | PM <sub>2.5</sub> | CO                | O <sub>3</sub>    | Benzene          | PM <sub>10</sub>          | PM <sub>10</sub>          |
| Averaging period                  | Areas / stations | 1 h                     | 24 h                  | 1 h                   | 1 year  | 24 h                  | 1 year  | 1 year            | 8 h <sup>1)</sup> | 8 h <sup>2)</sup> | 1 year           | 12 h                      | 12 h                      |
| Parameter                         |                  | Number of exceedances   | Number of exceedances | Number of exceedances | average | Number of exceedances | average | average           | average           | average           | average          | Duration of exceedance[h] | Duration of exceedance[h] |
| Limit value [µg·m <sup>-3</sup> ] |                  | 350                     | 125                   | 200                   | 40      | 50                    | 40      | 20                | 10 000            | 120               | 5                | 100                       | 150                       |
| Maximum number of exceedances     |                  | 24                      | 3                     | 18                    |         | 35                    |         |                   |                   | 25                |                  |                           |                           |
|                                   |                  |                         |                       |                       |         |                       |         |                   |                   |                   |                  |                           |                           |
| Senica, Hviezdoslavova            | UT               | 0                       | 0                     |                       |         | 4                     | 17      | 12                |                   |                   | 0,6*             | 0                         | 0                         |
| Trnava, Kollárova                 | UT               |                         |                       | 0                     | 25      | 10                    | 20      | 11                | 1030              |                   |                  | 0                         | 0                         |
| Topoľníky, Aszód, EMEP            | RB               | 0                       | 0                     | 0                     | 4       | 6                     | 16      | 10                |                   | 3                 |                  | 0                         | 0                         |
| Sereď, Vinárska                   | UB               |                         |                       | 0                     | 10      | 3                     | 17      | 12                |                   |                   |                  | 0                         | 0                         |

■ ≥ 90 % valid measures

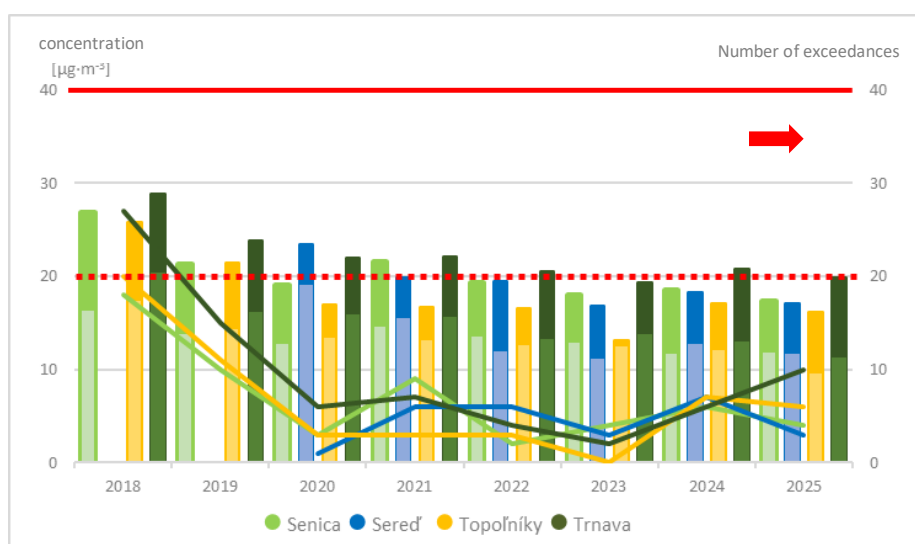
<sup>1)</sup> maximum eight-hour concentration

<sup>2)</sup> IT, AT – duration of exceedance (in hours) of the information threshold (IP) and alert threshold (VP) for PM<sub>10</sub>

\* output from the CMAQ model

#### 3.1 PM<sub>10</sub> and PM<sub>2.5</sub>

**Fig. 3.1** Average annual concentrations of PM<sub>10</sub>, PM<sub>2.5</sub> and the number of exceedances of the PM<sub>10</sub> daily limit value.



PM<sub>10</sub> – dark coloured columns, PM<sub>2.5</sub> – bright coloured columns; number of exceedances – horizontal dashed line  
The red lines indicate the limit values (LV): solid line for PM<sub>10</sub> (annual average concentration: 40 µg·m<sup>-3</sup>); dashed line for PM<sub>2.5</sub> (annual average concentration: 20 µg·m<sup>-3</sup>); arrow – LV for the number of exceedances (daily average PM<sub>10</sub> concentration of 50 µg·m<sup>-3</sup>; maximum number of exceedances: 35 per calendar year).

**Fig. 3.1** shows the average annual concentrations of PM<sub>10</sub> and PM<sub>2.5</sub> and the number of days with an average daily PM<sub>10</sub> concentration above 50 µg·m<sup>-3</sup>, based on measurement results from monitoring stations in the Trnava Region zone for the years 2018–2025.

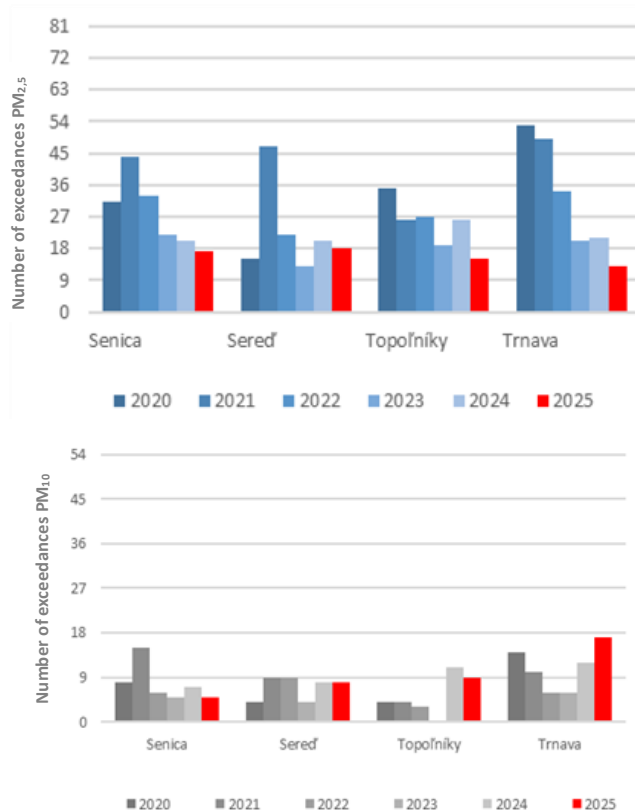
All stations complied with the annual and daily limit values for PM<sub>10</sub> and the annual limit value for PM<sub>2.5</sub>.

The highest PM concentrations are measured at the traffic monitoring station in Trnava on Kollárova Street; however, due to good ventilation of the area, the measured values are not high compared with the currently valid limit values. The monitoring stations in the Trnava Region do not record a high number of exceedances of the daily limit value for PM<sub>10</sub> (above 50 µg·m<sup>-3</sup>) (**Fig. 3.1**). The highest number of exceedances was recorded at the AMS in Trnava (10).

## ■ Assessment of compliance with the requirements of the new Directive

The new EU legislative requirements include stricter annual limit values for particulate matter: PM<sub>10</sub> (20 µg·m<sup>-3</sup>) and PM<sub>2.5</sub> (10 µg·m<sup>-3</sup>). For PM<sub>2.5</sub>, a daily limit value (25 µg·m<sup>-3</sup>) has been introduced, which must not be exceeded more than 18 times per calendar year.

**Fig. 3.2** Number of exceedances of the PM<sub>2.5</sub> and PM<sub>10</sub> daily limit values applicable from 2030.\*



\* The daily average concentration of PM<sub>2.5</sub> > 25 µg·m<sup>-3</sup> and PM<sub>10</sub> > 45 µg·m<sup>-3</sup> may be exceeded a maximum of 18 times per year; the limit applies from 1 January 2030.

The Directive introduces, from 2027, a parallel assessment of air quality according to both the existing and the new limit values.

The new limit value for the annual average PM<sub>10</sub> concentration would be met by all stations in the zone. The new annual limit value for PM<sub>2.5</sub> would only be met at the Topoľníky AMS; the other AMS would exceed the limit value by approximately 10%. **Fig. 3.2** shows the number of exceedances of the stricter daily limit value.

The daily limit value for PM<sub>2.5</sub> would not be exceeded at any AMS in the Trnava Region zone (**Fig. 3.2**, top). The highest number of exceedances was recorded at the Sereď AMS (18), followed by the Senica AMS, while the lowest values were recorded at the Trnava AMS (13). Despite being significantly influenced by traffic, this station has the lowest local impact from household heating.

Compared with previous years, an overall decrease in the number of exceedance days can be observed. Significantly higher values were recorded in the period 2020–2022, particularly at the Trnava and Senica stations. Since 2023, a gradual reduction in exceedances has been observed, especially at these two AMS.

The stricter daily limit value for PM<sub>10</sub> would be met at all AMS (**Fig. 3.2**, bottom).

In line with the objectives of the European Green Deal and the EU Zero Pollution Action Plan, air quality in the Trnava Region zone is assessed with an emphasis on achieving pollution levels corresponding to

the WHO guideline values by 2050. The stricter WHO recommendation for the annual average PM<sub>10</sub> concentration (15 µg·m<sup>-3</sup>) was not met by any monitoring station in the Trnava Region in 2025.

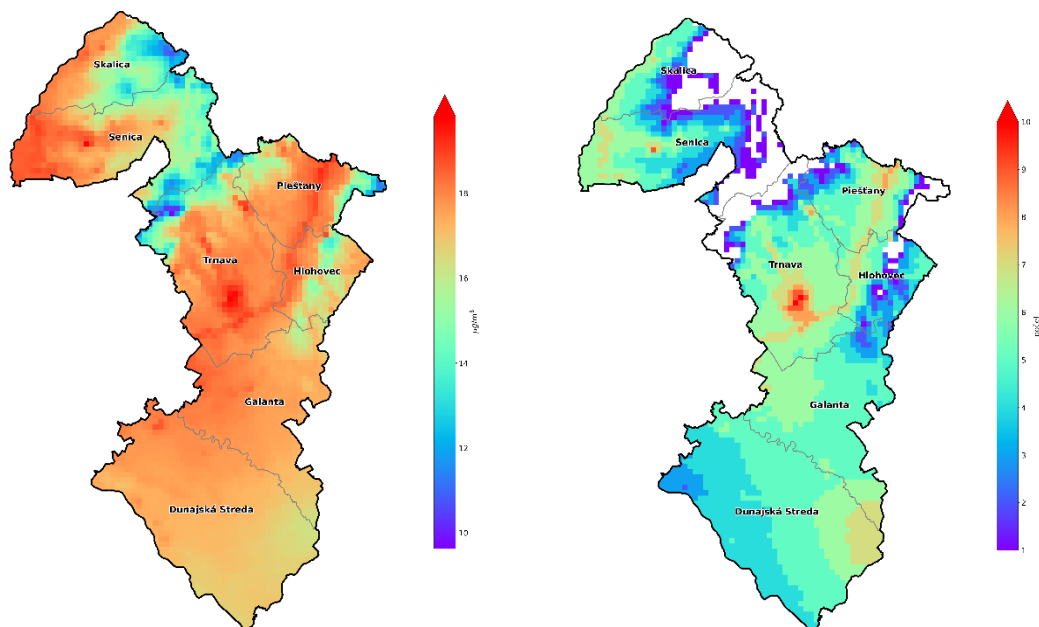
Overall, the results indicate that although the annual average concentrations of particulate matter remain within the proposed limit values, the number of short-term episodes with elevated concentrations remains a concern, particularly in traffic-exposed areas of the region.

**Fig. 3.3** (left) presents the PM<sub>10</sub> modelling results calculated for 2025 using the RIO model and subsequently adjusted using the IDW-R regression method.

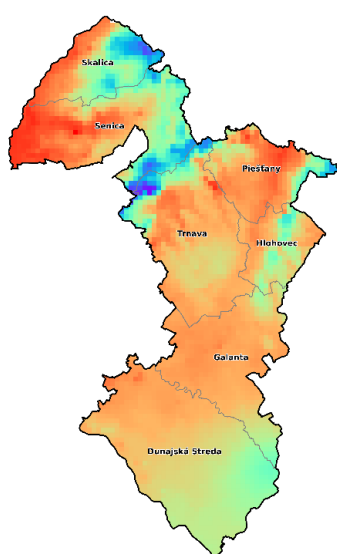
The model outputs also indicate that PM<sub>10</sub> concentration levels do not exceed either the current or the stricter limit values established by the new EU Directive. The highest annual concentrations were identified mainly in the districts of Trnava, Piešťany, and Senica. The highest number of exceedances of the PM<sub>10</sub> daily limit value (**Fig. 3.3**, right) is predicted by the model in the area of the city of Trnava and along the D1 motorway corridor, where increased impacts from traffic and local emission sources are evident.

### ■ Outputs of mathematical modelling

**Fig. 3.3** Annual average PM<sub>10</sub> concentration (left) and the number of exceedances of the PM<sub>10</sub> daily limit value (right).



**Fig. 3.4** Annual average  $PM_{2,5}$  concentrations.



**Fig. 3.4** shows the spatial distribution of annual average  $PM_{2,5}$  concentrations based on the output of the RIO model combined with the IDW-R model.

The modelling results indicate that annual average  $PM_{2,5}$  concentrations exceed  $10 \mu\text{g}\cdot\text{m}^{-3}$  outside mountainous areas. In 2025, the new EU limit value would be exceeded across almost the entire zone by approximately 10%, which corresponds with the measurements from the AMS stations in the zone.

*In 2025, dispersion conditions were more favourable than in 2024, with the worst situation occurring in February. Nevertheless, no exceedance of any currently valid air quality limit values was recorded in the Trnava Region. The area is characterised by good ventilation, which contributes to more favourable conditions for the dispersion of pollutants.*

The highest concentrations were identified by the model in the northern part of the zone, in the districts of Skalica, Senica, and Piešťany.

### 3.2 Nitrogen dioxide

Nitrogen dioxide monitoring is carried out at four stations in the zone. The average concentrations for individual stations in 2025 compared with the average values for the period 2017–2024 are shown in **Fig. 3.5**.

The highest  $\text{NO}_2$  concentration was recorded in Trnava; however, a significant decrease compared with the average values from previous years was also observed there. A decrease in concentrations can also be seen in Sered' and Topoľníky.

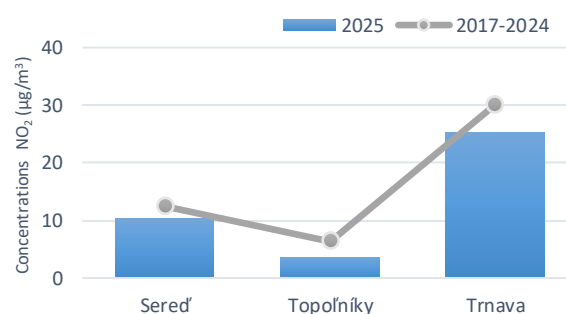
Overall, the graph indicates a reduction in  $\text{NO}_2$  concentrations at all monitored locations compared with the period 2017–2024.

The main source of  $\text{NO}_2$  emissions is road transport. For this reason, the highest concentrations are recorded at the traffic AMS Trnava, Kollárova, where the annual average  $\text{NO}_2$  concentration reached  $25 \mu\text{g}\cdot\text{m}^{-3}$ . The current limit value ( $40 \mu\text{g}\cdot\text{m}^{-3}$ ) was not exceeded at any monitoring station.

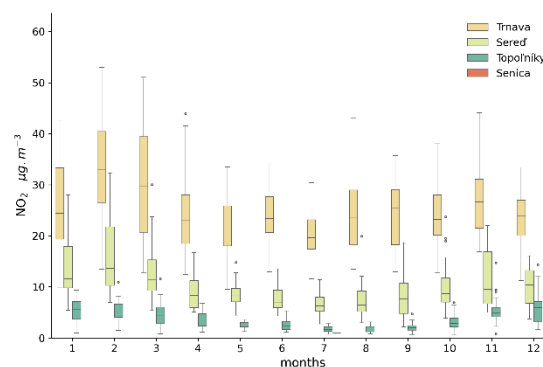
The WHO guideline value ( $10 \mu\text{g}\cdot\text{m}^{-3}$ ), which is significantly stricter than the current EU limits, is met only at the Topoľníky AMS.

The average monthly  $\text{NO}_2$  concentrations are shown in **Fig. 3.6**. Values remain relatively stable throughout the year, with no significant differences observed between individual months.

**Fig. 3.5** Comparison of annual  $\text{NO}_2$  concentrations with the long-term trend.



**Fig. 3.6** Box plots of  $\text{NO}_2$  concentration variability.



Slightly higher maximum concentrations and a greater number of elevated values occurred in February and March, as expected, at the traffic monitoring station in Trnava.

### ■ Assessment of compliance with the requirements of the new Directive

All suburban and background stations in the zone would comply with the new EU limit value for NO<sub>2</sub> (20 µg·m<sup>-3</sup>), applicable from 2030. This value would only be exceeded at the traffic AMS Trnava – Kollárova (25 µg·m<sup>-3</sup>).

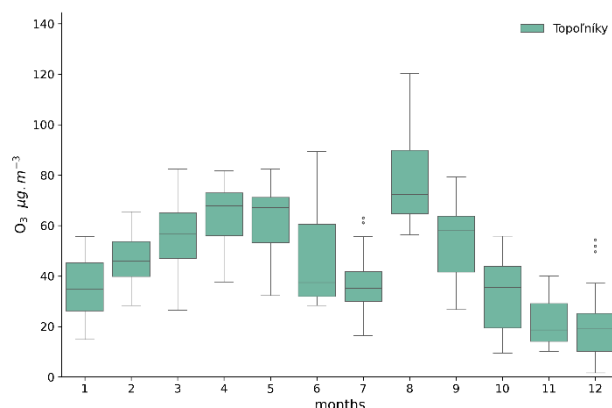
## 3.3 Ozone

Ozone monitoring in the Trnava Region is carried out at the rural background station in Topoľníky.

The highest concentrations of ground-level ozone generally occur during warm months with high solar radiation intensity. As shown in Fig. 3.7, August recorded the highest maximum values and, overall, the highest ground-level ozone concentrations.

Ozone concentrations also exhibit a pronounced diurnal pattern – they increase after sunrise, reach their peak around midday, and gradually decrease during the evening hours to a minimum occurring in the early morning.

Fig. 3.7 Box plots of O<sub>3</sub> concentration variability.



Tab. 3.2 Number of days with exceedances of the target value for ground-level ozone protection of human health.

| Station                | 2023 | 2024 | 2025 | Average 2023 – 2025 |
|------------------------|------|------|------|---------------------|
| Topoľníky, Aszód, EMEP | 2    | 1    | 5    | 3                   |

■ ≥ 90% required valid data

Note: According to Decree of the Ministry of the Environment of the Slovak Republic No. 250/2023 Coll. on air quality, the target value for the protection of human health for ground-level ozone is defined as follows: The maximum daily eight-hour average concentration must not exceed 120 µg·m<sup>-3</sup> on more than 25 days per calendar year, averaged over three years.

Ground-level O<sub>3</sub> is formed in the atmosphere in the presence of solar (UV-B) radiation through chemical reactions involving nitrogen oxides (NO, NO<sub>2</sub>) and volatile organic compounds (VOC) or carbon monoxide. Sources of nitrogen oxides include combustion processes; in urban agglomerations, road transport is the main source, while in the case of Bratislava, the refinery also contributes. Sources of VOC emissions include transport, industrial sources, and vegetation during the growing season.

The target value for the protection of human health for ozone was not exceeded in the assessed years 2022–2025 in the Trnava Region zone.

### ■ Assessment of compliance with the requirements of the new Directive

The target value for the protection of human health for ozone (18 days with exceedances of 120 µg·m<sup>-3</sup>) would not be exceeded at this station in the Trnava Region zone.

### 3.4 Benzo(a)pyrene

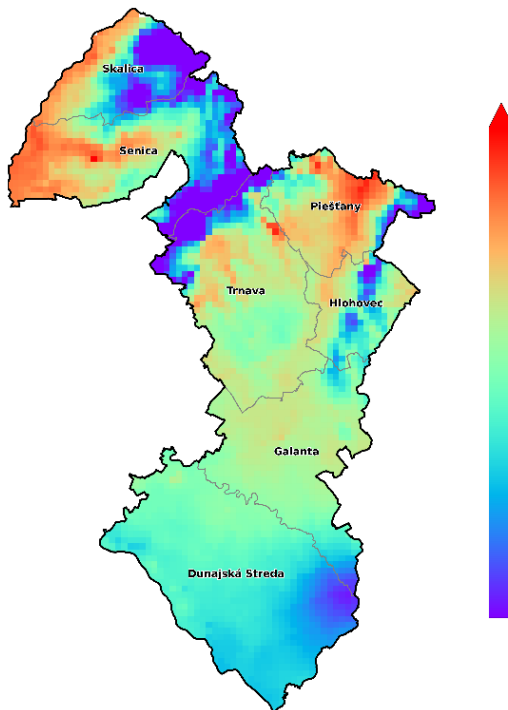
The pollutant benzo(a)pyrene is monitored in the Trnava Region at the Trnava, Kollárova monitoring station. Similar to previous years, the target value ( $1 \text{ ng}\cdot\text{m}^{-3}$ ) **was not exceeded** at this station in the previous year.

**Tab. 3.3** Annual average benzo(a)pyrene concentrations in 2018–2025.

|                                                | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|------------------------------------------------|------|------|------|------|------|------|------|------|
| Target value [ $\text{ng}\cdot\text{m}^{-3}$ ] | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  | 1,0  |
| Trnava, Kollárova                              | 0,9  | 0,7  | 0,5  | 0,6  | *0,5 | 0,5  | 0,6  | 0,5  |

  $\geq 90\%$  valid measures

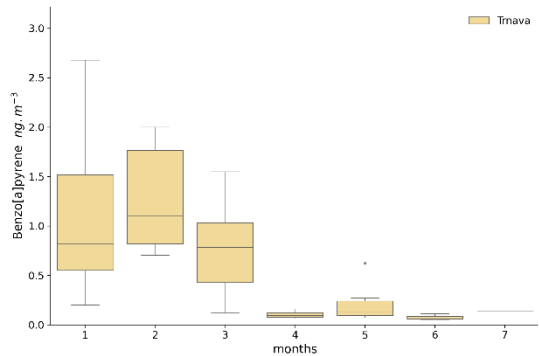
**Fig. 3.8** Annual average benzo(a)pyrene concentration according to the RIO and IDW-R model outputs.



Higher B(a)P values were, as expected, measured during the colder months of the year (Fig. 3.9), with a maximum occurring in January.

Based on the outputs of mathematical modelling (Fig. 3.8), it can be assumed that the annual target value for B(a)P is likely not exceeded in the Trnava Region zone. According to the model output at the given resolution, the maximum values remain below the target value. The highest concentrations occur in the northern part of the zone, in the districts of Skalica, Senica, and Piešťany. Risk areas are described in Chapter 3.7.

**Fig. 3.9** Boxplots of benzo(a)pyrene concentrations.

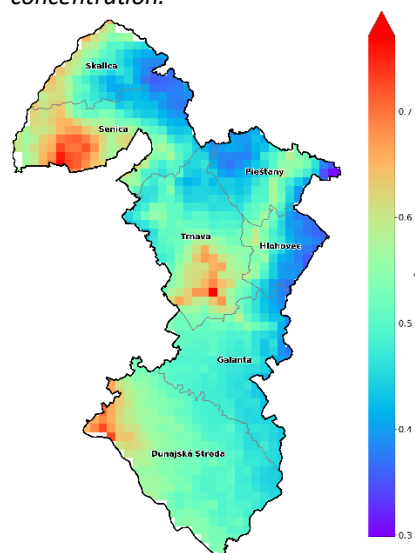


### 3.5 Benzene

The modelling indicates spatial differences in benzene concentrations in the Trnava Region. Relatively higher values occur mainly in the north-western part of the region, around Senica and Skalica, locally also in the central part of the region southwest of Trnava and in municipalities northwest of the Dunajská Streda district.

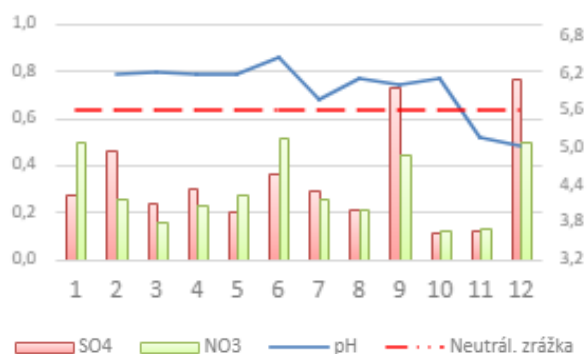
Despite these local maxima, the modelled benzene concentrations remain well below the limit value and below the lower assessment threshold throughout the entire region, indicating an overall low level of air pollution by this pollutant.

**Fig. 3.10** Annual average benzene concentration.



### 3.6 Chemical composition of precipitation

**Fig. 3.11** Chemical parameters of precipitation in Topoľníky.



At the rural background station in Topoľníky, precipitation quality is monitored on a weekly basis. The monitoring focuses on the qualitative composition of major ions, pH values, and conductivity. The annual weighted average pH of precipitation reached a value of 5.65. The lowest pH value (5.0) was recorded in December, which was mainly related to the low precipitation amount during this period and the increased concentration of ions in the small volume of precipitation. Similarly, precipitation totals were low in January.

Wet deposition of oxidised nitrogen in the form of  $\text{NO}_3^-$  was  $0.10 \text{ g/m}^2/\text{year}$ , reduced nitrogen in the form of  $\text{NH}_4^+-\text{N}$  reached  $0.23 \text{ g N/m}^2/\text{year}$ , and

sulphur in the form of  $\text{SO}_4^{2-}$  amounted to  $0.12 \text{ g/m}^2/\text{year}$ .

Wet deposition of lead was  $1.5 \text{ g/ha/year}$ . Detailed monitoring results are provided in Chapter 3.4 Regional Monitoring in the main section of the Air Quality Report in the Slovak Republic for 2025.

### 3.7 Risk areas

**Fig. 3.12** shows municipalities at risk of deteriorated air quality, identified using the Integrated Municipal Assessment Method. Risk level 3 corresponds to the highest probability of being affected by air pollution.

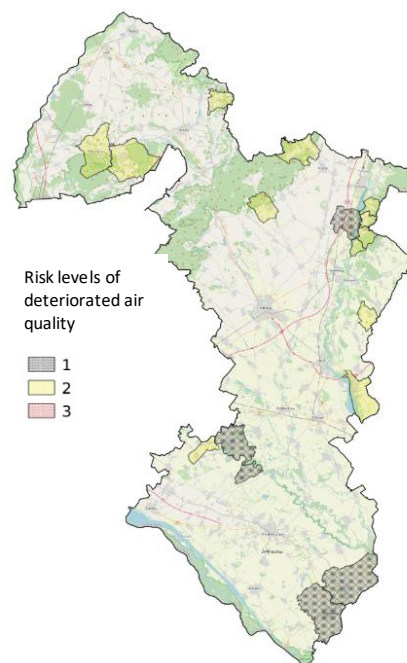
The methodology includes the extent of household heating using solid fuels, the influence of adverse dispersion conditions from both short-term and long-term perspectives, the results of the CMAQ chemical transport model, the RIO interpolation model, and high-resolution modelling results from the CALPUFF model in selected domains where deteriorated air quality is expected.

Municipalities where high-resolution modelling identified exceedances of the limit value for PM,  $\text{NO}_2$ , or the target value for B(a)P were automatically assigned risk level 3, as were municipalities where exceedances of limit or target values were detected by measurements. The list of municipalities and their risk levels is available on the SHMÚ website.

Zones and agglomerations containing at least one municipality with risk level 3 are required to prepare an Air Quality Improvement Programme. In this context, municipalities with risk level 3 correspond to air quality management areas. However, emission reduction measures must be implemented throughout the designated zone in all municipalities with risk levels 2 or 3, and ideally also in municipalities with risk level 1.

The assessment using the Integrated Assessment Method aims to identify areas where measures to improve air quality should be targeted. Considering the distribution of air pollution sources and the microclimatic characteristics of the area, it is likely that pollution levels vary between individual locations

**Fig. 3.12** Risk areas in Trnava region.



within the risk area. The spatial distribution of air pollution is represented by the results of high-resolution modelling, which are gradually being added to the SHMÚ<sup>1</sup> website.

### 3.8 Summary

In 2025, no exceedances of the limit values for SO<sub>2</sub>, NO<sub>2</sub>, CO, and O<sub>3</sub> were recorded in the Trnava Region zone, nor were the limit values for annual average PM<sub>10</sub> and PM<sub>2,5</sub> concentrations exceeded. A decrease in annual average PM<sub>10</sub> and PM<sub>2,5</sub> concentrations was recorded at all monitoring stations. An increase in NO<sub>2</sub> concentrations was observed at the AMS Trnava, Kollárova Street.

The number of days with an average daily PM<sub>10</sub> concentration above 50 µg·m<sup>-3</sup> in 2025 remained below the permitted limit. The target value for the annual average concentration of B(a)P was not exceeded. In the Trnava Region, no exceedance of limit or target values for any pollutant has been measured during the last four assessed years; therefore, no air quality management area has been designated in this zone based on monitoring results.

When assessing compliance with the requirements arising from the new Air Quality Directive 2024/2881, the Trnava Region zone would already meet the 2030 targets for both annual and daily PM<sub>10</sub> averages in 2025, including at the traffic station in Trnava.

The limit value for the number of exceedances of daily PM<sub>2,5</sub> concentrations would not be exceeded at any AMS. The new annual NO<sub>2</sub> limit value would be exceeded only at the traffic station in Trnava. The annual PM<sub>2,5</sub> limit value would be exceeded at all AMS except the Topoľníky AMS.

If air quality in the zone were assessed according to WHO recommendations, none of the monitoring stations would meet the recommended annual concentration values for PM<sub>10</sub> and PM<sub>2,5</sub>. Only the Topoľníky AMS (EMEP) would comply with the recommended annual average NO<sub>2</sub> limit.

From the perspective of air quality, the Trnava Region zone is among the least problematic areas.

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<sup>1</sup> <https://www.shmu.sk/sk/?page=2699>