

# Air Quality Plan for the Malopolska Region

Malopolska  
in a healthy atmosphere

## Summary

### Attachment 1

Resolution No. XXV/373/20 of  
the Assembly of the Małopolskie  
Voivodeship of September 28, 2020.

---

Marshal Office of the  
Malopolska Region

---

 **MAŁOPOLSKA**  
IN A HEALTHY ATMOSPHERE

---

  **MAŁOPOLSKA**

---

## The Management Board of the Malopolska Region

Witold Kozłowski	The Marshal of the Malopolska Region
Tomasz Urynowicz	Deputy Marshal of the Malopolska Region
Łukasz Smółka	Deputy Marshal of the Malopolska Region
Marta Malec-Lech	Member of the Management Board of the Malopolska Region
Edward Czesak	Member of the Management Board of the Malopolska Region

## Supervision:

Tomasz Urynowicz	Deputy Marshal of the Malopolska Region
Karolina Laszczak	Director of the Environment Department of the Marshal's Office of the Malopolska Region
Tomasz Pietrusiak	Deputy Director of the Environment Department of the Marshal's Office of the Malopolska Region
Piotr Łyczko	Deputy Director of the Environment Department of the Marshal's Office of the Malopolska Region
Katarzyna Stadnik	Head of the Air Quality Team of the Marshal's Office of the Malopolska Region
Aleksandra Pup	Senior Specialist in the Air Quality Team of the Marshal's Office of the Malopolska Region

## Team of authors\*:

headed by *Aneta Lochno MSc*

Magdalena Załupka, MSc  
Iwona Rackiewicz, PhD, Eng.  
Edyta Benikas, MSc  
Ewelina Wikarek-Paluch, MSc  
Anna Wahlig, MSc  
Ireneusz Sobecki, MSc  
Tomasz Przybyła, MSc  
Wojciech Wahlig, MA  
Roman Grzebiela, MSc



*Financed by the Regional Fund for Environmental Protection and Water Management in Krakow. Implemented as part of the project "Implementation of Air Quality Plan for Malopolska Region – Malopolska in a healthy atmosphere" / LIFE-IP MALOPOLSKA / LIFE14 IPE/PL/021 co-financed by the LIFE Programme of the European Union.*

\*The Plan was modified and its content was being changed by the contracting authority.

# Contents

---

1. STRATEGY OF THE AIR QUALITY PLAN.....	4
2. New possibilities and conditions for the implementation of the Plan .....	5
3. Diagnosis of air quality .....	7
3.1. Analysis of the problem .....	7
3.2. Air quality in Malopolska .....	7
3.2.1. Air quality assessment.....	7
3.2.2. Areas of exceedances .....	13
3.2.3. Expected air quality over the next few years.....	21
3.3. Causes of poor air quality .....	26
3.3.1. Impact from outside the region .....	26
3.3.2. Sources of emissions from the Malopolska Region .....	27
3.3.3. Impact of emission sources on air quality .....	29
4. Effects of exposure to pollutants .....	32
4.1. Impact on health .....	32
4.2. The cost of poor air quality .....	34
5. Previous actions .....	37
5.1. Actions at local level .....	37
5.2. Actions at regional level.....	39
5.3. Conclusions from previous actions .....	39
6. Clean Air Actions .....	41
Action 1. Low-stack emission reduction and improvement of energy efficiency .....	41
Action 2. Reduction of emissions from the transport sector.....	52
Action 3. Reduction of emissions from economic activities.....	57
7. Short-term actions .....	61
1 <sup>st</sup> degree of danger – code yellow .....	63
2 <sup>nd</sup> degree of danger – code orange .....	63
3 <sup>rd</sup> degree of danger – code red .....	64
8. The effect of the Air Quality Plan implementation .....	66
8.1. Monitoring of effects .....	74
9. SUMMARY .....	75

## 1. STRATEGY OF THE AIR QUALITY PLAN

---

The Air Quality Plan (AQP) for the Malopolska Region aims to achieve the limit values of air pollutants, set out in Polish and EU regulations, as soon as possible. The AQP shall set out the most effective actions to achieve the limit values for PM<sub>10</sub> and PM<sub>2.5</sub> in ambient air no later than 2023 and the target value for benzo(a)pyrene and the limit value for nitrogen dioxide no later than 2026.

Effective implementation of the actions is to lead not only to the quickest possible achievement of the limit values of pollutants, but also the concentration levels of PM<sub>10</sub> and PM<sub>2.5</sub> recommended by the World Health Organisation (WHO) in the perspective of the year 2030. The strategy to improve air quality in Malopolska includes integration with actions aimed at reducing climate change.

The strategy requires intensive efforts at local, regional and national level.

The previous **Air Quality Plan was adopted by resolution No. XXXII/451/17** of the Regional Assembly of the Malopolska Region of 23 January 2017. It sets out actions aimed at achieving in the entire Malopolska Region by 2023 limit values of the following air pollutants: PM<sub>10</sub>, PM<sub>2.5</sub>, benzo(a)pyrene, nitrogen dioxide and ozone.

This document shall be the new Air Quality Plan based on revised air protection legislation, including:

- Regulation of the Minister of the Environment of 14 June 2019 on air quality plans and short-term action plans<sup>1</sup>
- Regulation of the Minister of Environment of 8 June 2018 on the assessment of substance levels in the air<sup>2</sup>.

Within the zones of the Malopolska Region, there are still exceedances of the limit values for PM<sub>10</sub>, PM<sub>2.5</sub> and nitrogen dioxide (Krakow Agglomeration) and the target values for benzo(a)pyrene and ozone.

This document is based on analyses for 2018 and covers 3 air quality zones:

- Krakow Agglomeration,
- Tarnow City Zone,
- Malopolska Zone.

The main activities of the Air Quality Plan are designed to implement the Clean Air Program and other governmental instruments for air protection in Malopolska and fully implement anti-smog resolutions for Krakow and Malopolska. The revised rules of the Clean Air Program require greater involvement of local governments in helping residents to make use of subsidy for the replacement of heat sources, thermo-modernization of buildings and the use of renewable energy sources. Municipalities should also be prepared to help people affected by energy poverty using the Stop Smog Program.

Malopolska is aiming at low-carbon transformation, which is connected with preferences for using renewable energy sources. As part of the AQP, options for corrective actions have been identified that will bring the greatest effects of improving air quality. Additionally, an analysis of the potential and use of renewable energy sources in the region was also included.

In order to support the implementation of activities aimed at air protection in the Malopolska Region, the LIFE integrated project "*Implementation of Air Quality Plan for Malopolska Region – Malopolska in a healthy atmosphere*" / LIFE-IP MALOPOLSKA / LIFE14 IPE/PL/021 is being implemented.

Full description of the data presented in this document, the specification of issues related to the inventory of emission sources, analysis of air quality and description of economic, ecological and local conditions of selected directions of remedial actions, have been included in a separate document of *Air Quality Plan* constituting Attachment 2 to the resolution of the Regional Assembly of the Malopolska Region.

---

<sup>1</sup> Journal of Laws 2019 item 1159

<sup>2</sup> Journal of Laws 2018 item 1119

## 2. New possibilities and conditions for the implementation of the Plan

During the work on the Plan, the conditions for implementing actions to improve air quality have changed. On both national and European scale, new opportunities have emerged that will facilitate the implementation of the Plan's assumptions. They are the result of decisions taken at the governmental level, as well as at the level of the European Union. In view of the new opportunities that can support the process of improving air quality, the Plan sets out corrective actions that focus on the effective use of available tools that can accelerate the implementation of actions to reduce emissions of harmful substances.

### Changes in the Clean Air Priority Program

On May 15, 2020, the National Fund for Environmental Protection and Water Management announced a simplification of the rules for the selection of applications for co-financing from the Clean Air Program. The new version of the Clean Air Program introduces a number of changes, including:

- change and simplification of income criteria,
- simplification of the grant application,
- the possibility of submitting online applications,
- shortening the time of processing applications for co-financing – from 90 to 30 days,
- strengthening cooperation with municipalities,
- integration of the Clean Air Program with the "My Electricity" Programme,
- inclusion of the Banking Sector in the implementation of Programme, which will enable a source of complementary and bridge funding,
- enabling the combination of co-financing offered by the Programme with co-financing from municipal low-stack emission reduction programs.

In addition, changes to the Programme are to encourage municipalities to establish Clean Air information points. There are currently 58 of them in the Malopolska Region.

### Draft Act on the Central Building Emission Register

The Ministry of Climate has prepared a draft amendment to the *Act on supporting thermo-modernization and renovation* as well as the *Act on the Inspection for Environmental Protection*, which will result, among others, in the launch of the Central Building Emission Register (CEEB<sup>3</sup>).

The database, which is a kind of inventory of heating sources, is aimed at creating the basis for planning corrective actions and improving housing conditions of the society. The CEEB is to support the implementation of other activities such as improving energy efficiency, improving air quality and combating energy poverty. Inventory carried out as part of the Base will allow to diagnose low-stack emission sources, which will be implemented by collecting uniform and coherent data across the country regarding buildings and their sources of emissions.

### Renovation Wave as part of the European Green Deal

In March 2020, the European Commission presented a new draft regulation on the decarbonisation of the economy and achieving climate neutrality. The European Green Deal<sup>4</sup> was created in order to present the possibilities of implementing solutions serving the pursuit of climate neutrality by European Community countries. The European Green Agreement suggests "*renovation wave*" of public and private buildings. Construction accounts for 36% of Europe's total greenhouse gas emissions – building renovation can bring significant benefits in terms of energy efficiency, affordability, lower energy bills and support for small and medium-sized enterprises and jobs. The Clean Energy for all Europeans package

<sup>3</sup>Source: <https://bip.kprm.gov.pl/kpr/bip-rady-ministrow/prace-legislacyjne-rm-i/prace-legislacyjne-rady/wykaz-prac-legislacyjnych/r1273188465185,Projekt-ustawy-o-zmianie-ustawy-o-wspieraniu-termomodernizacji-i-remontow-oraz-u.pdf>

<sup>4</sup>Source: commission communication, European Green Deal <https://eur-lex.europa.eu/legal-content/PL/TXT/HTML/?uri=CELEX:52019DC0640&from=EN>

offers the opportunity to accelerate the energy transformation in Europe – with a significant improvement in the energy efficiency of buildings.

Despite the delay in implementing climate and environmental actions which results from the epidemic, Minister of Climate Michal Kurtyka emphasizes that *"(...) the slump, caused in the economy by the coronavirus pandemic, causes the need to mobilize large funds to revive the economy. The flywheel here can be just changing energy sector, which must continue its transformation."* In Poland such means are, among others, The Clean Air Priority Program or My Electricity Programme, which in the coming years will be the driver for investments in renewable energy sources and improvement of energy efficiency in the municipal and household sector.

### Just Transition Mechanism

One of the instruments for implementing the assumptions of the European Green Deal is the Just Transition Fund. It is one of the three pillars of the Just Transition Mechanism<sup>5</sup>, which is to provide a comprehensive solution to support the ability of Member States to finance activities related to energy transformation.

The purpose of the Fund is to provide subsidies to regions most affected by the effects of climate transformation, in particular regions in which energy is based on solid fuels such as hard coal. All Member States can apply for support, while the distribution of funds will be proportional to the needs resulting from the energy transformation. In order to receive financing, Member States are required to prepare at least

one territorial just transition plan that is part of the national plan of the state's transformation by 2030.

At present, 6 regions from Poland will apply for the Fund. The European Commission plans to allocate a total of EUR 17,5 billion to the needs of the fund, of which EUR 3,5 billion (the largest part of the fund) would be allocated to Poland. **In order to accelerate the implementation of climate, energy and environmental measures, the Malopolska Region is also applying for available funds.**

### Activities of the Regional Fund for Environmental Protection and Water Management

By December 31, 2023, the Regional Fund for Environmental Protection and Water Management in Krakow is implementing a project called "A nationwide system of advisory support for the public, housing and industry sectors in the field of energy efficiency and renewable energy" (PDE), which supports the achievement of the objectives set in the Air Quality Plan for the Malopolska Region.

The project is implemented under Sub-measure 1.3.3 OPI & E 2014-2020 in cooperation with the National Fund for Environmental Protection and Water Management and 16 Partners at the voivodship level - 15 regional funds for environmental protection and water management and the Lubelskie Voivodship, what ensures complementarity of actions taken in Malopolska with actions taken all over the country. In addition, preparations are underway for the continuation of the nationwide Energy Consultancy project in the next financial perspective of the European Union.

<sup>5</sup> Source: Regulation of the European Parliament and of the Council establishing the Just Transition Fund

<https://eur-lex.europa.eu/legal-content/PL/TXT/HTML/?uri=CELEX:52020PC0022&from=EN>

### 3. Diagnosis of air quality

---

#### 3.1. Analysis of the problem

---

Air quality has become a national problem. Poland is obliged to keep the concentrations of certain pollutants below the level specified as the limit or target value. Under the NEC Directive, it is also required to reduce emissions with respect to harmful air pollutants: PM<sub>10</sub>, PM<sub>2.5</sub>, benzo(a)pyrene and nitrogen dioxide.

The ruling of the Court of Justice in Luxembourg of February 2018 obliged Poland to immediately implement actions that will make a real improvement in air quality in Poland and visibly reduce the levels of harmful particulates.

---

*According to the World Health Organisation Report of 2018, more than 30 of Europe's 50 most-polluted towns are located in Poland, and 7 of them are located in Malopolska.*

---

For years Malopolska has been struggling with the problem of too high levels of air pollution. The annual air quality assessment indicates which pollutants exceed the statutory limit and target values.

---

**The Air Quality Plan is concerned with limiting emissions and reducing concentrations of:**

**PM<sub>10</sub> particulate matter**

**PM<sub>2.5</sub> particulate matter**

**benzo(a)pyrene**

**nitrogen dioxide**

---

It is the duty and responsibility of authorities at all levels to reduce the impact of pollution on the health of residents. The impact of each pollutant depends on the emissions, the harmfulness of the substance and its level of interaction with other substances in the air. The impact also depends on the place of emission, the time the pollutant is in the atmosphere and, ultimately, where the pollutant actually affects and how vulnerable the population or environment exposed to it is. Vulnerable people, such as children and the elderly, are most affected by poor air quality.

#### 3.2. Air quality in Malopolska

---

##### 3.2.1. Air quality assessment

Air quality in the Malopolska Region is monitored by the Chief Inspectorate of Environmental Protection. In 2018, pollutant concentrations were measured at 24 monitoring stations located within 3 air quality zones (*Figure 1*). Within the air quality monitoring network, there were also mobile stations enabling annual change of measurement locations. This allows for a better diagnosis of areas where there may be exceedances of permissible or target concentrations of substances in the province. The results of air quality tests from the measuring stations are continuously updated on the website of the Chief Inspectorate of Environmental Protection:

<http://powietrze.gios.gov.pl/pjp/current/>.

---

*Limit values for annual average concentrations of substances and levels recommended by the WHO:*

*PM<sub>10</sub> – 40 µg/m<sup>3</sup> (WHO 20 µg/m<sup>3</sup>)*

*PM<sub>2.5</sub> – 25<sup>6</sup> µg/m<sup>3</sup> (WHO 10 µg/m<sup>3</sup>)*

*NO<sub>2</sub> – 40 µg/m<sup>3</sup> (WHO 40 µg/m<sup>3</sup>)*

---

---

<sup>6</sup> The value of 25 µg/m<sup>3</sup> was applicable until December 31, 2019. Since January 1, 2020 the annual mean concentration of PM<sub>2.5</sub> cannot exceed a value of 20 µg/m<sup>3</sup>.



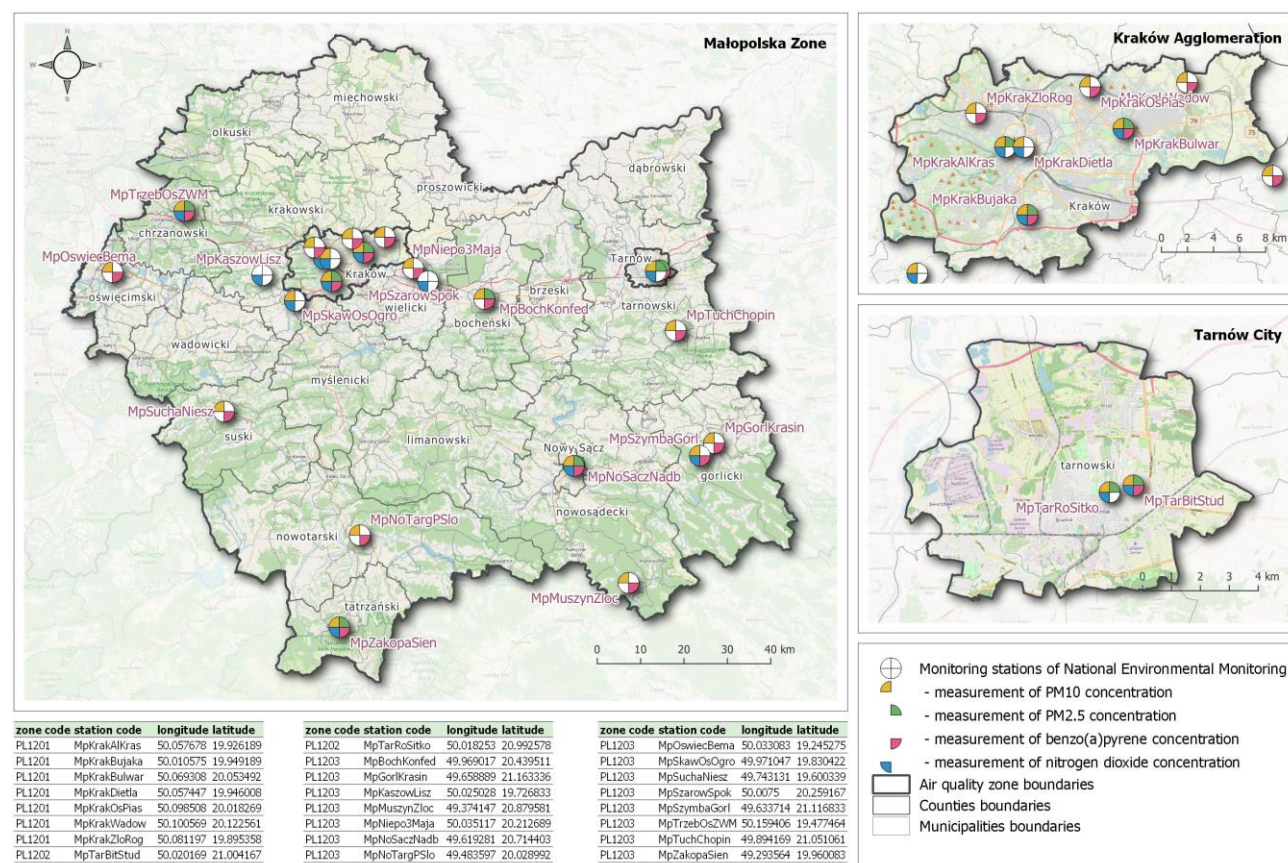


Figure 1. Location of air quality zones and monitoring stations used in Annual air quality assessment in the Malopolska Region for 2018<sup>7</sup>.

Intensive actions taken in the Malopolska Region contribute to the improvement of air quality. However, despite this, the amount of harmful substances in the air continues to exceed the limit and target values. The annual air quality assessment for 2018 indicates for each zone in the region areas where exceedances occur.

### PM10 particulate matter

Since 2015, to which the previous Air Quality Plan refers, changes in the level of annual average concentrations of PM10 indicate a decrease in the concentration level at a significant part of measuring stands.

The limit value for the annual average concentration of PM10 is  $40 \mu\text{g}/\text{m}^3$ . Measurements of PM10 indicate that this standard is exceeded continuously

over the whole analysed period (2013-2018). In 2018 the annual standard was exceeded at the measuring stations in Krakow. Compared to 2017, the annual average concentrations at 2 stations increased (Krakow Bujaka and Al.Krasinskiego). On the other hand, at 5 stations the annual average concentrations dropped by up to 15% (Krakow ul. Bulwarowa). The highest concentration was still recorded at Al. Krasinskiego traffic station in Krakow ( $56 \mu\text{g}/\text{m}^3$ ). However, compared to 2015, it has fallen by 17% (Figure 2). Apart from Krakow, exceedances above  $40 \mu\text{g}/\text{m}^3$  for PM10 were also recorded in Oswiecim, Sucha Beskidzka, Tuchow, Nowy Targ and Skawina (Figure 3).

In Tarnow, the average annual PM10 limit value was not exceeded in 2018 (Figure 2).

<sup>7</sup> Source: Based on data from National Monitoring System, CIEP (Chief Inspectorate of Environmental Protection)



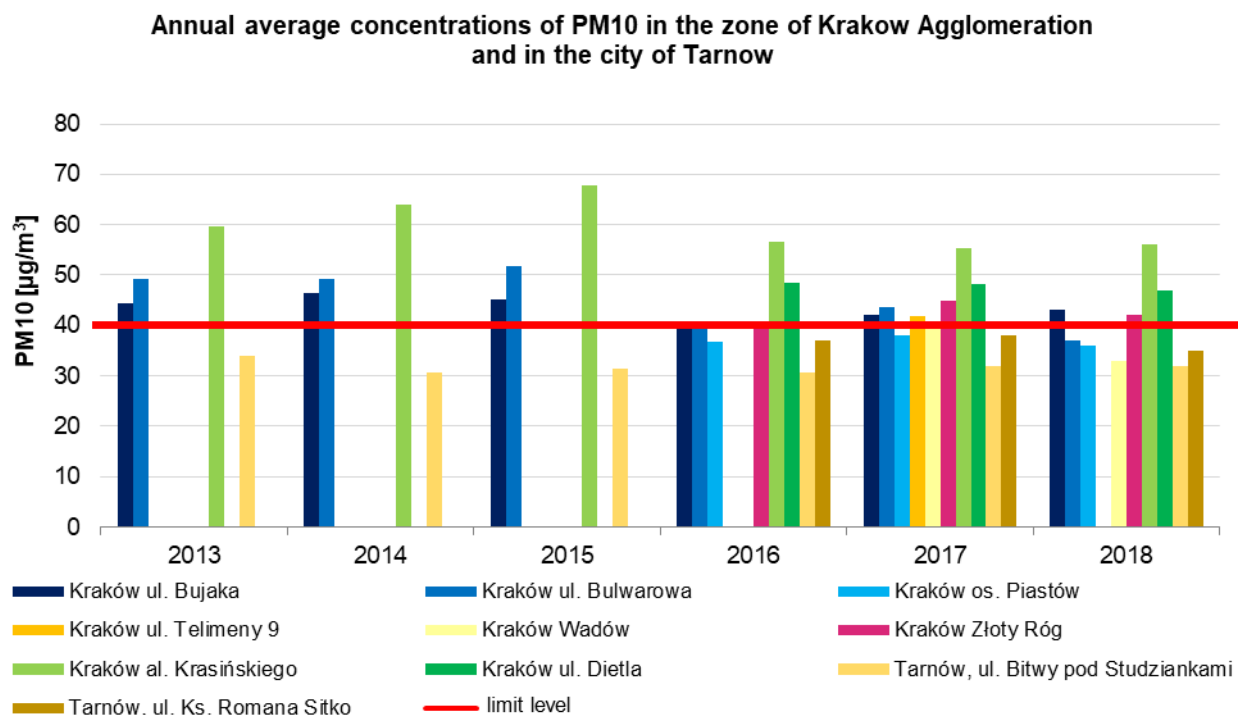


Figure 2. Annual average concentrations of PM10 in the zones of Krakow Agglomeration and in the city of Tarnow.<sup>8</sup>

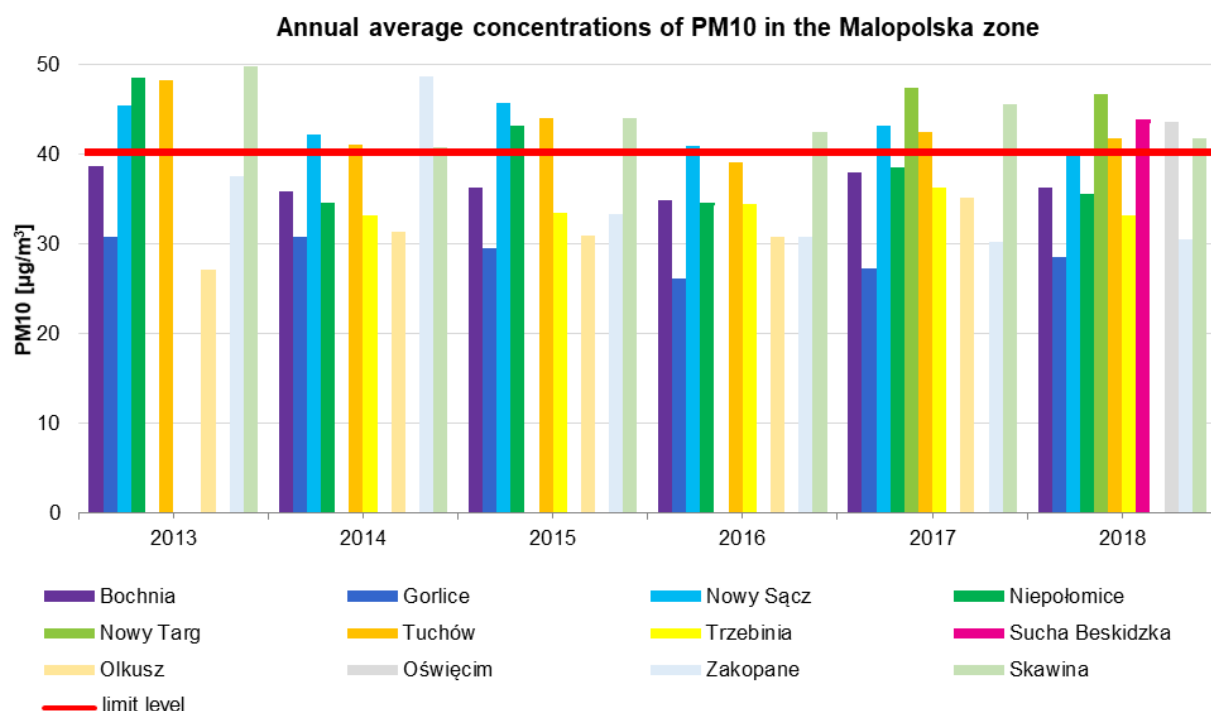


Figure 3. Annual average concentrations of PM10 in the Malopolska zone<sup>9</sup>.

<sup>8</sup> Source: Preparation based on measurement data of the State Environmental Monitoring network and data from Annual air quality assessment in the Malopolska Region, CIEP, ATMOTERM S.A.

<sup>9</sup> Source: Preparation based on measurement data of the State Environmental Monitoring network and data from Annual air quality assessment in the Malopolska Region, CIEP, ATMOTERM S.A.

The limit values for PM<sub>10</sub> were also exceeded in relation to daily limit values. In accordance with the Regulation of the Minister of the Environment *on the levels of certain substances in the air*, the number of days when the value of 50 µg/m<sup>3</sup> of PM<sub>10</sub> is exceeded may be maximum 35. In the Krakow Agglomeration zone in 2018 there were a maximum of 161 such days (Al. Krasinskiego station). The lowest number of days with exceedances was recorded at the Wadow station in Krakow (58 days). Since 2015, there has been a decrease in the number of days with exceedance – a particularly significant decrease was recorded at the measuring station located at al. Krasinskiego (from 200 days in 2015 to 161 days in 2018).

There were 54 days in Tarnow when the daily value of PM<sub>10</sub> exceeded 50 µg/m<sup>3</sup>, i.e. 19 days above the 35-day limit.

In the Malopolska zone there have been high concentrations of PM<sub>10</sub> for 104 days in Nowy Targ. The lowest number of days with high concentration occurred in 2018 in Muszyna (6 days), Szymbark (14 days) and Gorlice (33 days), i.e. less than the permissible 35 days with daily level excess. In the scale of the zone, there were areas where the number of days with exceedances increased over the last three years (2016-2018) of the Air Quality Plan implementation: Bochnia (from 62 days to 63 days), Niepolomice (from 62 days to 74 days), Nowy Targ (from 42 days to 104 days), Tuchow (from 74 days to 86 days) and Zakopane (from 44 days to 48 days). The number of days with exceedances in individual years is variable and is largely related to weather conditions and changing temperatures.

#### Alert and information threshold

Since 2015, the number of high concentration episodes – exceeding the alert threshold for PM<sub>10</sub> (300 µg/m<sup>3</sup>) and the information threshold for PM<sub>10</sub> (200 µg/m<sup>3</sup>) – has decreased. In 2017 there was one day with exceedance of the alert threshold of PM<sub>10</sub> concentration in as many as 5 cities (Krakow, Nowy Targ, Bochnia, Niepolomice and Skawina). Particularly high concentrations of PM<sub>10</sub> occurred in 2017

at the station in Brzeszcze. At the indicated station, for 9 days the daily concentration of PM<sub>10</sub> have exceeded 300 µg/m<sup>3</sup>. In 2018, there were no days with exceedances of the alert threshold at any of the stations.

The information threshold for PM<sub>10</sub> was mostly exceeded in 2017. In Krakow, the number of days when the PM<sub>10</sub> concentration level was above 200 µg/m<sup>3</sup> ranged from 3 to 8, while in Tarnow – 2 days. In the Malopolska zone, the information level was most often exceeded at the station in Brzeszcze in 2017 – 9 days, and at the station in Nowy Targ – 9 days. In 2018, there was one day with exceedance of the information level in Krakow, while in the Malopolska Region – maximum 4 days – in Nowy Targ. In Tarnow, the information threshold was not exceeded.

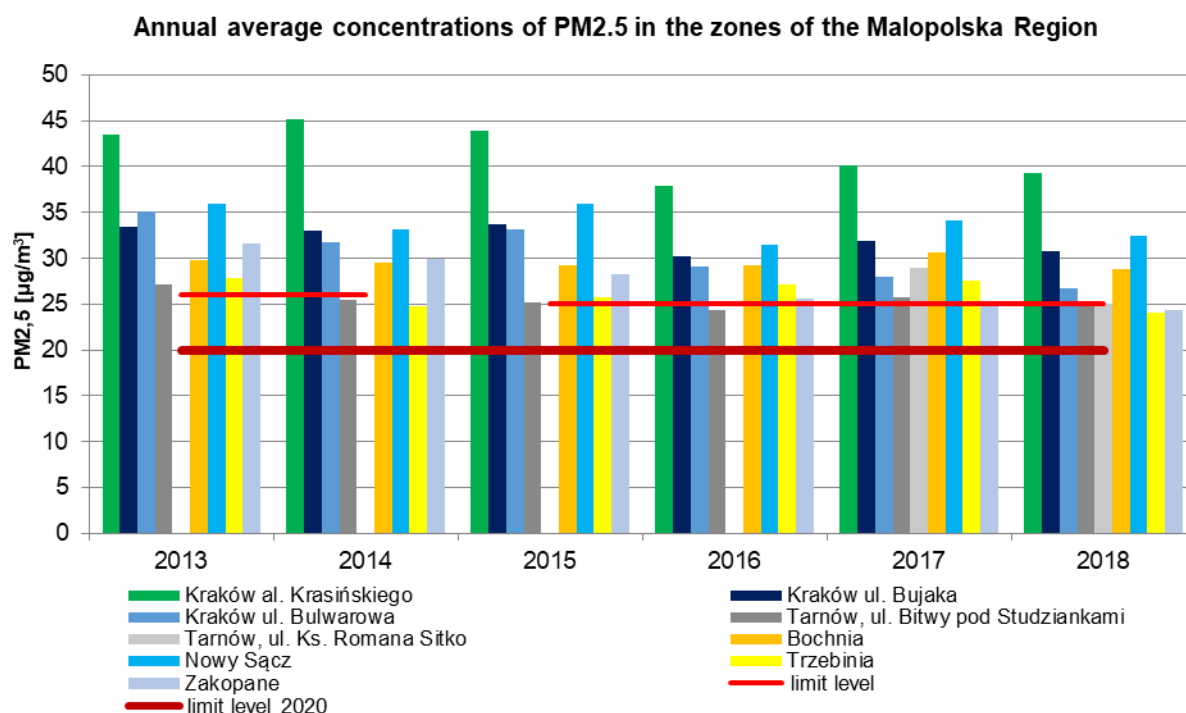
The amendment of the Regulation of the Minister of Environment of 8 October 2019 *on the levels of certain substances in the air*<sup>10</sup> changed the values of the information level and alert level. According to the changes, the smog alert is announced when the daily average value of 150 µg/m<sup>3</sup> for PM<sub>10</sub> is exceeded (with 300 µg/m<sup>3</sup> previously in force). In turn, the information threshold is currently set at the level of 100 µg/m<sup>3</sup> (previously the value was 200 µg/m<sup>3</sup>).

#### PM<sub>2.5</sub> particulate matter

The annual average concentration standard for PM<sub>2.5</sub> for 2018 was set at the level of 25 µg/m<sup>3</sup>, while from 2020 it was tightened to 20 µg/m<sup>3</sup>.

The highest concentration of PM<sub>2.5</sub> occurred in Krakow at the traffic station at Al. Krasinskiego (39 µg/m<sup>3</sup>) and the lowest was recorded at the Trzebinia station (24 µg/m<sup>3</sup>). Over the past 5 years, a steady downward trend has been observed at most stations. The largest decreases in concentrations are visible at the measuring stations in Krakow at ul. Bulwarowa (5% decline) and ul. Bujaka (6% decline). The annual average concentration of PM<sub>2.5</sub> recorded in Tarnow (24.8 µg/m<sup>3</sup>), Trzebinia (24 µg/m<sup>3</sup>) and Zakopane (24.4 µg/m<sup>3</sup>) does not exceed the standard in force in 2018. (25 µg/m<sup>3</sup>) (Figure 4).

<sup>10</sup> Journal of Laws 2019 item 1931



\* The limit level of average annual PM<sub>2.5</sub> concentration in 2013-2014 was 26 µg/m<sup>3</sup>, in 2015-2019 it was 25 µg/m<sup>3</sup>, from 2020 the norm is 20 µg/m<sup>3</sup>.

Figure 4. Annual average concentration values of PM<sub>2.5</sub> at air quality monitoring stations<sup>11</sup>.

PM<sub>2.5</sub> is also characterised by the Average Exposure Index calculated for cities with a population of more than 100,000 and for agglomerations. In 2018, the value of the index for the Krakow Agglomeration amounted to 31 µg/m<sup>3</sup> (it is highest value for all country), and for Tarnow it showed 25 µg/m<sup>3</sup>. The national average exposure index amounts to 22 µg/m<sup>3</sup>. Compared to previous years, a decrease is observed in the value of the indicator for the aforementioned locations (in 2015 it amounted to 33 µg/m<sup>3</sup> for Krakow and 26 µg/m<sup>3</sup> for Tarnow).

### Benzo(a)pyrene

The level of benzo(a)pyrene in the air has for many years repeatedly exceeded a target value of 1 ng/m<sup>3</sup>. The decrease in concentration levels over the last three years is small, and in some towns even negligible. In 2016, there was a visible decrease in benzo(a)pyrene concentrations, but in 2017 the

concentrations increased again at all measuring stations. In 2018, the highest concentrations were reported in Nowy Targ (18.3 ng/m<sup>3</sup>), Sucha Beskidzka (12.7 ng/m<sup>3</sup>), Tuchow (9.7 ng/m<sup>3</sup>) and Nowy Sacz (9.7 ng/m<sup>3</sup>). Moreover, Nowy Targ recorded the highest concentrations in the whole analysed period. The average concentration is over 1700% above the target value for B(a)P. The lowest concentration of benzo(a)pyrene occurred in Muszyna and Szymbark (Figure 6). It amounted to 2 ng/m<sup>3</sup>, which is still 2 times the required standard.

In Krakow, there is a slow decline in benzo(a)pyrene concentrations, but the target level is still exceeded on average by 400%. In 2018, the lowest concentration occurred at the station of os. Piastow – 4.8 ng/m<sup>3</sup>, while the highest was recorded at Wadow station and at ul. Bulwarowa – 5.5 ng/m<sup>3</sup> (Figure 5).

<sup>11</sup> Source: Preparation based on measurement data of the State Environmental Monitoring network and data from Annual air quality assessment in the Malopolska Region, CIEP, ATMOTERM S.A.

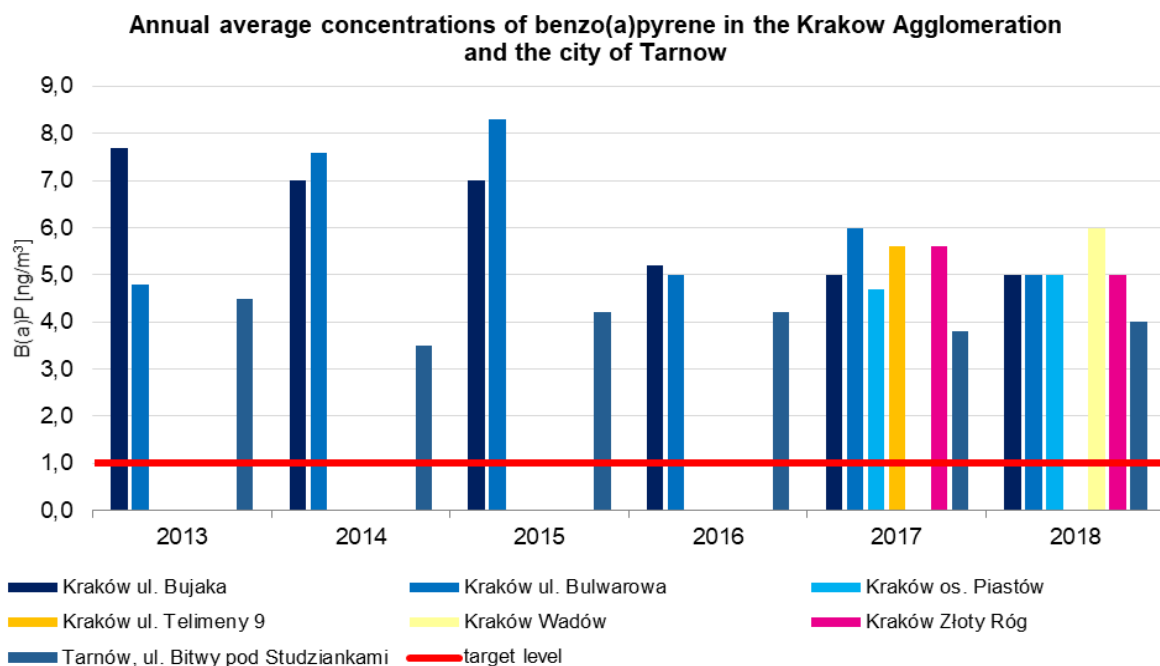


Figure 5. Annual average concentration values of benzo(a)pyrene at air quality monitoring stations in the Krakow Agglomeration and Tarnow<sup>12</sup>.

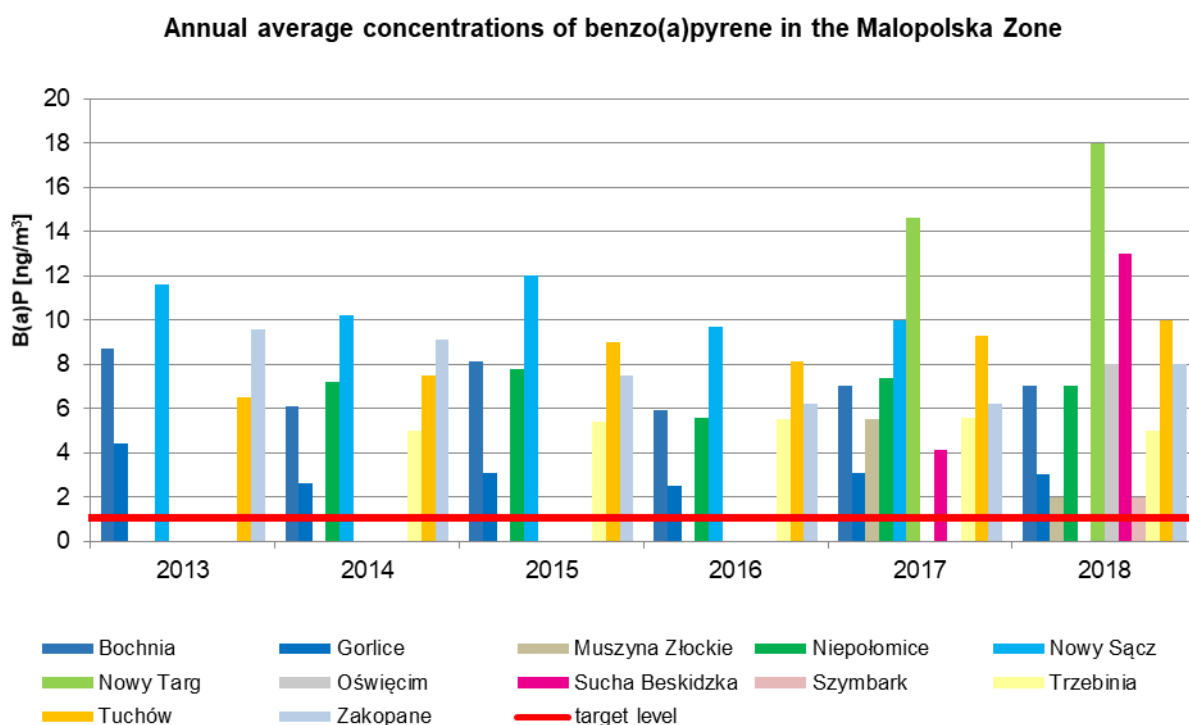


Figure 6. Annual average concentration values of benzo(a)pyrene at air quality monitoring stations in Malopolska zone<sup>13</sup>.

<sup>12</sup> Source: Preparation based on measurement data of the State Environmental Monitoring network and data from Annual air quality assessment in the Malopolska Region, CIEP, ATMOTERM S.A.

<sup>13</sup> Source: Preparation based on measurement data of the State Environmental Monitoring network and data from Annual air quality assessment in the Malopolska Region, CIEP, ATMOTERM S.A.

The problem of benzo(a)pyrene air pollution occurs in all neighbouring regions of Malopolska. The inhabitants of the southern part of the country are particularly exposed to very high concentrations of this carcinogenic pollutant.

### Nitrogen dioxide

The problem of exceeding annual average concentrations of nitrogen dioxide is mainly faced by agglomerations with increased vehicle traffic. In Krakow, ex-

ceedances of the permissible annual average concentration of nitrogen dioxide ( $40 \mu\text{g}/\text{m}^3$ ) are recorded annually at the traffic station. Over the previous 5 years, annual average concentrations were about 50% higher than the standard indicates.

Since 2015,  $\text{NO}_2$  concentration has dropped by 4% only. At the remaining monitoring stations in the zones of Malopolska Region, the concentrations do not exceed 51% of the standard (*Figure 7*).

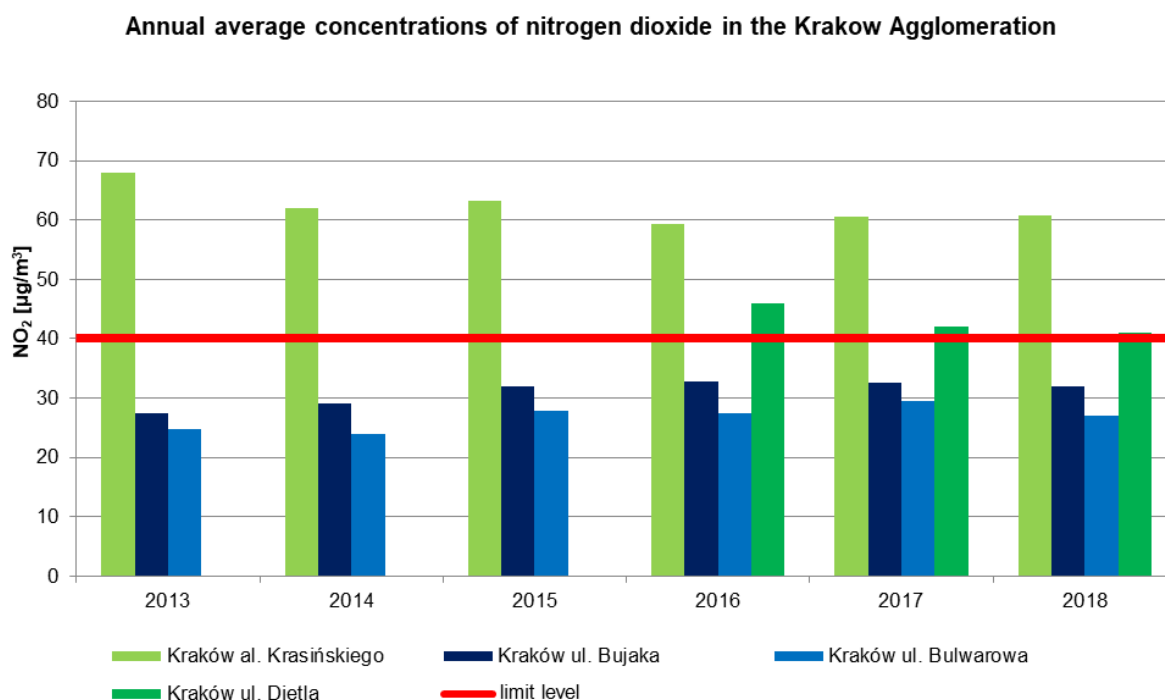


Figure 7. Annual average concentration values of nitrogen dioxide in the Krakow Agglomeration at air quality monitoring stations<sup>14</sup>.

### 3.2.2. Areas of exceedances

Areas of exceedances of limit and target values have been determined on the basis of the annual assessment of air quality for Malopolska Region for 2018 carried out by the Chief Inspectorate of Environmental Protection. The basis for air quality diagnosis based on modelling were data on emissions from point, linear and surface sources, numerical terrain model and detailed meteorological data from 2018.

The exceedances of the permissible annual average concentration of PM<sub>10</sub> occur in the area of 532.1 km<sup>2</sup> (3.5% of the whole region's area) inhabited by about 800.5 thousand people (23.5% of the region's population) (*Table 1*). In relation to the areas designated in the Air Quality Plan for 2015, the area of exceedances has increased and the number of vulnerable population has doubled. Such a significant difference in results was influenced by the change in the method of determining areas of exceedances in air quality assessments and the method of calculating the number of exposed population.

<sup>14</sup> Source: Preparation based on measurement data of the State Environmental Monitoring network and data from Annual air quality assessment in the Malopolska Region, CIEP, ATMOTERM S.A.



Table 1. Exceedances of the annual average PM10 concentration limit value.<sup>15</sup>

Exceedances of the annual average PM10 concentration limit value		
Air quality zone	Exposure area [km <sup>2</sup> ]	Number of exposed residents
Krakow Agglomeration	156.5	493 259
Tarnow	0	0
Malopolska Zone	375.6	307 288
Malopolska Region	532.1	800 547

Taking into account daily concentrations of PM10 in the region, over 54% of the inhabitants of Malopolska (1,866.3 thousand) in the area of about 6.2 thousand km<sup>2</sup> (40.9% of the region's area) are exposed to exceedance of the limit value of 50 µg/m<sup>3</sup> for more than 35 days a year (Table 2). Compared to the areas in 2015, there is no significant difference in the population exposed, but the area of exposure has increased significantly.

In total, 119 municipalities were diagnosed with areas where the 24-hour PM10 limit value was exceeded, of which in 8 municipalities the area of exceedances does not exceed 1 km<sup>2</sup>.

Table 2. Exceedances of the 24-hour PM10 concentration limit value.<sup>16</sup>

Exceedances of the 24-hour PM10 concentration limit value		
Air quality zone	Exposure area [km <sup>2</sup> ]	Number of exposed residents
Krakow Agglomeration	327	767 348
Tarnow	72	109 650
Malopolska Zone	5 816.9	989 306
Malopolska Region	6 215.9	1 866 304

The limit values for annual average concentrations of PM2.5 (25 µg/m<sup>3</sup>) were exceeded in 72 municipalities with a total area of 2 332.1 km<sup>2</sup>, which constitutes about 15.36% of the area of the Malopolska Region (Table 3). Since 2015, the exceedance area has increased significantly and the number of exposed populations has also increased.

The high PM2.5 content affects the health and life of more than 1,108.3 thousand inhabitants of the region (32.6% of the region's population). Taking into account the PM2.5 standard in force from 2020 (20 µg/m<sup>3</sup>), the size of the exceedance area is 4 437.9 km<sup>2</sup>, while the number of exposed population in the region increases by over 400 thousand (Table 3).

Table 3. Exceedances of the annual average PM2.5 concentration limit value.<sup>17</sup>

Exceedances of the annual average PM2.5 concentration limit value		
Air quality zone	Exposure area [km <sup>2</sup> ]	Number of exposed residents
Krakow Agglomeration		
PM2.5 > 25 µg/m <sup>3</sup>	327	767 348
PM2.5 > 20 µg/m <sup>3</sup>	327	767 348
Tarnow		
PM2.5 > 25 µg/m <sup>3</sup>	0	0
PM2.5 > 20 µg/m <sup>3</sup>	72	109 650
Malopolska Zone		
PM2.5 > 25 µg/m <sup>3</sup>	2 005.1	340 999
PM2.5 > 20 µg/m <sup>3</sup>	4 038.9	686 914
Malopolska Region		
PM2.5 > 25 µg/m <sup>3</sup>	2 332.1	1 108 347
PM2.5 > 20 µg/m <sup>3</sup>	4 437.9	1 563 912

<sup>15</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP

<sup>16</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP

<sup>17</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP

Annual average concentrations of benzo(a)pyrene in all 182 municipalities of the region exceed the target level of 1 ng/m<sup>3</sup> (*Table 4*). The concentrations of benzo(a)pyrene and the area of exceedances have not changed with respect to the calculation for 2015. This area covers 98% of the region.

*Table 4. Exceedances of the annual average benzo(a)pyrene concentration target value.<sup>18</sup>*

Exceedances of the annual average benzo(a)pyrene concentration target value		
Air quality zone	Exposure area [km <sup>2</sup> ]	Number of exposed residents
Krakow Agglomeration	327.00	767 348
Tarnow	72.00	109 650
Malopolska Zone	14 547.7	2 474 139
<b>Malopolska Region</b>	<b>14 946.7</b>	<b>3 351 137</b>

The modelling of nitrogen dioxide concentrations concerned only the Krakow Agglomeration, in the area of which the permissible annual concentration was exceeded in the measurements. The concentration of nitrogen dioxide depends mainly on transport sources, therefore the areas with increased annual average NO<sub>2</sub> concentrations in Krakow are located along the main communication routes, especially in the city centre and along the A4 motorway (*Table 5*).

*Table 5. Exceedances of the annual average nitrogen dioxide concentration limit value.<sup>19</sup>*

Exceedances of the annual average nitrogen dioxide concentration limit value		
Air quality zone	Exposure area [km <sup>2</sup> ]	Number of exposed residents
Krakow Agglomeration	23.9	220 230

<sup>18</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP

<sup>19</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP

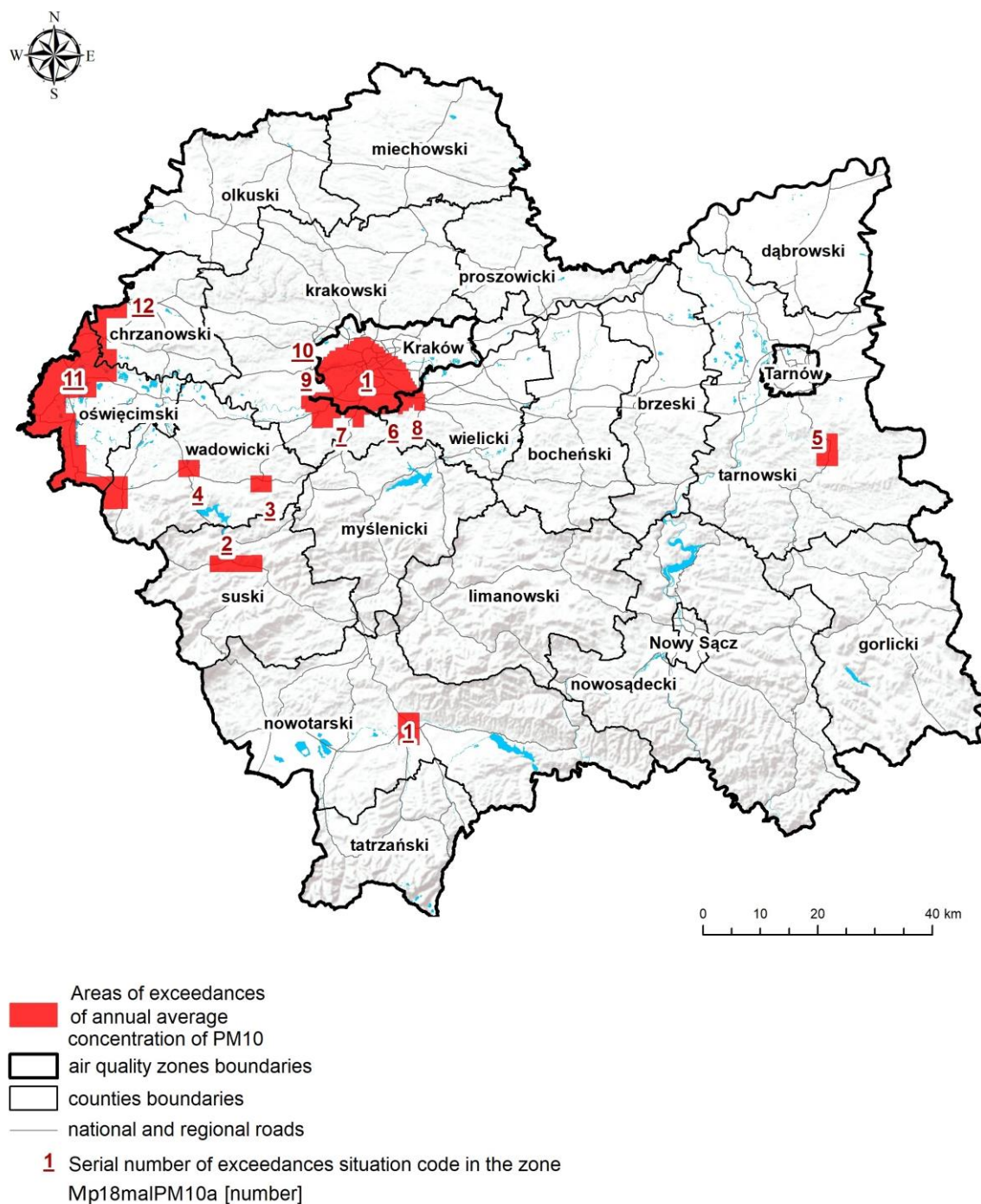


Figure 8. Areas of exceedances of annual average concentrations of PM10 in zones of the Malopolska Region in accordance with the Annual air quality assessment in the Malopolska Region for 2018<sup>20</sup>

<sup>20</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP

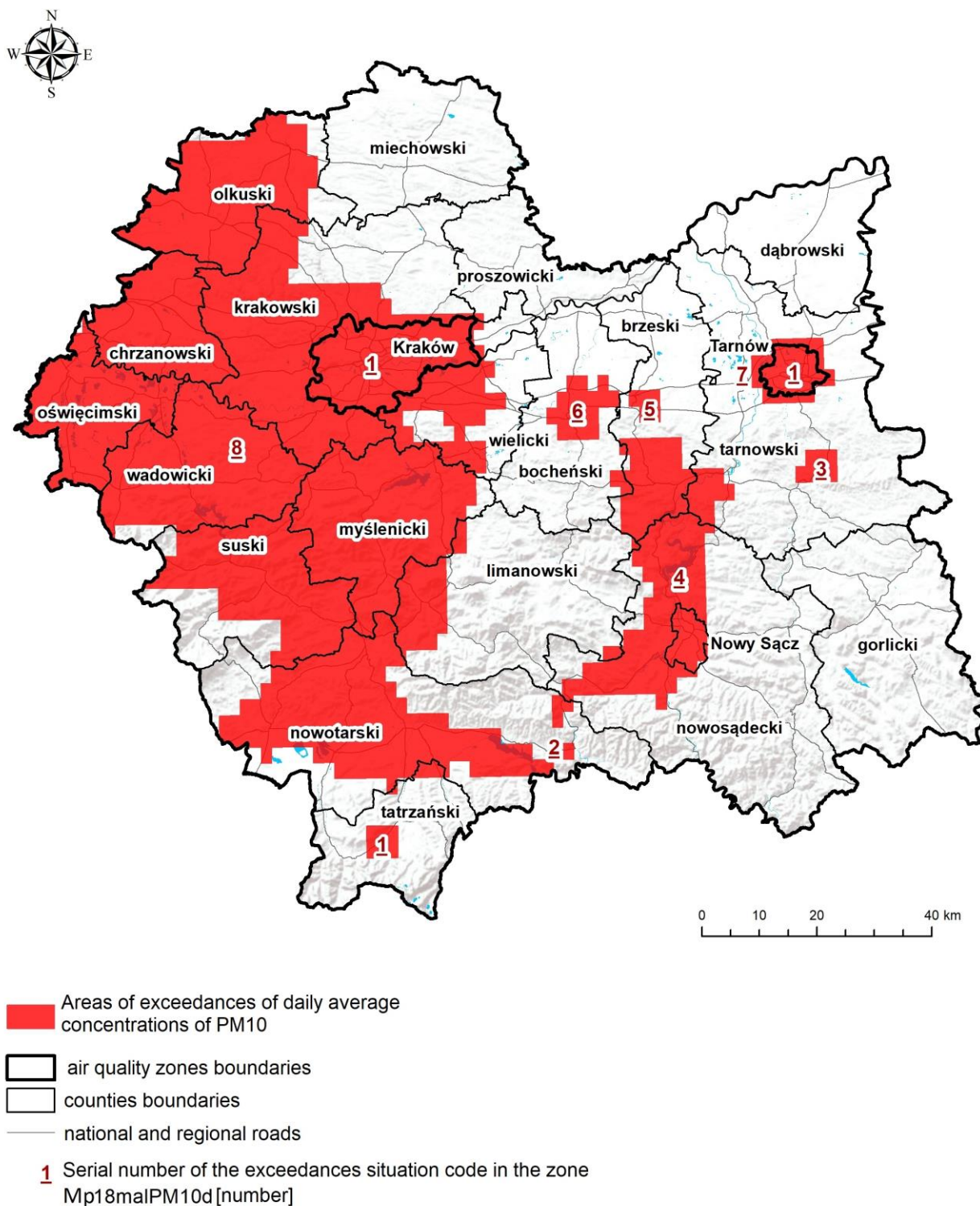


Figure 9. Areas of exceedances of daily average concentrations of PM10 in zones of the Malopolska Region in accordance with the Annual air quality assessment in the Malopolska Region for 2018.<sup>21</sup>

<sup>21</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP



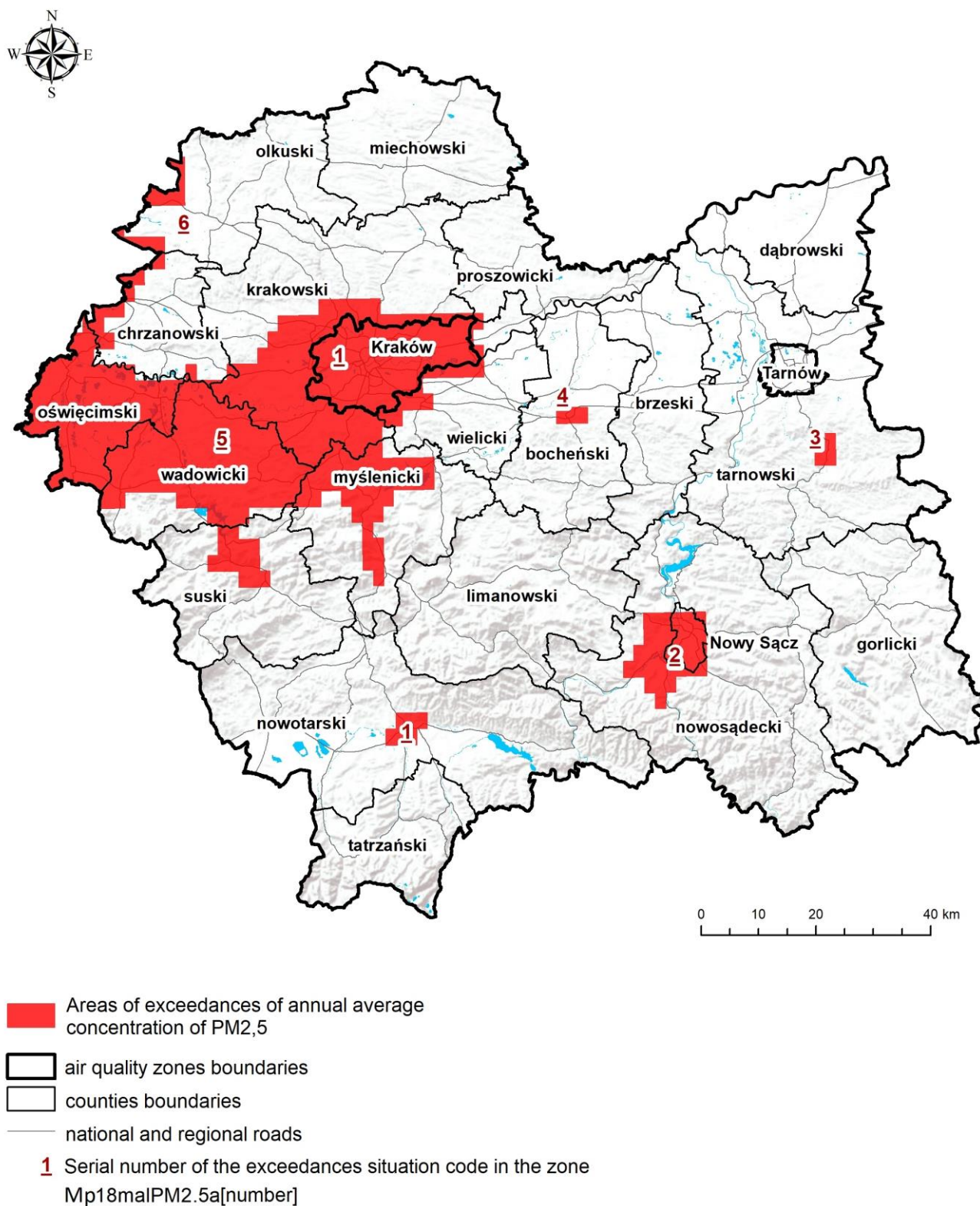


Figure 10. Areas of exceedances of annual average concentrations of PM<sub>2.5</sub> (Phase 1 up to 2020) in zones of the Malopolska Region in accordance with the Annual air quality assessment in the Malopolska Region for 2018.<sup>22</sup>

<sup>22</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP



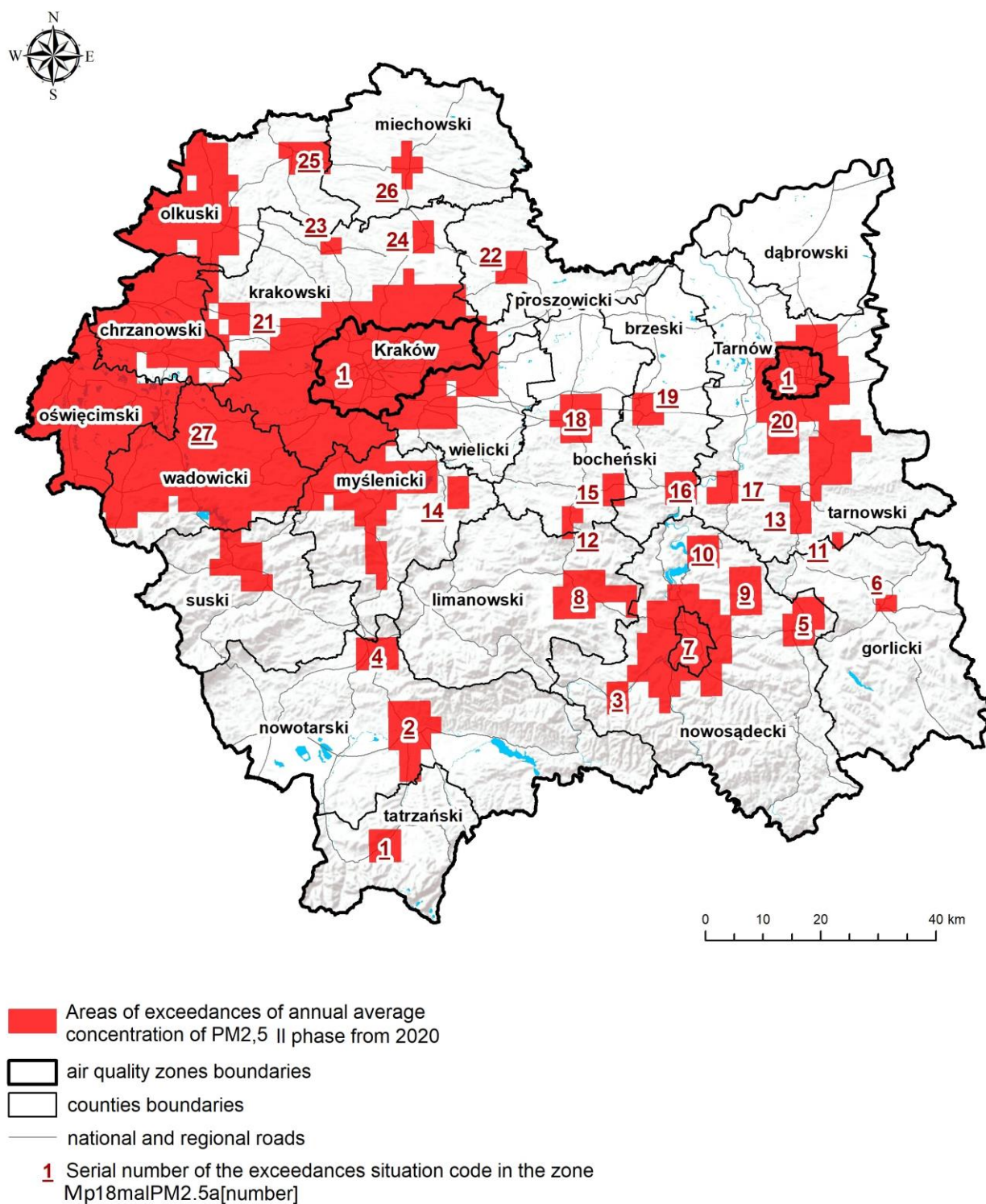


Figure 11. Areas of exceedances of annual average concentrations of PM<sub>2.5</sub> (Phase 2 from 2020) in zones of the Malopolska Region in accordance with the Annual air quality assessment in the Malopolska Region for 2018.<sup>23</sup>

<sup>23</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP

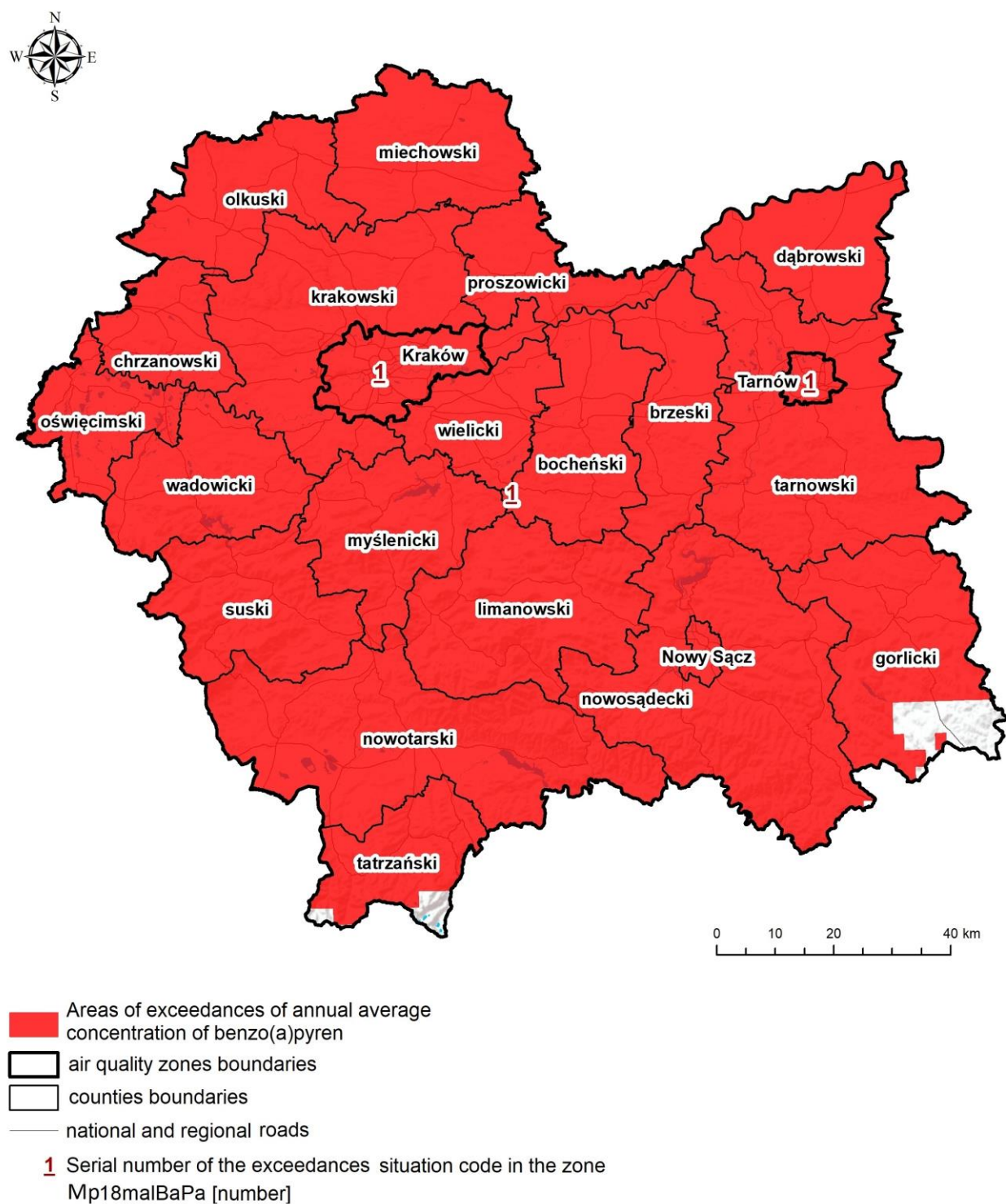


Figure 12. Areas of exceedances of annual average concentrations of benzo(a)pyrene in zones of the Malopolska Region in accordance with the Annual air quality assessment in the Malopolska Region for 2018.<sup>24</sup>

<sup>24</sup> Source: Annual air quality assessment in the Malopolska Region for 2018. Regional Department of Environmental Monitoring CIEP





emission standards for new MCPs (with a total rated thermal input equal to or greater than 1 MW and less than 50 MW) are in force from 2018. For existing facilities with a total rated thermal input greater than 5 MW the standards will be tightened from 2025. In the case of particulate matter, the required reduction compared to the currently binding regulation of the Minister of Environment<sup>29</sup> will be between 50 and 70%. In industry, it is possible to achieve a 10% reduction by 2026 due to technological progress and EU requirements in the field of emissions trading as well as legal regulations and adaptation to the new requirements.

Taking into account the need to improve the environment, in 2021 the Commission will adopt action plan to eliminate air, water and soil pollution. The Commission will take into account the lessons learned from the evaluation of existing air quality legislation and will propose to strengthen the provisions on air quality monitoring and modelling and air quality plans to help local and regional authorities achieve better air quality. In particular, it will propose to revise the air quality standards to bring them more into line with the recommendations of the World Health Organisation (WHO).

In 2011, the European Commission presented a plan to create a Single European Transport Area (*White Paper*), which aims to achieve a competitive and resource-efficient transport system. The plan provides guidelines for the most desirable EU actions in the field of transport in the 2050 perspective. At the national level, the basic document is the *Transport Development Strategy until 2020 with an outlook to 2030*.

For the European Union to achieve climate neutrality, emissions from all modes of transport must be reduced by 90% by 2050. In 2020, the Commission will adopt a strategy for sustainable and intelligent mobility that addresses this matter and the issue of all sources of emissions.

The considered factors of transport and climate policy, transport strategies, existing and evolving legis-

lation, allocated funds, economic and political conditions have made it possible to determine the trend of change and the impact of transport on air quality in subsequent years. It is estimated that the volume of passenger vehicle traffic on the roads of Malopolska will increase by as much as 36% by 2020. On average, the volume of heavy transport may increase by around 38% by 2025. According to the analyses of the Central Statistical Office (GUS), in Malopolska Region passenger cars are increasing in number by 71-82 thousand yearly. 60% on average are brand new vehicles. On the other hand, out of 7.5 thousand heavy duty trucks registered annually in the region, 75% are brand new vehicles. Of all the vehicles on the roads in the Malopolska Region, the number of new (up to 3 years old) vehicles increases annually. In 2015 there were 5.7% of them, in 2016 – 6.2%, in 2017 this number increased to 6.8% and in 2018 – to 7.3%. This means a steady growth of new vehicles that meet the highest emission standards within the EURO 6 category.

According to the requirements of the EURO standards for petrol vehicles, the emission of nitrogen oxides from EURO 3 vehicles, i.e. 20-year-old vehicles, is 2.5 times higher than from EURO 6 vehicles, i.e. 5-year-old vehicles. For diesel fuelled vehicles, nitrogen oxide emissions are six times lower when meeting EURO 6 (5-year-old vehicles) than EURO 3 (20-year-old vehicles). Even for 14-year-old vehicles, nitrogen oxide emissions are 3 times higher than for 5-year-old and younger vehicles. Given the increase in the number of cars meeting the newer EURO standards, nitrogen dioxide emissions from these sources can be naturally reduced by replacing the fleet of vehicles travelling on the road.

The impact of emissions from transport on concentrations of PM10 and PM2.5 is mainly dependent on the amount of extra-fuel PM generated by vehicles on the roads. Therefore, appropriate actions not directly related to vehicle emissions (e.g. appropriate road maintenance) can reduce the impact of transport on particulate matter concentrations in the air.

<sup>29</sup> Regulation of the Minister of the Environment of 1 March 2018 on emission standards for certain types of installations, fuel combustion sources and waste incineration or co-incineration equipment (uniform text: Journal of Laws of 2019, item 1806)

In addition, it is necessary to take into account activities envisaged for implementation in the Transport Development Strategy in the Malopolska Region for the years 2010-2030, which:

- assumes improvement of transport safety in the region,
- draws attention to the need for further development of road and rail infrastructure to ensure better accessibility to Krakow, other transport hubs and neighbouring regions;
- points to the creation of effective transport links between cities and rural areas in order to increase the mobility of inhabitants of peripheral areas of the region;
- attaches importance to the creation of instruments for managing integrated transport systems;
- stresses the need to improve transport connections of the Krakow Metropolitan Area with the Upper Silesian conurbation, using the cooperation of regional and city authorities to develop an integrated transport system.

Air quality will not improve without specific, intensive actions, because economic factors will not allow individual heating systems to be changed to more environmentally friendly ones, and the increase in the price of environmentally friendly media, such as natural gas or district heating, will increase the use of solid fuels, such as coal or biomass.

According to the European Union Commission Regulation 2015/1189 of 28 April 2015 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for solid fuel boilers, from 1 January 2020 solid fuel boilers placed on the market shall comply with the ecodesign requirements.

In the Malopolska Region, anti-smog resolutions are in force, thanks to which restrictions in the use of solid fuels have been introduced. The resolutions

will contribute to changes in trends in the use of fuels for heating purposes:

- Resolution No. XVIII/243/16 of the Regional Assembly of the Malopolska Region of 15 January 2016 on the introduction in the area of the Municipality of Krakow of restrictions on the operation of installations in which fuel is burned.
- Resolution No. XXXII/452/17 of the Regional Assembly of the Malopolska Region of 23 January 2017 on the introduction in the area of the Malopolska Region of restrictions and prohibitions on the operation of installations in which fuel is burned.

The introduction of restrictions on the use of solid fuels in Krakow allowed for changes in the structure of the heating systems used. The inhabitants, with a strong support from the city authorities, changed heating systems to ecological ones. Despite the entry into force of the ban on the use of solid fuels in Krakow as of 1 September 2019, approximately 2,850 solid-fuel powered devices is still operating in the city (January 2020 status).

Activities in the region in connection with the anti-smog resolution indicate that the rate of replacement of heating sources is too slow in relation to the set target. The past actions have resulted in improved air quality, but the environmental effects achieved have not been sufficient to reach the level of air quality required by the law. In such circumstances, the required air quality levels will not be achieved in 2023.

Determination of changes in the functioning of emission sources in Malopolska was analysed in 5 different options of corrective actions. These options concerned the analysis of the introduction of legal regulations limiting the use of solid fuel powered devices and solid fuels themselves. A broad analysis of the assumptions and effects of the options has been presented in the AQP Justification (Attachment 2 to the resolution).



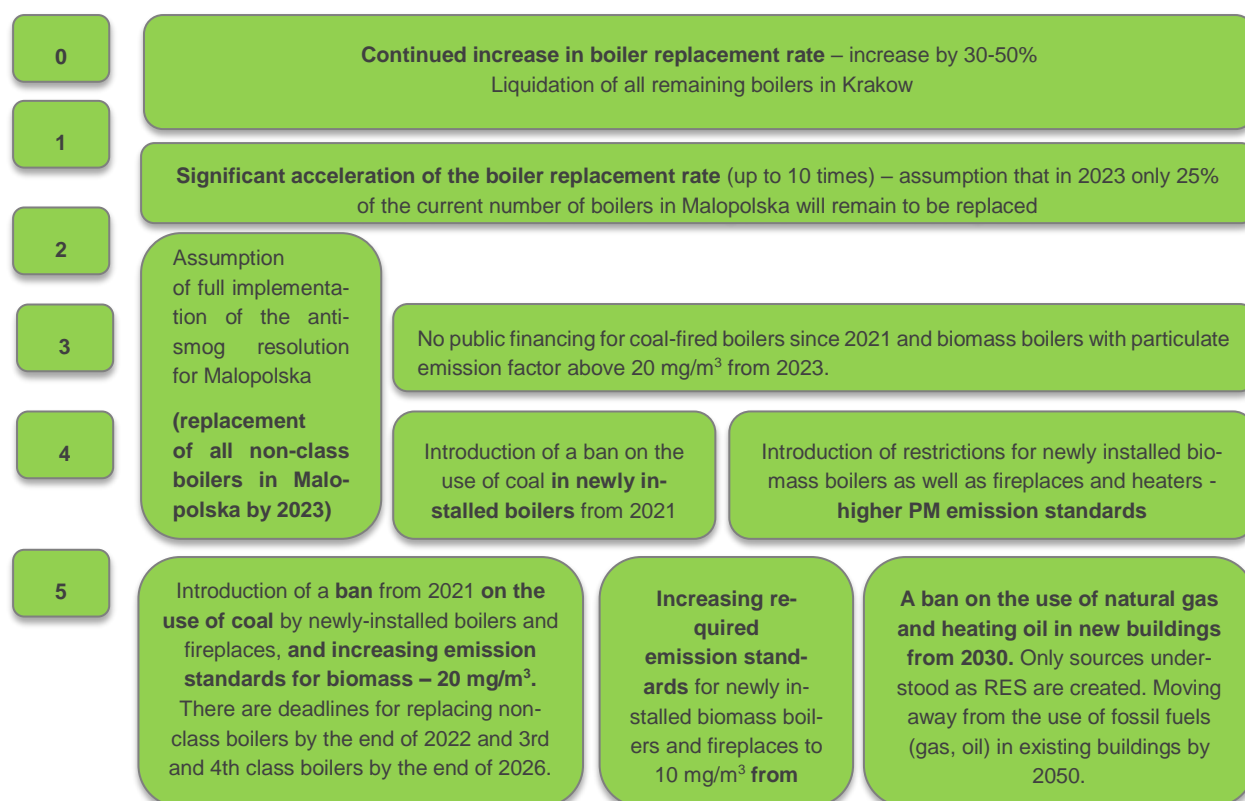


Figure 14. Scenarios for the implementation of actions to reduce emission from the municipal and household sector in Malopolska Region by 2023.

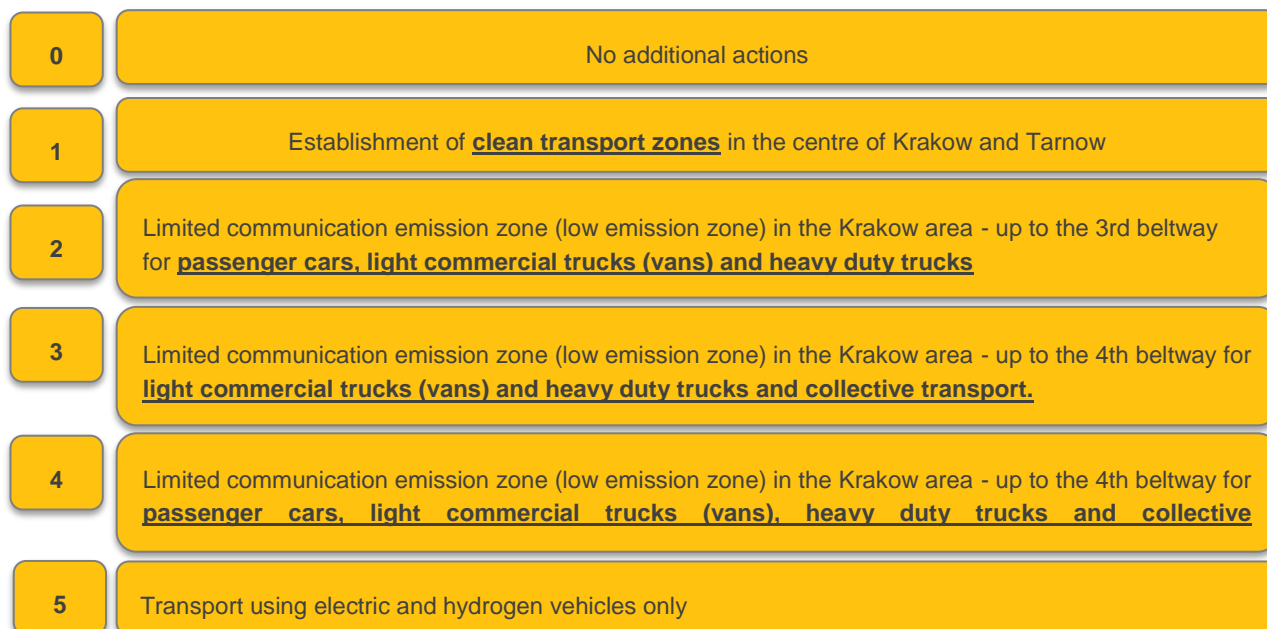


Figure 15. Scenarios for the implementation of actions to reduce emission from the transport in Malopolska Region by 2023.

The modelling of air quality in the baseline option<sup>30</sup> (no additional actions) for 2023 showed that actions limited to certain exceedance areas only might not improve air quality sufficiently. This may be caused by too low level of emission reduction in the municipalities with exceedance areas, partly also by emissions from newly emerging emission sources, as well as a significant share of the total background in the amount of substance concentrations, especially in areas along the western border of the region.

The results indicate in which areas this problem will be significant in 2023. This particularly concerns the area of the town of Nowy Sącz, the counties of the western part of the region, as well as the cities of the Suski, Wadowicki, Nowotarski and Tatrzański counties.

In the case of benzo(a)pyrene, an additional factor affecting the failure to reach the target level in 2023 is the very high impact of the regional background on the level of pollution in the Malopolska Region. National and regional actions need to be very intensive in order to significantly reduce benzo(a)pyrene emissions throughout the country. The analysis of modelling results for the forecast year 2023 showed that the actions in the Malopolska Region alone will not bring about sufficient reduction of benzo(a)pyrene concentrations.

*In view of the indicated national circumstances, in the analysis of air quality in the projected year, **2026 was indicated for benzo(a)pyrene as the closest possible year to achieve the target level.** This year is coinciding with the deadline for activities carried out on a scale of neighbouring regions under the Air Quality Plans.*

*In the field of **nitrogen dioxide**, it is assumed that corrective actions will contribute to reaching the limit value **in 2026**, which will also be influenced by the development of electromobility, a change in the fleet of vehicles travelling on the roads and actions on emission reduction focused on limiting urban traffic.*

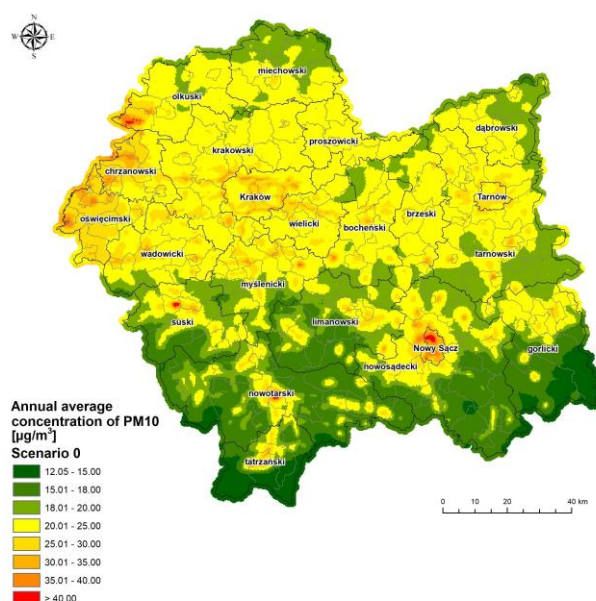


Figure 16. The annual average concentration of PM10 in the forecast year 2023 in the event of not taking systemic actions and maintaining the current trend of corrective actions.<sup>31</sup>

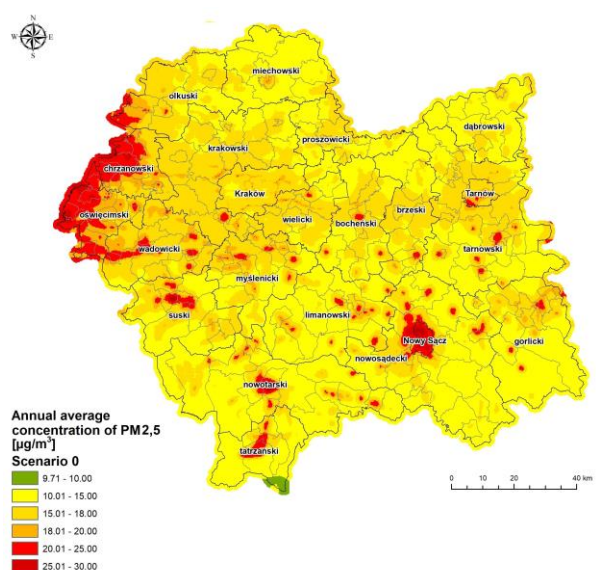


Figure 17. The annual average concentration of PM2.5 in the forecast year 2023 in the event of not taking systemic actions and maintaining the current trend of corrective actions.<sup>32</sup>

<sup>30</sup> Details on the method of air quality modelling for the purpose of the Air Quality Plan are included in Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region in Chapter 18.1.

<sup>31</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The

detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A.

<sup>32</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A.

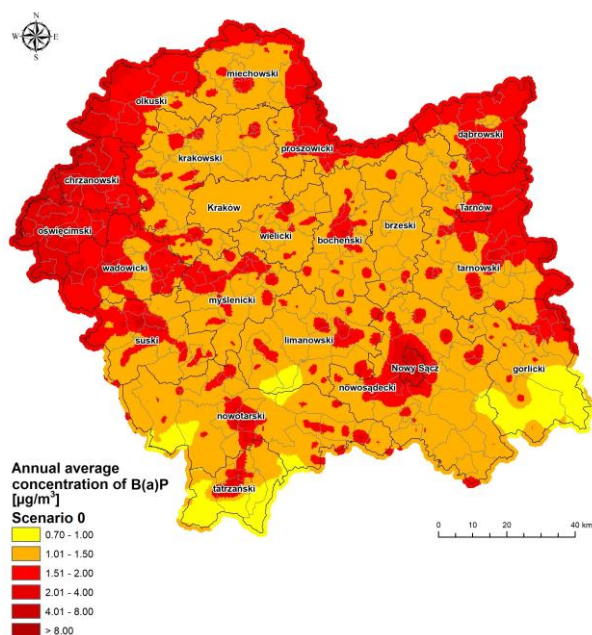


Figure 18. The annual average concentration of benzo(a)pyrene in the forecast year 2023 in the event of not taking systemic actions and maintaining the current trend of corrective actions.<sup>33</sup>

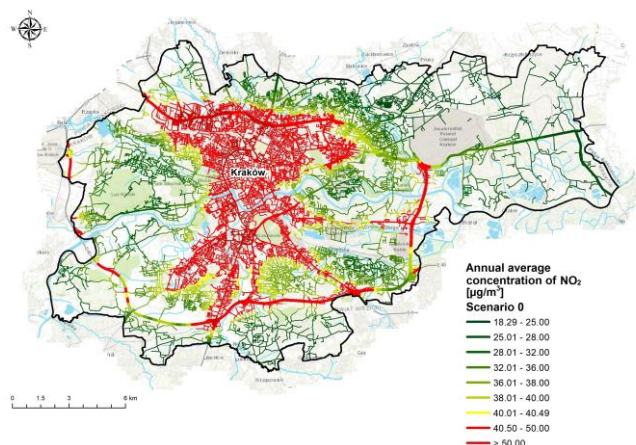


Figure 19. The annual average concentration of nitrogen dioxide in the Krakow Agglomeration in the forecast year 2023 in the event of not taking systemic actions and maintaining the current trend of corrective actions.<sup>34</sup>

The results of the above analysis indicate that it is necessary to introduce actions that will affect a much larger number of emission sources than indicated by the current trend of actions. Proposals of solutions in accordance with the analyses of the selected scenario have been indicated for implementation in the perspective of the forecast year for the zones of the Malopolska Region.

### 3.3. Causes of poor air quality

#### 3.3.1. Impact from outside the region

Air quality depends not only on the functioning of emission sources located in the Malopolska Region. The analyses must also take into account the flow of pollutants from other regions of the country and the transboundary movement of pollutants from outside Poland. In order to determine the share of emission sources outside the Malopolska Region, all sources of emission constituting a regional background within the 30 km range from the regional border were taken into account, as well as sources constituting a supra-regional background, i.e. outside the 30 km range from the regional border. This zone includes emission sources located in the following regions: Silesia, Subcarpathian, Opolskie and Swietokrzyskie, as well as those located on the territory of Slovakia and partly in Czech Republic. However, in order to examine the impact of supra-regional sources on air quality, an analysis was also carried out based on modelling results for the national scale.

The analysis of emissions of particular pollutants from sources outside the Malopolska Region showed that the largest inflow emission of both PM<sub>10</sub>, PM<sub>2.5</sub> and benzo(a)pyrene comes from the Silesia Region, which is a strongly industrialised and urbanised region. The arrangement of directions of prevailing winds is also important.

As a result of the mathematical modelling carried out, the highest annual average concentrations of PM<sub>10</sub> from inflow sources were determined. They occur in the counties of Chrzanow, Olkusz and Oswiecim and reach the level of 19.7 µg/m<sup>3</sup>. In the case of PM<sub>2.5</sub>, the annual average concentrations from sources outside the Malopolska Region reach 19.2 µg/m<sup>3</sup>. With regard to benzo(a)pyrene, the concentration values from outside the region reach as high as 3.3 ng/m<sup>3</sup>. At the same time, it should be borne in mind that emissions of pollutants from the Malopolska area also affect the areas of other regions.

<sup>33</sup>Source: Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A

<sup>34</sup>Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A



Table 6. The regional background concentration in the zones of the Malopolska Region.

Regional background $\mu\text{g}/\text{m}^3$				
	PM10	PM2.5	B(a)P ( $\text{ng}/\text{m}^3$ )	NO <sub>2</sub>
<b>Krakow Agglomeration</b>				
Cross-border	2.96	2.34	0.14	0.96
Domestic	9.53	8.05	0.68	4.14
Natural	0.83	0.05	-	0.00
<b>City of Tarnow</b>				
Cross-border	2.96	2.37	0.14	-
Domestic	9.88	8.44	0.68	-
Natural	1.02	0.06	0.00	-
<b>Malopolska Zone</b>				
Cross-border	3.03	2.42	0.17	-
Domestic	9.72	8.26	0.76	-
Natural	1.08	0.06	0.00	-

### 3.3.2. Sources of emissions from the Malopolska Region

A detailed analysis of air quality in Malopolska required determining the amount of each of the analysed substances according to the types of sources from which the emission occurs. In the air quality assessment for the Malopolska Region, the inventory of emission sources for 2018 was used in order to perform air quality modelling. Modelling for the needs of annual air quality assessment in the region was performed with the use of the Central Emissions Inventory for Poland prepared by the National Centre for Emissions Management (KOBIZE IOS-PIB) of the Institute of Environmental Protection – National Research Institute.

#### Sources of emissions included in the Central Emissions Inventory:

- Municipal and household sector
- Industry
- Heaps and excavations
- Transport
- Agriculture including crops and husbandry
- Forests and land
- Landfills

In order to perform a detailed analysis of air quality in the zones of Malopolska Region according to the scenarios of actions, an additional database of emissions of substances from sources located in Malopolska Region was created. For this purpose, an inventory of emission sources was carried out on the basis of data for 2018, taking into account, inter alia, the emissions of PM10, PM2.5, benzo(a)pyrene, nitrogen dioxide and carbon dioxide from Malopolska Region. The same emission sources as in the Central Emissions Inventory are included in the inventory for the sake of consistency. The database of emissions from the municipal and household sector was updated in relation to 2015 according to the same methodology, but with the use of the Inventory Database for Heating Sources of Buildings in Malopolska created for regional needs and updated by local governments.

The database created for the purpose of the Air Quality Plan includes the following:

- surface sources in the resolution of 0.1 km x 0.1 km for urban areas with more than 50,000 inhabitants, 0.25 km x 0.25 km for built-up areas and 0.5 km x 0.5 km for other areas, covering mainly individual combustion sources from the municipal and household sector and the service sector, as well as agriculture (agricultural crops, animal husbandry and use of fertilizers and working machines), opencast mines, gravel pits and heaps, airports;
- linear sources including national and regional roads, taking into account the traffic volume on individual road sections by vehicle type, as well as municipal and county roads, taking into account local vehicle traffic in the resolution as for surface sources.
- point sources covering industrial sources, including professional energy, manufacturing industry, chemicals and other production facilities.

In 2018, according to the air quality assessment, 32.63 thousand Mg of PM10, including 28.23 thousand Mg of PM2.5, were emitted from the Malopolska area. The emission of nitrogen oxides amounted to 53.25 thousand Mg, while that of benzo(a)pyrene 14.19 Mg.

The main factor influencing the air quality in Malopolska Region shall be the emissions from the municipal and household sector. In the structure of pollutants, it is responsible for approximately: 77% of PM10 emissions, 88% of PM2.5 emissions, 97% of B(a)P emissions and 14% of NOx emissions (*Figure 20*).

It is estimated that in the scale of Malopolska Region, there may still be from about 363 to even 420 thousand solid-fuel boilers, the use of which causes emissions of pollutants into the air (non-class boilers, and Class 3 and Class 4 boilers).

Another source of emissions, particularly visible in large cities and agglomerations, is transport, which is responsible for about: 5% of PM10 emissions, 4% of PM2.5 emissions and 44% of NOx emissions in the region. At traffic stations, increased levels of PM10 and NO<sub>2</sub> are maintained throughout the year, due to the high level of traffic – in addition to the emissions associated with the combustion of fuels in the engines, also the processes of abrasion of tyres, brake pads and road surfaces. Car traffic also causes a secondary lift-off of particulate matter from the road surface.

Industrial emissions on a regional scale generate small amounts of particulate matter (8% of PM10 and 4% of PM2.5 emissions), but it is an important source of gas emissions into the air – it is responsible for 28% of NOx emissions (*Figure 20*).

Other sources, such as agriculture (crops and husbandry), forests and fires, are responsible for the following emissions: 13% of NOx, 10% of PM10 and 4% of PM2.5 (*Figure 20*).

On a national scale, the Malopolska Region, according to the air quality assessment, is responsible for the emission of: 9% of PM10, 10% of PM2.5, 11% of B(a)P, 7% of NOx and 8% of SOx.

The indicated emissions of substances were also used to estimate the required environmental effect of reductions from individual sources in the analysis of scenarios of actions. A detailed comparison of the emissions used in the Air Quality Plan, the Annual Air Quality Assessment and the Central Emission Inventory KOBIZE are given in Attachment 2 in Chapter 4.

Table 7. Summary of the amount of pollutant emissions released into the air in Malopolska Region in 2018<sup>35</sup>

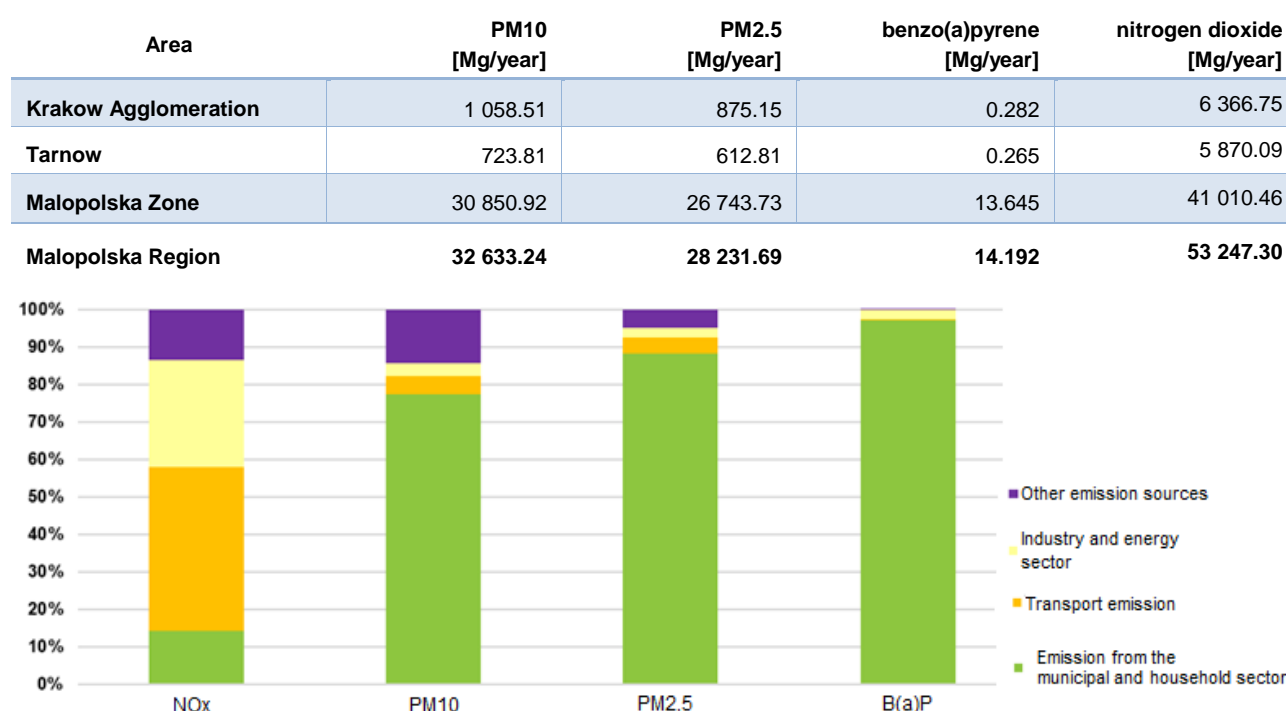


Figure 20. Emissions of PM10, PM2.5, benzo(a)pyrene and nitrogen dioxide by source types in the Malopolska region in 2018. <sup>36</sup>

<sup>35</sup> Source: Annual air quality assessment for the Malopolska Region for 2018.

<sup>36</sup> Source: Own study based on the Central Emission Inventory of The National Centre for Emissions Management (KOBIZE)



### 3.3.3. Impact of emission sources on air quality

The emissions of substances from each type of source shall be reflected in the concentrations from that source. To effectively implement actions, it is extremely important to determine which sources and from which area have the most significant impact on the concentration levels in the area where exceedances occur. Understanding the causes of exceedances is a key task in diagnosing air quality.

The annual air quality assessment shall generally identify the sectors of emission sources responsible for the occurrence of exceedances in the zones. The pollution dispersion modelling made it possible to indicate the areas where the concentrations of a given substance are determined by the sources originating in the Malopolska Region, broken down into:

- surface sources from the municipal and household sector from housing development,
- linear sources from national, regional, county and municipal roads,
- point sources from industrial emitters,
- other sources, including agriculture or fugitive sources.

The share of individual emission sources at the measuring station points was estimated in order to determine to what extent the emission sources located in the municipality in which the measuring stand is located influence the measurement results of a given substance concentration.

Surface sources are the main source of particulate matter and benzo(a)pyrene emissions, which is also visible in the concentrations occurring in the region.

Increased concentrations in dense urban development areas and areas with high population density are particularly noticeable. At urban background monitoring stations, concentrations from surface sources represent on average about 33% of the annual average concentration of PM<sub>10</sub> (*Figure 21*) and 85% of benzo(a)pyrene concentration (*Figure 22*). The share of these sources in the levels of nitrogen dioxide amounts only to 7.6% of the concentration at urban background monitoring stations (*Figure 23*).

In concentrations of PM<sub>10</sub> there is a significant share of sources from outside the region, constituting the total background. The average total background for PM<sub>10</sub> is about 13 µg/m<sup>3</sup>, therefore the lower PM<sub>10</sub> concentrations recorded at the stations, the higher the share of inflow from outside the region (*Figure 21*).

The share of the sum of emission sources located outside the county where the measuring station is located has also been allocated. The impact of neighbouring counties is significant in the case of Krakow, Szarow, Tarnow and Skawina, where the impact of neighbouring counties reaches 15 to 21% of the annual average concentration. Transport has the most significant impact on concentrations in cities, where it is responsible for 20-35% of the annual average concentration of PM<sub>10</sub>, especially at a traffic station (*Figure 21*). Sources from the transport sector are not responsible for high concentrations of benzo(a)pyrene in Malopolska.

Sources of fugitive emissions and agriculture have no significant impact on concentrations of PM<sub>10</sub> (*Figure 21*).

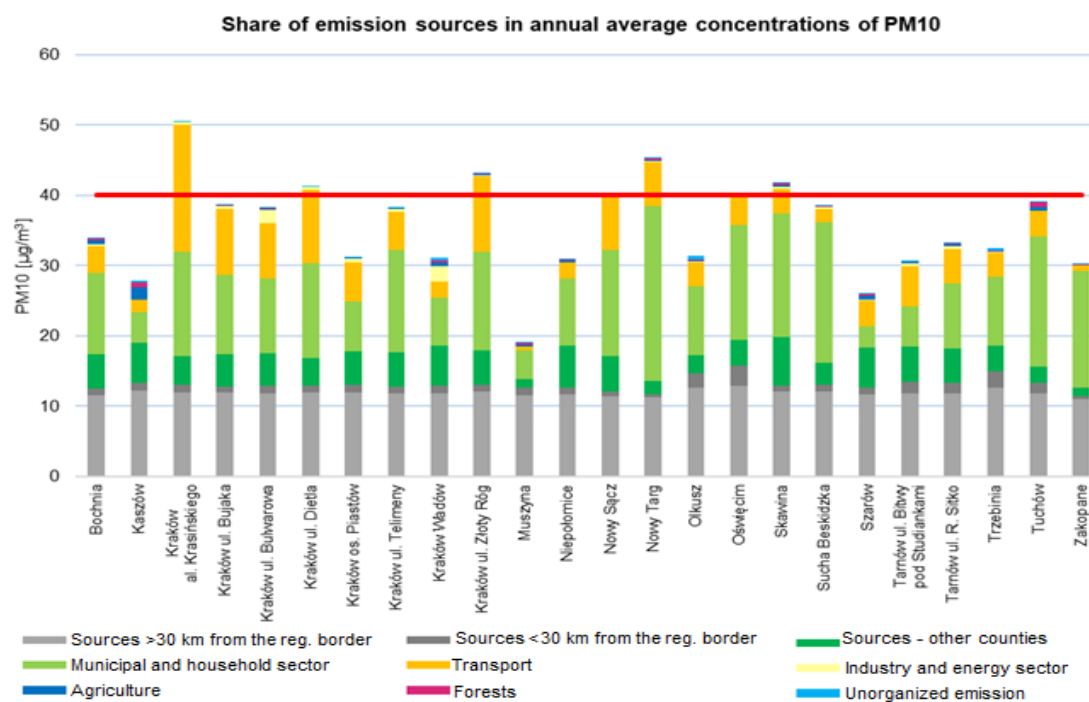


Figure 21. Share of emission sources in annual average concentrations of PM10 at measuring stations in the region in 2018<sup>37</sup>.

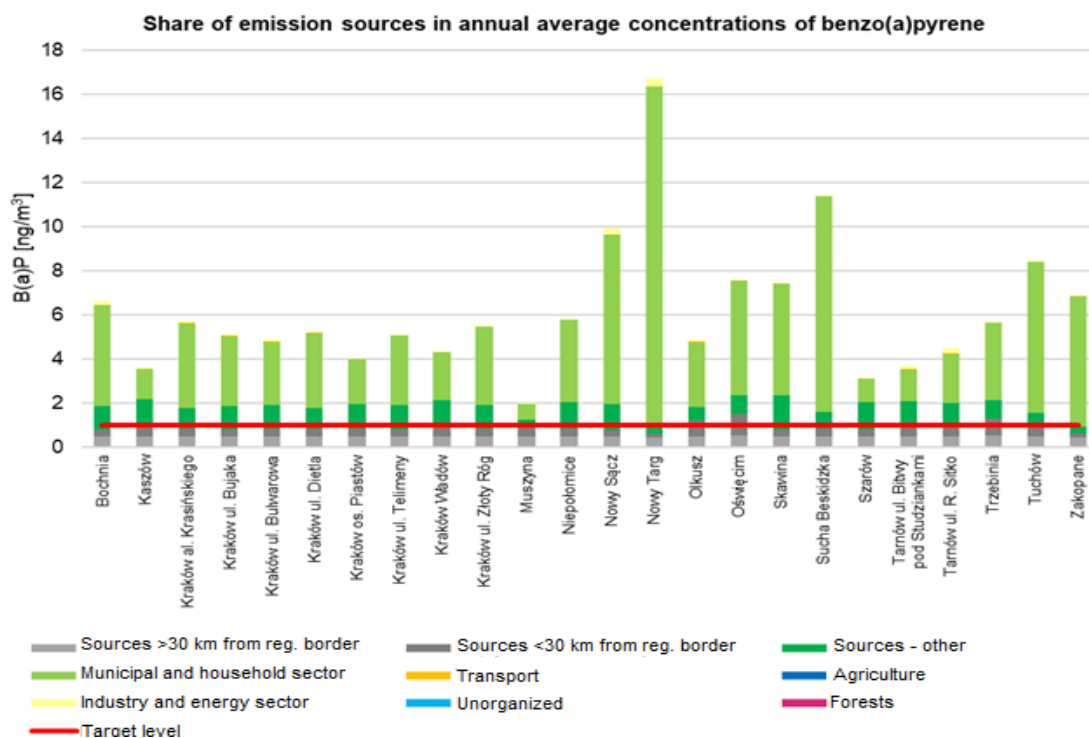


Figure 22. Share of emission sources in annual average concentrations of benzo(a)pyrene at measuring stations in the region in 2018<sup>38</sup>.

<sup>37</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A

<sup>38</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A

For annual average concentrations of benzo(a)pyrene, the share of sources outside the area where the station is located is up to 60% of the B(a)P concentration, which means that local activities need to be integrated with those in the whole region in order to achieve air quality improvement. In addition to the inflow of emissions from sources outside the zone, a significant share is held by local surface emissions, which account for 91% of the concentration in Nowy Targ. In such areas, the implementation of actions at the local level will have the effect of improving air quality, but, due to the scale of the exceedance, only in combination with actions at national and regional level.

Nitrogen dioxide is a substance strongly dependent on transport sources so they play the greatest role in shaping concentration levels in residential areas. The industry is not responsible for the occurrence of exceedances of permissible concentrations of nitrogen dioxide in Krakow. Its share reaches about 2%

of the annual average concentration. At urban background stations, the share of transport sources in nitrogen dioxide concentrations reaches on average 43% of the total concentration, while in Krakow, at transport stations, the share reaches 67-75%. Emissions from the municipal and household sector are responsible for about 7.6% of the nitrogen dioxide concentration in Krakow.

Other emission sources, such as agricultural emissions from crops and husbandry or fugitive emissions, are responsible for 2% of the annual average concentrations of PM10, and about 0.6% of the nitrogen dioxide concentrations recorded at measuring stations.

The share of sources from outside the region, affecting the concentration of nitrogen dioxide, is about 13-14%. The remaining area of Malopolska Region (other counties) also affects the level of nitrogen dioxide concentrations. The share of all sources from other counties amounts to 15.5% on average.

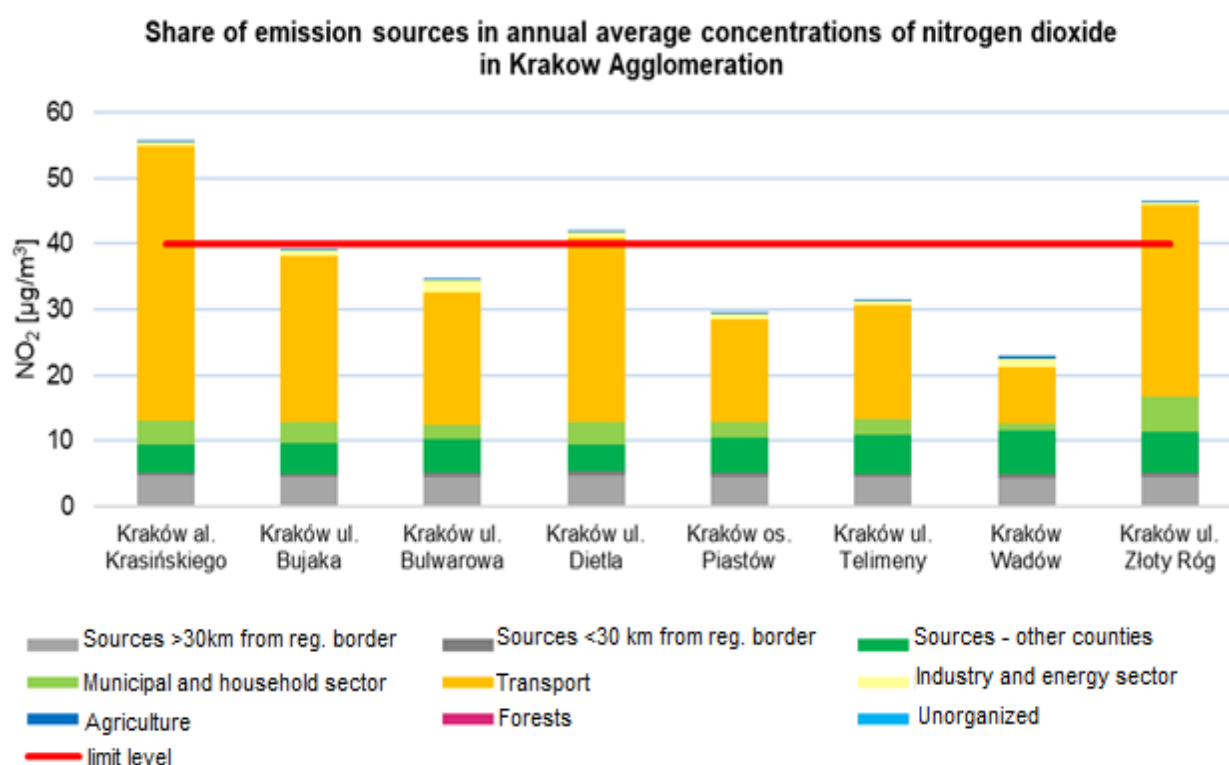


Figure 23. Share of emission sources in annual average concentrations of nitrogen dioxide at measuring stations in the Krakow Agglomeration in 2018.<sup>39</sup>

<sup>39</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A

## 4. Effects of exposure to pollutants

### 4.1. Impact on health

The impact of each pollutant depends on the emissions, the harmfulness of the substance and its level of interaction with other substances in the air. The impact also depends on the place of emission, the time the pollutant is in the atmosphere and, ultimately, where the pollutant reaches and how vulnerable the population or environment exposed to it is. Vulnerable people are most affected by poor air quality.

*The World Health Organisation places air pollution and climate change at the top of the 10 biggest threats to global health in 2019. According to WHO, air pollution causes 25% of deaths due to heart disease – in Malopolska 3,700 people could have died of it in 2018*

Air pollution is one of the main risk factors for public health, alongside cancer, heart disease and obesity. It causes more damage than passive smoking. The World Health Organisation review concluded that long-term exposure to air pollution reduces life expectancy by increasing the incidence of lung, heart and cardiovascular diseases.

Conditions caused or exacerbated by air pollution include asthma, chronic bronchitis, chronic heart disease (CHD) and stroke. These conditions significantly reduce the quality of life. It also means that people are less able to work and require more medical care, resulting in higher social costs and a burden on national health services.

Poor air quality can affect health at all stages of life. Children and the elderly are most vulnerable. In the case of children, there is evidence of reduced lung capacity, reduced birth weight, and even the effect of air quality on the intelligence quotient (IQ).

Increased exposure to air pollution throughout life can result in a reduction in life expectancy and

a deterioration in well-being at the end of life. There is also new evidence of a link between air pollution and the acceleration of cognitive decline.

The standards identified by the WHO as safe for health in terms of PM10 concentrations are 20 µg/m<sup>3</sup> for annual average concentration and 50 µg/m<sup>3</sup> for daily average concentration. For PM2.5 these values are 50% lower and amount to 10 and 25 µg/m<sup>3</sup> respectively.

Particularly high levels of pollution occur locally at the sources of their emissions, for example near busy roads, industrial installations or large clusters of single-family buildings. This exposure to high concentrations of pollutants is most likely to have direct negative social and health effects. This impact is cumulative, so the exposure of inhabitants to pollution should be reduced in all places and situations, at home, on the road, at school and at work.

While conducting research on the quality of life and human health, the World Health Organisation also examines the impact of air quality on the lives of residents of individual countries. According to a report<sup>40</sup> from September 2016, nine out of ten people live in an environment where the level of air pollution is excessive, which contributes to occurrence of strokes, heart disease and lung cancer, among others. **It is estimated that air pollution contributes to 3 million deaths annually worldwide.** In Europe, due to atmospheric pollution, life expectancy is reduced on average by 8.5 months.

According to estimates, air pollution is responsible for:

- 25% of deaths due to cardiovascular diseases,
- 43% of deaths due to respiratory diseases,
- 29% of deaths from lung cancer,
- 24% of deaths due to strokes.<sup>41</sup>

<sup>40</sup>Source:

[http://www.who.int/phe/health\\_topics/outdoorair/databases/cities/en/](http://www.who.int/phe/health_topics/outdoorair/databases/cities/en/)

<sup>41</sup> Source:

[https://www.who.int/gho/phe/outdoor\\_air\\_pollution/en/](https://www.who.int/gho/phe/outdoor_air_pollution/en/)

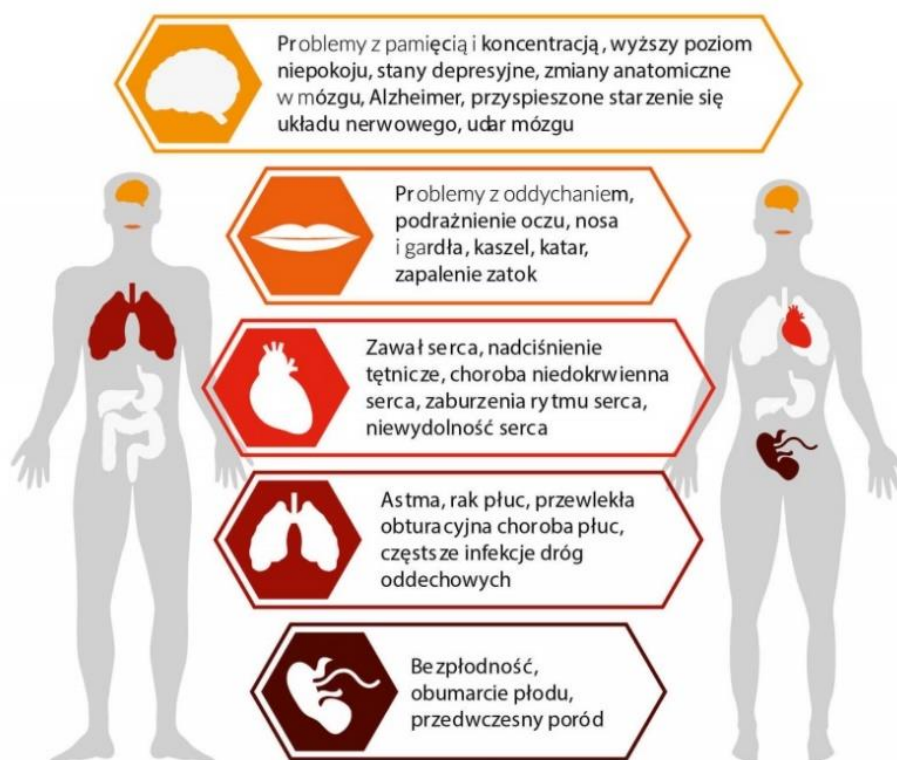


Figure 24. Impact of air pollution on human health<sup>42</sup>

### Air quality and the COVID-19 disease pandemic

New light on the issue of the impact of air quality on human health is also shed by observations made after the outbreak of the COVID-19 pandemic – a disease caused by the SARS-CoV-2 virus. The number of cases in the most polluted places in Europe and in the world prompted scientists to study the impact of air quality on both the scale of the disease and the course of the disease itself.

**The results of the analyses carried out by the scientists from Harvard University showed that even a small increase in the average long-term concentration of PM<sub>2.5</sub> leads to a huge increase in the risk of death from COVID-19 disease<sup>43</sup>.** In addition to cardiovascular disease, diabetes and smoking, lung damage that is caused by low-quality air breathing is an important risk factor.

Similar conclusions have been made by researchers from Denmark and Italy<sup>44</sup>. Prolonged exposure to air pollution leads to chronic inflammatory disease of the respiratory tract even in young and healthy people. Abnormal concentrations of pollutants should be considered as an additional factor increasing mortality in the analysed areas. The living conditions of the inhabitants, whose organisms have already been weakened by harmful substances present in the air, may lead to complications and more severe course of the COVID-19 disease.

Furthermore, Italian scientists have found that the genetic material of SARS-CoV-2 was present of more than a half of tested PM<sub>10</sub> samples (20 out of 34 samples). The authors conduct further research to confirm the initial conclusions, but also to determine how many virus particles can be transmitted through PM<sub>10</sub> dust and how long it remains able to infect<sup>45</sup>.

<sup>42</sup> Source: The influence of air pollutants on human health, The Krakow Smog Alert Association 2017

<sup>43</sup> Source: *Exposure to air pollution and COVID-19 mortality in the United States: A nationwide cross-sectional study*, Xiao Wu i in., T.H. Chan School of Public Health, Boston

<sup>44</sup> Source: *Can atmospheric pollution be considered a co-factor in extremely high level of SARS-CoV-2 lethality in Northern Italy?* Edoardo Conticini, Bruno Frediani, Dario Caro, Uniwersytet w Sienie, Uniwersytet w Aarhus

<sup>45</sup> Source: SARS-Cov-2RNA found on particulate matter of Bergamo in Northern Italy: First evidence, Leonardo Setti i in.



The scientific researches conducted so far show that air quality is one of the factors that can influence both the course of the disease and the percentage of cases lethal COVID-19. This is an extremely important fact in the context of the second wave of incidence forecasted by scientists in the autumn and winter, when pollution concentrations are the highest in the whole year. Experts note that in the view of a potential second wave of the COVID-19 epidemic

## 4.2. The cost of poor air quality

The Ministry of Entrepreneurship and Technology (currently The Ministry of Development) has commissioned an estimation of external health costs of the emission of pollutants from the municipal and household sector for 2016. The analysis focused on the effects of exposure to PM<sub>2.5</sub> particulate matter. The results indicate that in 2016, 19 thousand deaths can be attributed to emissions from the municipal and household sector.

Depending on the methodology adopted, external health costs nationwide were between EUR 12.9 and 30.0 billion in 2016. **In 2016, the external health cost of low-stack emissions per capita in Poland was between 300 and 800 euro.**

According to these data, the external costs of emissions from the municipal and household sector in the Malopolska Region in 2018 could amount to an estimated EUR 2 to 2.6 billion, or about PLN **8-11 billion**.

The effects of exposure to air pollution include:

- increased mortality,
- hospital visits caused by cardiovascular and respiratory diseases,
- emergency interventions caused by attacks of respiratory or cardiovascular diseases,
- absence from work or school,
- acute symptoms (cough, respiratory infections),
- costs of treating respiratory and cardiovascular diseases.

the anti-smog actions should be strengthened. **Actions related to the reduction of emissions and improvement of air quality are particularly urgent during the epidemic as they relieve the health service.**

The observations made to date should therefore be a driving force for even more intense efforts to protect the air, which may contribute to positive health effects not only in the long term, but also in the short term.

The analysis of the economic impact of poor air quality on a local scale was also carried out by the Malopolska Regional Development Observatory.<sup>46</sup> It showed that the level of air pollution translates into the level of sickness in the region. In terms of sickness absence related to exposure to polluted air, the citizens of Malopolska **lose from 2.05 million to 2.23 million working days a year** due to air pollution.

Most sick days are observed in January and February, i.e. the heating season. In turn, the worst month in 2015-2018 was January, which means that on average it is the worst period in terms of air quality and during this period the most lost work days attributable to air pollution occur. **The average annual cost of lost working days associated with the gross salary is PLN 400 million.**

The analysis allowed also for estimating for each county the average level of absence at work resulting from the group of diseases caused by air pollution per one employee. The group of counties with the highest average level of absence included: Nowy Sacz (5.23 days per person), Limanowski (5.13), Gorlicki (5.04), Chrzanowski (4.84), Miechowski (4.79) and Oswiecimski (4.74). The best situation in this respect was in the following counties: Proszowicki (3.31), Tatrzański (3.35), Wadowicki (3.6), Nowotarski (3.67) and in Krakow (3.67).

In addition, the analysis examined the impact of air quality on various industries, including the tourism industry. It was pointed out that air pollution in Malopolska has little impact on the functioning of these entities. However, among entrepreneurs operating in towns that are considered polluted among tourists, there are great fears of a decrease in the number

<sup>46</sup> The influence of air pollution on economic activities in Malopolska Region, Regional Development Observatory of the Malopolska Region,

[https://www.obserwatorium.malopolska.pl/wp-content/uploads/2020/06/Wp%C5%82yw\\_zanieczyszczenia\\_powietrza\\_na\\_dzia%C5%82alno%C5%9B%C4%87\\_gospodarcz%C4%85.pdf](https://www.obserwatorium.malopolska.pl/wp-content/uploads/2020/06/Wp%C5%82yw_zanieczyszczenia_powietrza_na_dzia%C5%82alno%C5%9B%C4%87_gospodarcz%C4%85.pdf)

of tourists. Poor air quality may discourage them from visiting the region in winter. Representatives of the tourism industry are afraid that without solving the problem of poor air quality they may lose more and more customers, because awareness about air quality is increasing. Such a trend may contribute to lowering the revenues resulting from tourist activities.

In the case of the outsourcing industry (information and communication, professional, scientific and technical activities), the impact of air pollution is very small. Despite the still occurring exceedances of air quality standards in Krakow, where a significant number of enterprises from this industry are located, the city of Krakow is perceived as effectively fighting smog, which causes no impact on recruitment processes. In addition, the number of days of sick leave due to air pollution in Krakow is one of the lowest in the region.

Table 8. Summary of the amount of external costs that can be avoided by reducing pollutant emissions from surface and linear emission sources in the Malopolska Region as part of the Air Quality Plan

The amount of external costs that can be avoided by reducing pollutant emissions	
Substance	The amount of external costs [PLN million/year]
Reduction of surface emission according to scenario 3	
PM2.5	1 422
PM10	80
NOx	3
Linear emission reduction	
NOx	89
PM2.5	19
PM10	0.5

It is possible to separate external costs resulting from emissions from the municipal and household sector and costs arising from emissions from transport. The national average costs of pollutant emissions from transport were based on the data contained in Table 14 of the *Handbook on the external costs of transport*<sup>47</sup> (data for 2016). With respect to emissions from the municipal and household sector, the unit costs indicated in the study *Internalization of external costs in Lithuania and Poland* were adopted using the analysis of external costs for 2020.

The tables below show costs incurred in 2018 due to poor air quality, and the costs that can be avoided annually after the implementation of proposed actions according to the scenarios selected for implementation under the Program, i.e. scenario 3.

Table 9. List of external costs in 2018 which are incurred due to the emission of pollutants from surface and linear sources in Malopolska Region.

The amount of costs incurred due to poor air quality in 2018	
Substance	The amount of external costs [PLN million]
Surface emission	
NOx	333 <sup>48</sup>
PM2.5	2 830
PM10	141
Linear emission	
NOx	1 657
PM2.5	1 674
PM10	40

<sup>47</sup> Source: Handbook on the external costs of transport, ver.2019, European Commission, January 2019, <https://ec.europa.eu/transport/sites/transport/files/studies/internalisation-handbook-isbn-978-92-79-96917-1.pdf>

<sup>48</sup>Total cost of impact on health, changes in biodiversity and impact on buildings.

After the implementation of planned actions, i.e. reduction of particulate matter and nitrogen oxide emissions, it is possible to obtain financial benefits resulting from the reduction of external costs of poor air quality thanks to the implementation of actions in the municipal and household sector and transport. Total financial savings may amount to **PLN 1.6 billion per year in the Malopolska Region** (Table 8).

The total value of external costs incurred, resulting from the current level of pollution emissions **may reach PLN 6.7 billion** (Table 9).

In addition to the benefits expressed as financial savings, it is also possible to indicate health benefits resulting from the implementation of actions specified in the Plan. The analysis of the impact of the implementation of the proposed scenarios of actions on health was carried out by the European Clean Air Center<sup>49</sup>. As part of it, the number of avoided health effects per year compared to the base year 2018 was determined.

The highest health benefits per year are achieved in the case of scenario 5, i.e. achieving levels recommended by the World Health Organization. The implementation of the measures proposed in it would avoid over 1,800 deaths per year in Malopolska. The authors of the analysis indicate that scenario 5 should be the long-term goal of the air protection strategy. **In the short term, however, full implementation of the anti-smog resolution should be ensured. The analysis indicates that achieving this goal avoids over 1,400 deaths per year.** Therefore, emphasis should be placed on the decommissioning of non-class boilers by the end of 2022 and class 3 and 4 boilers by the end of 2026, which is the goal of Scenario 3 selected for implementation.

---

<sup>49</sup> Source: „Health analysis of variants of the draft Air Quality Plan for the Malopolska Region 2020, Łukasz Adamkiewicz, Dominika Mucha, Warszawa, April 2020

## 5. Previous actions

### 5.1. Actions at local level

Limiting emissions in the Malopolska Region was one of the key tasks carried out by local governments of municipalities and cities in the years 2016-2018. Due to the objectives set for the improvement of air quality in the whole region, two important resolutions were adopted, resulting in the intensification of activities to reduce emissions from fuel combustion.

In 2016, the Regional Assembly of the Malopolska Region adopted the Anti-smog Resolution for the city of Krakow (Resolution No. XXXII/243/16 of the Regional Assembly of the Malopolska Region of 15 January 2016) that bans the use of solid fuels in boilers, stoves or fireplaces as of 1 September 2019.

At the beginning of 2017, an anti-smog resolution for the remaining area of Malopolska was also adopted (Resolution No. XXXII/452/17 of the Regional Assembly of the Malopolska Region of 23 January 2017), prohibiting the installation of new boilers and fireplaces that do not meet ecodesign requirements in terms of emissions and energy efficiency and the use of coal sludge and flotoconcentrates. A transitional resolution was also adopted for Krakow, prohibiting the use of poor quality coal until the end of August 2019.

In 2016-2018, a total of 33,406 solid fuel boilers were liquidated in Malopolska. The number of replacements increases every year – 7,333 boilers were liquidated in 2016, 10,081 boilers in 2017 and 15,992 boilers in 2018. Of this, 14,644 devices were liquidated in Krakow itself (Figure 25). In the years 2016-2018, the gas network was significantly expanded. The increase in the length of the gas network in Malopolska amounted to 1145.31 km. As a result of the implementation of the activity, as many as 58 267 users were connected to the gas network. Most connections were made in Wieliczka (14 487) and Krakow (13 708).

Among the activities in the field of improving energy efficiency, thermo-modernization was carried out in 2,650 buildings.

The number of renewable energy sources installations was gradually increasing. 3 165 installations have been built in the entire region, of which the most were installed in 2017. The largest percentage of applications for funding for renewable energy sources concerned the installation of photovoltaic panels in 2017 and heat pumps in 2018.

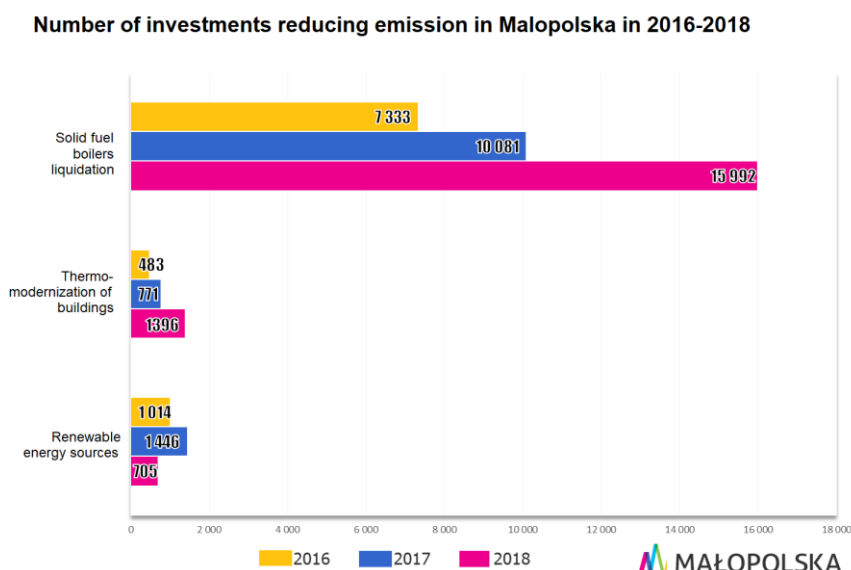


Figure 25. Number of investments limiting emissions in Malopolska in 2016-2018.<sup>50</sup>

<sup>50</sup> Based on the annual reports on the implementation of Air Quality Plan for the Malopolska Region



In the years 2016–2018, the total length of heating networks in the region increased by 85.67 km. Most networks were commissioned in Krakow (49.9 km), as well as in Zakopane (7.76 km) and in Tarnow (7.73 km). Within the framework of activities related to the Air Quality Plan and the adopted anti-smog resolutions, waste and plant incineration controls were carried out. On a total of approx. 39 thousand audits, 3.4 thousand cases of non-compliance were detected (8.9%). The fines were imposed in the total amount of PLN 234 thousand. 138 cases were taken to court.

With regard to the implementation of the resolutions introducing restrictions on the use of solid fuels in the Malopolska Region in 2017-2018, approximately 24,633 checks on their compliance were carried out, of which 868 cases of non-compliance were detected. As a result of the fines imposed, 10 cases were taken to court, while the amount of the fines was over PLN 30 thousand.

From the beginning of 2017 to August 2019, data on more than 160 thousand Malopolska heating sources were entered into the Inventory Database for Heating Sources for Buildings in Malopolska. It is estimated that this represents about 28% of all units that should be included in the inventory.

In Malopolska there are 13 Park&Ride car parks and 7 Bike&Ride car parks. Between 2016 and 2018, 27.46 km of bypasses and alternative roads transferring vehicle traffic from the city centre were put into operation.

The county offices carried out over 1.3 thousand inspections of vehicle diagnostic stations, out of which 122 cases of irregularities were detected in the area of emission tests or vehicle technical condition.

In 2016-2018, a total of approximately 3.5 thousand actions or educational campaigns on air protection were organised in municipalities and counties of the Malopolska Region, in which more than 1 million inhabitants took part.

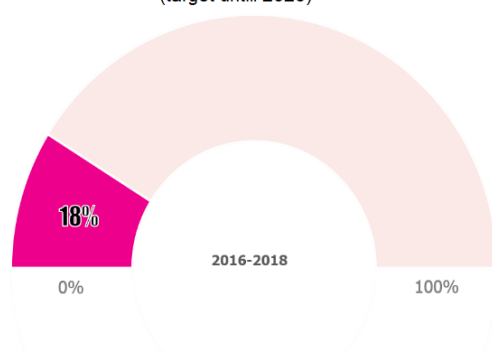
On a regional scale, 171 municipalities indicated that they had adopted a Low-Carbon Economy Plan, 141 of the municipalities included tasks related to low-stack emission reduction. The assumptions for the plan or the plan for the supply of heat, electricity and gas fuels were adopted in 97 municipalities.

The total cost of implementation of actions relating to the implementation of the Air Quality Plan in 2016-2018 amounted to PLN 2.75 billion, including among others:

- **PLN 437.1 million** was spent on thermal modernization of buildings,
- **PLN 388 million** was spent on liquidation of old heating devices,
- **PLN 264 million** was spent for expansion and modernization of heating networks,
- **PLN 85.52 million** was spent for RES-related investments,
- **PLN 50 million** was allocated for the expansion of gas networks,
- **PLN 13.7 million** was allocated for inspections on the compliance with the anti-smog resolutions and controlling waste incineration,
- **PLN 100.3 million** to expand the restricted access zone and limited paid parking together with a system of "Park and Ride" car parks, as well as traffic optimization in cities,
- **PLN 668.2 million** to maintain roads in a way that limits the secondary emission of pollutants through regular washing, repairs and improvement of the condition of road surfaces,
- **PLN 614.5 million** was allocated for the development of public transport, including the purchase of modern buses,
- **PLN 101.3 million** was allocated for the development of bicycle communication,
- **PLN 7.9 million** was allocated for environmental education in municipalities.

The actions taken under the air Quality Plan throughout the region in 2016-2018 allowed the reduction of PM10 emissions at the level of 1,045.2 Mg and PM2,5 at the level of 955.8 Mg. The degree of reduction of pollutant emissions compared to the target assumed by the end of 2019 was 17.74% for PM10, 16.85% for PM2.5 and 17.62% for BaP.

### Level of implementation Air Quality Plan for Malopolska (target until 2020)



## 5.2. Actions at regional level

In 2018, the Malopolska Region received a positive assessment of the Supreme Audit Office for the anti-smog actions undertaken so far. In particular, the Air Quality Plan for the Malopolska Region was appreciated, which clearly defines, among other things, the initial state of air quality, proposes specific actions and presents the expected environmental effects.

Since 2015, the Malopolska Region has been coordinating the LIFE Integrated Project "Implementation of Air Quality Plan for Malopolska Region – Malopolska in a healthy atmosphere", co-financed by the LIFE Programme of the European Union. Within its framework, there are 60 Eco-managers operating in the region on a continuous basis, whose aim is to take actions for full and faster implementation of the Air Quality Plan for the Malopolska Region.

By the end of 2018, the Eco-managers:

- distributed 607.1 thousand leaflets, 14.1 thousand posters and 66.5 thousand other educational materials;
- organised more than 1,030 meetings in schools or kindergartens, attended by 44.9 thousand students;
- organised 259 competitions on air protection, in which 11.9 thousand people took part;
- organized 639 meetings with residents, attended by 41.1 thousand people;

- organized 1,634 meetings with local leaders, attended by 9.2 thousand people;
- organised 483 other events, e.g. shows of low-emission boilers, attended by 183.9 thousand people.

As part of the Regional Operational Programme of the Malopolska Region for the years 2014-2020, a call for applications for the replacement of boilers, thermo-modernization of buildings and development of heating networks was conducted. Over PLN 88.3 million (most in 2018 – PLN 82 million) was allocated from ROP funds in 2016-2018 for the replacement of heating sources in municipalities of the region and PLN 16 million for the installation of renewable energy sources in the region. The funds were also allocated for the expansion of the heating network (PLN 48 million) and the expansion of the gas network (PLN 0.13 million). EU funds were also used to increase the energy efficiency of buildings in the region. Investments related to thermo-modernization were carried out with the share of PLN 95 million from ROP funds.

However, the largest pool of EU funds from the ROP was allocated to the development of public transport in the analysed period. ROP funds in investments in the development of communication constituted 47% of the total costs, i.e. a total of PLN 289 million. The costs of environmental education financed from the ROP funds constituted about 14% of the total costs, i.e. about PLN 1.1 million.

## 5.3. Conclusions from previous actions

The Air Quality Plan in force indicated which of the actions were the most effective, but its implementation was less rapid than assumed. Only in Krakow, with the huge involvement of the city of Krakow, was it almost 100% successful to achieve the assumed goal of replacing outdated boilers.

Accelerating the replacement of heating devices that do not meet the requirements of the anti-smog resolution requires greater involvement of all local authorities. It is necessary to use existing government programmes, especially the Clean Air Program and the municipalities' own resources.

Despite growing public awareness, the activities of non-governmental organisations and a number of control and educational activities, there is still social acceptance for burning municipal waste or coal waste. Not all local governments carry out control activities despite the obligation resulting from Article 379 of the Environmental Protection Law.

Intensive educational and informational activities should be carried out with regard to the requirements of the anti-smog resolution and available

ecological solutions. For those who, for economic reasons, are unable to replace their heating, support programmes for the poorest residents should be launched.

The involvement of municipalities in the implementation of actions is essential, as only the cooperation between municipal, county and regional authorities will allow effective implementation of air quality improvement strategies at all levels.

## 6. Clean Air Actions

---

Proposed actions are based on full implementation of the so-called anti-smog resolutions for Krakow and Malopolska and maximum use of available financial resources from government programmes: Clean Air, Stop Smog, and thermo-modernization tax relief.

Five scenarios of actions to reduce emissions from the municipal and transport sectors have been analysed. From among the analysed options, an optimal set of actions was selected in terms of environmental effect, costs and giving the opportunity

to achieve the fastest possible significant improvement in air quality. A detailed analysis of possible options of actions to reduce emission was included in the AQP Attachment 2 to the resolution.

According to the chosen course of action, it is assumed that the limit values for PM10 and PM2.5 will be reached by 2023. In order to achieve the target value of benzo(a)pyrene and the limit value of nitrogen dioxide, all actions are planned to be implemented by 2026.

### Action 1. Low-stack emission reduction and improvement of energy efficiency

---

The main objective of the action is to fully implement the requirements of anti-smog resolutions for Malopolska and Krakow, as well as to improve energy efficiency of buildings and increase the use of renewable energy sources.

#### Tasks to be implemented

##### Tasks of all public institutions:

1. When public funding is provided for solid fuel heating installations up to 1 MW, the public authorities shall provide:

- financing from 1 January 2021 only for biomass installations<sup>51</sup>,
- financing from 1 January 2023 only for biomass installations with particulate matter emission factor up to 20 mg/m<sup>3</sup> (at 10% of O<sub>2</sub>),
- the use of buffer tanks as mandatory for boilers with manual fuel feeding (gasification boilers) and recommended for boilers with automatic fuel feeding. The minimum capacity of the buffer tanks should be in accordance with the technical documentation of the boiler.

In addition, preferences in the form of higher funding for heat pumps, photovoltaic panels,

solar collectors, heating installations connected to geothermal heating plants and biomass boilers with particulate emission factor up to 20 mg/m<sup>3</sup> (at 10% O<sub>2</sub>) should be ensured.

2. The municipality, county and the region are obliged to ensure that from 1 January 2023 at least 50% and from 1 January 2025 100% of electricity consumed during the year by its public buildings will come from renewable sources<sup>52</sup>. The goal can be achieved by:

- investment in own installation generating electricity from renewable energy sources,
- purchase of energy certified with a guarantee of electricity origin from renewable sources or conclusion of a direct PPA (Power Purchase Agreement) with an energy producer with RES,
- participation in an energy cluster or an energy cooperative that produces electricity from RES,
- leasing of installations or purchase of energy from cooperatives or enterprises investing in RES on municipal facilities,
- purchase or lease of a virtually operated RES installation.

---

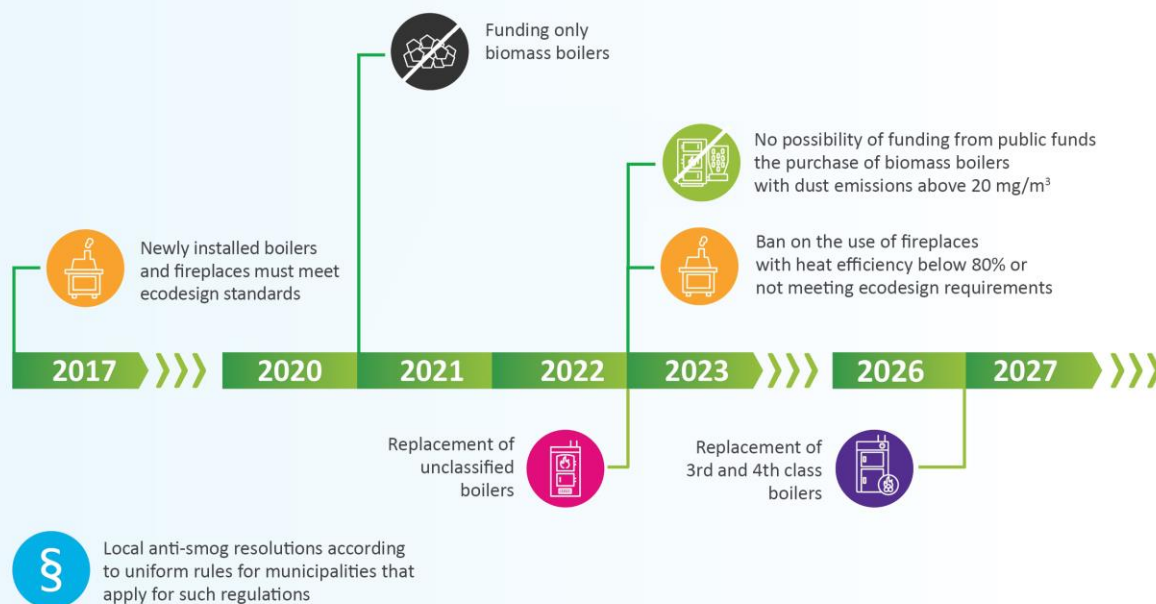
<sup>51</sup> Excluding ongoing projects

<sup>52</sup> The requirement refers to the total electricity consumption of all public buildings owned by a municipality, county, the region



## Towards a healthy atmosphere

### REQUIREMENTS FOR SOLID FUELS



#### Tasks of heads of the municipalities, mayors, city presidents, and municipal councils:

1. Establishment of the Clean Air Program information point based on the agreement with the Regional Fund for Environmental Protection and Water Management in Krakow until 1 January 2021 and its further maintenance.
2. Employment until 30 September 2021 and maintenance of the position of an Eco-manager. In municipalities with a population of up to 20 thousand inhabitants at least 1 Eco-manager should be employed, in municipalities with a population of over 20 thousand inhabitants – at least 2 Eco-managers, in municipalities with a population of over 50 thousand inhabitants – at least 3 Eco-managers, in the case of the municipalities with a population of over 500 thousand inhabitants – at least 6 Eco-managers.

#### The support for employment costs of Eco-managers from the ROP funds for 2021-2027 is envisaged.

The tasks of the Eco-managers will, among others, include:

- advisory for residents in the field of RES technologies, heating sources, co-financing programmes and requirements of the anti-smog resolution,
- environmental education at the local level in the field of air protection,
- the Clean Air Program management, initiating and management of investments under the Stop Smog Program.

3. Conducting, in municipalities covered by the anti-smog resolution for Malopolska<sup>53</sup>, an information campaign on the requirements of the resolution and the available forms of co-financing for heating source replacement. From 2021, the municipality is required to provide information at least once in each half year to each address point where the solid fuel installation is operated (applies to residential and non-residential buildings).
4. By 31 October 2020 the following information should be published on the official website of the municipality (prominently displayed on the main page):
  - current air quality and the degree of air pollution danger (if introduced),
  - link to the Eco-intervention application (possibility of reporting violation of environmental protection provisions),
  - link to information about the Clean Air Program.
5. Conducting an inventory of heat sources and installations of renewable energy sources in residential, non-residential and public buildings in the municipality:
  - at least 70% of buildings by the end of 2021,
  - at least 90% of buildings by 30 June 2022.

The data should be entered in the electronic Inventory Database for Heating Sources of Buildings in Malopolska.

After launching Central Building Emission Register<sup>54</sup>, cooperation with chimney sweepers and county buildings inspectorates should be undertaken in order to make a full inventory of the solid fuel sources.

It is necessary to provide an ongoing update of the inventory database on the basis of data provided by building owners and managers as well as obtained as part of the controls carried out.

6. Conducting intervention inspections in the field of compliance with air protection regulations<sup>55</sup> by the municipal or inter-municipal guards, authorized municipal employees or in cooperation with the police.
  - a) Intervention inspections (reactions to notifications of infringements) should be carried out within 12 hours from the notification.
  - b) In the case of notifications made by the Eco-intervention application administered by the Marshal's Office, information on the actions taken and the results of the inspection should be updated within 3 working days from the inspection.
  - c) In case of at least 10% of conducted intervention inspections per year, an ash sample should be collected and ordered to be tested<sup>56</sup>.
  - d) Intervention inspections should be combined with updating data in the database of heating sources.
7. Conducting planned inspections in the field of compliance with air protection regulations by the municipal or inter-municipal guards, authorized municipal employees or in cooperation with the police.
  - a) Planned inspections in 2020 should cover:
    - 20 buildings in municipalities with up to 10,000 inhabitants,
    - 40 buildings in municipalities with a population between 10,000 and 20,000,

<sup>53</sup> Resolution No. XXXII/452/17 of the Regional Assembly of the Malopolska Region of 23 January 2017 on the implementation of restrictions and bans which relate to operation of fuel combustion installations on the territory of the Malopolska Region (so called anti-smog resolution for the Malopolska Region)

<sup>54</sup>Central Building Emission Register gathering uniform and coherent data across the country regarding emission sources in the municipal and household sector

<sup>55</sup> In the field of the thermal treatment of wastes and the implementation of the so-called "anti-smog resolutions"

<sup>56</sup> It is not applicable to intervention inspections which are conducted by the municipality of Krakow

- 80 buildings in municipalities with a population between 20,000 and 50,000,
  - 200 buildings in municipalities with more than 50,000 inhabitants.
- b) Planned inspections in 2021 and 2022 should annually cover:
- 60 buildings in municipalities with up to 10,000 inhabitants,
  - 100 buildings in municipalities with a population between 10,000 and 20,000,
  - 200 buildings in municipalities with a population between 20,000 and 50,000,
  - 500 buildings in municipalities with more than 50,000 inhabitants.
- c) Planned inspections from 2023 should annually cover:
- 120 buildings in municipalities with up to 10,000 inhabitants,
  - 200 buildings in municipalities with a population between 10,000 and 20,000,
  - 400 buildings in municipalities with a population between 20,000 and more and 50,000,
  - 1,000 buildings in municipalities with a population of over 50,000
- d) In view of the anti-smog resolution applicable in the municipality of Krakow<sup>57</sup>, planned inspections there should each year cover all buildings in which individual solid fuel heating sources are still in operation.
- e) Planned controls should be combined with updating data in the database of heating sources.
- f) By 30 September 2021 municipalities should prepare an internal procedure for conducting inspections of heating sources in terms of compliance with the anti-smog

resolution and the ban on waste incineration<sup>58</sup>. The procedure should be prepared in accordance with the guidelines provided by the Marshal's Office of the Malopolska Region.

8. Preparation of an analysis of the problem of energy poverty in the municipality by 30 June 2022, in accordance with the guidelines prepared by the Marshal's Office:
  - Preparation of a database of people who meet the requirements of the Stop Smog Program.<sup>59</sup>
  - Identification of investment needs in the scope of replacement of heat sources and thermo-modernization in buildings where the abovementioned persons live.
9. Support for residents affected by energy poverty:
  - It is recommended to launch a shielding programme in the form of subsidies for higher heating costs.
  - It is recommended to implement the Stop Smog Program by the municipality through subsidising boiler replacement and thermo-modernization.
10. As part of the update of the study on conditions and directions of spatial management of the municipality, the municipality should identify and designate areas that, for technical and legal reasons, may be designated for facilities generating energy from renewable energy sources with a capacity exceeding 100 kW. The case of lack of such areas should also be indicated in the study.
11. It is recommended that from 2021, within the municipality's budget, at least 1% of own revenues is allocated to activities related to air protection, among others including:

<sup>57</sup> Resolution No. XXXII/243/16 of the Regional Assembly of the Malopolska Region of 15 January 2016 on the implementation of restrictions which relate to operation of fuel combustion installations on the territory of the City of Krakow (so called anti-smog resolution for Krakow)

<sup>58</sup> By the time an internal procedure for conducting inspections of heating sources is prepared, it is recommended to conduct

inspections in accordance with "[The guidelines for conducting inspections of residential furnaces](#)" prepared by Institute for Chemical Processing of Coal and Frank Bold Foundation

<sup>59</sup> According to Article 11d paragraph 1, points 1-4 of the Act on supporting thermomodernization and renovation (Journal of Laws of 2020, item 412) or further changes in the program's criteria

- employment of Eco-managers, establishment and service of the Clean Air Program information points,
- implementation of subsidy programs supporting the Clean Air Program and shielding programs for people affected by energy poverty,
- inspections regarding violations of air protection regulations,
- educational and information activities regarding air protection,
- inventory of building heating sources in the municipality,
- thermomodernization of public buildings or installation of renewable energy sources.

12. The municipalities covered by the anti-smog resolution for Małopolska<sup>60</sup>, through activities carried out by them, should lead to the situation when the number of installed heating devices that do not meet the requirements of the anti-smog resolution:

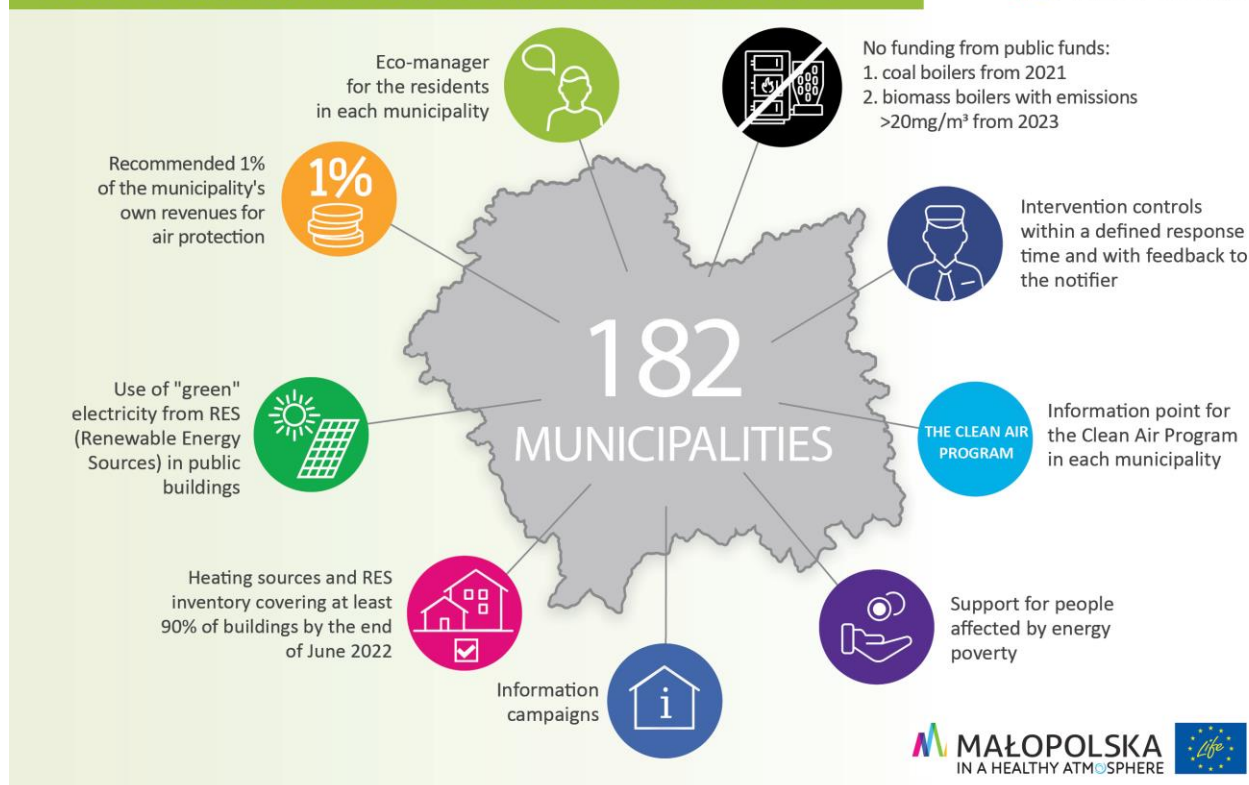
- from 1 January 2023 will not exceed 15% of all heating devices installed in the municipality,
- from 1 January 2027 will not exceed 3% of all heating devices installed in the municipality.

The abovementioned does not exempt entities subject to the anti-smog resolution<sup>60</sup> from compliance with its provisions, i.e. from a full adjustment to its requirements within the prescribed deadlines. It also does not release inspection bodies from the obligation to enforce the requirements of the anti-smog resolution.

## Towards a healthy atmosphere

### NEW TASKS OF MAŁOPOLSKA MUNICIPALITIES

*eko*  
MAŁOPOLSKA



<sup>60</sup> Resolution No. XXXII/452/17 of the Regional Assembly of the Małopolska Region of 23 January 2017



### Tasks of county governors:

1. Hiring until 31 June 2021 at the latest and maintaining a position of at least one Climate Eco-manager. The responsibilities of the Climate Eco-manager include:

- coordination of municipalities' activities in the field of RES use and energy-efficient construction,
- cooperation with municipalities and the Marshal's Office,
- exchange of experience and good practices of municipalities in the county area,
- initiating joint activities, projects and educational actions in municipalities,
- consulting services for municipal Eco-managers on the use of RES and energy-efficient construction,
- technical support for municipalities in implementing climate neutrality for schools and public buildings.

Support from the LIFE Programme is envisaged.

2. By 31 October 2020 the following information should be published on the county official website (prominently displayed on the home page):

- current air quality and the degree of air pollution danger (if introduced),
- link to the Eco-intervention application (possibility of reporting violation of environmental protection provisions),
- link to information about the Clean Air Program.

3. Conducting an information campaign on the requirements of anti-smog resolutions as part of issuing building permits and accepting building notifications.

4. It is recommended to allocate from 2021 within the county budget at least 0.5% of own revenues for activities related to air protection, including, among others:

- employment of Climate Eco-managers,
- support for municipalities in the implementation of tasks in the field of air protection,

- inspections regarding infringements of air protection regulations by entrepreneurs,
- educational activities regarding air and climate protection, renewable energy promotion, promotion of sustainable transport,
- thermomodernization of public buildings and installation of renewable energy sources.

### Tasks of County Buildings Inspectors:

1. Cooperation with heads of the municipalities, mayors and city presidents on inventorying heat sources and renewable energy installations in municipalities.

### Tasks of the Management Board of the Malopolska Region and the Regional Assembly of the Malopolska Region:

1. Ensuring co-financing of investments in the field of air protection from the Regional Operational Programme for 2021-2027:

- Co-financing of employment of Eco-managers in municipalities.
- Co-financing of equipment for inter-municipal guards carrying out inspections in the field of compliance with environmental protection regulations,
- Investment financing preferences for the most ambitious municipalities, i.e. those achieving the highest AQP implementation rates,
- Investment financing preferences for municipalities subject to additional restrictions in the field of operation of solid fuel devices (local anti-smog resolutions).

2. Preparation and adoption of resolutions introducing, at the municipalities' request, restrictions on the operation of installations in which fuel is burned (based on the Article 96 of the Environmental Protection Law).

- Developing by 31 March 2021 unified rules for implementing the regulations in order to maintain a consistent approach at the regional level.

- In case of covering installations operating in a municipality by the requirements of environmental protection based on the Article 154 of the Environmental Protection Law (i.e. emission requirements ensuring achievement of limit and target values of pollutants in the air), the municipality is allowed to apply for an exemption for the abovementioned installations from the provisions of the anti-smog resolution.
3. Support for the implementation of tasks of other units and bodies in the field of air protection:
- Administration of the Eco-Intervention application for reporting violations of environmental law.
  - Administration of the Inventory Database for Heating Sources of Buildings in Malopolska. Export of the database to the Central Building Emission Register at the moment of its launch.
  - Providing guidelines for preparation of a database of people affected by energy poverty in a municipality by 31 June 2021.
  - Organization of at least 6 trainings a year for employees of municipalities and counties on topics related to, among others air and climate protection, renewable energy sources and co-financing programs for the replacement of high-emission heating sources.
  - Developing substantive and graphic educational materials related to the subject of air and climate protection and making their graphic designs available to all local government units and other interested entities.
4. Coordination and monitoring of the implementation of the Air Quality Plan and anti-smog resolution, including:
- Preparation and publication by 31 May of each year of a report on the state of implementation of the Air Quality Plan and implementation of the anti-smog resolution in the Malopolska Region for the preceding year.
  - Performing by 31 December 2021 an analysis of technological possibilities of adapting agricultural activity, smoke-house and traditional bread baking to the requirements of the anti-smog resolution.
  - Preparation by 31 December 2021 a guide book on financing the adaptation of agricultural activity to the air and climate protection priorities within the financial resources of the EU 2021-2027 financial perspective.
  - Ordering by 31 December 2021 dust composition tests in order to identify its origins. The analysis should include the heating season and the period outside the heating season.
  - Conducting at least once a year an educational and information campaign on a regional scale on topics related to air and climate protection.
  - Preparation of a renewable energy sources potential map for the area of the Malopolska Region by 31 December 2023.
  - Ordering and coordinating by 30 June 2022 technical and economic analysis regarding the possibility of introducing a total ban on burning solid fuels in the health resorts of the Malopolska Region with preference for the use of renewable energy sources, district heating and gas network.
  - Preparation of guidelines for the procedure of inspecting furnaces in terms of compliance with the anti-smog resolution and the ban on waste incineration by 31 March 2021.
5. Cooperation with the National Fund for Environmental Protection and Water Management and the Regional Fund for Environmental Protection and Water Management in Krakow:
- organization of information meetings and trainings for employees of municipalities and counties regarding current and future financial programs, in particular the Clean Air Program,

- creating and sharing information materials regarding the conditions of co-financing programs to be used at service points of the Clean Air Program,
  - cooperation in obtaining support from the ELENA Program to support the implementation of the Clean Air Program in municipalities.
6. Coordination of the energy transformation process and the use of the funds of the Just Transition Fund (JTF):
- preparation of a territorial just transition plan,
  - cooperation in developing projects that will be implemented under JTF.
7. Carrying out activities aimed at supporting and accelerating legal changes at the national level, which will make it possible to cover agricultural activities, smokehouses and traditional baking of bread with the obligation of notification (as part of the procedure of reporting installations introducing gases or dust into the air, from which emission does not require an emission permit) in order to exclude them from the requirements of the anti-smog resolution.
8. It is recommended to allocate from 2021 within the region's budget at least 0.5% of own revenues for activities related to air and climate protection, including, among others:
- information and education activities in the field of air protection and climate protection,
  - substantive support for municipalities and counties in the scope of implementation of tasks resulting from the Air Quality Plan,
  - implementation of actions designated in the Air Quality Plan.

9. Conducting, throughout the whole period of implementation of the air quality plan, a wide-ranging social campaign to raise awareness of people of the obligations arising from the anti-smog resolution for Malopolska and to encourage them to the replacement of heat sources that do not meet the requirements of this resolution.

**Tasks of entities using the environment and natural persons who are not entities using the environment:**

1. Managers and owners of buildings are obliged to submit and make available information on heating devices and RES installations to the head of the municipality, mayor, city president for the purpose of the inventory of heating devices and RES installations in the municipality. The obligation includes:
- providing information on existing heating devices and RES installations together with the data required in the inventory related to those devices and installations,
  - providing information on the replacement or installation of new heating devices and RES installations together with the data required as part of the inventory of these devices and installations.

After the entry into force of the national regulations related to the Central Building Emission Register, the abovementioned obligations will be regulated by those regulations.

### Expected costs of implementing actions by 2026

[illegible]

### Sources of financing the activities

Central programmes (Clean Air, Stop Smog)	PLN 4 736,9 million
Regional programmes (ROP, LIFE, regional budget)	PLN 420.2 million
Municipal and county budgets (1% of the municipality's own revenues)	PLN 727.6 million
Beneficiaries of the AQP – residents of the Malopolska Region	PLN 1 777.4 million

### Expected results

The assumptions adopted to determine the reduction of emissions result from the selected option of actions at the scale of the voivodship based on the data adopted to estimate the volume of emissions in the municipalities of the Malopolska Voivodship. The following data were taken into account: the use of gas, district heating and RES networks to cover heat demand, the use of coal and wood in old and new devices. Based on the assumptions, it was determined how much the emission would change if the corrective actions specified in the scenario were applied. The estimated ecological effect of the emission reduction resulting from the activities carried out was estimated taking into account the change in the quality of the devices used in the forecast years, the change in the supply of heat in subsequent years, as well as the increase in the energy efficiency of residential and service buildings. Detailed assumptions for the analysis of options for implementing actions are included in Attachment 2 in chapter 17.4.

#### Estimated environmental effect (reduction of emissions) [Mg/year]

Year	2020	2021	2022	2023	2024	2025	2026	Total
<b>Krakov Agglomeration</b>								
<b>PM10</b>	116.39	116.39	145.49	145.53	-	-	-	523.80
<b>PM2.5</b>	107.05	107.05	133.81	133.82	-	-	-	481.73
<b>B(a)P</b>	0.05	0.05	0.07	0.07	-	-	-	0.24
<b>NO<sub>2</sub></b>	19.86	19.86	29.79	29.79	-	-	-	99.30
<b>Tarnow City Zone</b>								
<b>PM10</b>	16,30	65,21	130,42	55,43	2,28	2,28	2,28	274,20
<b>PM2.5</b>	13,58	54,32	108,65	46,17	1,90	1,90	1,90	228,42
<b>B(a)P</b>	0,006	0,026	0,052	0,022	0,001	0,001	0,001	0,109
<b>NO<sub>2</sub></b>	1,69	6,78	13,56	5,76	0,24	0,24	0,24	28,51
<b>Malopolska Zone</b>								
<b>PM10</b>	636,34	2 545,36	5 090,72	2 163,55	89,09	89,09	89,09	10 703,24
<b>PM2.5</b>	553,00	2 211,98	4 423,96	1 880,18	77,42	77,42	77,42	9 301,38
<b>B(a)P</b>	0,31	1,23	2,46	1,05	0,04	0,04	0,04	5,17
<b>NO<sub>2</sub></b>	-4,21	-16,83	-33,66	-14,31	-0,59	-0,59	-0,59	-70,78



### Planned impact on concentration levels in the year of Air Quality Plan completion

Measuring stations where the highest concentrations are recorded	PM10 Annual average concentration $\mu\text{g}/\text{m}^3$		PM10 number of days with exceedance		PM2.5 Annual average concentration $\mu\text{g}/\text{m}^3$		Benzo(a)pyrene Annual average concentration $\text{ng}/\text{m}^3$	
	2018	2023	2018	2023	2018	2023	2018	2026
Krakow al. Krasinskiego	57	32	166	35	39	17	-	-
Tarnow ul. R. Sitko	36	21	55	10	25	14	-	-
Tarnow, ul. Bitwy pod Studziankami	32	22	39	11	25	14	3.8	1.3
Nowy Targ	47	20	106	20	-	-	18.3	1.46
Nowy Sacz	40	22	83	13	32	14	9.7	1.20
Tuchow	42	20	90	11	-	-	9.7	1.02

## Action 2. Reduction of emissions from the transport sector

---

The main objective of the action is to reduce the number of high-pollution vehicles and to eliminate vehicles that do not comply with emission regulations. For Krakow, it is particularly important to limit vehicle traffic in the city centre using restricted traffic zones – Low Emission Zones.

Actions that should be taken into account in strategies and plans at the municipality, county and regional level:

- a) organisation of urban traffic should aim to reduce the number of vehicles in city centres and ensure the traffic flow,
- b) creation and enforcement of calm traffic zones with a speed limit of 30 km/h,
- c) expansion of public transport, in particular the connections between urban municipalities and the neighbouring municipalities located around,
- d) creation of regular bus connections mainly in places where there is no (or no regular) bus communication,
- e) implementation of energy-efficient and low-carbon solutions in public transport, including purchase of low-carbon and zero-carbon fleet,
- f) development of connections within the Rapid Agglomeration Railway (the SKA), and cross connections to SKA railway lines – bus lines providing connection to SKA railway stations,
- g) maintaining roads, pavements, bicycle paths and other paved passageways in a way that limits the secondary emission of pollutants through regular washing, repairs and improvement of the condition of road surfaces,
- h) development of bicycle communication (including cargo bikes) through continuous modernization and extension of bicycle infrastructure,
- i) creation of pedestrian-friendly green zones,
- j) construction of Park&Ride and Bike&Ride car parks located near railway stations (including those of the Rapid Agglomeration Railway – SKA), bus and tram loops with lower P&R/B&R parking fees for those using periodic public transport tickets,
- k) promotion of sustainable forms of transport (cycling and walking, public transport, car/bike sharing, scooters, car-pooling)
- l) implementation and development of city bicycle systems, including cargo bikes and special bikes for people with disabilities, both for short-term and long-term rental based on a subscription fee system; providing the necessary infrastructure for their functioning,
- m) taking measures to develop a network of generally accessible charging stations,
- n) restricting car traffic in city centres in favour of walking and cycling, including the creation of car-free zones,
- o) no new parking spaces are created in the paid parking zone as they result in increased traffic in the city centre; development of paid parking zones in terms of their range and price level, and possible restrictions on the maximum parking time as a tool supporting the aim of limiting vehicle traffic in the city centre,
- p) prioritizing pedestrian needs in public spaces,
- q) inclusion in public procurement for the purchase of a fleet of vehicles commissioned by public institutions, bicycles, including cargo bikes,
- r) ensuring the traffic flow and efficiency of public transport vehicles through appropriate measures, including creation of bus lanes,
- s) creating integrated passenger hubs (interchange points) with appropriate infrastructure,
- t) providing a user-friendly and affordable public transport as an alternative to the introduced restrictions on individual vehicles.

## Tasks to be implemented

### Tasks of all public institutions:

1. As part of green public procurement, the following requirements should be included in procurement criteria from 1 January 2022:
  - a) obligation for vehicles carrying out special regular transport and occasional transport services to comply with specified emission standards – the operator providing transport services must perform it with vehicles with a minimum standard EURO 4 for vehicles with petrol engines and EURO 6 for vehicles with Diesel engines,
  - b) as part of works contracts:
    - obligation for non-road mobile machinery (i.e. construction machinery – excavators, loaders, bulldozers, etc.) **with a power exceeding 18 kW<sup>61</sup>** to meet the requirements of being equipped with a particulate filter,
    - obligation to wet clean (by the contractor of the ordered order) streets and terrain around the construction site that are contaminated as a result of construction,
    - sprinkling loose material dumps in the rainless period,
    - use of stands for removing soil or mud from heavy equipment wheels leaving the construction site,
    - use of wet concrete cutting elements,
    - use of covers when transporting dusty materials.

### Tasks of presidents and city councils of cities on the rights of a county:

1. Developing and adopting by 30 June 2022 a Sustainable Urban Mobility Plan according to European Commission guidelines. The plan may be adopted as part of other plans and programmes (e.g. Low Carbon Economy Plan).

### Additional tasks of presidents and city councils of cities with a population of over 500 thousand inhabitants:

1. Preparation of a detailed plan for the implementation of a low emission zone based on the EURO emission standards and implementation of the zone in a pilot version **within 1 year of the entry into force of the national legislation** enabling its implementation.
  - a) The implementation plan should specify the vehicle types and EURO emission standards to be restricted and the area of the zone. For the pilot version it is recommended to apply restrictions to light duty vehicles, heavy duty vehicles, public transport vehicles and passenger cars whose emission standards are lower than:
    - EURO 4 for petrol and EURO 5 for Diesel vehicles (passenger cars and light duty vehicles),
    - EURO5/V (for heavy duty vehicles and public transport vehicles)and implementation of the pilot zone in the area limited at least by the II ring road of the city of Krakow<sup>62</sup>.

---

<sup>61</sup> According to the Regulation of the Minister of Economy of 30 April 2014 *on the detailed requirements for internal combustion engines to reduce the emission of gaseous and particulate emissions for these engines* (Journal of Laws from 2014, item 588 and its further changes)

<sup>62</sup> The II ring road includes: M. Konopnicka Street with a tunnel under Grunwaldzkie Roundabout, Debnicki Bridge, Al. Krasinskiego, Al. A. Mickiewicza, Al. J. Słowackiego, viaduct over Warszawska Street and over the railway line (1977), A. 29 Listopada

(road section), W. Stwosza Street (2004), A. Lubomirskiego street, Mogiłskie Roundabout, Al. Powstania Warszawskiego, Grzegorzeckie Roundabout, Kotlarska Street, Kotlarski Bridge (2001), Herlinga-Grudzinskiego Street (2002), Klimeckiego street, voivodship road no. 776:, al. Powstancow Wielkopolskich, Obrońców Lwowa overpass over Wielicka Street (only one direction; 2003), Al. Powstancow Śląskich, H. Kamińskiego Street (road section), Matecznego Roundabout

- b) The plan should include details of restrictions, the zone area, exemptions during the transition period and groups covered by it (e.g. residents living in the area of the zone, companies operating within the zone area), location of signs, control plan, proposals for alternative routes and exclusions used in the zone (e.g. historic vehicles, vehicles owned by people with disabilities, LPG-powered vehicles, single-tracked vehicles).
2. The implementation of the zone in the target version by 31 December 2025 or after the completion of construction of the IV ring road<sup>63</sup> of the city of Krakow.
    - a) The implementation plan of the target version of the zone should define types of vehicles and EURO emissions standards to be restricted and the area of the zone ensuring that the limit levels of nitrogen dioxide are achieved.
    - b) It is recommended to:
      - create the zone on the area limited by the IV ring road of the city of Krakow,
      - introduce the restrictions for Diesel vehicles meeting the EURO emission standard lower than EURO 6 and petrol vehicles meeting the EURO emission standard lower than EURO 4 (for passenger cars and light duty vehicles) and meeting the EURO emission standard lower than EURO 6/VI (for busses and heavy duty vehicles)
      - impose the restrictions on residents of the zone in the future.
3. Preparation and implementation by the City of Krakow by 31 December 2025 of a traffic emission monitoring system, allowing for ongoing monitoring of the impact of road traffic on air quality, including:
    - a) a system for automatic measurement of the traffic volume and structure of vehicle traffic and the sectional speed of vehicles (by the use of a camera system recognising vehicle license plates),
    - b) using traffic volume and structure modelling for all road sections in the city and conducting forecasting calculations,
    - c) information on actual vehicle emissions by vehicle type and Euro category on the basis of remote emissions testing of vehicles updated annually,
    - d) information on the number of passengers on particular traffic routes, determining changes in transport-related behaviour,
    - e) linking individual traffic measurement points with information on concentrations of PM10, PM2.5 and NO<sub>2</sub>.
  4. Preparation (by 31 December 2021) of the Tempo-30 zones implementation plan for the area of Krakow. Zones should be designated on selected road sections inside the III ring road<sup>64</sup> of the city of Krakow.
 

The introduction of Tempo-30 zones according to the prepared implementation plan should take place in stages by 31 December 2025.

The Tempo-30 zones implementation plan should also specify the principles of control and enforcement of the restrictions introduced.

<sup>63</sup> The IV ring road includes: national road no 94, S7 and S52 express road S52, A4 motorway

<sup>64</sup> The III ring road includes: national road no 79, S7 and S52 express road

### Tasks of county governors:

1. Carrying out inspections of each vehicle diagnostic station at least once a year, and in the event of irregularities in the field of emission tests being detected at the station, carrying out a re-inspection.
2. Carrying out annually, in cooperation with the Police and Road Transport Inspection, at least 10 verification actions of vehicles leaving diagnostic stations.

### Tasks of the Management Board of the Malopolska Region and the Regional Assembly of the Malopolska Region:

1. Conducting activities aimed at supporting and accelerating legal changes at the national level, which will enable the implementation of low emission zones in cities based on EURO standards defined for pollutant emissions from vehicles.

## Towards a healthy atmosphere

### REDUCTION OF TRAFFIC EMISSIONS



#### Low emission zone



#### I step

**Where?** → Inside II ring road

**For whom?** → Available for vehicles with emission standards:

minimum Euro 4 minimum Euro 5/VI

**When?** → 1 year from adoption of national law regulations

#### II step

**Where?** → Inside IV ring road

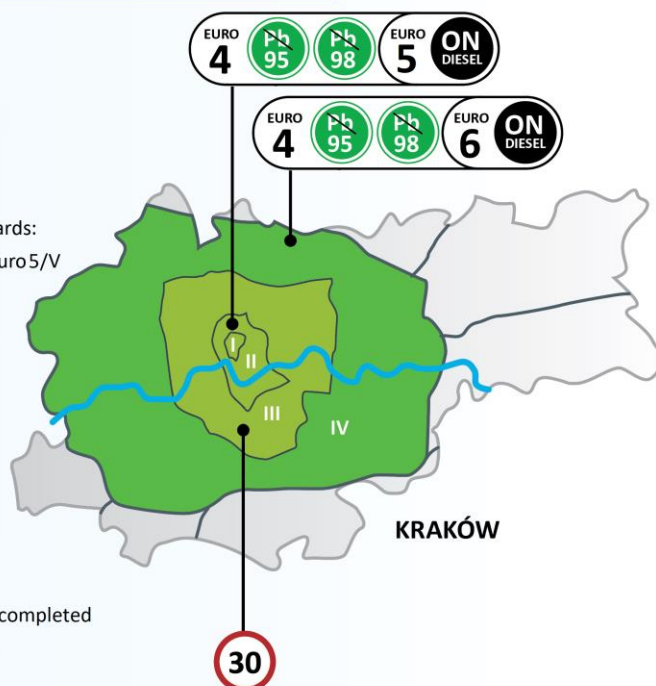
**For whom?** → Available for vehicles with emission standards minimum Euro 4

minimum Euro 6/VI

**When** → until 31 of December, 2025 or after the construction of IV ring road of Krakow is completed

#### Zones

**Where?** → In selected areas inside III ring road



### Expected costs of task implementation

Implementation of the low emission zone based on the EURO emission standards in Krakow and the Tempo-30 zone	PLN 850.0 thousand
Implementation of urban mobility plans	PLN 750.0 thousand
Implementation of the traffic emission monitoring system in Krakow	PLN 60 000.0 thousand
Control activities	PLN 403.2 thousand
Estimation of total costs on a regional scale	<b>PLN 62 003.2 thousand</b>

### Sources of financing the activities

Budgets of municipalities and counties:	PLN 62 003.2 thousand
---	-----------------------



## Expected results

Estimated environmental effect (reduction of emissions) [Mg/year]								
Year	2020	2021	2022	2023	2024	2025	2026	Total
Krakow Agglomeration								
PM10	0	0.3	0.3	7.2	2.5	2.5	2.5	15.3
PM2.5	0	0.2	0.2	5.7	1.7	1.7	1.7	11.2
B(a)P	0	0	0	0	0	0	0	0
NO <sub>x</sub>	9.5	94.8	94.8	445.9	120	120	120	1 005

## Planned impact on concentration levels in the year of Air Quality Plan completion

The change of NO<sub>2</sub> concentrations in the forecast year 2026 after the implementation of actions at the measuring points in the Krakow Agglomeration will be between 0.9 and 20.08 µg/m<sup>3</sup>. The change in the concentration of nitrogen dioxide at the station with the largest exceedances of the limit value (al. Krasinskiego) is indicated in the table below.

Measuring station where the highest concentrations are recorded	Annual average concentration of nitrogen dioxide µg/m <sup>3</sup>	
	2018	2026
Krakow al. Krasinskiego station	61	35

## Action 3. Reduction of emissions from economic activities

---

The aim of the action is to reduce the negative impact of industry and economic activity on the environment, including the impact on air quality. The action is also aimed at increasing the residents' awareness of the impact of economic entities on air quality.

### Tasks to be implemented

#### **Tasks recommended for the Malopolska Regional Inspector of Environmental Protection:**

1. Carrying out regular planned controls and intervention controls on compliance with the legislation and permit records at the plants. Planned inspections in the field of air protection should cover at least 100 entities per year.
2. Conducting intervention controls of economic entities as a response to notifications of infringements of environmental protection regulations (including reactions to notifications under the Eco-intervention application) in accordance with statutory competences. Verification of notifications and control should be carried out immediately in accordance with statutory requirements.

#### **Tasks of heads of the municipalities, mayors, city presidents, and municipal councils:**

1. Conducting an information campaign on the requirements of the anti-smog resolution for Malopolska and the available forms of co-financing for boiler replacement with reaching at least once a year to every entity operating in the municipality that operates a solid fuel combustion installation.

#### **Tasks of county governors:**

1. Conducting intervention controls of economic entities as a response to notifications of infringements of environmental protection regulations (including reactions to notifications under the Eco-intervention application) in accordance with statutory competences. Verification of notifications and control should be carried out immediately in accordance with statutory requirements.
2. Entering data on annual emissions of pollutants (defined in the permits issued for the introduction of gases or PM into the air and in the integrated permits) into the database made available by the Marshal's Office. The data should be entered and updated within 30 days of the issue of the permit or its amendment.
3. In the case of newly issued and amended permits for gas or PM emissions into the air and integrated permits, the authority should analyse and, where justified, introduce obligation to implement actions to reduce particulate matter emissions from installations in case of introduction of the third degree of air pollution danger. Information on the installations required to implement these actions should be forwarded to the relevant county crisis management centre.
4. Authorities issuing decisions should keep the municipality authorities informed about issued decisions or changes in decisions regarding the emission of pollutants into the air for plants located in a given municipality.

**Obligations of entities which operate an installation covered by the obligation to obtain a permit for gas or PM emissions or to obtain an integrated permit or which operate an installation subject to notification procedure:**

1. Providing information on emergency incidents resulting in emissions of pollutants into the air or emissions in abnormal conditions, to a system made available by the Marshal's Office. The information should include an indication of the degree of danger of the event according to the following classification:
  - a) **1st degree** – an event whose impact does not go beyond the premises of the plant and does not constitute a serious failure within the meaning of the Environmental Protection Act – the information must be provided within 24 hours from the moment the entity gains knowledge about the event,
  - b) **2nd degree** – an event whose impact goes beyond the premises of the plant, but does not constitute a serious failure within the meaning of the Environmental Protection Act – the information must be provided within 6 hours from the moment the entity gains knowledge about the event,
  - c) **3rd degree** – an event which is a serious failure within the meaning of the Environmental Protection Act – the information must be provided within 3 hours from the moment the entity gains knowledge about the event.
2. The obligation to comply with the requirements arising from BAT conclusions. No possibility of applying derogations for installations located in areas where the limit values of air pollutants are exceeded in relation to pollutants whose permissible and targets values are exceeded (according to the current annual assessment of the Chief Inspectorate of Environmental Protection).

**Tasks of the Management Board of the Malopolska Region:**

1. Creating by 31 December 2021 and administering a database by the Marshal's Office on industrial emissions, containing information on the following:
  - a) annual emissions granted under the emission permits and integrated permits and scans of such permits,
  - b) emissions reported under environmental charges,
  - c) environmental inspections carried out at the plant,
  - d) information on emergency events that occurred at the plant.
2. In the case of newly issued and amended permits for gas or PM emissions into the air and integrated permits, the authority should analyse and, where justified, introduce obligation to implement actions to reduce particulate matter emissions from installations in case of introduction of the third degree of air pollution danger. Information on the installations required to implement these actions should be forwarded to the relevant county crisis management centre.
3. Authorities issuing decisions should keep the municipality authorities informed about issued decisions or changes in decisions regarding the emission of pollutants into the air for plants located in a given municipality.
4. Preparation by 31 December 2021 of guidelines regarding introducing within emission permits and integrated permits the obligation of taking measures to limit dust emissions to air from installations in the event of the third degree of air pollution danger.



Best Available Technologies (BAT) in large plants



Effective plants inspections by RIEP (the Regional Inspectors of Environmental Protection) and county governors regarding compliance with regulations



Public emission database from permits and reported emissions



Immediate public disclosure of information about:  
1. Accidents on plant area  
2. Accidents and consequences outside plant areas  
3. All serious accidents



Keeping municipalities informed about the proceedings regarding the issue of emission decisions for industrial plants

### Expected costs of task implementation

Estimated costs of creating and maintaining an emission permits database	PLN 350 thousand
Estimated costs of the inspection of the Regional Inspectorate of Environmental Protection	PLN 500 thousand
Estimation of total costs on a regional scale	<b>PLN 850 thousand</b>

### Sources of financing the activities

Regional programmes (LIFE Programme, regional budget):	PLN 350 thousand
Budget of the Regional Inspectorate of Environmental Protection, funds of the Regional Fund for Environmental Protection and Water Management:	PLN 500 thousand

## Expected results

Estimated environmental effect (reduction of emissions) [Mg/year] <sup>65</sup>								
Year	2020	2021	2022	2023	2024	2025	2026	Total
<b>Krakov Agglomeration</b>								
PM10	0	0	0	3.29	6.58	6.58	5.48	21.93
PM2.5	0	0	0	2.55	5.10	5.10	4.25	17.00
B(a)P	0	0	0	0.0001	0.0002	0.0002	0.0002	0.0007
NO <sub>x</sub>	0	0	0	57.16	114.31	114.31	95.26	381.04
<b>City of Tarnow</b>								
PM10	0	0	0	3.49	6.98	6.98	5.81	23.26
PM2.5	0	0	0	2.30	4.59	4.59	3.83	15.31
B(a)P	0	0	0	0.001	0.001	0.001	0.001	0.0040
NO <sub>x</sub>	0	0	0	80.93	161.86	161.86	134.88	539.53
<b>Malopolska Zone</b>								
PM10	0	0	0	9.98	19.97	19.97	16.64	66.56
PM2.5	0	0	0	6.08	12.16	12.16	10.13	40.53
B(a)P	0	0	0	0.005	0.010	0.010	0.008	0.033
NO <sub>x</sub>	0	0	0	88.20	176.40	176.40	147.00	588.00

<sup>65</sup> Estimated ecological effect defined as 10% of emission reduction from the industrial sector by 2026. The description of the assumptions is given in Attachment 2, chapter 6.2.1.



## 7. Short-term actions

Short-term actions should be implemented in situations when there is a risk of exceedance of alert or information thresholds and permissible or target values of substances in ambient air or when the exceedances occur. Their aim is to reduce the risk of such exceedances and to limit the consequences and duration of their occurrence.

There are 3 degrees of air pollution danger:

1. 1<sup>st</sup> degree of danger (code yellow) means the risk of exceeding the permissible values or target values of pollution in the air,
2. 2<sup>nd</sup> degree of danger (code orange) means the risk of exceeding the information threshold for air pollutants,
3. 3<sup>rd</sup> degree of danger (code red) means the risk of exceeding the alert threshold for air pollutants.

Due to the method of averaging the results of measurements of substances in the air, the danger levels are determined on the basis of concentrations of PM10, ozone, sulphur dioxide and nitrogen dioxide. Danger levels (degrees) are introduced separately for each county.

### Tasks supporting the implementation of the short-term action plan:

1. The Chief Inspectorate of Environmental Protection will eventually launch an application interface (API) that will automatically read the introduction of the 2<sup>nd</sup> or 3<sup>rd</sup> degree of danger, its area of validity and the notification content.
2. The Regional Crisis Management Centre is obliged to update the contact list to the representatives of the largest regional media (radio, press, television, online media) on an ongoing basis and to transmit directly notifications about introduction of the 2<sup>nd</sup> and 3<sup>rd</sup> degree of danger.
3. Municipalities are obliged to supervise the completeness and timeliness of the list of e-mail addresses of educational and child-care centres as well as health and social care institutions to which messages about the introduction of the danger degree should be sent.

Current lists of e-mail addresses should be forwarded to the county crisis management centres.

4. The authorities issuing decisions, where obligations of entities to reduce emissions in the case of introduction of the 3<sup>rd</sup> degree of danger are defined, are obliged to transmit information about these entities to the locally competent county crisis management centres.

### The way citizens should behave when degrees of danger are announced

General population:

- consider reducing intense outdoor activities if you experience burning eyes, coughing or sore throat,
- limit room ventilation,
- avoid activities that increase air pollution, such as using a fireplace, using a car, using a leaf blower, lighting campfire.

Sensitive groups of the population – children under 5 and adolescents, seniors and the elderly people, people with respiratory system disorders, people with blood system disorders, people professionally exposed to particulate matter and other contaminants, smokers and passive smokers:

- limit intense outdoor activity,
- do not forget about the medicines you normally take,
- limit room ventilation,
- avoid activities that increase air pollution, such as using a fireplace, using a car, using a leaf blower, lighting campfire.
- people with asthma may experience symptoms (dyspnea, coughing, swishings) more often and need their medication more often than normal.

If the symptoms worsen, consultation with a doctor is recommended.

The following is also recommended:

- increasing supervision of chronically ill people, including the disabled,
- conducting broad education addressed primarily to primary and secondary school students and their legal guardians, regarding

the problem of air pollution and possible behaviours and activities to reduce the risk of exposure to high concentrations of pollutants, including particulate matter,

- keeping track of information on air pollution.

## Towards a healthy atmosphere

### SHORT-TERM ACTION PLAN



#### 1 degree



#### 2 degree



#### 3 degree



Preventive inspections on the waste incineration and prohibited fuels

Ban on the use of fireplaces and solid fuel local space heaters if they are not the only heating source

Ban on the use of leaf blowers

Ban on outdoor activity of children and adolescents during school hours

Recommended entry ban on lorries over 3.5 tonnes into the center of Krakow (area inside II ring road), Tarnow and Nowy Sacz

Ban on road and construction works related to PM emissions

Recommended free public transport in Krakow, Tarnow and Nowy Sacz

Implementation of restrictions for industrial plants specified in emission permits



## 1<sup>st</sup> degree of danger – code yellow

---

### Procedure and manner of announcing the occurrence of exceedances

The 1<sup>st</sup> degree of danger for PM10 is introduced automatically between 6:00 and 18:00 when the average concentration of PM10 over the last 12 hours exceeds 80 µg/m<sup>3</sup>. Once introduced, the degree of danger is valid for the rest of the day.

The 1<sup>st</sup> degree of danger for ozone is introduced automatically between 6:00 and 18:00 when the average concentration of ozone over the last 8 hours exceeds 120 µg/m<sup>3</sup>. Once introduced, the degree of danger is valid for the rest of the day.

The degree of danger is determined separately for each county or city with county rights on the basis of the average concentration from monitoring stations of the Chief Inspectorate of Environmental Protection (CIEP) located in a given county. In the case of counties where CIEP stations are not located, data from stations considered by CIEP to be representative of the area of a given county are used.

## 2<sup>nd</sup> degree of danger – code orange

---

### Procedure and manner of announcing the occurrence of exceedances

2<sup>nd</sup> degree of danger for PM10 or ozone is introduced on the basis of information from the Chief Inspectorate of Environmental Protection<sup>67</sup>.

#### Chief Inspectorate of Environmental Protection:

- sends the notification to the Regional Crisis Management Centre,
- forwards the notification to the Marshal's Office,
- forwards the message to the Ministry of Climate's Crisis Management Centre.

#### Marshal's Office:

- Publishes a notification on the website <https://powietrze.malopolska.pl/komunikaty>
- Allows for downloading the message via e-mail newsletter and API.

#### City, municipal, and county offices:

- publish a notification on the municipality/county website.

#### Short-term activities for the 1<sup>st</sup> degree<sup>66</sup>

##### General obligations:

- Ban on using fireplaces and local space heaters fired by solid fuels if they are not the only heating source.

##### Tasks of heads of the municipalities, mayors and city presidents:

- Obligation to carry out preventive inspections in terms of waste incineration and compliance with the requirements of the anti-smog resolution.

#### Regional Crisis Management Centre:

- immediately informs the public in the manner customary in the Malopolska Region,
- forwards the notification to the relevant county crisis management centres,
- publishes the notification in the Regional Alert System,
- forwards the notification to the media.

---

<sup>66</sup> Activities to be taken in the case of the 1<sup>st</sup> degree of danger for PM10

<sup>67</sup> According to the value of the information threshold specified in the Regulation of the Minister of Environment of 24 August

2012 on levels of certain substances in ambient air (Journal of Laws of 2019, item 1931).

### County Crisis Management Centres:

- forward the announcement to municipality offices in their area,
- forward the announcement to the e-mail addresses of educational and childcare centres (schools, kindergartens, nurseries, children's homes, etc.), health care and social welfare facilities,
- publish the announcement on the county's website.

### City and municipal offices:

- publish a notification on the municipality website.

## 3<sup>rd</sup> degree of danger – code red

### Procedure and manner of announcing the occurrence of exceedances

3<sup>rd</sup> degree of danger for PM10, ozone or nitrogen dioxide is introduced on the basis of information from the Chief Inspectorate of Environmental Protection.<sup>69</sup>

### Chief Inspectorate of Environmental Protection:

- forwards the notification to the Regional Crisis Management Centre,
- forwards the notification to the Marshal's Office.
- forwards the notification to the Ministry of Climate's Crisis Management Centre,
- forwards the message to the Government Security Centre

### Short-term activities for the 2<sup>nd</sup> degree<sup>68</sup>

#### General obligations:

- Ban on outdoor activity of children and adolescents studying in educational and childcare centres.
- Ban on leaf blowers.
- Ban on using fireplaces and local space heaters fired by solid fuels if they are not the only heating source.

#### Tasks of heads of the municipalities, mayors and city presidents:

- Obligation to carry out preventive inspections in terms of waste incineration and compliance with the requirements of the anti-smog resolution in the amount of at least 5 inspections per day for municipalities with a population of up to 20,000 inhabitants, at least 10 inspections per day for municipalities with a population of between 20 and 50,000 inhabitants and at least 20 inspections per day in other municipalities.

### Regional Crisis Management Centre:

- immediately informs the public in the manner customary in the Malopolska Region,
- forwards the notification to the relevant county crisis management centres,
- publishes the notification in the Regional Alert System,
- requests the RCB (Government Centre for Security) to send SMS alerts,
- forwards the notification to the media.

### County Crisis Management Centres:

- forward the notification to the municipal offices in their area,
- forward the notification to the e-mail addresses of educational and childcare centres

<sup>68</sup> Activities to be taken in the case of the 2<sup>nd</sup> degree of danger for PM10

<sup>69</sup> According to the value of the alert threshold specified in the Regulation of the Minister of Environment of 24 August 2012 on

levels of certain substances in ambient air (Journal of Laws of 2019, item 1931).

(schools, kindergartens, crèches, orphanages, etc.) as well as health and social care institutions,

- forward a notification to entities using the environment obliged under the gas or PM emission permit or the integrated permit to take actions to reduce emissions,
- publish a notification on the county website.

#### City and municipal offices:

- publish a notification on the municipality website.

#### Short-term activities for the 3<sup>rd</sup> degree<sup>70</sup>

##### General obligations:

- Ban on outdoor activity of children and adolescents studying in educational and child-care centres.
- Ban on using fireplaces and local space heaters fired by solid fuels if they are not the only heating source.
- Ban on using heating devices powered by solid fuels (coal, biomass) if alternative heating can be used.
- Ban on using leaf blowers.
- Ban on dry cleaning of the streets, excluding devices operating in a vacuum system, reducing dust pollution.

#### Tasks of heads of the municipalities, mayors and city presidents:

- Obligation to carry out preventive inspections in terms of waste incineration and

compliance with the requirements of the anti-smog resolution in the amount of at least 5 inspections per day for municipalities with a population of up to 20,000 inhabitants, at least 10 inspections per day for municipalities with a population of between 20 and 50,000 inhabitants and at least 20 inspections per day in other municipalities.

#### Tasks of presidents and city councils of cities on the rights of a county:

- Recommended introduction of free public transport.
- Recommended introduction of an entry ban for lorries over 3.5 tonnes<sup>71</sup>:
  - in the case of Krakow – to the area inside the city's second ring road,
  - in the case of Tarnow – to the paid parking zone.
  - in the case of Nowy Sacz – to the paid parking zone.

#### Tasks of the entities using the environment:

- Implementation of actions limiting the emission of pollutants specified in permits for the emission of gases or PM into the air and in integrated permits in situations where the third degree of danger is announced.
- Ban on road and construction works related to PM emissions in built-up areas except for renovations carried out in emergency and intervention mode.<sup>72</sup>

---

<sup>70</sup> Activities to be taken in the case of the 3<sup>rd</sup> degree of danger for PM10

<sup>71</sup> The restriction does not apply to emergency vehicles, vehicles performing activities related to road cleaning and waste collection, vehicles performing activities carried out in an emergency and intervention mode

<sup>72</sup> The competent county buildings inspector is responsible for the enforcement of the ban.



## 8. The effect of the Air Quality Plan implementation

---

The effect of the implementation of the Air Quality Plan shall include improvement of air quality and achievement of the permissible values and target values for concentrations of substances in the air. Clean air actions implemented up to 2023 will allow to achieve the limit values for PM<sub>10</sub> and PM<sub>2.5</sub>.

In the case of benzo(a)pyrene, actions to reduce its emissions will continue until 2026. This is related to national and regional activities. In order to meet the target level of 1 ng/m<sup>3</sup> for annual average concentration, it is required to reduce the emission of benzo(a)pyrene on a national scale at the level of about 60% (in relation to the base year) as a result of implementation of the Air Quality Plans in other regions. The inflow of benzo(a)pyrene emissions has a significant share in the total concentration of this pollutant, which is why only if actions are taken outside the region it is possible to achieve air quality that is compliant with the regulations.

However, it is important to act on many regional levels, including inter-regional cooperation, in particular with the Silesian Region, in order to limit mutual interactions.

For nitrogen dioxide, the actions introduced must be supported by system actions in the field of changing the way vehicles are used and introducing a new fleet of vehicles that meet the latest emission standards. Due to the above mentioned conditions, the year 2026 was projected to be the forecast year for NO<sub>2</sub>. A decrease in nitrogen dioxide emissions resulting from changes in the structure of vehicles on the roads in 2026 was assumed, which will contribute to a decrease in NO<sub>2</sub> concentrations especially on national roads and motorways, where it is not possible to introduce restrictions on vehicle traffic.

All implemented actions in the Malopolska Region have been configured in a way that ensures the fastest possible achievement of the standards set for air quality using the possible legal, organizational and financial measures. The implementation of the planned actions will be effective in achieving an air quality status corresponding to the standards set in Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on Ambient Air Quality and Cleaner Air for Europe.

Table 1. Summary of expected effects of the implementation of all actions in Malopolska Region.

EFFECT OF ACTIONS	ZONE	BASELINE VALUE FOR 2018	PREDICTED VALUE FOR 2023	PREDICTED VALUE FOR 2026
<b>PM10 EMISSION LEVEL [MG/YEAR]</b>	Krakov Agglomeration	1 058.51	523.62	497.48
	City of Tarnow	723.81	452.96	426.35
	Malopolska Zone	30 850.92	20 404.97	20 081.12
	Malopolska Region	32 633.24	21 381.55	21 004.95
<b>PM2.5 EMISSION LEVEL [MG/YEAR]</b>	Krakov Agglomeration	875.15	384.77	365.22
	City of Tarnow	612.82	387.80	369.09
	Malopolska Zone	26 743.73	17 668.53	17 401.82
	Malopolska Region	28 231.69	18 441.10	18 136.13
<b>BENZO(A)PYRENE EMISSION LEVEL [MG/YEAR]</b>	Krakov Agglomeration	0.282	0.042	0.041
	City of Tarnow	0.265	0.158	0.152
	Malopolska Zone	13.645	8.590	8.442
	Malopolska Region	14.192	8.790	8.635
<b>NITROGEN DIOXIDE EMISSION LEVEL [MG/YEAR]</b>	Krakov Agglomeration	6 366.75	5 565.29	4 881.41
	City of Tarnow	5 870.09	5 761.37	5 302.05
	Malopolska Zone	41 010.46	40 991.27	40 493.24
	Malopolska Region	53 247.30	52 317.93	50 676.70
<b>TOTAL ESTIMATED COSTS OF IMPLEMENTING ACTIONS [PLN MLN]</b>	Malopolska Region	-	-	PLN 7 725.0 million



Table 2. Summary of expected performance indicators for the individual years of AQP implementation

IMPLEMENTATION RATE		UNIT OF MEASUREMENT	2020	2021	2022	2023	2024	2025	2026
REDUCTION OF LOW-STACK EMISSION AND IMPROVEMENT OF ENERGY EFFICIENCY	The number of liquidated solid fuel devices (non-class, 3-class and 4-class) (including approx. 10,500 units of the 3rd and 4th class)	pcs.	25 000	100 000	200 000	85 000	3 500	3 500	3 500
	Number of maintained Clean Air Program information points	pcs.	53	182	182	182	182	182	182
	Number of Eco-managers in municipalities	people	67	67	223	223	223	223	223
	Number of Climate Eco-managers in counties	people	-	22	22	22	22	22	22
	Number of system inspections of heating sources carried out by municipalities	pcs.	10 570	22 100	21 100	41 400	41 250	41 200	41 200
	The level of completeness of heat sources inventory in Malopolska Region	%	-	70	90	100	100	100	100
REDUCTION OF EMISSIONS FROM THE TRANSPORT SECTOR	Number of vehicle diagnostic stations checked from among all stations in the region	%	100	100	100	100	100	100	100
	Number of vehicle verification actions carried out at diagnostic stations in the region	pcs.	88	88	88	88	88	88	88
REDUCTION OF EMISSIONS FROM ECONOMIC ACTIVITIES	Number of planned inspections carried out by the Regional Inspectorate of Environmental Protection on the compliance with environmental legislation of entities conducting economic activity	pcs.	100	100	100	100	100	100	100

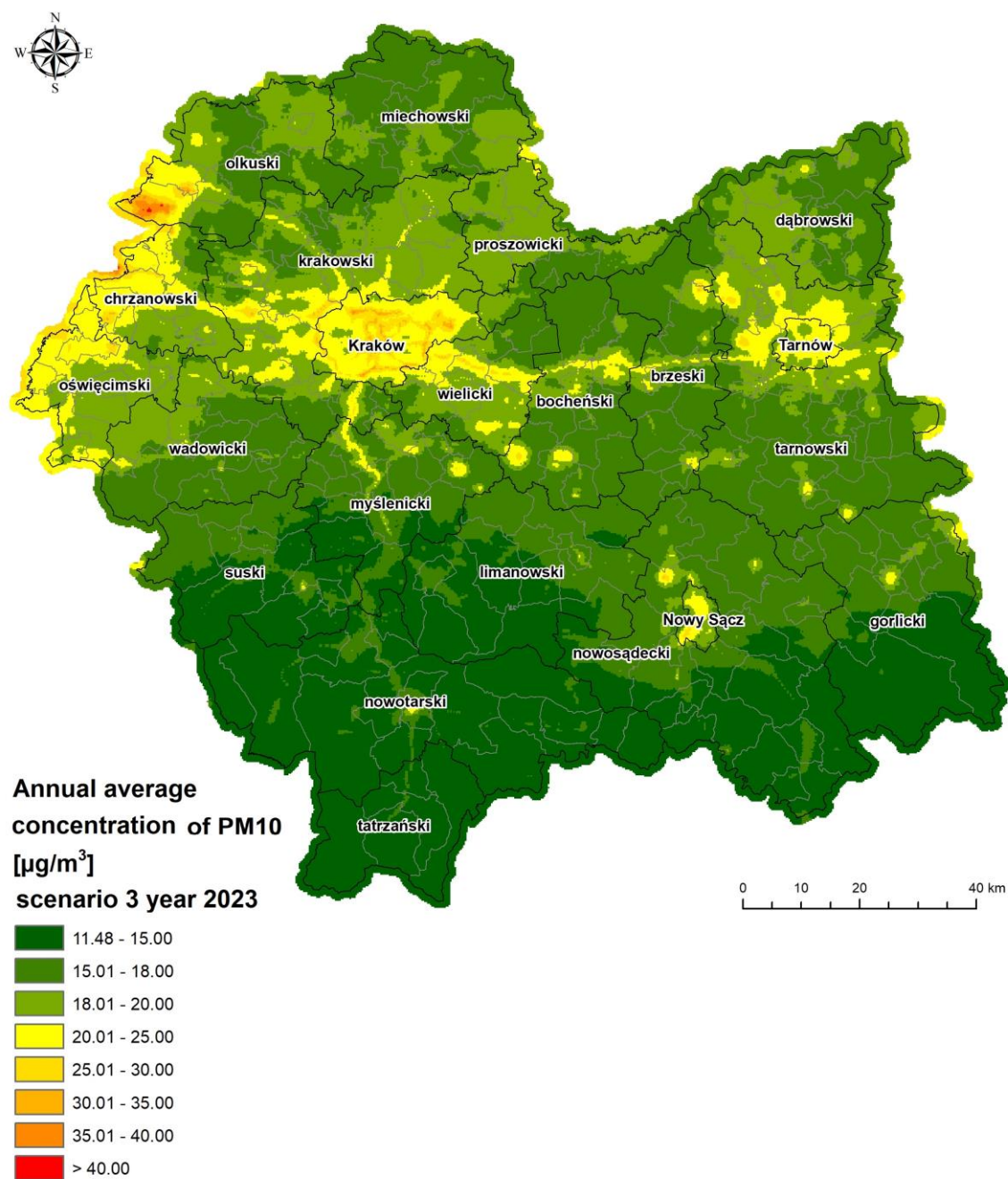


Figure 26. Distribution of expected annual average concentrations of PM10 in the Malopolska Region in 2023.<sup>73</sup>

<sup>73</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A.

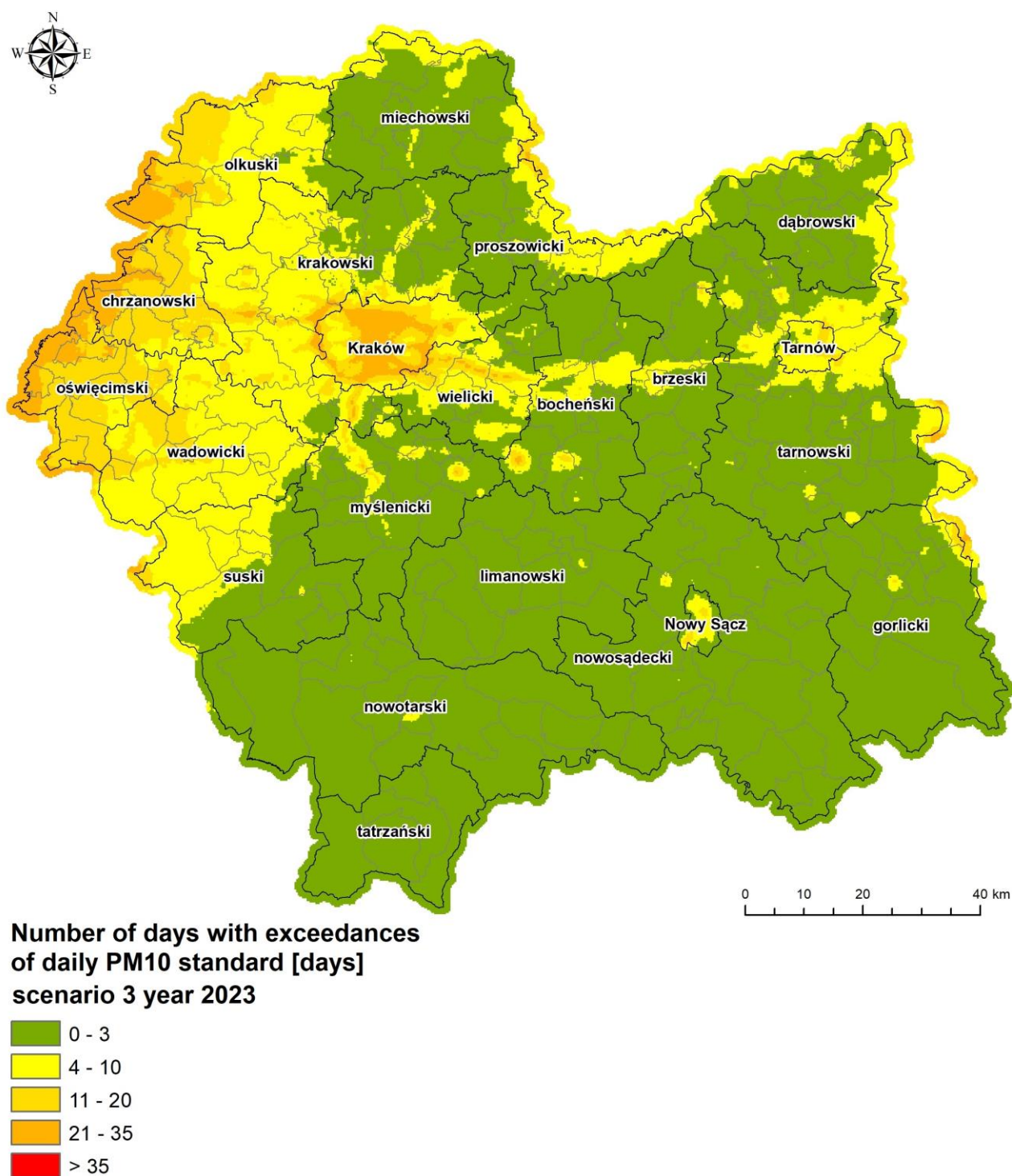


Figure 27. Distribution of the number of days with exceedance of the daily PM10 standard in the Malopolska Region in 2023.<sup>74</sup>

<sup>74</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A.



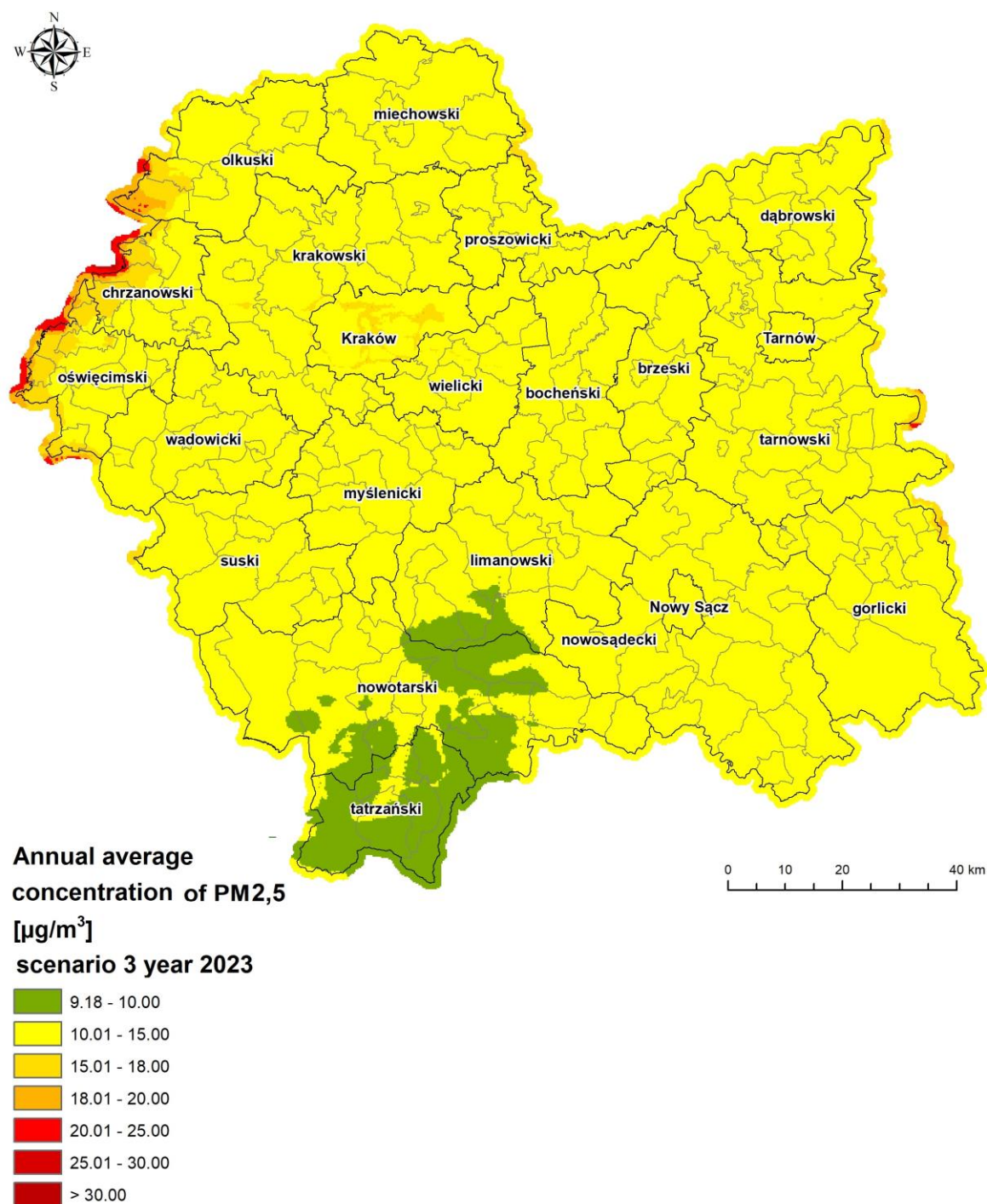


Figure 28. Distribution of expected annual average concentrations of PM<sub>2.5</sub> in the Malopolska Region in 2023.<sup>75</sup>

<sup>75</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A.



Figure 29. Distribution of expected annual average concentrations of benzo(a)pyrene in the Malopolska Region in 2026.<sup>76</sup>

<sup>76</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A.



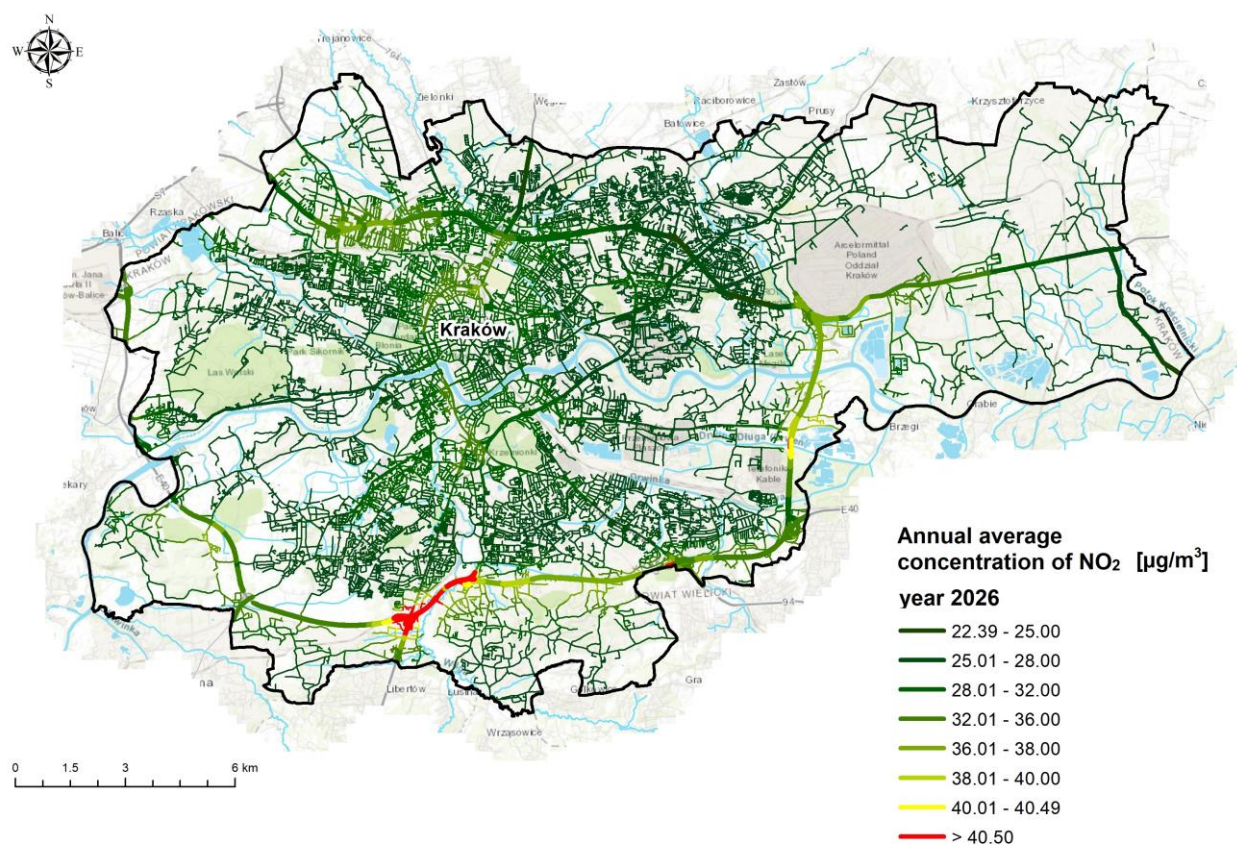


Figure 30. Distribution of expected annual average concentrations of nitrogen dioxide in the Krakow Agglomeration in 2026.<sup>77</sup>

<sup>77</sup> Source: Own work based on CALPUFF modelling results which are based on the emission inventory for the projected year. The detailed configuration of the model is described in Chapter 17.2 of Attachment 2 to the Resolution of the Regional Assembly of the Malopolska Region, ATMOTERM S.A.

## 8.1. Monitoring of effects

Effective monitoring of the progress of the implementation of the Air Quality Plan allows for effective implementation of corrective and preventive actions and allows for current information on the degree of implementation of the AQP objectives. The reporting system for monitoring the progress of the implementation of the AQP's activities will cover all municipalities and counties in the Malopolska Region. The scope of information provided under the report on the implementation of actions of the AQP is determined within ready-made reporting tools introduced by the Marshal's Office of the Malopolska Region.

Municipalities and counties are obliged to submit data to the Marshal's Office according to the provided template of the report:

- a) by 31 July each year, municipalities should provide data on the progress of the replacement of solid fuel heating devices, and the progress of the inventory of heating sources as at 30 June,
- b) by 31 January of each year, municipalities and counties should submit an annual report on the implementation of the tasks of the Air Quality Plan as at 31 December.

The report on activities related to the reduction of surface emissions should cover all activities included in the material and financial schedule that have been designated for a given entity.

The reports should be submitted only in an electronic version according to the template available on the website of the Marshal's Office of the Malopolska Region: <http://powietrze.malopolska.pl>. If the Marshal's Office of the Malopolska Region provides IT tools for preparing reports, the reports will be transmitted using a dedicated software.

Evaluation of the progress of implementation of the Air Quality Plan for Malopolska Region should be carried out on the basis of monitoring indicators included in the Air Quality Plan (Attachment 2) and Chapter 8 of the summary.

On the basis of the reports received, the Management Board of the Malopolska Region prepares and submits a report on the implementation of the Air Quality Plan to the competent Minister and to the Malopolska Region Inspector of Environmental Protection.

The information contained in the reports is used to exercise the statutory powers of the Regional Inspectorate of Environmental Protection to control the implementation of the tasks specified in the AQP. The Governor of the Malopolska Region, with the assistance of the Malopolska Regional Inspector of Environmental Protection under the Article 96a of the Environmental Protection Act, supervises the performance of long-term and short-term tasks (specified in the Air Quality Plan) by heads of the municipalities, mayors, city presidents, county governors and other entities. In the event of failure to meet the deadlines for the performance of the designated tasks, the authority responsible for this is subject to a fine of between PLN 50,000 and PLN 500,000.

On the basis of the reports on the implementation of corrective actions, as well as on the basis of the results of air pollution measurements carried out by the Chief Inspector of Environmental Protection, every 3 years the Management Board of the Malopolska Region should analyse the need to update the Air Quality Plan and possibly correct lines of actions and individual tasks.

## 9. SUMMARY

---

The previous Air Quality Plan from 2017 assumes the implementation of actions to reduce emission and compliance with air quality standards by 2023. The designated actions assumed the improvement of air quality by reducing emissions of PM<sub>10</sub> and PM<sub>2.5</sub>. On the basis of the annually reported data from the regional municipalities, the degree of implementation of the designated target was set at 18% in relation to the assumptions for 2020. The reasons for the insufficient degree of implementation of the actions were related to the insufficient effectiveness of the activities and the insufficient number of replacements of heating sources by the inhabitants of the region. Anti-smog resolutions adopted by the Regional Assembly of the Malopolska Region allowed to start the process of eliminating old solid fuel boilers in the region, and also introduced a ban on using poor quality fuels.

The data contained in the annual air quality assessment prepared for 2018, i.e. during the Air Quality Plan period, show that the permissible and target values of substances in the air are still exceeded. This results in the need to develop a new Air Quality Plan for Malopolska.

Currently, the proposed actions to reduce emission focus on supporting the implementation of the provisions of the anti-smog resolutions and the use of funds under government programmes: Clean Air, Stop Smog and thermo-modernization tax relief.

It is assumed that the implementation of anti-smog resolutions and limitation of the emergence of new sources of coal fuel combustion will allow achieving the limit values for PM<sub>10</sub> and PM<sub>2.5</sub> in 2023. Achieving the target value for benzo(a)pyrene is possible if extensive national and regional actions are taken in the neighbouring regions. They should allow for a 60% reduction in emissions, which will reduce significant inflow emissions of benzo(a)pyrene. The activities taken only in the Malopolska Region are insufficient to achieve the air quality required by the regulations.

In the case of nitrogen dioxide, the planned actions are aimed at limiting the movement of vehicles within the Krakow Agglomeration. These activities, such as the introduction of a low emission zone based on Euro emission standards, can be implemented after a change in legal regulations at national level. Therefore, it is assumed that it will only be possible to achieve the limit value for nitrogen dioxide in 2026 with appropriate legal instruments at national level.

This Air Quality Plan updates the Short-term Action Plan, which continues to have three levels of danger determined by the amount of concentrations of substances in the air. In order to protect the inhabitants of Malopolska, operational activities aimed at improving air quality will be implemented as part of the first degree of danger.

It is estimated that the improvement of air quality in the region will allow to avoid indirect costs incurred due to, among others, excessive emission of fine particulate matter (PM) such as PM<sub>2.5</sub> and excessive emission of nitrogen oxides at the level of almost PLN 1.6 billion per year. The cost of implementation and execution of actions to reduce emission set out in the Air Quality Plan amounts to nearly PLN 7.7 billion in the years of the AQP's validity, i.e. until 2026.

Currently, the proposed actions focus on supporting the implementation of the provisions of the anti-smog resolutions and the use of funds under government programmes: Clean Air, Stop Smog and thermo-modernization tax relief. These programmes require greater involvement of municipal authorities by launching information points, providing assistance of Eco-managers and organising educational actions. In addition, the creation of the Central Building Emission Register requires an inventory and inspections of heating sources in the buildings.