D.T1.1.1:

REPORT ON REVIEW OF EXISTING STUDIES ON THE CAUSES OF AIR POLLUTION

AIR TRITIA CE 1101

Version 1
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Content

1. Executive Summary

Introduction:

This "Report on review of existing studies on the causes of air pollution" focuses on the current knowledge of causes of air pollution in the TRITIA region and 6 FUAs and on existing measures for air quality improvement being applied or expected".

Due to very high number of relevant documents analysis has been carried out for selected number of actual documents describing situation in 2015 and 2016..

List of available reports, studies and other relevant documents is presented in Annex.

Attention has been paid to air quality and its causes (emissions of air pollutants into the air) as existing and planned measures for air quality improvement are described in detail in deliverable D.T1.1.2: Report on the state of current national legislation and policies to improve the air quality. In addition, special attention has been paid to health and environmental impact of air pollution.

This report is mainly focused on suspended particulate matter PM10 and PM2.5 and benzo(a)pyrene which represent the highest negative impacts on human health in the whole AIR TRITIA project area.

Conclusions:

European context:

- Air quality in the AIR TRITIA project region is the worst in the EU as for exceedances of air quality standards for PM10, PM2.5 and benzo(a)pyrene
- The most important stationary air polluting sources (Top 50) include:
    - ArcelorMittal Poland Dąbrowa Górnicza (the fifth biggest polluter of PM10 in the EU)
    - Power Plant "RYBNIK" S.A., Poland (No 14 of more than 12 thousand most damaging installations)
    - Power Plant "Nováky", Slovak Republic (No 18 of more than 12 thousand most damaging installations)

Regional context:

- the Czech part of AIR TRITIA project area (especially Agglomeration Ostrava/Karviná/Frýdek-Místek; O/K/F-M) is the most polluted part of the Czech Republic in terms on PM10, PM2.5 and benzo(a)pyrene for which air quality standards are being exceeded substantially every year (in the case of benzo(a)pyrene in multiples of target value)
- More than 40 % of population of the Moravian-Silesian Region is exposed to concentrations of PM10 exceeding daily limit value; in the case of benzo(a)pyrene almost 80 % of population is exposed to concentrations exceeding annual target value
- Within the Moravian-Silesian Region, air quality in the O/K/F-M agglomeration is worse than that in the Moravian-Silesian Zone.
- The Polish part of AIR TRITIA project area and especially the Silesian Voivodship represent the most polluted part of Poland in terms of PM10, PM2.5and benzo(a)pyrene for which air quality standards are being exceeded substantially every year (in the case of benzo(a)pyrene in multiples of target value)
- 100 % of population of the Silesian Voivodship lived in areas with exceeded annual limit value for benzo(a)pyrene and 24-hours limit value for PM10, 43 % in areas with exceeded annual limit value for PM2.5 and 38 % in areas with exceeded annual limit value for PM10

- More than 72 % of population of the Opolskie Voivodship lived in areas with exceeded annual target value for benzo(a)pyrene, almost 34 % in areas with exceeded 24-hours limit value for PM10, and more than 5 % in areas with exceeded annual limit value for PM2.5.
- Air quality in the Silesian Voivodship is worse than that in the Opolskie Voivvodship
- Air quality standards have not been exceeded in the Žilina Self-governing region in 2015 and 2016
- Daily limit value for PM10 was exceeded in 2012, 2013 and 2014 in Žilina and Ružomberok
- In 2014, the number of inhabitants living in the air quality management areas (areas with exceeded daily limit value for PM10) accounted for 26.55% of the population of the region.
- Air quality in the Czech and Polish part of AIR TRITIA project area is very poor, limit and target values for PM10, PM2.5 and benzo(a)pyrene are being exceeded every year seriously
- In the Slovak part of project area, air quality is much better than that in the Czech and Polish parts, however limit values for PM10 were in certain years exceeded as well
- Fugitive emissions from local heating are considered the most important source of air pollution in all three countries followed by emissions from road transport
- Coal fired power plants and industrial installations (metallurgy and coke production) play important role in the Czech Republic and Poland

2. Introduction

The project called “Uniform approach to the air pollution management system for functional urban areas in Tritia region” (CE 1101, acronym AIR TRITIA) is the Interreg CENTRAL EUROPE project focused on programme priority specific objective 3.3 To improve environmental management of functional urban areas to make the more livable places.

As the problem of air pollution has been presented to decision makers with some distortions, inaccuracies and almost exclusively at a national level, the AIR TRITIA project aims to create effective international air quality management through development of joint information database, management and prediction tools and air quality strategies. The project is implemented by cooperation of 11 partners from 3 different countries: Czech Republic, Slovakia and Poland.

According the AIR TRITIA Project Work Plan, this “Report on review of existing studies on the causes of air pollution” focuses on the current knowledge of causes of air pollution in the TRITIA region and 6 FUAs and on existing measures for air quality improvement being applied or expected”.

List of available reports, studies and other relevant documents is presented in Annex.

Due to very high number of relevant documents analysis has been carried out for selected number of actual documents describing and analysing situation in 2015 and 2016.

Attention has been paid to air quality and its causes (emissions of air pollutants into the air) as existing and planned measures for air quality improvement are described in detail in deliverable D.T1.1.2: Report on the state of current national legislation and policies to improve the air quality. In addition, special attention has been paid to health and environmental impact of air pollution.

Analysis is structured in the following way:

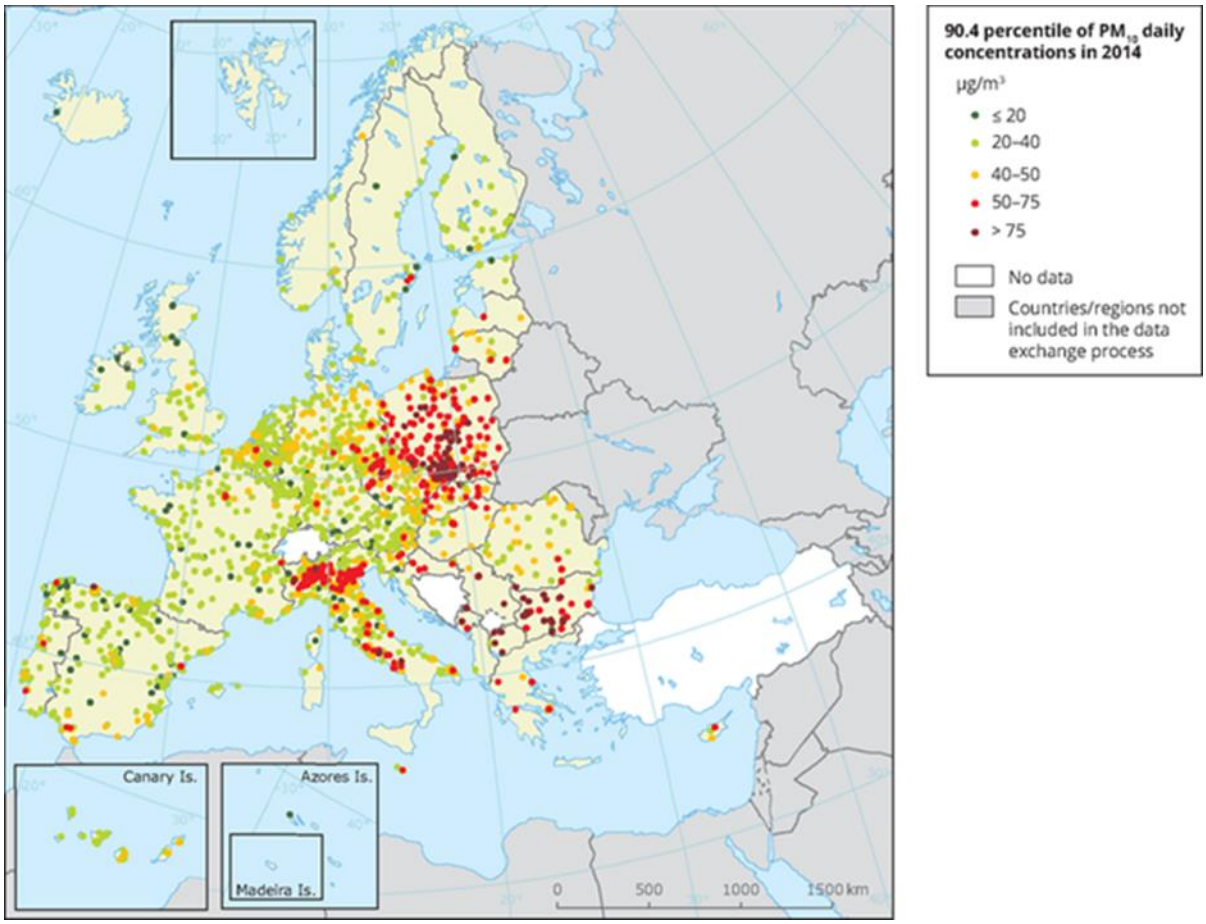
- European context
    - Air quality in the AIR TRITIA project region (in comparison with other European areas)
    - Most important stationary air polluting sources (in comparison with the EU countries)
- Regional context
    - Air quality in the AIR TRITIA project region
    - Emissions of pollutants in the AIR TRITIA project region

3. European context

3.1. Air quality in the AIR TRITIA project region (in comparison with other European areas)

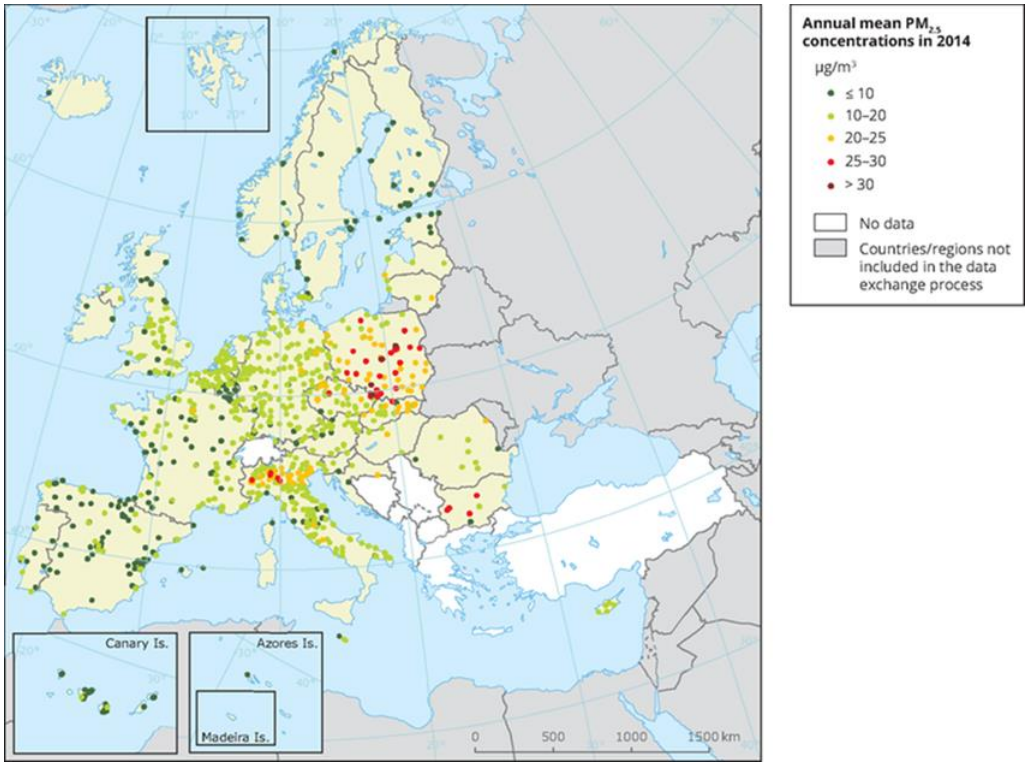
Assessment of air quality at the EU level is being carried out annually by the European Environmental Agency (EEA) and published in "Air Quality in Europe" reports. The recent edition (Air Quality in Europe 2016) presents for 2014 the following comparisons of air quality in the countries of EEA region as for PM10, PM2.5 and benzo(a)pyrene:

Figure 1: 90.4 percentile of PM10 daily concentrations in Europe 2014



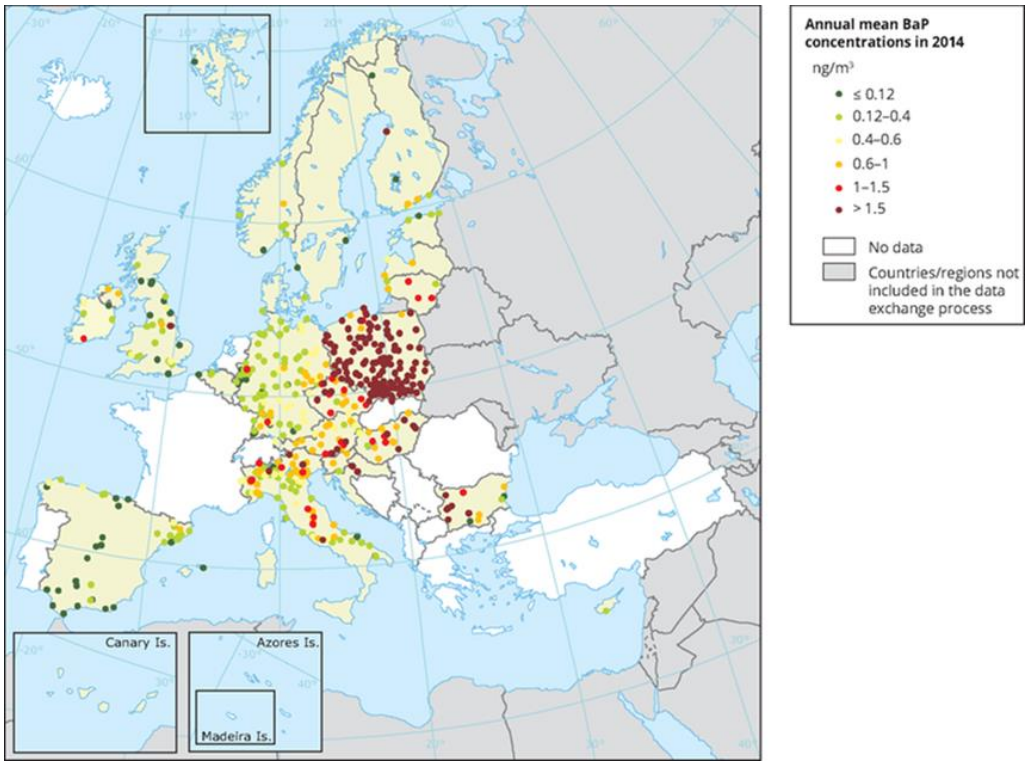
Source: Air quality in Europe — 2016 report, European Environmental Agency, 2017 (https://www.eea.europa.eu/publications/air-quality-in-europe-2016)

Figure 2: Annual mean PM2.5 concentrations in Europe in 2014



Source: Air quality in Europe — 2016 report, European Environmental Agency, 2017 (https://www.eea.europa.eu/publications/air-quality-in-europe-2016)

Figure 3: Annual mean benzo(a)pyrene concentrations in Europe in 2014



Source: Air quality in Europe — 2016 report, European Environmental Agency, 2017 (https://www.eea.europa.eu/publications/air-quality-in-europe-2016)

It can be seen that the AIR TRITIA project area is the most polluted part of Europe in terms of exceedances of annual limit value for PM2.5 and annual target value for benzo(a)pyrene.

3.2. Most important stationary air polluting sources (in comparison with the EU countries)

In accordance with the EEA list of the most polluting industrial installations[1]:

- ArcelorMittal Poland Dąbrowa Górnicza is the fifth biggest polluter of PM in the EU (1.39 kt/year)

In accordance with the EEA List of Industrial facilities causing the highest damage costs to health and the environment:

- Power Plant "RYBNIK" S.A. (Rybnik, Poland) keeps No 14 of more than 12 thousand
- Power Plant “Nováky” (Nováky, Slovakia) keeps No 18 of more than 12 thousand. Not a part of AIR TRITIA project area, however located 80 km from Žilina and 75 km from the Czech border.

[1] Link(EN): Releases of pollutants to the environment from Europe's industrial sector - 2015 https://www.eea.europa.eu/themes/industry/releases-of-pollutants-from-industrial-sector/#t1

4. Regional context

4.1. Air quality in the AIR TRITIA project area

4.1.1. Czech Republic – Air quality in the Moravian-Silesian Region

In accordance with the Czech legislation, the Czech part of the AIR TRITIA project area – Moravian-Silesian Region – is divided between agglomeration Ostrava/Karvina/Frydek-Mistek and the Moravian-Silesian Zone.

The results of air quality assessment are being published annually by the Czech Hydro-meteorological Institute in "Air Pollution in The Czech Republic in the Year 20XX" data[2] and graphic yearbooks[3]. Data yearbooks include all available data while graphic yearbooks include selected data and interpretations

Obviously, graphic yearbooks include a separate chapter devoted **to air quality in Agglomeration Ostrava/Karvina/Frydek-Mistek in the Moravian-Silesian region (the latest yearbook available covers year 2015)[4]:**

The agglomeration of Ostrava/Karviná/Frýdek-Místek (O/K/F-M) is one of the most urbanized and industrialized areas in Central Europe. Geographically, it covers the southwestern part (approximately one fifth) of the Upper Silesian basin, most of which is part of Poland. The area is historically burdened by extensive industrial activities in the Upper Carboniferous basin. The sources of ambient air pollution in this area include a high concentration of industrial production, high density of built-up areas with local heating using solid fuels and a concentrated transport infrastructure on both sides of the Czech-Polish border.

Specific problems of the area are caused, for example, by emissions from burning slag heaps and by the significant effect of fugitive emissions from large industrial facilities. The villages and towns in most of the agglomeration are very close to each other, almost connected (the so-called Silesian type of house building), and industrial zones are part of the towns.

Concentrations of suspended particles measured at stations classified as rural or background stations are significantly higher than at similarly classified stations in other parts of the Czech Republic. This is caused by high emissions in the cross-border area, i.e. not only by the production of pollutants produced by sources on the Czech side of the border, but also by the cross-border exchange of pollutants with the Republic of Poland (for more details, see the results of the projects Air Silesia and Clean Border[5]).

For the purpose of monitoring concentrations and trends of atmospheric pollutants that exceed limit values in the long term, the area is covered by a dense network of over twenty measurement stations belonging to various organizations, which are supplemented by specialized temporary measurements[6].

[2] Link (CS): http://portal.chmi.cz/files/portal/docs/uoco/isko/tab_roc/tab_roc_CZ.html

Link (EN): http://portal.chmi.cz/files/portal/docs/uoco/isko/tab_roc/2016_enh/index_GB.html

[3] Link (CS): http://portal.chmi.cz/files/portal/docs/uoco/isko/grafroc/grafroc_CZ.html

Link (EN): http://portal.chmi.cz/files/portal/docs/uoco/isko/grafroc/15groc/gr15en/Obsah_GB.html

[4] Official translation cited

[5] The project Ambient air quality improvement in the border area of the Czech Republic and Poland (www.cleanborder.eu) and the project Air quality information system in the Polish-Czech border area in the Silesian region and the Moravia-Silesia region (www.air-silesia.eu) within the Operation programme of trans border cooperation Czech Republic–Republic of Poland 2007–2013.

[6] For comparison purposes, the evaluation presented below also shows concentrations measured at air pollution monitoring stations in the southern part of the Silesian Voivodship in Poland, see http://stacje.katowice.pios.gov.pl/monitoring. Data of comparable quality are available only from the year 2010 onwards.

Ambient air quality in the Agglomeration Ostrava/Karviná/Frýdek-Místek (O/K/F-M) in 2015:

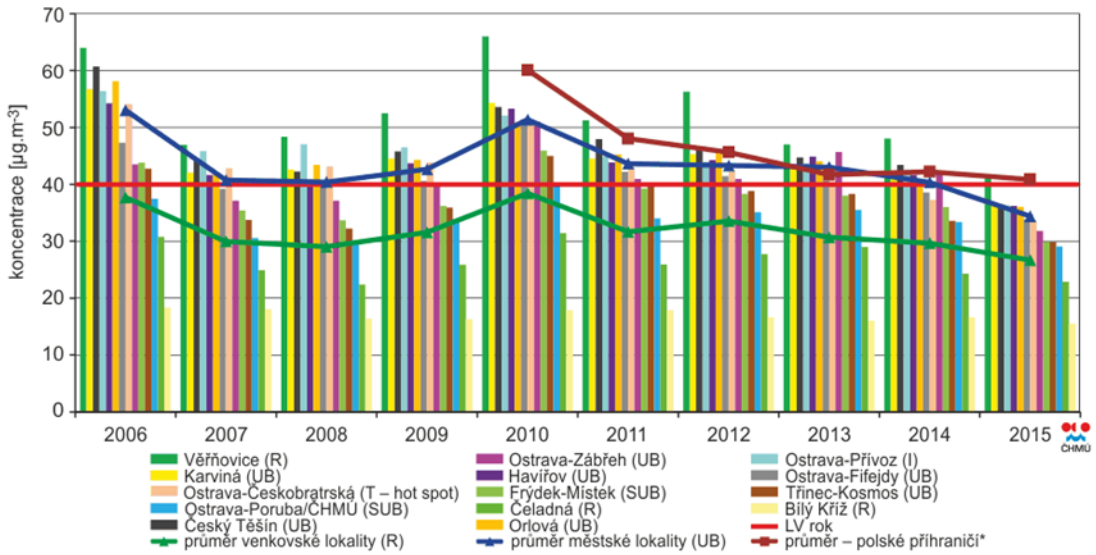
Suspended particles PM10 and PM2.5:

The limit values of suspended particles and some other pollutants bound to them, such as polycyclic aromatic hydrocarbons (PAH), are exceeded in the agglomeration of O/K/F-M in the long term. The values measured at localities of the agglomeration rank high in the statistical records within the Czech Republic. The greatest annual average concentrations of PM_{10} and $PM_{2.5}$ are measured not only in the vicinity of industrial sites, but mostly continuously along the Czech-Polish border, an area affected by emissions both from the Czech Republic and Poland. Concentrations below the limit values are measured mostly in the southern part of the agglomeration at background and rural localities of the Moravskoslezské Beskydy Mountains and their foothills.

PM_{10} and $PM_{2.5}$ concentrations in the agglomeration are characterized by more prominent growth in the winter period in comparison with other areas of the Czech Republic. Despite this, average concentrations of PM_{10} and $PM_{2.5}$ at industrial localities during the summer period reach the annual limit value; in other words, air pollution by PM in the agglomeration is not a problem only in the cold half of the year and during smog situations. The ratio of $PM_{2.5}/PM_{10}$ concentrations is higher than in other parts of the Czech Republic not only in the agglomeration, but in the entire Moravia-Silesia region; the share of fine particles in PM_{10} is higher mainly in the cold part of the year.

In 2015 limit value-exceeding annual average concentrations of PM_{10} particles were measured for the first time in a series of ten years at only one background locality, specifically in the locality Věřňovice, part of the village Dolní Lutyně in the Karviná region in the Czech-Polish border area (Figure 4).

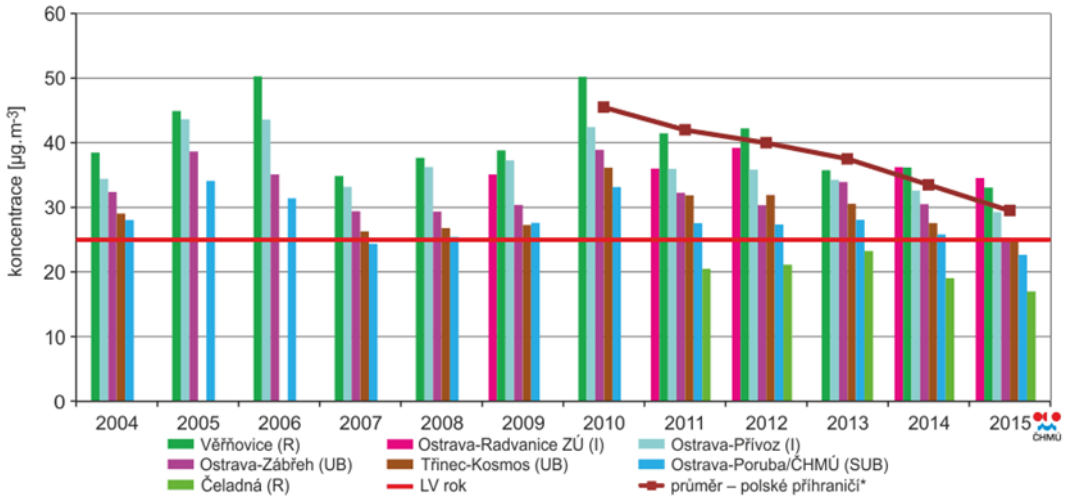
Figure 4: Average annual concentrations of PM10 at selected sites of Agglomeration Ostrava/Karviná/Frýdek-Místek



Source: Air quality in Agglomeration Ostrava/Karvina/Frydek-Mistek in the Moravian-Silesian region Czech Hydro-meteorological Institute
(http://portal.chmi.cz/files/portal/docs/uoco/isko/grafroc/15groc/gr15en/Obsah_GB.html)

Limit value-exceeding annual average concentrations of PM2.5 were measured at most localities monitoring this fraction. The only exceptions were the locality Čeladná in the foothills of the Beskydy Mts. and localities lying at the fringe of the most polluted core of the agglomeration (Ostrava-Poruba/CHMI and Třinec-Kosmos; (Figure 5).

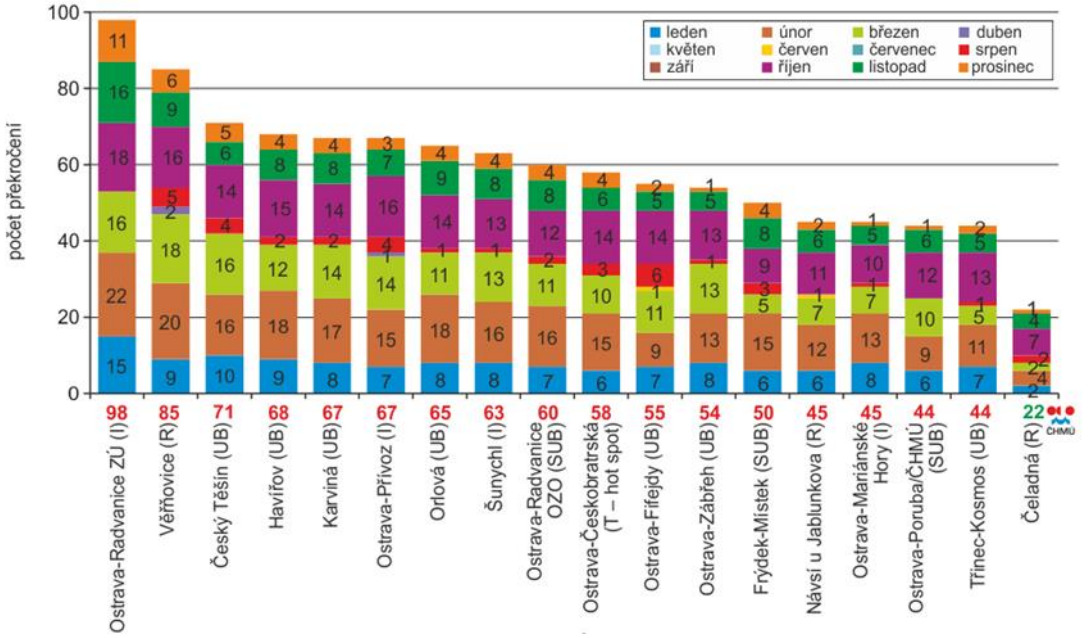
Figure 5: Average annual concentrations of PM2.5 at selected sites of Agglomeration Ostrava/Karviná/Frýdek-Místek



Source: Air quality in Agglomeration Ostrava/Karvina/Frydek-Mistek in the Moravian-Silesian region Czech Hydro-meteorological Institute
(http://portal.chmi.cz/files/portal/docs/uoco/isko/grafroc/15groc/gr15en/Obsah_GB.html)

Unlike other areas, the measuring stations in the O/K/F-M agglomeration record limit value-exceeding daily concentrations of PM10 also in summer months, even at suburban localities. The cause of the unusually high number of days with over-limit value daily concentrations in August 2015 were extraordinarily high temperatures, which caused increased dustiness. The annual course of PM10 pollution was uncharacteristic in the year 2015. The largest shares of days with above-the-limit values were recorded in February and October whereas in January and December the frequency of such days was below average (Figure 6).

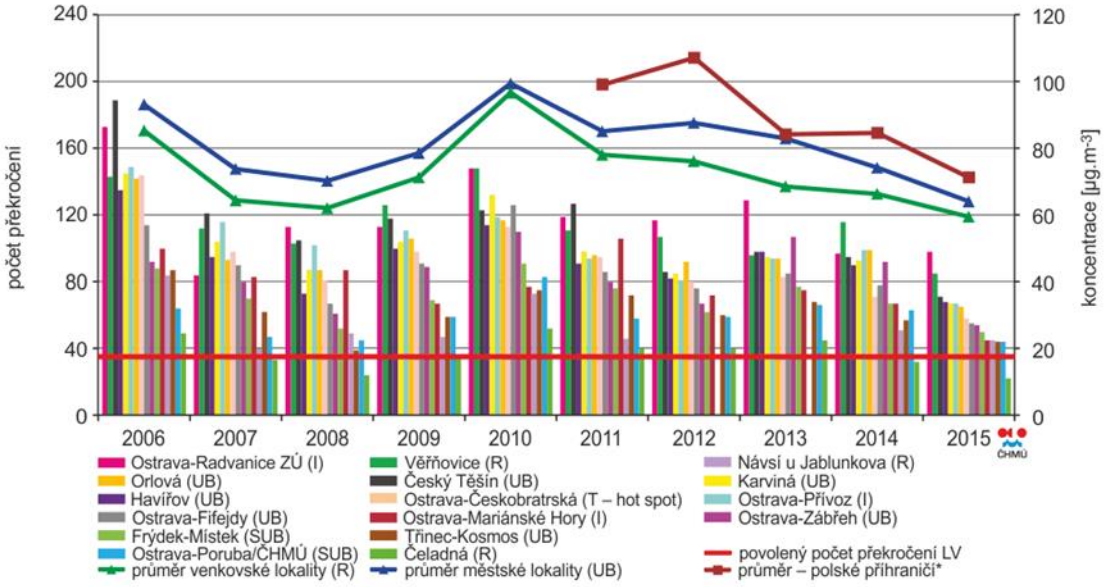
Figure 6: Number of days with exceeded daily limit value for PM10 in Agglomeration Ostrava/Karviná/Frýdek-Místek



Source: Air quality in Agglomeration Ostrava/Karvina/Frydek-Mistek in the Moravian-Silesian region Czech Hydro-meteorological Institute
(http://portal.chmi.cz/files/portal/docs/uoco/isko/grafroc/15groc/gr15en/Obsah_GB.html)

The permissible number of 35 days with above-the-limit value daily concentration set by the legislation was exceeded in 2015, but similarly as in previous years, at all localities with continuous measurement of PM10 with the exception of the background locality Čeladná. At the most polluted localities, the limit number of 35 days was again exceeded already in the first quarter of the year, and over-limit daily values occurred there on up to one-fourth of the days of the year. Year-on-year, the number days with over-limit daily concentrations of PM10 decreased at all stations in the agglomeration, except the industrial locality Ostrava-Radvanice ZÚ (Figure 7).

Figure 7: Number of days with exceeded daily limit value for PM10 and the 36th highest concentrations at selected sites of Agglomeration Ostrava/Karviná/Frýdek-Místek



Source: Air quality in Agglomeration Ostrava/Karvina/Frydek-Mistek in the Moravian-Silesian region Czech Hydro-meteorological Institute (http://portal.chmi.cz/files/portal/docs/uoco/isko/grafroc/15groc/gr15en/Obsah_GB.html)

In the cold part of the year during longer-lasting episodes with gentle air currents and inversion weather long episodes with inversions, concentrations of pollutants (especially suspended particles) gradually increase in the O/K/F-M agglomeration, leading to exceedances of limit values and threshold values. Even in the abnormally warm year of 2015, three smog situations were announced in the agglomeration (without the Třinec area) due to the exceedance of threshold values for suspended PM10 particles. One smog situation occurred in January, and two occurred in November. No regulation of the mentioned sources that significantly contributed to the level of pollution was issued.

Between-year oscillations of concentrations are substantially affected by the meteorological conditions that prevail in the individual years (especially in their cold parts). In years with longer episodes of inversion weather conditions (2005, 2006, 2010), there was an increase of average annual values. Annual average concentrations of PM10 and PM2.5 particles in the agglomeration in 2015 decreased at all types of localities, while at both urban and rural stations they reached their ten-year minimum. In the Karviná district, annual average concentrations of PM10, with the exception of the locality Věřňovice, did not reach the limit for the first time in the last 10 years (Figure 4).

At localities with uninterrupted 20-year series of PM10 measurements, concentrations mostly approached the lowest values recorded in the years 1998 and 1999.

Nitrogen dioxide

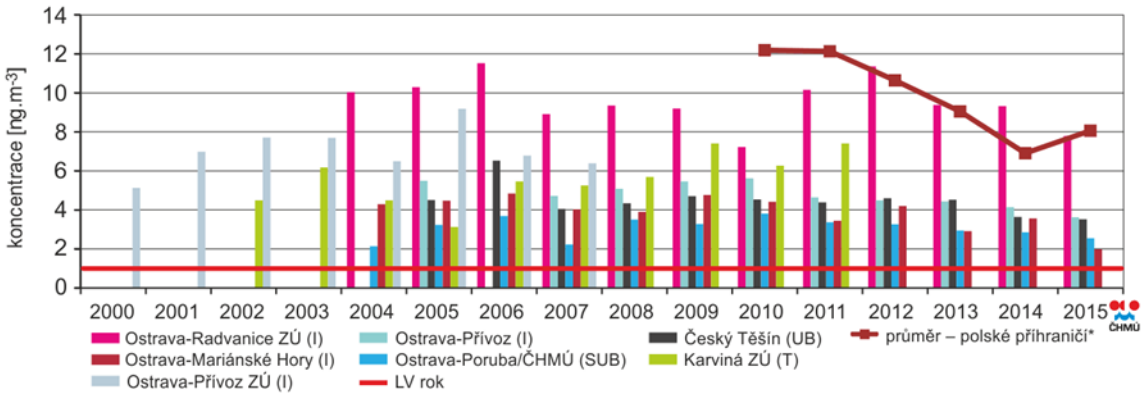
In 2015 annual average concentrations of NO2 did not exceed their limit values at any of the monitored localities in the agglomeration. At all types of localities, the very slight decreasing trend lasting since 2010

was thus retained. For the second year in a row, there was a marginally below-limit average annual concentration of NO2 at the traffic hotspot locality Ostrava-Českobratrská, which is focused on monitoring pollution originating mainly from transport.

Benzo[a]pyrene

The level of air pollution caused by benzo[a]pyrene is a very serious problem in the whole transboundary area of Silesia and Moravia. The annual progression shows maximum values for benzo[a]pyrene in cold parts of the year; summer concentrations are markedly lower. In 2015, similarly as in previous years, the annual average concentrations in the agglomeration exceeded the ambient limit value several-fold. The highest concentration was again measured at the industrial locality Ostrava-Radvanice. With regard to considerably high concentrations measured in southern Poland, it can be assumed that similarly high levels occur also in the Czech-Polish boundary area (Figure 8).

Figure 8: Average annual concentrations of benzo(a)pyrene at selected sites of Agglomeration Ostrava/Karviná/Frýdek-Místek



Source: Air quality in Agglomeration Ostrava/Karvina/Frydek-Mistek in the Moravian-Silesian region Czech Hydro-meteorological Institute
(http://portal.chmi.cz/files/portal/docs/uoco/isko/grafroc/15groc/gr15en/Obsah_GB.html)

Year-on-year, there was a decrease of concentrations. The downward trend of annual average concentrations manifested itself at all types of localities.

Ground-level ozone

In 2015 the number of exceedances of the limit value for ground-level ozone (maximum daily 8-hour average) on average over three years did not exceed the permissible number of 25 days at any of the localities within the agglomeration. Considering the extraordinarily warm summer months, the number of days on which this limit value was exceeded increased at all localities compared to the previous year, though the concentrations did not reach values typical of seasons with higher measured levels than before 2010).

In the O/K/F-M agglomeration (without the Třinec area), as in the Třinec area, one smog situation was announced in 2015 due to high one-hour concentrations of ground-level ozone.

Further evaluation

For the second year in a row, annual average concentrations of benzene did not reach their limit in 2015 at any of the localities within the agglomeration and decreased year-on-year at most localities. An increase almost to the level of the limit value, however, occurred at the industrial locality Ostrava-Přívoz, where markedly over-limit values were measured until the year 2013. Short-term extremely high peaks of 1-hour concentrations again occurred irregularly during the course of the year. Concentrations of carbon monoxide remain below the limit value in the long term in spite of the fact that the values measured at two localities in Ostrava within the agglomeration are higher than in other areas of the Czech Republic, in connection with higher emissions from industrial sources.

Concentrations of sulphur dioxide in the agglomeration do not exceed the limit values for the protection of human health. The annual average concentrations decreased slightly at most stations except for the industrial locality Ostrava-Radvanice ZÚ. Higher concentrations are reached in industrial localities and at localities near the state border with the Republic of Poland.

Since the year 2006, concentrations of metals in PM10 suspended particles have decreased in the agglomeration. Limit values were not exceeded in 2015. Compared to the year 2014, concentrations of almost all metals decreased slightly, with the exception of the stagnant concentration level of arsenic at localities of all types.

Air quality in the Moravian-Silesian Zone

Ambient air quality in the Moravian-Silesian Zone is historically much better than that in Agglomeration Ostrava/Karviná/Frýdek-Místek (this was the reason why the Moravian-Silesian Region has been divided between one zone and one agglomeration). Comparison of air quality in 2015 and 2016 is presented in the following tables:

Table 1: Comparison of air quality in the Moravian-Silesian Zone and Agglomeration Ostrava/Karviná/Frýdek-Místek, 2015

	Moravian-Silesian Zone	Agglomeration O/K/F-M
PM_{10}		
Total number of monitoring stations	6	22
Number of stations with exceeded annual limit value	0	2
Highest annual average concentration (μg/m³)	27.6	42.2
Number of stations with exceeded daily limit value	2	19
Highest number of days with exceeded daily limit value	57	98
Highest daily average concentration (μg/m³)	125.1	241.9
Share of area with exceeded annual value (%)	0	0.77
Share of area with exceeded daily limit value (%)	24.24	53.96
$PM_{2.5}$		
Total number of monitoring stations	1	8
Number of stations with exceeded annual limit value	0	5
Highest annual average concentration (μg/m³)	23.9	34.6
Share of area with exceeded annual value (%)	3.5	28.73
Benzo(a)pyrene		
Total number of monitoring stations	1	8
Number of stations with exceeded annual limit value	1	8
Highest annual average concentration (μg/m³)	2.0	7.83
Share of area with exceeded annual value (%)	69.68	100.0

Source: Czech Hydro-meteorological Institute, 2016

Table 2: Comparison of air quality in the Moravian-Silesian Zone and Agglomeration Ostrava/Karviná/Frýdek-Místek, 2016

	Moravian-Silesian Zone	Agglomeration O/K/F-M
PM_{10}		
Total number of monitoring stations	6	22
Number of stations with exceeded annual limit value	0	1
Highest annual average concentration (μg/m³)	33.0	41.0
Number of stations with exceeded daily limit value	1	16
Highest number of days with exceeded daily limit value	55	89
Highest daily average concentration (μg/m³)	184.8	232.9
Share of area with exceeded annual value (%)	0	0.77

	Moravian-Silesian Zone	Agglomeration O/K/F-M
Share of area with exceeded daily limit value (%)	24.24	53.96
$PM_{2.5}$		
Total number of monitoring stations	5	12
Number of stations with exceeded annual limit value	1	8
Highest annual average concentration (µg/m³)	26.3	35.5
Share of area with exceeded annual value (%)	3.50	28.73
Benzo(a)pyrene		
Total number of monitoring stations	3	8
Number of stations with exceeded annual limit value	3	8
Highest annual average concentration (µg/m³)	3.0	9.0
Share of area with exceeded annual value (%)	69.98	100

Source: Czech Hydro-meteorological Institute, 2017

In 2017 (till 20 October), daily limit value for PM10 has been exceeded at 21 monitoring stations in the Moravian-Silesian Region (maximum number of days 60, maximum average daily concentration 501.5 ▫g/m3).

It can be concluded that:

- the Czech part of AIR TRITIA project area (especially Agglomeration Ostrava/Karviná/Frýdek-Místek; O/K/F-M) is the most polluted part of the Czech Republic in terms on PM10, PM2.5 and benzo(a)pyrene for which air quality standards are being exceeded substantially every year (in the case of benzo(a)pyrene in multiples of target value)
- More than 40 % of population of the Moravian-Silesian Region is exposed to concentrations of PM10 exceeding daily limit value; in the case of benzo(a)pyrene almost 80 % of population is exposed to concentrations exceeding annual target value
- Within the Moravian-Silesian Region, air quality in the O/K/F-M agglomeration is worse than that in the Moravian-Silesian Zone.

4.1.2. Poland – Air quality in the Silesian Voivodship

Detailed analysis of air quality in the Silesian Voivodship is presented in the Air Protection Program for the Silesian Voivodship aiming at reaching air quality standards, Katowice 2014[7].

Actual information on air quality can be found in the annual State-of-the-Environment Report in the Silesian Voivodship in 2015[8].

Table 3: Exceedance of limit values in the Silesian Voivodship, 2012

Name	Share of area with exceedances (%)	Population exposed
PM_{10} annual limit value		
agglomeration górnośląska	69.4	1 334 937
agglomeration rybnicko-jastrzębska	48.9	144 528
zone miasto Bielsko-Biała	35.3	61 579
zone miasto Częstochowa	18.8	43 211
zone śląska	9.3	18 572
Total Silesian Voivodship	16.6	1 770 978
PM_{10} 24-hours limit value		
agglomeration górnośląska	100	1 927 787
agglomeration rybnicko-jastrzębska	100	295 159
zone miasto Bielsko-Biała	100	174 503

[7] Link (PL): https://bip.slaskie.pl/dokumenty/2015/01/29/1422520775.pdf

[8] Link (PL): http://www.katowice.wios.gov.pl/monitoring/raporty/2015/raport2015.pdf

Name	Share of area with exceedances (%)	Population exposed
zone miasto Częstochowa	100	235 798
zone śląska	99.7	1 993 110
Total Silesian Voivodship	99.9	4 646 357
		$PM_{2.5}$ annual limit value
agglomeration górnośląska	75.7	1 456 272
agglomeration rybnicko-jastrzębska	55.3	163 355
zone miasto Bielsko-Biała	53.6	93 158
zone miasto Częstochowa	30.9	72 860
zone śląska	11.7	232 813
Total Silesian Voivodship	19.7	2 018 458
benzo(a)pyrene annual limit value		
agglomeration górnośląska	100	1 927 787
agglomeration rybnicko-jastrzębska	100	295 159
zone miasto Bielsko-Biała	100	174 503
zone miasto Częstochowa	100	235 798
zone śląska	100	1 993 110
Total Silesian Voivodship	100	4 646 357

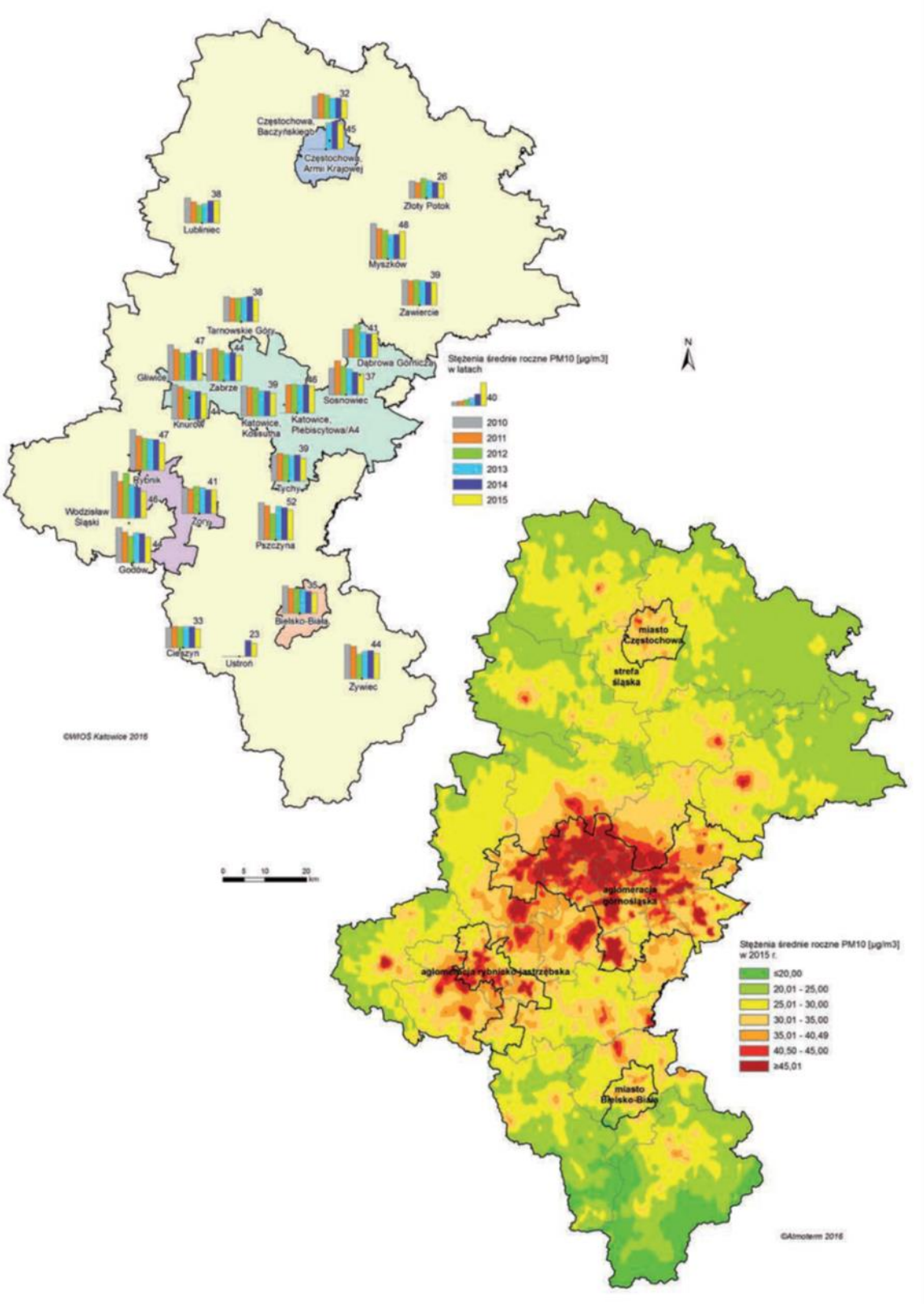
Air Protection Program for the Silesian Voivodship aiming at reaching air quality standards, Katowice 2015 (https://bip.slaskie.pl/dokumenty/2015/01/29/1422520775.pdf)

It can be concluded that:

- 100 % of population of the Silesian Voivodship lived in areas with exceeded annual limit value for benzo(a)pyrene and 24-hours limit value for PM10, 43 % in areas with exceeded annual limit value for PM2.5 and 38 % in areas with exceeded annual limit value for PM10

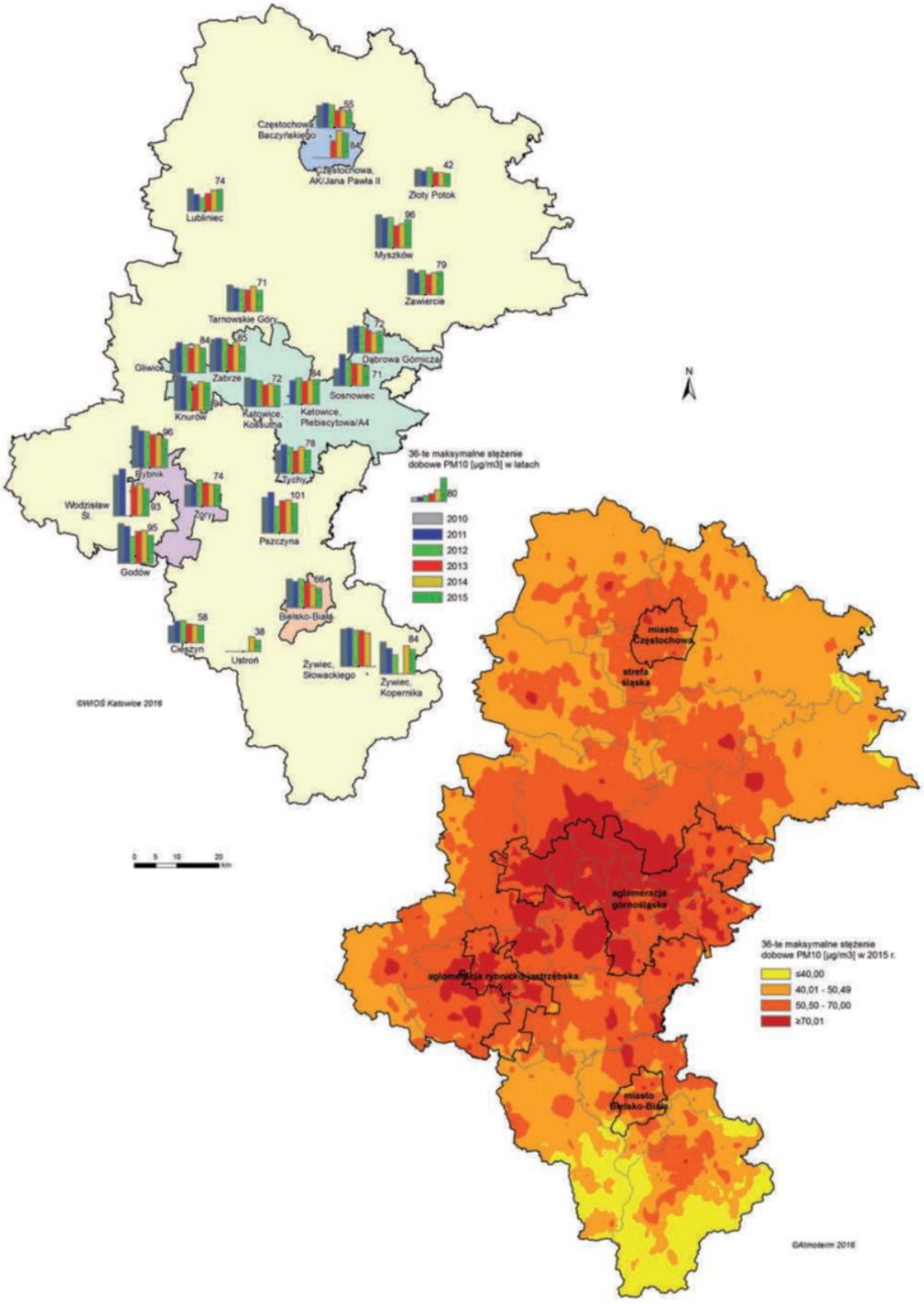
Examples of distribution of annual average concentrations of PM10, PM2.5, and benzo(a)pyrene and daily concentrations of PM10 in the Silesian Voivodship are presented in the following figures 9 – 12.

Figure 9: PM10 annual average concentrations at measuring stations in the years 2010-2015 and distribution of PM10 concentrations in the Silesian Voivodship in 2015



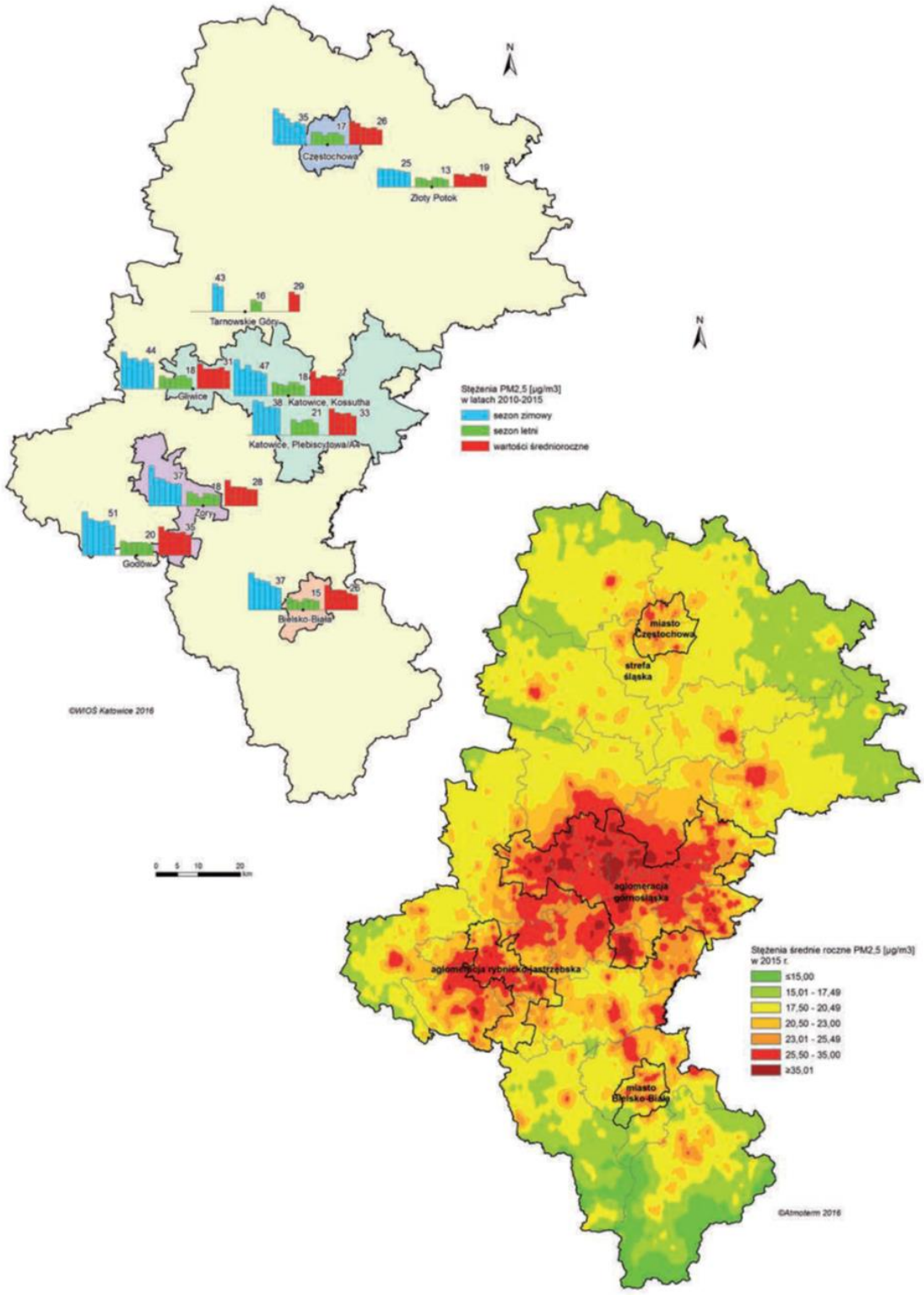
Source: STAN ŚRODOWISKA w województwie śląskim w 2015 roku, Inspekcja Ochrony Środowiska, 2016 (http://www.katowice.wios.gov.pl/monitoring/raporty/2015/raport2015.pdf)

Figure 10: 36 maximal PM10 concentrations at measuring stations in the years 2010-2015 and distribution of PM10 concentrations in the Silesian Voivodship in 2015



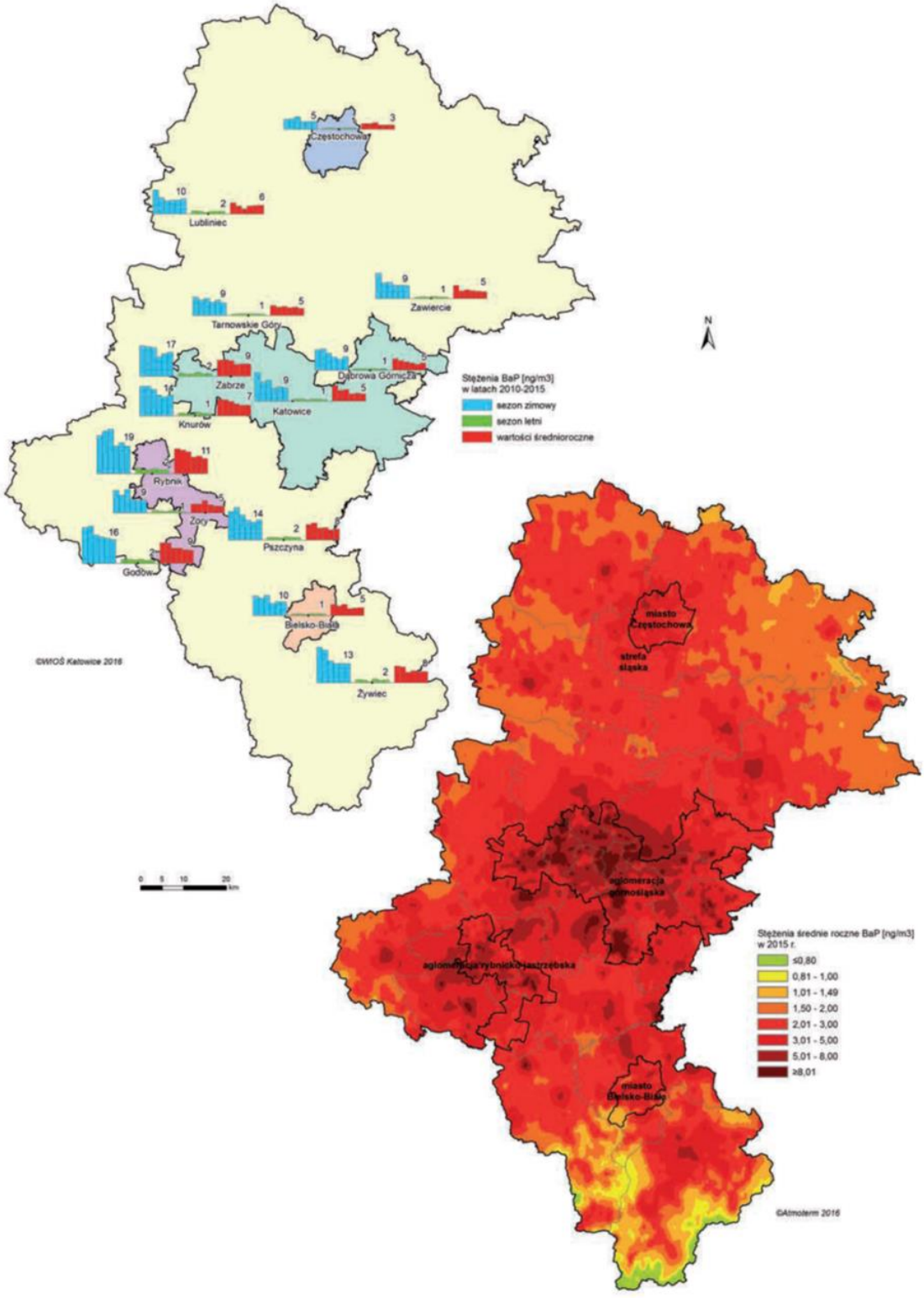
Source: STAN ŚRODOWISKA w województwie śląskim w 2015 roku, Inspekcja Ochrony Środowiska, 2016 (http://www.katowice.wios.gov.pl/monitoring/raporty/2015/raport2015.pdf)

Figure 11: PM2.5 annual average concentrations at measuring stations in the years 2010-2015 and distribution of PM2.5 concentrations in the Silesian Voivodship in 2015



Source: STAN ŚRODOWISKA w województwie śląskim w 2015 roku, Inspekcja Ochrony Środowiska, 2016 (http://www.katowice.wios.gov.pl/monitoring/raporty/2015/raport2015.pdf)

Figure 12: Average annual, summer and winter benzo(a)pyrene concentrations at measurement sites in 2010-2015 and distribution of mean concentrations of this substance in the Silesian Voivodship in 2015



Source: STAN ŚRODOWISKA w województwie śląskim w 2015 roku, Inspekcja Ochrony Środowiska, 2016 (http://www.katowice.wios.gov.pl/monitoring/raporty/2015/raport2015.pdf)

4.1.3. Poland – Air quality in the Opolskie Voivodship

Detailed analysis of air quality in the Opolskie Voivodship is presented in:

- Program of air protection for the Opolska zone, due to exceeding the limit values of PM10 and target values for PM2.5 and benzo (a) pyrene together with the Short-term action plan, Opole 2013[9]
- Program of air protection for the city Opole zone, due to exceeding the limit values of PM10 and target value for benzo (a) pyrene together with the Short-term action plan, Opole 2013[10]

Actual information on air quality in the Opolskie Voivodship is presented in the Complex State-of-the Environment Report 2013-2015[11].

Table 4: Exceedance of limit values in the Opolskie Voivodship, 2015

Name	Share of area with exceedances (%)	Population exposed (%)
	PM_{10} 24-hours limit value	
Total Opolskie Voivodship	3.3	33.9
	$PM_{2.5}$ annual limit value	
Total Opolskie Voivodship	0.2	5,2
benzo(a)pyrene annual limit value		
Total Opolskie Voivodship	45.9	72.2

Source: Complex State-of-the Environment Report 2013-2015, Opole 2016 (www.opole.pios.gov.pl/wms/Pliki/2016/Kompleksowy_raport_o_stanie_srodowiska_w_wojewodztwie_opolskim_w_latach_2013-2015.pdf)

It can be concluded that:

- More than 72 % of population of the Opolskie Voivodship lived in areas with exceeded annual target value for benzo(a)pyrene, almost 34 % in areas with exceeded 24-hours limit value for PM10, and more than 5 % in areas with exceeded annual limit value for PM2.5.

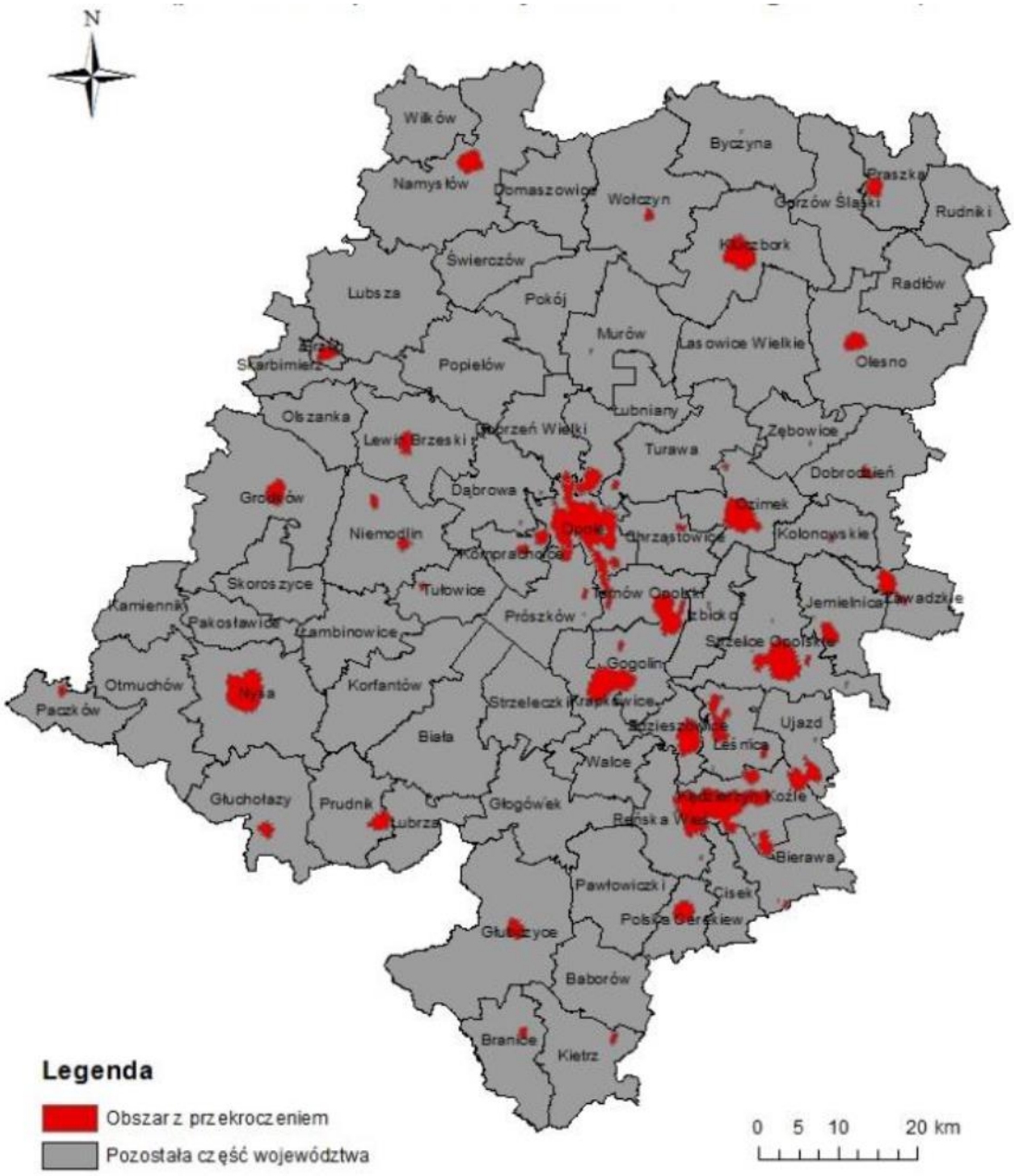
An example of distribution of annual average concentrations of PM2.5 and benzo(a)pyrene and of daily concentrations of PM10 in the Opolskie Voivodship is presented in the following figures:

[9] Link (PL): http://archiwum.opolskie.pl/docs/pop_strefa_opolska5.pdf

[10] Link (PL): http://archiwum.opolskie.pl/docs/wnioski/pop_strefa_miasto_opole_1.pdf

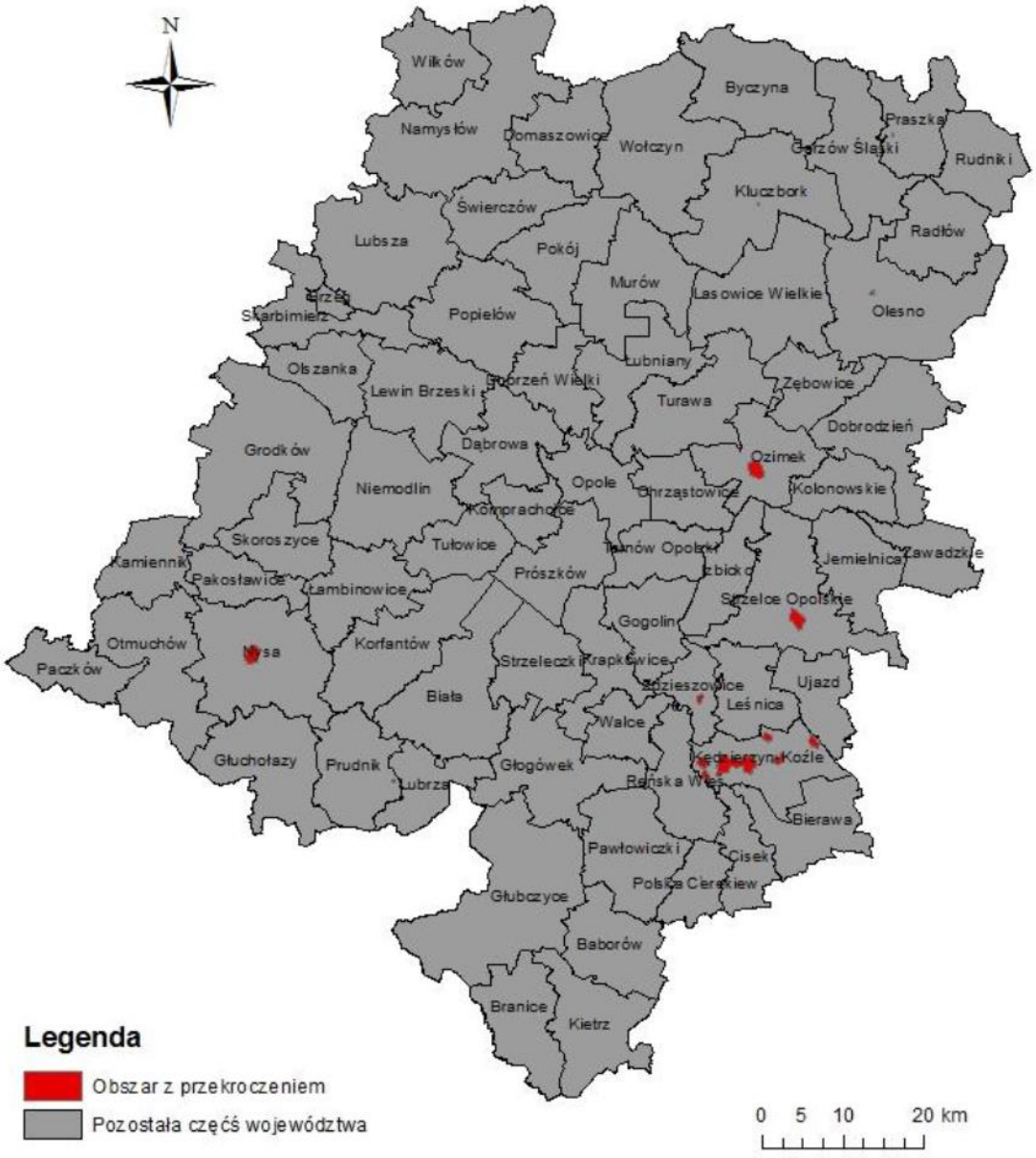
[11] Link (PL): www.opole.pios.gov.pl/wms/Pliki/2016/Kompleksowy_raport_o_stanie_srodowiska_w_wojewodztwie_opolskim_w_latach_2013-2015.pdf

Figure 13: Distribution of daily concentration of PM10 in the Opolskie Voivodship, 2015



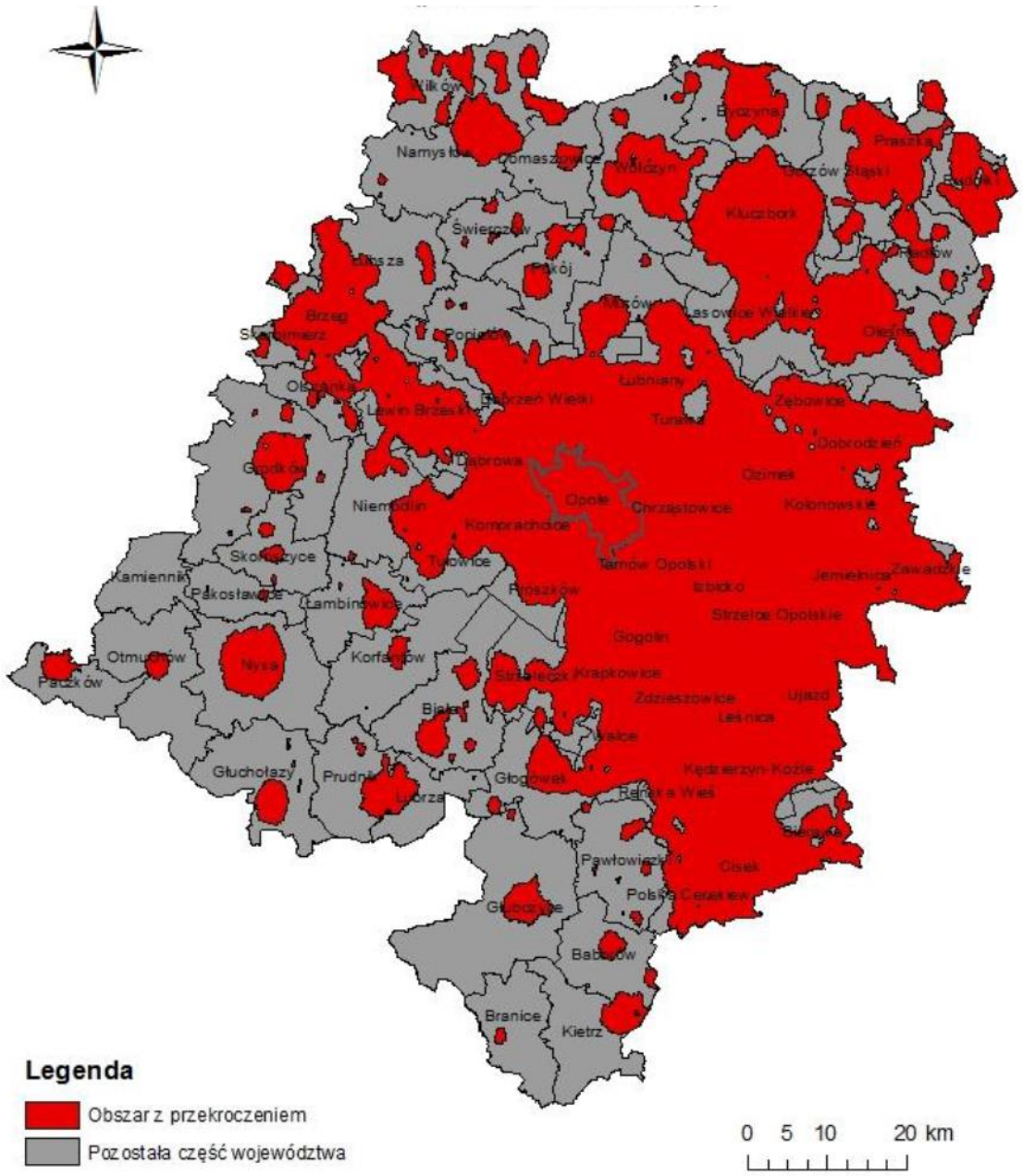
Source: Complex State-of-the Environment Report 2013-2015, Opole 2016 (www.opole.pios.gov.pl/wms/Pliki/2016/Kompleksowy_raport_o_stanie_srodowiska_w_wojewodztwie_opolskim_w_latach_2013-2015.pdf)

Figure 14: Distribution of annual average concentration of PM2.5 in the Opolskie Voivodship, 2015



Source: Complex State-of-the Environment Report 2013-2015, Opole 2016 (www.opole.pios.gov.pl/wms/Pliki/2016/Kompleksowy_raport_o_stanie_srodowiska_w_wojewodztwie_opolskim_w_latach_2013-2015.pdf)

Figure 15: Distribution of annual average concentration of benzo(a)pyrene in the Opolskie Voivodship, 2015



Source: Complex State-of-the Environment Report 2013-2015, Opole 2016 (www.opole.pios.gov.pl/wms/Pliki/2016/Kompleksowy_raport_o_stanie_srodowiska_w_wojewodztwie_opolskim_w_latach_2013-2015.pdf)

4.1.4. Slovak Republic – Air quality in the Zilinsky Region

For the purpose of air quality assessment and management, the whole territory of the Slovak Republic has been divided, In accordance with the Slovak legislation, among 2 agglomerations and 8 zones, one of the **being zone which includes the whole area of the Žilina Self-governing Region**.

Within zones and agglomerations, **areas of air quality management** (territories of certain municipalities) are not permanent but are being updated in accordance with the actual results of air quality monitoring. The last update has been carried out in the following way[12]:

"The Slovak Hydro-meteorological Institute (SHMI) on the basis of air quality assessment in zones and agglomerations in 2015, proposes, according to § 9 par. 3 of Act No. 137/2010 Coll., on Air, as amended, an update of the air quality management areas of the Slovak Republic after 2016. The pollutant will be exempted from the area of air quality management only after it is 3 years below the limit value for the next year."

Slovak Hydro-meteorological Institute publishes two annual publications devoted to air quality:

- Air Pollution in the Slovak Republic (annual reports 1998 - 2015)[13]
- Air Quality Assessment in the Slovak Republic (annual reports 2004 – 2016)[14]

In the Žilina Self-governing Region, the Slovak Hydro-meteorological Institute operates 3 standard air quality monitoring station (Žilina, Martin, Ružomberok) and one EMEP station (Chopok). In addition, one monitoring station is being operated by private company (Mondi Ružomberok – paper and pulp production).

Results of air quality monitoring in the Žilina zone are presented below:

- In 2015 and 2016, the limit or target value for human health protection was not exceeded for any pollutant measured.
- In 2014, the daily limit value for human health protection for PM10 was exceeded at the stations Ružomberok-Riadok and Žilina-Obežná. Both had the same number of PM10 exceedances 51 times. Compared to 2013, a slight decrease in the annual average concentrations of PM10 and PM2.5 was observed in the whole area. Other pollutants did not exceed limit values.
- In 2013, the daily limit value for the protection of human health for PM10 was exceeded at the stations Ružomberok-Riadok and Žilina-Oběžná. Compared to 2012, the significant trend of decreasing PM10 concentrations has been maintained throughout the zone. Unlike 2012, limit value for PM2.5 was not exceeded at any station. Other pollutants did not exceed limit values.
- In 2012, the daily limit value for the protection of human health for PM10 was exceeded at the stations Ruzomberok-Riadok and Žilina-Obežná. Compared to 2011, the entire area of the zone showed a marked tendency of decrease of PM10 concentrations, although at the Ružomberok-Riadok station, the average annual concentration of 40.1 μg.m-3 was just above the limit value. At both stations, the limit value plus margin of tolerance for PM2.5 was also exceeded. Other pollutants did not exceed limit values.

Detailed air quality assessment in the Žilina Self-governing Region was presented in the report **Information on air quality, the contribution of stationary sources to its pollution, air quality improvement programs and action plans in the Zilina Region in 2014**[15].

[12] See http://www.shmu.sk/sk/?page=2186

[13] Link (SK/EN): http://www.shmu.sk/sk/?page=997

[14] Link (SK): http://www.shmu.sk/sk/?page=996

[15] Link (SK):

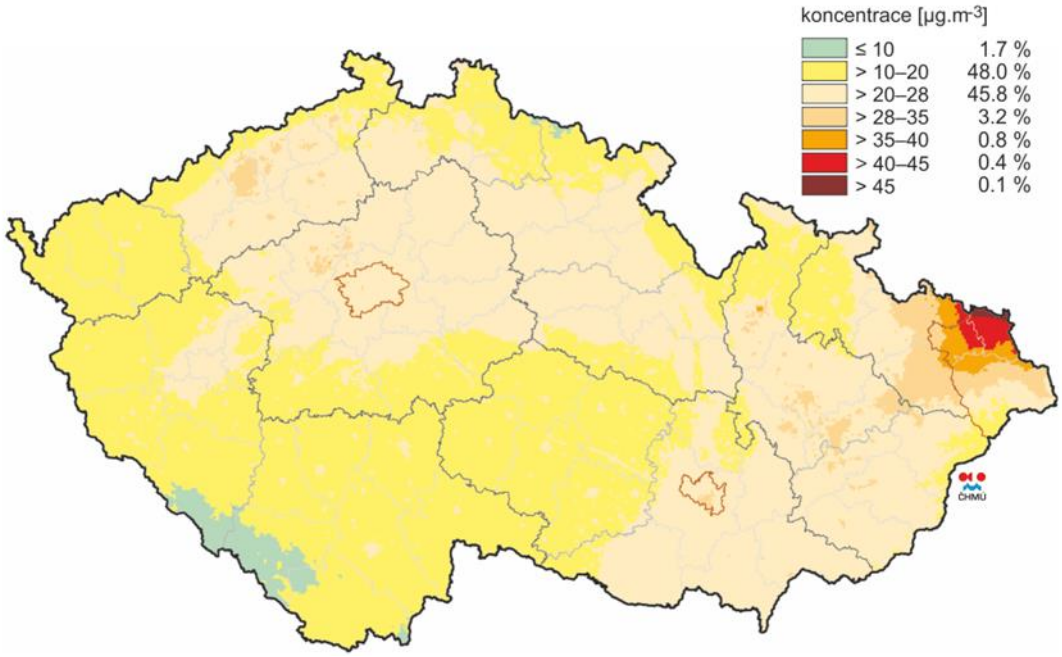
In 2014, the air quality management areas (areas with exceeded daily limit value for PM_{10}) made up 4.55% of the area of the region. The number of inhabitants living in the air quality management areas accounts for 26.55% of the population of the region.

4.1.5. Position of AIR TRITIA project areas (CS, PL, SK) in national contexts

Czech Republic:

Position of the Moravian-Silesian Region (Agglomeration Ostrava/Karviná/Frýdek/Místek, Moravian-Silesian Zone) with respect to air quality in the Czech Republic can be seen in the following figures:

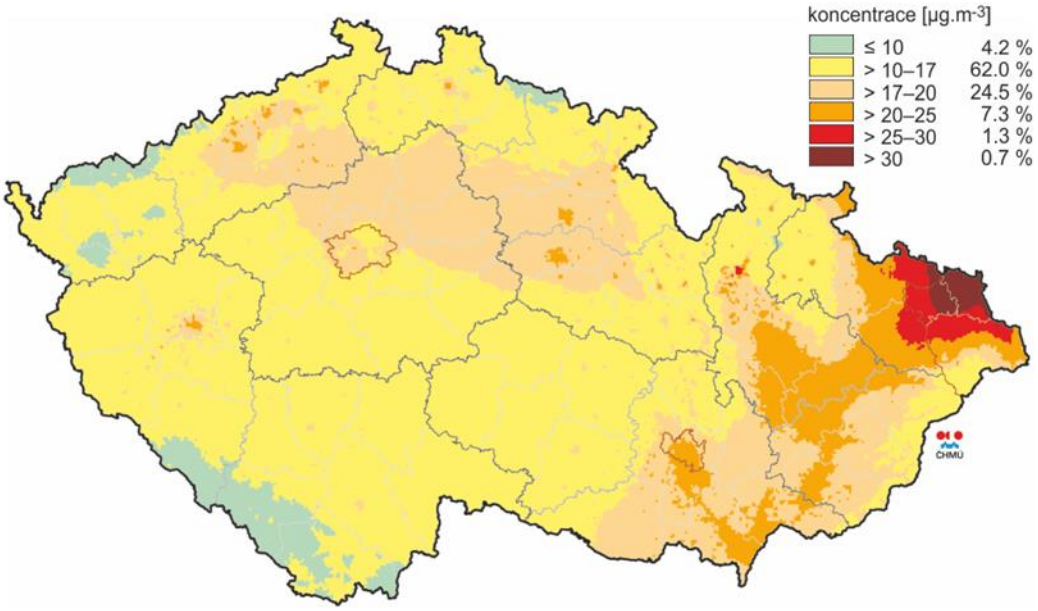
Figure 16: Five-year average of annual average concentration of PM10, Czech Republic, 2011 – 2015



Source: Report on Air Quality 2015, Ministry of Environment, Czech Republic, 2016 (https://www.mzp.cz/C1257458002F0DC7/cz/zprava_o_kvalite_ovzdusi/$FILE/OOO-Zprava_o_kvalite_ovzdusi_2015-20170105.pdf)

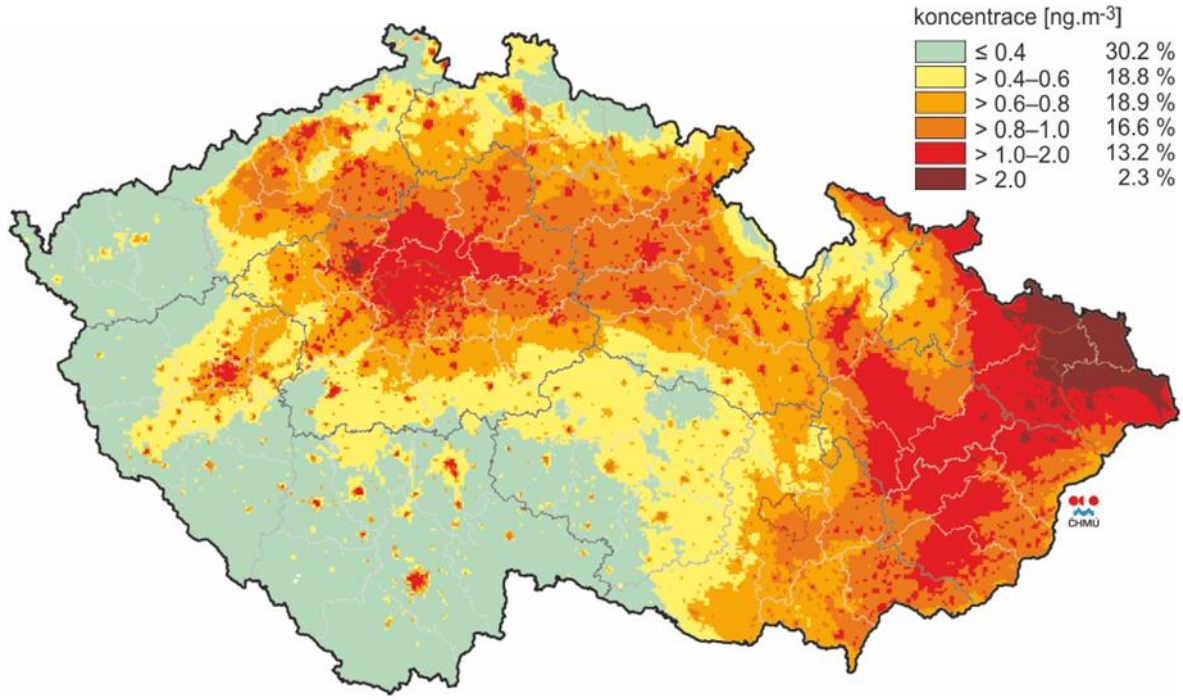
https://www.minv.sk/swift_data/source/miestna_statna_sprava/okres_zilina/zivotne_prostredie/ochrana_ovzdusia/kvalita_ovzd_2014_OU_OSZP2.pdf

Figure 17: Five-year average of annual average concentration of PM2.5, Czech Republic, 2011 – 2015



Source: Report on Air Quality 2015, Ministry of Environment, Czech Republic, 2016 (https://www.mzp.cz/C1257458002F0DC7/cz/zprava_o_kvalite_ovzdusi/$FILE/OOO-Zprava_o_kvalite_ovzdusi_2015-20170105.pdf)

Figure 18: Five-year average of annual average concentration of benzo(a)pyrene, Czech Republic 2011 – 2015



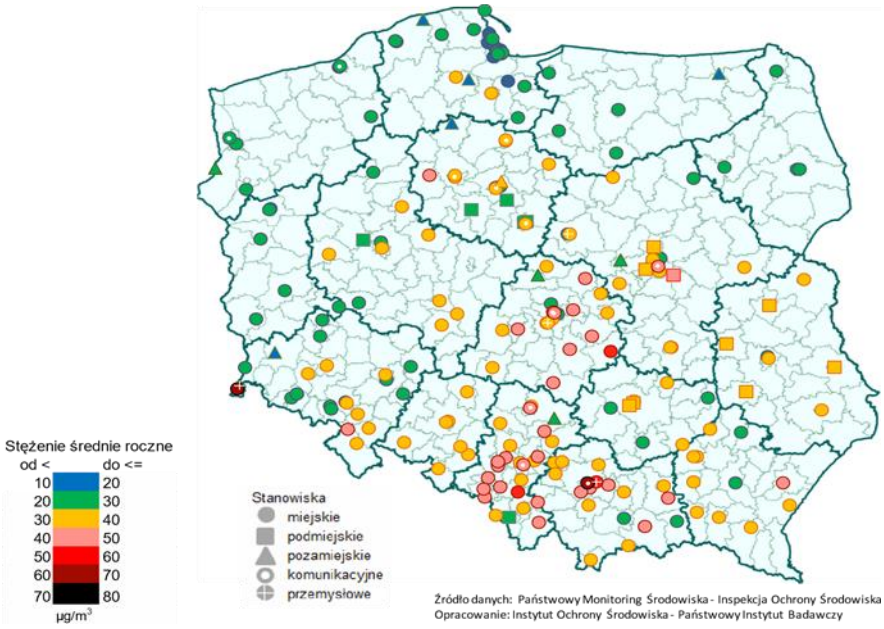
Source: Report on Air Quality 2015, Ministry of Environment, Czech Republic, 2016 (https://www.mzp.cz/C1257458002F0DC7/cz/zprava_o_kvalite_ovzdusi/$FILE/OOO-Zprava_o_kvalite_ovzdusi_2015-20170105.pdf)

It can be concluded that the Czech part of AIR TRITIA project area (especially Agglomeration Ostrava/Karviná/Frýdek-Místek) is the most polluted part of the Czech Republic in terms on PM10, PM2.5 and benzo(a)pyrene for which air quality standards are being exceeded substantially (in the case of benzo(a)pyrene in multiples of target value).

Poland:

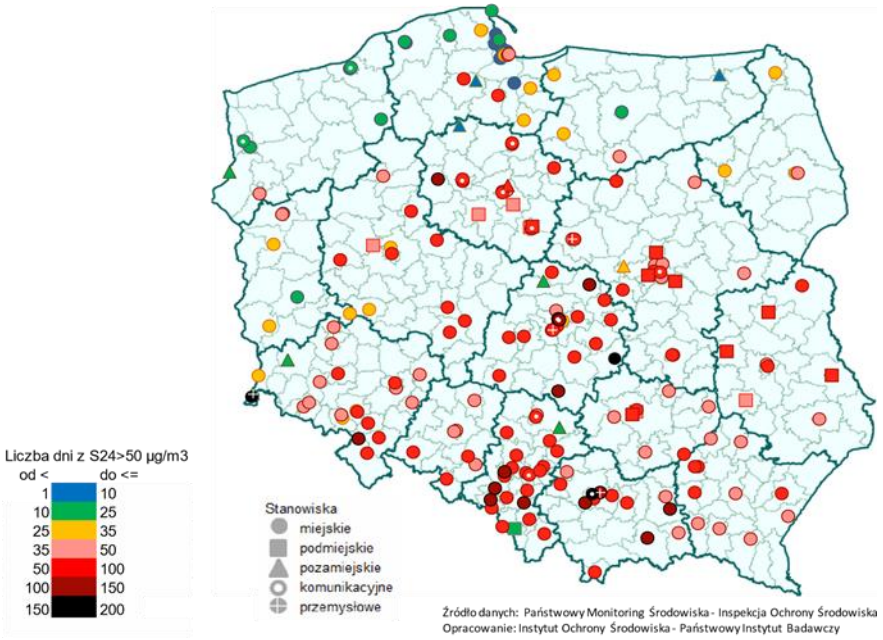
Regular assessment of air quality in Poland is being published by the General Environmental Inspectorate in annual reports (Air quality in Poland in the light of the results of measurements conducted within the framework of the State Environmental Monitoring). Recent results (2015) are presented in the following figures which show that the AIR TRITIA project areas and especially the Silesian Voivodship represent the most polluted part of Poland in terms of PM10 and PM2.5.

Figure 19: Annual average concentrations of PM10 in Poland, 2015



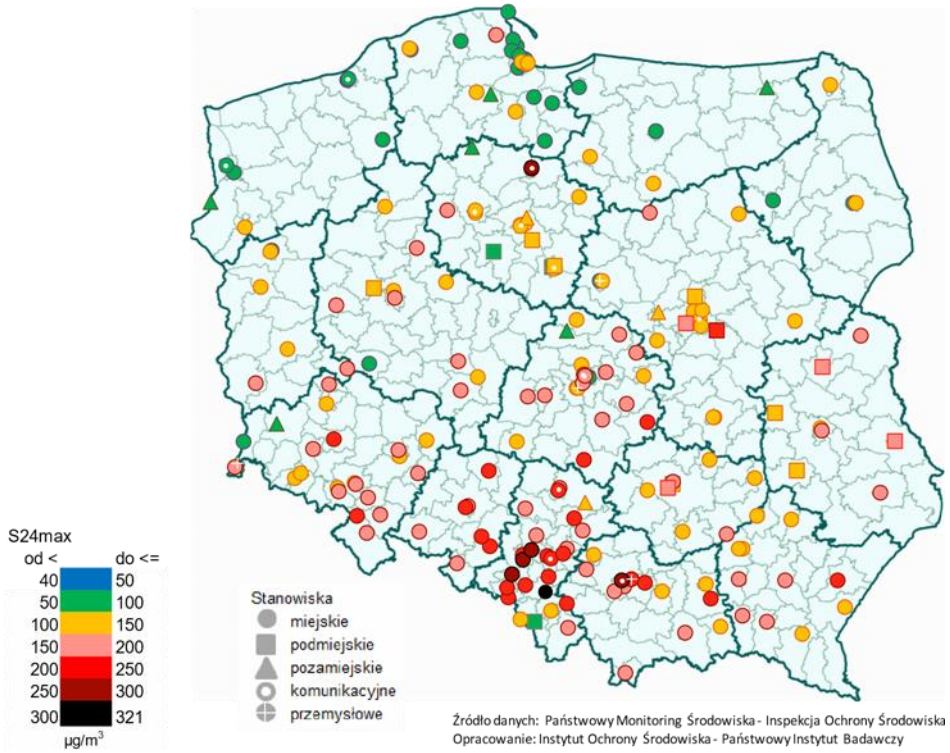
Source: Air quality in Poland in the light of the results of measurements conducted within the framework of the State Environmental Monitoring, 2015 (http://powietrze.gios.gov.pl/pjp/content/publications)

Figure 20: Number of days with exceeds of 50 µg / m3 by 24-hour concentration. PM10 in Poland, 2015



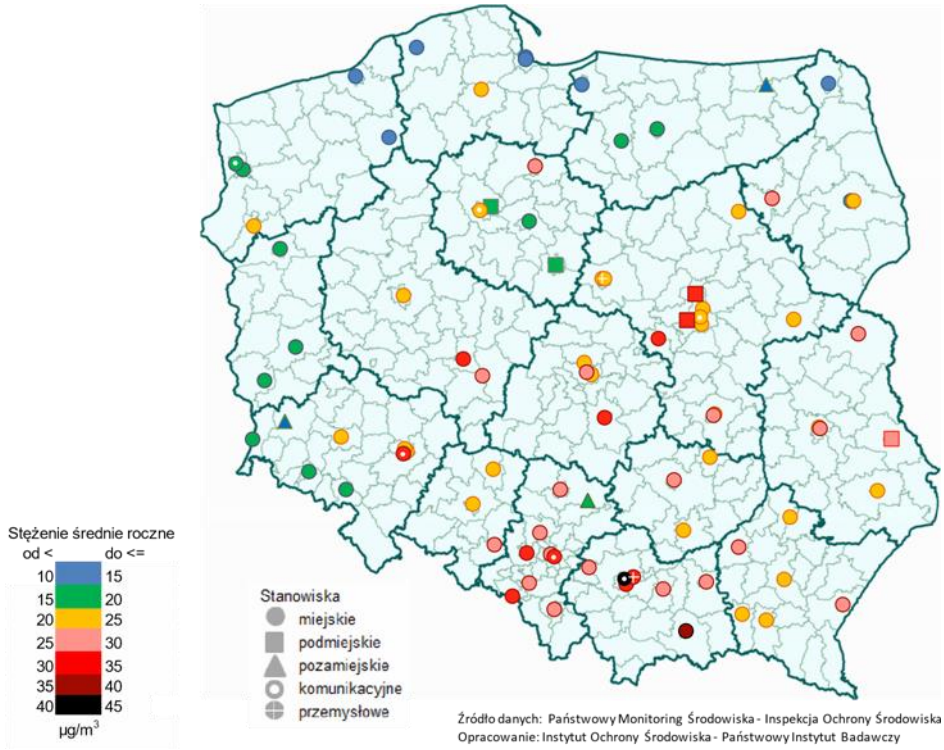
Source: Air quality in Poland in the light of the results of measurements conducted within the framework of the State Environmental Monitoring, 2015 (http://powietrze.gios.gov.pl/pjp/content/publications)

Figure 21: Maximum concentrations of 24-h. PM10 (S24max) registered in Poland, 2015.



Source: Air quality in Poland in the light of the results of measurements conducted within the framework of the State Environmental Monitoring, 2015 (http://powietrze.gios.gov.pl/pjp/content/publications)

Figure 22: Annual average concentrations of PM2.5 in Poland, 2015



Source: Air quality in Poland in the light of the results of measurements conducted within the framework of the State Environmental Monitoring, 2015 (http://powietrze.gios.gov.pl/pjp/content/publications)

Slovak republic:

Position of the Žilina Self-governing Region (Zone Žilina) with respect to air quality in the Slovak Republic can be seen in the following figures (modelling):

Figure 23: Annual average concentration of PM10 [µg.m3], Slovak Republic, 2016

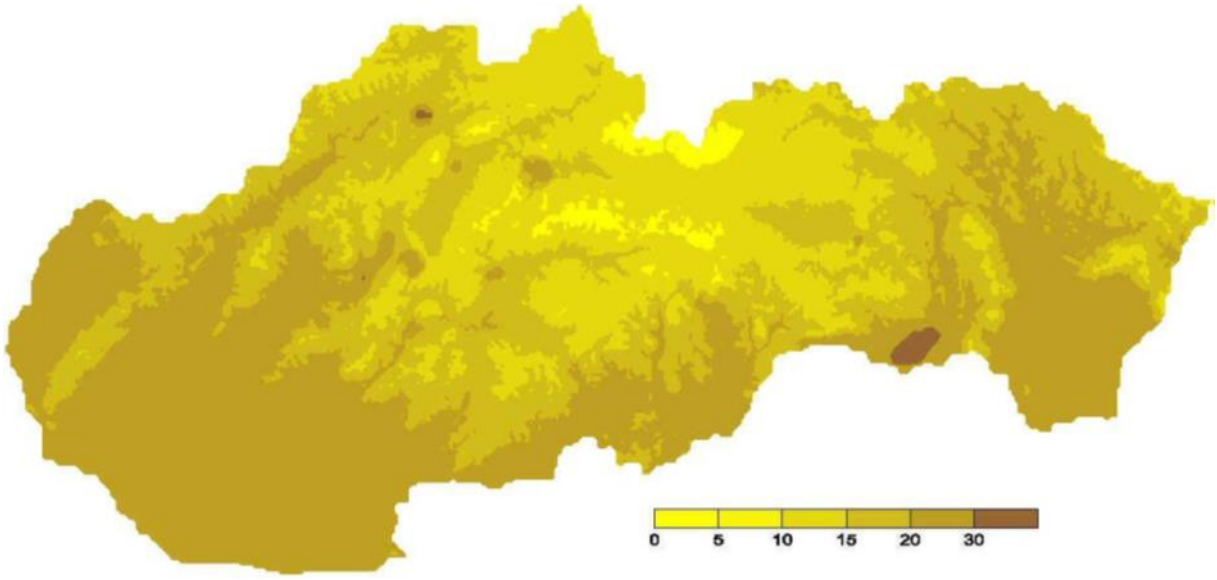
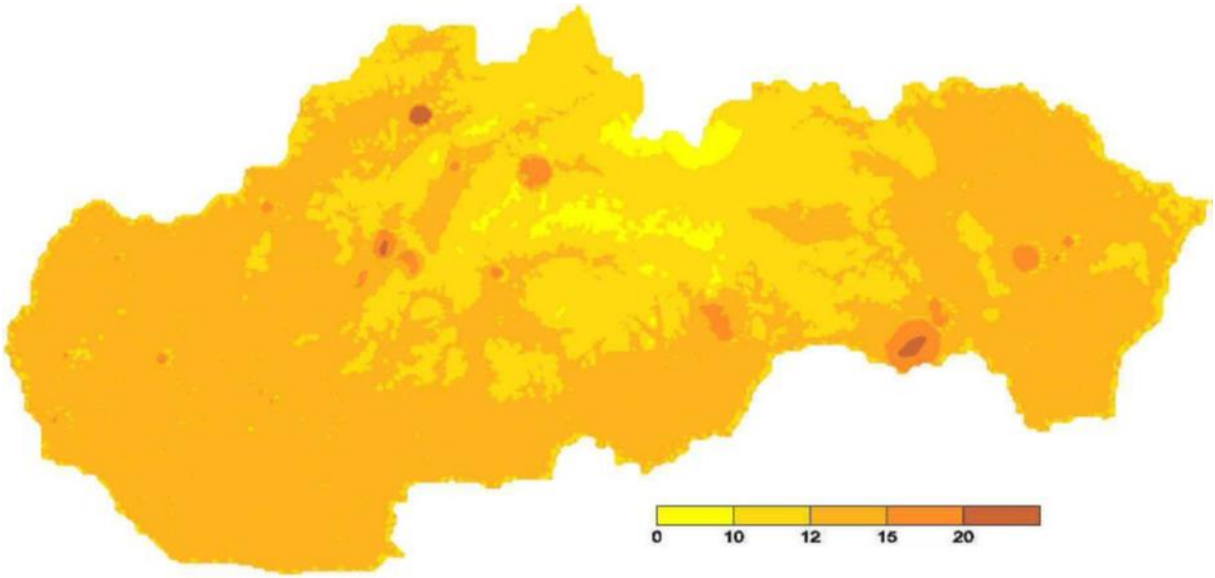


Figure 24: Figure 25: Annual average concentration of PM2.5 [µg.m3], Slovak Republic, 2016



Regardless limit values for PM and PM were not exceeded in 2016, it can be seen that concentrations are elevated comparing to the majority of area of the Slovak Republic.

4.1.6. Mutual comparison of regions (CS, PL, SK)

Air quality in the Czech and Polish part of AIR TRITIA project area is very poor, limit and target values for PM10 , PM2.5 and benzo(a)pyrene are being exceeded every year seriously. In the Slovak part of project area, air quality is much better than that in the Czech and Polish parts, however limit values for PM10 were in certain years exceeded as well.

4.2. Emissions of pollutants in the AIR TRITIA project region

4.2.1. Czech Republic - Emissions in the Moravian-Silesian Region

The results of air quality assessment are being published annually by the Czech Hydro-meteorological Institute in "Air Pollution in The Czech Republic in the Year 20XX" data[16] and graphic yearbooks[17]. Data yearbooks include all available data while graphic yearbooks include interpretations

Obviously, graphic yearbooks include a separate chapter devoted **to air quality and emissions in Agglomeration Ostrava/Karvina/Frydek-Mistek in the Moravian-Silesian region (the latest yearbook available covers year 2015)[18]:**

Emissions in the agglomeration of Ostrava/Karviná/Frýdek-Místek:

Individual categories of emission sources in the O/K/F-M agglomeration have a different distribution than in other areas of the Czech Republic. As concerns primary emissions of TSP, the dominant position is still occupied by emissions from large industrial plants. In 2015 important steelworks together with coking stations and the energy sector produced more than 1,300 t of TSP emissions, which, however, was approximately 400 t less than in the previous year. In the cases of SO2 and NOX emissions, such sources unequivocally dominate with a share of 95 % in total emissions from stationary sources. In the case of benzo[a]pyrene, the share of emissions from local heating clearly predominates, and the remaining amount is significantly contributed to, in contrast to other areas under assessment, by emissions from industrial production of coke and iron. The decrease of the share of these producers in total emissions of benzo[a]pyrene compared to previous years is related to the update of the emissions inventory for the years 2000–2013 to the NFR format, which was done in 2015. Its changes are most apparent in emissions of heavy metals and persistent organic substances.

At present there are more than 770 individually registered plants – sources of ambient air pollution included in the REZZO 1 and REZZO 2 database. Only several dozens of them have their significant contribution to total emissions. These include primarily metallurgy (agglomeration of ores, production of pig iron, steel and metal casting), coke production, production of electric energy (e.g. power station Třebovice and power station Dětmarovice) and thermal energy suppliers. Approximately 15 most significant plants produce annually 90 % of all emissions from individually monitored sources, while the considerable share is contributed also by hardly determinable fugitive emissions of TSP, produced, for example, in storage areas, handling of loose materials and in industrial buildings with dusty operations.

According to the outputs of the 2011 general census, heating in households is predominantly supplied by central sources of heat energy (about 59 % of flats), followed by gas boiler stations and local gas boilers (about 25 % of flats). There are significant differences in the evaluated area resulting primarily from the character of the structure of dwellings in individual districts. While in the district of Frýdek-Místek the share of flats heated locally by solid fuels approaches 20 %, in the district of Karviná this share is 8%and in the district of Ostrava it is a mere 4 %. This fact, stressed moreover by higher average altitude of settlements in the district of Frýdek-Místek and by larger average flat area, is apparent primarily in emissions with a more significant share of the REZZO 3 category, i.e. in TSP and particles, VOC, benzene and mainly in benzo[a]pyrene emissions.

In the period 2002–2013 the above-mentioned significant sources recorded decreases of emissions of all monitored pollutants (e.g. TSP by about 50 %, SO2 and NO2 by about 25 %). This decrease is partly the result

[16] Link (CS): http://portal.chmi.cz/files/portal/docs/uoco/isko/tab_roc/tab_roc_CZ.html
Link (EN): http://portal.chmi.cz/files/portal/docs/uoco/isko/tab_roc/2016_enh/index_GB.html
[17] Link (CS): http://portal.chmi.cz/files/portal/docs/uoco/isko/grafroc/grafroc_CZ.html
Link (EN): http://portal.chmi.cz/files/portal/docs/uoco/isko/grafroc/15groc/gr15en/Obsah_GB.html
[18] Official translation cited

of a decline in production of pig iron and the associated production of metallurgical coke and steel related, for example, to the shutdown of the coking plant Jan Šverma and some of the production technologies of EVRAZ Vítkovice Steel in Ostrava. Simultaneously, a number of important measures have been implemented in the recent period, mainly to reduce TSP and toxic emissions of heavy metals and POP bound to them. In spite of these positive trends, the production of emissions of the mentioned pollutants, but also of other pollutants, such as CO and VOC, is still high and contributes to deteriorated ambient air quality not only in the territory of the agglomeration, but also in the neighbouring districts and regions including the Republic of Poland.

The share of emissions from household heating (not only in Czechia, but also in Poland, especially in the border area), in the air pollution load of the whole agglomeration is questionable. An important factor, manifested primarily in the local ambient air quality, is the higher probability of operating dual-fuel domestic household heating systems (e.g. combining a natural gas boiler with a furnace or fireplace for burning wood), which cannot be correctly evaluated based on census data. Similarly, the structure of operating solid fuel boilers, as concerns their types, age and emission class, is in terms of ambient air quality evaluation rather unfavourable. If year-to-year changes occur in the production of emissions from household heating, they are connected mainly with the meteorological situation in the given year, i.e. with temperatures especially during the cold half of the year and thus the length of the heating season. Past or current programmes for the improvement of ambient air quality, for example, supporting environmentally sound methods for producing heat and hot water through the Green Savings Programme or the Boiler Subsidy Programme, have not yet produced changes in the overall structure of household heating sources which would significantly reduce the number of outdated combustion appliances and replace them with environmentally friendly ones.

Most important stationary sources of air pollution in the Moravian Silesian Region:

List of most polluting stationary sources of air pollution in the Czech part of AIR TRITIA project region (Moravian-Silesian Region) is presented in the following table (in order on decreasing emissions of PM10):

Table 5: Most important stationary sources of air pollution in the Moravian-Silesian Region in 2015

Name	Technology	Emissions (t/year)
	PM_{10}	
ArcellorMittal Ostrava	Metallurgy	456
Třinecké železárny	Metallurgy	263
Elektrárna Třebovice	Power plant (coal)	91
Elektrárna Dětmarovice	Power plant (coal)	82
Kamenolom Jakubčovice	Quarry	75
	NO_X	
Elektrárna Třebovice	Power plant (coal)	2 878
ArcellorMittal Ostrava	Metallurgy	2 460
Elektrárna Dětmarovice	Power plant (coal)	2 713
TAMEH Czech	Heating plant	1 902
Třinecké železárny	Metallurgy	1 369
	SO_2	
Elektrárna Třebovice	Power plant (coal)	3 001
TAMEH Czech	Heating plant	2 822
Třinecké železárny	Metallurgy	2 521
Elektrárna Dětmarovice	Power plant (coal)	1 746
Energetika Třinec	Heating plant	1 456

Source: Pollutant Release and Transfer Register

4.2.2. Poland – Emissions in the Silesian Voivodship

Detailed analysis of emissions of air pollutants in the Silesian Voivodship is presented in **the Air Protection Program for the Silesian Voivodship aiming at reaching air quality standards, Katowice 2014**[19]. Actual information on air quality can be found in the annual **State-of-the-Environment Report in the Silesian Voivodship in 2015**[20].

- Air pollution in poviats is most affected by local fugitive sources (mainly local household heating), whose share in the average annual concentration of PM10 is from 7% for Jastrzębie Zdrój to 43% in the Żywiec district and 44% in the Kłobuck district.
- On the whole, fugitive sources (local, other districts and other voivodships) account for 24% in the case of Jastrzębie Zdrój and 53% in Świętochłowice. The largest share of fugitive sources from other districts is found in the cities of Jastrzębie Zdrój (15.7%), Żory (16.7%) and Świętochłowice (15%), and Chorzów and Ruda Śląska (13%).
- The sources outside the voivodship have the largest share in the case of neighboring poviats bordering with Małopolskie Voivodship ie Bielsko, Pszczyno, Bieruńsko-Lędzińsk, Jaworzno, in the south of the voivodship in Wodzisław Śląski, Racibórz and Jastrzębie Zdrój. These sources can account for up to 14% of the average annual concentration of PM10;
- The maximum impact of emissions from road transport on exceedances of annual limit value for PM10 are can be seen in Częstochowa (19%); Gliwice (22%); Bielsko Biała (18%), Katowice (15%) and Czestochowa counties (17%) and Myszków (14%).

4.2.3. Poland – Emissions in the Opolskie Voivodship

Detailed analysis of air quality and emissions of air pollutants in the Opolskie Voivodship is presented in:

- Program of air protection for the Opolska zone, due to exceeding the limit values of PM10 and target values for PM2.5 and benzo (a) pyrene together with the Short-term action plan, Opole 2013[21]
- Program of air protection for the city Opole zone, due to exceeding the limit values of PM10 and target value for benzo (a) pyrene together with the Short-term action plan, Opole 2013[22]

Actual information on air quality and emissions of ait pollutants in the Opolskie Voivodship is presented in **the Complex State-of-the Environment Report 2013-2015**[23].

Opolska Zone:

The main source of emissions of PM10, PM2.5 and benzo (a) pyrene are fugitive emissions (mainly from local household heating), which represent in the case of PM10 51.8%, PM2.5 less than 57% and benzene (a) pyrene - over 90% share in total emissions. Emissions from road transport are also significant, reaching a 27.5% share in total PM10 and PM2.5 emissions.

[19] Link (PL): https://bip.slaskie.pl/dokumenty/2015/01/29/1422520775.pdf

[20] Link (PL): http://www.katowice.wios.gov.pl/monitoring/raporty/2015/raport2015.pdf

[21] Link (PL): http://archiwum.opolskie.pl/docs/pop_strefa_opolska5.pdf

[22] Link (PL): http://archiwum.opolskie.pl/docs/wnioski/pop_strefa_miasto_opole_1.pdf

[23] Link (PL):

www.opole.pios.gov.pl/wms/Pliki/2016/Kompleksowy_raport_o_stanie_srodowiska_w_wojewodztwie_opolskim_w_latach_2013-2015.pdf

City of Opole:

The highest impact on air quality in Opole in terms of PM10 is represented by fugitive sources, mainly local ones (17.4%). Local industry is also of importance. Road transport communication has an impact on emissions of around 11%.

According to emission inventory, the largest amount of PM10 emissions is originated in fugitive emissions, mainly from household heating - over 42% of total emissions. In case the case of benzo(a)pyrene, the largest share of total emissions is from fugitive sources (almost 77%), followed by point sources (23%).

It can be concluded that fugitive emissions (mainly local household heating) represent the main contributor to poor air quality in both voivodships followed by road transport.

4.2.4. Slovak Republic – Emissions in the Zilinsky Region

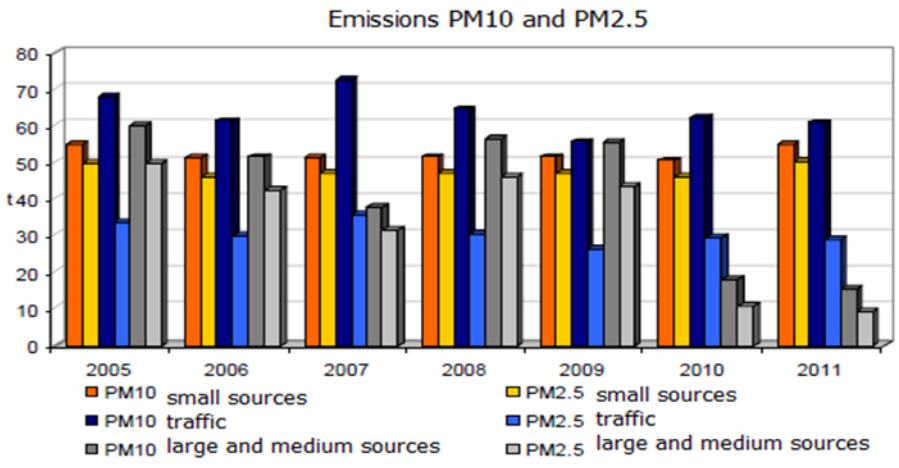
Emissions of TSP, SO_2 and NO_X from registered stationary emission sources are collected annually in the National Emission Inventory System[24], operated by the Slovak Hydro-meteorological Institute. The development of emissions in the Zilina Region is presented in the following table:

Table 6: Emissions from registered stationary emission sources in the Zilina Self-governing region 2010-2015 (t/year)

	2015	2014	2013	2012	2011	2010
TSP	427,516	563,406	667,916	585,566	594,931	506,248
SO2	1 687,203	1 598,893	1 693,207	1 904,408	1 927,907	2 200,452
NOX	2 754,947	2 610,756	2 783,097	3 310,108	3 448,380	3 308,766

Source: National Emission Inventory System

Figure 25: PM10 and PM2.5 emissions from individual sources in Žilina



Source: National Emission Inventory System

It can be concluded that fugitive emissions (mainly local household heating) represent the main contributor to poor air quality in Žilina followed by road transport.

[24] Link (SK): http://www.shmu.sk/sk/?page=992

4.2.5. Mutual comparison of AIR TRITIA project regions (CS, PL, SK)

Fugitive emissions from local heating are considered the most important source of air pollution in all three countries followed by emissions from road transport. Coal fired power plants and industrial installations (power plants, metallurgy) play important role in the Czech Republic and Poland.

5. Conclusions

European context:

- Air quality in the AIR TRITIA project region is the worst in the EU as for exceedances of air quality standards for PM10, PM2.5 and benzo(a)pyrene
- The most important stationary air polluting sources (Top 50) include:
  - ArcelorMittal Poland Dąbrowa Górnicza (the fifth biggest polluter of PM10 in the EU)
  - Power Plant "RYBNIK" S.A. , Poland (No 14 of more than 12 thousand most damaging installations)
  - Power Plant "Nováky", Slovak Republic (No 18 of more than 12 thousand most damaging installations)

Regional context:

- the Czech part of AIR TRITIA project area (especially Agglomeration Ostrava/Karviná/Frýdek-Místek; O/K/F-M) is the most polluted part of the Czech Republic in terms on PM10, PM2.5 and benzo(a)pyrene for which air quality standards are being exceeded substantially every year (in the case of benzo(a)pyrene in multiples of target value)
- More than 40 % of population of the Moravian-Silesian Region is exposed to concentrations of PM10 exceeding daily limit value; in the case of benzo(a)pyrene almost 80 % of population is exposed to concentrations exceeding annual target value
- Within the Moravian-Silesian Region, air quality in the O/K/F-M agglomeration is worse than that in the Moravian-Silesian Zone.
- The Polish part of AIR TRITIA project area and especially the Silesian Voivodship represent the most polluted part of Poland in terms of PM10, PM2.5and benzo(a)pyrene for which air quality standards are being exceeded substantially every year (in the case of benzo(a)pyrene in multiples of target value)
- 100 % of population of the Silesian Voivodship lived in areas with exceeded annual limit value for benzo(a)pyrene and 24-hours limit value for PM10, 43 % in areas with exceeded annual limit value for PM2.5 and 38 % in areas with exceeded annual limit value for PM10
- More than 72 % of population of the Opolskie Voivodship lived in areas with exceeded annual target value for benzo(a)pyrene, almost 34 % in areas with exceeded 24-hours limit value for PM10, and more than 5 % in areas with exceeded annual limit value for PM2.5.
- Air quality in the Silesian Voivodship is worse than that in the Opolskie Voivodship
- Air quality standards have not been exceeded in the Žilina Self-governing region in 2015 and 2016
- Daily limit value for PM10 was exceeded in 2012, 2013 and 2014 in Žilina and Ružomberok
- In 2014, the number of inhabitants living in the air quality management areas (areas with exceeded daily limit value for PM10) accounted for 26.55% of the population of the region.
- Air quality in the Czech and Polish part of AIR TRITIA project area is very poor, limit and target values for PM10 , PM2.5 and benzo(a)pyrene are being exceeded every year seriously
- In the Slovak part of project area, air quality is much better than that in the Czech and Polish parts, however limit values for PM10 were in certain years exceeded as well

- Fugitive emissions from local heating are considered the most important source of air pollution in all three countries followed by emissions from road transport
- Coal fired power plants and industrial installations (metallurgy and coke production) play important role in the Czech Republic and Poland

6. Figures and abbreviations

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List of abbreviations

AMS	Automated Monitoring Station
AT	Alert threshold
BAT	Best Available Technique
BC	Black carbon
BREF	BAT Reference document
CHMI	Czech Hydro-meteorological Institute
CIEP	Chief Inspectorate of Environmental Protection (Poland)
CL	Critical level
CLRTAP	UNECE Convention on Long-range Transboundary Air Pollution
CNG	Compressed Natural Gas
CR	Czech Republic
CS	Czech language
DPSIR	Analytical concept: Driving forces – Pressures – State – Impact - Response
EAP	Environment Action Program
EEA	European Environment Agency
EIA	Environmental impact assessment
ELV	Emission limit value
EMEP	The European Monitoring and Evaluation Programme
ETD	Emission Trading Directive (Directive 2003/87/EC)
EU	European Union
FUA	Functional Urban Area
GAINS	Greenhouse Gas - Air Pollution Interactions and Synergies model
GHG	Greenhouse gas
HCB	Hydrochlorinated biphenyl
HM	Heavy metal
IED	Industrial Emissions Directive (2010/75/EU)
IIASA	International Institute for Applied System Analysis

IIR	Informative Inventory Report
IPPC	Integrated Pollution Prevention and Control
ISP	International Organization for Standardization
IT	Information threshold
KZK GOP	Municipal Transport Union of the Upper Silesian Industrial District
LCP	Large combustion plant
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LTO	Long-term objective
LV	Limit value
MCP	Medium sized combustion plant
MoE	Ministry of Environment
NEAP	National Environmental Action Program
NERP	National Emission Reduction Program
NFR	Nomenclature for reporting
NIP	National Implementation Program
NMVOC	Non-methane volatile organic compounds
NPSE	National Emission Reduction Program of the Czech Republic
O/K/F-M	Agglomeration Ostrava-Karviná-Frýdek-Místek (Czech Republic)
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PGN	Low Emission Economy Plan (Poland)
PL	Poland, Polish language
PM	Particulate matter
POP	Persistent organic pollutant
SEA	Strategic environmental assessment
SHMI	Slovak Hydro-meteorological Institute
SK	Slovakia, Slovak language
SR	Slovak Republic
SRA	Slovak Road Administration
TSP	Total suspended particles
TV	Target value
UN	United Nations
UNECE	United Nations Economic Commission for Europe
VOC	Volatile organic compounds
WHO	World Health Organization
ZU	Health Institute (Czech Republic)

7. Annexx

List of relevant reports and studies to use as base information air quality activities.

International/Global:

- Global Environment Outlook (UNEP 2012) Link (EN): http://www.unep.org/geo/assessments/global-assessments/global-environment-outlook-5
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- Air pollution trends in the EMEP region between 1990 and 2012 (EMEP 2016) Link (EN): http://www.unece.org/index.php?id=42906
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- Climate & Clean Air Coalition Link: http://www.ccacoalition.org/en
- Updated Handbook for the 1979 Convention on Long-range Transboundary Air Pollution and its Protocols (UNECE 2015) Link (EN): http://www.unece.org/index.php?id=41371
- Strategies and Policies for Air Pollution Abatement (UNECE 2013) Link (EN): http://www.unece.org/index.php?id=35140

Europe:

- Mapping Europe's environmental future: understanding the impacts of global megatrends at the national level Link (EN): https://www.eea.europa.eu/publications/mapping-europes-environmental-future-understanding
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- Air quality in Europe — 2011 report (EEA Report 12/2011) Link (EN): https://www.eea.europa.eu/publications/air-quality-in-europe-2011
- Status of black carbon monitoring in ambient air in Europe (EEA Technical Report 18/2013) Link (EN): https://www.eea.europa.eu/publications/status-of-black-carbon-monitoring
- Reporting and exchanging air quality information using e-Reporting (EEA Technical Report 5/2012) Link (EN): https://www.eea.europa.eu/publications/reporting-and-exchanging-air-quality
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- OECD Environmental Performance Review Slovak Republic (OECD 2011) Link (EN): http://www.keepeek.com/Digital-Asset-Management/oecd/environment/oecd-environmental-performance-reviews-slovak-republic-2011_9789264121836-en#.WT6G1rpuLL8
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- Energy and the Environment in the Slovak Republic 2014 Link (SK): http://www.enviroportal.sk/uploads/report/6804.pdf
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