COMPONENTS OF THE ENVIRONMENT AND THEIR PROTECTION

• AIR

Emission situation

♦ **Balance of particulate matter emissions**

Pursuant to Act 478/2002 Coll. on air protection, which amends Act 401/1998 Coll. on fees for air pollution as amended (Air Act) (Sect. 19, par. 2(d)) an operator of a **large and medium-sized source** is required to provide to the pertinent local environment protection authority always before February 15 of the current year, a complete and true information on the source, emissions, and keeping of the emission limits and quota for the previous calendar year. Local environmental protection authority will submit these processed electronic data to the authorized MoE SR organization - the SHMI (Slovak Hydrometeorological Institute), which operates the central **National Emission Inventory System (NEIS)**. SHMI processes these data on the national level. In 2001, the SHMI for the first time collected and processed information through the NEIS module, which replaced the previously used REZZO system.

SHMI assesses the volume of polluting compond emissions from the from **small sources** on a yerly basis, based on the volume and quality of sold solid fuels to retailers and households. This information is available from the submitted data to the local environment protection authority by individual sellers, as well as from natural gas consumption by households.

Mobile sources emissions have been monitored since 1990 and are determined on the year-to-year basis. To calculate road transport emissions, the method of Computer Programme to Calculate Emissions from Road Transport (COPERT) is used. The method builds on the number of individual automobile types, volume of travelled kilometres, and consumption of individual fuel types. Besides road transport, calculated are also emissions from the railway, air, and ship transports, all in compliance with the Intergovernmental Panel Climate Change (IPCC) methodology.

♦ **History of particulate matter emissions and sulphur dioxide emissions**

Emissions of solids and **sulphur dioxide (SO_2)** have shown a steady reduction since 1990, which, apart from reduction in production and energy consumption, has been caused by a change within the fuel group toward more purified fuels, as well as by using fuels with higher quality labels.

Reduction in PM and SO_2 emissions at large-size stationary sources in 2007 was caused by ending the operation of several major sources (the Vojany power plant)

♦ **Trend in emissions of nitrogen oxides**

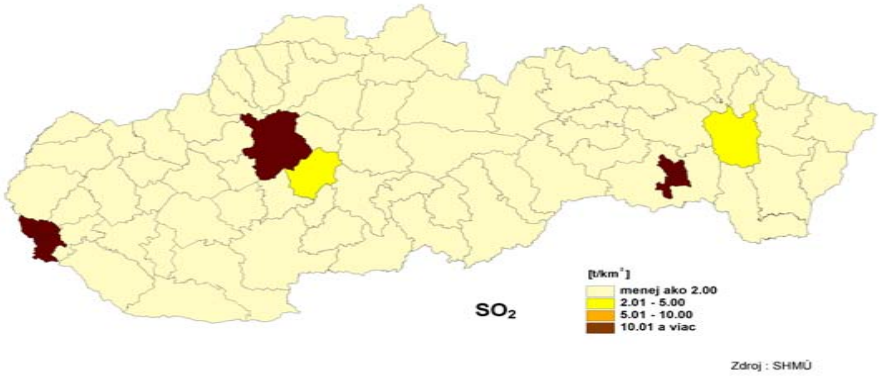
Nitrogen emissions (NO_X) have shown a slight reduction since 1990. Slight increase in emissions in 1995 was related to an increased consumption of natural gas. Decrease in nitrogen oxides in 1996 was

caused by a change to the emission factor that took into consideration the level of equipment and technology of incineration processes. Reduction in solid fuel consumption since 1997 has led to a further decrease in NO_X emissions. In the years 2002 and 2003, de-nitrification played a significant role in emission reduction (electric power plant Vojany). In 2006, there was a significant reduction in the NO_X emissions, especially in case of large and medium stationary sources. This reduction relates to reduced production (Zemianske Kostoľany and Vojany electrical power plants) and consumption of solid fuels and natural gas (Zemianske Kostoľany and Vojany electrical power plants and the Slovak gas industry company – transit, Inc. Nitra - /SPP/). Mobile sources also, mainly road transportation, have shown significant NO_X emissions. This reduction relates to reduced consumption of liquid carbohydrate fuels, compared to 2005, as well as to renovated fleet of personal and cargo vehicles.

- **Trend in carbon monoxide emissions**

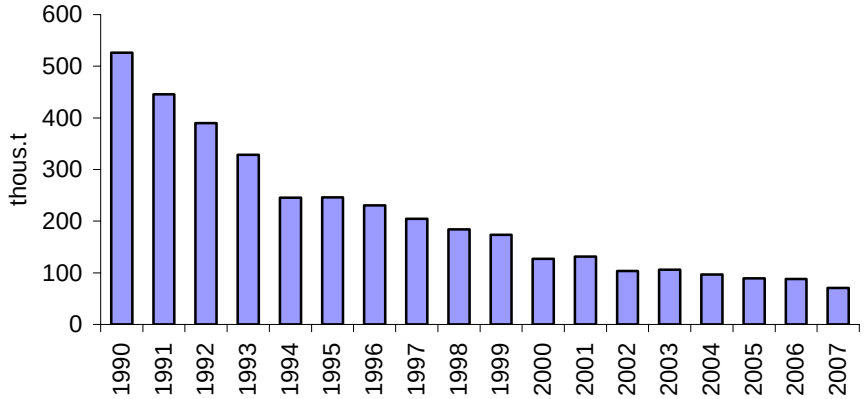
Carbon monoxide emissions (CO) since 1990 have shown a falling tendency, which was caused mainly by reduced consumption and change in fuel composition in the sphere of retail consumers. CO emissions from large sources were decreasing only slightly. The most significant share on CO emissions from large sources comes from iron and steel industries.

Element regional emission of SO_2 in 2007 ($t.km^{-2}$)



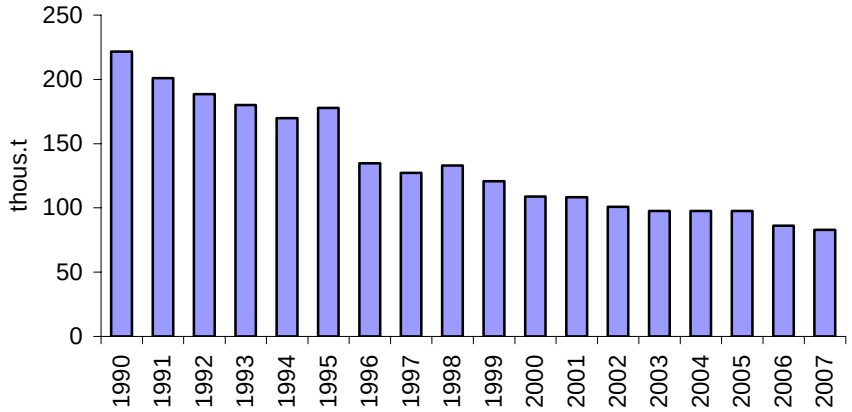
Source: SHMI

Trend in emission of SO_2



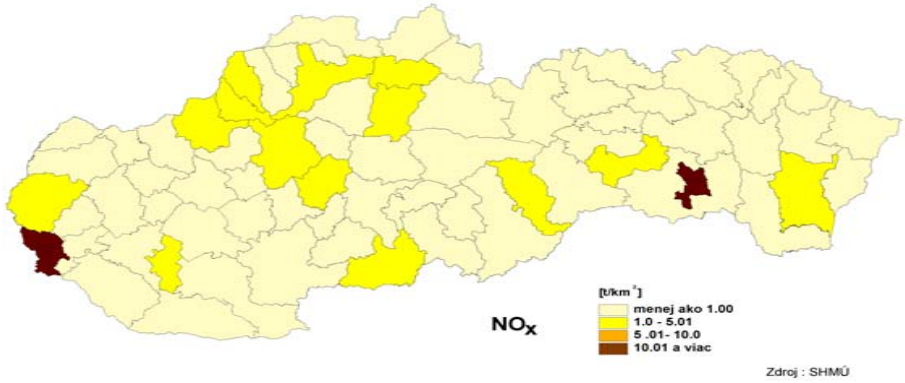
Source: SHMI

Trend in emission of NO_x



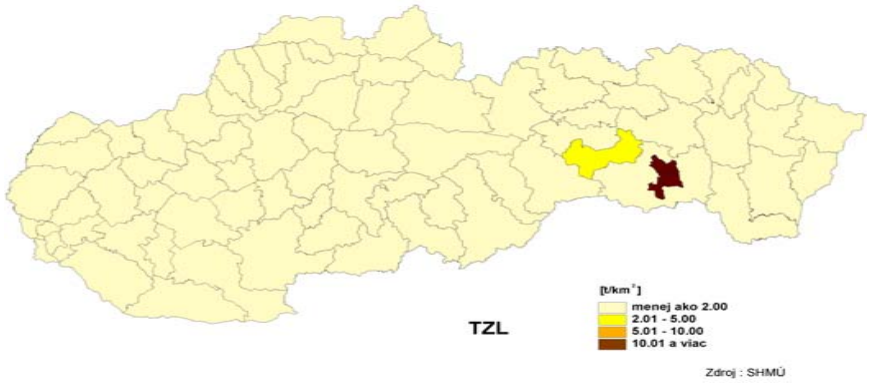
Source: SHMI

Element regional emission of NO_x in 2007 ($t.km^{-2}$)



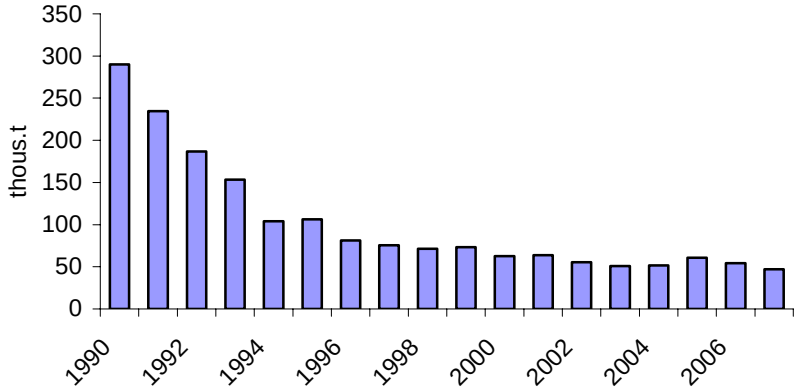
Source: SHMI

Element regional emission of PM in 2007 (t.km^{-2})



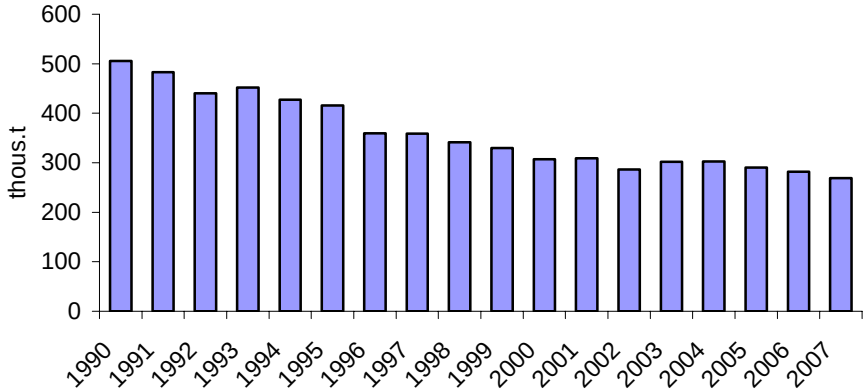
Source: SHMI

Trend in emission of PM



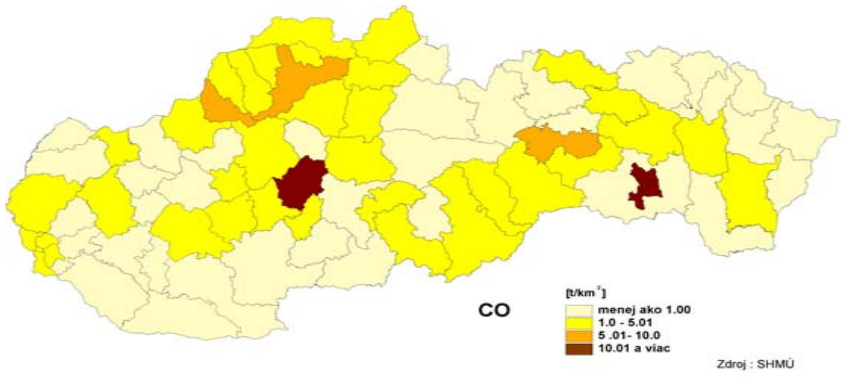
Source: SHMI

Trend in emission of CO



Source: SHMI

Element regional emission of CO in 2007 (t.km^{-2})

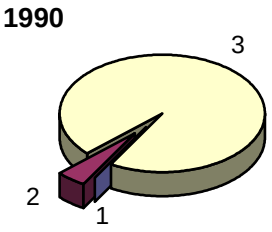


Source: SHMI

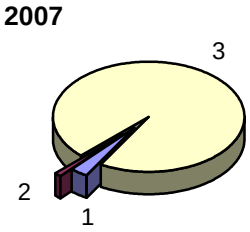
♦ **Balance of ammonia emissions (NH_3)**

Ammonia emissions show a rising tendency mainly due to rising emissions from road transport. Production of the NH_3 emissions in 2007 was 27 234.44 tonnes.

The contribution of the particular sectors in NH_3 emission



0.05 %	1. Transport	2.99 %
4.79 %	2. Industry	1.21 %
95.17 %	3. Agriculture	95.79 %



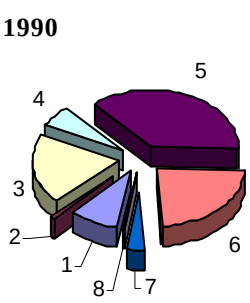
Emissions were stated to the date 31.10.2008 Source: SHMI

♦ **Emissions of non-methane volatile organic compounds**

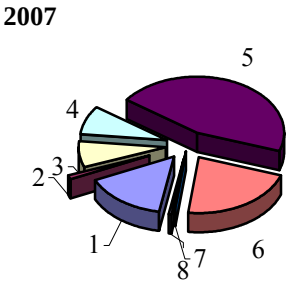
NM VOC emissions show a lasting decreasing trend since 1990. In 2007, volume of **NM VOC** emissions reached the value of 73 994 tons, which is a reduction by 46.4 %, compared to 1990.

Slight increase in emissions in 2003 and 2004 relates to the consumption of fuels in road transport, paint material used mainly in the engineering industry and construction, as well as to the growth in manipulated volumes of fuels in the sector of fuel distribution.

The contribution of the NM VOC emission according to sector of their origin

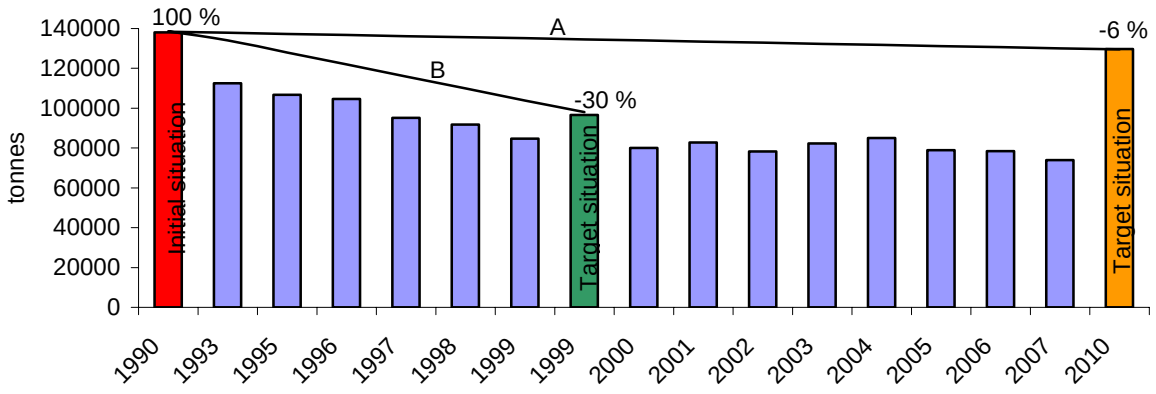


9.1 %	1. Combustion processes	15.2 %
0.8 %	2. Combustion processes in the industry	1.2 %
19.8 %	3. Industrial technologies	7.4 %
6.2 %	4. Mining and distribution of raw materials	8.3 %
37.0 %	5. Using the solvents and other products	45.4 %
23.5 %	6. Transport	21.6 %
3.2 %	7. Waste disposal	0.3 %
0.5 %	8. Agriculture	0.6 %



Emissions were stated to the date 31.10.2008 Source: SHMI

Trend in NM VOC emissions with regard to fulfilling of the international agreements (tons)



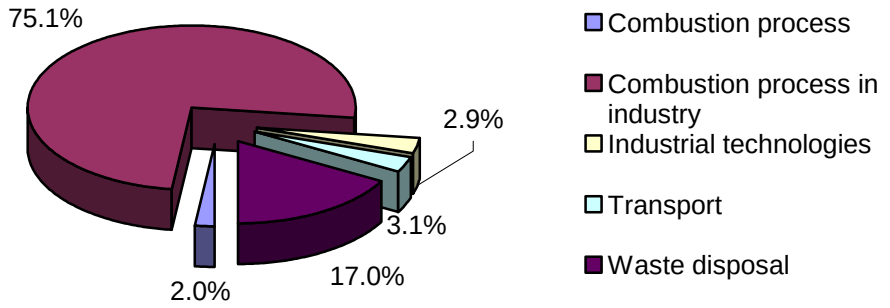
Source: SHMI

A – Reduction aim of the Protocol to abate acidification, eutrophication and tropospheric ozone
B – Reduction aim of the Protocol on limitation of VOC emissions or their Cross-Border Transfers

♦ **Balance of heavy metals emissions**

Heavy metal emissions (Pb, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, Sn, Mn) have decreased as opposed to 1990. In that year, heavy metal emissions were at the volume of 675.44 tons, while in 2007 it was 269.746 tons, which is a 60 % reduction in comparison to 1990. Besides shutting off a number of old-fashioned and non-effective technologies, this trend has been influenced by extensive reconstructions of the separation equipment, change in raw material used, and, most of all, by transition to using unleaded petrol types since 1996. Since 2004 there has been an increase in Pb emissions as a consequence of increasing production in the areas of ore agglomeration and copper production.

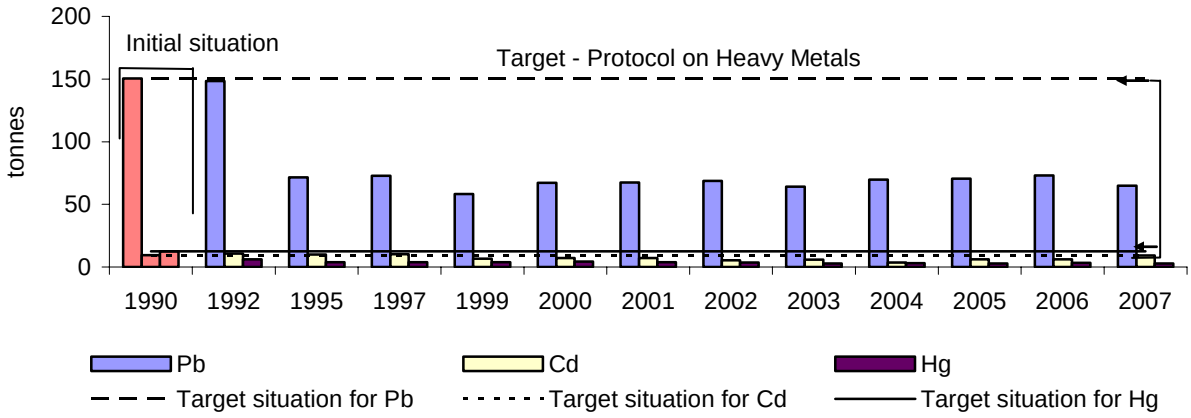
The contribution of the particular sectors in the Pb emission production for year 2007



Emissions were stated to the date 31.10.2008

Source: SHMI

Trend in emissions of heavy metals regarding the fulfilment of the international conventions

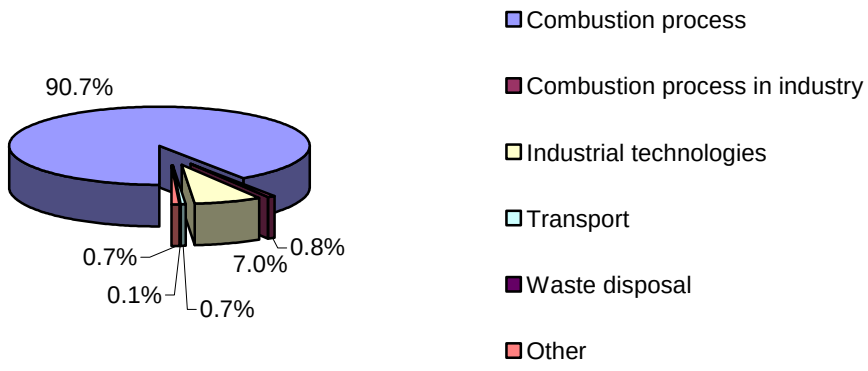


Source: SHMI

♦ **Balance of Persistent organic pollutants (POPs)**

Slight reduction to the poly-chlorinated dioxin and furan emissions (PCDD/PCDF) in 2007 was caused by reduction in the sector of Incineration processes within industry (mainly agglomeration of ferrous ores) and waste incineration. Slight increase to polychlorinated biphenyl emissions (PCB) and polycyclic aromatic hydrocarbons (PAH) resulted in increase of road transport (increased consumption of diesel), while the slight increase in the emissions of hexachlorbenzene (HCB) was caused by increased production of secondary copper, slight increase of cement production, and increase in road transport compared to 2006.

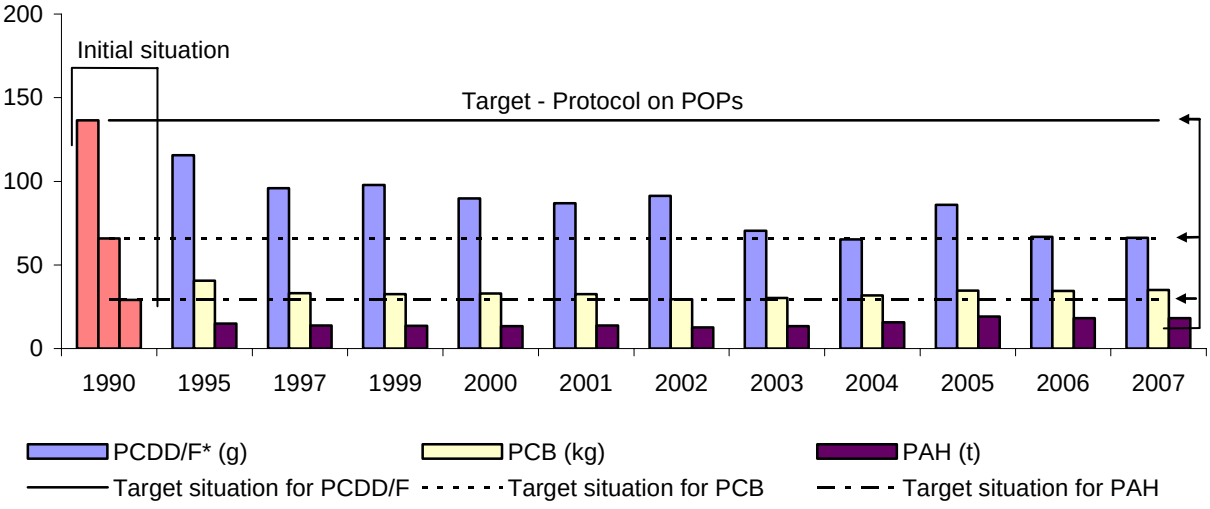
The contribution of the particular sectors in the PAH emission production for year 2007



Emissions were stated to the date 15.2.2009

Source: SHMI

Trend of POPs emissions regarding the fulfilment of the international conventions

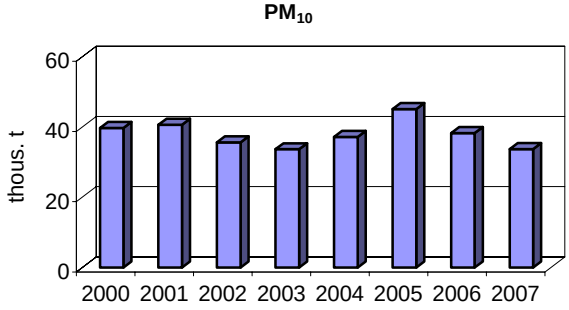


Source: SHMI

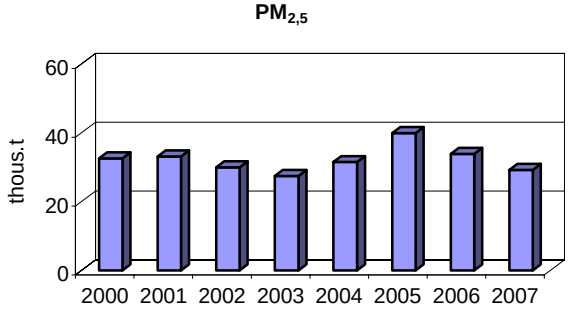
♦ **Assessment of PM_{10}, $PM_{2,5}$ emissions**

Every year, the PM_{10} and $PM_{2,5}$ emissions have been set on the basis of the requirements of the UNECE on Emission Inventory, with the year 2000 being the reference year. Although the PM_{10} and $PM_{2,5}$ emissions are set on the basis of PM emission values under the IIASA methodology (Institute for Applied System Analysis), they are still in line with the EMEP/EEA Guidebook, which adds the topics of abrasion and emissions from diesel engines to the emissions from petrol engines computed through the COPERT IV programme. In the sector of road transport, diesel engines are among the major contributors to the PM_{10} and $PM_{2,5}$ emissions. The share of abrasion is less significant than in the case of the PM emissions. In total, the most significant contributors to the PM_{10} and $PM_{2,5}$ emissions include small sources (heating of houses). Increased emissions in this sector reflects the increased consumption of wood caused by growing prices of natural gas and coal. Significant reduction in emissions in the sector of Incineration processes I is caused by gradual shutdowns of non-ecological sources at the Nováky Power Plant and the Vojany Power Plant of the SE-ENEL Inc. company in line with the valid legislation, which allows for the operation of such installations until 31.12.2008.

Development trends in PM_{10} and $PM_{2,5}$ emissions



Source: SHMI



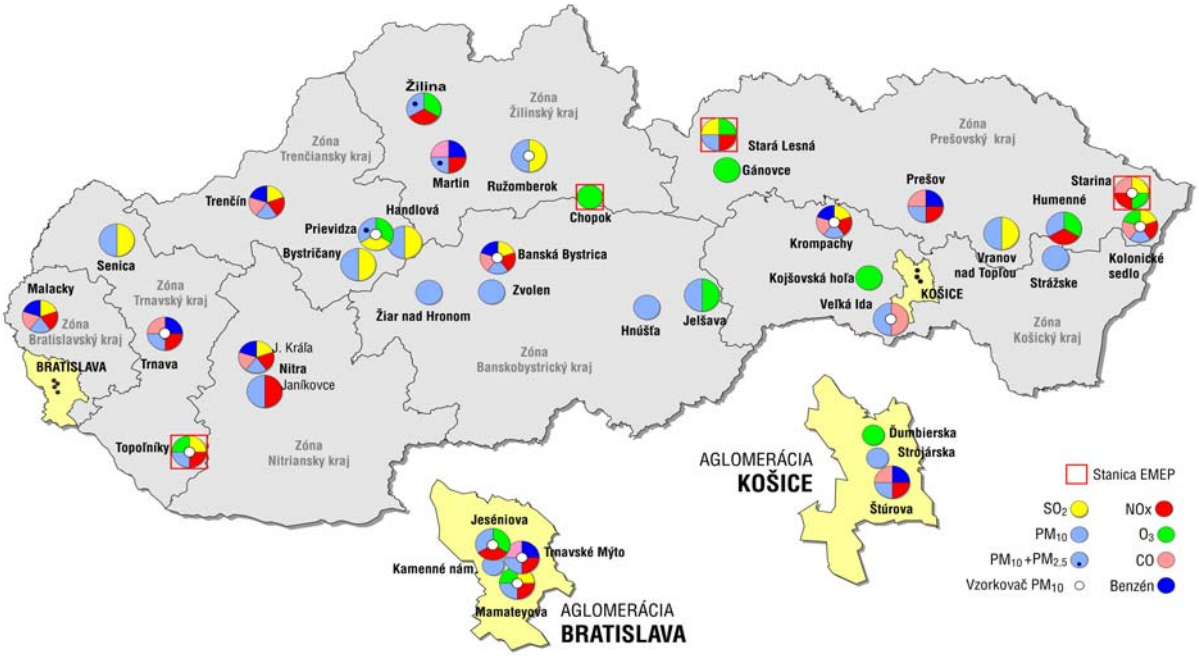
Source: SHMI

Air pollution

- **National monitoring air quality network**

In 2008, the **national air assessment quality monitoring network consisted of 37 automated monitoring stations including 4 stations to monitor regional air pollution and precipitation water chemical composition**. Stations that monitor regional air pollution are part of the EMEP – Co-operative Program for the Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe.

National monitoring air quality network - owned by SHMI - 2008



Source: SHMI

- **Local air pollution**

Sulphur dioxide

In 2008, no agglomeration showed exceeded levels of pollution in hourly or daily values beyond the public health limit.

Nitrogen dioxide

The annual limit value for human health protection was exceeded only at the stations of Banská Bystrica - Štefánikovo nábrežie. This value was greater than the limit value increased by the tolerance threshold. Local reconstruction of the sewerage collector was the major contributor to this high value. For the major part of the year, a diesel aggregate used for ground works was located immediately next to the measuring station, with a movement of trucks.

PM_{10}

The biggest challenge in the area of air protection in Slovakia and most European countries is currently air pollution by particulate matter (PM_{10}). In 2008, there was a drop in the level of pollution by suspended particulate matter PM_{10} as compared to 2007 in the Bratislava agglomeration and the zones of the Trenčín and Žilina regions. On the other hand, increased levels of pollution were detected in the zones of the Trenčín and Trnava regions. In total, the 24-hour limit value was exceeded at 16 stations, with 2 AMS stations also showing the exceeded annual limit value.

Carbon monoxide

Carbon monoxide pollution level is relatively low and limit value was not exceeded at any monitoring station.

Benzene

The highest level of 1.5 ug.m^{-3} for benzene in 2008 was detected at the stations of Malacky - Sasinkova, Krompachy - Lorenzova, and Trenčín - Hasičská, which is deep below the limit value of 5 ug.m^{-3} that is to become effective as from 2010.

Pb

The sector of metallurgic industry shows the highest level of air pollution detected at the Krompachy-Lorenzova station, however, all average annual concentrations are substantially smaller than the bottom assessment treshhold.

As, Ni, Cd

There was no occurrence of exceeded target values for any pollutant in 2008.

BaP

The obtained outcomes showed the target value to be reached on 31.12.2010 were exceeded at the stations of Veľká Ida - Letná, Prievidza - Malonecpalská, and Krompachy - Lorenzova.

- **Regional air pollution**

Sulphur dioxide, sulphates

In 2008, regional sulphur dioxide concentrations calculated per sulphur were 0.15 µg.m^{-3} at Chopok, and 0.66 µg.m^{-3} at Starina. The limit value for the protection of ecosystems ***(20 µg SO_2.m^{-3})*** was not exceeded at the mentioned stations even during the winter season ***(Chopok 0.2 µg SO_2.m^{-3} and Starina 2.2 µg SO_2.m^{-3})*** or the calendar year ***(Chopok 0.3 µg SO_2.m^{-3} and Starina 1.3 µg SO_2.m^{-3})***.

Percentage share of sulphates on total particulate matter mass was 19.6 % at Chopok and 17.1 % at Starina. Sulphates to sulphur dioxide concentration ratios expressed in sulphur was 1.5 at Chopok and 1.2 at Starina.

Nitrogen oxides, nitrates

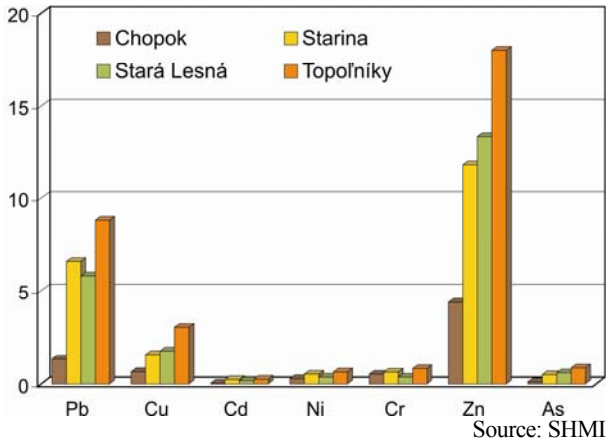
Concentration of nitrogen oxides at regional stations expressed in NO_2-N were in 2008 0.54 µg.m^{-3} at Chopok and 1.27 µg.m^{-3} at Starina. The limit value for the protection of vegetation ***(30 µg NO_X.m^{-3})*** was not exceeded for the calendar year ***(Chopok 1.78 µg NO_X.m^{-3} and Starina 4.19 µg NO_X.m^{-3})***.

Atmospheric **nitrates** at Chopok and at Starina were mostly in the aerosol form. Gaseous nitrates in 2008 were in comparison with the aerosol ones lower at both stations. Despite the fact that gaseous and particulate nitrates are trapped and monitored separately, their sum is expressed in line with EMEP, since their phase distribution depends on atmospheric temperature and humidity. Percentage share of nitrates on atmospheric aerosol was 8.1 % at Chopok and 9.6 % at Starina. Ratio of total nitrates (HNO_3 + NO_3) to NO_X-NO_2, as expressed in nitrogen, was 0.12 at Chopok and 0.25 at Starina.

Atmospheric aerosol, heavy metals

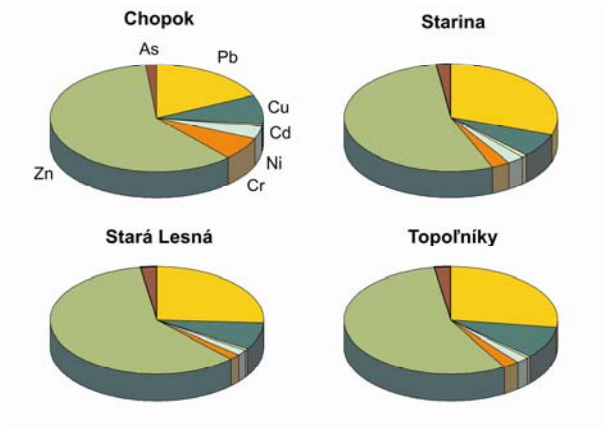
Percentage share of the sum of assessed heavy metals on air-borne dust at regional stations of Slovakia varies between 0.16 and 0.21 %.

Heavy metals in the air - 2008



Source: SHMI

Percentage share of heavy metals in 2008

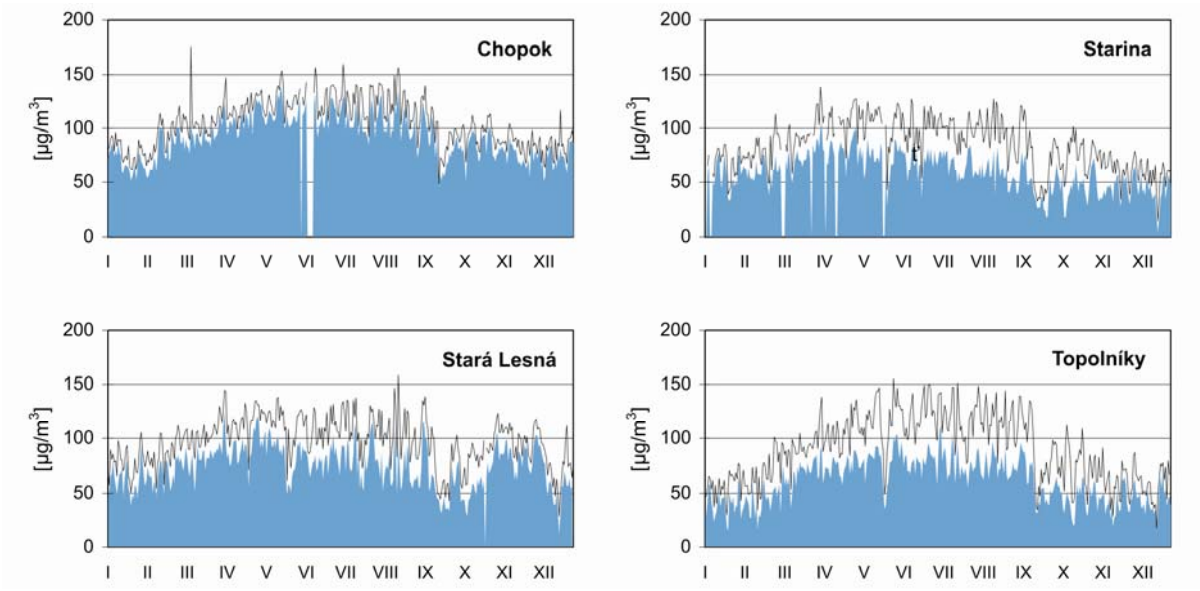


Source: SHMI

Ozone

The following figures show the **annual characteristics in the ozone concentration** at regional stations of Chopok, Starina, Stará Lesná, and Topoľníky. Stará Lesná has had the longest time sequence of ozone measurements since 1992. Ozone measurements at Topoľníky, at Starina, and at Chopok started in the course of the year 1994. In 2008, average ozone concentration at Chopok was 92 µg.m^{-3}, at Stará Lesná 74 µg.m^{-3}, at Topoľníky 60 µg.m^{-3}, and at Starina 59 µg.m^{-3}.

Tropospheric ozone 2008



Source: SHMI

Volatile organic compounds $C_2 – C_6$

Volatile organic compounds $C_2 – C_6$ or the so-called light carbohydrates began to be captured at the Starina station in the Fall of 1994. Starina belongs to the few European stations listed in the EMEP network, with regular monitoring of volatile organic compounds. The compounds are assessed in line with the EMEP methodology under the NILU. Their concentrations range between individual units to hundreds of units ppb. Ethane presents the worst, next is propane, ethene and acetylene. Isoprene releases from ambient forest.

Average annual VOC concentrations in ambient air (ppb) - Starina 2008

ethane	ethene	propane	propene	i-butane	n-butane	acetylene	butene	pentene	i-pentane	n-pentane	isoprene	n-hexane	benzene	toluene	o-xylene
1.708	0.390	0.786	0.073	0.311	0.294	0.564	0.065	0.022	0.160	0.121	0.069	0.045	0.220	0.023	0.214

Source: SHMI