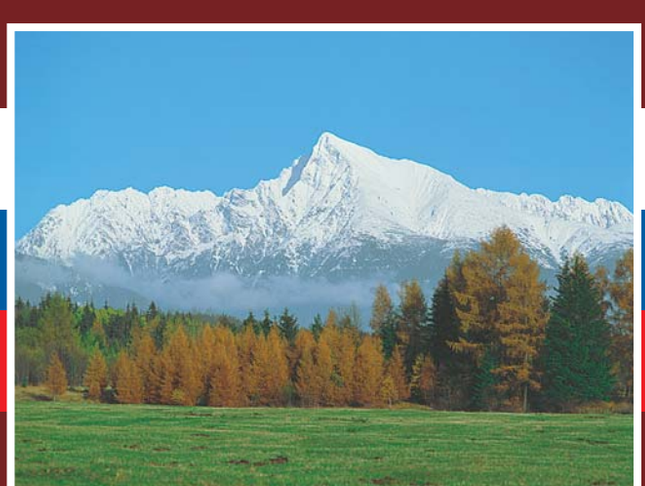
Ministry of the Environment
of the Slovak Republic

STATE OF THE ENVIRONMENT REPORT SLOVAK REPUBLIC 2007



Slovak Environmental Agency

j. Klinda

Environment *is everything that creates natural conditions for existence of organisms, including the humans, and is a condition of their further development. Environment is created* ***by its parts,*** *first of all air, water, rocks, soil and living organisms.*

§2 of Act No 17/1992 Coll. on Natural Environment as amended

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.

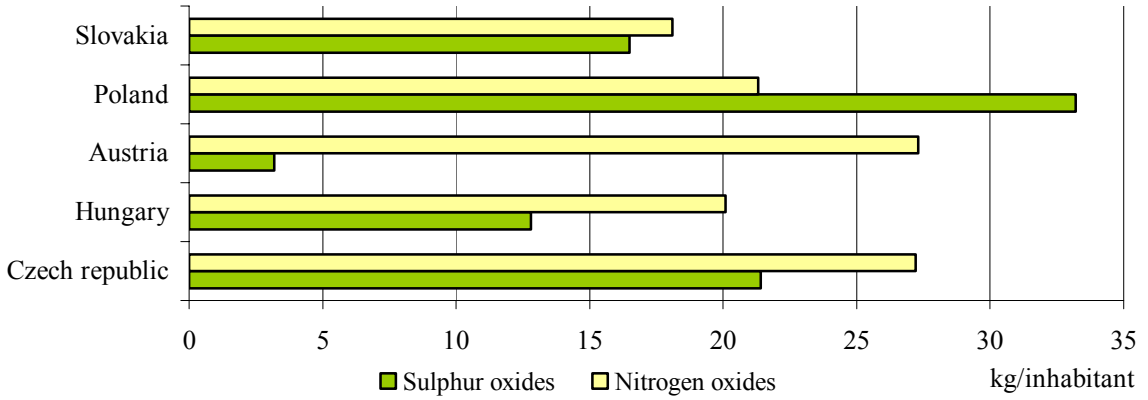
- **Trend in emissions of nitrogen oxides**

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**

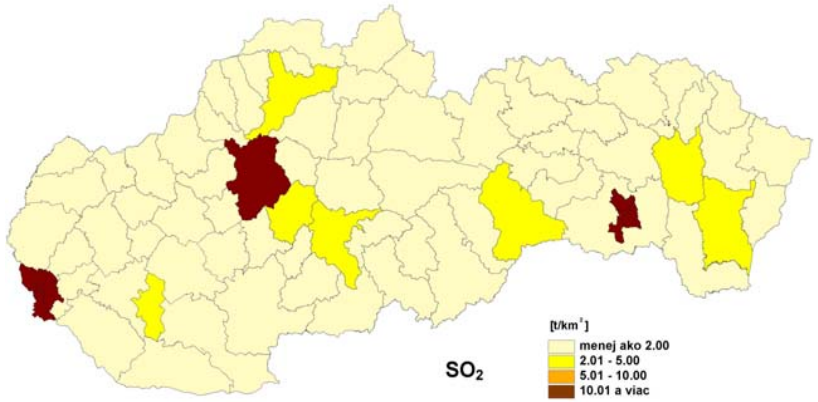
Carbon monoxide emissions (CO) since 1990 have shown a falling tendency, which was caused mainly by reduced consumption and change in fuel composition in the sphere of retail consumers. CO emissions from large sources were decreasing only slightly. The most significant share on CO emissions from large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

Emissions of nitrogen oxides (NO_X) and sulphur oxides (SO_X) per capita in Slovakia and neighbouring countries in 2005



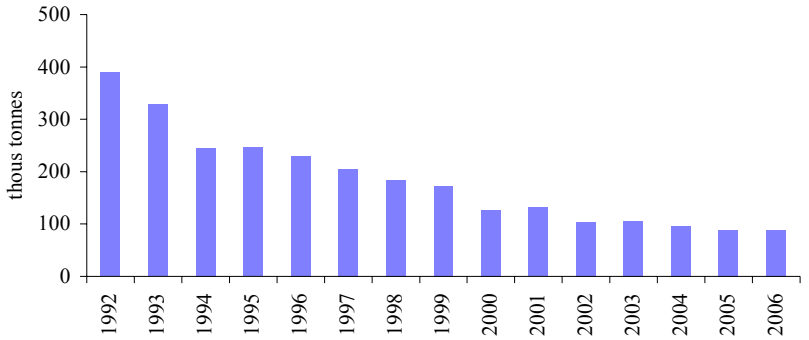
Source: OECD

Element regional emission of SO_2 in 2006 ($t.km^{-2}$)



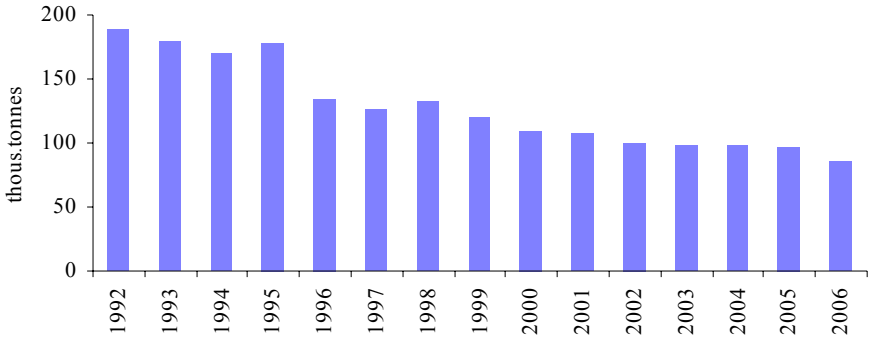
Source: SHMI

Trend in emission of SO_2



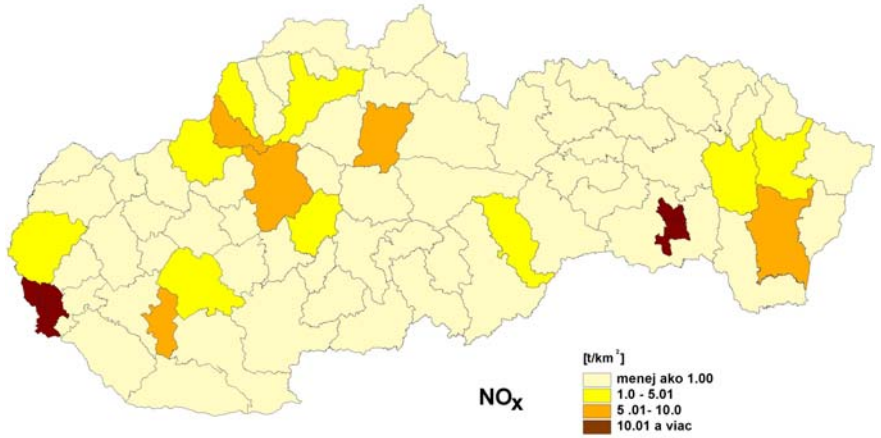
Source: SHMI

Trend in emission of NO_x



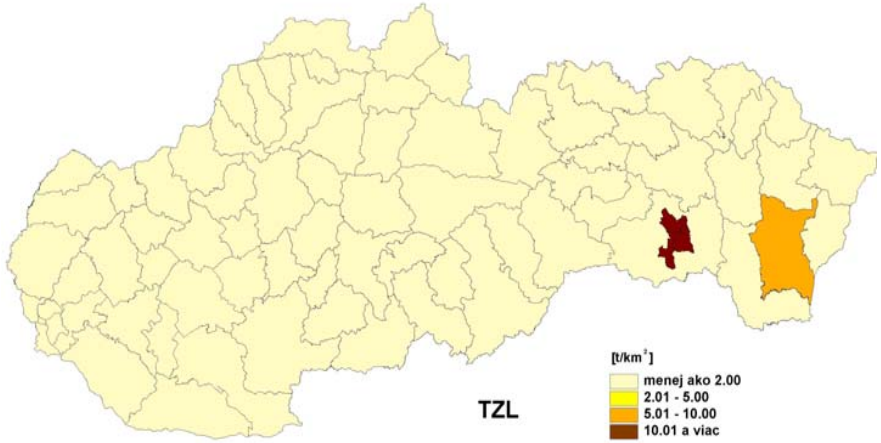
Source: SHMI

Element regional emission of NO_x in 2006 ($t.km^{-2}$)



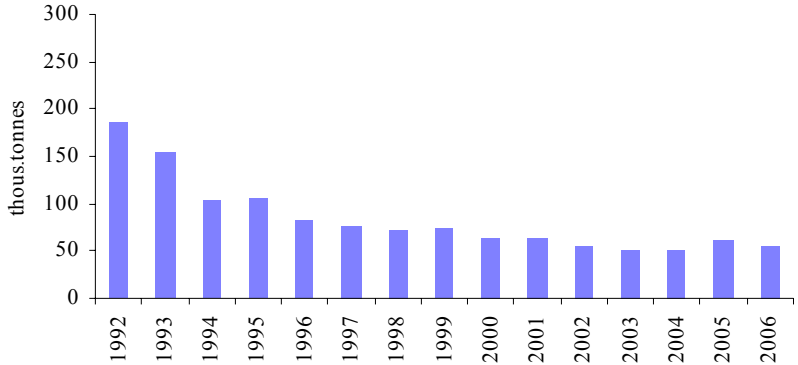
Source: SHMI

Element regional emission of PM in 2006 (t.km^{-2})



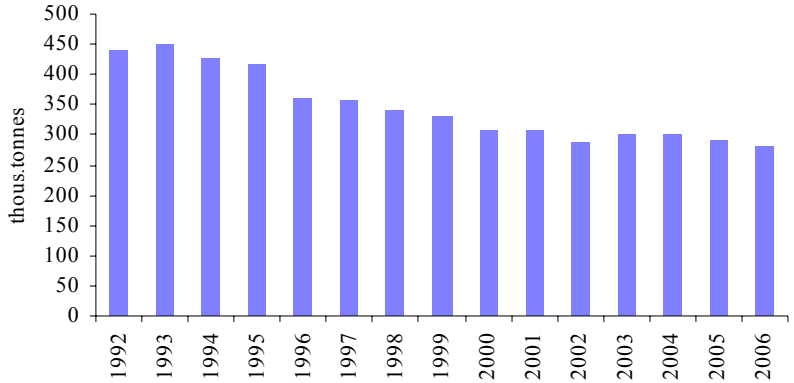
Source: SHMI

Trend in emission of PM



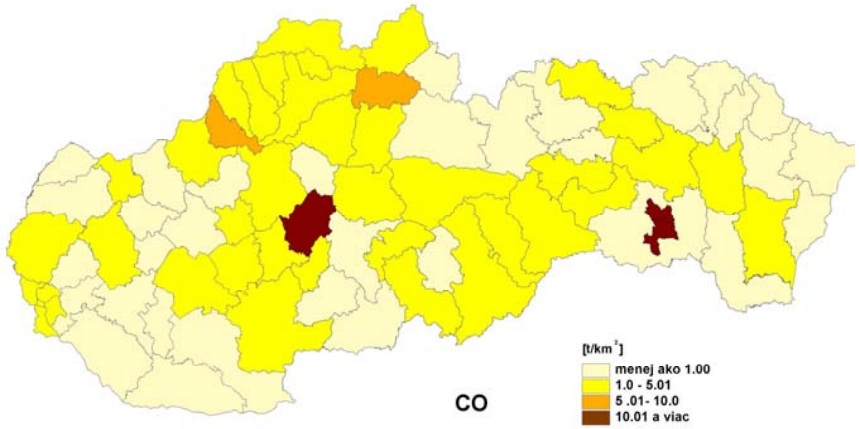
Source: SHMI

Trend in emission of CO



Source: SHMI

Element regional emission of CO in 2006 (t.km^{-2})

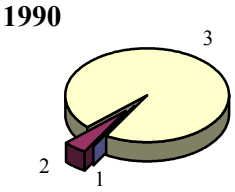


Source: SHMI

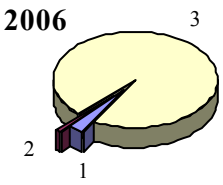
♦ **Balance of ammonia emissions (NH_3)**

NH_3 emissions in 2006 reached 26 665.7 tons. In 1990-2006 ammonia emissions were reduced by 59 %. This reduction was caused mainly by changes in agriculture. Numbers of livestock was reduced, which in turn contributed to decreased production of animal waste. Organic and industrial fertiliser volumes on agricultural land were also reduced.

The contribution of the particular sectors in NH_3 emission



0.05 %	1. Transport	2.73 %
4.79 %	2. Industry	1.10 %
95.17 %	3. Agriculture	96.17 %



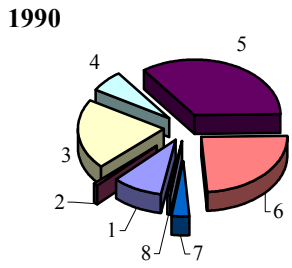
Source: SHMI

Emissions were stated to the date 31.10.2007

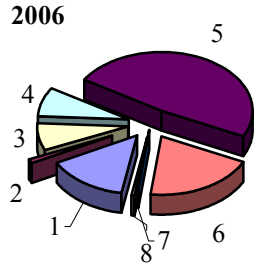
♦ **Emissions of non-methane volatile organic compounds**

NM VOC emissions show a lasting decreasing trend since 1990. In 2006, volume of **NM VOC** emissions reached the value of 78 397 tons, which is a reduction by 43.2 %, compared to 1990.

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



9.4 %	1. Combustion processes	14.4 %
0.8 %	2. Combustion processes in the industry	1.1 %
20.5 %	3. Industrial technologies	7.4 %
6.4 %	4. Mining and distribution of raw materials	8.0 %
34.8 %	5. Using the solvents and other products	48.1 %
24.3 %	6. Transport	19.6 %
3.3 %	7. Waste disposal	0.3 %
0.5 %	8. Agriculture	0.6 %

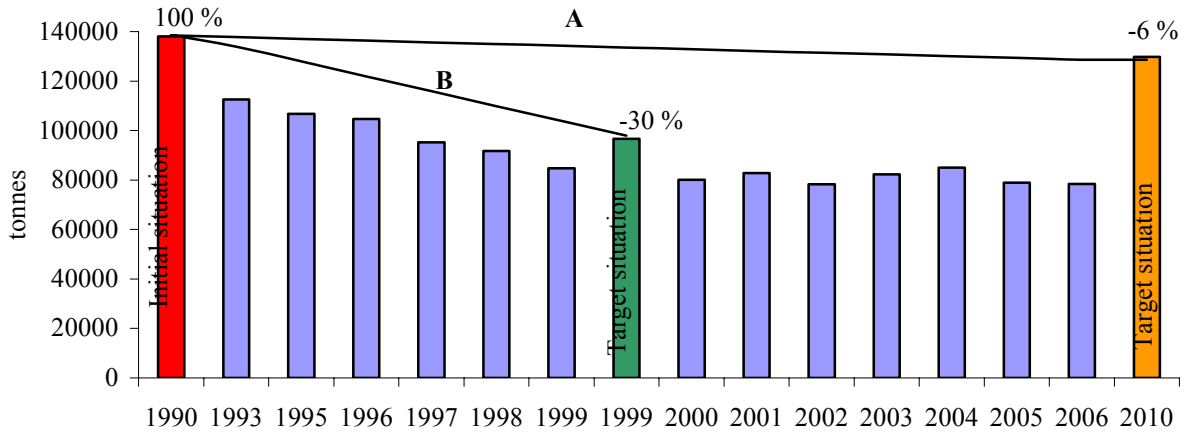


Source: SHMI

Emissions were stated to the date 31.10.2007

In 1999, the Slovak Republic signed the Protocol on the Reduction of Acidification, Eutrophication and Ground Ozone, and bound itself to reduce the volume of NM VOC by 6 % by 2010, compared to emissions from 1990. This plan has been followed so far.

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



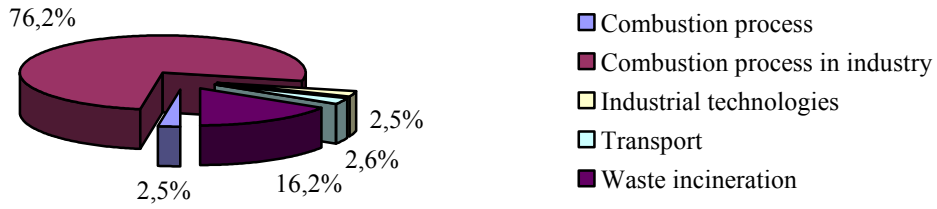
Source: SHMI

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, As, Cd, Cr, Cu, Hg, Ni, Se, Zn) have been decreasing since 1990. In that year, heavy metal emissions were at the volume of 675.44 tons, while in 2006 it was 287.77 tons, which is a 57 % 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 2003 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 2006

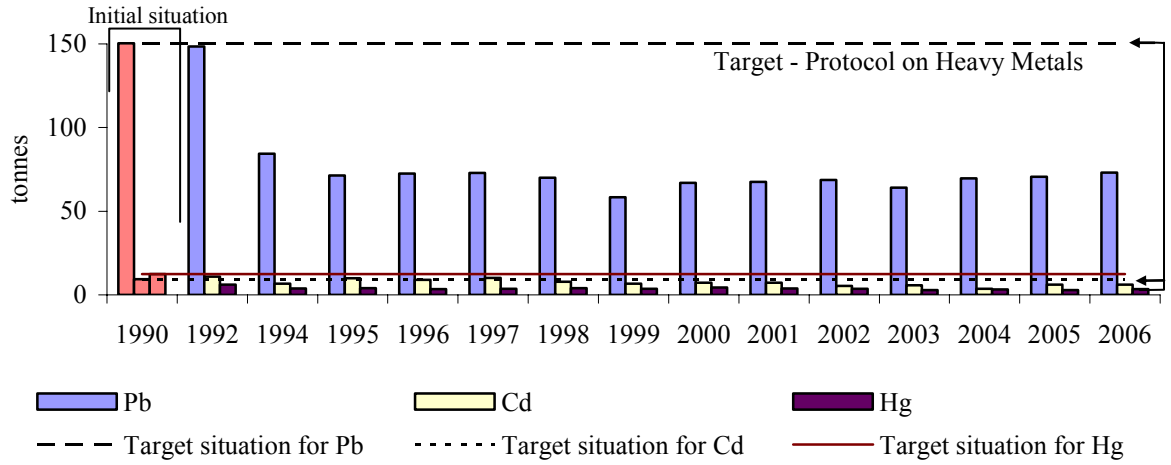


Emissions were stated to the date 31.10.2007

Source: SHMI

Heavy metals in the air do not represent an environmental issue of only one country. In 1998, the **Protocol on heavy metals** was drafted in Aarhus. This document **followed the UN EEC Convention on Long - Range Trans-boundary Air Pollution,** whose only objective is the decrease heavy metal emissions (Pb, Cd, Hg) to the level of 1990. SR signed this Protocol in that same year. This goal is still being followed.

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

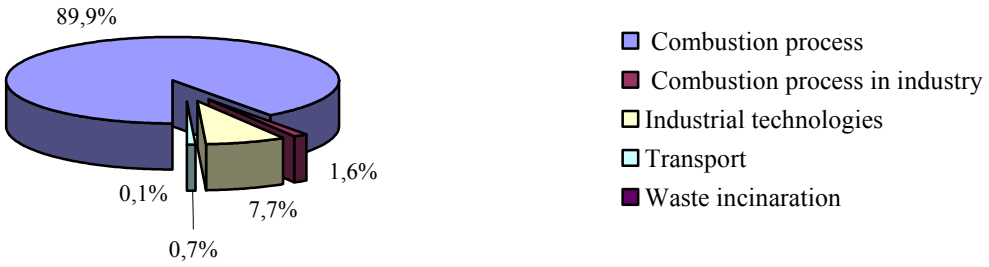


Emissions were stated to the date 31.10.2007 Source: SHMI

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

In 1990-2006 **emissions of persistent organic particles** (PCDD/PCDF, PCB, and PAH {B(a)P, B(k)F, B(b)F, I(1,2,3-cd)P}) had a decreasing trend with fluctuating characteristics over the last years. They were most apparent in the emissions of poly-aromatic carbohydrates (PAH).

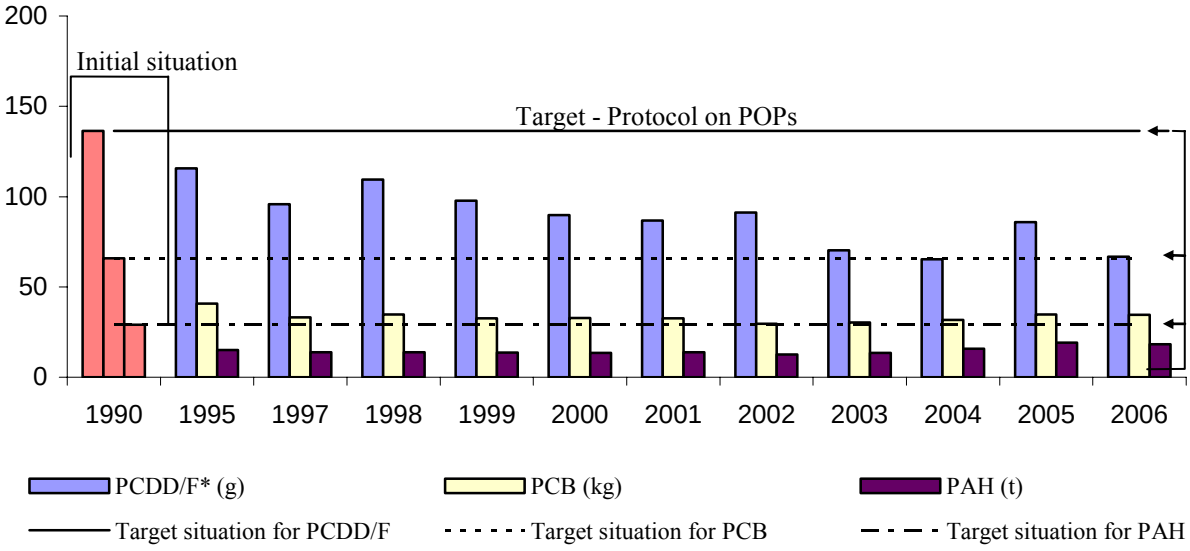
The contribution of the particular sectors in the PAH emission production for year 2006



Emissions were stated to the date 31.10.2007 Source: SHMI

In 1998, the Slovak Republic also accessed to **Protocol on Limitation of Persistent Organic Compounds (POP) Emissions under the mentioned Convention**, whose objective was to reduce POP emissions to the emission level of the year 1990, compared to the reference year of 1990. The Slovak Republic signed the Protocol in the same year. This goal is still being followed.

Trend of POPs emissions regarding the fulfillment of the international conventions



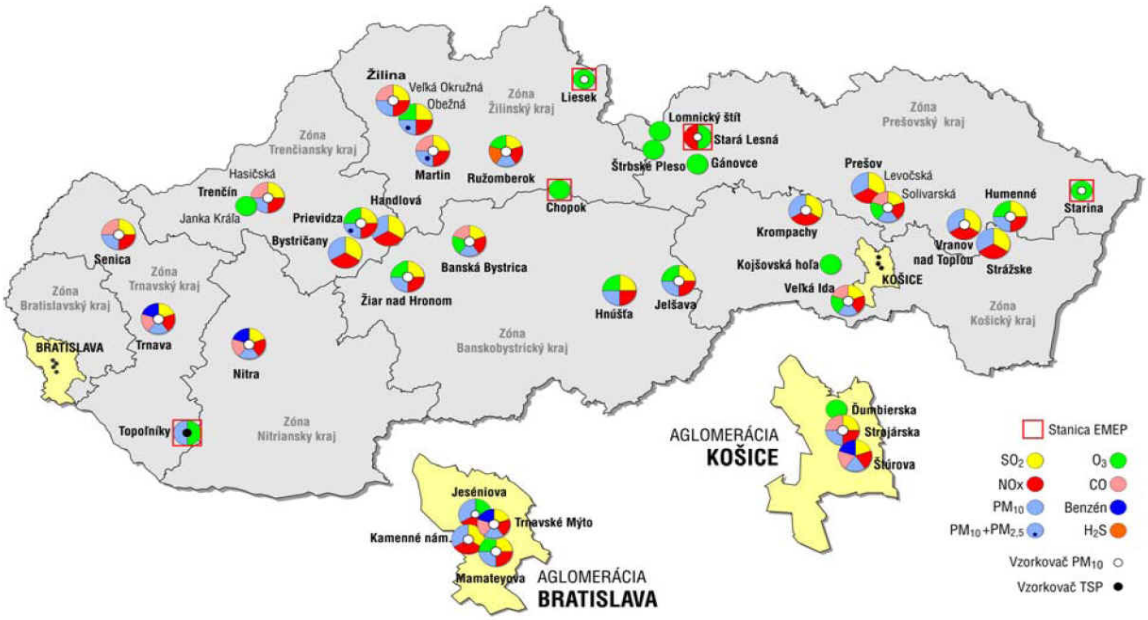
Source: SHMI

Air pollution

- **National monitoring air quality network**

In 2007, the **national air assessment quality monitoring network consisted of 34 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



Source: SHMI

- **Local air pollution**

Assessment of local air pollution focuses on air quality in residential areas, and belongs to critical indicators of the quality of environment.

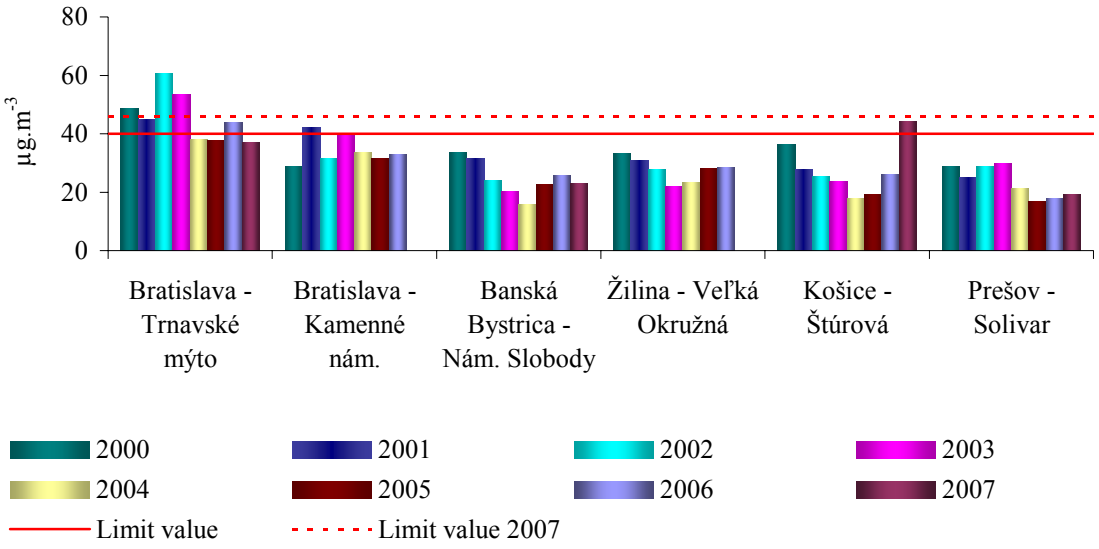
Sulfur dioxide

In 2007, no agglomeration showed exceeded levels of pollution in hourly or daily values beyond the public health limit.

Nitrogen dioxide

In 2007, yearly limit value was exceeded only at the Košice - Štúrova monitoring station, however, the yearly limit value incremented with tolerance threshold was no exceeded. Exceeded values for public health protection for hour concentrations were not detected at any monitoring station.

Average annual concentrations of nitrogen dioxide at selected monitoring stations



Source: SHMI

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 2007, there was a significant reduction in the PM_{10} pollution level at most NMSKO stations. Despite this fact, 14 stations showed exceeded 24-hour values for this particular pollutant, while 4 AMS showed exceeded also the yearly limit value.

Carbon monoxide

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

Lead

None of the monitoring stations showed exceeded limit value. Pollution level for the previous period of 2003-2007 is below the bottom assessment threshold.

Benzene

In 2007, highest benzene level of 2.0 μg.m^{-3} was detected at the stations of Bratislava - Mamateyova, and Trenčín – Hasičská, which is below the 5.0 μg.m^{-3} limit value, which will become effective as from 2010.

Heavy metals

In 2007 no pollutant limit values were exceeded.

- **Regional air pollution**

Average annual concentrations of air-borne hazardous compounds – 2007

Station	Prach μg.m^{-3}	SO_2-S μg.m^{-3}	NO_2-N μg.m^{-3}	HNO_3-N μg.m^{-3}	SO_4^{2-}-S μg.m^{-3}	NO_3^--N μg.m^{-3}	O_3 μg.m^{-3}	Pb μg.m^{-3}	Cu μg.m^{-3}	Cd μg.m^{-3}	Ni μg.m^{-3}	Cr μg.m^{-3}	Zn μg.m^{-3}	As μg.m^{-3}
Chopok	5.1	0.18	0.72	0.01	0.27	0.08	92	1.59	0.84	0.05	0.44	0.60	4.14	0.13
Stará Lesná	12.6	-	-	-	-	-	68	5.92	2.39	0.20	0.44	0.48	13.03	0.52
Starina	17.7	0.80	1.24	0.02	0.86	0.32	63	8.46	2.10	0.29	0.58	0.59	12.61	0.45
Topoľníky	23.2	-	-	-	-	-	58	11.09	4.11	0.28	1.15	1.01	19.44	0.83

Source: SHMI

Sulfur dioxide, sulfates

In 2007, regional sulphur dioxide concentrations calculated per sulphur were 0.18 μg.m^{-3} at Chopok, and 0.80 μg.m^{-3} at Starina.

In line with Annex 1 of the MoE SR Resolution No. 705/2002 Coll. quoting Resolution 351/2007 Coll., the limit value for the protection of ecosystems is 20 μg $S0_2$.m^{-3} for the calendar year and the winter season. This level was not exceeded neither for the calendar year (Chopok 0.4 μg SO_2.m^{-3}, and Starina 1.6 μg SO_2.m^{-3}) neither for the winter season (Chopok 0.5 μg SO_2.m^{-3}, and Starina 3.3 μg SO_2. m^{-3}).

Percentage share of sulfates on total particulate matter mass was 16 % at Chopok and 15 % at Starina. Sulfates to sulphur dioxide concentration ratios expressed in sulfur was 1.5 at Chopok and 1.1 at Starina.

Nitrogen oxides, nitrates

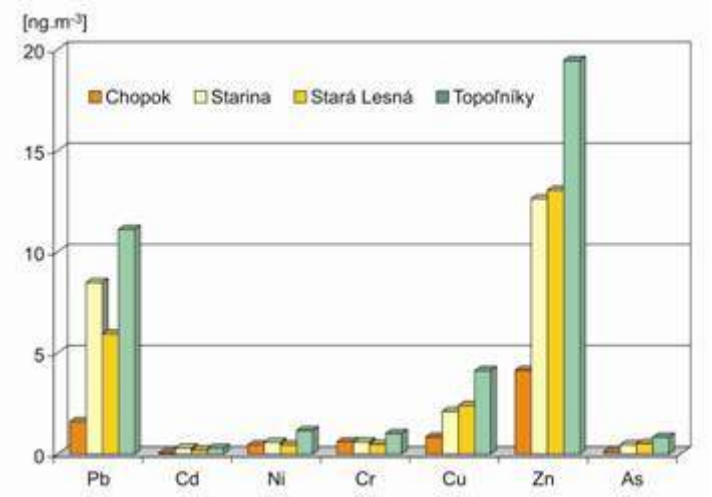
Concentration of nitrogen oxides at regional stations expressed in NO_2-N were in 2007 0.72 μg.m^{-3} at Chopok and 1.24 μg.m^{-3} at Starina. In line with Annex 1 of the MoE SR Resolution No. 705/2002 Coll. quoting Resolution 351/2007 Coll., the **limit value for the protection of ecosystems is 30 μg N.m^{-3}** for the calendar year. This value was not exceeded for the calendar year (Chopok 2.4 μg NO_x.m^{-3} and Starina 4.1 μg NO_x.m^{-3}).

Atmospheric **nitrates** at Chopok and at Starina were mostly in the aerosol form. Gaseous nitrates in 2007 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 6 % at Chopok and 8 % at Starina. Ratio of total nitrates ($HNO_3 + NO_3$) to NO_X-NO_2, as expressed in nitrogen, was 0.13 at Chopok and 0.27 at Starina.

Atmospheric aerosol, heavy metals

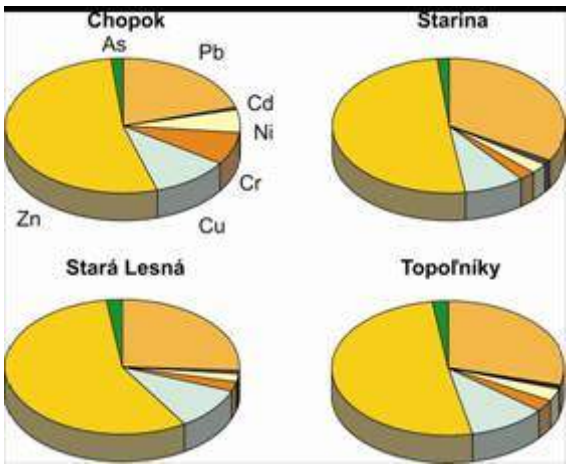
Percentage share of the sum of assessed heavy metals on air-borne dust at regional stations of Slovakia varies between 0.15 and 0.18 %.

Heavy metals in the air - 2007

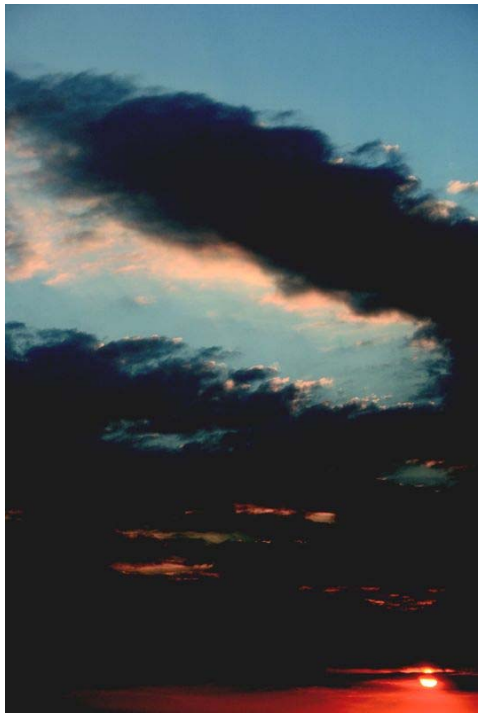


Source: SHMI

Percentage share of heavy metals in 2007



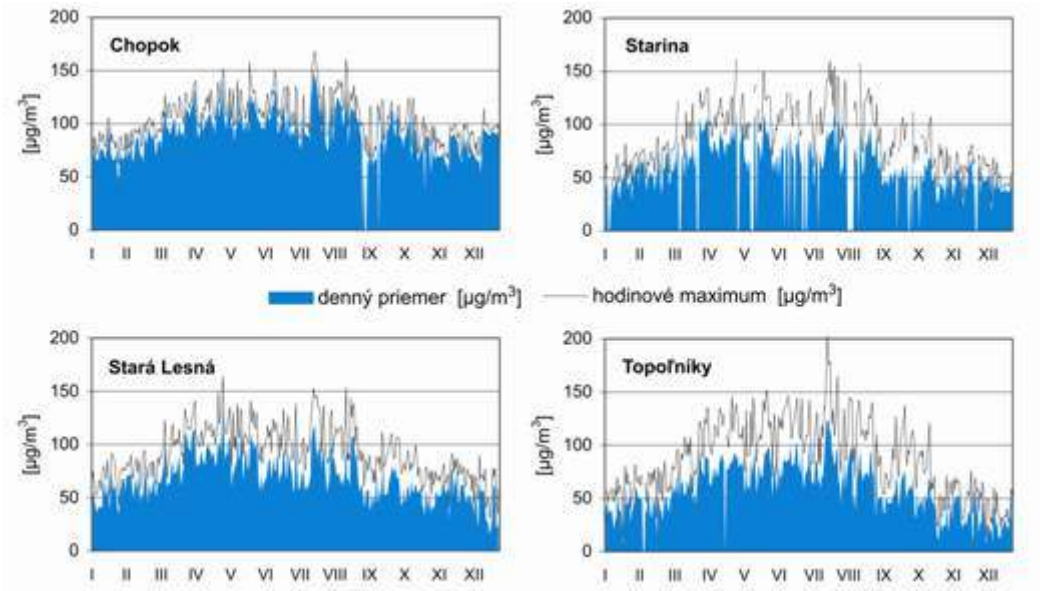
Source: SHMI



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 2007, average ozone concentration at Chopok was 92 µg.m^{-3}, at Stará Lesná 68 µg.m^{-3}, at Topoľníky 58 µg.m^{-3}, and at Starina 63 µg.m^{-3}.

Tropospheric ozone 2007



Source: SHMI

During the years 1970 -1990 was recorded an increase in ozone concentrations by 1-3 µg.m^{-3} per year on average. Following the year 1990, in line with other European monitoring, the trend slowed down and even stopped. This trend relates to the European trend in the generation of ozone precursors.

Volatile organic compounds $C_2 – C_6$

Volatile organic compounds (VOC) $C_2 – C_6$ or the so-called light carbohydrates began to be captured at the Starina station in the Fall of 1994. 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 2007

ethane	ethene	propane	propene	i-butane	n-butane	acetylene	butene	pentene	i-pentane	n-pentane	isoprene	n-hexane	benzene	toluene	o-xylene
1.80	0.65	0.80	0.12	0.34	0.31	0.53	0.07	0.02	0.24	0.13	0.15	0.05	0.25	0.03	0.29

Source: SHMI