MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC

STATE OF THE ENVIRONMENT REPORT

SLOVAK REPUBLIC 2006

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. **In 2005, this system processed data from 843 large sources and 12 082 medium sources.**

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.

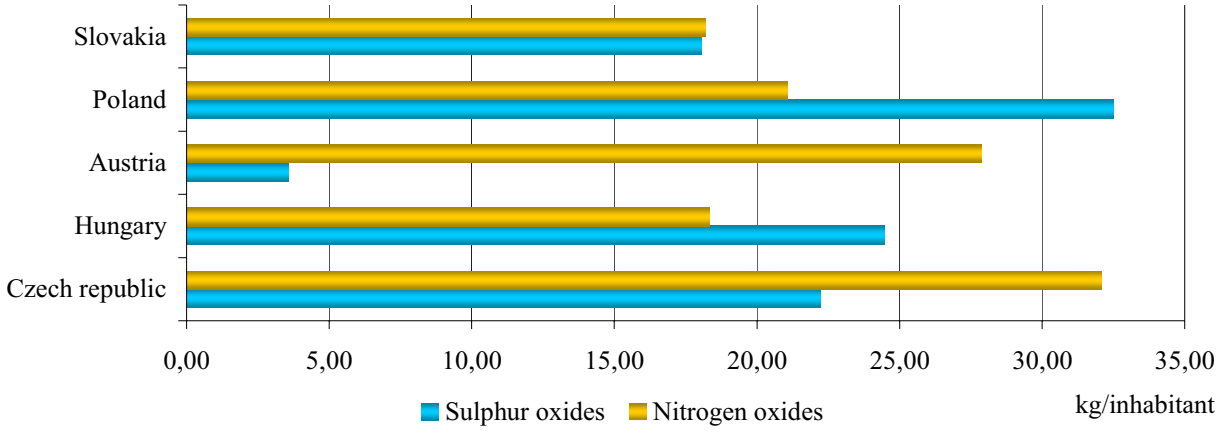
- **Trend in emissions of nitrogen oxides**

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 the years 2004 and 2005, the emissions trend has marked no major changes.

- **Trend in carbon monoxide emissions**

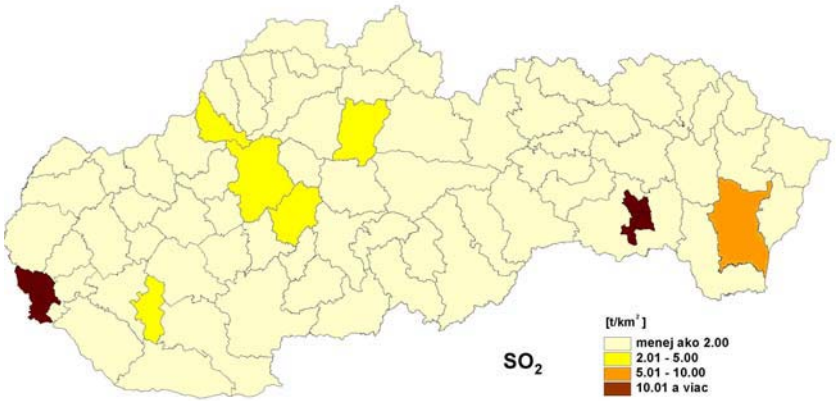
Carbon monoxide emissions (CO) since 1990 have shown a falling tendency, which was caused mainly by reduced consumption and change in fuel composition in the sphere of retail consumers. CO emissions from large sources were decreasing only slightly. The most significant share on CO emissions from large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

Emissions of nitrogen and sulphur oxides (shown as NO_2 and SO_2 equivalents) per capita in Slovakia and neighbouring countries in 2004



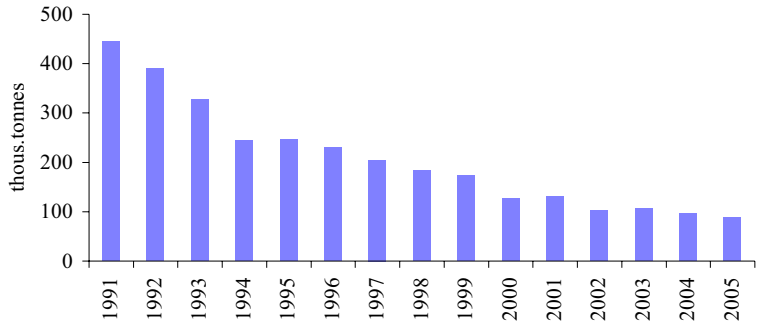
Source: Eurostat

Element regional emission of SO_2 in 2005 ($t.km^{-2}$)



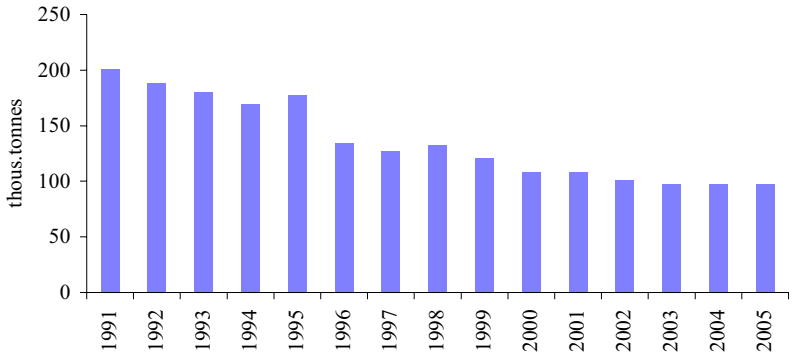
Source: SHMI

Trend in emission of SO_2



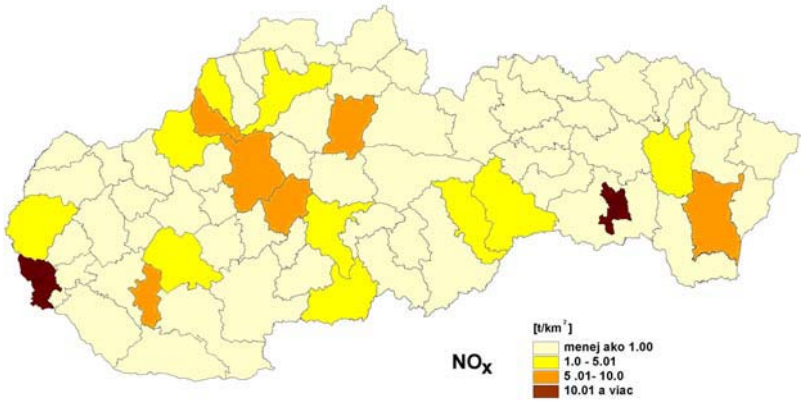
Source: SHMI

Trend in emission of NO_x



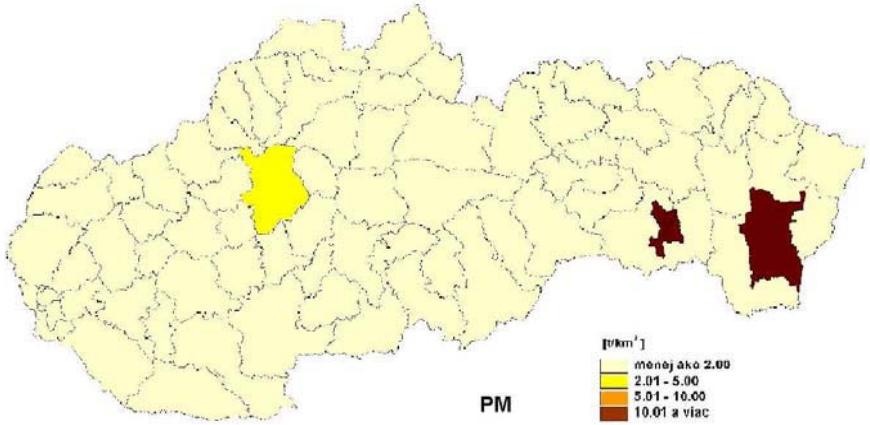
Source: SHMI

Element regional emission of NO_x in 2005 ($t.km^{-2}$)



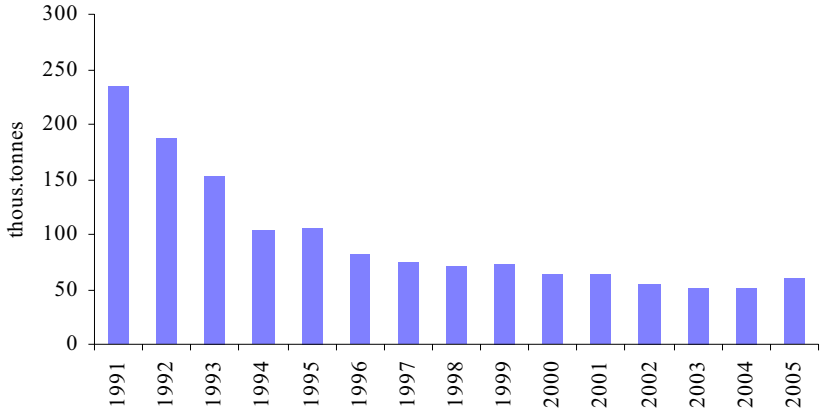
Source: SHMI

Element regional emission of PM in 2005 (t.km^{-2})



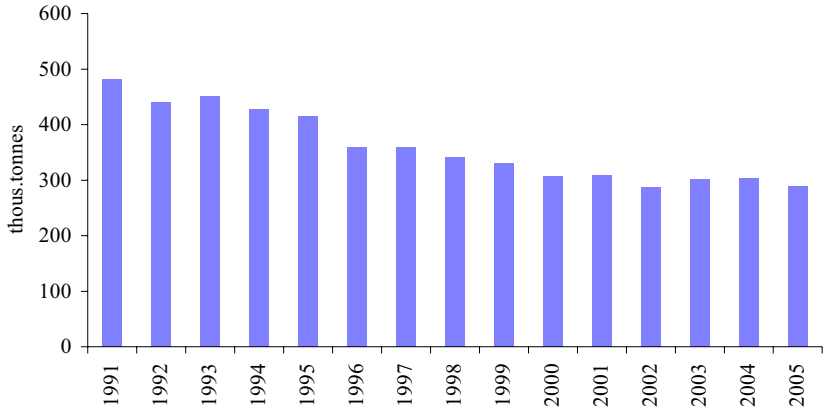
Source: SHMI

Trend in emission of PM



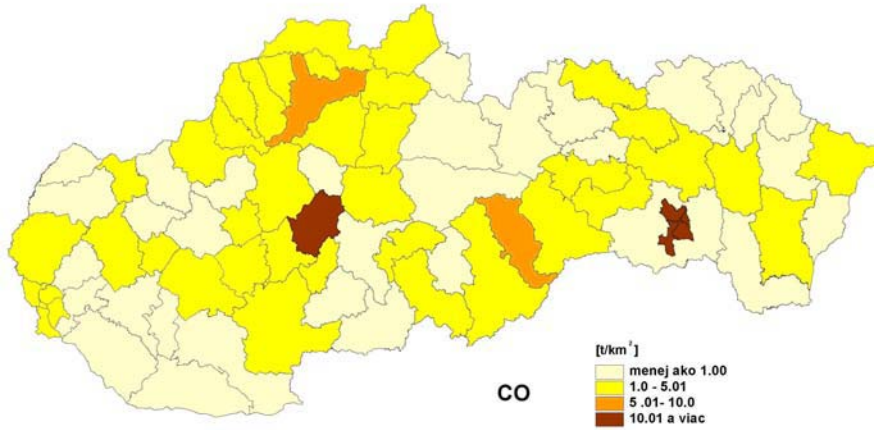
Source: SHMI

Trend in emission of CO



Source: SHMI

Element regional emission of CO in 2005 (t.km^{-2})

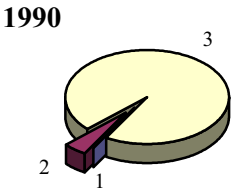


Source: SHMI

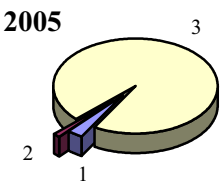
♦ **Balance of ammonia emissions (NH_3)**

NH_3 emissions in 2005 reached 26 926.5 tons. In 1990-2005 ammonia emissions were reduced by 58.5 %. This reduction was caused mainly by changes in agriculture.

The contribution of the particular sectors in NH_3 emission



0.05 %	1. Transport	2.94 %
4.79 %	2. Industry	1.42 %
95.17 %	3 . Agriculture	95.64 %



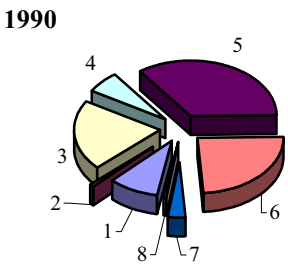
Source: SHMI

Emissions were stated to the date 15.02.2007

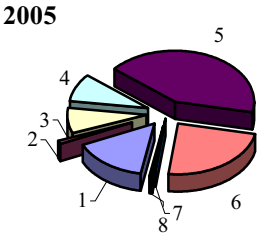
♦ **Emissions of non-methane volatile organic compounds**

NM VOC emissions show a lasting decreasing trend since 1990. In 2005, volume of **NM VOC** emissions reached the value of 78 940 tons, which is a reduction by 42.8 %, compared to 1990.

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



9.4 %	1. Combustion processes	15.3 %
0.8 %	2. Combustion processes in the industry	1.0 %
20.5 %	3. Industrial technologies	8.2 %
6.4 %	4. Mining and distribution of raw materials	9.0 %
34.8 %	5. Using the solvents and other products	42.0 %
24.3 %	6. Transport	23.7 %
3.3 %	7. Waste disposal	0.3 %
0.5 %	8. Agriculture	0.6 %

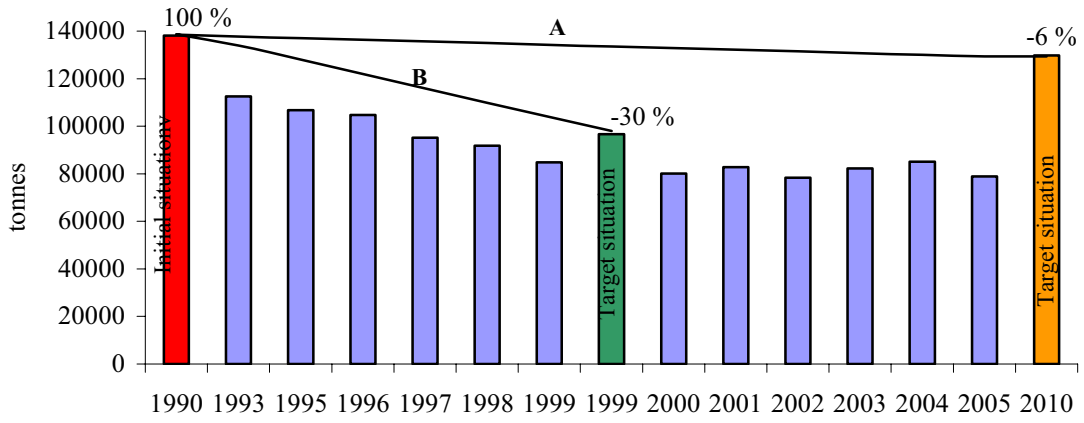


Source: SHMI

Emissions were stated to the date 15.02.2007

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)



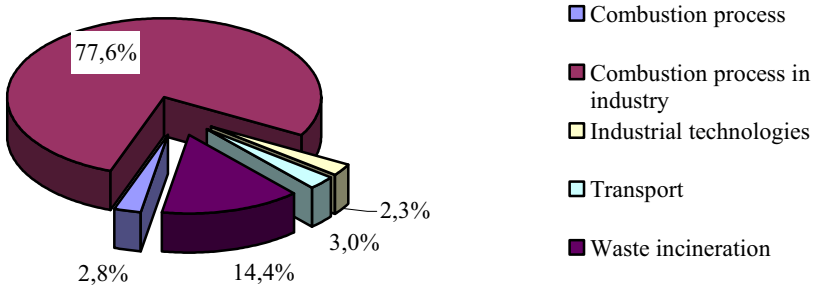
Source: SHMI

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 2005 it was 242.95 tons, which is a 64 % reduction in comparison to 1990.

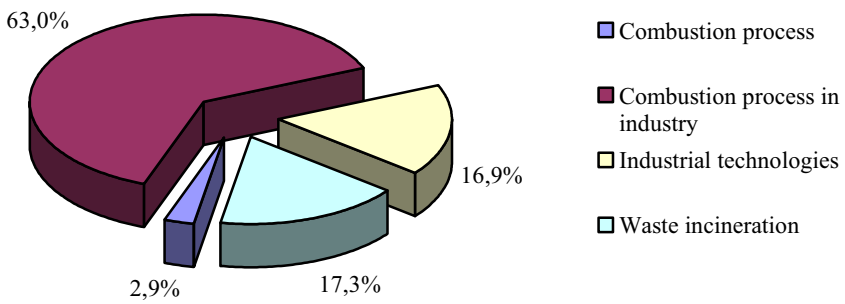
The contribution of the particular sectors in the Pb emission production for year 2005



Emissions were stated to the date 15.02.2007

Source: SHMI

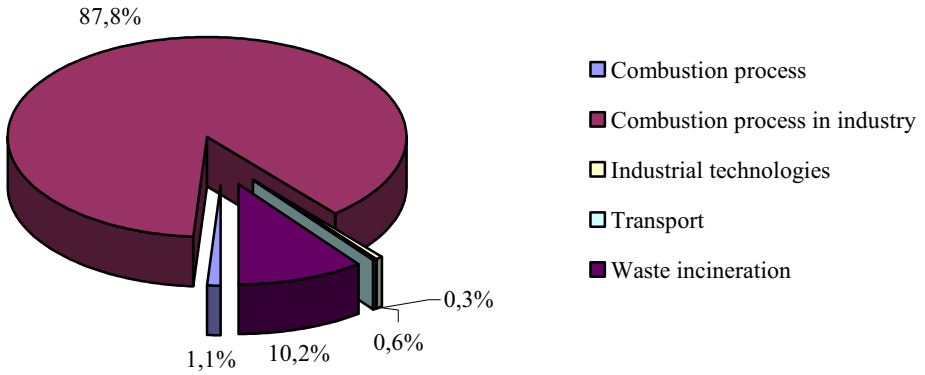
The contribution of the particular sectors in the Hg emission production for year 2005



Emissions were stated to the date 15.02.2007

Source: SHMI

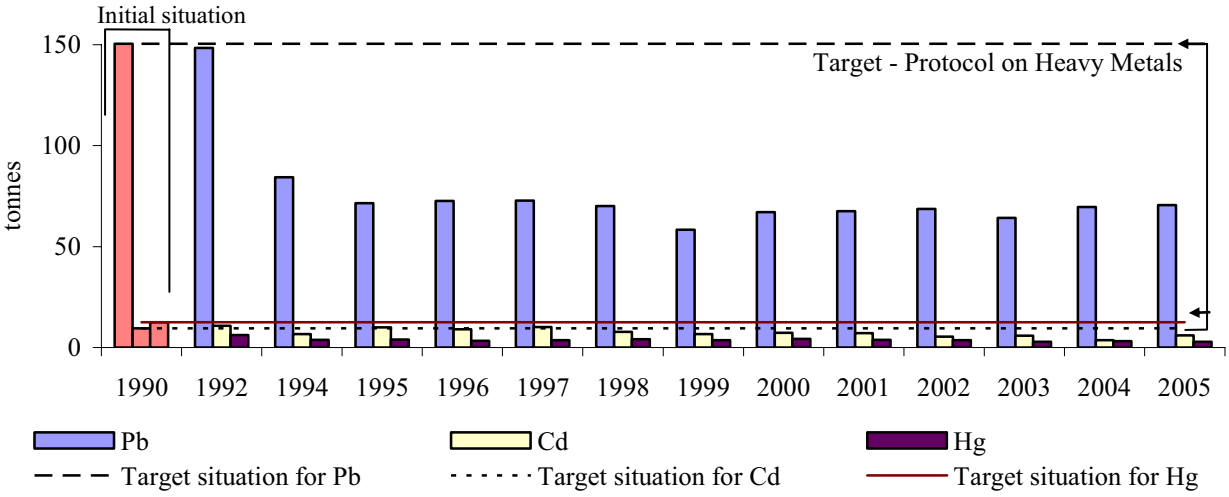
The contribution of the particular sectors in the Cd emission production for year 2005



Emissions were stated to the date 15.02.2007 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 fulfilmentof the international conventions

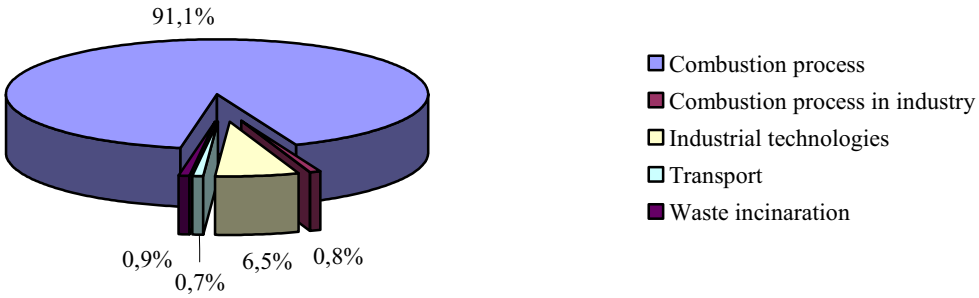


Source: SHMI

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

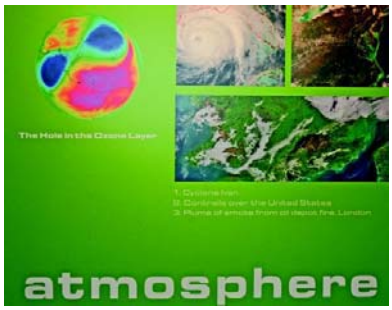
In 1990-2005 **emissions of persistent organic particles** (PCDD/PCDF, PCB, and PAH {B(a)P, B(k)F, B(b)F, I(1,2,3-cd)P}) had a decreasing trend with fluctuating characteristics over the last years. They were most apparent in the emissions of poly-aromatic carbohydrates (PAH).

The contribution of the particular sectors in the PAH emission production for year 2004

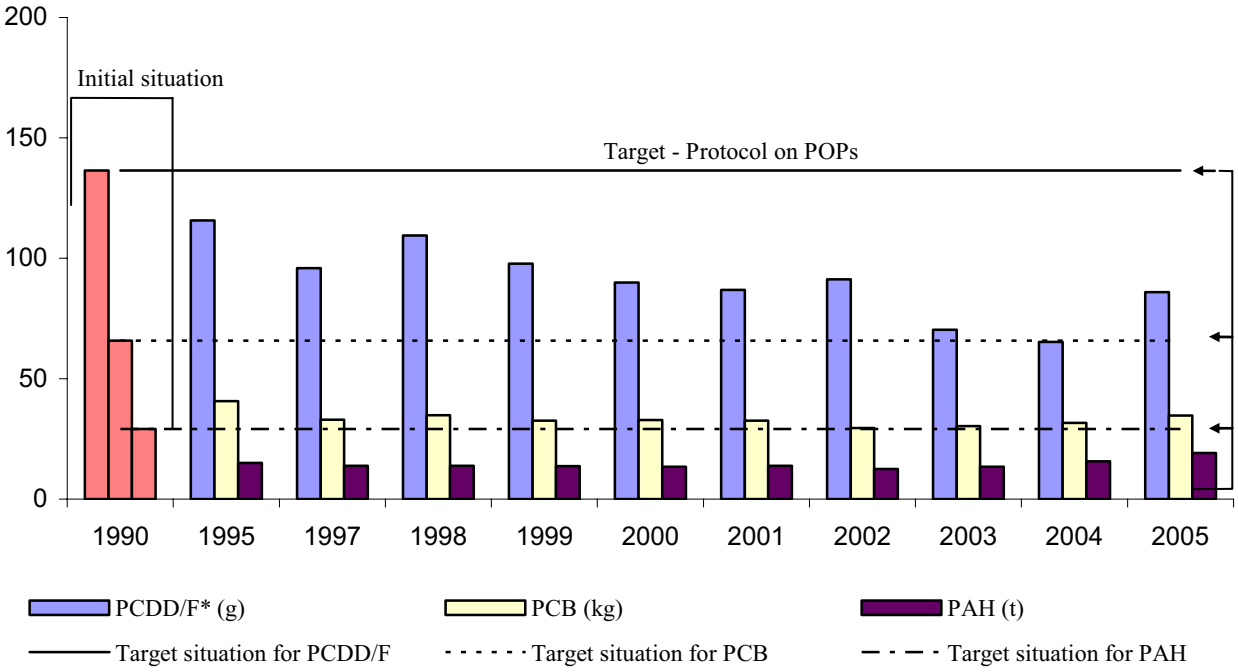


Emissions were stated to the date 15.02.2007 Source: SHMI

In 1998, the Slovak Republic also accessed to **Protocol on Limitation of Persistent Organic Compounds 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

Remote transport of air pollutants

In 2005, approximately 38 500 tons of sulphur were imported and 39 000 tons were exported. This meant a continuing trend in significant reduction to total volumes of imported and exported sulphur.

Slovakia has still remained an exporter of oxidized nitrogen. In 2005, 43 400 tons of nitrogen were received; however, 47 600 tons left the country. This also shows a long-term reduction in total volumes.

Volumes of emitted substances from the Slovak territory (t, %)

	Volumes of emitted sulphur		Volumes of emitted nitrogen	
	(t)	(%)	(t)	(%)
1998	74 600	83	53 900	82
2002	42 300	83	46 214	84
2003	45 621	86	47 761	87
2004	41 900	87	46 000	86
2005	39 000	88	47 600	89

Source: SHMI

Volumes of deposited substances on the Slovak territory (t, %)

	Volumes of deposited sulphur		Volumes of deposited nitrogen	
	(t)	(%)	(t)	(%)
1998	75 700	84	48 700	77
2002	53 320	86	46 282	84
2003	52 800	88	45 326	87
2004	45 600	88	49 600	87
2005	38 500	88	43 400	88

Source: SHMI

Volumes of emitted and deposited sulphur and nitrogen as compared in SR and other European countries

Volumes of emitted sulphur from areas Slovakia in 2005 (t, %)

Target country	Volumes of emitted sulphur	
	(t)	(%)
Slovakia	5 500	12
Ukraine	2 800	6
Poland	3 900	9
Hungary	2 800	6
Russia	3 500	8
Romania	2 000	4
Czech republic	3 200	7
Other	20 800	48
Together	**44 500**	**100**

Source: SHMI

Volumes of deposited sulphur from areas Slovakia in 2005 (t, %)

Target country	Volumes of deposited sulphur	
	(t)	(%)
Slovakia	5 500	13
Ukraine	3 900	9
Poland	10 500	24
Hungary	4 900	11
Russia	300	1
Romania	3 600	8
Czech republic	2 000	5
Other	13 300	29
Together	**44 000**	**100**

Source: SHMI

Volumes of emitted nitrogen from areas Slovakia in 2005 (t, %)

Target country	Volumes of emitted nitrogen	
	(t)	(%)
Ukraine	3 100	6
Russia	4 600	9
Poland	4 200	8
Hungary	3 300	6
Romania	2 200	4
Slovakia	5 900	11
Czech republic	3 300	6
Other	26 900	50
Together	**53 500**	**100**

Source: SHMI

Volumes of deposited nitrogen from areas Slovakia in 2005 (t, %)

Target country	Volumes of deposited nitrogen	
	(t)	(%)
Ukraine	4 400	9
Russia	600	1
Poland	7 800	16
Hungary	7 000	14
Romania	3 100	6
Slovakia	5 900	12
Czech republic	2 200	4
Other	18 300	38
Together	**49 300**	**100**

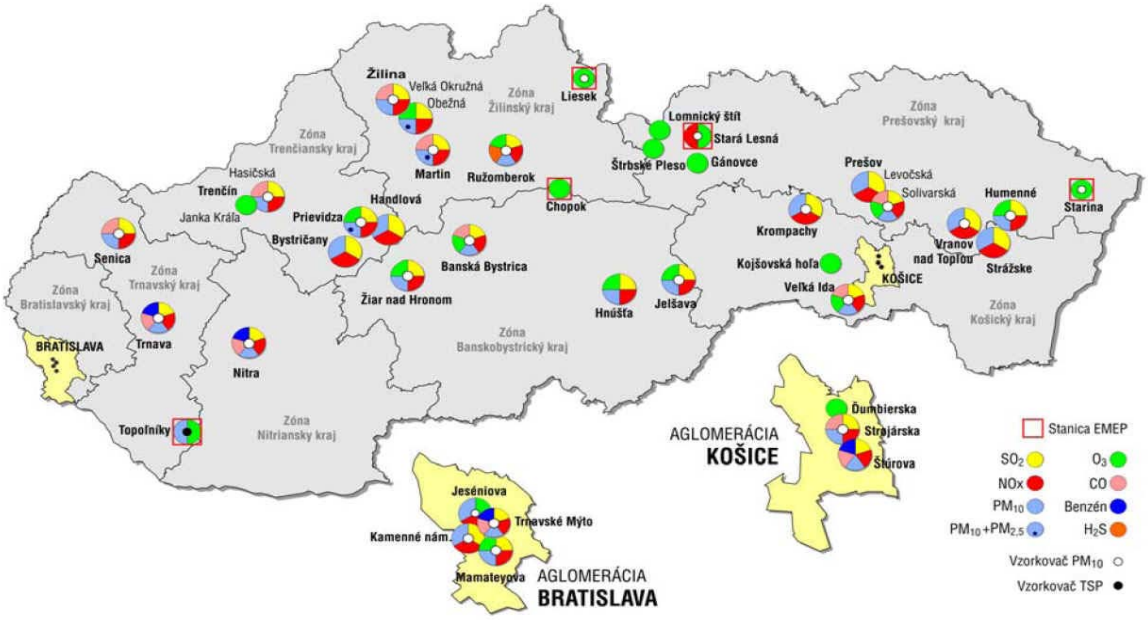
Source: SHMI

Air pollution

- **National monitoring air quality network**

In 2006, the **national air assessment quality monitoring network consisted of 38 automated monitoring stations including 5 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 2006, no agglomeration showed exceeded levels of pollution in hourly or daily values beyond the public health limit.

Nitrogen dioxide

Annual limit value for human health protection was exceeded at the following stations: Bratislava – Trnavské mýto, Nitra - Štefánikova, and Trnava - Kollárova. However, no station showed the exceeded limit value increased by tolerance threshold.

PM_{10}

In 2006, PM_{10} particles were monitored at 27 stations. At the same time, the $PM_{2.5}$ measurements were carried out at 3 stations, with no limits set for this fraction up to this day. The biggest challenge in the area of air protection in Slovakia and most European countries is currently air pollution by marticulate matter (PM_{10}). With the exception of the stations of Bratislava – Jeséniova, Strážske-MIerova, and Humenné-Nám.slobody, the daily limit value was exceeded at all stations, while 8 AMS stations showed also an exceeded annual limit value.

Carbon monoxide

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

Lead

At present, air pollution by lead does not pose a major risk in Slovakia. Its concentrations do not exceed the upper threshold evaluation limit.

Benzene

One site (in the Nitra region's zone) shows the pollution level slightly above the limit value of 5 $\mu g.m^{-3}$ (in Nitra it was 5.2 $\mu g.m^{-3}$), to be reached by Slovakia in 2010.

♦ **Regional air pollution**

Average annual concentrations of air-borne hazardous compounds - 2006

Station	Prach $\mu g/m^3$	SO_2-S $\mu g/m^3$	NO_2-N $\mu g/m^3$	HNO_3-N $\mu g/m^3$	SO_4^{2-}-S $\mu g/m^3$	NO_3^--N $\mu g/m^3$	O_3 $\mu g/m^3$	Pb $\mu g/m^3$	Mn $\mu g/m^3$	Cu $\mu g/m^3$	Cd ng/m^3	Ni ng/m^3	Cr ng/m^3	Zn ng/m^3	As ng/m^3
Chopok	7.0	0.27	0.59	0.02	0.33	0.09	96	2.67	2.66	1.24	0.08	0.60	0.97	6.40	0.22
Topoľníky	24.5	1.34	2.80	0.04	1.37	0.97	60	13.10	6.92	3.59	0.31	2.83	2.94	20.84	1.26
Starina	19.2	1.36	1.24	0.05	1.23	0.38	62	11.18	5.83	1.99	0.31	0.69	0.72	16.32	0.76
St. Lesná	14.9	0.77	1.52	0.05	1.01	0.34	73	9.36	4.76	2.21	0.23	0.51	0.64	16.32	0.67
Liesek	23.4	2.00	1.94	0.06	1.21	0.57	66	14.41	23.08	2.71	0.41	0.85	0.84	26.65	1.71

Source: SHMI

Sulfur dioxide, sulfates

In 2006, regional level of **sulfur dioxide concentrations** varied within the interval of 0.27 µg $S.m^{-3}$ (Chopok) and 2.00 µg $S.m^{-3}$ (Liesek). Stations in lower altitude that include Topoľníky, Starina, and Liesek, showed increased concentration values for sulphur dioxide. The values exceeded 1 µg $S.m^{-3}$. On the other hand, stations situated in higher altitudes, including Stará Lesná, and Chopok, showed values 2-7 times lower.

In line with Annex 1 of the MoE SR Resolution No. 75/2002 Coll. the limit value for the protection of ecosystems is 20 µg $S0_2.m^{-3}$ for the calendar year and the winter season.

Regional level of sulphate concentration calculated for sulphur was in 2006 the lowest at Chopok, 0.33 $\mu g.m^{-3}$ and the highest at Topoľníky, 1.37 $\mu g.m^{-3}$. Percentage of sulfates on total mass of atmospheric ozone was 14 - 20 %. Sulfates and sulfur dioxide concentration ratios expressed in sulfur is shown in the interval of 0.61- 1.31, which corresponds to the regional pollution level.

Nitrogen oxides, nitrates

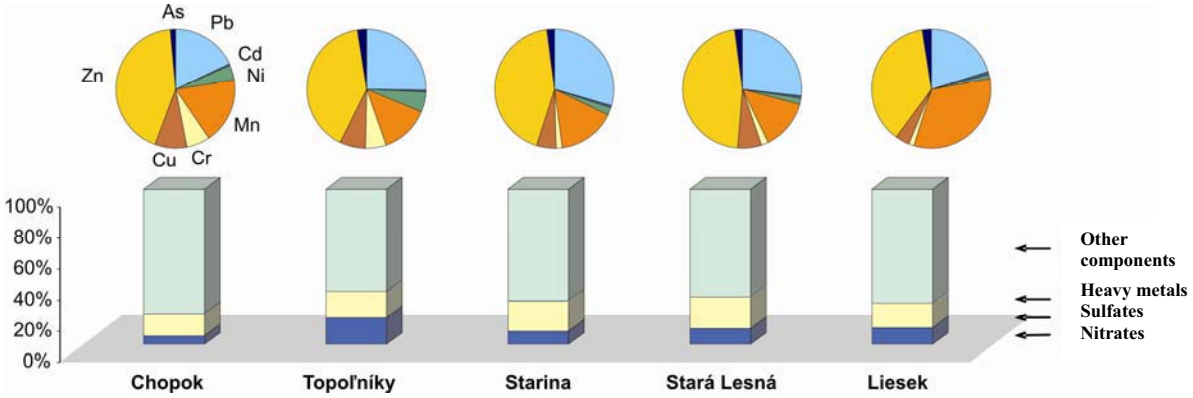
Concentration of nitrogen oxides at regional stations expressed in NO_2-N varied in 2006 between 0.59 $\mu g.m^{-3}$ (Chopok) – 2.80 $\mu g.m^{-3}$ (Topoľníky). In line with Annex 1 of the MoE SR Resolution No. 705/2002 Coll. the **limit value for the protection of ecosystems is 30 µg $N.m^{-3}$** for the calendar year. This value was not exceeded at any regional station. Maximum value of 9.2 µg $NO_x.m^{-3}$ from all stations at Topoľníky is at the level lower than 30 % of the limit value.

Atmospheric **nitrates** at regional stations in Slovakia were mostly in the aerosol form, and at almost all the stations they showed values little increased than in 2006. Gaseous nitrates are in comparison with the aerosol ones lower at all stations and, compared to the previous year, differences were negligible. 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 varied between 6 % and 17 %. Ratio of total nitrates (HNO_3 + NO_3) to NO_2, as expressed in nitrogen, varied between 0.15 – 0.35.

Atmospheric aerosol, heavy metals

Percentage share of the sum of assessed heavy metals on air-borne dust at regional stations of Slovakia varies between 0.2 and 0.3 %.

Composition of atmospheric aerosol and percentage share of heavy metals in 2006



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. Their concentrations range between individual units to hundreds of units ppb. Ethane presents the worst, next is propane and acetylene. Isoprene releases from ambient forest.

Average annual VOC concentrations in ambient air (ppb) - Starina 2006

ethane	ethene	propane	propene	i-butane	n-butane	acetylene	butane	pentene	i-pentane	n-pentane	isoprene	n-hexane	benzene	toluene	o-xylene
2.034	0.746	0.915	0.119	0.284	0.350	0.879	0.048	0.035	0.270	0.160	0.107	0.085	0.334	0.043	0.247

Source: SHMI