Ministry of Environment
of the Slovak Republic

STATE OF THE ENVIRONMENT REPORT SLOVAK REPUBLIC 2010

Slovak Environmental Agency

COMPONENTS OF THE ENVIRONMENT AND THEIR PROTECTION

• AIR

Key questions and key findings

♦ **Key questions**

- **What is the recent trend in the area of production of polluting substances in the Slovak Republic?**
- **Is Slovakia fulfilling its obligations given by international conventions in the area of air protection?**
- **Are the air pollutants limit values for human health protection complied with?**
- **Are the air pollutants limit values for vegetation protection complied with?**
- **What has been the trend in the condition of the ozone layer and intensity of solar radiation over the SR territory?**
- **Is the SR fulfilling its international obligations in the area of the Earth's ozone layer protection?**

♦ **Key findings**

- **Emissions of basic pollutants (PM, SO_2, NO_X, CO) over a long-term horizon (1990-2009) have been consistently reduced; however, the speed of reduction after 2000 has been significantly slower. There was a temporary increase in emissions detected in 2003-2005; however, after 2005 the trend was falling again.**
- **Ammonia emissions have been persistently decreasing over a long time period.**
- **NMVOC emissions over a longer time horizon (1990-2000) have been decreasing persistently. In the period of 2000 to 2009 the values were maintained more-less at the same level, with slight fluctuations in specific years.**
- **Persistent organic pollutants (POPs) emissions dropped significantly over the period of 1990-2000. When the years 2001 and 2009 were compared, there was seen a reduction in the PCDD/PCDF emissions by 50.3%, PCB emissions by 4.4%, and the sum of PAH emissions increased by 29%.**
- **Slovakia is fulfilling its obligations given by international legislation in the area of air protection.**
- **The designated 19 areas of air quality management in 2010 covered the size of 2 904 km^2 with 1 404 721 people, which represent 26% of total Slovak population.**
- **Notwithstanding the persistent decrease in the pollutants emission, in 2010 a number of monitoring stations again detected exceeded limit values for selected air-borne pollutants (NO_X, PM_{10}, $PM_{2.5}$) designated to ensure human health protection.**
- **The massive reduction in national emissions of ozone precursors over the last years has not resulted in reduced ground ozone concentrations in Slovakia. Some ground ozone characteristics in 2010 remained at a relatively high level achieved in the previous years.**
- **Limit values of air-born pollutants (SO_2, NO_X) designated for the protection of vegetation have not been exceeded. Exceeded values were detected for ground ozone.**
- **Total atmospheric ozone was above the long-term average values, within a 2.4% deviation above the mean value; total sum of daily doses of the ultraviolet erythema radiation decreased.**
- **Slovakia is fulfilling its obligations given by international legislation in the area of ozone layer protection.**

Emission situation

♦ Balance of basic pollutants emissions

Trend in emissions of particulate matter

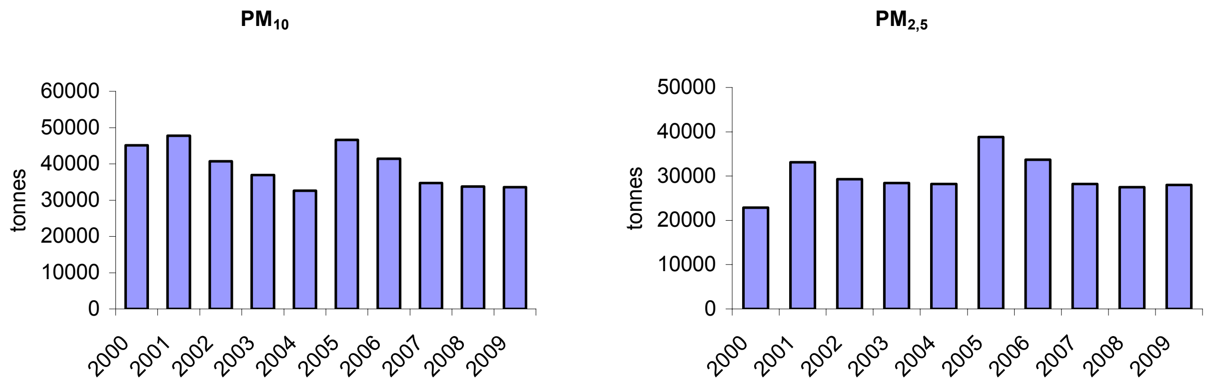
Emissions of particulate matter have shown a steady reduction since 1990, which, apart from reduction in production and energy consumption, has been caused by a change within the fuel group toward more purified fuels, as well as by using fuels with higher quality labels.

Reduction in particulate matter emissions was further contributed to by introduction of separation equipment or increasing its efficiency, respectively. Increase in the PM emissions over 2004-2005 was caused by an increased consumption of wood within the sector of small-size sources (heating up of houses) due to increased natural gas and coal prices for small consumers. Reduction in the PM emissions in 2006 was caused mainly by reconstructions of the separation equipment in several power management and industrial installations. Further decrease in the PM emissions by large stationary sources in 2007 was caused by the fact that some incineration units installed at significant sources were out of operation. Since 2008, the PM emissions trend has continued to decrease slightly.

Balance of PM_{10}, $PM_{2.5}$ emissions

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 reflect the increased consumption of wood caused by growing prices of natural gas and coal.

Development trends in PM_{10} a $PM_{2.5}$ emissions



Emissions were stated to the date 15.2.2011

Source: SHMI

Trend in emissions of sulphur dioxide

Emissions of 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.

Decreasing trend in the SO_2 emissions until 2000 was caused by reduction in the consumption of brown coal and lignite, heavy heating oil, using of low-sulphur heating oils, and installation of desulphurisation plants at all large power sources. Fluctuating trend in the CO_2 emissions in 2001 through 2003 was caused by partial or full operation, by the quality of burnt fuel types, and by the volume of production at energy sources. In 2004-2006, there was another reduction in the SO_2 emissions, especially in large stationary sources. This reduction was caused mainly by burning low-sulphur heating oils and coal, and by a reduced production volume. In 2005, there was a significant reduction in the SO_2 emissions from road transport, by as much as 77%. This reduction, despite the increased fuel consumption, was caused by implemented measures relating to the sulphur content in fuels (Resolution of the Slovak Ministry of Environment no. 53/2004 Coll.) Further decrease in the SO_2 emissions by large stationary sources in 2007 was caused by the fact that some incineration units installed at significant sources were out of operation. Since 2008, the SO_2 emissions trend has continued to decrease.

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Trend in emissions of nitrogen oxides

Emission of nitrogen oxides since 1990 dropped slightly despite the fact that they grew slightly in 1994-1995 due to an increased natural gas consumption.

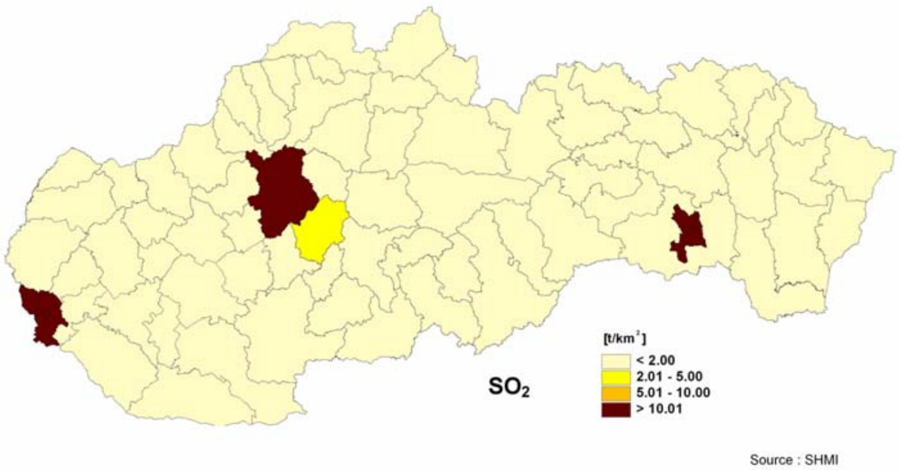
Decrease in nitrogen oxides in 1996 was caused by a change to the emission factor that took into consideration the level of equipment and technology of incineration processes. Reduction in solid fuel consumption since 1997 has led to a further decrease in NO_X emissions. In the years 2002 and 2003, de-nitrification 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 also relates to the modernisation of personal and freight vehicles, as well as the use of a more exact emission factor.

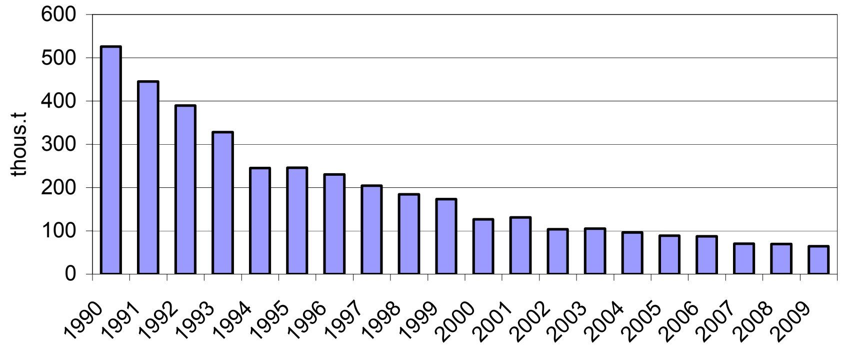
Trend in carbon monoxide emissions

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 2009 ($t.km^{-2}$)

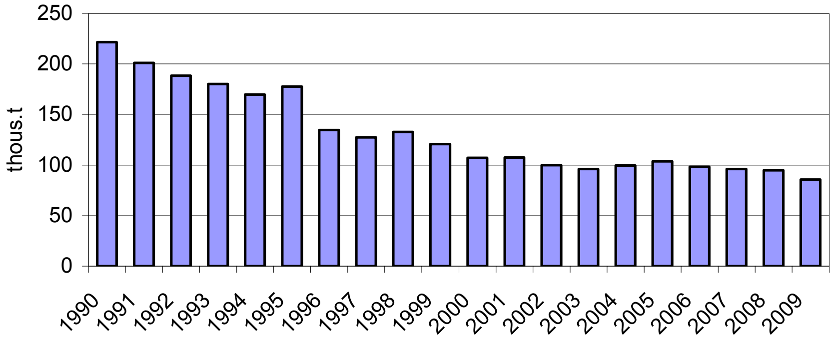


Trend in emission of SO_2



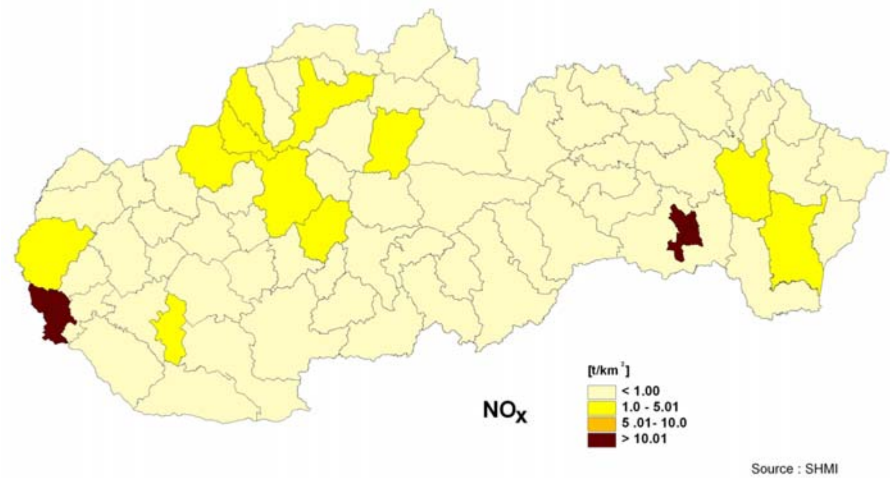
Source: SHMI

Trend in emission of NO_X

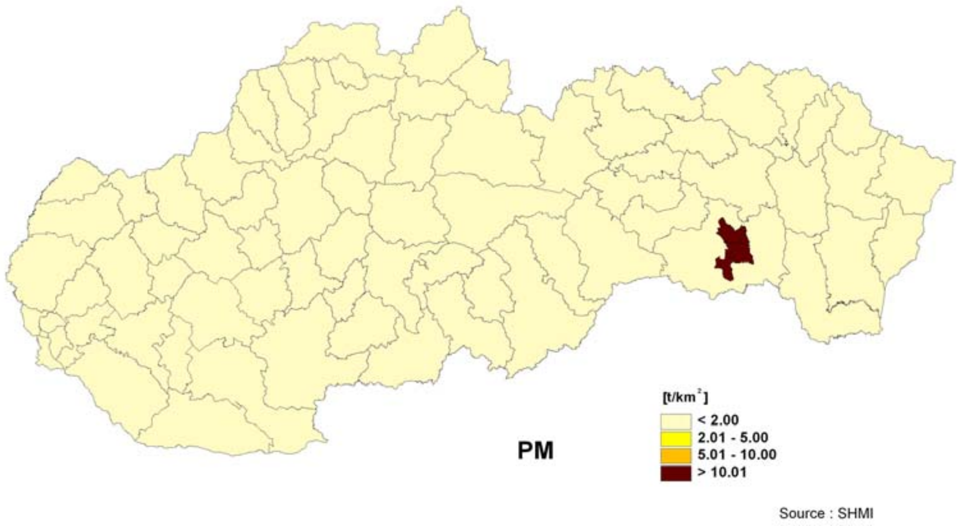


Source: SHMI

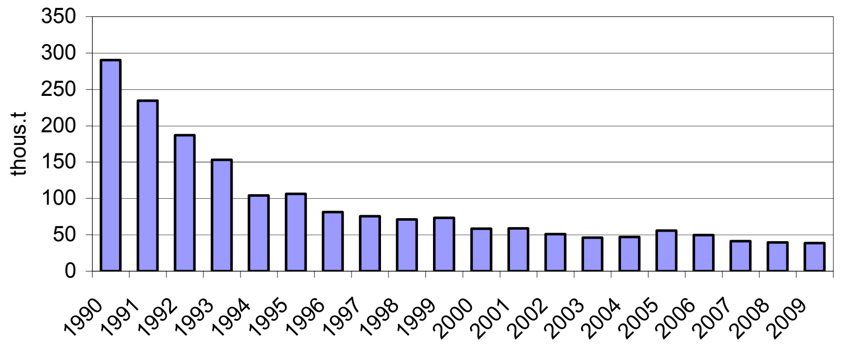
Element regional emission of NO_X in 2009 ($t.km^{-2}$)



Element regional emission of PM in 2009 ($t.km^{-2}$)

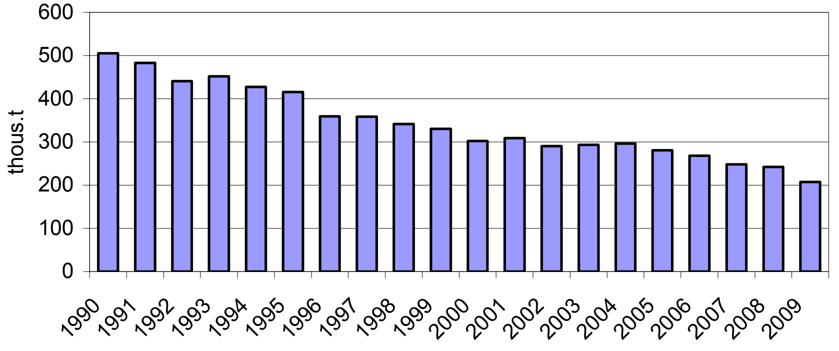


Trend in emission of PM



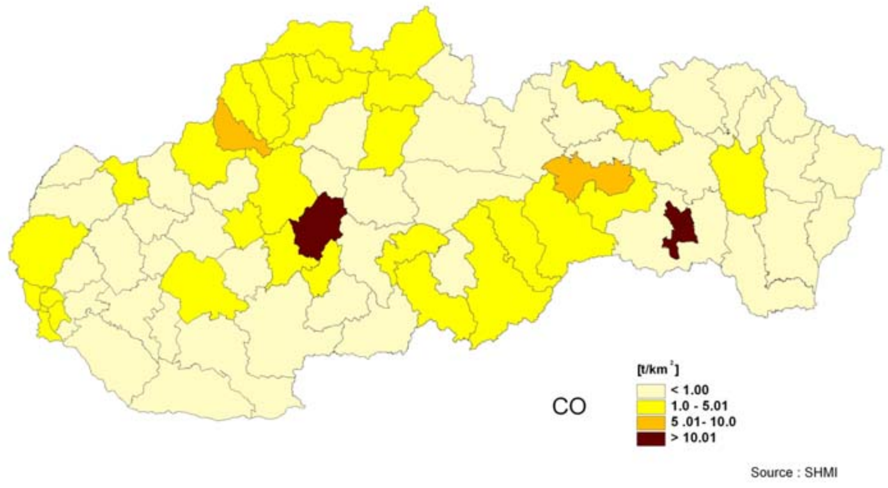
ource: SHMI

Trend in emission of CO



Source: SHMI

Element regional emission of CO in 2009 ($t.km^{-2}$)



Meeting international obligations for the basic pollutants emissions

Slovakia is a signatory to the UN Economic Commission Convention on Long-Range Trans-boundary Air Pollution (which became effective for ČSFR in March, 1984, and Slovakia being its successor since May, 1993). This Convention became the basis for protocols, which also spelled out obligations for the signatories to reduce individual anthropogenic emissions of pollutants contributing to global environmental problems. The following text shows how individual protocols' obligations in the area of acidification are met:

- ***Protocol on further reduction of sulphur emissions***

This protocol was signed in Oslo in 1994. Ratified by the Slovak Republic in January 1998 the protocol became effective in August 1998. Obligations of the Slovak Republic to reduce the SO_2 emissions as set forth in the Protocol (compared to the reference year of 1980) include:

Obligation to reduce SO_2 emission pursuant to Protocol on further reduction of sulphur emissions

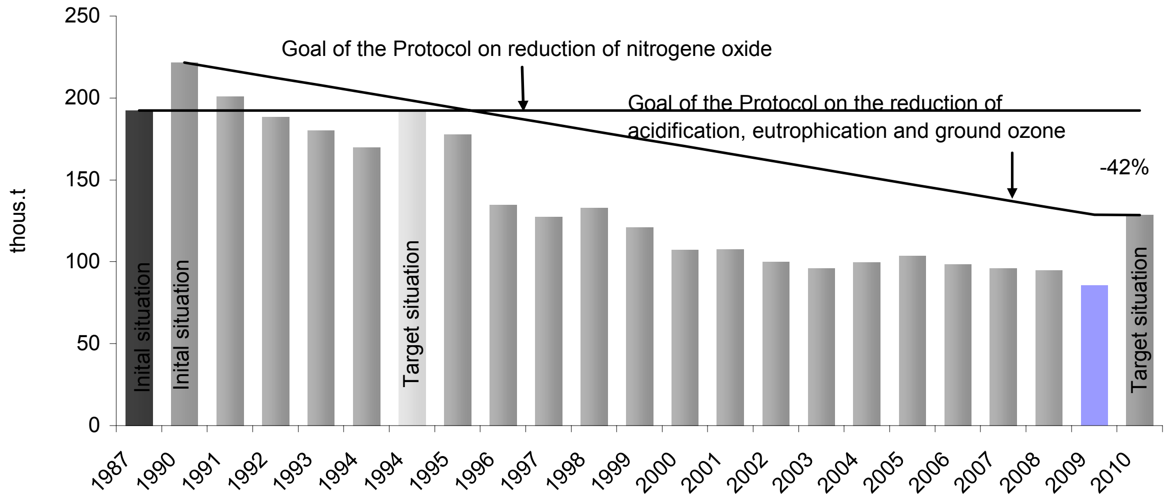
Year	1980 (initial year)	2000	2005	2010
SO_2 emission (thous. t)	843	337	295	236
SO_2 emission reduction (%)	100	60	65	72

Slovakia met one of its Protocol objectives to reduce the SO_2 emissions in 2000 by 60%, compared to the reference year of 1980. In 2000, sulphur dioxide emissions reached the level of 123.880 thousand tons, which is 85% less than in the years 1980. In 2005 it was 89 thousand t, which is 89% less than in 1980. In 2009, sulphur dioxide emissions reached the level of 64.082 thousand tons, which is 89% less than in 1980.

- ***Protocol on the Reduction of Acidification, Eutrophication and Ground Ozone***

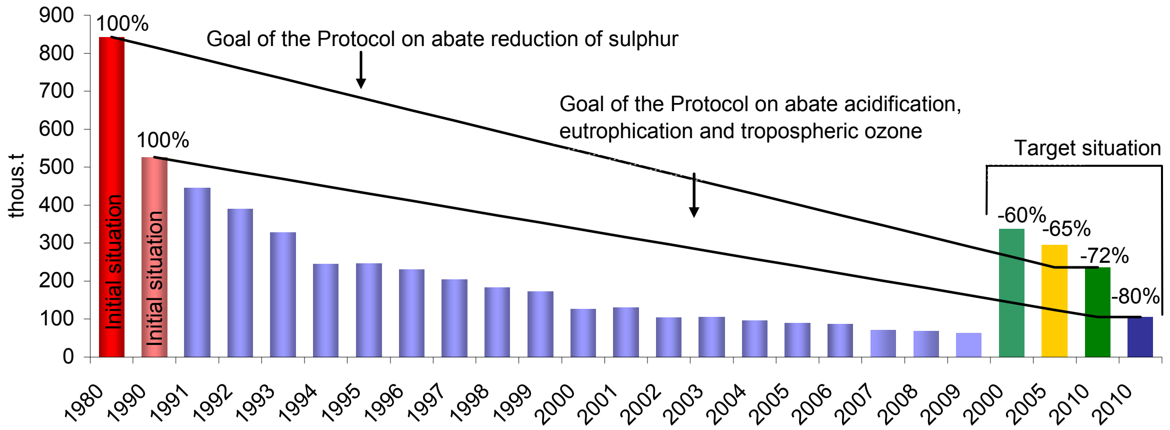
The protocol was signed in Göteborg in 1999. Slovakia signed the protocol in 1999 and ratified in 2005. Slovakia obliged itself to reduce the SO_2 emissions by 2010 by 80%, the NO_2 emissions by 2010 by 42%, the NH_3 emissions by 2010 by 37% and the VOC emissions by 2010 by 6% in comparison to the year 1990. Slovakia has the potential to fulfill this obligation.

Trend in NO_X emission with regard to following the outcomes of international agreements



Source: SHMI

Trend in SO_2 emission with regard to following the outcomes of international agreements



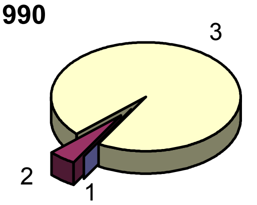
Source: SHMI

♦ Balance of ammonia emissions (NH_3)

Production of the NH_3 emissions$_3$ in 2009 was 25 016.39 tonnes. More than 90% of all NH_3 emissions originate in the sector of agriculture - livestock production and animal waste management. NH_3 emissions from the use of artificial nitrogen fertilisers also represent a significant category in the sector of agriculture. NH_3 emissions from the energy sector/industrial production and transport are less significant. NH_3 emissions from industrial production originate mainly from nitric acid production. NH_3 emissions from transport originate mainly from road transport.

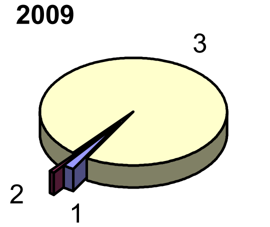
The contribution of the particular sectors in NH_3 emission

1990



1990	Sector	2009
0.05%	1. Transport	1.85%
4.79%	2. Industry	0.85%
95.17%	3. Agriculture	97.30%

2009

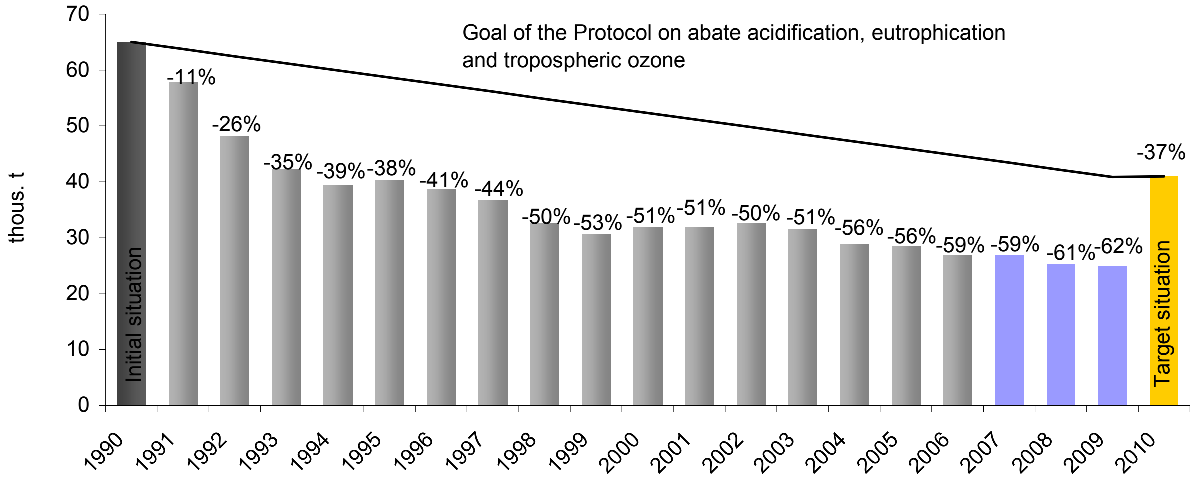


Emissions were stated to the date 15.2.2011

Source: SHMI

Over a long-term period, there is a persistent decrease in total volumes of NH_3 emissions. This reduction in 2009 represents a 62% decrease compared to 1990.

Trend in NH_3 emission with regard to following the outcomes of international agreements



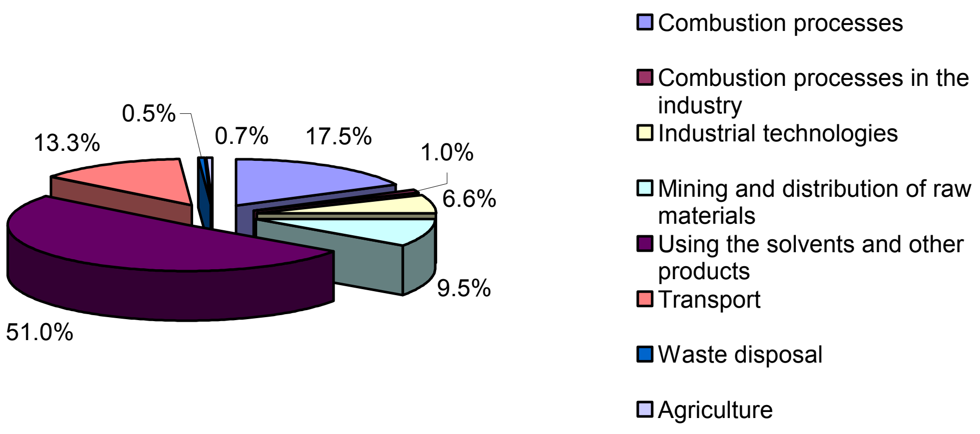
Source: SHMI

♦ Emissions of non-methane volatile organic compounds

Drop in total NMVOC emissions was caused by a number of measures, such as reduction in using coating compounds and by gradual introduction of low-solvent types of coatings, extensive introduction of measures in the sector of crude oil processing and fuel distribution, introduction of gas technologies into incineration, especially in the energy area, and by the change to the portfolio of cars toward vehicles equipped with the operated catalyser. Since 2000, the NMVOC emissions in the area of paints and glues have increased by 54%, since the use of these products is part of a wide spectrum of industrial activities and various technological operations. The consumption and import of printer colours and solvent-based paint systems has been continually increasing. In 2004 and 2005 there was a growth in the production of cars, many paint shops were opened, thus increasing also the consumption of paint substances. In 2007, complete time line data for the industrial area of cleansing and degreasing were recalculated due to the need of better precision in calculating the consumption of solvents in the area of paints and glues.

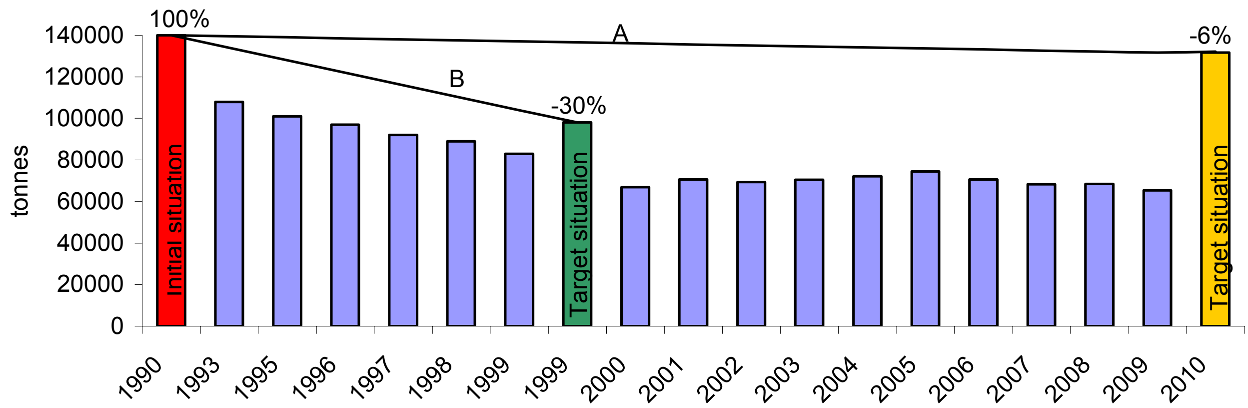
Recalculation of the NMVOC emissions in 2010 was carried out for the sector of waste management for the years 2002, 2004, 2005, and 2008, due to an update in the input data. A new version of the COPERT IV model was used for the road transport emission analysis; therefore, emissions were recalculated until 2000. Total NMVOC emissions dropped from 68.9 kt in 2008 to 65.4 kt in 2009. Reduction in the emissions was caused mainly due to a decreased industrial production.

The contribution of the NMVOC emission according to sector of their origin in 2009



Emissions were stated to the date 15.2.2011 Source: SHMI

Trend in NMVOC emissions with regard to fulfilling of the international agreements



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

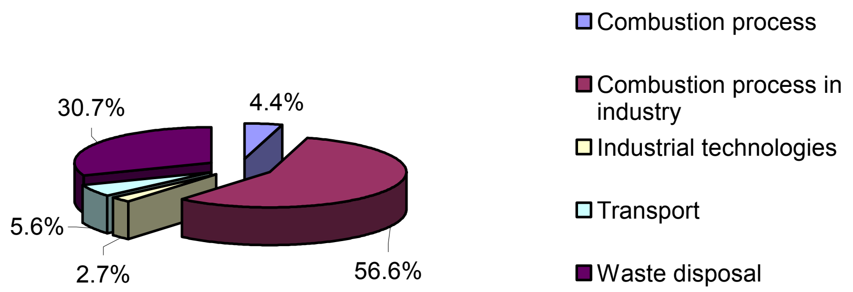
♦ Balance of heavy metals emissions

Heavy metal emissions have decreased significantly since 1990. Besides shutting off a number of old-fashioned and non-effective productions, this trend has been influenced by extensive reconstructions of separation equipment, change in raw material used, and, most of all, by transition to using unleaded petrol types since 1996. Since 2004, the register of heavy metals from household fuel burning has included the burning of wood. Trends in the heavy metal emissions over the recent years are characteristic for slight fluctuations. In 2007, lead and mercury emissions dropped, compared to the 2006 figures, due to a reduction in the ore agglomeration and glass production. At the same time, cadmium emissions increased in the same year, which related to an increased copper production. In 2008, lead, cadmium, copper, zinc, and selenium emissions increased due to an increased volume of incinerated industrial waste and increased emissions in the area of industrial, municipal power management , and system power industry.

In 2009, there was a reduction in heavy metal emissions which related to a reduction in the industrial production. In 2010, there was a recalculation carried out in the sector of waste handling for the years 2002, 2004, 2005, and 2008, due to an update in the input data. A new version of the

COPERT IV model was used for the road transport emission analysis; therefore, emissions were recalculated until 2000. Next, cadmium emissions from glass production were calculated for the years 2007 and 2008, due to a revised emission factor for colour glass.

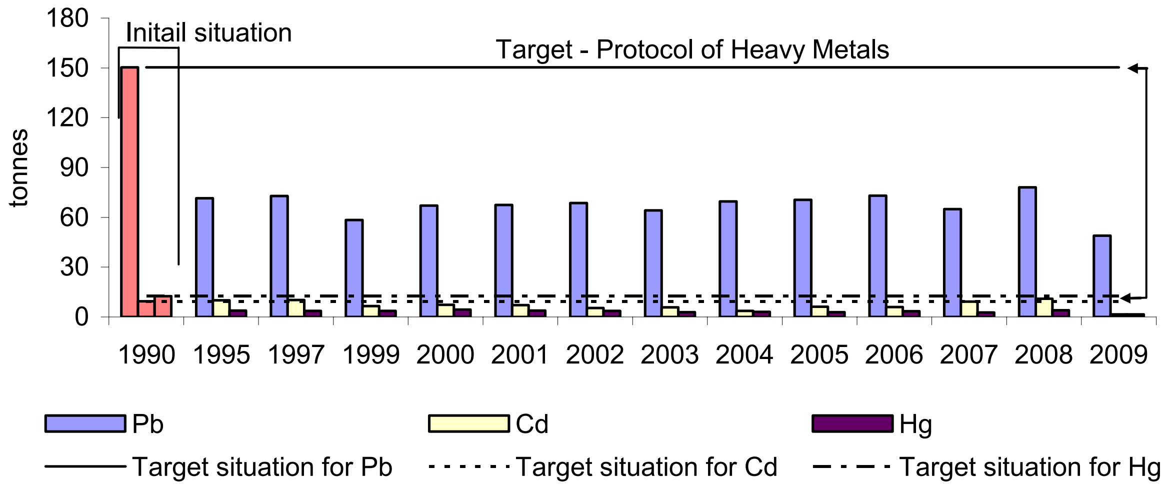
The contribution of the particular sectors in the Pb emission production for year 2009



Emissions were stated to the date 15.2.2011

Source: SHMI

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



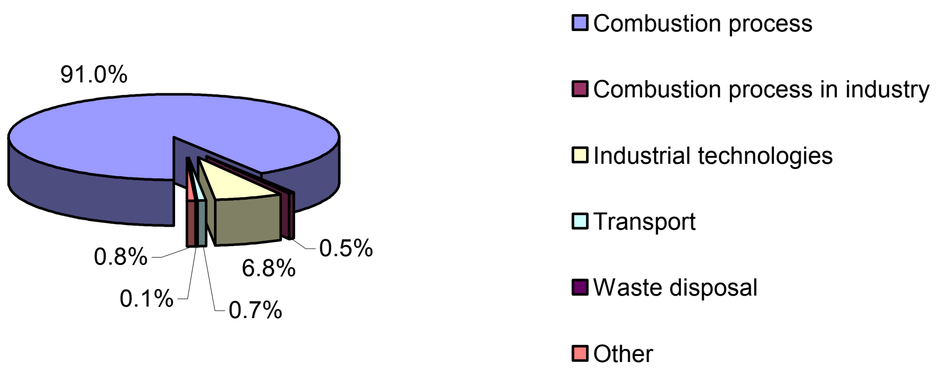
Source: SHMI

♦ Balance of Persistent organic pollutants (POPs)

The POPs emissions in 2010 were recalculated for the complete time line while considering technological improvement at waste incineration.

Decreasing trend in the POPs emissions was most clearly seen in the 90ties for PAH where the reduction in emissions was mainly caused by a change to the aluminium production technology. (using previously burnt anodes) Growth in the PCB emissions (polycyclic biphenyls) over the last years has been influenced primarily by an increased consumption of diesel in road transport and an increased consumption of wood by small sources (heating of households). Increased wood consumption in this sector influenced also the growth in total PAH emissions. PCDD/F emissions have dropped since 2000 due to the reconstruction of a number of installations (municipal waste incineration units). PCDD/F emissions are influenced by the volume of incinerated medical waste, volume of agglomerated iron ore, and by fuel composition in the sector of household heating. A slight increase in the emissions of polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAH) caused increased volume of modal split in road transport and an increased fuel consumption. Fluctuating emissions of hexachlorbenzene (HCB) reflects the fluctuating production of secondary copper together with a growth in the volume of modal split in road transport. A slight reduction in the emissions of polychlorinated dioxins and furans (PCDD/PCDF) and polychlorinated biphenyls (PCB) in 2009 was caused by reduced waste incineration; total emissions of polycyclic aromatic hydrocarbons (PAH) show a slight reduction compared to 2008, due to a lower coke production.

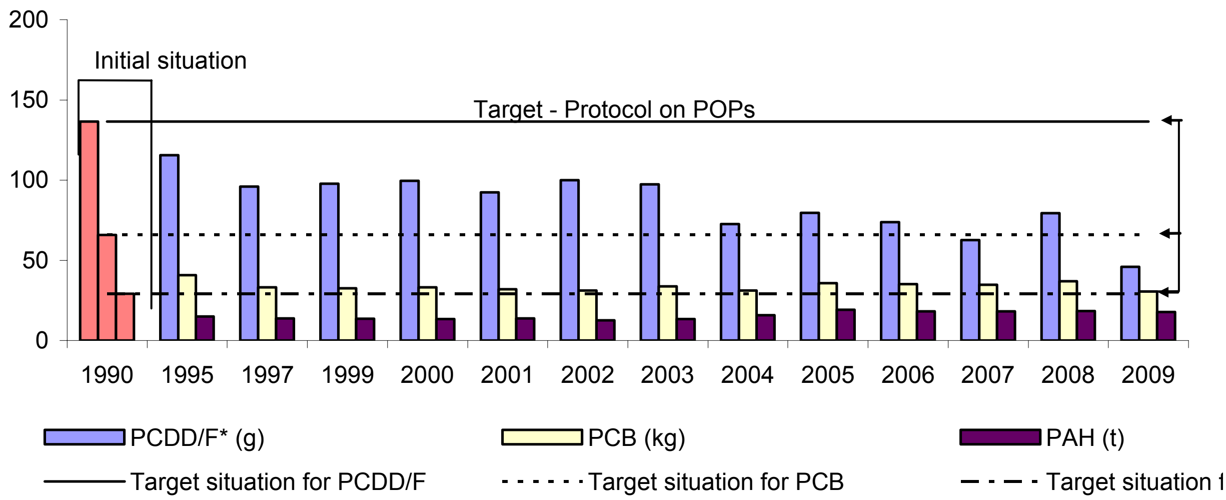
The contribution of the particular sectors in the PAH emission production for year 2009



Emissions were stated to the date 15.2.2011

Source: SHMI

Trend of POPs emissions regarding the fulfilment of the international conventions



Source: SHMI

Air pollution

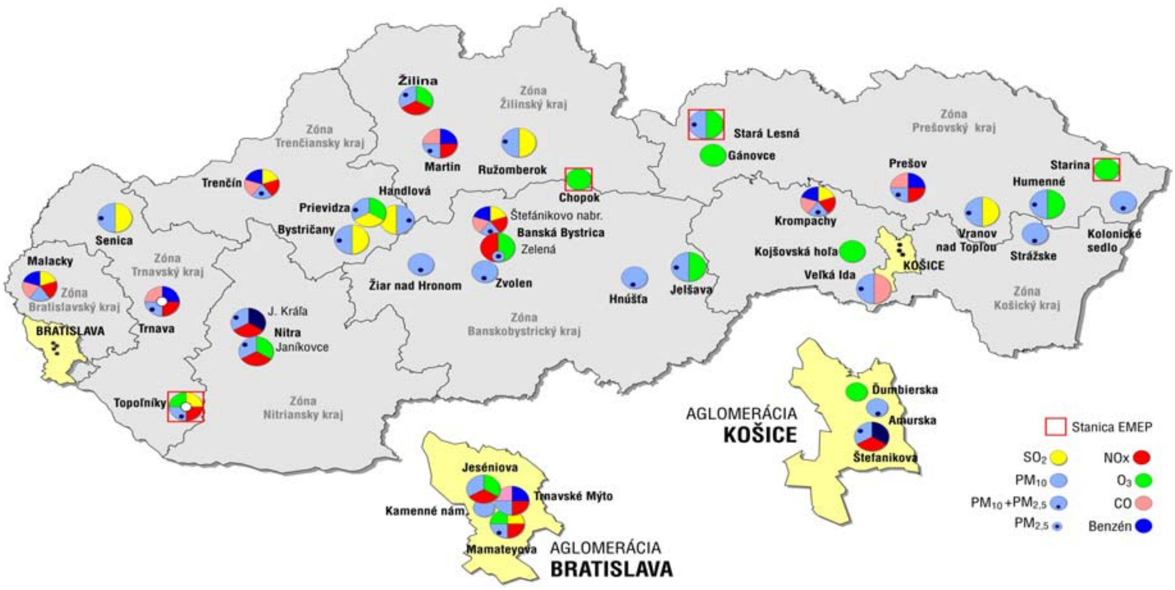
♦ Air quality and its limits

In compliance with the requirements of Act **137/2010 Coll.** on air protection, the whole Slovak territory was divided into 8 **zones** and 2 **agglomerations** that are further subdivided into 19 **air quality management areas.**

Air quality management area is an agglomeration or a designated part of the zone with exceeded:

- limit values for one substance or more pollutants increased by tolerance threshold,
- limit value of one substance or more pollutants, if no tolerance threshold is set,
- target value for ozone, $PM_{2.5}$, arsenic, cadmium, nickel, or benzo(a)pyrene.

National monitoring air quality network - 2010



Source: SHMI

♦ Local Air pollution

Sulphur dioxide

In 2010, no agglomeration showed exceeded levels of pollution in hourly or daily values for public health protection limit beyond what is allowed by Directive 360/2010 Coll. on air quality.

Nitrogen dioxide

In 2010, annual limit value was exceeded at the monitoring stations of Banská Bystrica-Štefánikovo nábrežie, and Bratislava-Trnavské mýto. The highest average annual concentration of 62.5 $\mu g.m^{-3}$ shown at the Banská Bystrica station significantly exceeded the limit value of 40 $\mu g.m^{-3}$ due to ongoing construction and terrain works on building a road bypass in Banská Bystrica. Exceeded limit value for the protection of human health for hourly concentrations was not detected by any monitoring station beyond what is allowed by Directive 360/210 Coll. on air quality.

PM_{10}

In 2010, daily limit value was exceeded at 21 stations. In the same year, Slovakia was exempted by the EC, pursuant to article 22 of Directive 2008/50/EC from applying daily limit values for PM_{10} defined in Annex XI. This exception can be practically applied for the zones of the Trenčín, Trnava, and Prešov regions on June 11, 2011. None of the 6 stations that exceeded the daily value at the mentioned stations showed exceeded daily values with added tolerance threshold. Assessment of

PM_{10} by the limit value increased with tolerance threshold ended at these stations on June 11, 2011. By then, Slovakia must comply with the limit value for pollution for the whole Slovak Republic. 4 AMS also showed the annual limit value exceeded at the same time.

$PM_{2.5}$

There is only the annual limit of 25 μg.m^{-3} set for the $PM_{2.5}$, which will become effective on January 1, 2015; however, this value is considered the target value designated in 2010 and should not be exceeded. In 2010, this value was exceeded at 4 stations.

Carbon monoxide

None of the monitoring stations showed exceeded limit values, and the air pollution figures for the previous time period of 2006-2010 remains below the lower assessment threshold.

Benzene

The highest value for benzene in 2010 was detected at 2.9 μg.m^{-3}, which is significantly lower than the limit value of 5 μg.m^{-3}.

Pb

None of the monitoring stations showed exceeded limit values. The sector of metallurgic industry shows the highest level of air pollution detected at the Krompachy-SNP station, however, all average annual concentrations are substantially smaller than the lower assessment threshold.

As, Ni, Cd

There was no occurrence of exceeded target values for any pollutant in 2010. Cd and Ni concentrations for the last 5 years remained below the lower assessment threshold.

BaP

Target value needed be reached by 31.12.2010 was exceeded at the monitoring stations of Bratislava-Trnavské mýto, Veľká Ida-Letná, Krompachy-SNP, and Prievidza-Malonecpalská.

♦ Regional air pollution and atmospheric precipitations

In 2010, Slovakia operated 4 stations for monitoring regional air pollution and chemical composition of precipitation water. All the stations are part of the EMEP network.

Sulphur dioxide, sulphates

In 2010 regional sulphur dioxide concentrations calculated per sulphur were 0.22 μg.m^{-3} at Chopok, and 0.72 μg.m^{-3} at Starina. Pursuant to Annex 13 to Regulation no. 360/2010 Coll., critical level for the protection of vegetation is 20 μg SO_2.m^{-3} for the calendar year and the winter season. This level was exceeded neither for the calendar year (Chopok 0.44 μg SO_2.m^{-3} and Starina 1.44 μg SO_2.m^{-3}) nor for the winter season (Chopok 0.6 μg SO_2.m^{-3} and Starina 2.0 μg SO_2.m^{-3}). Percentage share of sulphates on total particulate matter mass was 15.54% at Chopok and 16.2% at Starina. Sulphates to sulphur dioxide concentration ratios expressed in sulphur was 1.18 at Chopok and 1.16 at Starina.

Nitrogen oxides, nitrates

Concentration of nitrogen oxides at regional stations expressed in NO_2-N were in 2010 0.76 $\mu g.m^{-3}$ at Chopok and 1.13 $\mu g.m^{-3}$ at Starina. Pursuant to Annex 13 to Regulation no. 360/2010 Coll., critical level for the protection of vegetation is 30 μg $NO_X.m^{-3}$ for the calendar year. This level was not exceeded over the last calendar year (Chopok 2.51 μg $NO_X.m^{-3}$ and Starina 3.72 μg $NO_X.m^{-3}$). Atmospheric **nitrates** at Chopok and at Starina were mostly in the aerosol form. Gaseous nitrates in 2010 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 9.2% at Chopok and 8.8% at Starina. Ratio of total nitrates (HNO_3 + NO_3) to NO_X-NO_2, as expressed in nitrogen, was 0.14 at Chopok and 0.29 at Starina.

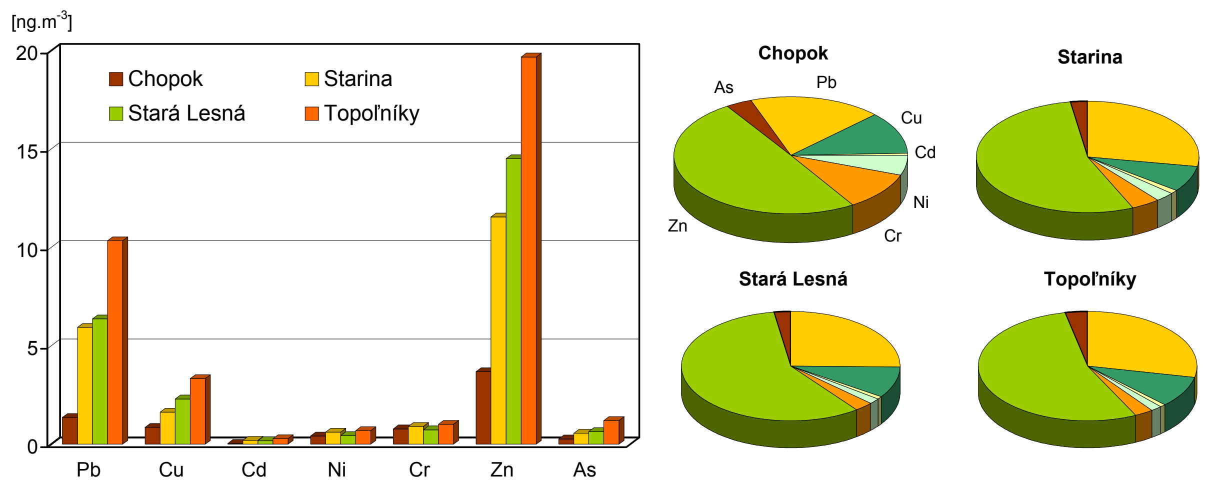
Ammonia, ammonium ions, and alkali metals

In compliance with the requirements of the EMEP monitoring strategy, measurements of ammonia, ammonium ions, and ions of sodium, potassium, calcium, and magnesium in the air at the station of Stará Lesná were initiated in May 2005. The measurements were completed in 2007. Measurements for these ions began at Starina in July 2007. For ammonia ions the annual concentration was 0.84 μg $N.m^{-3}$ and their percentage proportion in PM was 7.1%. For ammonia, the annual concentration is 0.27 μg $N.m^{-3}$ and the ratio of the ammonia ions and ammonium concentration expressed in nitrogen is 3.1.

Atmospheric aerosol, heavy metals

Percentage share of the sum of assessed heavy metals on air-borne dust at regional stations of Slovakia varies between 0.14 and 0.19%.

Heavy metals in the air and percentage share of heavy metals in 2010



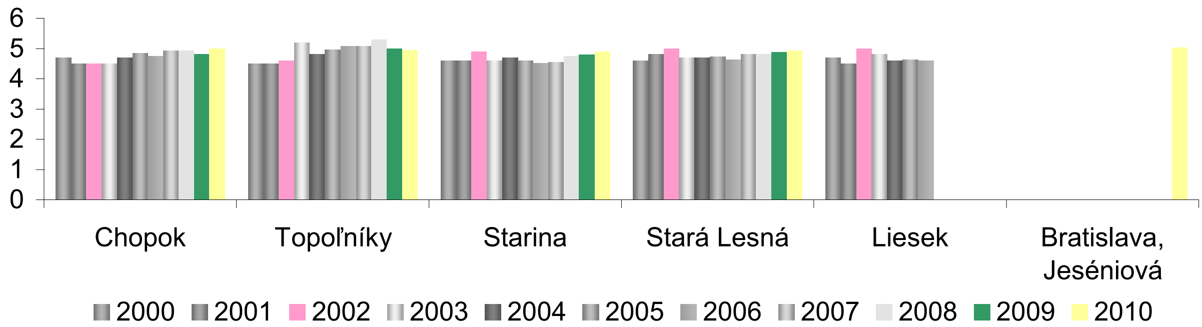
Source: SHMI

Atmospheric precipitations

Beside the 4 EMEP stations, the quality of rainfalls is also measured at the Bratislava-Jeséniova station, which serves only for the purposes of making comparisons with the regional stations.

In 2010, total atmopheric precipitations at regional stations were between 926.3 and 1 377.4 mm. Upper limit of the interval was occupied by the highest located station of Chopok, while the bottom limit was occupied by Topoľníky, with the lowest altitude. Acidity of atmospheric precipitations was dominant at Starina, copying the lower limit of the pH interval of 4.9-5.0. Time sequence and pH trend over a longer time period show a reduced acidity.

Trend of pH precipitation



Source: SHMI

Concentrations of dominant sulphates in precipitation water showed the interval of 0.39-0.45 mg.l^{-1}. Sulphates concentrations measured at two stations - Chopok and Starina, are the same for the annual average values; they have been slightly lower at Stará Lesná and little higher at Topoľníky. The overall reduction in sulphate concentrations over a long period corresponds to the reduction of SO_2 emissions since 1980.

Nitrates that show less influence on the acidity of precipitations than sulphates showed the concentration interval of 0.23-0.37 mg N.l^{-1}. Chopok and Stará Lesná represent the lower limit of the span, while Topoľníky forms the upper limit. Ammonium ions also belong to the major ions and their concentration span has been 0.28-0.44 mg.l^{-1}.

Annual averages of heavy metals in monthly precipitation - 2010

Station	Precip. mm	Pb µg/l	Cd µg/l	Ni µg/l	As µg/l	Zn µg/l	Cr µg/l	Cu µg/l
Chopok	1 145	1.86	0.07	0.33	0.19	23.71	0.16	0.94
Topoľníky	873	0.95	0.04	0.25	0.13	5.71	0.22	0.63
Starina	967	0.96	0.05	0.42	0.10	10.6	0.09	0.95
Stará Lesná	1 027	1.27	0.10	0.30	0.12	9.94	0.08	1.23
Bratislava, Jeséniova	1 071	1.66	0.07	0.46	0.18	17.24	0.18	2.10

Source: SHMI

Tropospheric ozone

Average annual concentrations of ground ozone in Slovakia in contaminated urban and industrial locations in 2010 were within the interval of 44-87 µg.m^{-3}. Greatest average annual ground ozone concentrations in 2010 were recorded at the Chopok station (87 µg.m^{-3}).

Target value for ground ozone concentration in terms of public health protection is set by the MoE SR Resolution No. 360/2010 Coll. on air quality at 120 μg.m^{-3} (max. daily 8-hour value). Alert threshold (240 μg.m^{-3}) for warning the public was exceeded in 2010 at the station in Bratislava-Jeséniova. Information threshold (180 μg.m^{-3}) for informing the public has been exceeded at two stations (Bratislava-Jeséniova, and Bratislava-Mamateyova).

Number of days with exceeded target value for protection of public health - 2008, 2009, 2010, average for 2008-2010

Station	2008	2009	2010	Averaged in 2008-2010
Bratislava, Jeséniova	32	24	24	29
Bratislava, Mamateyova	24	22	21	22
Košice, Ďumbierska	6	106	14	42
Banská Bystrica, Zelená	-	[b] 18	17	18
Jelšava, Jesenského	22	17	4	14
Kojšovská hoľa	39	71	[a] 55	55
Nitra, Janíkovce	-	[a] 85	[a] 16	50
Humenné, Nám. slobody	10	43	8	20
Stará Lesná, AÚ SAV, EMEP	32	15	15	21
Gánovce, Meteo. st.	14	5	7	9
Starina, Vodná nádrž, EMEP	5	22	2	10
Prievidza, Malonecpalská	13	19	9	14
Topoľníky, Aszód, EMEP	39	41	23	34
Chopok, EMEP	66	62	36	55
Žilina, Obežná	21	36	20	26

[a] 75-90 %, [b] 50-75 % of valid measurements Source: SHMI

Target value for the **AOT 40 vegetation protection exposition index** is 18 000 μg.m^{-3}.h (MoE SR Resolution No. 360/2010 Coll. on air quality). This value applies to the concentrations calculated as the average for the period of five years. Average values for the years 2006-2010 were exceeded at all reference urban and rural stations, with the exception of Banská Bystrica, Starina, and Prievidza.

Values for the AOT 40 for vegetation protection - the year 2008 and for the averaged period of 2006-2010

Station	Averaged in 2006-2010	2010
Bratislava, Jeséniova	22 499	21 253
Bratislava, Mamateyova	18 991	14 712
Košice, Ďumbierska	20 482	12 496
Banská Bystrica, Zelená	16 144*	15 110
Jelšava, Jesenského	18 081	8 542
Kojšovská hoľa	25 822	23 077
Nitra, Janíkovce	22 550*	12 991
Humenné, Nám. slobody	21 806	9 606
Stará Lesná, AÚ SAV, EMEP	18 007	12 894
Gánovce, Meteo. st.	18 185	12 786
Starina, Vodná nádrž, EMEP	12 823	5 107
Prievidza. Malonecpalská	14 734	11 874
Topoľníky, Aszód, EMEP	23 245	16 764
Chopok, EMEP	28 096	20 815
Žilina, Obežná	20 044	16 248

** the station did not measure data for enough years*

Source: SHMI

The reference AOT 40 value for the protection of forests for annual reporting to EC is 20 000 μg.m^{-3}.h, and is valid for urban, rural and rural reference stations. These stations show values that are exceeded every year, at some stations during the photochemical active years, the values are exceeded more than two times as much. In 2010, this value was not exceeded at 3 stations.

Ozone layer depletion

♦ International liabilities concerning ozone layer protection

Due to the urgency of this global problem, the international community adopted at its UN platform a number of steps to eliminate the ozone layer depletion. First international forum with the first-ever mentioning of the ozone layer took place in Vienna in 1985, with the **Vienna Convention on the Ozone Layer Protection** signed there. In 1987, this document was closely followed by adopting the first enforcing protocol to the **Montreal Protocol on Ozone-depleting Substances**. Since that year, signatories to the Montreal Protocol met five times (in London (1990), in Copenhagen (1992), in Vienna (1995), in Montreal (1997) and in Beijing (1999)), to limit or, if necessary, totally eliminate the production and consumption of substances that deplete the ozone layer.

Slovakia made effective the **Montreal Annex** to the Montreal Protocol on February 1, 2000. This document prohibits Slovakia to import and export all controlled substances, including methyl bromide, from and to non-signatory countries, as well as sets forth the obligation to introduce a licensing system for import and export of controlled substances. In 2002, Act 408/2000 Coll. was adopted, which amends Act 76/1998 Coll. on the Earth's ozone layer protection and on amendment to Act 455/1991 Coll. on small business (Small Business Act) as amended, which transposed the decisive majority of responsibilities stipulated under the European Parliament and Commission Directive 2 037/2000 EC and banned the production of brom-chloro-methane, creating conditions for ratification of the **Beijing Annex** of the Montreal Protocol. (for Slovakia effective as from August 20, 2002). Since January 1, 2010, a new Regulation (EC) No 1005/2009 of the European Parliament and of the Council on substances that deplete the ozone layer.

♦ Consumption of controlled substances

Sovakia does not produce any ozone-depleting substances. All such consumed substances come from the export. These imported substances are used mainly in cooling agents and detection gases, solvents, and cleaning chemicals.

Consumption of substances under control in SR (t)

Group of substances	1986/ 1989#	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
AI - freons	1 710.5	4.1	0.996	0.81	0.533	0.758	0.29	0.43	0.46	0.34	0.49
A II - halons	8.1	-	-	-	-	-	-	-	-	-	-
BI* - freons	0.1	-	-	-	-	-	-	-	-	-	-
B II* - CCl_4	91	0.03	0.01	0.009	0.047	0.258	0.045	0	0.016	0.099	0.119
BIII* - 1,1,1	200.1	-	-	-	-	-	-	-	-	-	-

trichloroethane											
C I*	49.7	66.8	71.5	52.91	38.64	48.76	43.94	41.32	34.35	31.12	0.578
C II - HBFC22B1	-	-	-	-	-	-	-	-	-	-	-
E - CH_3Br**	10.0	0.48	0.48	0.48	0.48	-	-	-	-	-	-
Total	2 019.5	71.4	72.986	54.21	39.7	49.78	44.28	41.75	34.83	31.56	1.187

Initial usage

Source: MoE SR

* Initial year 1989

** Initial year 1991

Note 1*: 0.48 tons of methyl bromide were imported in 2001-2004 for Slovakofarma as a raw material for the production of medications, which is not considered as consumption, according to the valid methodology.*

Note 2*: Consumption of C1 substances in 2010 represents the import of regenerated R22. As from January 1, 2010, Regulation no. 1005/2009/EC allows to introduce to the market and use only recycled or regenerated substances for the maintenance and service of mechanisms; import, introduction and use of pure C1 substances is prohibited.*

Usage of substances under control in 2010 (t)

Usage	**Group of substances**							
	AI	A II	BI	B II	BIII	C I	C II	E
Coolant						0.578		
Detection gases, diluents, detergents	0.49			0.119				

Source: MoE SR

♦ Total atmospheric ozone and ultraviolet radiation

The average annual value of total atmospheric ozone in 2010 was 346.3 Dobson units (D.U.), which is 2.4% above the long-term average from measurements in Hradec Králové in 1962-1990. Values from these measurements have been used also for our territory as the long-term normal value.

Average monthly devations within 2010

Month	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Year**
Average (DU)	365	377	394	396	360	344	335	310	315	307	306	349	**346.3**
Deviation (%)	7	2	3	3	-3	-4	-2	-4	4	7	6	13	**2.4**

Source: SHMI