MINISTRY OF THE ENVIRONMENT OF THE SLOVAK REPUBLIC

STATE OF THE ENVIRONMENT REPORT

SLOVAK REPUBLIC 2005

*The aim of the **air quality** care is to sustain the air quality in places, where it is adequate, and to improve the air quality in other cases.*

§ 5 par. 1 of Act No. 478/2002 Coll. on Air Production, amending Act No. 401/1998 Coll. on Air Pollution Surcharges as subsequently amended (Air Act)

MAJOR CUMMULATIVE ENVIRONMENTAL PRESSURES

• CLIMATE CHANGES

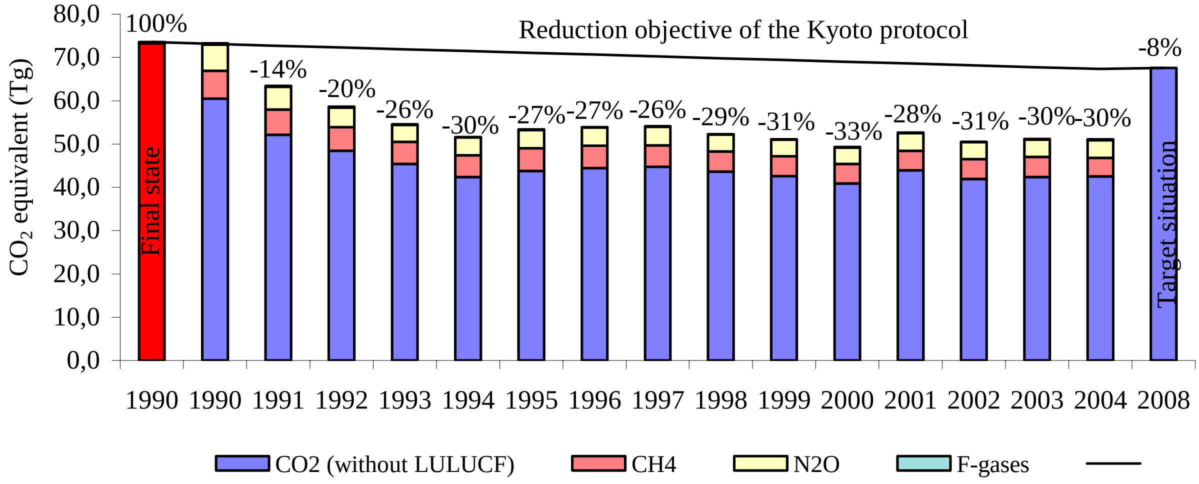
In Slovakia, over the last 100 years, there has been recorded an increasing **trend in the average annual air temperature** by 1.1 °C, and reduction in annual precipitation balance by 5.6 % (south of the SR showed a reduction by more than 10 %, while the north and some sporadic northeast locations showed an increase up to 3 % over the whole century). Significant reduction in **relative air humidity** (up to 5 %) and **reduction in snowcap** almost in the whole of Slovakia were recorded. Characteristics of the potential and actual evaporation, soil humidity, global radiation and radiation balance also prove that the south of Slovakia is gradually drying up (potential evapo-transpiration rises and soil humidity decreases); however, no substantial changes were detected in solar radiation characteristics (with the exception of temporary reduction in the years 1965-1985).

Special attention is given to characteristics of climate variability, especially **precipitation balances.** Over the last 7 years, there was a significant increase in the occurrence of extreme daily precipitation figures, which consequently produced a significant increase in local floods in various regions of Slovakia. On the other hand, mainly in the years 1989-2002, there was a more frequent occurrence of local or overall drought, which was caused mainly by long periods of relatively warm weather patterns. Especially harmful were droughts in the periods of 1990-1994, 2000, and 2002.

International obligations in the area of climate changes

At the UN Conference on Environment and Development (Rio de Janeiro, 1992) was adopted **framework Convention on Climate Change** – basic international legal instrument for protection of global climate. The convention became effective in the Slovak Republic on November 23, 1994. Slovakia accepted all obligations stemming from the Convention, including the obligation to decrease greenhouse gases emissions by the year 2000 to the level of 1990. Aggregated emissions of greenhouse gases in 2000 (48.625 Gg CO_2 equivalent) did not exceed the level of 1990 (72.107 Gg CO_2 equivalent). Next internal goal that Slovakia set to achieve was to reach the „Toronto Objective" i.e. 20 % reduction in emissions by 2005, compared to 1988. At the conference of signatories to the UN Framework Convention on Climate Change in Kyoto, Japan, in December 1997, Slovakia bound itself to reduce the production of greenhouse gases by 8 % by 2008, compared to 1990, and to continue keep the same level until 2012. The Protocol became effective after its ratification by the Russian Federation, on February 16, 2005, which is the 90th day after its signing by at least 55 countries, including the countries listed in Annex 1, that contribute by at least 55 % to total CO_2 emissions for the year 1990 as listed in Annex B accompanying the article 25 of the Kyoto Protocol.

Assessment of anthropogenic emission of greenhouse gases under compliance with the Kyoto protocols outcomes



Source: SHMI

Balance of greenhouse gases emissions

On the basis of **greenhouse gases emissions** assessed under the IPCC methodology (Intergovernmental Panel of Climate Change) in 2004, total anthropogenic CO_2 emissions, without deducting detections in the LULUCF sector (Land use, land use change and forestry), reached the value of 42.498 Gg. Sink of carbon dioxide in forest ecosystems in 2004 was 4 230.16 Gg (appr. 2 388.48 Gg in 1990). Total CH_4 emissions in 2004 reached the value of 203.9 Gg (306.9 Gg in 1990), while total NO_2 emissions in the same year reached 13.15 Gg (19.76 Gg in 1990). Anthropogenic emissions of greenhouse gases reached their highest level in the late 80-ties, while in 2004 their levels dropped by 30 %, compared to the reference year of 1990.

Aggregated greenhouse gases emissions constitute total emissions of greenhouse gases expressed as the CO_2 equivalent, calculated through the GWP 100 (Global warming potential). In 2004, CO_2

emissions represent more than 81 %, CH_4 emissions are on the level of 9 %, while N_2O emissions contribute by approximately 9 %, and the share of the F-gases (HFC, PFC, and SF_6) is less than 1 %.

Share of individual industries on the production of greenhouse gases remains very similar to the year 1990. The area of agriculture shows the most significant difference, with the reduction in emissions by 3.1 %, compared to 1990. This change was caused mainly by a reduced use of industrial fertilizers and reduced numbers of livestock.

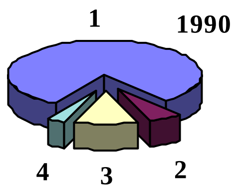
Aggregated emissions of greenhouse gases (Tg) in CO_2 equivalents

Tg (CO_2 equivalent)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Net CO_2	58.1	48.6	44.2	41.1	39.1	41.1	42.0	43.3	41.7	41.0	38.5	38.7	36.7	37.5	38.2
CO_2*	60.5	52.1	48.4	45.4	42.4	43.8	44.4	44.7	43.6	42.6	40.9	43.9	41.9	42.4	42.5
CH_4	6.4	5.9	5.5	5.1	5.0	5.2	5.2	5.0	4.7	4.6	4.5	4.5	4.6	4.6	4.3
N_2O	6.1	5.2	4.5	3.9	4.1	4.2	4.2	4.3	3.9	3.8	3.8	4.1	3.9	4.0	4.1
HFCs, PFCs, SF_6	0.27	0.27	0.25	0.16	0.14	0.15	0.08	0.11	0.08	0.09	0.10	0.11	0.13	0.17	0.19
Total (with CO_2)	71.0	60.0	54.5	50.3	48.4	50.7	51.5	52.6	50.5	49.5	47.0	47.3	45.3	46.3	46.8
Total*	**73.4**	**63.5**	**58.6**	**54.6**	**51.7**	**53.4**	**54.0**	**54.0**	**52.4**	**51.2**	**49.4**	**52.5**	**50.5**	**51.1**	**51.0**

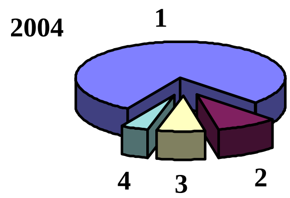
Source: SHMI

The table shows calculated years of 1990, 2000 – 2004 (the energy sector and LULUCF), 1991 – 1999 (LULUCF) and the use of solvents (1998-2004)
** Emissions without deducting the sinks in the sector of LULUCF (Land use-Land use change and forestry)*

Share of individual sources on greenhouse gases emissions



83.1 %	1. Power Industry	85.8 %
6.0 %	2. Industry Processes	10.3 %
11.3 %	3. Agriculture	8.2 %
2.9 %	4. Waste	4.4 %



Emission were assessed by 15.04.2006 Source: SHMI

Aggregated emissions of greenhouse gases (Tg) by sectors in CO_2 equivalents

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Power Industry*	59	51.2	47.4	44.5	41.5	42.8	43.4	43.6	41.9	40.8	39.4	42.3	40.2	40.8	40.2
Industry Processes**	4.26	3.37	3.35	3.04	3.36	3.56	3.59	3.74	4.36	4.47	3.91	4.11	4	3.99	4.85
Using solvents	NE	NE	NE	NE	NE	NE	NE	NE	0.01	0.01	0.01	0.03	0.06	0.06	0.08
Agriculture	8.06	6.89	5.87	5.13	4.94	5.1	4.89	4.76	4.33	4.1	4.14	4.22	4.14	4.02	3.86
LULUCF	-2.4	-3.5	-4.1	-4.3	-3.3	-2.7	-2.4	-1.4	-1.9	-1.6	-2.4	-5.2	-5.2	-4.8	-4.2
Waste	2.09	2.03	1.99	1.91	1.92	1.93	2.11	1.93	1.8	1.82	1.92	1.86	2.13	2.22	2.08

Source: SHMI

The table shows calculated years of 1990, 2000 – 2004 (the energy sector and LULUCF), 1991 – 1999 (LULUCF) and the use of solvents (1998-2004)
** Including the traffic*
*** Including the F-gases*

The most important greenhouse gas in the atmosphere is **water vapor** (H_2O) which contributes to total greenhouse effect by two thirds. CO_2 emissions are responsible for more than 30 % share on the greenhouse effect, CH_4, N_2O, and O_3 emissions make up approximately 3 %. The **HFC, PFC, and SF_6** groups of substances is not as important in terms of their total volumes, by which they contribute to greenhouse gases. It is more important in terms of their occurrence in the atmosphere, caused mainly by the human activity. The most important CO_2 emissions sources include incineration and transformation of fossil fuels, which represent more than 95 % of total anthropogenic emissions of CO_2 in Slovakia. Technological processes related to cement, lime, and magnesite production, as well as limestone use are the second most significant emission sources. The share of Slovakia on global anthropogenic emissions of greenhouse gases is approximately 0.2 %. Annual CO_2 emission corresponding to one inhabitant is currently around 7.7 tons/year per capita and places Slovakia among the leading European countries.

The limit value of air pollution is ***the level of air pollution*** *defined in order to avert, prevent or diminish harmful impact on human health, which should be reached in particular time, and from that time on it shall not be exceeded.*

§2 letter e/ of the Act No 478/2002 Coll. on Air Protection

• ACIDIFICATION

Air Acidification

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' s obligations in the area of acidification are met:

➢ ***Protocol on further reduction of sulfur 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 sulfur emissions

Year	1980 (initial year)	2000	2005	2010
SO_2 emission (thous. t)	843	337	295	240
SO_2 emission reduction (%)	100	60	65	72

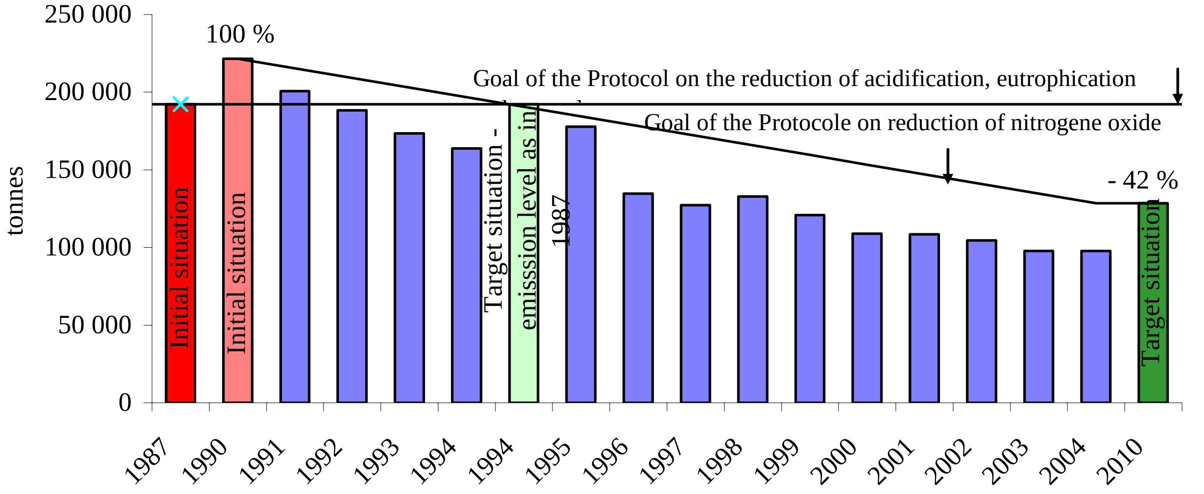
Slovakia met one of its Protocol objectives to reduce the SO_2 emissions in 2000 by 60 % compared to the reference year of 1980. In 2000 sulfur dioxide emissions reached the level of 123.880 thousand tons. which is 85 % less than in the years 1980.

➢ ***Protocol on the reduction of acidification eutrofication and ground ozone***

The protocol was signed in Göteborg in 1999. Slovakia signed the protocol in 1999. 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.

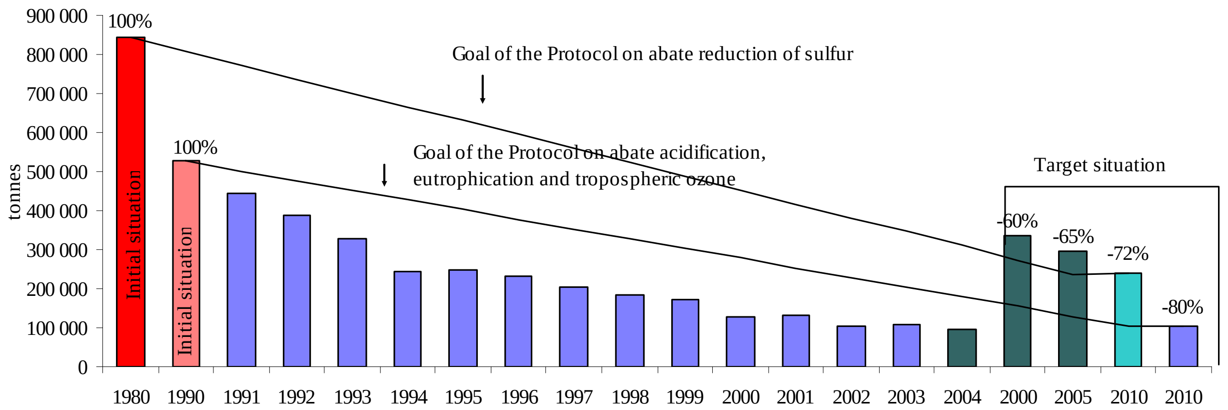
Slovakia has the potential to fulfill this obligation.

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



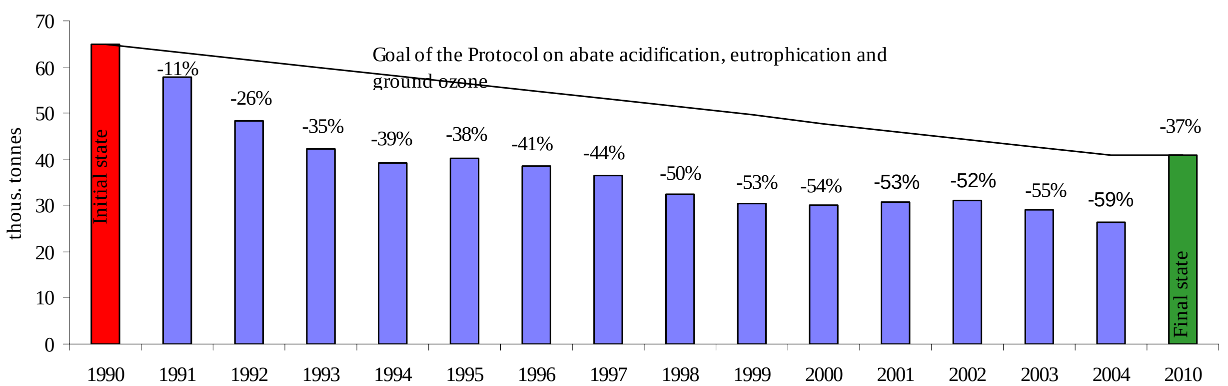
Source: SHMI

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



Source: SHMI

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



Source: SHMI

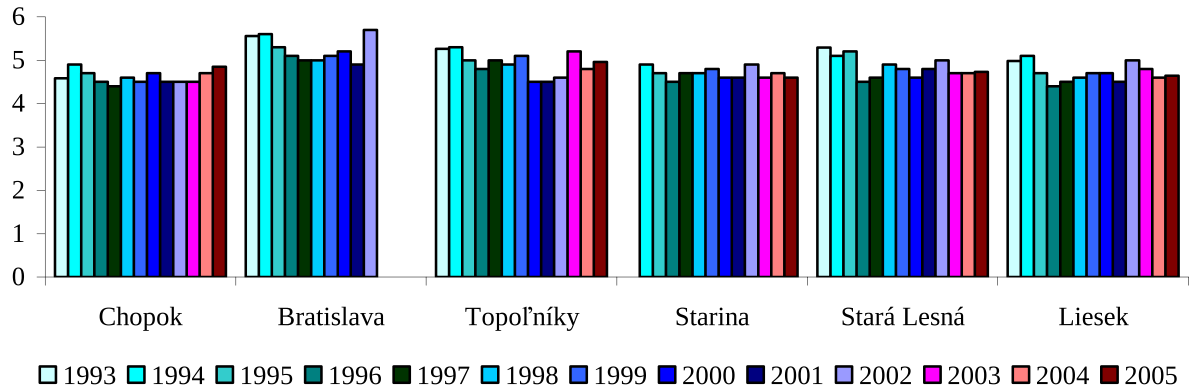
During the period of the years 1990 – 2004 in case of SO_2 and HN_3 the recorded reduction in emissions was obvious (with slight deviations in some years). Nitrogen oxides emissions showed a slight decrease only in 1995 and 1998 their increase was caused by increased natural gas consumption by retail consumers.

Acidity of atmospheric precipitations

Natural acidity of precipitation water in equilibrium with carbon dioxide has the pH of 5.65. Atmospheric precipitations are considered acidic if the bulk charge of the acidic anions is greater than the charge of cations and the pH value is below 5.65. Sulfates by approximately 60-70 % and nitrates by approximately 25-30 % contribute to the acidity of precipitation water.

Chemical analyses of atmospheric precipitation compared to the previous year document a slight reduction in the acidity at monitoring stations while at Starina there was a slight increase in acidity. Interval of the pH values in monthly precipitation figures varied at regional stations in the between 4.6 - 4.96. Time progression and the pH trend over a longer period of time suggest a reduction in acidity.

Trend of pH precipitation



Source: SHMI

Wet deposition of sulfates – year 2005

Station	Wet deposition of sulfates ($g.S.m^{-2}.y^{-1}$)
Chopok	0.47
Topoľníky	0.32
Starina	0.51
Stará Lesná	0.41
Liesek	0.50

Source: SHMI

Concentrations of dominant sulfates in precipitation water showed the interval of 0.41 - 0.62 mg $S.l^{-1}$ while values at all stations were lower than in the previous year. Greatest reduction was recorded at Chopok. The overall reduction in sulfate concentrations over a long period corresponds to the reduction of SO_2 emissions since 1980. Values of wet deposition of sulfur varied between 0.32 to 0.51 g $S.m^{-2}.r^{-1}$.

Critical load values for wet deposition are not yet specified. In USA and Canada wet deposition value of 0.7 g $S.m^{-2}$ per year for sulfates is considered the critical load for forests.

Nitrates that show less influence on the acidity of precipitations than sulfates showed the concentration interval of 0.25 - 0.40 mg $N.l^{-1}$. Nitrate concentrations at all the regional monitoring stations were lower than in 2004 with the exception of the Starina monitoring station.

Concentrations of ammonia ions in 2005 were lower at all regional stations in Slovakia compared to the previous year. The values remained the same at the station of Liesek. When compared to the previous year chlorides at most stations showed lower values with the exception of the Topoľníky and Liesek stations. Greatest reduction in chlorides was recorded at the Chopok station and the annual concentration level reached only two thirds of the value recorded in 2004. In 2005 the alkaline metals of sodium and potassium showed lower concentrations at most stations compared to 2004. Potassium showed a more significant reduction with the maximum value recorded at Chopok (50 %). Alkaline metals of calcium and magnesium were significantly lower than in the previous year. Topoľníky station was the only exception with both elements showing increased values while the Stará Lesná station showed also an increased level of calcium. Values at all stations were lower than in the previous year due to a significantly lower ionization in atmospheric precipitations in 2005.

Acidification of surface water

In general considering the diversity of the rock aquifer soil types hydrological and climate conditions general assessment of acidification renders itself difficult. In total we can say that the trend in the pH values sulfate concentrations and alkalinity of surface water show variable and fluctuating characteristics. Currently thanks to valid legal standards for releasing acidification mixtures the content of atmospheric and precipitation sulfates and nitrates dropped, meanwhile reducing the risk of acidification of surface and groundwater.

Acidification of soils

Acidification as a process of raising the soil's acidity represents one of the important processes of chemical degradation. Ability of the agro-ecosystem to cope with natural and anthropogenic acidification is defined by the capacity and potential of the buffering function of the soil. This reflects a degree of soil resistance to acidification. Since the major part of the agricultural land in Slovakia used to be acidic forestland humans are forced to introduce permanent measures to retain favorable degree of soil fertility and optimal soil reaction.

Partial Monitoring System – Soil provides information on the state and development of acidification of agricultural land. First cycle took place in the years 1992 - 1996 with the extraction of soil samples in the year 1993 out of 312 monitoring sites. Second cycle took place in 1997 - 2001 with the extraction year of 1997 from 318 monitoring sites. Third cycle took place in 2002 - 2006 with the extraction year of 2002 from 318 monitoring sites.

The three monitoring cycles offer a possibility to assess not only the state but also the trend in acidification of agricultural land in Slovakia pH value of soil as well as the state of active aluminium are monitored within the Slovak soil monitoring process.

Outcomes from the Partial Monitoring System – Soil (PMS-S) showed that during 1993 through 1997 there were statistically negligible changes and stabilization in the soil‘s acidity. On the contrary outcomes from the third monitoring cycle with the extraction year of 2002 showed significantly greater acidification tendencies especially in case of mollic fluvisoils, cambisoils, rendzins, podsoils, rankers and lithomorphic soils.

Dependence of the active aluminium content on pH in selected Slovak soils in the A horizon within the basic PMS-S III. monitoring cycle

Major soil unit	**pH/$CaCl_2$**	**Al ($mg.kg^{-1}$)**
Cambisols and planosols – TTP	**4.39**	86.36
Cambisols and planosols – OP	**5.93**	16.32
Cambisols on acidic substrates - PG	**4.76**	55.85
Cambisols on acidic substrates - AL	**5.49**	4.380

AL - Arable Land
PG – Permanent Grassland

Source: SSCRI

The mass media regularly and free of charge inform the public about the ***situation of the ozone layer of the Earth*** *and about the values of the ultra-violet radiation falling on the area of Slovak Republic.*

§ 13 par.1 of the Act No. 76/1998 Coll. on Protection of the Ozone Layer of the Earth ... as amended by the Act No. 408/2000 Coll. and the Act No. 553/2001 Coll.

• 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), and in Montreal (1997)), to limit or, if necessary, totally eliminate the production and consumption of substances that deplete the ozone layer.

Based on the Montreal Protocol's amendments and changes introduced by the **London and Copenhagen annexes**, consumption of the following controlled substance groups in the Slovak Republic should be zero, beginning by January 1, 1996: group I of Annex A of the Protocol (chlor-fluorinated fully-halogenated hydrocarbons), group II of Annex A of the Protocol (halones), group I of Annex B of the Protocol (other chlor-flourinated fully-halogenated hydrocarbons), group II of Annex B of the Protocol (other fully-chlor-fluorinated hydrocarbons), group II of Annex B of the Protocol (tetrachloromethane), and group III of Annex B of the Protocol (1,1,1-trichloroethane). Only substances from stores that are recycled and regenerated may be used. Exception is possible for these substances only for laboratory and analytical purposes. In accordance with the Annex to the Montreal Protocol signed in 1992 in Copenhagen and subsequently amended in Vienna in 1995, since 1996 the production and consumption of substances under group I, Annex C of the Protocol (non-fully-halogenated chlor-fluorinated hydrocarbons) is regulated with the obligation for their total elimination by 2020, and in the following 10 years these substances may be produced and used only for maintenance purposes at 0.5 %

of the reference year‘s 1989 calculated levels. Consumption of methyl bromide from the E I group, and pursuant to amendments approved in Montreal in 1997, should decrease by 25 % by 1999, by 50 % by 2001, by 70 % by 2003, and be totally eliminated by 2005. The year 1991 is the reference year. From January 1, 1996, production and consumption of substances under group II of Annex C of the Protocol (non-fully-halogenated bromine-fluorinated hydrocarbons) is forbidden.

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. By adopting a new legislation, production and consumption of bromine-chloromethane was prohibited. This created conditions for ratification of the **Beijing Annex** to Montreal Protocol.

Consumption of controlled substances

Slovakia 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 during 1992-2005 (tons)

Group of substances	1986/8[#]	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
AI - freons	1 710.5	609.6	986.9	229.4	379.2	1.21[1)]	2.05[1)]	1.71[1]	1.69[1)]	2.07	4.1	0.996	0.81	0.533	0.758
A II - halons	8.1	2.5	2.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0	-	-	-	-
BI* - freons	0.1	0.0	0.1	0.0	0.0	0.00	0.00	0.00	0.00	0.00	0	-	-	-	-
B II* - CCl4	91.0	251.8	250.0	315.4	0.6	0.00	0.16[1)]	0.07	0.08	0.022	0.03	0.01	0.009	0.047	0.258
BIII* - 1,1,1 trichloroethane	200.1	107.3	180.0	136.7	69.4	0.00	0.11[1)]	0.00	0.00	0.00	0	-	-	-	-
C I*	49.7				37.2	61.00	59.90	90.48	44.92	64.73	66.8	71.5	52.91	38.64	48.76
C II - HBFC22B1						14.30	0.00	0.00	0.00	0.00	0	-	-	-	-
E - CH_3Br**	10.0					9.60	5.60	10.20	0.00	0.00	0.48	0.48	0.48	0.48	0.0
Total	2 019.5	971.2	1419.0	717.5	449.2	86.10	61.81	102.50	46.69	66.82	71.4	72.986	54.21	39.7	49.78

Source: MoE SR

[#] Initial usage

∗ Initial year 1989

∗∗ Initial year 1991

[1)] Usage of substances in groups A I, B II a B III between 1996-2001 represents import of these substances for their analytical and laboratory use in accordance with the general exception from the Montreal Protocol

***Note 1: Besides the indicated substances, another 250 tons of recycled tetrachloromethane and 20 tons of regenerated freon CFC 12** were imported in 1996, which (with reference to applicable methodology) are not counted in the consumption figures. The data from previous years on usage of substances in groups C I, C II and E are not available.*

***Note 2:** Besides the indicated substances, another 40 tons of used Freon CFC 12 were imported in 1997, which (with reference to applicable methodology) are not counted in the consumption figures, and 2.16 tons of methyl bromide for Slovakofarma, which was used as base material for pharmaceutical production and with reference to applicable methodology also are not counted in the consumption figures.*

***Note 3:** Besides the indicated substances, 8.975 tons of used coolant R 12 were imported in 1998, which belongs to group A1. With reference to applicable methodology of the Montreal Protocol it is not are not counted in the consumption figures.*

***Note 4:** Besides the indicated substances, another 1.8 tons of used Freon CFC 12 were imported in 1999, which (with reference to applicable methodology) are not counted in the consumption figures, and 1.04 tons of methyl bromide for*

Slovakofarma, which were used as base material for pharmaceutical production and with reference to applicable methodology also are not counted in the consumption figures.
***Note 5**: In 2001, 0.48 tons of methyl bromide were imported for Slovakofarma, which were used as base material for pharmaceutical production and with reference to applicable methodology are not counted in the consumption figures.*
***Note 6**: In 2002, 0.48 tonnes CH_3Br were imported for Slovakofarma, which were used as base material for pharmaceutical product (Septonex) and with reference to applicable methodology are not counted in the consumption figures.*

Usage of substances under control in 2005 (tons)

Usage	Group of substances							
	AI	A II	BI	B II	BIII	C I	C II	E*
Coolant	-	-	-	-	-	48.76	-	-
Fire extinguishers	-	-	-	-	-	-	-	-
Isolating gases	-	-	-	-	-	-	-	-
Detection gases, diluents, detergents	0.758	-	-	0.258	-	-	-	-
Aerosols	-	-	-	-	-	-	-	-
Swelling agents	-	-	-	-	-	-	-	-
Sterilizers, sterile mixtures	-	-	-	-	-	-	-	-

Source: MoE SR

E- CH_3Br was used by production of a pharmaceutical product (Septonex), where it is used completely*

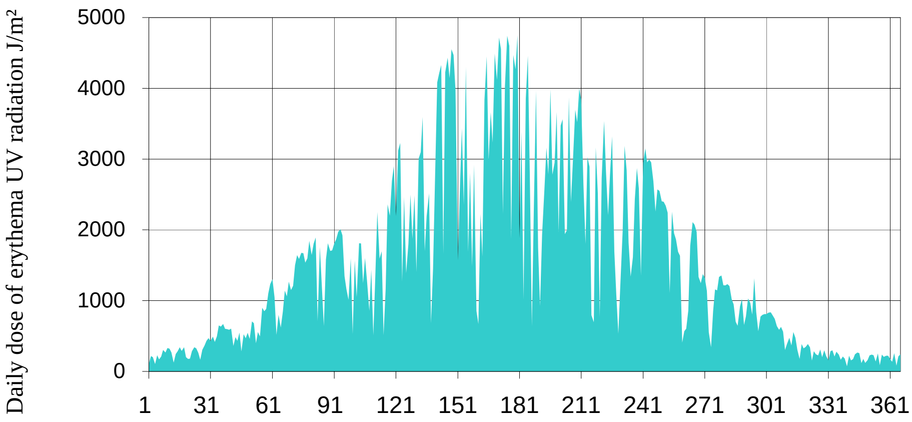
Situation of the ozone layer above the territory of SR

Due to ozone's depletion, its state in the atmosphere is monitored. In 2005, the **average annual value of total atmospheric ozone was 324.2 Dobson units**, which is 2.3 % below 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.

Situation was better, compared to 2004 when 4.1 % of total atmospheric ozone was missing on average. This was the fourth highest annual average since 1994. Average monthly deviations showed positive values only for February, November, and December. In other months, there was 1-7 % of total atmospheric ozone missing on average. In 2005, May was the month with the weakest ozone layer above our territory.

Total sum of daily doses of the erythematous ultraviolet radiation for the period of April-September was 440 144 J/m^2. This value is lower by 0.2 % than in 2004.

The annual course of the midday values of erythema (CIE) radiation – Gánovce 2005



Source: SHMI

With respect to the recent scientific knowledge, the long-range goal concerning the ozone is to achieve ***the level of ozone concentration in air,*** *at which the direct harmful effects on human health or on the environment will be unlikely; this goal should be achieved, if possible, with the long range prospective, so that effective protection of human health and environment is provided for.*

§ 5 par.4 of the Act No. 478/2002 Coll. on Air Protection

• TROPOSPHERIC OZONE

Average concentrations of tropospheric ozone in the Slovak territory were growing during the years 1973 – 1990 by app. 1 µg.m^{-3} per year. After 1990, in line with all Central European monitoring outcomes, no significant trend in average concentrations was recorded. Maximal concentrations were decreasing over the last decade. However, ground ozone values are more than two-times higher than they were in the beginning of this century. The exceptional year of 2003 showed extraordinary hot patterns with increased concentrations recorded at all stations.

Ground ozone concentrations in the Slovak territory in 2005 were only slightly below the figures of the record-breaking year of 2003. The highest average concentration was recorded at the mountain station of Chopok (96 µg.m^{-3}).

Target value of ground ozone concentration in terms of public health protection is set by the MoE SR Resolution No. 705/2002 Coll. on air quality at 120 µg.m^{-3} (max. daily 8-hour average). This value must not be exceeded on more than 25 days in of the year, for three consecutive years. For the period of 2002 - 2005, this target value has been exceeded at all stations, with the exception of Ružomberok, Prievidza, and Veľká Ida. Concentrations exceeding the public alarm threshold value (240 µg.m^{-3}) were no recorded in 2005. Four stations recorded figures that exceeded the information threshold (180 µg.m^{-3}), mostly in Bratislava (8 times at Mamateyova).

Number of days with exceeded target value for the 8-hour concentration (120 µg.m^{-3}) in 2003 - 2005

Station	Averaged in 2003 - 2005
Banská Bystrica, Nám. slobody	29
Bratislava – Jeséniova	53
Bratislava - Mamteyova	36
Chopok, EMEP	78
Gánovce, Meteo. st.	30
Hnúšťa, Hlavná	34
Humenné, Nám. slobody	40
Jelšava, Jesenského	30
Kojšovská hoľa	66

Košice, Ďumbierska	34
Liesek, Meteo. st., EMEP	-
Martin, Jesenského	-
Prešov, Solivarská	26
Prievidza, J. Hollého	17
Ružomberok, Riadok	11
Stará Lesná, AÚ SAV, EMEP	27
Starina, Vodná nádrž, EMEP	40
Štrbské Pleso, Helios	33
Topoľníky, Aszód, EMEP	59
Trenčín, Janka Kráľa	-
Veľká Ida, Letná	0
Žiar nad Hronom, Dukel. hrdinov	43
Žilina	28

Source: SHMI

Target value for the **AOT40 vegetation protection exposition index** is 18 000 µg.m^{-3}.h (MoE SR Resolution No. 705/2002 Coll. on air quality). The average value for the years 2001-2005 was exceeded at all urban background and rural background stations.

Index of AOT40 exposition for protection of vegetation during 2001-2005 (µg.m^{-3}.h)

Station	**Averaged in 2001 - 2005**
Banská Bystrica, Nám. slobody	19 512
Bratislava - Jeséniova	22 158
Bratislava - Mamteyova	16 975
Chopok, EMEP	31 739
Gánovce, Meteo. st.	19 283
Hnúšťa, Hlavná	19 437
Humenné, Nám. slobody	17 061
Jelšava, Jesenského	19 758
Kojšovská hoľa	25 157
Košice, Ďumbierska	19 770
Liesek, Meteo. st., EMEP	-
Martin, Jesenského	-
Prešov, Solivarská	16 092
Prievidza, J. Hollého	13 039
Ružomberok, Riadok	11 348
Stará Lesná, AÚ SAV, EMEP	16 586
Starina, Vodná nádrž, EMEP	17 180
Štrbské Pleso, Helios	25 974
Topoľníky, Aszód, EMEP	19 748
Trenčín, Janka Kráľa	-
Veľká Ida, Letná	8 165
Žiar nad Hronom, Dukel. hrdinov	20 160
Žilina	15 804

Source: SHMI

1 Arranged in compliance with the EU requirements for the missing values according to relationship
AOT40 (arranged) = AOT40 (measured) x number of available values/number of valid measured values

* According to Regulation of the MoE SR 705/2002 Coll. Of Laws on Air Quality (in line with the EU Directive 2002/3/EC dated 12.2.2002 on ozone in the Ambient Air) the exposition index AOT40, expressed in µg.m^{-3}.h, means the sum of all differences between hourly concentrations bigger than 80 µg.m^{-3} (40 ppb) and 80 µg.m^{-3} between 8.00 and 20.00 Central European time from 1May until 31 August, averaged in 5-year time. The AOT40 values in the table were corrected upon the requirements of the EU to the absent measurements, according to relationship: *AOT40 (corrected) = AOT40 (measured) x number of available values/number of valid measured values.*

***Eutrophication** is enrichment of water by nutrients, especially compounds of nitrogen and phosphorus, causing an increase in growing cyanobacteria, algae and higher herbal species, which can result in undesirable deterioration of ecological stability and quality of this water.*

§ 2 letters ac/ of the Act on Water No. 364/2004 Coll., amending the Act No. 372/1990 Coll. on Offences as subsequently amended (Water Act)

• EUTROPHICATION

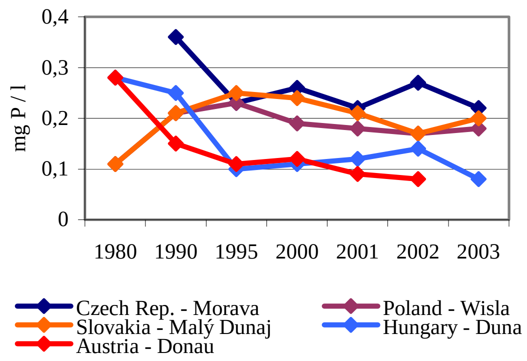
Eutrophication means enriching the water with nutrients, mainly nitrogen and phosphorus compounds, which causes an increased growth of algae and higher plant forms. This may bring about an undesirable deterioration in the biological equilibrium and quality of such water. Indicators for the surface water eutrophication include $N\text{-}NH_4$, $N\text{-}NO_3$, $N\text{-}NO_2$, $N_{org.}$, $N_{tot.}$, $P_{tot.}$, with phosphorus as the limiting element being most critical.

General requirements for the surface water quality are set forth in the Government Ordinance SR No. 296/2005 Coll. which introduces requirements on the quality and qualitative goals of surface water, as well as the limit indicator values for wastewater and special water contamination. Annex 1 of this Ordinance defines the recommended values for total nitrogen (9.0 $mg.l^{-1}$), total phosphorus (0.4 $mg.l^{-1}$), and chlorophyl „a“ (50.0 $\mu g.l^{-1}$). In this sense, the most problematic watercourses include Morava, Nitra, and Ipel. Nutrient concentrations are generally higher toward the mouth of the river. Acceptable surface water quality that meets class II. and III. criteria for the period 2004-2005 was around 64 %. Assessing the whole **C - nutrients** group and comparing it with previous time period, there have not been major changes.

Effect on nutrients concentrations in the EU countries may be seen in agriculture and other industries that produce nitrates, as well as in hydrological conditions of individual countries. Concentration of total phosphorus in the EU watercourses is relatively stable and shows a decreasing trend. Nitrates concentrations in watercourses remained relatively stable and are higher in those west-European countries (e.g. Denmark) with most intensive agriculture activities. New member states show a falling tendency in nitrates, which may be caused by a gradual decrease in agricultural production and more orientation on the market economy.

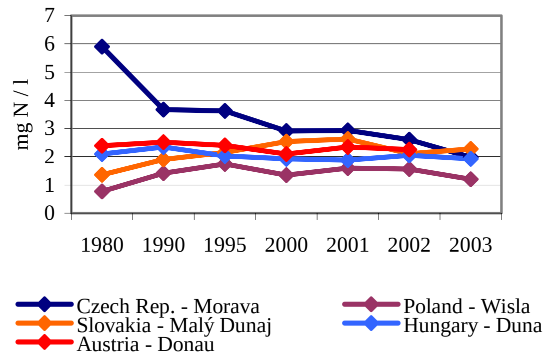
Development in nutrients' concentration in selected countries

Total Phosphorus (mg P. l^{-1})



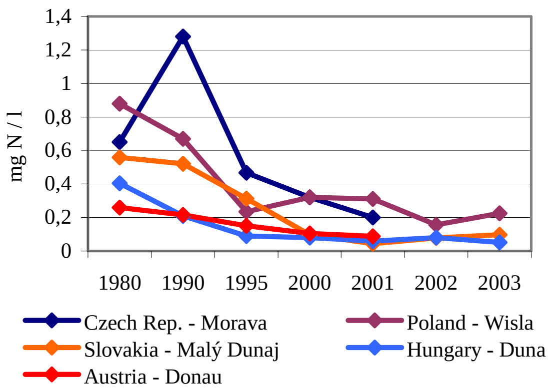
Source: OECD

Nitrates (mg N. l^{-1})



Source: OECD

Ammonium (mg N.l^{-1})



Source: OECD

Quality of recreational water in 2005

The summer tourist season in 2005 was significantly influenced by adverse weather patterns. This resulted in low tourist figures at recreational water resorts, low number of extracted samples, and in shorter length of the swimming season. Natural pools and non-thermal artificial pools showed the highest degree of weather impact. Operators in the northern districts evaluate the full operation during at a typical summer weather to last the maximum of 13 days.

Demands for recreational water quality are set forth by the Act No. 272/1994 Coll. on public health protection as amended, and the Regulation of the MoH SR No. 30/2002 Coll. on recreational water demands, recreational water and pools quality control as amended, which is in accordance with the Board Resolution 76/160/EEC from December 8, 1975 on recreational water quality.

Over the season, 315 water samples were extracted and 4 060 tests were done on chemical, physical, microbiological, and biological water quality indicators. Limit value of detected indicators was exceeded in 141 samples and for 218 indicators. Causes for unacceptable water quality included increased values in **chemical indicators**: color, transparency, pH, and **in microbiological indicators**: enterococci, coliform bacteria, thermo-tolerant coliform bacteria, Escherichia coli, molds, and in **biological indicators**: chlorophyl "a“, numbers of blue-green algae, saprobic index, algae.

Selected indicators of water quality in lakes and ponds in the SR, assessed as natural swimming resorts in 2005

Name of location in the cadastral area (district)	Area (km^2)	Min. Transparency (m)	N anorg. ($N\text{-}NO_3+N\text{-}NO_2+N\text{-}NH_4$) - ($mg.l^{-1}$)	$P\text{-}PO_4$ ($\mu g.1^{-1}$)	Chlorophyll "a" max. value ($mg.m^{-3}$)	Saprobity Index
Veľký Draždiak	0.13	1.0	0.6825	-	2.4	1.81
Zlaté Piesky	0.56	0.8	0.72	-	9.2	1.85
Vajnorské jazerá	0.14	1.0	1.83	-	2.75	1.84
Slnečné jazerá Senec	1.16	0.65	-	-	6.62	1.77
VN Ružiná – pri obci Divín	1.7	0.80	1.24	-	16.95	1.4
Zelená voda - Kurinec	0.25	0.20	1.07	-	21.53	1.945
Teplý Vrch - Drieňok	1.2	1.7	1.165	-	7.66	1.835
Dolnohodrušské jazero	0.049	1.1	0.91	-	4.82	1.69
Veľké Richňavské jazero	0.076	1.6	0.76	-	4.17	1.726
Počúvadelské jazero	0.117	1.7	1.04	-	2.73	1.69
Veľké Kolpašské jazero	0.191	1.1	0.92	-	3.83	1.83
Bukovec – rekreačná nádrž	0.297	1.5	1.25 ($N_{tot.}$)	-	7.70	1.47
Ružín – Košice a okolie	0.46	1.8	1.408 ($N_{tot.}$)	-	17.93	1.59
Vinianske jazero - Vinné	0.08	0.4	0.51 ($N_{tot.}$)	-	23.798	1.91
Zemplínska Šírava – Biela Hora	34	1.0	1.15 ($N_{tot.}$)	-	14.91	1.76
Veľká Domaša - Tíšava	0.005	1.1	1.2	-	5.4	1.72
Veľká Domaša - Valkov	0.01	1.2	1.4	-	4.4	1.71
Veľká Domaša – Dobrá pláž	15.1	1.9	0.94	-	-	1.7
Nové Mesto nad Váhom - Zelená voda	0.18	1.2	2.92 ($N_{tot.}$)	-	4.98	1.73
Kunovská priehrada	0.633	0.95	-	-	14.4	1.8
Gazarka – Šaštín Stráže	0.12	0.2	-	-	62.4	1.85
Šulianske jazero	0.742	1.5	-	-	4.1	1.85
Vojkanské jazero	0.814	1.7	-	-	<4.0	1.76
Liptovská Mara	0.8	1.5	1.61 (N_{tot})	-	18.51	1.702

Legend: ND – non detected, ŠJ – gravel deposit of lake, VN – water reservoir Source: MoH SR

Report on recreational water quality was also submitted for the year 2005, in compliance with the Bathing Water Directive No. 76/160/EEC for the 2005 swimming season. The Report included only 39 monitored aquatic areas, which meant a reduction by 41.8 %, compared to 2004. Of all 39 water areas, less than 35.9 % met the recommended standards, while 46.3 % met at least the minimum standards. Almost 35.9 % of water areas were not sufficiently monitored and swimming was prohibited in less than 7.7 %. The overall European Commission Report suggested that more than 10.3 % of water tanks and lakes in Slovakia do not meet the minimum EU standards.