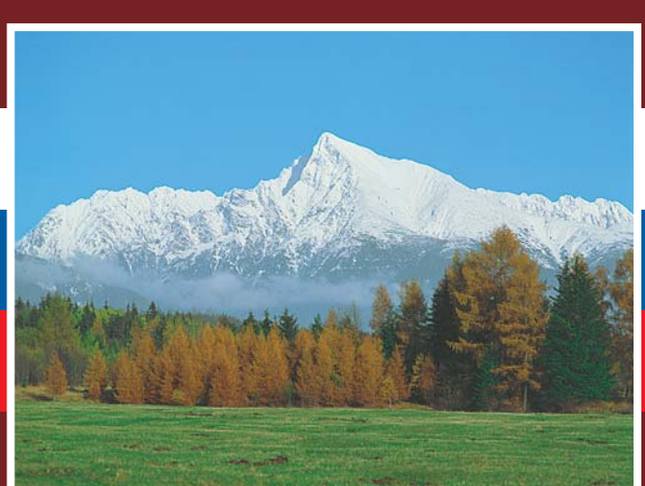
Ministry of the Environment
of the Slovak Republic

STATE OF THE ENVIRONMENT REPORT SLOVAK REPUBLIC 2007



Slovak Environmental Agency

j. Klinda

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

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

COMPONENTS OF THE ENVIRONMENT AND THEIR PROTECTION

• AIR

Emission situation

♦ **Balance of particulate matter emissions**

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

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

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

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

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

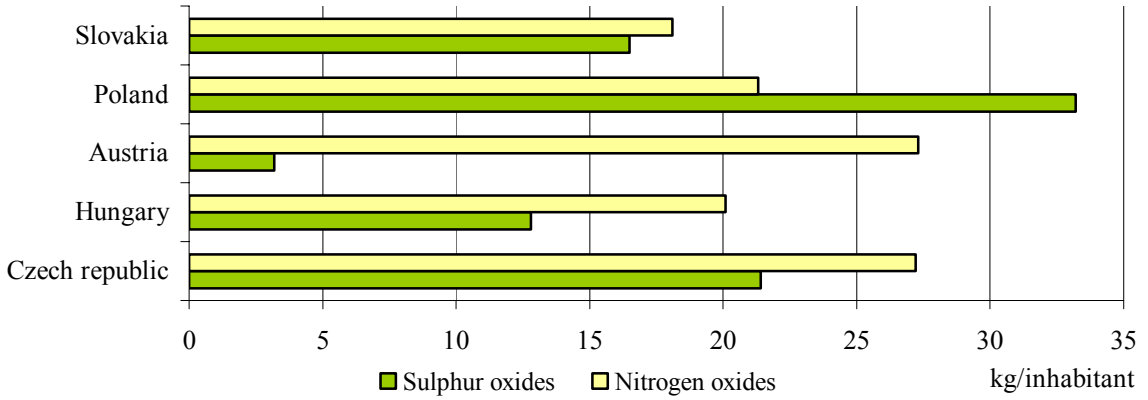
- **Trend in emissions of nitrogen oxides**

Nitrogen emissions (NO_X) have shown a slight reduction since 1990. Slight increase in emissions in 1995 was related to an increased consumption of natural gas. Decrease in nitrogen oxides in 1996 was caused by a change to the emission factor that took into consideration the level of equipment and technology of incineration processes. Reduction in solid fuel consumption since 1997 has led to a further decrease in NO_X emissions. In the years 2002 and 2003, de-nitrification played a significant role in emission reduction (electric power plant Vojany). In 2006, there was a significant reduction in the NO_X emissions, especially in case of large and medium stationary sources. This reduction relates to reduced production (Zemianske Kostoľany and Vojany electrical power plants) and consumption of solid fuels and natural gas (Zemianske Kostoľany and Vojany electrical power plants and the Slovak gas industry company – transit, Inc. Nitra - /SPP/). Mobile sources also, mainly road transportation, have shown significant NO_X emissions. This reduction relates to reduced consumption of liquid carbohydrate fuels, compared to 2005, as well as to renovated fleet of personal and cargo vehicles.

- **Trend in carbon monoxide emissions**

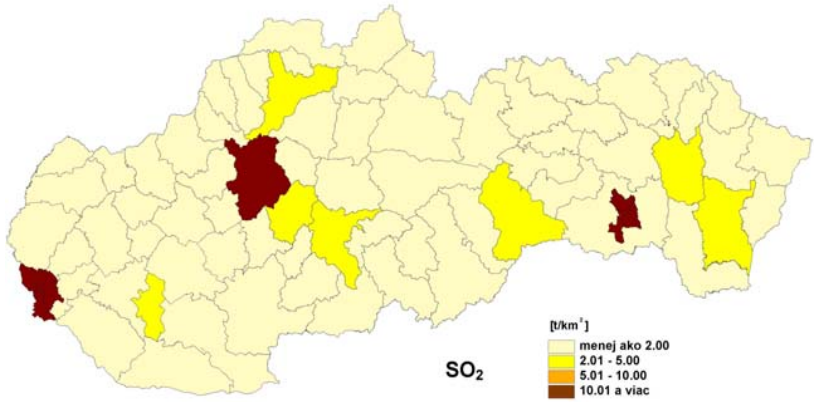
Carbon monoxide emissions (CO) since 1990 have shown a falling tendency, which was caused mainly by reduced consumption and change in fuel composition in the sphere of retail consumers. CO emissions from large sources were decreasing only slightly. The most significant share on CO emissions from large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

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



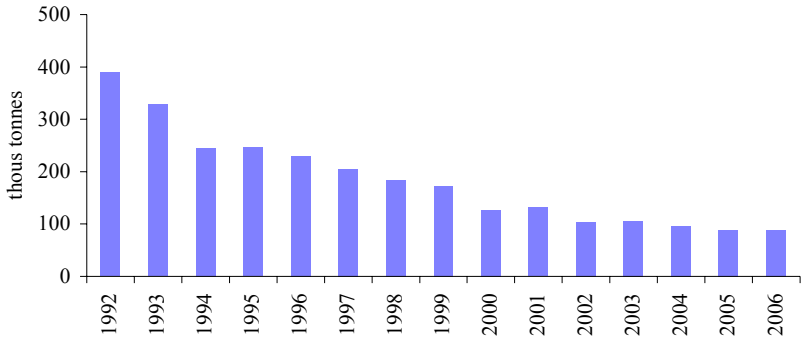
Source: OECD

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



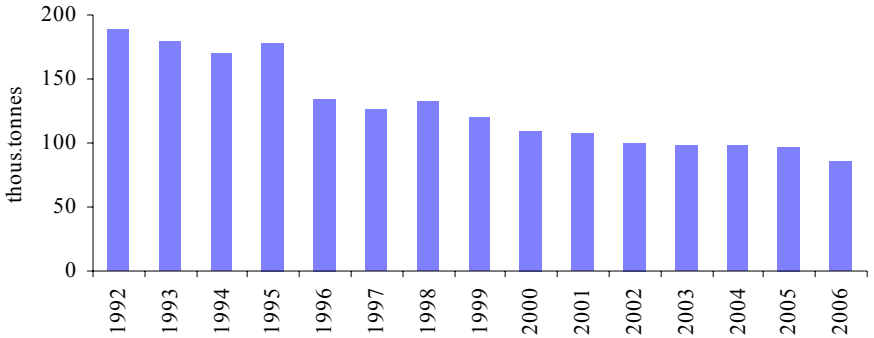
Source: SHMI

Trend in emission of SO_2



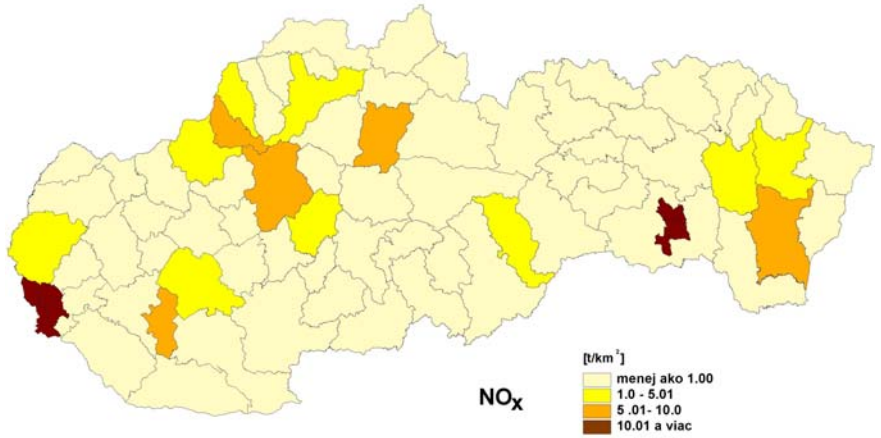
Source: SHMI

Trend in emission of NO_x



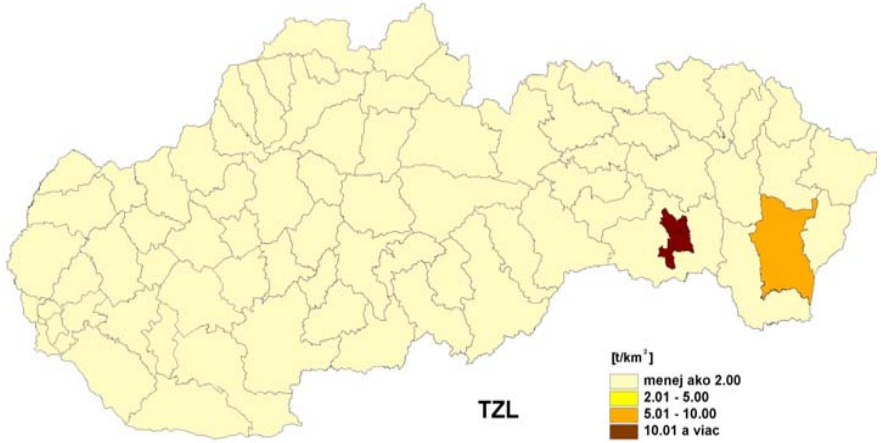
Source: SHMI

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



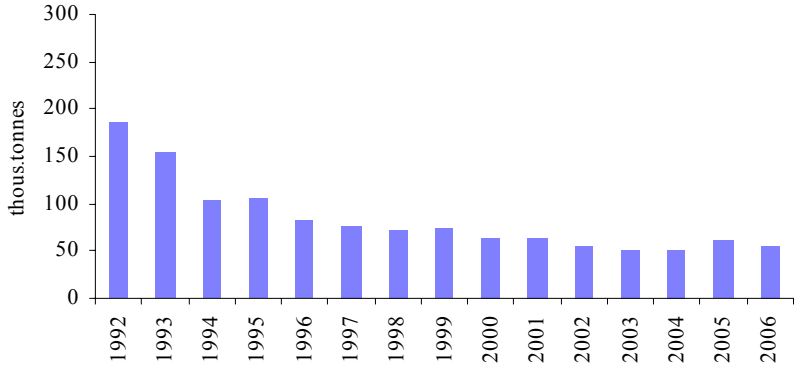
Source: SHMI

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



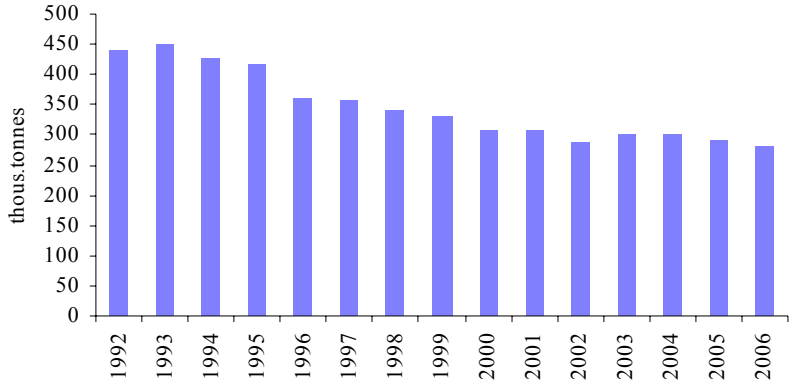
Source: SHMI

Trend in emission of PM



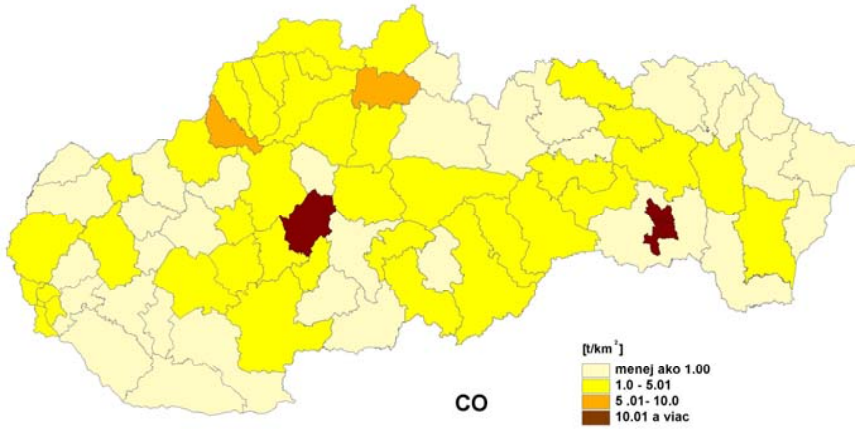
Source: SHMI

Trend in emission of CO



Source: SHMI

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

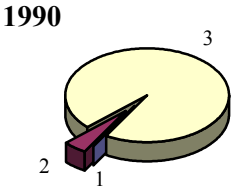


Source: SHMI

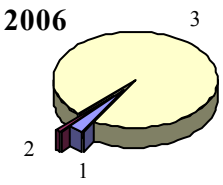
♦ **Balance of ammonia emissions (NH_3)**

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

The contribution of the particular sectors in NH_3 emission



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



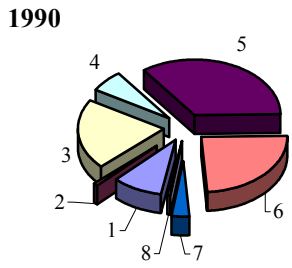
Source: SHMI

Emissions were stated to the date 31.10.2007

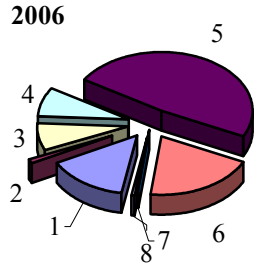
♦ **Emissions of non-methane volatile organic compounds**

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

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



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

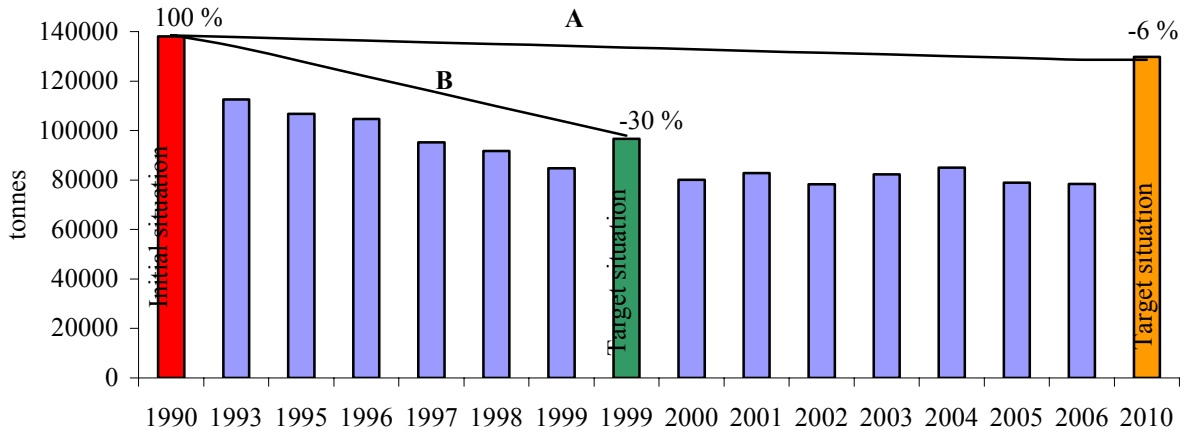


Source: SHMI

Emissions were stated to the date 31.10.2007

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

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



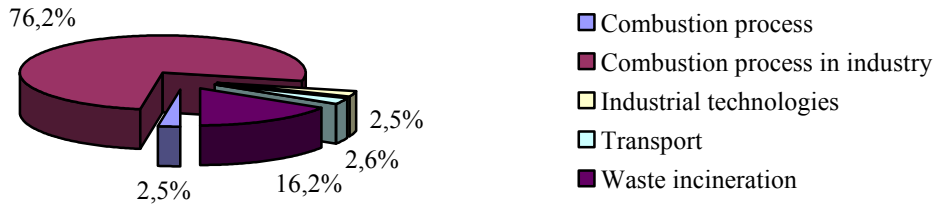
Source: SHMI

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

♦ **Balance of heavy metals emissions**

Heavy metal emissions (Pb, As, Cd, Cr, Cu, Hg, Ni, Se, Zn) have been decreasing since 1990. In that year, heavy metal emissions were at the volume of 675.44 tons, while in 2006 it was 287.77 tons, which is a 57 % reduction in comparison to 1990. Besides shutting off a number of old-fashioned and non-effective technologies, this trend has been influenced by extensive reconstructions of the separation equipment, change in raw material used, and, most of all, by transition to using unleaded petrol types. Since 2003 there has been an increase in Pb emissions as a consequence of increasing production in the areas of ore agglomeration and copper production.

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

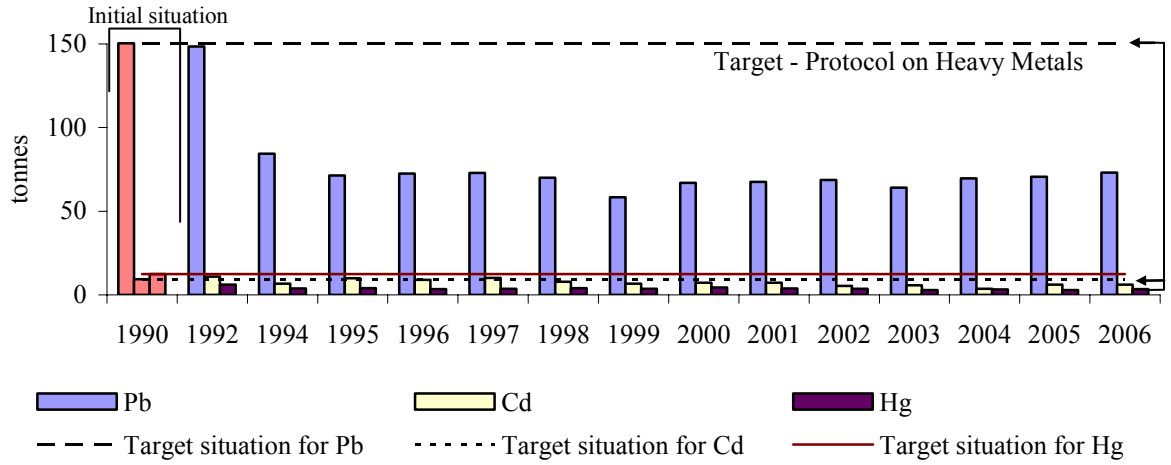


Emissions were stated to the date 31.10.2007

Source: SHMI

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

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

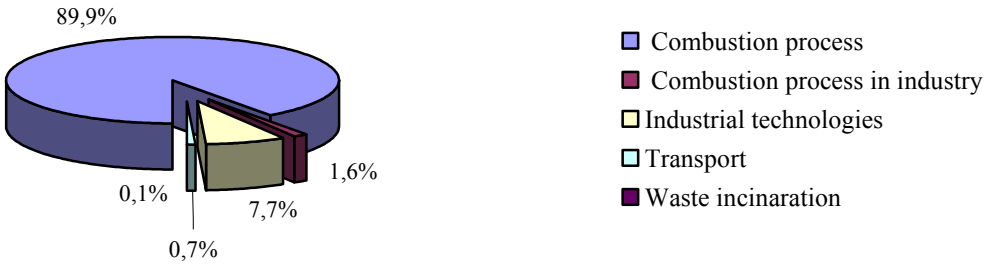


Emissions were stated to the date 31.10.2007 Source: SHMI

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

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

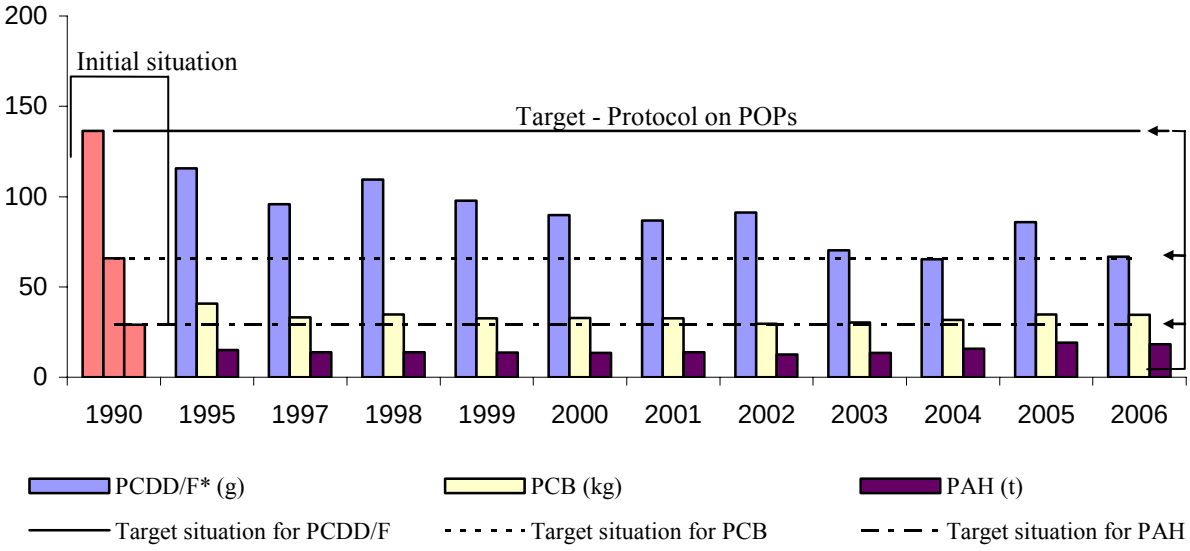
The contribution of the particular sectors in the PAH emission production for year 2006



Emissions were stated to the date 31.10.2007 Source: SHMI

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

Trend of POPs emissions regarding the fulfillment of the international conventions



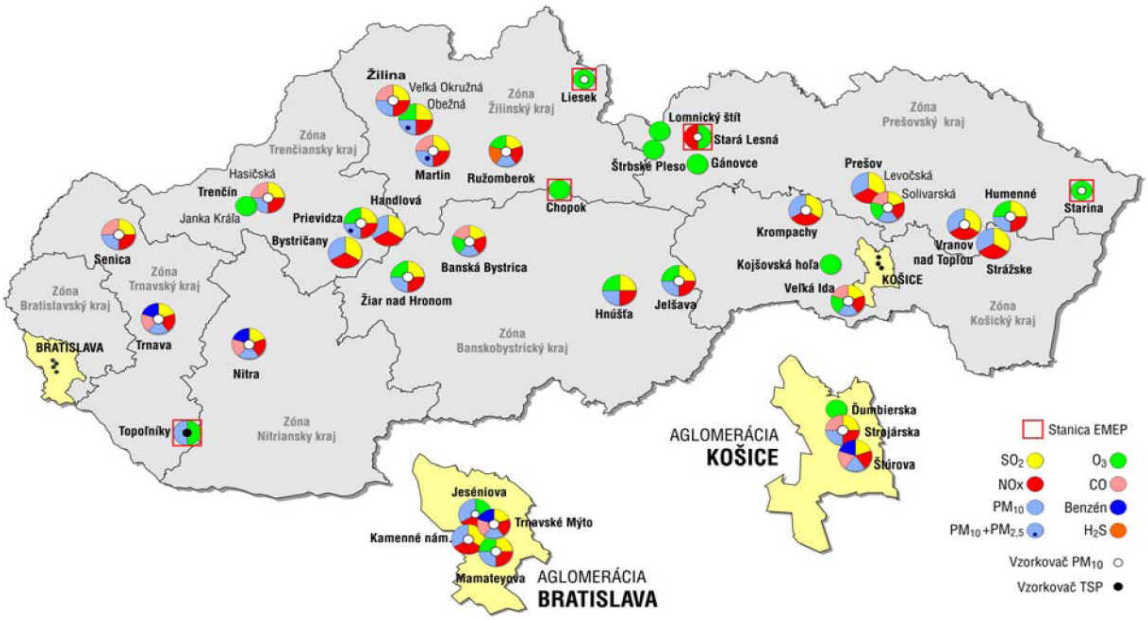
Source: SHMI

Air pollution

- **National monitoring air quality network**

In 2007, the **national air assessment quality monitoring network consisted of 34 automated monitoring stations including 4 stations to monitor regional air pollution and precipitation water chemical composition**. Stations that monitor regional air pollution are part of the EMEP – Co-operative Program for the Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe.

National monitoring air quality network - owned by SHMI



Source: SHMI

- **Local air pollution**

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

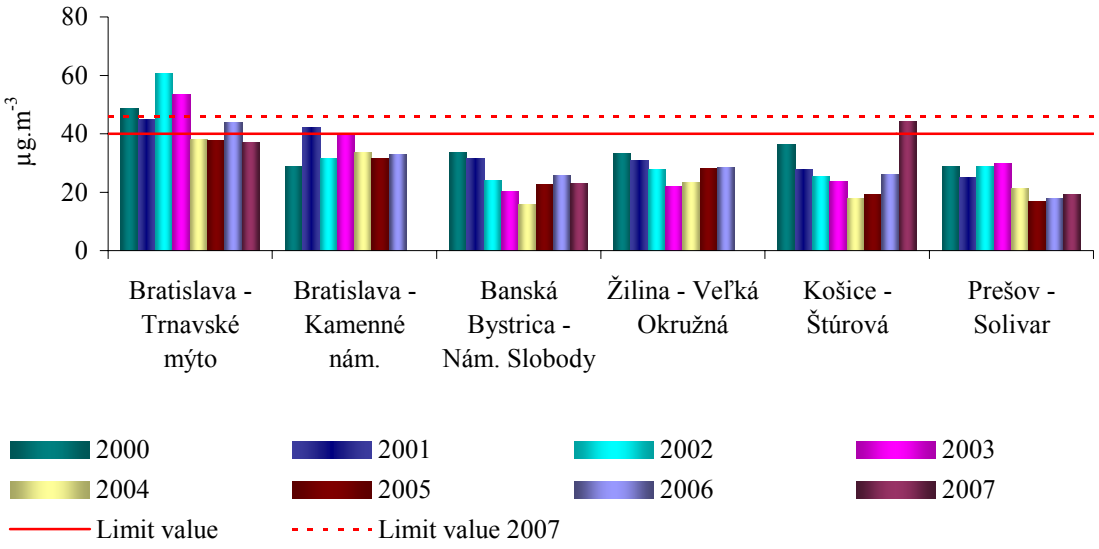
Sulfur dioxide

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

Nitrogen dioxide

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

Average annual concentrations of nitrogen dioxide at selected monitoring stations



Source: SHMI

PM_{10}

The biggest challenge in the area of air protection in Slovakia and most European countries is currently air pollution by particulate matter (PM_{10}). In 2007, there was a significant reduction in the PM_{10} pollution level at most NMSKO stations. Despite this fact, 14 stations showed exceeded 24-hour values for this particular pollutant, while 4 AMS showed exceeded also the yearly limit value.

Carbon monoxide

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

Lead

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

Benzene

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

Heavy metals

In 2007 no pollutant limit values were exceeded.

- **Regional air pollution**

Average annual concentrations of air-borne hazardous compounds – 2007

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

Source: SHMI

Sulfur dioxide, sulfates

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

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

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

Nitrogen oxides, nitrates

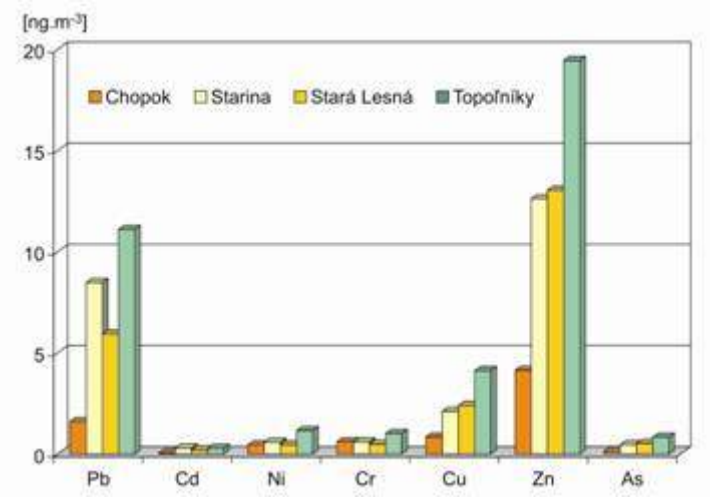
Concentration of nitrogen oxides at regional stations expressed in NO_2-N were in 2007 0.72 μg.m^{-3} at Chopok and 1.24 μg.m^{-3} at Starina. In line with Annex 1 of the MoE SR Resolution No. 705/2002 Coll. quoting Resolution 351/2007 Coll., the **limit value for the protection of ecosystems is 30 μg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

Atmospheric **nitrates** at Chopok and at Starina were mostly in the aerosol form. Gaseous nitrates in 2007 were in comparison with the aerosol ones lower at both stations. Despite the fact that gaseous and particulate nitrates are trapped and monitored separately, their sum is expressed in line with EMEP, since their phase distribution depends on atmospheric temperature and humidity. Percentage share of nitrates on atmospheric aerosol was 6 % at Chopok and 8 % at Starina. Ratio of total nitrates ($HNO_3 + NO_3$) to NO_X-NO_2, as expressed in nitrogen, was 0.13 at Chopok and 0.27 at Starina.

Atmospheric aerosol, heavy metals

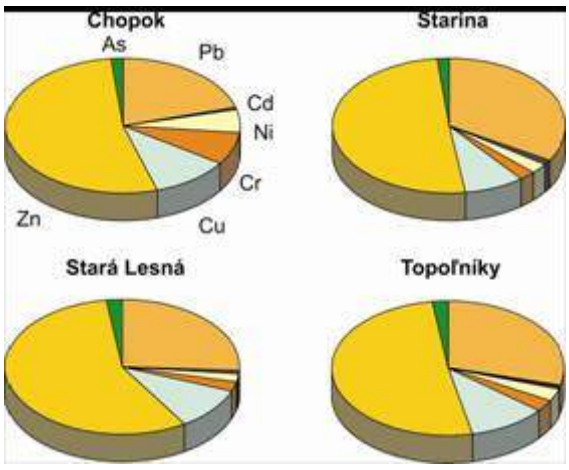
Percentage share of the sum of assessed heavy metals on air-borne dust at regional stations of Slovakia varies between 0.15 and 0.18 %.

Heavy metals in the air - 2007

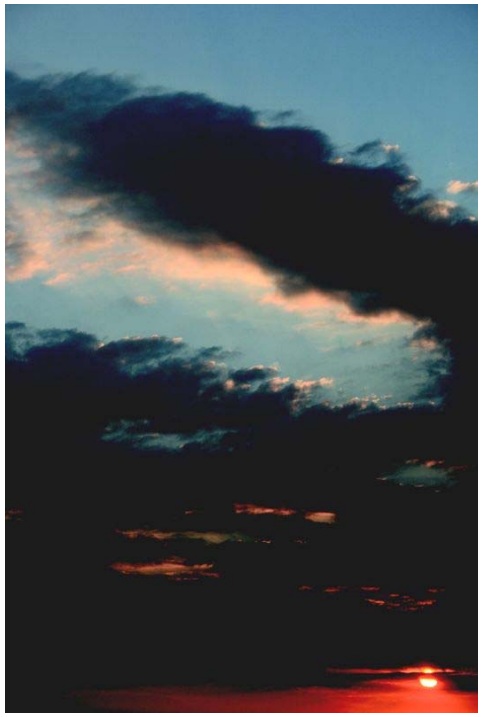


Source: SHMI

Percentage share of heavy metals in 2007



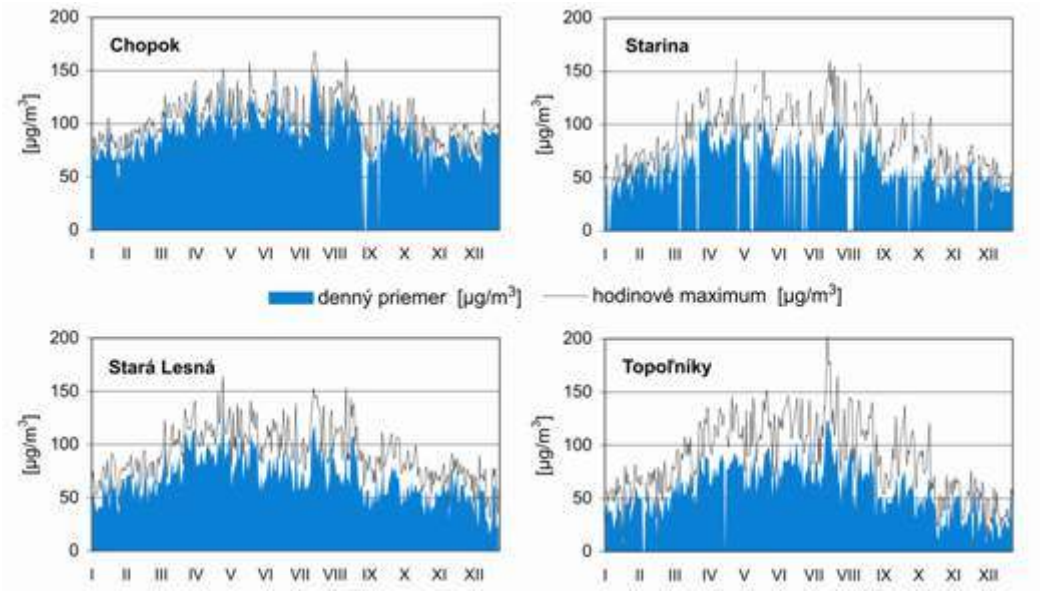
Source: SHMI



Ozone

The following figures show the **annual characteristics in the ozone concentration** at regional stations of Chopok, Starina, Stará Lesná, and Topoľníky. Stará Lesná has had the longest time sequence of ozone measurements since 1992. Ozone measurements at Topoľníky, at Starina, and at Chopok started in the course of the year 1994. In 2007, average ozone concentration at Chopok was 92 µg.m^{-3}, at Stará Lesná 68 µg.m^{-3}, at Topoľníky 58 µg.m^{-3}, and at Starina 63 µg.m^{-3}.

Tropospheric ozone 2007



Source: SHMI

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

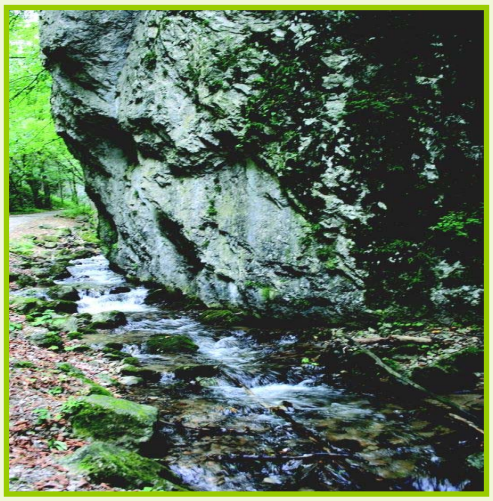
Volatile organic compounds $C_2 – C_6$

Volatile organic compounds (VOC) $C_2 – C_6$ or the so-called light carbohydrates began to be captured at the Starina station in the Fall of 1994. Their concentrations range between individual units to hundreds of units ppb. Ethane presents the worst, next is propane, ethene and acetylene. Isoprene releases from ambient forest.

Average annual VOC concentrations in ambient air (ppb) - Starina 2007

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

Source: SHMI



Whoever is performing an activity, which could have an impact on the ***condition of the surface waters and underground waters, and of water situation,*** *is obliged* ***to exert the necessary effort to provide for their preservation and protection.***

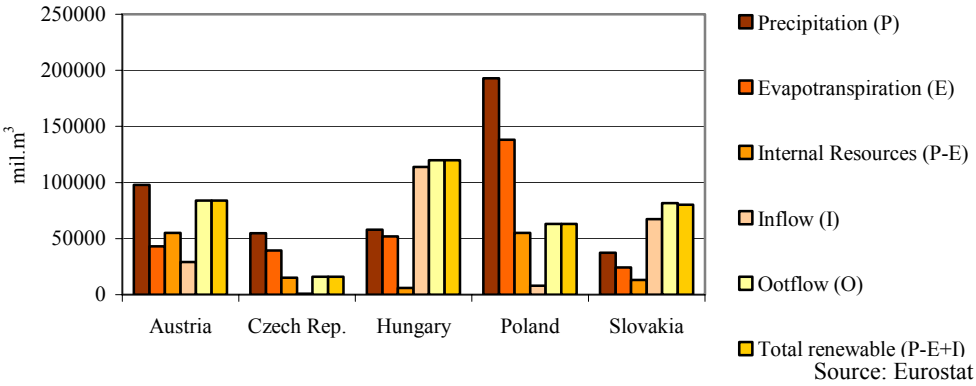
§ 30 par. 1 of the Act No. 364/2004 Coll. on Waters and on Amendment of Act No. 372/1990 Coll. on Offences as amended (Waters Act)

• WATER

Water sources and water fund

Significant part of the Slovak surface water fund flows in from the neighboring states and the usability of this fund is limited. In total, the long-term in-flow average is approximately 2.514 $m^3.s^{-1}$ of water, which is about 86 % of our total surface water fund. In the long run, there is approximately 398 $m^3.s^{-1}$ of water springing in Slovakia, which represents 14 % of the water fund.

Long term freshwater resources in the selected countries in 2007



Source: Eurostat

Surface water

♦ **Precipitation and runoff conditions**

Total **atmospheric precipitations** in the Slovak territory in 2007 reached the value of 854 mm, which represents 112.1 % of the normal level. In terms of precipitations, this year had been considered normal. Total excess of precipitations reached the value of 92 mm.

Average total precipitation in the area of the SR

Month	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	Year
Mm	101	58	70	6	82	92	58	94	133	54	66	39	854
% normal	220	138	149	11	108	107	65	117	210	88	107	74	112
Surplus (+)/ Deficit (-)	55	16	23	-49	6	6	-32	13	70	-7	4	-14	92
Character of rainfall period	MV	V	VV	MS	N	N	S	N	MV	N	N	S	V

Characteristics of the precipitation season: N - normal, S - dry, SS - very dry, V – humid, VV – very humid, MV – exceptionally humid Source: SHMI

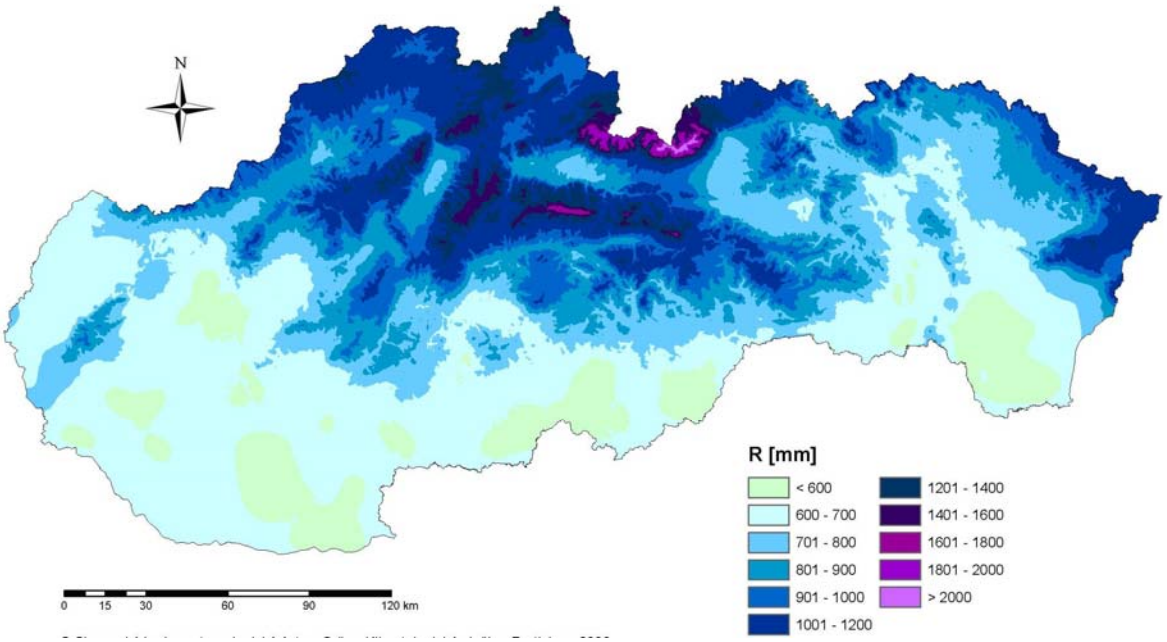
In terms of precipitation period, the year 2007 was humid in the catchments of Váh, Nitra, and Bodrog, and very humid in the catchments of Hornád, Poprad, and Dunajec. The same year was considered normal in all other partial catchments.

Average rates of precipitation and runoff in particular catchment areas

Catchment area	Dunaj		Váh		Hron			Bodrog a Hornád				SR
Subcatchment area	*Morava	*Dunaj	Váh	Nitra	Hron	*Ipeľ	Slaná	Bodva	Hornád	*Bodrog	*Poprad a Dunajec	
Catchment area extent (km^2)	2 282	1 138	14 268	4 501	5 465	3 649	3 217	858	4 414	7 272	1 950	49 014
Average precipitation (mm)	728	650	967	769	869	659	791	745	842	834	1 068	854
% of normal	107	104	115	111	110	96	100	102	124	118	127	112
Character of rainfall period	N	N	V	V	N	N	N	N	VV	V	VV	V
Annual runoff (mm)	65	27	309	113	199	45	98	60	143	198	456	189
% of normal	49	75	99	79	69	33	52	28	32	67	133	72

* watercourses and corresponding data only for the Slovak part of the watershed Source: SHMI
Characteristics of the precipitation season: N - normal, S - dry, SS - very dry, V – humid, VV – very humid, MV – exceptionally humid

Annual atmospheric precipitation (mm) in Slovakia in 2007



Source: SHMI

Annual runoff volumes in SR in 2007 reached 72 % of the long-term average value. Runoff volumes from partial catchments exceeded the long-term average only in the Poprad and Dunajec catchments with the value of 133 %. The remaining catchments showed values within 32 – 99 %.

♦ Water balance

Annual inflow to Slovakia in 2007 was 63 519 mil.m^3, which is 8 192 mil.m^3 less than in 2006. **Runoff** from the territory has grown by 13 053 mil.m^3, compared to the previous year.

Total water volume as of 1.1.2007, in water reservoirs was 766 mil.m^3, which represented 66 % of total usable water volume in water reservoirs. As of 01.01.08, total available volume of the assessed accumulation tanks compared to the previous year 2007 dropped to 798 mil.m^3, which represents 69 % of total exploitable water.

Total hydrological balance of water resources in the SR

	Volume (mil. m^3)		
	2005	**2006**	**2007**
Hydrological balance:			
Rainfall	46 029.00	36 274	39 460
Annual inflow to the SR	69 806.00	70 711	63 519
Annual runoff	79 979.00	85 646	72 593
Annual runoff from the territory of the SR	10 173.00	14 900	9 264
Water management balance			
Total abstraction of the surface and ground water in the SR	906.89	882.47	480
Evaporation from water reservoirs and dams	5.07	55.79	62
Discharge into surface waters	872.00	669.7	628
Impact of water reservoirs (WR)	111.61	7.8	
	improving	**improving**	**accumulation**
Total volume in WR as of 1st January of the following year	721.00	681.60	798
% of supply volume in accumulation WR in the SR	62.00	59.00	69
Rate of water exploitation (%)	8.91	6.38	5

Source: SHMI

♦ Surface water abstraction

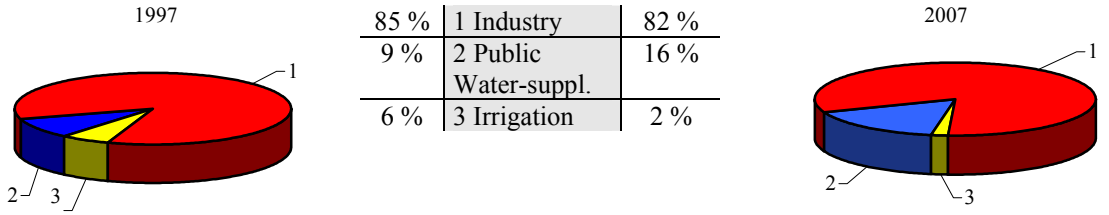
In 2007, surface water abstraction dropped to 326.139 mil.m^3, which means a reduction by 17.5 %, compared to the previous year. This year shows reduced abstractions for all surface water users. Industrial abstractions in 2007 reached 266.78 mil.m^3, which is 56.93 mil.m^3 less than in 2006, e.g. 17.7 %. A slight reduction was recorded also in surface water abstractions for waterlines, which, compared to the previous year, dropped by 2.33 mil.m^3, that is 4.2 %. Surface water abstractions for irrigation purposes also decreased, reaching the value of 6.04 mil.m^3. This means a reduction by 62 %. (Data on surface water use since 2006 have been calculated using information retrieved from the Complex Water Register maintained at SHMI. In previous years, data from the SWME, database were also added to this information.)

Surface water exploitation in the SR (mil.m^3)

Year	Public water-supplies	Industry	Irrigation	Other agriculture	Total	Discharging
1997	73.826	690.733	46.894	0.0360	811.484	1 114.608
2005*	53.828	467.957	11.006	0.0110	532.791	871.865
2006*	55.567	323.709	15.854	0.0120	395.142	748.537
2007*	53.315	266.776	6.036	0.0120	326.139	628.270

*data from database „Aggregate balance sheet of water“ Source: SHMI

Comparison of surface water exploitation between 1997 and 2007



85 %	1 Industry	82 %
9 %	2 Public Water-suppl.	16 %
6 %	3 Irrigation	2 %

Source: SHMI

♦ **Surface water quality**

At present, Slovakia is undergoing changes in surface water assessment, pursuant to the provisions of framework Directive on Water No. 2000/60/EC. In the past, the STN 75 7221 „Water quality. Surface water quality classification“ norm used as the primary reference in assessing water quality by the Slovak Institute of Technical Normalisation, was invalidated as of 01.03.2007.

Surface water quality is assessed primarily through biological indicators such as macro-zoo-benthos, phyto-zoo-bentos, fishes, and macrophytes. Supporting elements in **ecological state water assessment** include physical-chemical and hydro-morphological quality elements, expressed by **five quality categories** (from very good to very bad). Priority chemicals water concentrations define the situation in water chemistry expressed through only **two quality categories:** good/bad. The worse of the two states (ecological or chemical) shows the resulting water situation and determines other activities that relate to reaching the environmental goal by WFD – to attain good water quality for all water bodies by 2015.

Surface water quality assessment has been carried out on the basis of data obtained during the water level monitoring process. For the year 2007, surface water quality monitoring was split into the basic monitoring, operational monitoring, and monitoring of protected territories (PT). This division followed the provisions of **the MoE SR Resolution No. 221/2005 Coll. which sets forth details on detecting the occurrence and assessment of surface and ground water situation, its monitoring, keeping the water register and water balance records.** Surface water quality activities were carried out under the Water Situation Monitoring Programme in 2007. The Programme involved 124 abstraction sites in the catchments of Danube, Váh, Hron, Bodrog, Hornád, Dunajec, and Poprad. Surface water quality was assessed in the length of 4 314 km.

Number of monitored surface water sampling sites in 2007

Catchment	Sampling site		Monitored length
	Basic	Special	(km)
Danube catchments area	20	-	509.8
Váh catchments area	39	-	1 420.8
Hron catchments area	25	-	975.0
Bodrog catchments area and Hornád catchments area	36	-	1 248.9
Poprad and Dunajec catchment area	4	-	159.5
Total	**124**	**-**	**4 314.0**

Source: SHMI

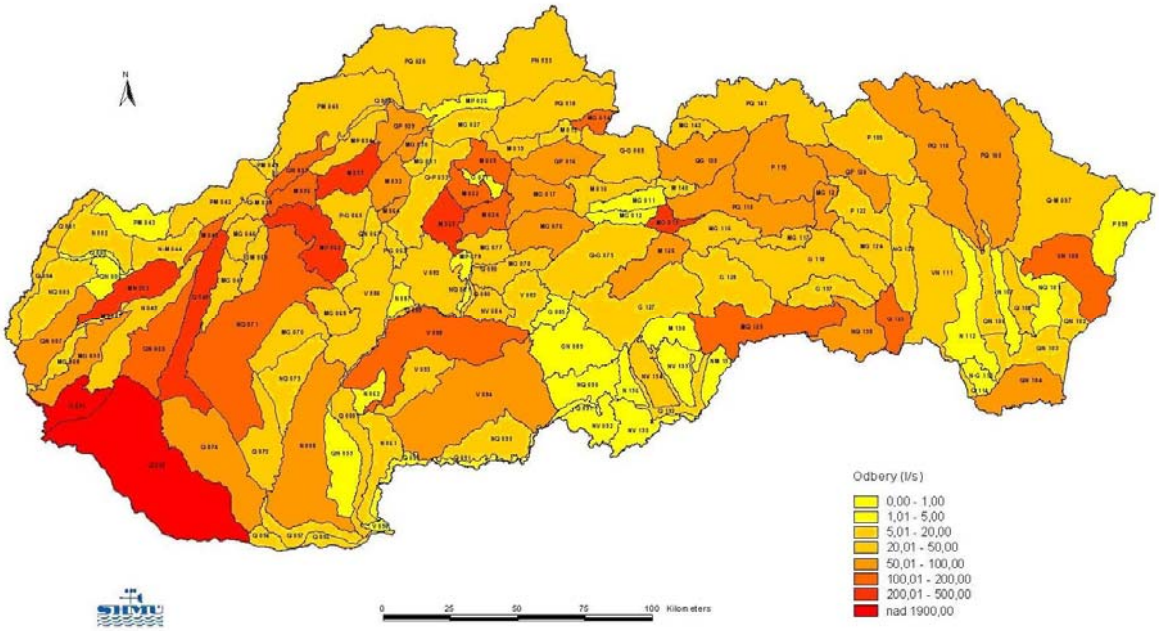
Indicators were monitored within this transitional period that are pursuant to the **SR Government Regulation No. 296/2005 Coll. which introduces requirements on the quality and qualitative goals for surface water, as well as the limit indicator values for wastewater and special water contamination.** General requirements for surface water quality (Annex 1) pursuant to the SR Government Resolution 296/2005 Coll. were fully complied with for the following physical-chemical indicators: total organic carbon, calcium, sulphates, magnesium, as well as micro pollutants that include tensides, cyanides, copper, nickel, chromium, and a various specific organic substances. Indicators with most exceeded values included aluminium and selenium with 100 % occurrence of excessive values. Other frequently exceeded values included AOX and chlorophorm. Values for faecal streptococci, thermo-tolerant and coliform bacteria as part of the microbiological indicators were frequently exceeded. Tetra chloromethane and 1,1,2- Trichloroethylene were not assessed since the set threshold was higher than the limit in NV No. 296/2005 Coll. Despite this, 14 sampling sites showed 1,1,2-Trichloroethylene values higher than the set threshold, therefore exceeding the NV limit 296/2005 Coll. Cis 1,2 – dichloroethene was assessed as complying with the provision of NV 296/2005 Coll. in case that there are only values detected below the set threshold which is 0,1 higher than the value under NV 296/2005 Coll. When the detected values were beyond the set threshold, the indicator was regarded as non-compliant with NV 296/2005 Coll.

Ground water

- **Water resources**

In 2007, based on the hydro-geological assessment and surveys in Slovakia, there were **76 830 l.s^{-1} available groundwater resources**. In comparison with the previous year 2006, there was observed a slight increase of the efficient groundwater volume by 82 l.s^{-1}, i.e. by 0.11 %. In the long-term evaluation, the increase of the efficient volume in comparison with 1990 makes 2,055 l.s^{-1}, i.e. 2.7 %.

Efficient groundwater volumes in the hydrogeological regions in 2006 ($l.s^{-1}$)



Source: SHMI

On the basis of assessment of water management balance expressed by the balance status (proportion of abstractable volumes/abstractions), which is the indicator that shows the rate of wate sources abstraction, we see that in **2007, out of total number of 141 hydro-geological regions in SR, 122 regions show good balance status, 19 regions show acceptable status.** Tensed, critical and emergency balancing state did not occur in any region.

- **Groundwater levels**

In 2007, highest recorded annual values in ground water levels and spring yields come from the period of January through March. In the catchments of Hornád, the autumn non-typical precipitation figures impacted the raising ground water levels with maximum annual recorded ground water values in the course of October. Minimal ground water levels and spring yields were recorded mainly during the winter season in November and December, and during September through October for the springs alone minimal yields persisted until February as well as in September through October.

- **Gabčíkovo interest area**

In 2007, precipitation figures at Žitný ostrov were slightly above the long-term annual average figures. At Bratislava and Veľký Meder, these exceeded also average annual figures for the period of the Gabčíkovo Hydro-electric plant operation. The highest monthly totals were shown at all stations in September, which together with annual maximum Danube levels caused also increased ground water levels. Lowest monthly rainfall totals detected in the whole Žitný ostrov were in April.

♦ **Groundwater abstraction**

In 2007 there was being **extracted 11.366 l.s^{-1} of ground water in average** by the users (which are subjects to reporting obligation) in Slovakia that was 14.8 % of the documented efficient volume. During the year 2007 the groundwater extractions slightly decreased by 299.2 l.s^{-1} which means 2.6 % in comparison with year 2006.

Groundwater extraction in 2006 according to the purpose of use

Year	Public water supplies	Food-processing industry	Industry excl. Food-processing	Agricult. and Livestock	Vegetable prod. Irrigation	Social purposes	Others	Total
2004	9 431.53	322.04	901.65	320.51	65.17	327.02	832.93	12 200.85
2005	9 159.87	288.25	856.75	308.82	95.07	279.72	878.98	11 867.46
2006	8 836.13	295.62	852.34	275.80	94.96	340.15	970.20	11 665.20
2007	8 441.59	383.87	891.32	267.84	146.25	333.44	901.65	11 365.96

Source: SHMI

♦ **Groundwater quality**

Pursuant to the WFD requirements, the older system of dividing Slovakia into significant water management areas was abandoned. Since 2007, classification has been based on delineation of groundwater formations. Monitoring of ground water chemical situation has been divided into:

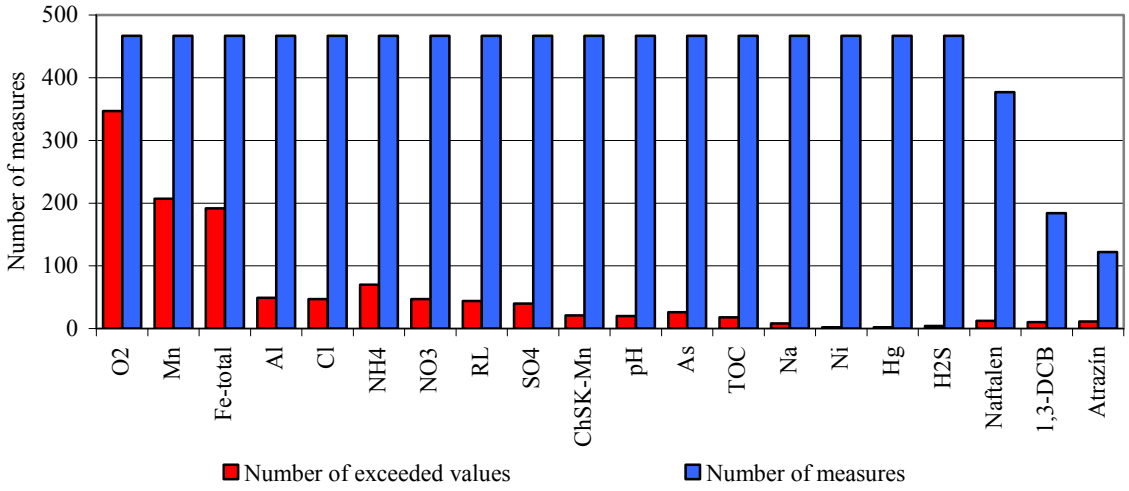
- basic monitoring,
- operation monitoring.

In 2007, ground water quality was monitored at 130 basic monitoring facilities. Ground water samples were taken 1-time in the Autumn for a selected group of indicators.

The results of the analyses were evaluated according to the SR Government Resolution No. 354/2006 Coll. about the requirements for the drinking water and the drinking water quality control, by comparing the measured and limit values for all analyzed indicators.

Adverse **oxidation-reduction** conditions dominate at ground water **basic monitoring** facilities, apparently caused by most frequent occurrences of exceeded acceptable concentrations of total Fe (31 times), Mn (31 times), and NH_4^+ (8 times). Besides these indicators, there has been an untypical event of exceeded concentrations in the group of **physical - chemical indicators,** specifically in the case of the Cl^-, SO_4^{2-}, and NO_3^- anions. Most frequently recorded excessive concentrations in **trace elements** included Al (25 times), As (4 times), Pb (2 times), and Sb (1 time). Contamination by **specific organic substances** shows only local character and the majority of specific organic substances was recorded below the detection limit.

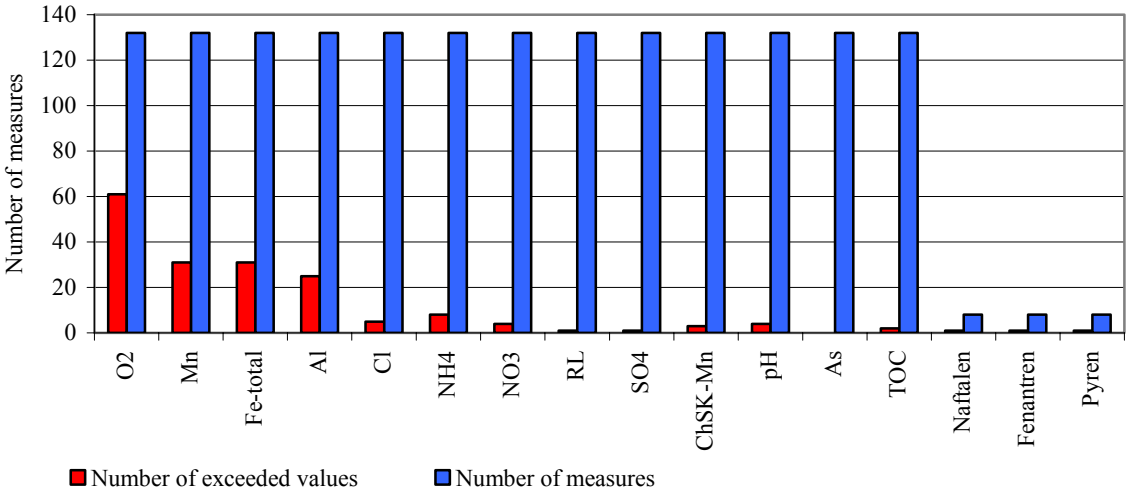
Occurrence of exceeded indicators at basic monitoring facilities pursuant to the SR Government Directive 354/2006 Coll. in 2007



Source: SHMI

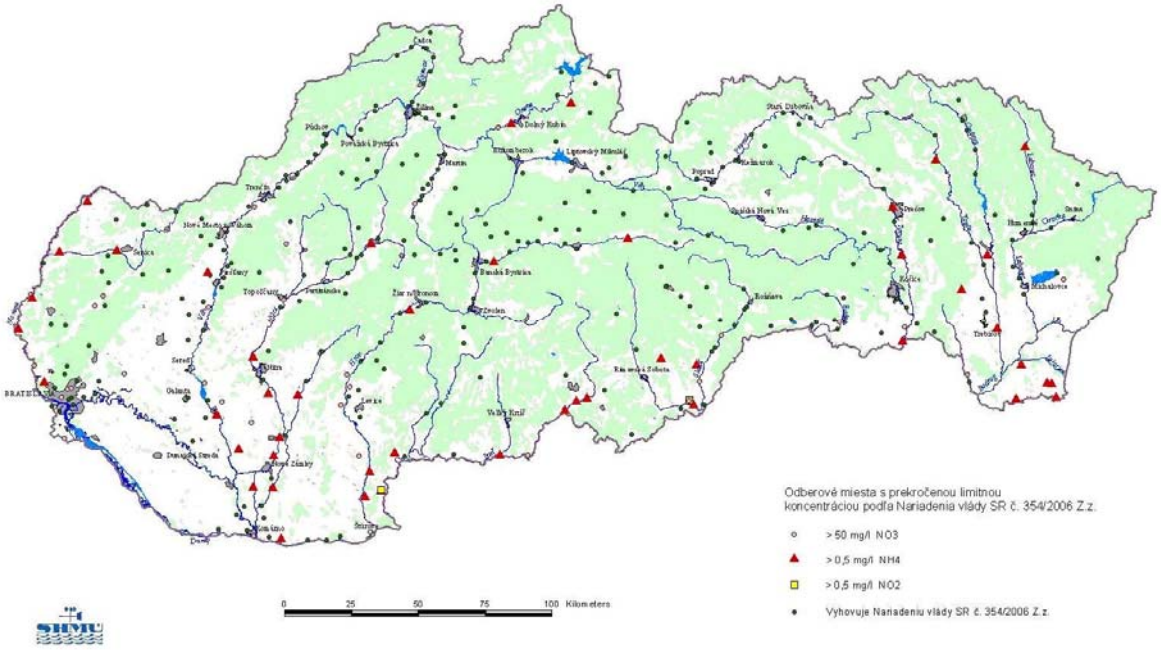
Ground water at **operation monitoring** is relatively low in oxygen, with the exception of the Žitný ostrov area. This is also apparent from the fact that the recommended percentage value for oxygen water saturation was reached only in 26 % of the samples. Most frequently exceeded indicators include Mn and total Fe, which suggests persisting adverse **oxidation-reduction situations.** Exceeded Cl^- and SO_4^{2-} limit values also indicate the impact of anthropogenic pollution on ground water quality. Character of land use (agricultural exploitation) is reflected into increased contents of oxidized and reduced nitrogen forms in ground water, with ammonia ions NH_4^+ (70 times) and NO_3^- (47 times) being the most prevalent. In 2007, the acceptable value set by legislation was exceeded in 5 **trace elements** (Al, As, Sb, Ni, and Hg) at operation monitoring facilities. Most frequently recorded increased contents include Al (49 times) and As (26 times). Presence of **specific organic substances** in ground water indicates impact by human activities. In 2007, operation monitoring facilities detected a wider range of specific organic substances. Most cases involved exceeded limit values in case of indicators from the group of poly-aromatic hydrocarbons (phenanthrene, fluoranthene, benzo(a)pyrene, pyrene) and the group of volatile aromatic hydrocarbons (1,3 dichlorobenzene, 1,4-dichlorobenzene, and 1,2-dichlorobenzene). Limit values for pesticides and volatile aliphatic hydrocarbons were exceeded only sporadically.

Occurrence of exceeded indicators at operation monitoring facilities pursuant to the SR Government Directive 354/2006 Coll. in 2007



Source: SHMI

Groundwater quality in Slovakia in 2007 – concentration NH_4, NO_2, NO_3



Source: SHMI

Waste Water

In 2007 there was discharged 634 419 thousands m^3 of the **waste water** into the Slovak watercourses, which meant the decrease by 99 686 thousands.m^3 (13.6 %) in comparison with year 2006 and 474 119 thousand.m^3 (42.8 %) less in comparison with year 1997.

Reduction in waste water load remained also for the selected indicators of contamination, most markedly seen in chemical oxygen balance by dichromate, by 4 650 tons/year, compared to 2006. For the other indicators, the reduction was less dramatic: insoluble substances (IS) by 1 795 tons/year, biochemical oxygen demand by 2 505 tons/year and indicator ENP_{uv} increase by 14 tons/year.

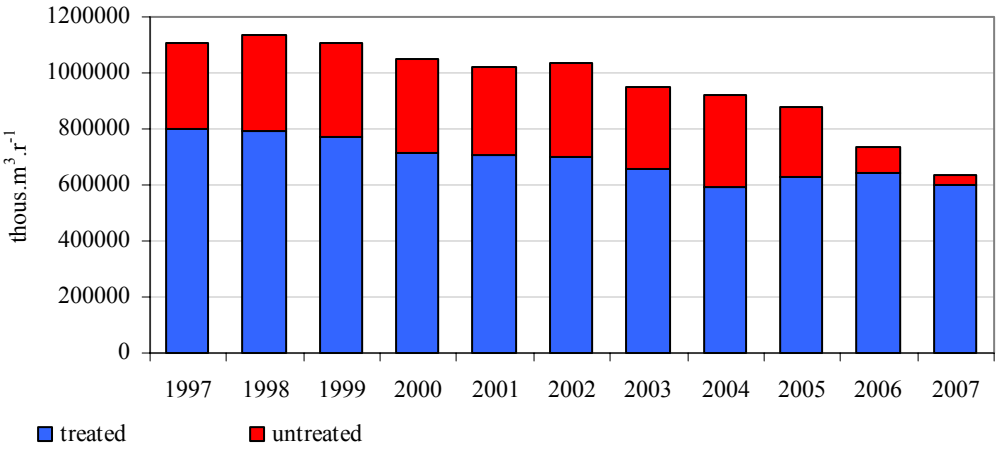
Percentage of discharged treated waste water to **total volumes of waste water** discharged into watercourses in 2007 was 94.05 %.

Load of the balanced contamination sources discharged into surface watercourses in the period of years 1997-2007

Discharged waste water	Volume (thous.$m^3.y^{-1}$)	IS ($t.y^{-1}$)	BOD_5 ($t.y^{-1}$)	COD_{Cr} ($t.y^{-1}$)	ENP_{uv} ($t.y^{-1}$)
1997	1 108 538	37 006	22 601	68 871	565
2004	919 869	21 389	13 702	45 162	57
2005	881 946	12 670	10 661	37 312	55
2006	733 594	11 200	9 026	31 563	44
2007	634 419	9 405	6 521	26 913	58

Source: SHMI

Trend in discharging of the treated and untreated waste waters into watercourses in the period of 1997-2007



Source: SHMI

Proportion of waste water treatment in specific parameters of Directive 91/271//EEC

Category	< 2000 EO	2001 – 10 000 EO	10 001 – 15 000 EO	15 001 – 150 000 EO	> 150 001 EO	Average
COD_{Cr}	78.2 %	91.5 %	90.0 %	90.4 %	66.7 %	**85.37 %**
BOD_5	64.1 %	78.0 %	80.0 %	76.9 %	66.7 %	**72.20 %**
IS	73.1 %	91.5 %	80.0 %	88.5 %	66.7 %	**82.44 %**
N_{total}	-	-	20.0 %	19.2 %	33.3 %	**20.59 %**
P_{total}	-	-	10.0 %	23.1 %	50.0 %	**23.53 %**

Source: WRI

Mentioned values show that the level of treatment in the smallest agglomerations that are not so demanding in terms of the depth of purification is relatively poor, and the ratio of acceptable waste water treatment plants to all plants is little below three quarters. Medium and large size waste water treatment plants remove organic contamination with good efficiency; however, they stay behind in their capacity to remove nutrients. In fact, the largest waste water treatment plants show several cases of overload, when they are not able to remove all received contaminants. This, in turn, is reflected in a lower proportion of acceptable parameters of basic organic contamination.

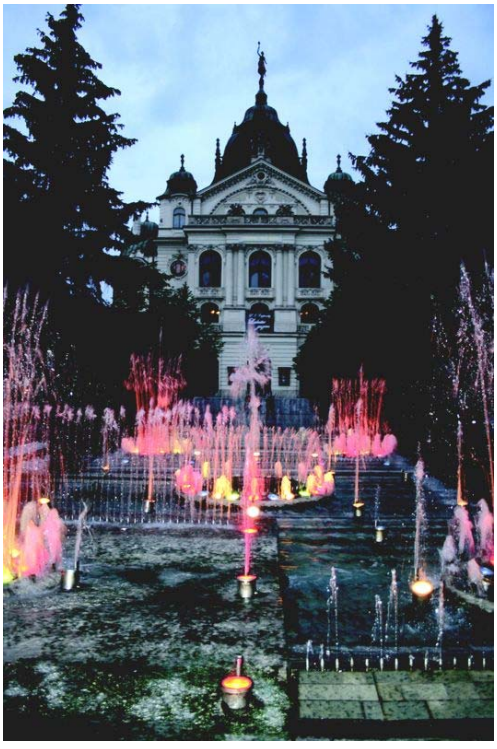
Public water supply, sewerage systems and waste water treatment plants

- **Public water supplies**

Number of inhabitants supplied with drinking water from the public water supply in 2006, reached the number of 4 679 thousand, which represented 86.6 % of supplied inhabitants. There were in the SR 2 353 individual municipalities that were supplied with public water supply, and their portion on total SR municipalities was 81.4 %.

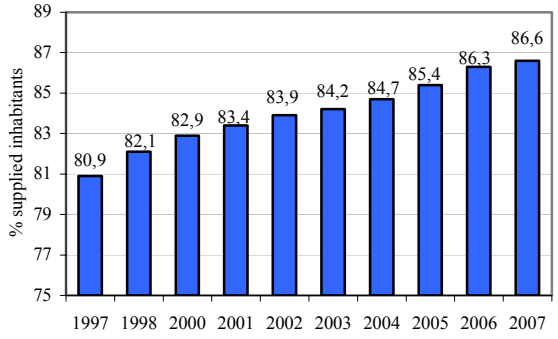
In 2007, there was a marked increase in the percentage of supplied municipalities in the regions of Banská Bystrica (78.5 %), Prešov (62.9 %), and Košice (71.6 %). On the other hand, regions with number of municipalities with public water supplies unchanged since 2006 included Bratislava, Trenčín, Žilina, with percentage from 93 % to 99 %.

Henceforth there persisted the long-term decrease in the drinking water demand. **The volume of the produced drinking water** reached in year 2007 the value of 322 mil. m^3 of the drinking water, which is the decrease in comparison with year 2006 by 12 mil. m^3. From the ground water resources there were produced 271 mil. m^3 (84 %) and from the surface water resources 51 mil. m^3 (16 %) of the drinking water. **Water losses** in the pipe system represented in year 2007 27.1 % from the total water produced in the water management facilities. **Specific water consumption in households** in year 2007 was 107.34 $l.inh^{-1}.day^{-1}$.



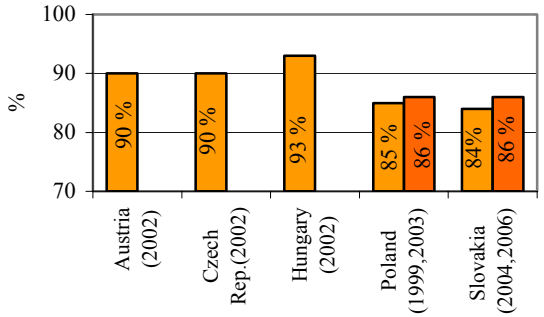
Also other countries showed a decreasing trend in the annual water consumption from public water supplies per capita. Czech Republic and Slovakia are approximately at the same level in terms of water consumption, while Poland shows the least consumption – only 57 $m^3.inhab^{-1}.year$, Hungary shows the best characteristics with having as much as 93 % of its inhabitants supplied with drinking water from public water supplies.

Drinking water supplying of the inhabitants from the public water supplying in the SR



Source: SO SR

Comparison of the drinking water supplying of the inhabitants from the public water supplying in selected countries



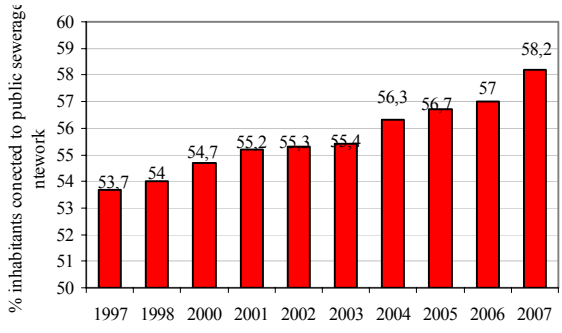
Source: OECD, SO SR

♦ **Sewerage system**

Development of public sewerage systems lags behind that of public water supplies. **Number of inhabitants** living in households **connected to public sewerage systems** in 2007 grew by 45 thousand and reached the number of 3 146 thous. inhabitants, which is 58.2 % of all inhabitants. Of the number of 2 891 of stand-alone municipalities in 2007, 688 of them had public sewerage systems in place (i.e. 23.8 % of all Slovak municipalities), while 568 municipalities (i.e. 19.6 % of all Slovak municipalities) had their wastewater sent directly off to the wastewater treatment plant. Adverse situation remains also in individual regions of Nitra, Trnava, and Prešov, these regions stay behind the national average.

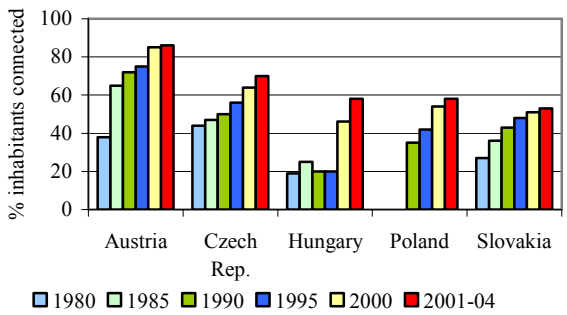
Greatest level of connectedness of the public to the public sewerage system from among the V4 countries reached Austria (86 %), and the Czech Republic (70 %), Poland, Hungary, and Slovakia show approximately the same level of connectedness, 56 % on average.

Connecting of the inhabitants to the public sewerage network in the SR (%)



Source: SO SR

Comparison of the connecting of the inhabitants to the public sewerage network in the selected countries (%)



Source: OECD

♦ **Waste water treatment plants**

In 2007, 46 waste water treatment plants were added into the Administration of water supplies and water sewerage systems (VaK) scheme, reaching the number of 500. Greatest share on these had mechanical-biological WWTPs (84.2 %). Increase in WWTP's capacity was still on the rise, reaching the value of 2 233.6 $m^3.day^{-1}$ in 2007.

In 2007, watercourses with public sewerage system (administered by municipalities and water management companies) received 414 mil.m^3 of discharged waste water, which was by 45 mil.m^3 less than in the previous year, and the volume of treated waste water discharged into the public sewerage system reached 405 mil.m^3.

Volume of the discharged wastewater by the public sewerage system (in administration of VaK and in administration of the municipalities) in 2007

Water discharged by the public sewerage and WWTP	Sewage	Industrial and other	Precipitation	Separate	Administration of the municipalities	Total
	(thous.$m^3.year^{-1}$)					
Treated	114 607	104 829	45 363	129 798	11 185	405 782
Untreated	2 020	916	1 404	2 609	1 376	8 325
Total	**116 627**	**105 745**	**46 767**	**132 407**	**12 561**	**414 107**

Source: WRI

In 2007, there were 55 305 tons of the sludge dry matter produced in municipal WWTPs. Of this, 42 315 tons (76.5 %) were used for soil processes, 9 400 tons (17.0 %) were temporarily stored, and 3 590 tons were landfilled (6.5 %). In 2007, there was direct application of sludge into the agricultural soil. 37 220 tons of sludge dry matter was used for compost production, while 5 095 tons of sludge were used for soil processes (reclamation of landfills, areas, etc.)

Sludge produced in the waste water treatment plant

Year	Amount of the sludge (tons of dry residue)							
	Total	Used			Disposed			
		Applied into the agricultural soil	Applied into the forest soil	Composted and used in other way	Incine-rated	Land filled		In other way
						Total	Suitable for the further use	
2003	54 340	16 640	605	22 085	0	8 110	7 610	6 900
2004	53 085	12 067	0	30 437	0	4 723	3 470	5 858
2005	56 360	5 870	0	33 250	0	8 530	6 960	8 710
2006	54 780	0	0	39 405	0	9 245	8 905	6 130
2007	55 305	0	0	42 315	0	3 590	583	9 400

Source: WRI

Drinking water

♦ **Drinking water quality monitoring and assessment**

As from June 1, 2006, new **SR Government Resolution No. 354/2006 Coll**. came into effect, which sets forth criteria for water for human consumption and control thereof, and which has lead to

minor changes to drinking water quality criteria and assessment criteria (e.g. saprophytic molds were left out of the range of microbiological and biological indicators).

In 2007, radiological indicators were determined in accordance with the SR Government Resolution No. 354/2006 Coll.

Water quality was assessed on the basis of the number or proportion of individual limits shown to have exceeded the pertinent sanitary norms. In 2007, were analysed at operation laboratories of water management companies 8 962 samples. The samples were abstracted at sites located within distribution networks and 240 909 analyses were carried out to monitor individual drinking water quality indicators. Share of drinking water analyses that complied with the sanitary limits in 2007 reached 99.32 % (in 2006 it was 99.44 %). Percentage of samples that meet drinking water quality demands for all indicators reached 89.78 % (in 2006 it was 91.18 %). These samples did not include the active chlorine indicator, as this test was done separately, in relation to the microbiological quality of drinking water.

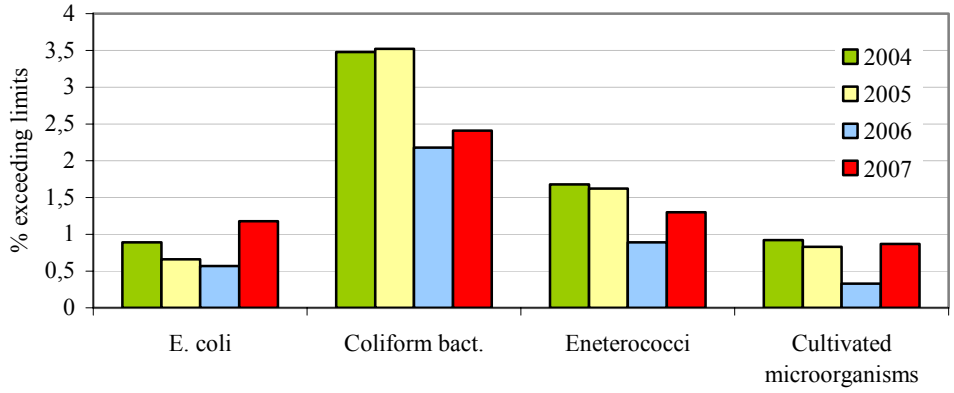
Exceeding limits in drinking water samples in accordance with the Regulation MoH SR No. 151/2004 Coll. on demands on drinking water and drinking water control

Year	2005	2006	2007
Share of drinking water samples that do not meet the NMH and MHRR limit.	2.10 %	1.32 %	2.03 %
Share of drinking water quality indicators analyses that do not meet NMH and MHRR	0.55 %	0.32 %	2.46 %
Share of drinking water samples that do not meet the MH, NMH, MHRR and IH limit.	19.29 %	17.84 %	-
Share of drinking water indicator analyses that do not meet the MH, NMH, MHRR, and IH limits, pursuant to STN 75 711.	1.15 %	1.05 %	-

Source: WRI

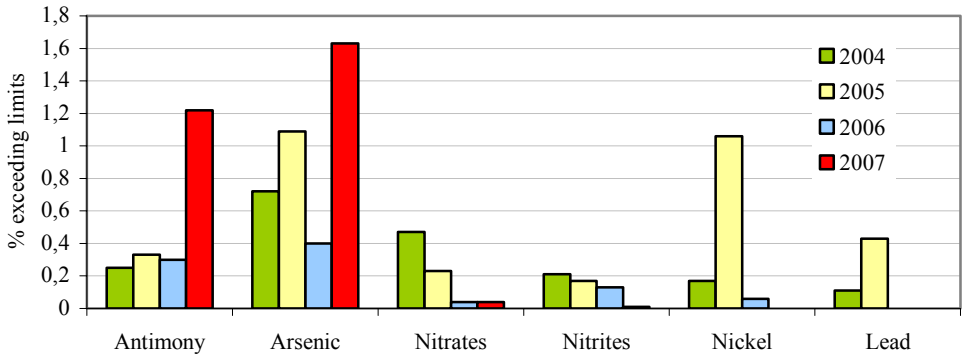
IH – indicative values, MH - threshold values, NMH - maximum threshold values, MHRR – threshold values of the reference risk

Results of monitoring the microbiological and biological indicators of drinking water within Slovakia's distribution networks



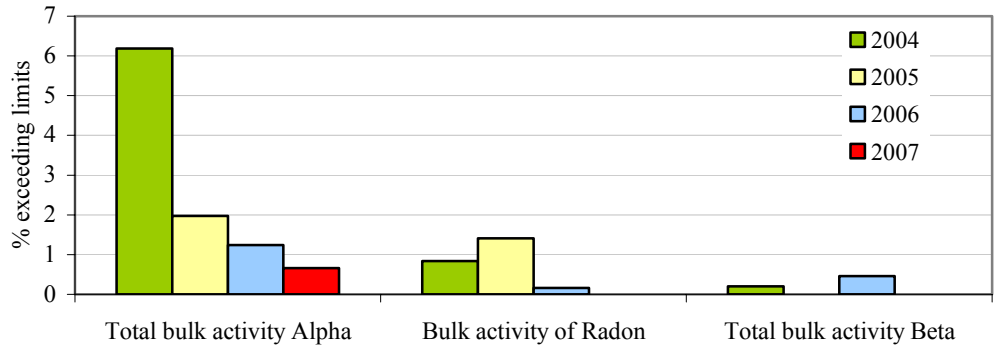
Source: WRI

Results of physical and chemical drinking water indicators monitoring within Slovakia's distribution networks - inorganic indicators



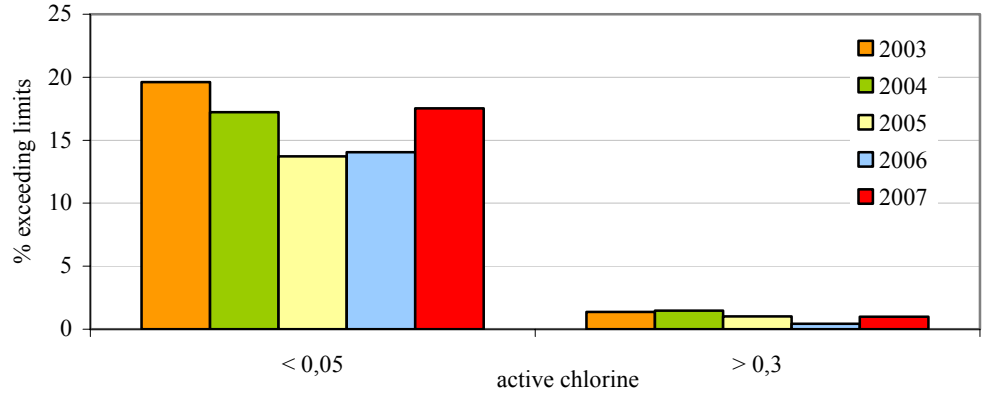
Source: WRI

Results of monitoring for the presence of radiological indicators in drinking water within Slovakia's distribution networks



Source: WRI

Results of monitoring for the presence of disinfection agents and their by-products in drinking water within Slovakia's distribution networks



Source: WRI

Quality of recreational water in 2007

Slovak government established a competency to monitor water designated for recreational use through its **Act 126/2006 Coll. on public health and on amendments of some laws, as well as through the SR Government Resolution 252/2006 Coll. on details regarding the operation of swimming areas, water suitable for swimming, and its control.** The commissioned, competent authorities include PHI SR (Public Health Institute of the Slovak Republic), and regional PHI in SR, along with operators of individual sites, that are to follow the frequency and methods in line with the Directive 76/160/EEC. Since September 2007, this issue has been addressed by a new **Act 355/2007 Coll. on protection, promotion and development of public health and on amendment to other laws.**

Out of 72 natural sites in Slovakia, there are 38 sites with declared water suitable for recreation use with regular monitoring. 21 of these have organized recreation operation with issued permits to operate, with the operator being responsible for quality of the operation and water quality. Sporadic recreational water quality controls were also carried out at sites with so-called non-organized recreation operation, always in the beginning and during the season as scheduled.

Over the season, 380 water samples were extracted in Slovakia and 4 621 tests were done on chemical, physical, microbiological, and biological water quality indicators. 166 analyses exceeded the national limit values. Most frequent cause for insufficient water quality included changes in transparency, in dissolved oxygen, colour, while the limit values for microbiological indicators – coliform bacteria and enterococci were exceeded in less degree. In comparison with the previous years, the occurrence of blue-green algae over the monitored time period was generally lower, in most cases below the limit values.

The SR report on the quality of water for recreational use in 2006 was developed on the basis of article 13 of Resolution 76/160/EEC on quality of water suitable for recrational use. For 2007, the report included 38 swimming areas, 76.3 % of which complied with more stringent water quality criteria. 86.8 % of swimming areas complied with the minimum standards, while 7.9 % did not. Swimming was prohibited in 5.3 %.

The purpose of this law is to establish the principles ***of protection and rational exploitation of mineral resources,*** *especially by carrying out geological researches, openings, preparation and breaking of mineral deposits, enrichment and refining of minerals, performed in relation with their extraction, as well as providing for security of operations and environment protections during these operations.*

§ 1 of the Act on Protection and Exploitation of the Mineral Resources No. 44/1988 Coll. (Mining Act) as subsequently amended

• ROCKS

Geological environmental factors

Partial Monitoring System - Geological Factors (PMS - GF) as part of environmental monitoring in Slovakia, is focused mainly on so-called geological hazards or harmful natural or anthropogenic geological processes that threaten the natural environment and eventually the humans.

From 1.1.2006 data are monitored:

01: Landslides and other slope deformation

02: Tectonic and seismic activity of the territory

03: Anthropogenic sediments of environmental loads sediments

04: Influence of mineral exploitation upon environment

05: Monitoring of the volume activity of Radon in the geological environment

06: Stability of massifs underlying historic objects

07: Monitoring of stream sediments

08: Volume unstable soils

Summary of the major outcomes from the monitoring activities in 2007:

In 2007, monitoring of three basic types of **slope movements** was carried out – slides, creep, and signs of activated falling movements. Measurements were for in 15 selected sites.

For **tectonic movements** in 2007, movements to the surface of the territory and along faults were monitored. Macro-seismic activity was thoroughly assessed in the territory of northern Slovakia and the adjacent part of Poland. Seismic activity of the Slovak territory was assessed. Operation of the Slovak spatial observing service was launched, taking advantage of global navigation satellite system

equipment. The service carries out monitoring at 21 geodetic points. On of these points is in Gánovce and is part of the European monitoring system. In 2007, movements along faults were monitored at these 7 sites: Košický Klečenov, Branisko, Demänovská cave of Freedom, Ipeľ, Vyhne, Banská Hodruša, Cave pod Spišskou. Greatest movements were recorded at the Košický Klečenov site, while other sites showed lower speeds of movements or their stabilization. More attention should be given to the Branisko site where the ongoing movements still threaten the tunnel insulation. In 2007, reports from seismic stations supplied for interpretation more than 5 721 tele-seismic, regional, or local seismic phenomena. 62 earthquakes were localised with the epicentre in the focal area of the Slovak Republic. Macro-seismic monitoring in Slovakia did not detect any earthquake in 2007. On March 2, 2007, there was an accident reported at the Nováky site in Slovakia, which was detected by most National seismic station network sites in Slovakia, some local seismic nuclear power plant stations, as well as several stations in the surrounding countries.

In 2007, the following limits for **anthropogenic sediments** were exceeded at the following monitoring stations: chloride limits (Myjava, Nové Mesto nad Váhom, Šulekovo), cyanides and crude oil products (Prakovce, Devínska Nová Ves, Šaľa), as well as contents of As, Cu, Sb, Pb, Zn, Ni, Ba (Halňa), Fe, and ammonia ions (Šulekovo).

Attention within the process of **environmental impact assessment of extraction activities** was directed toward the area of ore deposits of Rudňany, Slovinky, Smolník, Novoveská Huta, Rožňava, and Banská Štiavnica, together with magnesite and talc deposits in Jelšava – Lubeník – Hnúšťa and Košice – Bankov. Monitored areas of brown coal extraction include the area of Handlová – Cígeľ brown coal territory. Works were focused on introducing more precision and frequency to supplement measurements and to find out needs for adjustments to monitoring facilities. Works also dealt with assessment of hydro-geological, geochemical, and engineering-geological aspects.

Monitoring of the **volume activity of radon** in geological layers in 2007 continued at 14 sites distributed all over the whole Slovak territory. Monitoring of soil radon in 2007 were carried out at six sites that showed middle to high radon risk (Bratislava - Vajnory, Banská Bystrica - Podlavice, Košice-KVP, Novoveská Huta, Teplička, and Hnilec). Greatest average annual reduction in radon activity was detected at the Novoveská Huta site – almost by one third for major radon risk assessment parameters. Only the Hnilec site in the extreme radon risk group showed increased values of volume radon activity in soil. In the area of tectonically damaged site of Grajnár, the measurements of radon volume activity were conducted in soil air. Sampling and radon measurement in water was carried out at three springs of the Small Carpathian mountains, on the outskirts of Bratislava - Mária spring, Zbojníčka spring, and Himligárka spring, at Bacúch – spring of Božena Němcová, and at Sivá Brada near Spišské Podhradie – spring of St. Ondrej, spring Oravice near the OZ-1 bore hole, and in Zemplín – the Ladmovce bore hole

- preliv. Middle values in Radon concentration for all monitored springs in 2007 are higher than in the previous years. Variations to volume Radon activity at monitored ground water springs are of seasonal character.

In 2007, **monitoring of stability of rock massifs** below historic objects concentrated on the following sites: Spišský, Strečniansky, Oravský, Uhrovský and Lietavský castles, and castle Devín.

Within **stream sediments monitoring** exceeding the C category was detected (exceeding of this limit suggests impact of demolition activities) at Nitra - Chalmová (Hg), Štiavnica - river mouth (Pb), and Hornád - Kolinovce (Hg) sites. Snow solutions of most acidic character (with pH values around 4.4) were detected at the following sites: Starý Hrozenkov, Branisko, Donovaly, and Ľupčianska valley. As for the trace elements content, most prevalent in snow solutions in winter season are aluminium, nickel, and zinc.

Volume activity is shown either by reduced soil volume, known as sagging, or increased volume, known as swelling. In 2007, third phase of registration of impaired objects in the Východoslovenská lowland was carried out. Of total number of 950 registered objects in 71 municipalities, 16 most impaired objects were selected in 9 municipalities.

Geothermal energy

Regional **geothermal survey** was conducted in line with the approved Strategy of geothermal energy use in Slovakia by the end of 2007, which involved the following territories: Liptovská basin, Popradská basin, skorušinská plane, sites in Galanta, structures in Ďurkov, Žiarska basin, Hornonitrianská basin, Topoľčany záliv, and the Humenský ridge. At present, hydrogeothermal assessment of the Rimavská basin is underway.

Register of geological mapping

Registers of geological mapping (as of December 31, 2007)

Registers of	Accumulation in 2007	Total number
Surveyed territories	47	514
Surveyed territories drafts	97	517
Landslides	11	11 406
Wells	3 048	738 205
Hydro-geological wells	333	23 314
Landfills	4	8 454
Map drawing and purpose mapping	81	9 698
Geophysical mapping	178	4 628
Abandoned mining works	7	16 576

Source: SGI DS

Abandoned mining works

Pursuant to **Act No. 44/1988 Coll. on protection and exploitation of mineral deposits (Mining Act),** as amended, MoE SR also ensures searching for abandoned mining works. The State Geological Institute of Dionýz Štúr in Bratislava was commissioned to maintain the Register.

Abandoned mining works as of December 31, 2007

Type of abandoned mine	Number
Mining shaft	4873
Pit (hole)	517
Chute	65
Cut, excavation	88
Pingo	3 987
Pingo field	109
Pingo draw	128
Dump	6 125
Old randing	205
Sink mark	293
Placer	20
Tailings dump	10
Other	155
Total	**16 576**

Source: SGI DS

Survey territories

Under the geology legislation and pursuant to the GS SR status - the GEOFOND department keeps the register of survey areas for selected geological activities. In 2007, there were 47 survey areas and 85 registered proposals to designate a survey area. As of December 31, 2007, there were 132 recognised areas.

Overview of deposits in Slovakia

Energy deposits (state to the date 31st December 2007)

Source: SGI DS

Raw material	Number of deposits included into balance	Number of free balance deposits	Number of deposits for mining	Unit	Balance deposits free	Geological deposits
Anthracite	1	1	0	thous. t	2 008	8 006
Bitumen sediments	1	1	0	thous. t	9 780	10 797
Brown coal	11	6	4	thous. t	141 601	464 718
Flammable natural gas – gasoline gas	8	6	1	thous. t	201	398
Lignite	8	3	1	thous. t	112 221	619 790
Non-resinous gases	1	0	0	mil. m^3	0	6 380
Underground stores of natural gas	8	0	1	mil. m^3	0	1 790
Crude oil non-paraffinic	3	3	0	thous. t	1 632	3 422
Crude oil - semi-paraffinic	8	4	4	thous. t	140	6 413
Uranium ores	2	1	0	thous. t	1 396	5 272
Natural gas	39	22	14	mil. m^3	8 744	26 591
Total	**90**	**46**	**25**		**277 716**	**1 153 577**

Ore deposits (state to the date 31st December 2007)

Type of ore	Number of deposits included into balance	Number of free balance deposits	Number of deposits for mining in 2005	Unit	Balance deposits free	Geological deposits
Sb ores	9	1	0	thous. t	85	3 276
Complex Fe ores	7	2	0	thous. t	5 751	57 762
Cu ores	10	0	0	thous. t	0	43 916
Hg ores	1	0	0	thous. t	0	2 426
Poly-metallic ores	4	1	0	thous. t	1 623	23 671
Wolfram ores	1	0	0	thous. t	0	2 846
Gold and silver ores	11	4	1	thous. t	26 450	31 930
Fe ores	2	2	1	thous. t	15 049	19 316
Total	**45**	**10**	**2**		**49 848**	**185 143**

Source: SGI DS

Non-metallics deposits (state to the date 31st December 2007)

Source: SGI DS

Raw material	Number of deposits included into balance	Number of free balance deposits	Number of deposits for mining	Unit	Balance deposits free	Geological deposits
Anhydride	7	6	2	thous. t	806 380	1 250 410
Asbestos and aspestos rock	4	1	0	thous. t	1 808	26 905
Baryte	6	2	2	thous. t	9 233	12 683
Bentonite	23	17	8	thous. t	29 182	42 462
Cast basalt	5	5	3	thous. t	22 837	40 012
Decorative rock	23	20	3	thous. m3	22 196	27 754
Diatomite	3	2	0	thous. t	6 556	8 436
Dolomite	20	20	9	thous. t	609 303	635 770
Precious stones	1	1	0	ct	1 205 168	2 515 866
Graphite	1	0	0	thous. t	0	294
Halloysite	1	0	0	thous. t	0	2 249
Rock salt	4	4	1	thous. t	839 218	1 350 200
Kaolin	14	13	3	thous. t	54 554	59 836
Ceramic clays	38	35	4	thous. t	117 897	192 780
Quartz	7	7	0	thous. t	310	327
Quartzite	15	13	1	thous. t	18 351	26 950
Magnesite	11	6	3	thous. t	750 396	1 164 338
Talc	6	3	0	thous. t	93 709	242 273
Mineralized I - Br waters	2	1	0	thous. m3	3 658	3 658
Pearl stone	5	5	1	thous. t	30 244	30 564
Pyrite	3	0	0	thous. t	0	18 717
Gypsum	6	5	3	thous. t	62 733	93 493
Sialitic raw material	5	5	2	thous. t	109 456	122 819
Glass sands	4	4	2	thous. t	411 424	590 150
Mica	1	1	0	thous. t	14 073	14 073
Building rock	133	128	81	thous. m3	643 071	760 272
Gravel sands and sands	28	26	16	thous. m3	177 914	197 840
Brick clay	42	37	12	thous. m3	111 385	135 579
Techn. usable miner. crystals	3	1	0	thous. t	253	2 103
Limestone – unspecified	30	27	12	thous. t	1 971 214	2 314 973
High-content limestone	10	10	4	thous. t	3 196 102	3 360 024
Zeolite	8	7	2	thous. t	166 097	168 349
Foundry sands	6	6	2	thous. t	106 102	111 326
Refractory clays	14	14	1	thous. t	293 951	508 987
Feldspars	9	6	0	thous. t	3 105	5 487
Total	7	7	0	thous. t	17 658	18 896
	505	**445**	**177**		**11 905 538**	**16 056 855**

Classification of mineral deposits by state of extraction (state to the date 31st December 2007)

Extraction symbol	Characteristics	Number of deposits
1	*Deposits with developed extraction activity* include exclusive mineral deposits sufficiently open and technically apt for extraction of industrial deposit.	**212**
2	*Deposits with fading extraction activity* include extraction mineral deposits where extraction activity will cease in a near future (within 10 years)	**36**
3	*Deposits before completion* include exclusive mineral deposits with documented deposits that give basis to one of the construction phases (starting with the projection phase)	**40**
4	*Deposits with ceased extraction* include exclusive mineral deposits with definitely or temporarily stopped extraction activity.	**99**
5	*Non-extracted deposits* include documented exclusive mineral deposits soon **to be** constructed and extracted.	**60**
6	*Non-extracted deposits* include documented exclusive mineral deposits **with no plans** for their extraction.	**181**
7	*Surveyed deposits* include deposits of exclusive and non-exclusive minerals with various degree of mapping.	**12**

Source: SGI DS

Non-limited mineral deposits (as of December 31, 2007)

Raw material	Number of listed deposit sites	Number of sites with extraction activities
Shale	2	0
Floating sand	1	0
Tailings, waste	7	4
Clays	1	0
Building stone	153	42
Ballast and sand	201	86
Brick raw material	57	1
Tuff	2	0
Dried sludge – brucit	1	1
Total	**425**	**134**

Source: SGI DS

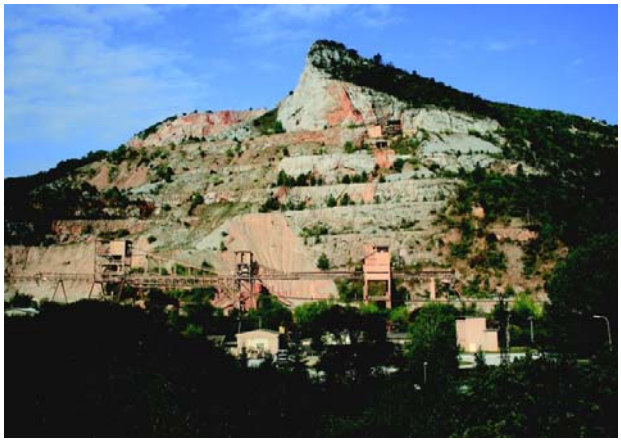
♦ Ground water volumes

Ground waters deposits in the SR (state to the date December 31, 2007)

Category	A	B	C	Total
Efficient deposits of the ground waters (l.s-1)	-	96.06	2 841.10	2 937.16
Efficient amounts of the ground waters (l.s-1)	-	-	9 851.76	9 851.76

Source: SGI DS

Legend:
C calculated on the basis of assessment of the existing hydrogeological mapping
B calculated on the basis of hydrogeological mapping with long-term extraction test
A calculated on the basis of hydrogeological mapping with semi-operational test



The terms sustainable exploitation of the arable land and farming the farmland mean exploitation and protection of the properties and functions of the soil by the means and to the extent, which would keep its biological diversity, fertility, restoration ability and potential to perform all functions.

§ 2 letter e/ of the Act on Protection and Use of Farmland No. 220/2004 Coll., including the change of Act on Integrated Pollution Prevention and Control No. 245/2003 Coll., and on change and amendment of some laws

• SOIL

Land use

♦ **Land Use on the basis of the Land Register's data**

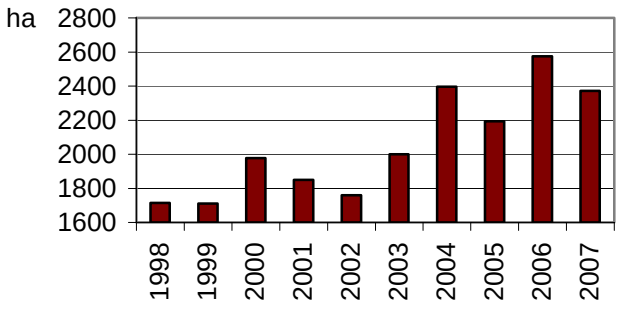
Land Use categories (state to the date 31st December 2007)

Land category	Area (ha)	% of total area
Agricultural land	2 428 899	49.53
Forest land	2 007 142	40.93
Water areas	93 656	1.91
Build-up land	227 931	4.65
Other land	145 945	2.98
Total area	4 903 573	100.00

Source: GCCA SR

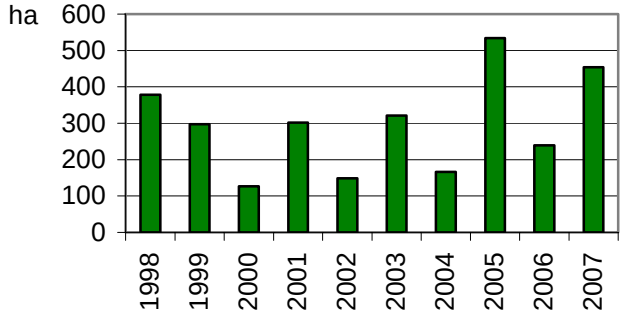
Anthropogenic pressure to use soil for purposes other than its primary production and environmental functions brings about its gradual decrease. In the years 1999-2007, **losses of agricultural soil to construction** grew on the year-year basis, mainly for public, house, and industrial construction purposes (1 398 ha in 2007).

Trend in agricultural soil loss including the losses of arable soil to forestland, non-agricultural and non-forested soil in the SR



Source: GCCA SR

Trend in forestland loss to agricultural soil, non-agricultural and non-forested soil in the SR



Source: GCCA SR

Soil properties

Information on state and trend in agricultural soil properties and their degradation may be obtained from the Partial Monitoring System - Soil (PMS-S) carried out by the Soil Science and Conservation Research Institute (SSCRI) and from the Agrochemical soil testing (AST) carried out by Central Controlling and Testing Institute in Agriculture (CCTIA). Information on state and trend in forest soil properties may be obtained from the Partial Monitoring System – Forests (PMS-F) carried out by the National Forest Centre – Forest Research Institute.

♦ Chemical properties of soil

Soil reaction

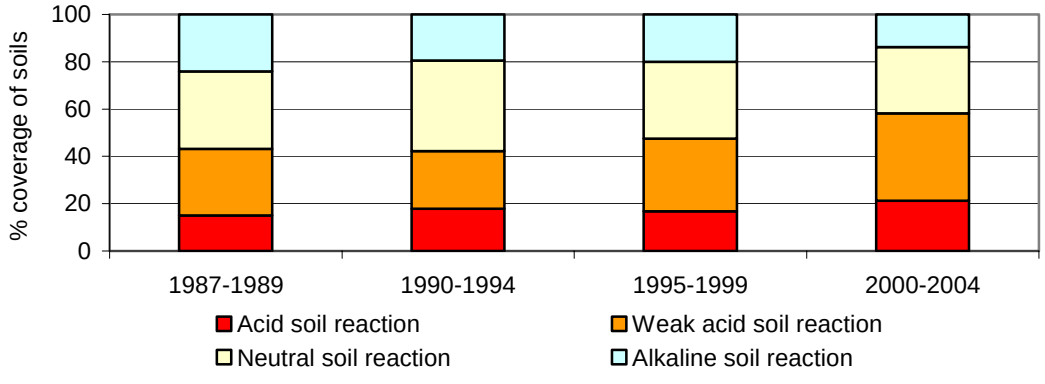
Trend in soil reaction (pH/H_2O) in the A-horizon of agricultural soil in Slovakia, based on the comparison of outcomes from three PMS-S cycles

Main soil unit	1993-1997	1997-2002	2002-2007
Mollic Fluvisols AL	7.29	7.24	7.03
Fluvisols AL	7.13	6.95	6.84
Chernozems AL	7.28	7.31	7.22
Haplic Luvisols AL	6.71	6.85	6.90
Planosols AL	6.66	6.70	6.47
Planosols PG	6.31	6.24	6.13
Rendzic Leptosols AL	7.27	7.25	7.54
Rendzic Leptosols PG	7.17	7.18	6.57
Regosols AL	6.68	6.54	6.95
Cambisols AL	6.56	6.42	6.18
Cambisols PG	5.61	5.56	5.29
Solonchaks and Solonetz PG	8.29	7.88	8.45
Podzols PG	4.21	3.93	3.88

AL – Arable Land, PG – Permanent Grassland Source: SSCRI

Outcomes from agrochemical soil testing for the VIII. (1987-1989) through XI. (2000-2004) cycle show an **increase in the proportion of agricultural soil with acid** (+6.2 %) and **weak acid** (+8.8 %) **soil reaction.** On the other hand, a reduction was seen in the proportion agricultural soil with neutral (-4.7 %) and alkaline (-10.3 %) soil reaction.

Trend in agricultural soil reaction in the SR (in KCl) based on the outcomes from Agrochemical soil testing



Source: CCTIA

Most Slovak forestland is mildly to strongly acidic.

Trend in exchange soil reaction (pH/$CaCl_2$) in forest soil in the SR based on comparison of the PMS-F results

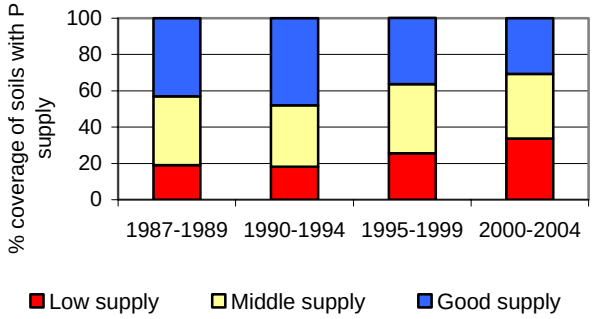
Depth	1988	1993	1998	2006
Upper humic horison	-	4.8	4.7	4.7
0-10 cm	4.2	4.1	4.1	4.1
10-20 cm	-	3.9	4.0	4.0

Source: NFC - FRI

Available nutrients

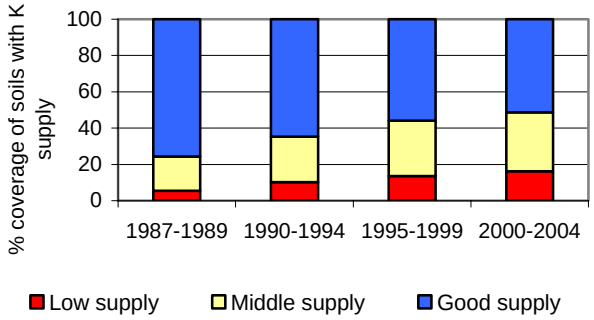
During the period VIII. (1987-1989) through XI. (2000-2004) of Agrochemical soil testing there was an **increase in low supply of all three available nutrients (phosphorus, potassium, and magnesium).** In phosphorus, it was by 14.6 %, by 10.7 % in potassium, and by 5.3 % in magnesium. However; during this period, good supply of all three available nutrients were reduced (by 12.4 % in phosphorus, by 24.2 % in potassium, and by 12 % in magnesium), which, in terms of plant nutrition, is a negative tendency.

Trend in phosphorus content in agricultural soil in the SR based on outcomes of Agrochemical soil testing



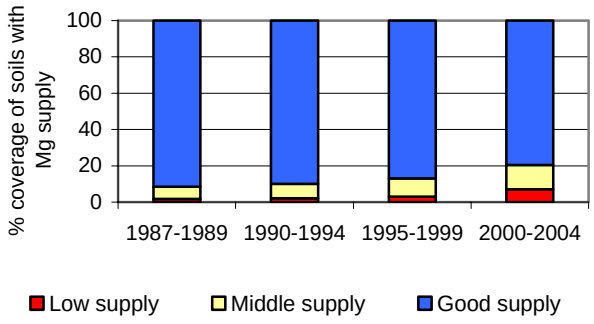
Source: CCTIA

Trend in potassium content in agricultural soil in the SR based on outcomes of Agrochemical soil testing



Source: CCTIA

Trend in magnesium content in agricultural soil in the SR based on outcomes of Agrochemical soil testing



Source: CCTIA

Humus

Trend in humus content in the A-horizon of agricultural soil in the SR, based on the comparison of outcomes from three PMS-S cycles (%)

Main soil unit	1993 - 1997	1997 - 2002	2002 - 2007
Chernozems AL	2.74	2.17	3.12
Mollic Fluvisols AL	3.62	3.10	3.72
Fluvisols AL	2.71	2.24	3.03
Haplic Luvisols AL	2.07	1.72	2.59
Planosols and Luvisols AL	2.05	1.69	2.38
Planosols and Luvisols PG	3.79	3.45	5.12
Cambisols AL	3.05	2.45	3.45
Cambisols PG	5.52	4.14	6.55
Regosols AL	2.07	1.60	2.07
Rendzic Leptosols AL	3.74	2.76	3.14
Rendzic Leptosols PG	5.94	4.32	6.61
Andosols PG	10.91	12.48	16.55
Podzols PG	18.79	20.17	24.79

AL – Arable Land, PG – Permanent Grassland Source: SSCRI

Note: Error in humus setting is app. 10%, i.e. 0.3 % of humus, for this reason, differences lower than 0.3 % may be attributed to analytical setting. In case of permanent grasslands differences between years may be caused by high heterogeneity of humus values between individual sites in the land, especially in case of lands above the upper forest border, and they are not statistically significant.

Changes to values in forest soil humus content in individual extraction cycles are shown in Table.

Trend in humus content in forest soil in the SR based on comparison of the PMS-F results

pth	% of humus		
	1993	1998	2006
Upper humic horizon	51.8	55.3	61.7
0-10 cm	9.55	9.79	8.60
10-20 cm	5.55	6.04	5.27

Source: NFC - FRI

♦ Physical properties of soil

The table shows changes to values of total porosity in the A-horizon of agricultural land during three PMS-S cycles.

Trend in overall porosity in the A-horizon of agricultural soils in the SR, based on the comparison of outcomes from three PMS-S cycles

Main soil unit	Volume %								
	Light soils			Medium heavy soils			Heavy soils		
	1993-97	1997-02	2002-07	1993-97	1997-02	2002-07	1993-97	1997-02	2002-07
Chernozems	-	-	-	51.8	47.3	49.6	45.0	50.7	46.7
Mollic Fluvisols	54.0	46.8	42.3	46.4	49.5	51.4	53.5	48.8	47.3
Fluvisols	45.8	50.3	48.4	47.8	48.4	52.2	47.5	50.8	52.6
Haplic Luvisols	-	-	-	49.8	47.3	48.7	50.5	46.3	51.5
Planosols and Luvisols	-	-	-	46.0	46.8	49.6	50.8	47.6	52.0
Cambisols	32.7	45.5	45.5	40.2	48.3	52.5	51.9	51.6	51.8

Source: SSCRI

Soil degradation

Serious soil degradation includes contamination with heavy metals and organic pollutants, acidification, as well as alkalinization and soil salinization. Recently, soil degradation through desertification grows in significance.

Soil contamination by hazardous substances

Results from the III. cycle of PMS-S with samples extracted in 2002 showed that the contents of the majority of hazardous substances in selected agricultural land of Slovakia are below the limit, especially being the case of arsenic, chromium, copper, nickel, and zinc. In case of cadmium, excessive limit values were recorded only in soils situated in higher altitudes, podzols, andosols, which might relate to remote transfer of emissions (Kobza and coll., 2002).

Hazardous substances (mg.kg^{-1}) in A horizon of selected agricultural soil of the SR (the third PMS-S cycle)

Main soil unit	Hazardous substances in 2 mol.dm^{-3} HNO_3						
	As*	Cd	Cr	Cu	Ni	Pb	Zn
Podzols and Rankers	3.55	0.48	2.24	4.52	0.85	63.61	12.94
Andosols	1.42	0.51	3.32	11.00	1.01	49.72	33.44
Regosols	0.65	0.17	3.31	8.38	1.84	5.31	9.34
Solonchaks and Solonetz	1.03	0.20	4.24	5.84	4.33	11.71	9.49
Cambisols	1.89	0.25	3.08	10.20	3.07	18.88	11.92
Rendzic leptosols	0.69	0.38	3.50	9.10	5.15	20.40	21.55
Mollic Fluvisols	1.45	0.22	3.55	13.05	5.95	16.10	15.55
Planosols and Luvisols	1.73	0.18	2.76	6.99	2.76	5.53	9.88
Planosols	1.70	0.22	2.59	5.59	1.67	16.09	9.16
Haplic Luvisols	1.13	0.14	2.94	10.16	4.8	11.55	9.73
Chernozems	1.11	0.15	2.49	11.49	7.11	11.86	8.92
Fluvisols and Gleyic Fluvisols	3.51	0.25	3.88	15.87	7.47	17.16	20.23
Fluvisols, Gleyic Fluvisols and Gley	2.42	0.63	5.76	16.27	6.35	57.45	41.7

*in 2M HCl

Source: SSCRI

Contents of contaminants in soil in selected cadastre areas are monitored under the Spatial Soil Contamination Survey (PPKP). Within the SSCS 2005, 861 soil samples from 71 agricultural companies were analysed for heavy metal contents. The analysed 861 soil samples represent the area of 3 6345.8 ha in the number of 861 hunts. The mentioned control area showed 1 436.0 ha over the limit, which are 42 hunts.

Overview of controlled areas, number of plots, parameters in SSCS 2005 – sampling year 2004

Name of district	Controlled plots		Parameter	Limit exceeding plots		Limit exceeding parameters
	ha	number		ha	number	
Malacky	1429.0	43	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Pezinok	33.0	6	Pb, Cd, Cr,Ni, Hg, As, Zn	-	-	-
Senec	1 634.0	33	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Galanta	1 191.0	13	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Hlohovec	720.0	15	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Piešťany	153.0	11	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Senica	681.0	19	Pb, Cd, Cr,Ni, Hg, As	56.0	2	Cd, Pb
Bánovce nad Bebravou	1 657.0	53	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Ilava	282.0	8	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Nové Mesto nad Váhom	392.0	13	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Prievidza	760.5	20	Pb, Cd, Cr,Ni, Hg, As, Zn	145.0	5	As
Trenčín	202.0	13	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Komárno	808.0	16	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Levice	613.0	15	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Nitra	1 180.0	17	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Nové Zámky	594.0	14	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Zlaté Moravce	1307.0	20	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Čadca	312.0	17	Pb, Cd, Cr,Ni, Hg, As	12.0	1	Cd
Dolný Kubín	206.2	14	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Liptovský Mikuláš	1 244.0	36	Pb, Cd, Cr,Ni, Hg, As	199.0	6	As, Cd, Cr,
Martin	852.0	38	Pb, Cd, Cr,Ni, Hg, As	51.0	2	Cd-
Ružomberok	306.0	17	Pb, Cd, Cr,Ni, Hg, As	47.0	2	Cd, Ni
Tvrdošín	598.0	21	Pb, Cd, Cr,Ni, Hg, As	93.0	5	Cd
Banská Bystrica	43.0	4	Pb, Cd, Cr,Ni, Hg, As	12.0	2	Cd, Pb
Brezno	99.0	5	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Detva	457.0	18	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Krupina	1 026.8	29	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Lučenec	1 572.7	41	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Revúca	101.1	3	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Rimavská Sobota	704.3	18	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Veľký Krtíš	262.2	9	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Zvolen	417.0	19	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Bardejov	541.0	10	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Humenné	138.0	5	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Levoča	597.0	15	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Medzilaborce	448.0	10	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Poprad	134.0	5	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Prešov	1 679.0	36	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Stará Ľubovňa	489.0	7	Pb, Cd, Cr,Ni, Hg, As	255.0	3	Cd
Stropkov	303.0	12	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Svidník	459.0	13	Pb, Cd, Cr,Ni, Hg, As	41.0	1	Cd
Vranov nad Topľou	855.0	14	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Košice-okolie	3 501.0	35	Pb, Cd, Cr,Ni, Hg, As	130.0	1	Hg
Michalovce	1 677.0	24	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Rožňava	717.0	17	Pb, Cd, Cr,Ni, Hg, As	165.0	7	Hg
Sobrance	2 217.0	24	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Spišská Nová Ves	230.0	5	Pb, Cd, Cr,Ni, Hg, As	230.0	5	Hg
Trebišov	523.0	11	Pb, Cd, Cr,Ni, Hg, As	-	-	-
Total	**36 345.8**	**861**		**1 436.0**	**42**	

Source: CCTIA

In case of forest soil, the most significant effect of their anthropogenic contamination involves accumulation of contaminants in upper humic horizon.

Content of risk elements in upper humic horizon of forest soil determined in aqua regia

Risk element		1993	1998	2006
Lead	Mean	61.8	38.4	30.5
	Maximum	300.4	234.8	180.5
Zinc	Mean	131.6	104.2	83.3
	Maximum	401.0	357.2	258.4
Copper	Mean	24.4	20.9	15.3
	Maximum	299.0	240.3	140.7
Cadmium	Mean	1.13	1.01	0.64
	Maximum	2.99	2.51	1.56

Source: NFC - FRI

Average content of polycyclic aromatic hydrocarbons (PAH) in agricultural soils of the SR in the I. monitoring cycle was around 200 $\mu g.kg^{-1}$, which represents **reference values.** Values beyond 1000 $\mu g.kg^{-1}$ were only of local character (Žiar nad Hronom, Strážske, Danube and Morava river flats).

In the III. monitoring cycle covering 274 agricultural hunts with the size of 15 802 ha, **no excessive limit pollutants (PAU, PCB, chlorinated hydrocarbons) were found in the monitored hunts.**

♦ Physical degradation

Erosion and soil compaction belong among the major phenomena of physical degradation in Slovakia.

Soil erosion

Water erosion is prevalent in Slovakia.

Agricultural land endangered by erosion in the SR

Erosion categories	Water erosion		Wind erosion	
	Land area in ha	% from Agricultural Land	Land area in ha	% from Agricultural Land
No erosion or slightly	1 378 697	56.7	2 277 268	93.6
Medium	227 392	9.3	75 422	3.1
Strong	332 519	13.7	48 660	2.0
Extremely strong	494 371	20.3	31 629	1.3
Total	2 432 979	100	2 432 979	100

Source: SSCRI

Soil compaction

Based on the results of the PMS-S for the years 1993-2002, there was an improving tendency in physical soil properties. This also suggests less dramatic compaction of heavy and medium heavy arable soil types. In case of subsoil, greater proportion of compacted sites was found. Heavy soil types show higher rate of compaction over the whole soil profile.

Desertification

Methodologically, recent soil monitoring process has shown the solution in its initial phase. Slightly observable phenomena have so far been recorded mainly in the south of Slovakia, in some monitored sites.

Application of the sewage sludge and bottom sediments into the soil

Aplying the sewage sludge from waste water treatment plant to agricultural soil and forestland follows the provisions of the SR National Council **Act 188/2003 Coll. on application of sewage sludge and river bed sediments to soil**, **and on amendment to Act 223/2001 Coll. on waste and amendments to certain laws as amended.**

In 2006, the overall sludge production in the SR was 55 305 tons of dry matter. Of this volume, 42 315 tons (76.5 %) were used in soil processes, 9 400 tones were temporarily stored (17.0 %), and 3 590 tons (6.5 %) were landfilled. In 2007, there was **no direct application of waste water treatment sludge into agricultural soil**. 37 220 tons of sludge dry matter was used for compost production, while 5 095 tons of sludge dry matter were used for soil processes (reclamation of landfills, areas, etc.).

*Everybody, while performing an activity, which could endanger, harm or destroy **plants or animals,** or their biotopes, are obliged proceed so that there is no pointless death loss or damage and destruction.*

§ 4 par. 1 of the Act No. 543/2002 Coll. on Nature and Landscape Protection as subsequently amended

• FLORA AND FAUNA

Flora

♦ Endangerment of plant taxons

State of endangered individual plant taxons has been elaborated pursuant to the relevant red lists. Complete *Red list of plants and animals of Slovakia* (In: Ochrana prírody /Nature protection/ vol. 20) was created in 2001.

State of endangerment of plant taxons in 2007

Group	Total number of taxons		Endangered (IUCN cat.)						Ed
	World (global estimation)	Slovakia	EX	CR	EN	VU	LR	DD	
Cyanophytes and Algae	50 000	3 008	-	7	80	196	-	-	-
Lower fungi	80 000	1 295	-	-	-	-	-	-	-
Higher fungi	20 000	2 469	5	7	39	49	87	90	-
Lichens	20 000	1 585	88	140	48	169	114	14	-
Bryophytes	20 000	909	26	95	104	112	85	74	2
Vascular plants	250 000	3 352	77	266	320	430	285	50	220

Source: SNC SR

Legend:
Ed – endemic species

IUCN categories of endangerment:
EX – extinct
CR – critically endangered
EN – endangered
VU – vulnerable
LR – less endangered
DD – data deficient

The basic **reason** of plants endangerment is especially **the destruction of the sites. The most endangered habitats** in Slovakia include: inland salt marshes and salt meadows, Carpathian travertine salt lakes, inland Pannonic sand dunes, alpine and sub-alpine grassland, alpine snow beds, xeric grassland and scrub vegetation on calcareous substrate with species of the *Orchideacae* family, active raised bogs, transition

mires and quaking bogs, Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae,* alkaline fens, petrifying springs with tufa formation.

Comparison of the vascular plant endangerment* in selected countries

	Slovakia	Austria	Hungary	Poland	Czech Rep.
Vascular plants (%)	30.3	33.4	19.8	11.2	42.5

Source: OECD

* Among "endangered" taxons are those taxons classified under categories: CR, EN, and VU under IUCN.
Czech Rep.: Data include extinct species.

♦ **Protection of plant taxons**

Protection of plant taxons is in the presence regulated by the **Resolution of MoE SR No. 24/2003 Coll.** to the *Act on Nature and Landscape Protection No. 543/2002 Coll.* as amended by Resolution 638/2007 Coll. Number of the **state protected taxons** is now **1 418** (vascular plants – 1 285; bryophytes – 47; higher fungi – 70; lichens – 17). There are **823 taxons** occurring in Slovakia (vascular plants – 713, bryophytes – 23, higher fungi – 70, lichens – 17).

Wild-growing plant taxons in Slovakia protected by international conventions and EU regulations (2007)

	Cyanophytes and Algae	Fungi	Lichens	Bryophytes	Vascular plants
In attachment II of **Habitats Directive**	-	-	-	9	40
In attachment IV of **Habitats Directive**	-	-	-	-	42
In attachment I and II of **CITES**	-	-	-	-	110
In attachment I of **Bern Convention**	-	-	-	8	34

Source: SNC SR

There were processed and realized **rescue programmes** for the following species of vascular plants:

Rescue programmes (RP)	Vascular plants species
Processed in 2007	There wasn´t processed RP in 2007.
Realized in 2007	There were realized RP for the following species in 2007: *Orchis coriophora subsp. coriophora, Ophrys holubyana, Drosera anglica, Rhynchosphora alba, Scheuchzeria palustris, Lycopodiella inundata, Pulsatilla zimmermannii, Pulsatilla pratensis subsp. flavescens, Orchis palustris, Orchis elegans, Anacamptis pyramidalis, Carex chordorhiza, Carex pulicaris, Glaux maritima*

Source: SNC SR

Actual problem endangering the diversity of plant species in last years has been becoming **invasive species**. In 2007, **elimination** of invasive plant species was carried out at 50 sites in protected areas of the size of almost 50 ha. This activity followed up on the measures implemented also in the previous years. 14 species

of introduced and invasive plant species were thus eliminated. Outside the protected areas, eliminated were 7 species of invasive plants at 73 sites of the size of 76 ha.

There was observed approximately **175 allochtonous species** of plants in Slovakia, whereof in the presence about **20** species behaves as invasive ones. **The most spread** invasive plant species in our country are *Fallopia japonica, Helianthus tuberosus, Heracleum mantegazzianum, Impatiens parviflora, Solidago canadensis, Fallopia sachalinensis, Impatiens glandulifera, Solidago gigantea, Aster novi-belgii, Aster lanceolatus, Robinia pseudoacacia, Ailanthus altissima, Rudbeckia laciniata.*

Fauna

- **Endangerment of animal species**

State of endangered individual animal taxons has been elaborated pursuant to the relevant red lists.

State of endangerment of the particular invertebrate taxons in 2007

Taxons	Number of taxons		Categories of endangerment (IUCN)							Endangerment total	Endang. %
Group	World	SR	EX	CR	EN	VU	LR	DD	NE		
Mollusca	128 000	277	2	26	22	33	45	8	135	136*	49.1
Aranea	30 000	934	16	73	90	101	97	45	-	422	45.2
Ephemers	2 000	132	-	8	17	16	-	-	-	41	31.1
Odonata	5 667	75	4	-	14	11	13	5	-	47	62.7
Orthoptera	15 000	118	-	6	7	10	20	10	-	53	44.9
Heteroptera	30 000	801	-	14	7	6	4	-	-	31	3.9
Coleoptera	350 000	6 498	2	15	128	490	81	2	-	718	11.1
Hymenoptera	250 000	5 779	-	23	59	203	16	-	-	301	5.2
Lepidoptera	100 000	3 500	6	21	15	41	17	11	-	111	3.2
Diptera	150 000	5 975	-	5	10	71	19	93	-	198	3.3

Source: SNC SR

* without the category of NE

State of endangerment of the particular vertebrate taxons in 2007

Taxons	Number of taxons		Categories of endangerment (IUCN)							Total	%
Group	World [4]	SR	EX	CR	EN	VU	LR	DD	NE		
Lampreys		4	-	4	-	-	-	-	-	4	100.0
Pisces	25 000	79	6	7	8	1	22	2	-	45[1]	57.0
Amphibians	4 950	18	-	-	3	5	10	-	-	18	100.0
Reptiles	7 970	12	-	1	-	4	6	-	-	11	91.6
Birds[2]	9 946	219	2	7	23	19	47	4	19	121	55.3 (35.5[3])
Mammals	4 763	90	2	2	6	12	27	15	4	68	75.6

Source: SNC SR

[1] taxon has two forms listed under two different categories (EX, CR)
[2] only nesting birds – of total number of 341 birds of Slovakia, only the all 219 species of nesting birds were assessed
[3] % of total number of birds 341
[4] Source: UNEP – GBO

IUCN Categories:
EX - extinct taxon
CR - critically endangered taxon
EN - endangered taxon
VU - vulnerable taxon
LR - lower risk taxon
DD - data deficient taxon
NE - non evaluated taxon

Comparison of vertebrates endangerment[1)] in selected countries (%)

	Slovakia	Austria	Hungary	Poland	Czech Rep.	EU*
Invertebrates	5.3	-	> 0.9	5.6	0.3	13.9
Pisces	24.1	41.7	32.1	14.5	29.2	38.1
Amphibians	44.4	100.0	100.0	-	90.0	46.7
Reptiles	38.5	75.0	100.0	33.3	100.0	85.7
Birds	14.4	26.0	18.8	14.5	55.9	100.0
Mammals	22.2	22.0	71.1	15.7	33.3	82.4

Source: OECD

[1)] "endangered" taxons include species under categories: CR, EN, and VU under IUCN
* proportion of globally endangered species according to IUCN, included in the European instruments (EU directives, Bern convention)

Austria) only autochthonous species; invertebrates: insecta, decapoda, mysidacea and mollusca.
Czech Rep.) data refer to autochthonous species and EX including.
Hungary) "Endangered" reptiles and amphibians refer to the protected and highly protected species.

♦ Protection of animal species

Protection of animal species is regulated by the **Resolution of MoE SR No. 24/2003 Coll.**, which implements the *Act on nature and landscape protection No. 543/2002 Coll.* as amended by **Resolution 638/2007 Coll.** The number of **animal taxons under state protection** is now **813 taxons** on the level of species and subspecies and to **12 taxons** on the level of genus.

Animal wildlife in Slovakia protected by international conventions and EU regulations (2007)

	Invertebrates	Pisces	Amphibians	Reptiles	Birds	Mammals
In annex II of **Habitats Directive**	53	23	5	1	-	22
In annex IV of **Habitats Directive**	50	1	10	9	-	46
In annex I of **Birds Directive**	-	-	-	-	74	-
In annexes I and II **of CITES**	2	5	-	-	61	5
In annexes II and III of **Bern Convention**	26	36	11	8	120	26
In annexes II and III of **Bonn Convention**	-	3	-	-	54	-
In annex of **AEWA***	-	-	-	-	122	-

* AEWA – African-Eurasian Migratory Water Bird Agreement
Source: SNC SR

Rescue programmes in 2007 were realized for the following taxons: *Marmota marmota*, *Aquila chrysaetos*, *Aquila pomarina*, *Falco cherrug*, *Falco peregrinus*, *Paranssius apollo* and *Umbra krameri*.

In **breeding** and **rehabilitation stations** operated by the nature and landscape protection organizations (including ZOO Bratislava and ZOO Bojnice) there were **adopted** in 2007 altogether **426** injured individuals or otherwise disabled animals. Back to wild nature there were **released** altogether **191** individuals and there was spent more than 260 thous. SKK.

There was provided **the guarding** of 146 nests of 10 bird of prey species (*Aquila chrysaetos, A. pomarina, A. heliaca, Haliaeetus albicilla, Falco peregrinus, F. vespertinus, Circus aeruginosus, C. pygargus, Pernis apivorus, Milvus milvus*) - information only for the organization organs of SNC SR. There were successfully **brought up 138 nestlings**, which is in average 1 brought up nestlings per nest and there were spent about 215 thous. SKK.

In term of in situ animal preservation in 2007 there were organized **transfers and restitutions** of protected and endangered animals into proper nature biotopes by nature and landscape protection organizations. There were these animals – *Spermophillus citellus, Amphibia, Umbra krameri, Parnassius apollo, Pholidoptera Friwaldskyi* and there was spent altogether 79.1 thous. SKK.

Within the **improvement of nesting and living conditions** of animals, there were realized more than 447 actions, while there was invested more than 550 thous. SKK.

In concern of preventing the collisions of **migrating Amphibians** with the car transport, in 2007, transfers of amphibians were carried out and foil barriers were installed in total length of 18,5 km within the protected areas, as well as in open nature. More than 50 thous. of amphibians were transferred, with app. 50 thous. SKK invested.

- **Game stock and hunting and fishing**

To 31st March 2007, the **spring stock numbers** of the ungulate game species, without Fallow deer species, were higher in comparison to the previous year. Hunting for the rare animal species is strictly regulated.

Spring stock of game and game hunting as of March 31 (pieces)

Species	2004		2005		2006		2007	
	stock	hunting	stock	hunting	stock	hunting	stock	hunting*
Deer	38 264	13 118	39 738	14 030	41 105	12 888	41 287	15 185[1)]
Fallow deer	7 475	2 011	8 425	2 529	8 010	2 208	8 125	2 890[1)]
Roe deer	84 547	20 269	85 124	20 659	87 324	17 313	89 439	22 723[1)]
Wild boar	27 415	23 727	27 116	22 551	27 175	17 820	27 124	25 758[1)]
Brown hare	201 316	31 842	199 226	36 511	208 946	17 560	202 724	39 892[1)]
Grey partridge	18 622	832	17 293	484	15 579	10	13 285	535[1)]
Pheasant	180 105	116 050	181 374	143 373	187 139	110 113	182 287	160 126[1)]
Chamois	522	7	625	12	665	8	645	10[1)]
Bear	1 419	34	1 483	35	1 577	16	1 739	25
Wolf	1 158	86	1 165	74	1 219	91	1 322	123
Otter	315	0	343	0	380	0	480	0

* Actual hunting in numbers, excluding other kills. Source: SO SR

Amount of the fish **caught** in the fish ponds, water dams and water flows for economic and sport purposes achieved **2 871 t** in 2007. The waters were **stocked** by **65 995 735 pieces of setting**.

Fishing for the economic and sport purposes in 2007 (t)

Fish species	2003		2004		2005		2006		2007	
	total	of this SFA*	total	of this SFA*	total	of this SFA*	total	of this SFA*	total	of this SFA*
Fish total Of these:	**2 528**	1 631	**2 783**	1 565	**2 652**	1 663	**2 979**	1 697	**2 871**	1 659
Carp	1 186	1 040	1 360	988	1 281	1 092	1 597	1 169	1 430	1 146
Trouts	743	50	878	52	800	49	837	49	939	54
Crucians	101	71	80	75	76	71	117	71	8	66
White amur	36	34	28	28	33	24	39	33	45	40
Bighead carps	10	4	8	5	12	6	12	4	8	4
Sheat fish	36	35	36	35	37	35	34	33	40	39
Maskalonge	59	56	66	60	74	67	62	60	58	55
Sand-eel	78	78	78	76	83	82	65	64	68	60
Grayling	12	12	9	8	13	7	8	7	12	6
Huchen	1	1	1	1	1	1	1	1	0,2	0,2
Breams	99	98	98	98	106	105	95	94	76	75
Torgoch	1	0	0	0	9	1	2	1	3	1
Chevins	27	27	21	21	16	16	16	16	17	17
Other fish species	139	125	120	117	111	107	94	95	168	96

*SFA – Slovak Fishing Association

Source: SO SR