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.

Reduction in PM and SO_2 emissions at large-size stationary sources in 2007 was caused by ending the operation of several major sources (the Vojany power plant)

♦ **Trend in emissions of nitrogen oxides**

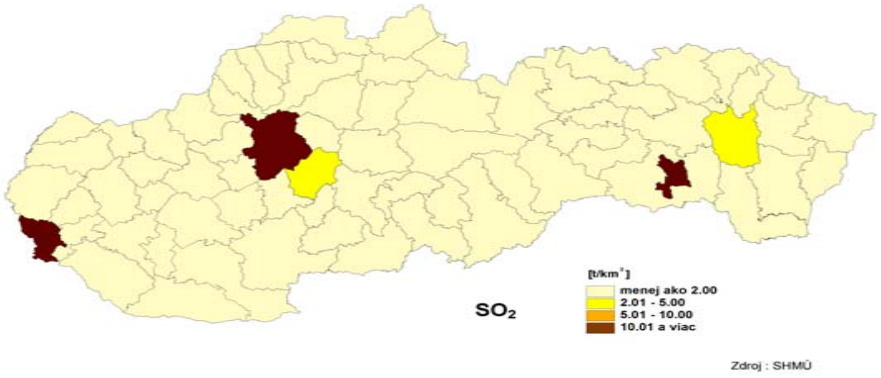
Nitrogen emissions (NO_X) have shown a slight reduction since 1990. Slight increase in emissions in 1995 was related to an increased consumption of natural gas. Decrease in nitrogen oxides in 1996 was

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**

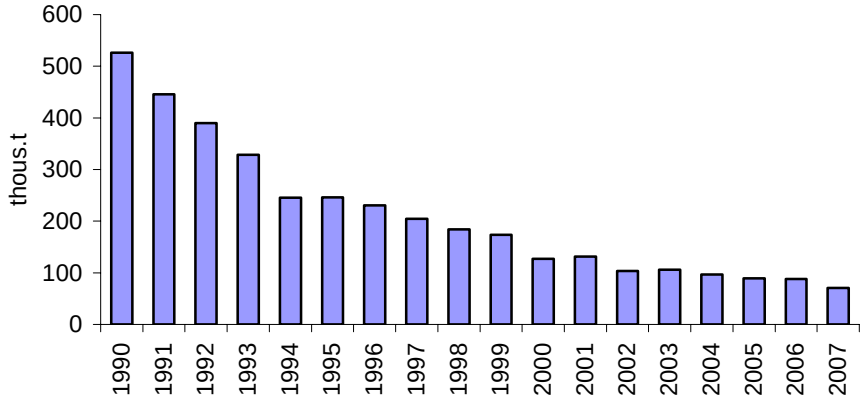
Carbon monoxide emissions (CO) since 1990 have shown a falling tendency, which was caused mainly by reduced consumption and change in fuel composition in the sphere of retail consumers. CO emissions from large sources were decreasing only slightly. The most significant share on CO emissions from large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

Element regional emission of SO_2 in 2007 ($t.km^{-2}$)



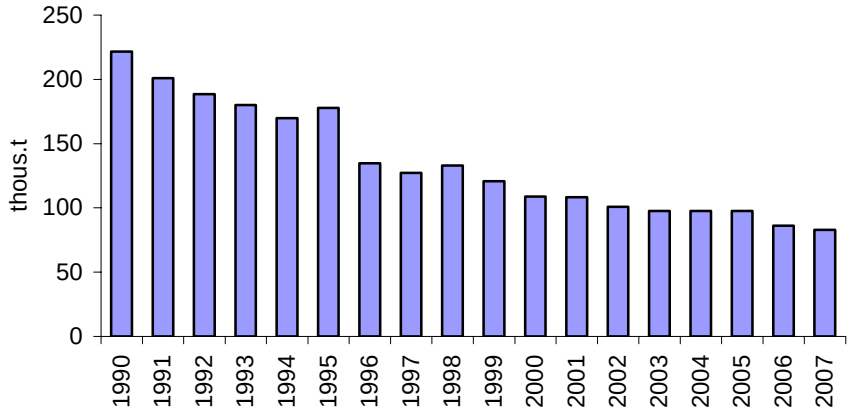
Source: SHMI

Trend in emission of SO_2



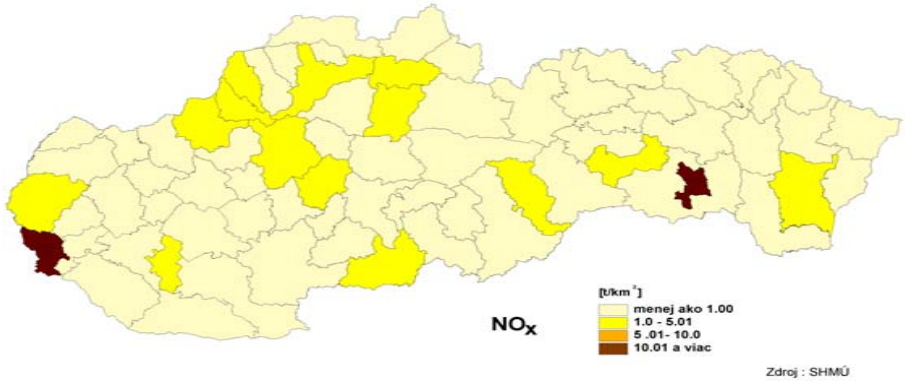
Source: SHMI

Trend in emission of NO_x



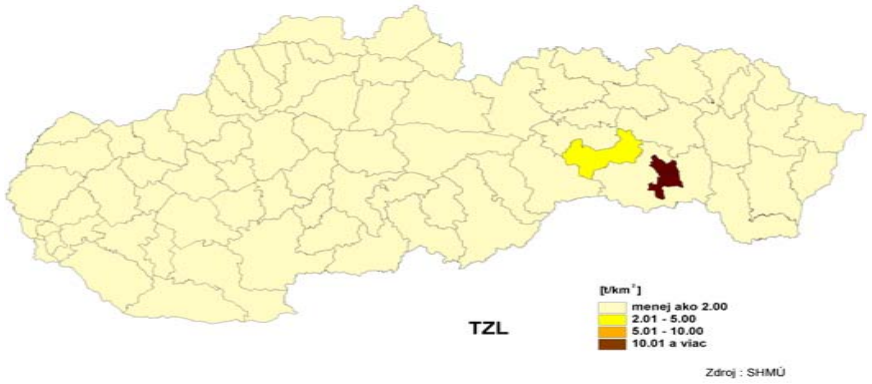
Source: SHMI

Element regional emission of NO_x in 2007 ($t.km^{-2}$)



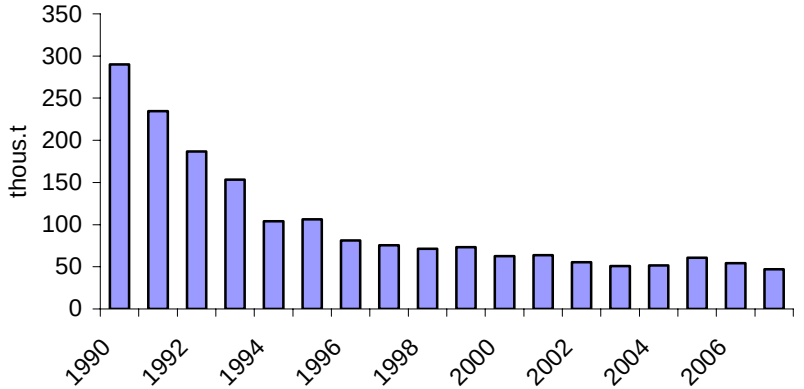
Source: SHMI

Element regional emission of PM in 2007 (t.km^{-2})



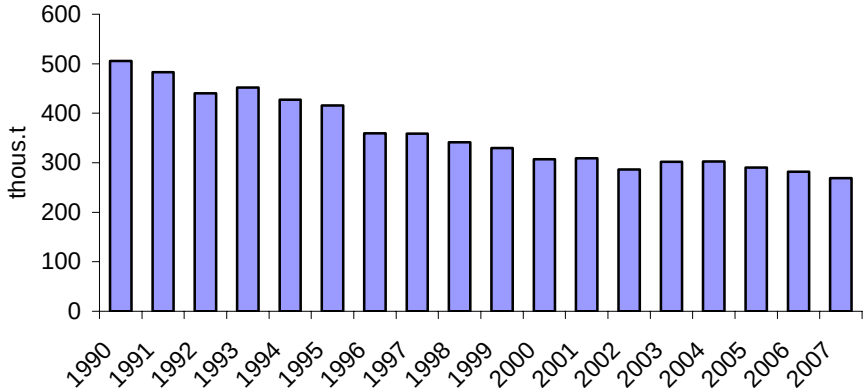
Source: SHMI

Trend in emission of PM



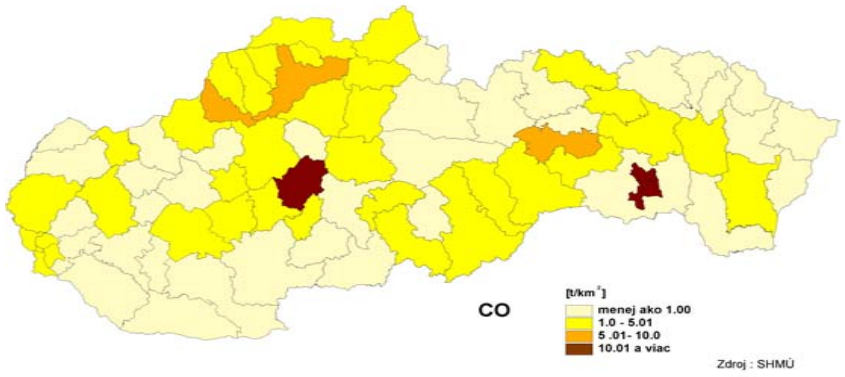
Source: SHMI

Trend in emission of CO



Source: SHMI

Element regional emission of CO in 2007 (t.km^{-2})

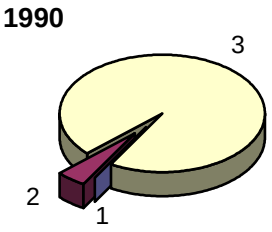


Source: SHMI

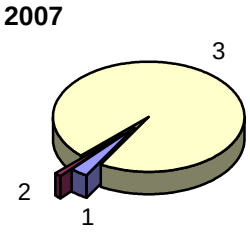
♦ **Balance of ammonia emissions (NH_3)**

Ammonia emissions show a rising tendency mainly due to rising emissions from road transport. Production of the NH_3 emissions in 2007 was 27 234.44 tonnes.

The contribution of the particular sectors in NH_3 emission



0.05 %	1. Transport	2.99 %
4.79 %	2. Industry	1.21 %
95.17 %	3. Agriculture	95.79 %



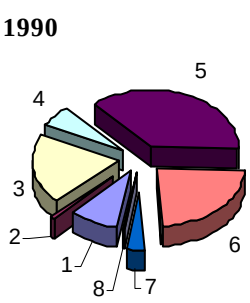
Emissions were stated to the date 31.10.2008 Source: SHMI

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

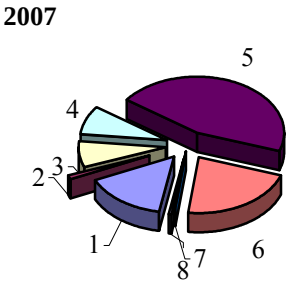
NM VOC emissions show a lasting decreasing trend since 1990. In 2007, volume of **NM VOC** emissions reached the value of 73 994 tons, which is a reduction by 46.4 %, compared to 1990.

Slight increase in emissions in 2003 and 2004 relates to the consumption of fuels in road transport, paint material used mainly in the engineering industry and construction, as well as to the growth in manipulated volumes of fuels in the sector of fuel distribution.

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

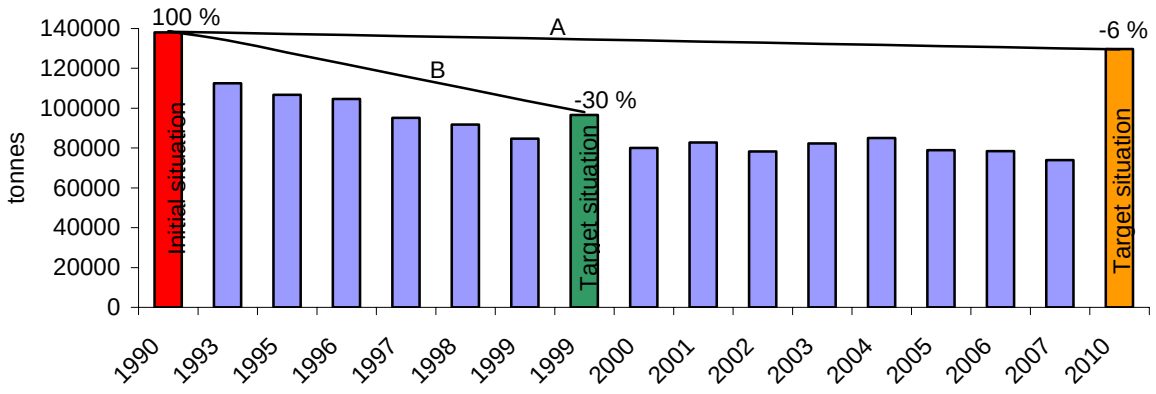


9.1 %	1. Combustion processes	15.2 %
0.8 %	2. Combustion processes in the industry	1.2 %
19.8 %	3. Industrial technologies	7.4 %
6.2 %	4. Mining and distribution of raw materials	8.3 %
37.0 %	5. Using the solvents and other products	45.4 %
23.5 %	6. Transport	21.6 %
3.2 %	7. Waste disposal	0.3 %
0.5 %	8. Agriculture	0.6 %



Emissions were stated to the date 31.10.2008 Source: SHMI

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



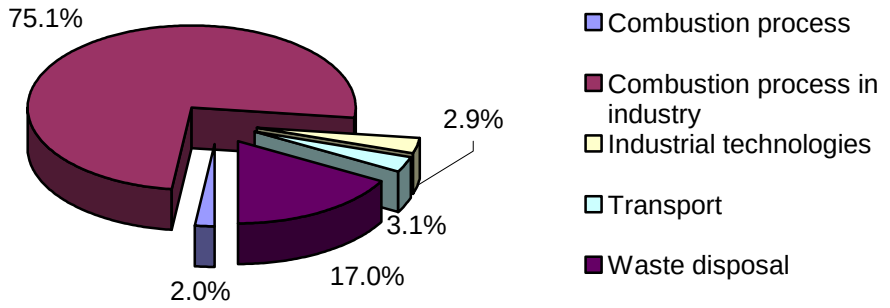
Source: SHMI

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, Cd, Hg, As, Cr, Cu, Ni, Se, Zn, Sn, Mn) have decreased as opposed to 1990. In that year, heavy metal emissions were at the volume of 675.44 tons, while in 2007 it was 269.746 tons, which is a 60 % 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 1996. Since 2004 there has been an increase in Pb emissions as a consequence of increasing production in the areas of ore agglomeration and copper production.

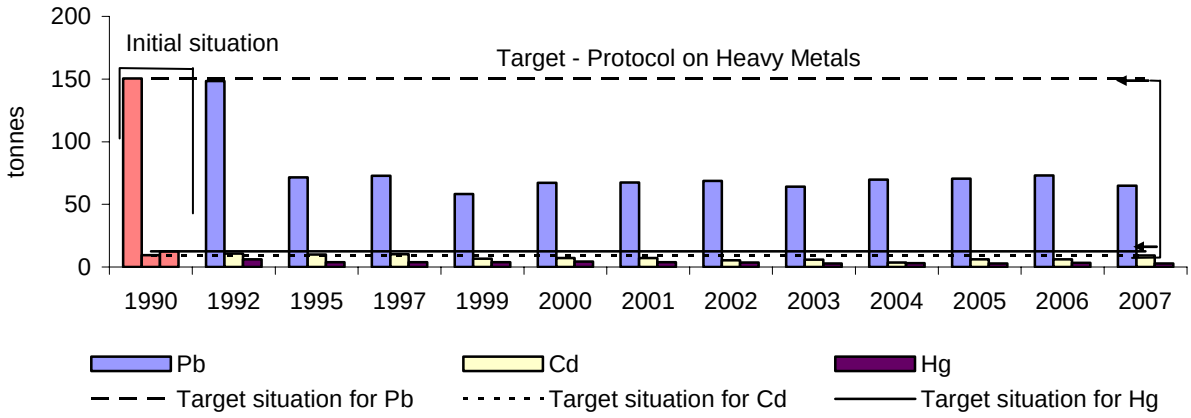
The contribution of the particular sectors in the Pb emission production for year 2007



Emissions were stated to the date 31.10.2008

Source: SHMI

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

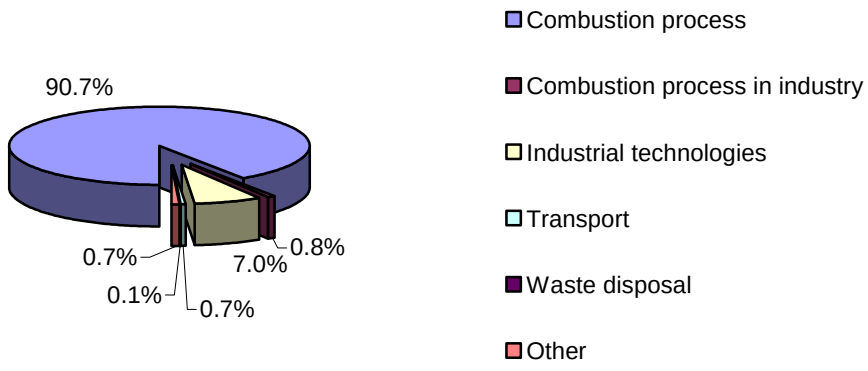


Source: SHMI

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

Slight reduction to the poly-chlorinated dioxin and furan emissions (PCDD/PCDF) in 2007 was caused by reduction in the sector of Incineration processes within industry (mainly agglomeration of ferrous ores) and waste incineration. Slight increase to polychlorinated biphenyl emissions (PCB) and polycyclic aromatic hydrocarbons (PAH) resulted in increase of road transport (increased consumption of diesel), while the slight increase in the emissions of hexachlorbenzene (HCB) was caused by increased production of secondary copper, slight increase of cement production, and increase in road transport compared to 2006.

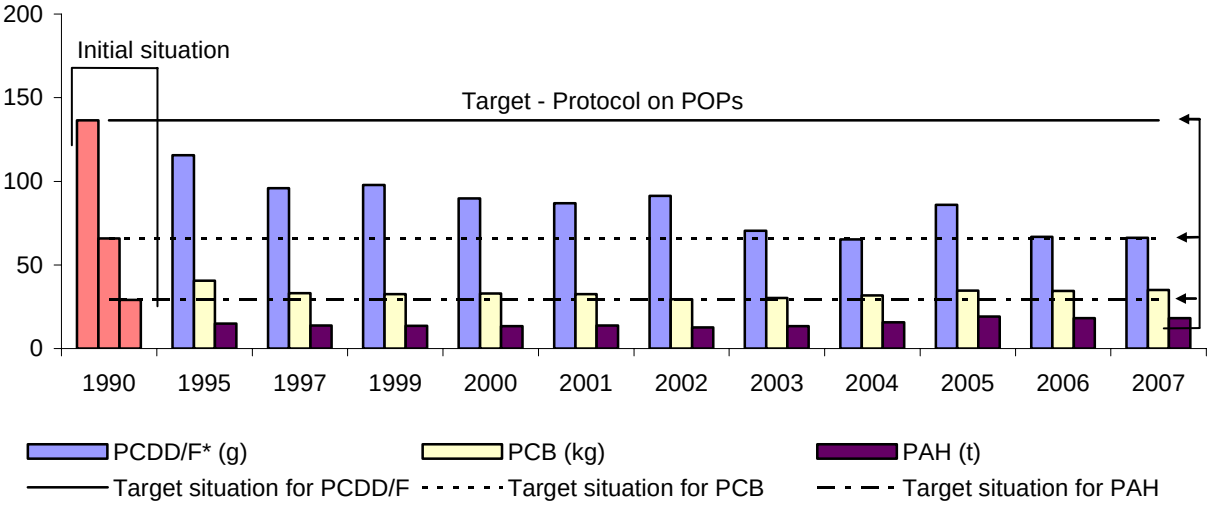
The contribution of the particular sectors in the PAH emission production for year 2007



Emissions were stated to the date 15.2.2009

Source: SHMI

Trend of POPs emissions regarding the fulfilment of the international conventions

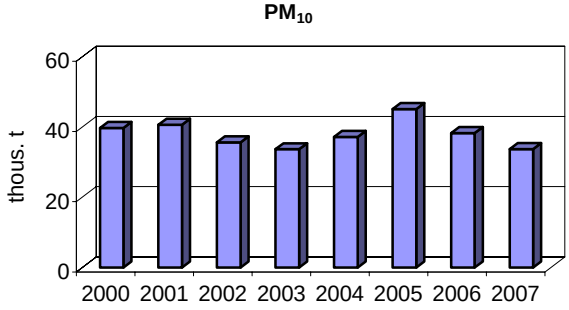


Source: SHMI

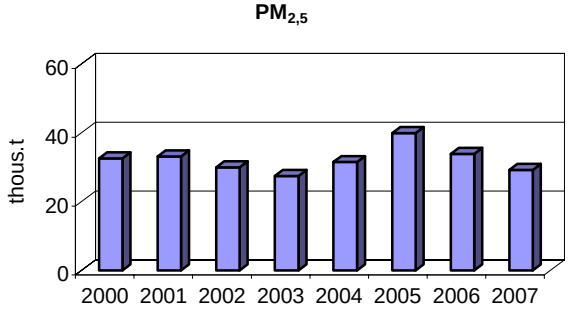
♦ **Assessment of PM_{10}, $PM_{2,5}$ emissions**

Every year, the PM_{10} and $PM_{2,5}$ emissions have been set on the basis of the requirements of the UNECE on Emission Inventory, with the year 2000 being the reference year. Although the PM_{10} and $PM_{2,5}$ emissions are set on the basis of PM emission values under the IIASA methodology (Institute for Applied System Analysis), they are still in line with the EMEP/EEA Guidebook, which adds the topics of abrasion and emissions from diesel engines to the emissions from petrol engines computed through the COPERT IV programme. In the sector of road transport, diesel engines are among the major contributors to the PM_{10} and $PM_{2,5}$ emissions. The share of abrasion is less significant than in the case of the PM emissions. In total, the most significant contributors to the PM_{10} and $PM_{2,5}$ emissions include small sources (heating of houses). Increased emissions in this sector reflects the increased consumption of wood caused by growing prices of natural gas and coal. Significant reduction in emissions in the sector of Incineration processes I is caused by gradual shutdowns of non-ecological sources at the Nováky Power Plant and the Vojany Power Plant of the SE-ENEL Inc. company in line with the valid legislation, which allows for the operation of such installations until 31.12.2008.

Development trends in PM_{10} and $PM_{2,5}$ emissions



Source: SHMI



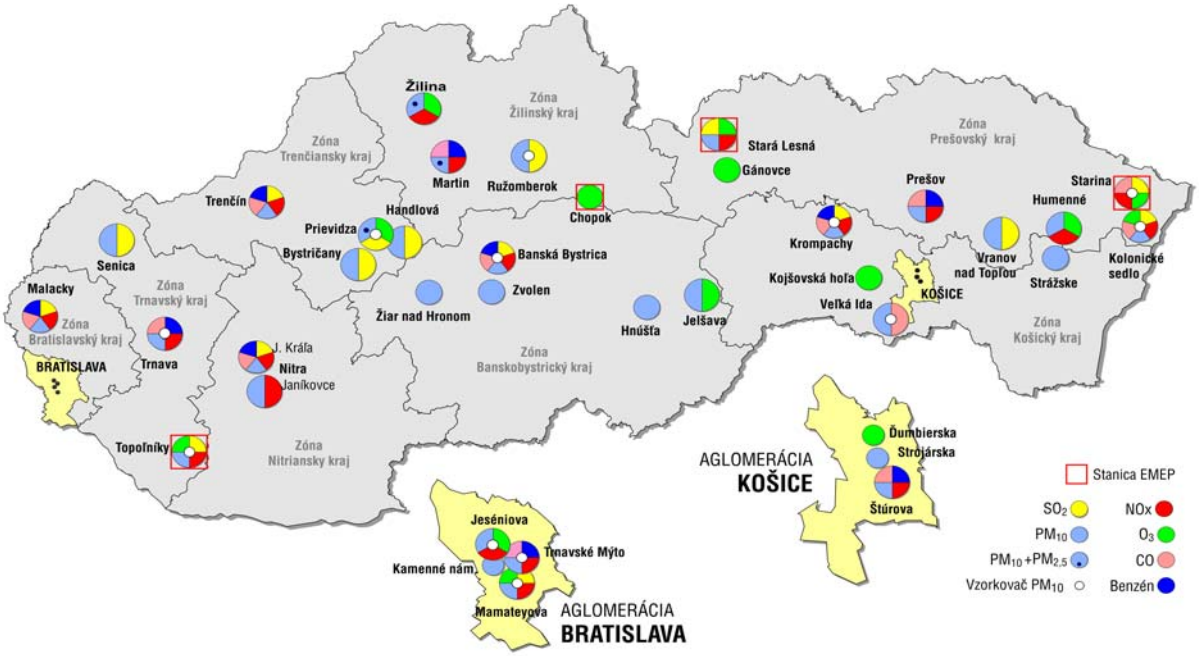
Source: SHMI

Air pollution

- **National monitoring air quality network**

In 2008, the **national air assessment quality monitoring network consisted of 37 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 - 2008



Source: SHMI

- **Local air pollution**

Sulphur dioxide

In 2008, no agglomeration showed exceeded levels of pollution in hourly or daily values beyond the public health limit.

Nitrogen dioxide

The annual limit value for human health protection was exceeded only at the stations of Banská Bystrica - Štefánikovo nábrežie. This value was greater than the limit value increased by the tolerance threshold. Local reconstruction of the sewerage collector was the major contributor to this high value. For the major part of the year, a diesel aggregate used for ground works was located immediately next to the measuring station, with a movement of trucks.

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 2008, there was a drop in the level of pollution by suspended particulate matter PM_{10} as compared to 2007 in the Bratislava agglomeration and the zones of the Trenčín and Žilina regions. On the other hand, increased levels of pollution were detected in the zones of the Trenčín and Trnava regions. In total, the 24-hour limit value was exceeded at 16 stations, with 2 AMS stations also showing the exceeded annual limit value.

Carbon monoxide

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

Benzene

The highest level of 1.5 ug.m^{-3} for benzene in 2008 was detected at the stations of Malacky - Sasinkova, Krompachy - Lorenzova, and Trenčín - Hasičská, which is deep below the limit value of 5 ug.m^{-3} that is to become effective as from 2010.

Pb

The sector of metallurgic industry shows the highest level of air pollution detected at the Krompachy-Lorenzova station, however, all average annual concentrations are substantially smaller than the bottom assessment treshhold.

As, Ni, Cd

There was no occurrence of exceeded target values for any pollutant in 2008.

BaP

The obtained outcomes showed the target value to be reached on 31.12.2010 were exceeded at the stations of Veľká Ida - Letná, Prievidza - Malonecpalská, and Krompachy - Lorenzova.

- **Regional air pollution**

Sulphur dioxide, sulphates

In 2008, regional sulphur dioxide concentrations calculated per sulphur were 0.15 µg.m^{-3} at Chopok, and 0.66 µg.m^{-3} at Starina. The limit value for the protection of ecosystems ***(20 µg SO_2.m^{-3})*** was not exceeded at the mentioned stations even during the winter season ***(Chopok 0.2 µg SO_2.m^{-3} and Starina 2.2 µg SO_2.m^{-3})*** or the calendar year ***(Chopok 0.3 µg SO_2.m^{-3} and Starina 1.3 µg SO_2.m^{-3})***.

Percentage share of sulphates on total particulate matter mass was 19.6 % at Chopok and 17.1 % at Starina. Sulphates to sulphur dioxide concentration ratios expressed in sulphur was 1.5 at Chopok and 1.2 at Starina.

Nitrogen oxides, nitrates

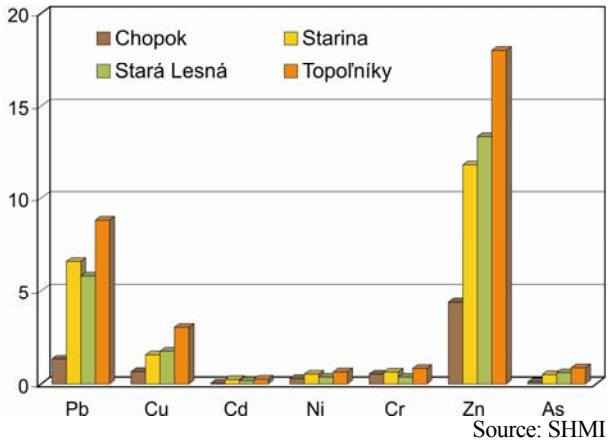
Concentration of nitrogen oxides at regional stations expressed in NO_2-N were in 2008 0.54 µg.m^{-3} at Chopok and 1.27 µg.m^{-3} at Starina. The limit value for the protection of vegetation ***(30 µg NO_X.m^{-3})*** was not exceeded for the calendar year ***(Chopok 1.78 µg NO_X.m^{-3} and Starina 4.19 µg NO_X.m^{-3})***.

Atmospheric **nitrates** at Chopok and at Starina were mostly in the aerosol form. Gaseous nitrates in 2008 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 8.1 % at Chopok and 9.6 % at Starina. Ratio of total nitrates (HNO_3 + NO_3) to NO_X-NO_2, as expressed in nitrogen, was 0.12 at Chopok and 0.25 at Starina.

Atmospheric aerosol, heavy metals

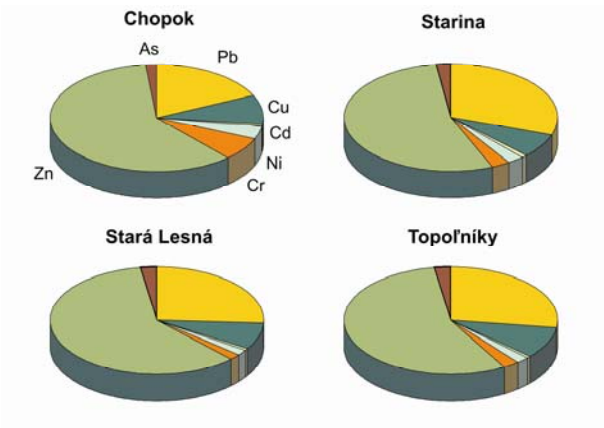
Percentage share of the sum of assessed heavy metals on air-borne dust at regional stations of Slovakia varies between 0.16 and 0.21 %.

Heavy metals in the air - 2008



Source: SHMI

Percentage share of heavy metals in 2008

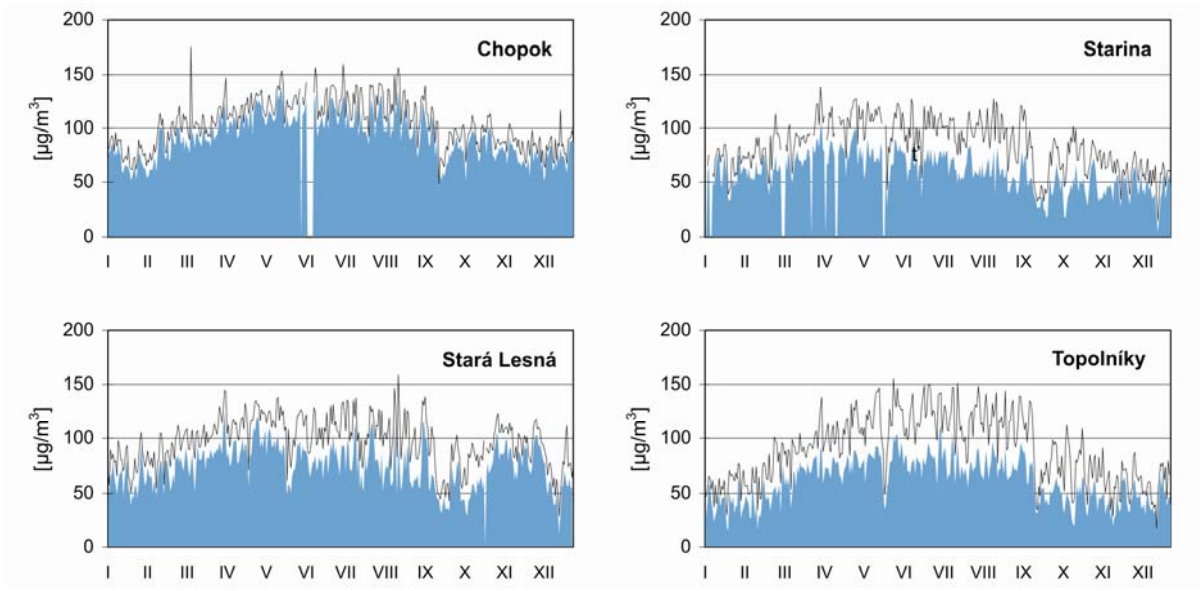


Source: SHMI

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 2008, average ozone concentration at Chopok was 92 µg.m^{-3}, at Stará Lesná 74 µg.m^{-3}, at Topoľníky 60 µg.m^{-3}, and at Starina 59 µg.m^{-3}.

Tropospheric ozone 2008



Source: SHMI

Volatile organic compounds $C_2 – C_6$

Volatile organic compounds $C_2 – C_6$ or the so-called light carbohydrates began to be captured at the Starina station in the Fall of 1994. Starina belongs to the few European stations listed in the EMEP network, with regular monitoring of volatile organic compounds. The compounds are assessed in line with the EMEP methodology under the NILU. 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 2008

ethane	ethene	propane	propene	i-butane	n-butane	acetylene	butene	pentene	i-pentane	n-pentane	isoprene	n-hexane	benzene	toluene	o-xylene
1.708	0.390	0.786	0.073	0.311	0.294	0.564	0.065	0.022	0.160	0.121	0.069	0.045	0.220	0.023	0.214

Source: SHMI

• WATER

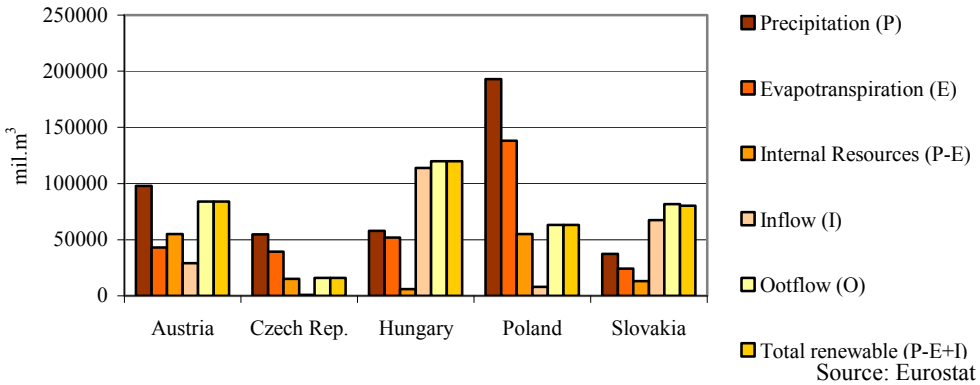
◆ Water management planning and River Basin Management Plans

The Slovak Republic creates and publishes documents required by the Water Act, which include **River Basin Management Plans, Water Management Plan of Slovakia, and International River Basin Management Plans.** Watershed management plans represent binding documents approved by the Ministry of Environment of the Slovak Republic for all who carry out activities within the scope of the Water Act. The Water Management Plan of Slovakia sets out broad responsibilities for protection and improvement of water conditions, and for economical exploitation of the water potential. Water Management Plan of Slovakia is approved by the Slovak Government and serves as the basis for drafting the International Danube River Basin District Management Plan and the International Visla River Basin District Management Plan.

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 2008



Source: Eurostat

Surface water

◆ Precipitation and runoff conditions

Total **atmospheric precipitations** in the Slovak territory in 2008 reached the value of 817 mm, which represents 107 % of the normal level. In terms of precipitations, this year had been considered normal. Total excess of precipitations reached the value of 55 mm.

Characteristics of total precipitation figures for most watersheds were normal, with the exception of partial watersheds of Hron, Bodrog, Poprad, and Dunajec that showed humid precipitation conditions. The only very humid partial watershed was that of the Hornád river.

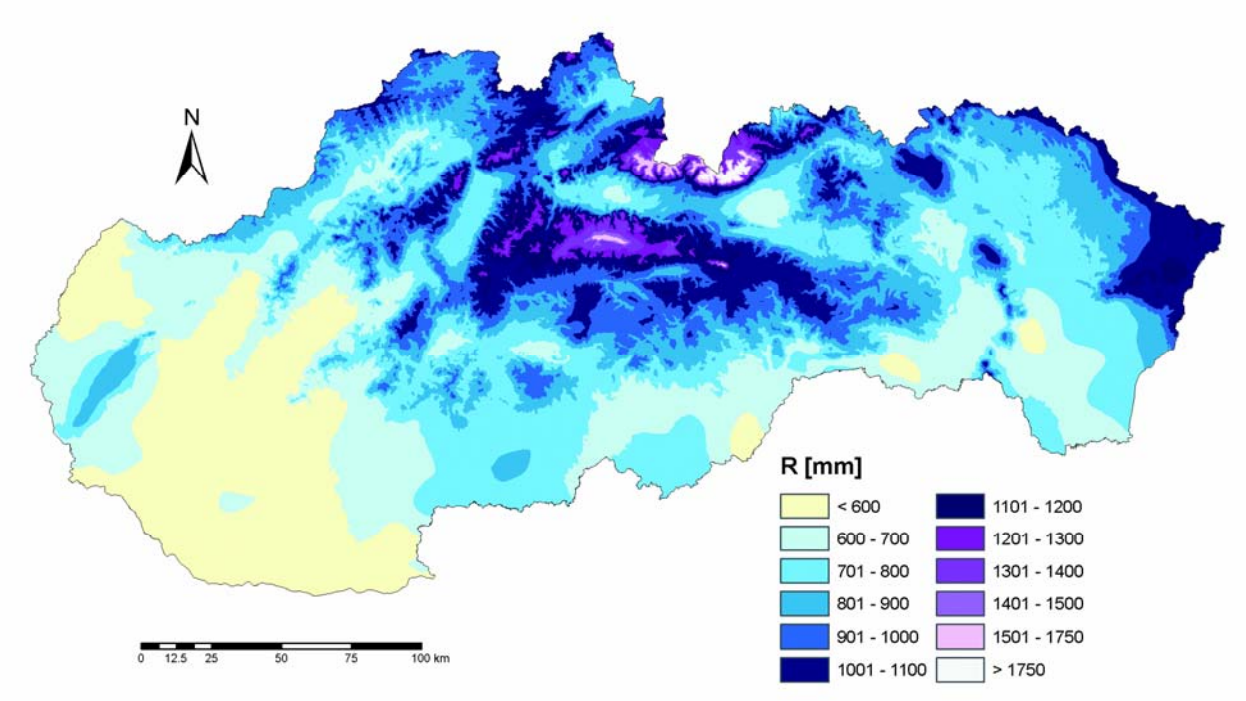
Average rates of precipitation and runoff in particular catchment areas

Catchment area	Dunaj		Váh		Hron			Bodrog a Hornád				SR
Subcatchment area	*Morava	*Dunaj	Váh	Nitra	Hron	*Ipeľ	Slaná	Bodva	Hornád	*Bodrog	*Poprad and 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)	663	600	851	689	872	745	812	737	856	847	981	817
% of normal	97	96	101	99	111	109	103	101	126	120	117	107
Character of rainfall period	N	N	N	N	V	N	N	N	VV	V	V	N
Annual runoff (mm)	94	22	259	105	216	68	140	86	319	219	419	208
% of normal	71	61	83	73	75	50	74	41	72	74	122	79

* 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 2008



Source: SHMI

Annual runoff volumes in SR in 2008 reached 79 % 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 122 %. The remaining catchments showed values within 41 – 83 %.

♦ Water balance

In 2008, there was 69 005 mil.m^3 of water flowing into Slovakia, which is 5 486 m^3 more than in 2007. **Runoff** from the territory has grown by 794 mil.m^3, compared to the previous year.

Total water volume as of 1.1.2008, in water reservoirs was 798 mil.m^3, which represented 69 % of total usable water volume in water reservoirs. As of 01.01.09, total available volume of the assessed accumulation tanks compared to the previous year 2008 dropped to 809.4 mil.m^3, which represents 70 % of total exploitable water.

Total hydrological balance of water resources in the SR

	Volume (mil. m^3)		
	2006	**2007**	**2008**
Hydrological balance:			
Rainfall	36 274	39 460	40 049
Annual inflow to the SR	70 711	63 519	69 005
Annual runoff	85 646	72 593	73 387
Annual runoff from the territory of the SR	14 900	9 264	10 146
Water management balance			
Total abstraction of the surface and ground water in the SR	882.47	480	664.6
Evaporation from water reservoirs and dams	55.79	62	51.9
Discharge into surface waters	669.7	628	608.9
Impact of water reservoirs (WR)	7.8	32	12.6
	improving	**accumulation**	**accumulation**
Total volume in WR as of 1st January of the following year	681.60	798	809.4
% of supply volume in accumulation WR in the SR	59.00	69	70
Rate of water exploitation (%)	6.38	5	6.55

Source: SHMI

♦ Surface water abstraction

Decreasing trend in surface water abstractions with all surface water users continued also in 2008, reaching the value of 312.991 mil.m^3, which is 4.2% lower than in the previous year. This year shows reduced abstractions for all surface water users. Industrial abstractions in 2008 reached 251.797 mil.m^3, which is 14.98 mil.m^3 less than in 2007, e.g. 5.62 %. A slight reduction was recorded also in surface water abstractions for waterlines, which, compared to the previous year, dropped by 1.26 mil.m^3, that is 2.7 %. Surface water abstractions for irrigation grew and reached the value of 9 133 mil.m^3.

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

Year	Public water-supplies	Industry	Irrigation	Other agriculture	Total	Discharging
1998	68.370	621.858	42.447	0.0400	732.707	1 078.500
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
2008*	52.057	251.797	9.133	0.0040	312.991	608.997

*data from database „Aggregate balance sheet of water“ 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.

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.** The basic monitoring network comprised 171 abstraction sites with 35 sites monitored within the water formation characterisation process, 68 within the reference conditions monitoring, 38 were monitored within the boundary water courses, 75 within the process of characterisation of water course types, and 9 abstraction sites were monitored for the ICPDR. (International Committee for the Protection of the Danube River)

Number of assessed surface water abstraction sites in 2007-2008

Catchment	Sampling site	
	Basic	Operational
Danube catchments area	21	10
Váh catchments area	25	52
Hron catchments area	22	35
Bodrog catchments area and Hornád catchments area	28	34
Poprad and Dunajec catchment area	6	5
Total	**102**	**136**

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. Chloroform and the nitrous form of nitrogen were among the often exceeded indicators. Values for faecal streptococci, thermo-tolerant and coliform bacteria as part of the microbiological indicators were frequently exceeded. Tetrachloromethane, 1,1,2-trichloroethylene, cis 1,2 - dichloroethene, and PCB were not assessed, since the detection threshold was greater than the limit defined in the Government Resolution 296/2005 Coll.

♦ **Indicative chemical balance assessment**

Indicative assessment of surface water bodies chemical balance involved the use of all measured data for the priority substances, together with other eight pollutants in surface water included in the SHMI database for 2007. The assessment included 67 abstraction sites classified into 46 water bodies. Of 46 water bodies, 24 are assessed as those with poor chemical balance, and 22 bodies are classified into the category of good chemical balance.

The poor chemical balance category included water bodies mainly due to their exceeded environmental quality norms (ENK) for Bis(2-ethylhexyl)phtalate - DEHP (14-times), PAU (6-times), nonylphenols (2-times), chloroform (6-krát), 1,2 dichloroethene (2-times), lead (2-times), and cadmium (2-times) Among the priority substances, the DEHP indicator most often classified the water bodies as "not reaching good chemical balance". Due to the universal occurrence of this substance, it is necessary to test the potential secondary contamination of the extracted surface water samples, especially at their extraction and transport (these are mainly samples extracted from water bodies in the eastern part of Slovakia)

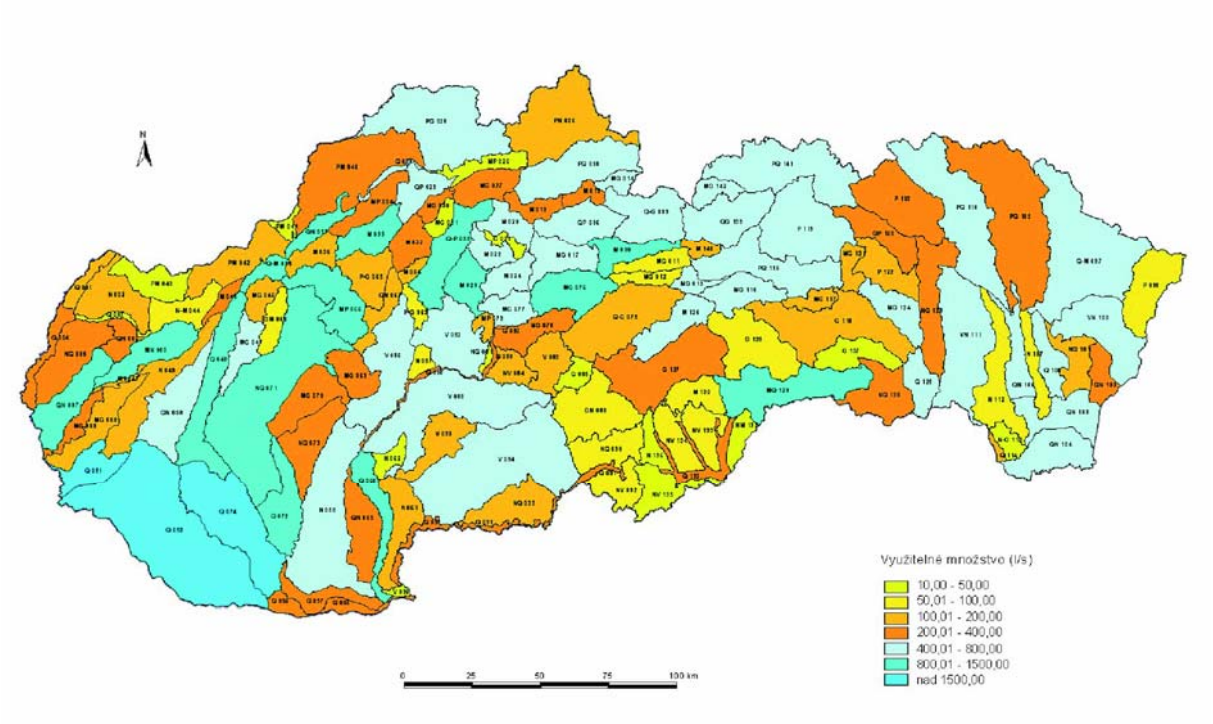
Ground water

♦ **Water resources**

In 2008, based on the hydro-geological assessment and surveys in Slovakia, there were **77 080 l.s^{-1} available groundwater resources**. In comparison with the previous year 2007, there was observed a slight increase of the efficient groundwater volume by 249 l.s^{-1}, i.e. by 0.32 %. In the long-term evaluation, the increase of the efficient volume in comparison with 1990 makes 2 305 l.s^{-1}, i.e. 3.1 %.

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 **2008, out of total number of 141 hydro-geological regions in SR, 123 regions show good balance status, 17 regions show acceptable status and one region show tense status.** Critical and emergency balancing state did not occur in any region.

Efficient groundwater volumes in the hydrogeological regions in 2008 (l.s^{-1})



Source: SHMI

♦ **Groundwater levels**

In 2008, the highest detected ground water levels were found especially in the period of July through October, with apparent influence of above-normal rainfall totals on the rise of ground water levels, reaching the maximum detected annual ground water levels. In the Morava, Nitra, and Hron watersheds, maximum ground water levels are associated with the Spring months of March - May. Minimum ground water levels were mainly recorded in the winter season, in the months of September - December, while springs showed minimal yields in September through October.

♦ **Gabčíkovo interest area**

Rainfall totals for the area of Žitný ostrov in 2008 were slightly higher or equal to the long-term average annual totals. Higher average rainfall totals during the operation period of the VDG were recorded at Veľký Meder and Veľký Blahov. Highest monthly totals were detected everywhere in July, only in the area of Bratislava these totals were highest in June. The latter, together with annual maximum Danube levels caused also the rising ground water levels. The lowest monthly rainfall totals were detected in the whole territory of Žitný ostrov in February.

♦ **Groundwater abstraction**

In 2008 there was being **extracted 11 122 l.s^{-1} of ground water in average** by the users (which are subjects to reporting obligation) in Slovakia that was 14.4 % of the documented efficient volume. During the year 2007 the groundwater extractions slightly decreased by 243.9 l.s^{-1} which means 2.1 % in comparison with year 2007.

Groundwater extraction in 2008 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
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
2008	8 468.82	284.98	823.02	253.29	67.52	271.23	953.23	11 122.09

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:

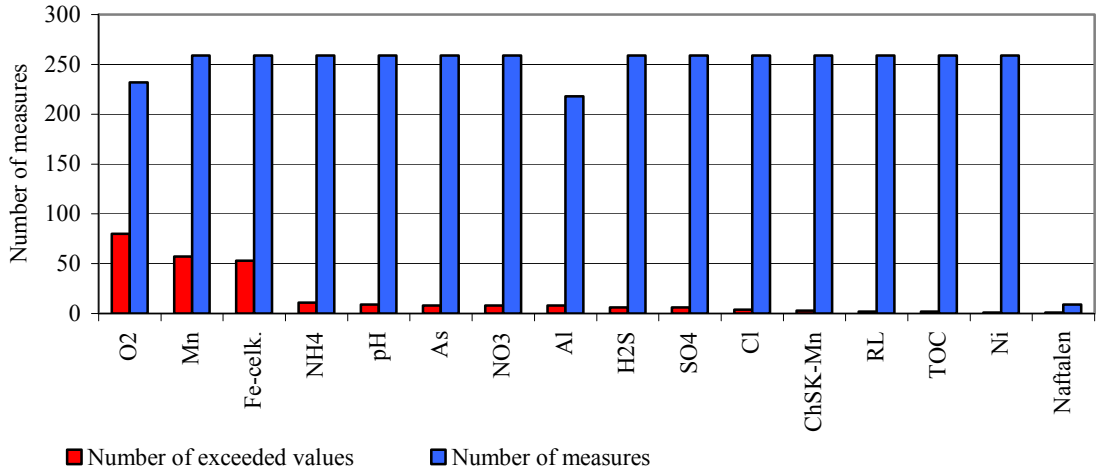
- basic monitoring,
- operation monitoring.

In 2008, ground water quality was monitored at 133 basic monitoring facilities. Ground water samples were extracted 2 times from 40 quaternary objects, 1 times in 49 pre-quaternary objects, and 3 times in 44 pre-quaternary karst objects.

Further, within the operational monitoring conducted for the Slovak territory (with the exception of the Žitný ostrov area) 212 objects were monitored with the assumption to detect a potential penetration of contaminants from a potential contamination source or group into the ground water. Ground water samples were extracted 2 times from 156 quaternary objects, 1 times in 28 pre-quaternary objects, and 3 times in 28 pre-quaternary karst objects.

Adverse **oxidation-reduction** conditions dominate at ground water **basic monitoring** facilities, apparently caused by most frequent occurrences of exceeded acceptable concentrations of total Fe (53 times), Mn (57 times), and NH_4^+ (11 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, COD_{Mn} and H_2S. Most frequently recorded excessive concentrations in **trace elements** included Al (8 times), As (8 times), Pb (3 times), Sb (6 times) and Ni (1 time). Contamination by **specific organic substances** shows only local character and the majority of specific organic substances was recorded below the detection limit.

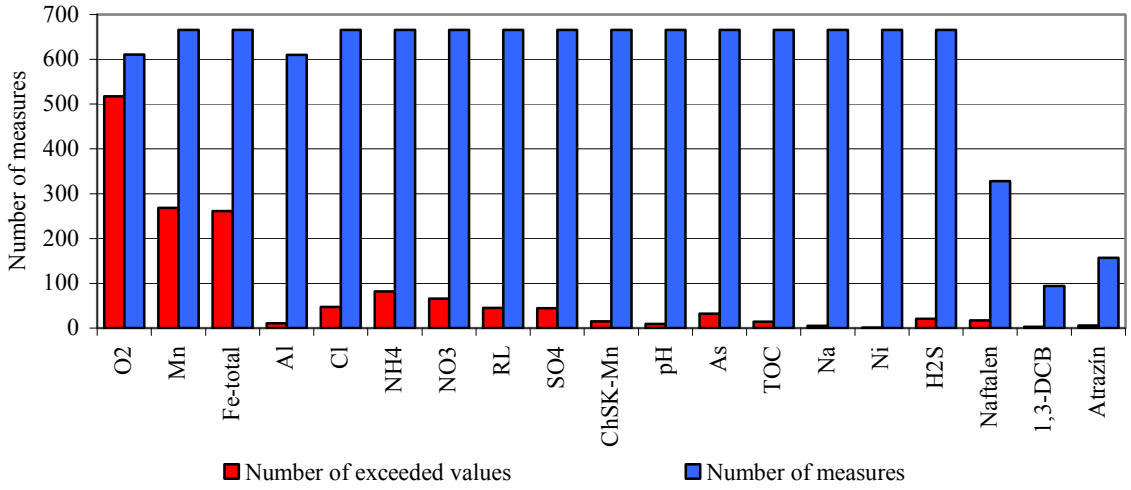
Occurrence of exceeded indicators at basic monitoring facilities pursuant to the SR Government Directive 354/2006 Coll. in 2008



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 15 % 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^+ (82 times) and NO_3^- (66 times) being the most prevalent. In 2008, the acceptable value set by legislation was exceeded in **6 trace elements** (Al, As, Sb, Cd, Ni, and Pb) at operation monitoring facilities. Most frequently recorded increased contents include Al (11 times) and As (32 times). Presence of **specific organic substances** in ground water indicates impact by human activities. In 2008, 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 2008



Source: SHMI

- **Ground water quality assessment on the Žitný ostrov territory in 2007-2008**

Ground water monitoring at Žitný ostrov suggests that there is a major issue of adverse **oxidation-reduction conditions** documented by frequently increased concentrations in Fe, Mn, and NH_4^+.

Continuing landscape use within the monitored area (urbanised and agriculture territory) is reflected in the increased contents of oxidised and reduced nitrogen forms in water.

In 2007, 56.97 % of all analyses did not meet the criteria set forth by the SR Government Resolution 354/2006 Coll., while in 2008 it was 52.02 %. This means that of the total number of 244 analyses, 139 were such that showed at least one indicator exceeding the values of the Government Resolution 354/2006 Coll. in 2007, while in 2008 it was 129 out of the total number of 248 analyses.

Waste Water

Decreasing trend in **discharge of waste water** into surface water courses continued in 2008 with 619 286 thous. m^3, which was less than in 2007 by 15 133 thous.m^3 (2.4 %), and less than in 1998 by 518 601 m^3 (54.4 %).

Also, decrease in the volumes of waste water for selected pollution indicators was slighter, with most reduction recorded in the indicator of insoluble substances (IS) - by 669 tons per year, compared to 2007. The other indicators showed only minimal reduction: chemical oxygen demand by dichromate was reduced by 225 tons per year, biochemical oxygen demand by 180 tons per year, and the non-polar extracting substances (NES_{UV}) by 27 tons per year, compared to the previous year.

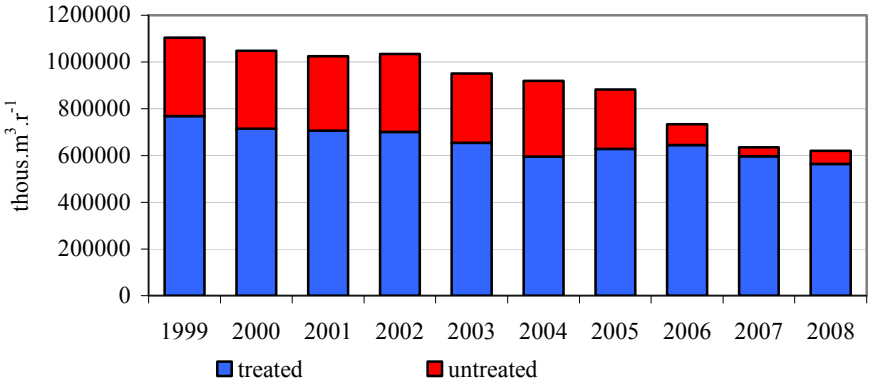
Percentage of discharged treated waste water to **total volumes of waste water** discharged into watercourses in 2008 was 90.94 %.

Load of the balanced contamination sources discharged into surface watercourses in the period of years 1998-2008

Discharged waste water	Volume (thous.$m^3.y^{-1}$)	IS ($t.y^{-1}$)	BOD_5 ($t.y^{-1}$)	COD_{Cr} ($t.y^{-1}$)	NES_{uv} ($t.y^{-1}$)
1998	1 137 887	29 443	21 993	66 351	512
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
2008*	619 286	8 736	6 641	26 688	31

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

Trend in discharging of the treated and untreated waste waters into watercourses in the period of 1999-2008



Source: SHMI

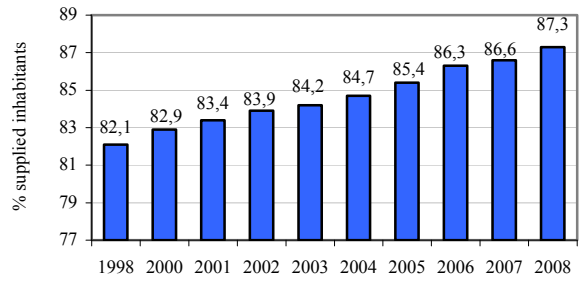
Public water supply, sewerage systems and waste water treatment plants

- **Public water supplies**

Number of inhabitants supplied with drinking water from the public water supply in 2008, reached the number of 4 727 thousand, which represented 87.3 % 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 %. Share of Slovak villages connected to public water supply remained roughly at the same level as in 2007.

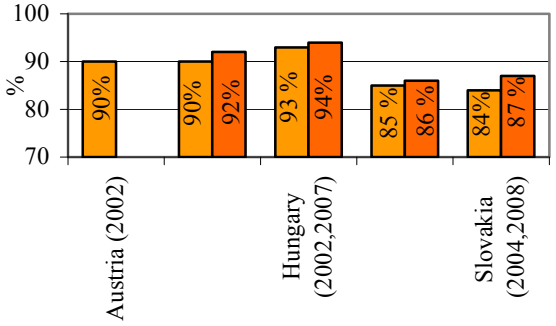
Henceforth there persisted the long-term decrease in the drinking water demand. **The volume of the produced drinking water** reached in year 2008 the value of 319 mil. m^3 of the drinking water, which is the decrease in comparison with year 2007 by 3 mil. m^3. From the ground water resources there were produced 270 mil.m^3 (84 %) and from the surface water resources 49 mil.m^3 (16 %) of the drinking water. **Water losses** in the pipe system represented in year 2008 28.5 % from the total water produced in the water management facilities. **Specific water consumption for households** decreased in 2008 to 87.3 $l.inhab^{-1}.day^{-1}$.

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

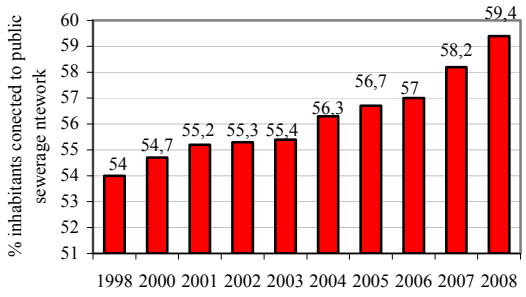


Source: Eurostat, SO SR

♦ **Sewerage system**

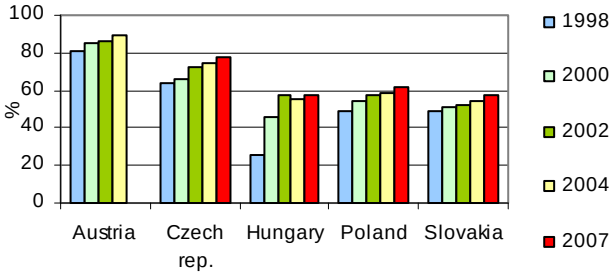
Development of public sewerage systems lags behind that of public water supplies. **Number of inhabitants** living in households **connected to public sewerage systems** in 2008 grew by 66 thousand and reached the number of 3 212 thous. inhabitants, which is 59.4 % of all inhabitants. Of the number of 2 891 of stand-alone municipalities in 2008, 846 of them had public sewerage systems in place (i.e. 29.3 % of all Slovak municipalities), while 636 municipalities (i.e. 22 % 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.

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 2008, 112 waste water treatment plants were added into the Administration of water supplies and water sewerage systems scheme, reaching the number of 612. Greatest share on these had mechanical-biological WWTPs (89.2 %). Increase in WWTP's capacity was still on the rise, reaching the value of 2 211.6 $m^3.day^{-1}$ in 2008.

In 2007, watercourses with public sewerage system (administered by municipalities and water management companies) received 394 mil.m^3 of discharged waste water, which was by 10 mil.m^3 less than in the previous year, and the volume of treated waste water discharged into the public sewerage system reached 395 mil.m^3.

Volume of the discharged wastewater by the public sewerage system (in administration of water sewerage systems and in administration of the municipalities) in 2008

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	108 312	100 482	45 947	128 782	11 462	**394 985**
Untreated	1 562	784	1 558	2 574	1 603	**8 081**
Total	**109 874**	**101 266**	**47 505**	**131 356**	**13 065**	**403 066**

Source: WRI

In 2008, there were 55 305 tons of the sludge dry matter produced in municipal WWTPs. Of this, 38 368 tons (66.4 %) were used for soil processes, 10 766 tons (18.6 %) were temporarily stored, and 8 676 tons were landfilled (15.0 %). In 2008, there was direct application of sludge into the agricultural soil. 33 455 tons of sludge dry matter was used for compost production, while 4 913 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	
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
2008	57 810	0	0	38 368	0	8 676	0	10 766

Source: WRI

Drinking water

- **Drinking water quality monitoring and assessment**

Water quality control and its health safety is determined through a set of water quality indicators representing physical, chemical, biological, and microbiological properties of water. Drinking water indicators are defined under the **SR Government Regulation 354/2006 Coll.,** which stipulates requirements on water designated for human consumption and its quality control. Water quality control for radioactivity follows the **Resolution of the Ministry of Health no. 528/2007 Coll.** which

stipulates details on requirements to limit the level of irradiation from natural radiation. Besides the **complete water analysis**, the implemented **minimum analyses** - e.g. analyses of 28 water quality indicators, is carried out to monitor and obtain periodic information on the stability of water bodies and effectiveness of water treatment, mainly water desinfection, biological quality and the sensoric properties of drinking water.

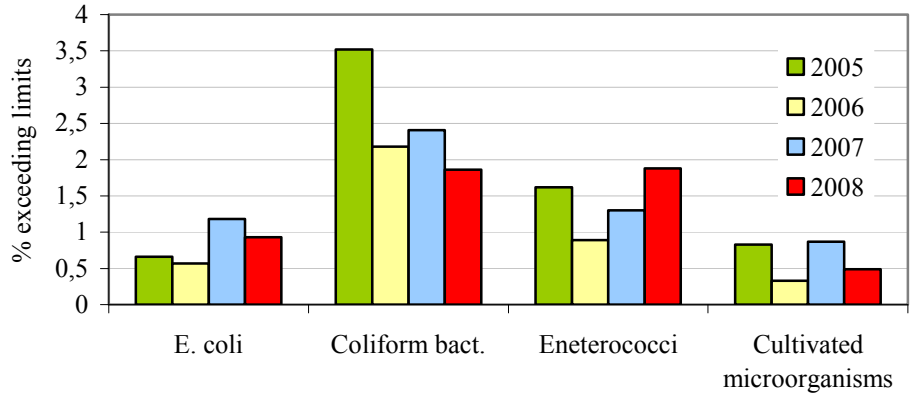
Water quality was assessed on the basis of the number or proportion of individual limits shown to have exceeded the pertinent sanitary norms. In 2008, were analysed at operation laboratories of water management companies 11 382 samples. The samples were abstracted at sites located within distribution networks and 287 783 analyses were carried out to monitor individual drinking water quality indicators. Share of drinking water analyses that complied with the sanitary limits in 2008 reached 99.45 % (in 2007 it was 99.32 %). Percentage of samples that meet drinking water quality demands for all indicators reached 91.84 % (in 2007 it was 89.78 %). 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 SR Government Resolution no. 354/2006 Coll. on demands on drinking water and drinking water control

Year	2006	2007	2008
Share of drinking water samples that do not meet the NMH and MHRR limit.	1.32 %	2.03 %	2.34 %
Share of drinking water quality indicators analyses that do not meet NMH and MHRR	0.32 %	2.46 %	1.02 %

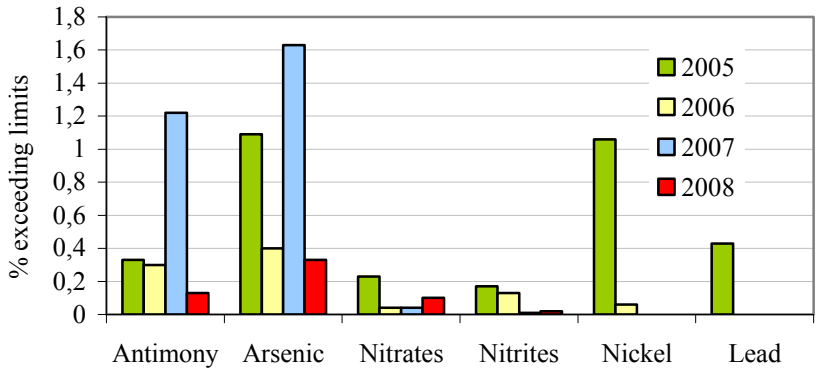
NMH - maximum threshold values, MHRR – threshold values of the reference risk Source: WRI

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

Quality of recreational water in 2008

Slovak Government Regulation no. 87/2008 Coll. on the requirements on natural bathing water bodies effective as from March 5, 2008 implements **Directive 2006/7/EC concerning the management of bathing water quality, and repealing Directive 76/160/EEC.**

In 2008, all public health offices launched the new **Information system** for water bodies and bathing. Besides processing data on natural and artificial bathing water bodies, the system is designed to produce reports in the area of bathing water, as well as to inform the public on the relevant conditions of bathing sites during the season.

The assessment included 70 natural sites - gravel pits, sand pits, and enclosed water tanks used for a number of purposes, including recreation. Organized recreational activities took place at 18 of these sites. 10 sites may be considered as those with partially organized recreational activities. In 2008, 35 natural sites in Slovakia were declared by generally binding resolutions issued by Regional Environmental Offices as those with water suitable for bathing. Compared to the previous year, this time the programme of monitoring did not include three sites - Zelená voda - Kurinec, Veľké Kolpašské lake, and Tona Šurany.

Over the season, 453 water samples were extracted and 6 883 tests were done on chemical, physical, microbiological, and biological water quality indicators. Limit value of detected indicators was exceeded in 218 samples and for 410 indicators. In the area of water quality at natural bathing sites, compared to the previous year, this year there was recorded a higher number of non-compliant water samples for the microbiological indicators - especially for intestinal enterococci.

• 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: Impact 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 2008:

In 2008, monitoring of three basic types of **slope movements** was carried out – slides (15 localities), creep (4 localities), and signs of activated falling movements (9 localities). Sites in the territory of the projected pumped-storage hydroelectric plant of Ipeľ together with the stabilisation water levy in Handlová form an individual category of specific cases of the environment stability assessment process.

In 2008, reports from seismic stations supplied for interpretation more than 5 390 tele-seismic, regional, or local seismic phenomena. 70-80 earthquakes were localised with the epicentre in the focal area of the Slovak Republic. Macro-seismic monitoring in Slovakia were detect 3 earthquakes in 2008, one with epicentre in Banska Bystrica and two in the east of Slovakia.

In 2008, the following localities were included to subsystem **anthropogenic sediments**: Myjava, Modra, Šulekovo, Bojná, Krompachy – Halňa, Šaľa, Chalmová a Poša. Increase in chlorides and ammonia ions was confirmed at the Šaľa site. Analyses carried out for the Poša site confirmed a decreasing trend in elution of the major contaminant - arsenic. Almost the whole area of the Bojná landfill has shown intense ground water contamination over a long time period (chlorides, ammonia ions, sulphates, and boron). Although the Myjava site was recultivated in 2006, it remains to be a long-term source of contamination(ammonia ions, Zn, Ni). The Halňa landfill was shut down in 1999. Subsequent ground water monitoring showed exceeded limits for a number of elements (As, Cd, Ni, B, Zn, Sb). In 2008, changes to mechanical properties at 2 sludge beds of the Slovak Electric Power Plants - ENO (Nováky - Original, and Chalmová - Definite). In 2008, identification sheets were developed for other

five sludge beds, ore waste deposited in the sludge bed of Rudňany and fly ashes in Zvolen, Žilina, Snina, and Sereď.

Monitoring of the **impact of the mining activities on environment** in the area of the brown-coal upper-Nitra territory was carried out for the system of four most important mine shafts (Handlová pri Rybe, the Cígeľ mine, Hlboká, and Lehota pod Vtáčnikom). Increased values in total mineralisation figures of water outflow from mines were recorded (within the interval of 500 – 750 $mg.l^{-1}$); however, these are comparable to the water figures for local recipients (500 – 700 $mg.l^{-1}$). Contents of potentially toxic elements (As, Se, Cu, Zn, Pb, Hg) in water are relatively low. The area of magnesite and talc extraction includes the sites of Jelšava, Lubeník, Hnúšťa - Mútnik, and Košice - Bankov, which have been entered into the monitoring system. Alcalisation of soils and damage to vegetation at the regional level represent the common and major environmental issue in the areas of extraction and treatment of magnesite and talc. Another major environmental issue is the surface stability above the extracted parts of the deposit, and the magnitude of surface collapses. The great number of sites afflicted by extraction of ores include the following sites under monitoring: Rudňany, Slovinky, Smolník, Novoveská Huta, Rožňava, Nižná Slaná, Banská Štiavnica, Hodruša, Kremnica, Špania dolina, Dúbrava, and Pezinok. Active mining works still continue only at the gypsum deposit in Novoveská Huta. The continuing environmental impacts shown at these sites include instability of the rock massif, contamination of surface water courses by mining water outflows, leaching from dumps and sludge beds and, in the case of operated facilities for thermal treatment of ores, also level of pollution of the territory, with negative impacts on the quality of soil, vegetation cover, and air quality. The danger of sudden gushing water from abandoned mines situated above inhabited areas has been a specific issue since 2008. For example, this involves periodic sudden outflows of mine water from the mine of Nová Štôlňa located in the extraction territory of the city of Spišská Nová Ves, above the city's local residential area of Pod Tepličkou.

Monitoring of the **volume activity of radon** in geological layers in 2008 continued at 14 sites distributed all over the whole Slovak territory (7 sites for radon in soil and 7 sites for radon in groundwater). Monitoring of soil radon in 2008 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). Sampling and radon measurement in water was carried out at thesee springs of the Malé Karpaty 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. Monitoring outcomes of the radon volume activity in ground water point to the fact that the middle values of radon concentration for springs monitored in 2008 are higher than in the previous years. Complex outcomes of radon monitoring from 2008 and the previous years show that the changes recorded for the radon volume activity within the geological environment are either short-lived (seasonal), long-term (counted in years), and random (local, temporal, climate, etc.)

In 2007, **monitoring of stability of rock massifs** below historic objects concentrated on the following sites: Spišský, Strečniansky, Oravský, Uhrovský, Trenčiansky and Lietavský castles, castle Devín and the Church of st. Juraj in Kostaľany under Tríbeč.

Within **stream sediments monitoring** was exceeding the reference concentration (Category A) at 35 sites. Exceeding the limite concentration of the B category (expextation of contamination) was detected at 12 sites. Exceeding the limite concentration of the C category was detected (exceeding of this limit suggests impact of demolition activities) at Nitra - Chalmová (Hg), Štiavnica - river mouth (Pb), and Hornád - Krompachy (Hg) sites. Alluvial sediments of the rivers of Váh, Hron, Muráň, Danube, together with the majority of water courses of the East-Slovakian lowland and the adjacent territories are in fact free of contamination, and concentrations of substances represent mainly their natural contents. Monitoring (over the last 13 years) has clearly shown substantially and permanently contaminated water courses of Nitra, Štiavnica, Hornád, and Hnilec. Contamination of the alluvial sediments of Ondava, typical for its increased levels of arsenic was not detected in 2008.

Partial information system

In 2008, data obtained from measuring the monitoring points were gradually stored and processed within the Partial information system of geological factors (PISGF). The data were then exported into a transparent level that enables spatial view of the monitoring outcomes in the form of maps, charts, as well as organized tables. Selected data from the information system are accessible for all interested professional and lay persons at the partial monitoring system website for geological factors (http://dionysos.gssr.sk/cmsgf). The Partial Monitoring System website for geological factors is connected to and accessible also from the SGIDS (www.geology.sk) and Enviroportal website (http://enviroportal.sk/).

Geothermal energy

At present, there are 26 designated geothermal areas in Slovakia, taking up 27 % of the state's territory. To this day, 120 geothermal wells have been made in these designated areas, analysing 1 787 $l.s^{-1}$ of water with the outflow temperature of 18 - 29°C. Geothermal water was detected through wells with the depth of 92 – 3.616 m. Yield at the free overflow from these wells fluctuated within the interval of tenths of a litre to 100 $l.s^{-1}$. Dominating are water types of Na-HCO_3, Ca-Mg-HCO_3-SO_4 and Na-Cl with the mineralisation of 0,4 - 90,0 $g.l^{-1}$. Thermal output of geothermal water used up to its reference temperature of 15°C is 306.8 MW, which represents 5.5 % of the total mentioned geothermal energy potential in Slovakia.

Regional **geothermal survey** was conducted in line with the approved Strategy of geothermal energy use in Slovakia by the end of 2008, which involved the following territories: Galanta, Komárňanská vysoká kryha, Liptovská basin, Košicka basin – site Ďurkov, Popradská basin, Skorušinská plane, sites

in Galanta, structures in Ďurkov, Žiarska basin, Hornonitrianská basin, Topoľčany záliv, Banovská basin, and the Humenský ridge.

Register of geological mapping

Registers of geological mapping (as of December 31, 2008)

Registers of	Accumulation in 2008	Total number
Surveyed territories	44	558
Surveyed territories drafts	50	568
Landslides	82	11 488
Wells	3 156	741 151
Hydro-geological wells	361	23 675
Landfills	6	8 460
Map drawing and purpose mapping	47	9 768
Geophysical mapping	625	5 376
Abandoned mining works	1	16 571

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, 2008

Type of abandoned mine	Number
Mining shaft	4 875
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	**16 577**

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 2008, there were 44 survey areas and 50 registered proposals to designate a survey area. As of December 31, 2008, there were 157 recognised areas.

Energy deposits (state to the date 31st December 2008)

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	tis. t	2 008	8 006
Bitumen sediments	1	1	0	tis. t	9 780	10 797
Brown coal	11	6	4	tis. t	138 596	461 391
Flammable natural gas – gasoline gas	8	6	3	tis. t	198	395
Lignite	8	3	1	tis. t	111 966	619 110
Non-resinous gases	1	0	0	mil. m^3	0	6 380
Underground stores of natural gas	9	0	0	mil. m^3	0	2 246
Crude oil non-paraffinic	3	3	0	tis. t	1 632	3 422
Crude oil - semi-paraffinic	8	3	4	tis. t	132	6 395
Uranium ores	2	1	0	tis. t	1 396	5 272
Natural gas	39	22	12	mil. m^3	8 663	26 037
Total	**91**	**46**	**24**		-	-

Source: SGI DS

Minerals deposits balance

Ore deposits (state to the date 31st December 2008)

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	5	1	thous. t	26 830	32 363
Fe ores	2	2	1	thous. t	14 476	18 743
Total	**45**	**11**	**2**		**48 765**	**185 003**

Source: SGI DS

Non-metallics deposits (state to the date 31st December 2008)

Minerals and minerals based products	Number of deposits included into balance	Number of free balance deposits	Number of deposits for mining	Unit	Balance deposits free	Geological deposits
Anhydride	7	5	2	thous. t	659 097	1 250 290
Asbestos and aspestos rock	4	1	0	thous. t	1 808	3 711
Baryte	6	2	2	thous. t	9 226	12 676
Bentonite	23	17	9	thous. t	29 031	42 179
Cast basalt	5	5	1	thous. t	22 774	39 949
Decorative rock	23	14	3	thous. m3	11 398	25 503
Diatomite	3	2	0	thous. t	6 556	8 436
Dolomite	20	20	9	thous. t	607 710	634 177
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	838 841	1 349 823

Kaolin	14	11	3	thous. t	50 903	59 790
Ceramic clays	38	34	5	thous. t	115 227	190 110
Quartz	7	6	0	thous. t	301	327
Quartzite	15	12	0	thous. t	17 448	26 950
Magnesite	10	6	3	thous. t	759 006	1 156 680
Talc	6	3	0	thous. t	93 709	242 178
Mineralized I - Br waters	2	1	0	thous. m^3	3 658	3 658
Pearl stone	5	5	1	thous. t	30 216	30 536
Pyrite	3	0	0	thous. t	0	14 839
Gypsum	6	4	3	thous. t	49 224	93 460
Sialitic raw material	5	2	2	thous. t	109 269	122 632
Glass sands	4	4	2	thous. t	411 158	589 884
Mica	1	1	0	thous. t	14 073	14 073
Building rock	134	131	83	thous. m^3	648 534	764 992
Gravel sands and sands	26	22	15	thous. m^3	135 402	155 097
Brick clay	40	36	12	thous. m^3	103 547	127 741
Techn. usable miner. crystals	3	1	0	thous. t	253	2 103
Limestone – unspecified	30	27	13	thous. t	1 943 382	2 303 066
High-content limestone	10	10	4	thous. t	3 195 519	3 359 441
Limestone-marl	8	7	2	thous. t	165 531	167 783
Zeolite	6	6	2	thous. t	106 012	111 236
Foundry sands	14	7	1	thous. t	277 940	508 632
Refractory clays	9	6	1	thous. t	3 093	5 318
Feldspars	7	7	1	thous. t	17 648	18 886
Total	**501**	**423**	**180**		-	-

Source: SGI DS

Classification of mineral deposits by state of extraction (state to the date 31st December 2008)

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.	219
2	*Deposits with fading extraction activity* include extraction mineral deposits where extraction activity will cease in a near future (within 10 years)	33
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)	37
4	*Deposits with ceased extraction* include exclusive mineral deposits with definitely or temporarily stopped extraction activity.	96
5	*Non-extracted deposits* include documented exclusive mineral deposits soon **to be** constructed and extracted.	56
6	*Non-extracted deposits* include documented exclusive mineral deposits **with no plans** for their extraction.	180
7	*Surveyed deposits* include deposits of exclusive and non-exclusive minerals with various degree of mapping.	16

Source: SGI DS

Non-reserved mineral deposits (as of December 31, 2008)

Raw material	Number of listed deposit sites	Number of sites with extraction activities
Other raw material	20	2
Building stone	162	52
Gravel sands and sands	223	99
Brick clay	58	1
Total	**463**	**154**

Source: SGI DS

Other raw material deposits (as of December 31, 2008)

Raw materail	Number of listed deposit sites	Number of sites with extraction activities
Shale	3	0
Floating sand	1	0
Waste rock	6	1
Clays	1	0
Sialitic raw material and marl	6	0
Tuff	2	0
Dried sludge – brucit	1	1
Total	**20**	**2**

Source: SGI DS

- **Ground water volumes**

Ground waters deposits in the SR (state to the date December 31, 2008)

Category	A	B	C	Total
Efficient deposits of the ground waters (l.s-1)	-	**191,63**	**4 020,95**	**4 212,58**
Efficient amounts of the ground waters (l.s-1)	-	-	**13 313,76**	**13 313,76**

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

• SOIL

Land use

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

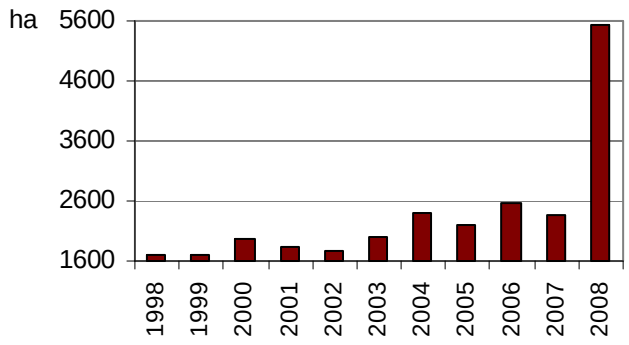
Land Use categories (state to the date 31st December 2008)

Land category	Area (ha)	% of total area
Agricultural land	2 423 478	49.42
Forest land	2 008 257	40.95
Water areas	94 575	1.93
Build-up land	229 059	4.67
Other land	148 335	3.03
Total area	**4 903 704**	**100.00**

Source: GCCA SR

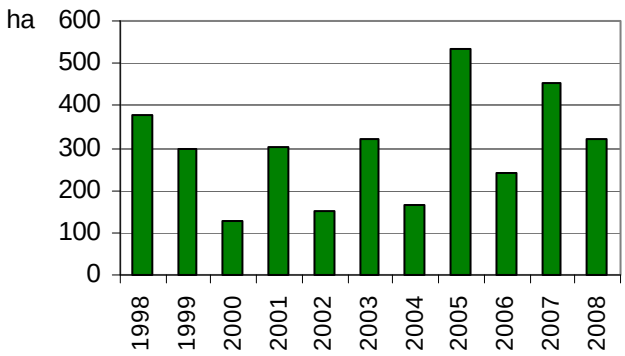
Anthropogenic pressure to use soil for purposes other than its primary production and environmental functions brings about its gradual decrease. In the years 1999-2008, **losses of agricultural soil to construction** grew on the year-year basis, mainly for public, house, and industrial construction purposes (3 190 ha in 2008).

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

♦ Changes to the land cover evaluated by comparing satellite images

Changes to land cover in 1990, 2000, and 2006 were mapped on the basis of analysis of satellite images being part of the projects of CORINE1990, I&CLC2000, and GMES-Land 2006. Most significant changes to land cover involved:

- restitutions and changes to land ownership after 1989, with most changes shown especially in 1990-2000 in the north-west of Slovakia,
- natural catastrophes - tornadoes, forest fires (the wind calamity of 2004 in the High Tatra mountains),
- expansion of the traffic infrastructure and industrial parks,

- and activities related to anti-flood activities and energy production. (Gabčíkovo)

Total changes to land cover in 2000 - 2006 in Slovakia

Source: SEA

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

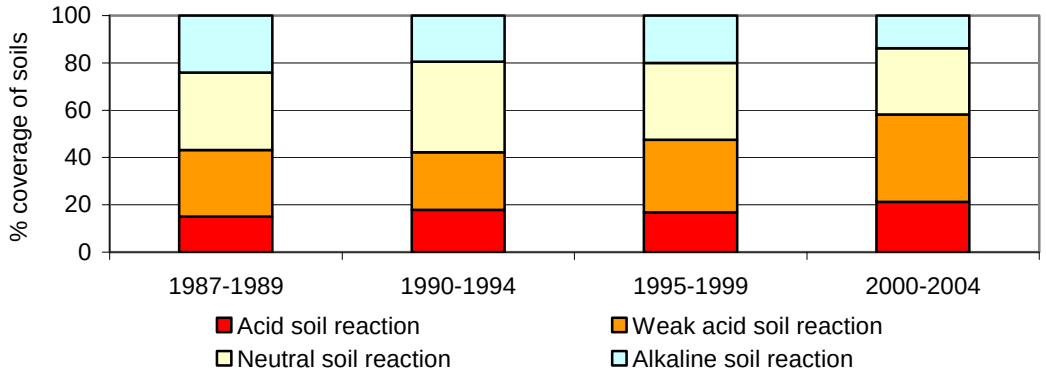
Main soil unit	1993	1997	2002	2007
Mollic Fluvisols AL	7.29	7.24	7.03	-
Fluvisols AL	7.13	6.95	6.84	-
Chernozems AL	7.28	7.31	7.22	7.14
Haplic Luvisols AL	6.71	6.85	6.90	-
Planosols AL	6.66	6.70	6.47	-
Planosols PG	6.31	6.24	6.13	-
Rendzic Leptosols AL	7.27	7.25	7.54	7.97
Rendzic Leptosols PG	7.17	7.18	6.57	7.27
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 KCI) 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 horizon	-	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

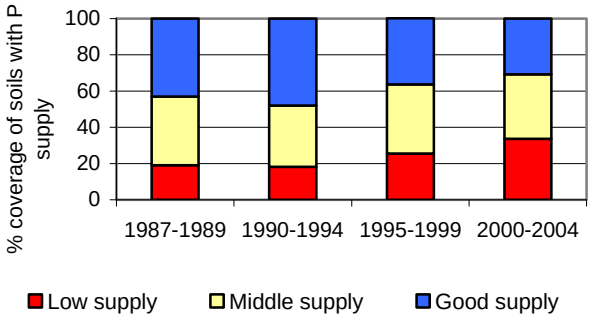
Source: NFC - FRI

Available nutrients

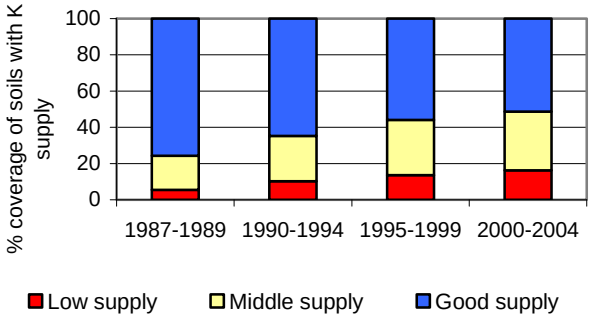
During the period VIII. (1987-1989) through XI. (2000-2004) of Agrochemical soil testing there was an **increase in low supply of all three available nutrients (phosphorus, potassium, and magnesium).** In phosphorus, it was by 14.6 %, by 10.7 % in potassium, and by 5.3 % in magnesium. However; during 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

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

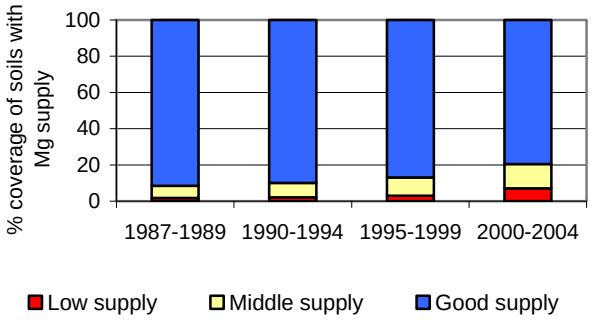


Source: CCTIA



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	2002	2007
Chernozems AL	2.74	2.17	3.12	3.19
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	4.29
Cambisols PG	5.52	4.14	6.55	6.09
Regosols AL	2.07	1.60	2.07	-
Rendzic Leptosols AL	3.74	2.76	3.14	3.83
Rendzic Leptosols PG	5.94	4.32	6.61	7.14
Andosols PG	10.91	12.48	16.55	15.71
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

Soil horizon	% 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	1997	2002	2007	1993	1997	2002	2007	1993	1997	2002	2007
Chernozems	-	-	-	-	51.8	47.3	49.6	49.2	45.0	50.7	46.7	52.1
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	51.3	51.9	51.6	51.8	49.5

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**

Load imposed on agricultural land types by hazardous substances - **diffuse contamination** is monitored directly within the partial monitoring system of **PMS - S** as well as its subsystem of the **Spatial soil contamination survey (SSCS).**

Outcomes of the II. **PMS -S** monitoring cycle with samples extracted in 1997 showed a slight improvement in the **sanitary condition of agricultural land types.** Apparent vertical migration of high-risk elements in the soil profile was detected (Kobza et al., 2002). Results from the III. cycle with samples extracted in 2002 showed that the **content of the majority of risk substances in selected agricultural land of Slovakia was below the limit**, especially in case of arsenic, chromium, copper, nickel, and zinc. In case of cadmium and lead, excessive limit values were recorded only in soils situated in higher altitudes, podzols, andosols, which may relate to remote transfer of emissions.

Soil samples extracted in the 4th extraction cycle were processed and analysed in 2008 (2007 being the year of extraction). Chemical analyses of monitored land types were completed in November 2008 for the types of andosols (PG), cambisols (PG and AL), rendzic leptosols (PG), and chernozems (AL).

Assessed were the basic statistical parameters (x_{min} - minimum value, x_{max} - maximum value, x_p - average value) of the monitored high-risk elements (As, Cd, Co, Cr, Ni, Pb, Zn).

Present condition in contamination of the analysed land types with samples extracted in 2007 was first time assessed on the basis of Annex 2 to Act No. 220/2004 Coll. on protection and exploitation of agricultural land as shown in the following table. Therefore, it is not possible to compare contaminations with the previous monitoring cycles assessed on the basis of laws that were in effect in the past.

Limit values of risk elements in the agricultural land types defined on the basis of the soil structure and value of soil reaction as well as the critical value of risk elements within the agricultural soil to plant relationship

Risk element	Limit values for risk elements in agricultural soil (in mg.kg^{-1} of dry matter, aqua regia decomposition, Hg total content)			Critical values for risk elements as they relate to the agricultural soil and plant (in mg.kg^{-1} of dry matter, in leachate of 1 mol/l amonnium nitrate, F in water leachate)
	Sandy, loam-sandy soil	Sand-loamy, loamy soil	Clay-loamy soil, clay	
Arsenic (As)	10	25	30	0.4
Cadmium (Cd)	0.4	0.7 (0.4)*	1 (0.7)*	0.1
Cobalt (Co)	15	15	20	-
Chromium (Cr)	50	70	90	-
Copper (Cu)	30	60	70	1
Mercury (Hg)	0.15	0.5	0.75	-
Nickel (Ni)	40	50 (40)*	60 (50)*	1.5
Lead (Pb)	25 (70)*	70	115 (70)**	0.1
Selenic (Se)	0.25	0.4	0.6	-
Zinc (Zn)	100	150 (100)*	200 (150)*	2
Fluorine (F)	400	550	600	5

Note: Supplied data apply to samples obtained in arable land types from the upper layer of 0.2 m and air-dried to reach constant weigh, * if pH (KCl) is less than 6, ** if pH (KCl) is less than 5,

Contents of risk elements for the soil types assessed in 2008 and extracted in 2007 are shown in the following tables.

Proportion of As, Cd, Co (in mg.kg^{-1} in aqua regia) in selected soils within the 4th extraction cycle (year of extraction - 2007)

Group of soils	Culture	Soil depth	As			Cd			Co		
			x_{min}	x_{max}	x_a	x_{min}	x_{max}	x_a	x_{min}	x_{max}	x_a
Andosols	PG	0-10	2.9	3.8	3.4	0.45	0.50	0.48	11.3	17.7	14.5
		35-45	1.2	1.3	1.2	0.01	0.22	0.11	12.9	17.8	15.4
Cambisols	PG	0-10	2.0	15.0	6.8	0.14	0.64	0.32	5.8	24.5	14.6
		35-45	1.5	10.2	4.6	0.01	0.17	0.07	6.9	25.3	16.7
Cambisols	AL	0-10	2.0	18.8	7.9	0.16	0.28	0.21	7.9	18.1	11.7
		35-45	2.0	17.0	8.6	0.02	0.13	0.07	10.4	15.8	13.0
Rendzic Leptosols	PG	0-10	2.3	28.8	13.3	0.11	1.87	0.62	1.1	24.0	12.7
		35-45	5.4	16.5	10.8	0.12	0.55	0.30	9.1	22.5	12.5
Rendzic Leptosols	AL	0-10	5.5	24.2	12.7	0.10	0.78	0.41	3.8	22.0	10.0
		35-45	5.6	20.7	12.7	0.06	0.65	0.27	2.9	19.2	8.9

Chernozems	Prevalent AL	0-10	6.6	14.9	9.5	0.03	0.38	0.18	6.6	10.9	8.8
		35-45	4.5	14.4	9.1	0.01	0.48	0.14	5.4	12.4	8.6

Source: SSCRI

Note: x_{min} – the minimum set value of a selected group, x_{mas} - the maximum set value of a selected group, x_2 average value of a selected group, AL - arable land, PG - permanent grassland

Contents of contaminating substances in soils of selected cadastre zones are monitored within the **Spatial soil contamination survey (SSCS).** Selections are made through soil analyses on the basis of detected increased contents of contaminants during the previous SSCS cycles. The file contains also outcomes from soil analyses in the cadastre zones included into the **Coordinated focus-specific monitoring (CFSM)** with monitoring of selected parameters of Pb, Cd, Cr, Ni, Hg, As, together with a number of other parameters required by the centre of coordination. Further, the file also contains soil samples from organic farming. 1,276 soil samples were analysed for inorganic and organic contaminants within the SSCS 2008

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

♦ **Environmental burdens**

Besides diffuse contamination, other environmental burdens are also monitored in Slovakia. Environmental burden means a condition created by negative impacts of anthropogenic activities beyond the measure of the pollution criteria, on the components of environment such as ground water, soil, and rock. Consequences of environmental burdens on ecosystems or human health can be so critical that their sanation is necessary.

As a consequence of the task of Systematic identification of environmental burdens of the Slovak Republic in 2006 - 2008, the Register of environmental burdens in Slovakia included

- 878 probable environmental burdens, 124 of them of high risk, 600 of medium risk, and 154 of low risk sites. The most frequent sources of contamination of sites are municipal waste landfills (39%), industrial production and services (22 %), warehouse facilities of goods and merchandise, including petrol stations (12 %). Other activities such as mining (11 %), military activities (7 %), and transport (4 %) are among the most frequent causes of soil and ground water contamination.

- 257 environmental burdens, 95 of them of high risk, 134 of medium risk, and 28 of low risk sites.
- 684 sanated / recultivated sites. Most of the sanated sites include municipal waste landfills (47 %), warehouse facilities for goods and merchandise (37 %), and industrial production. (7 %).

The most frequent soil contaminants include mineral oils, aromatic hydrocarbons, and heavy metals. Other contaminants include chlorinated hydrocarbons, polycyclic aromatic hydrocarbons, phenols, and cyanides.

♦ 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	1 357 390	56.01	2 291 157	94.54
Medium	230 473	9.51	55 253	2.28
Strong	354 555	14.63	45 805	1.89
Extremely strong	481 060	19.85	31 263	1.29
Total	**2 423 478**	**100.00**	**2 423 478**	**100.00**

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

Desertification is becoming a major global issue, mainly as a consequence of the global climate change.

Processes of salinisation and sodification are included within soil monitoring to build a network of stationary monitoring sites. The network includes both weak and medium solonchaks and solonetz, as well as the typical solonetz soil types. Of the total number of 8 monitored sites, 6 are situated in the Podunajská plane. Anthropogenic soil sodification is measured in Central Slovakia by the exhausts from the aluminium production plant in Žiar nad Hronom. In the Eastern Slovakian Lowland, the monitoring network includes a typical solonetz in the cadastre area of Malé Raškovce.

Outcomes of the saline soils monitoring in 2008 and their analysis are, with the exception of small deviations, identical to the outcomes obtained for the previous years. The monitored area shows

concurrent processes of salinisation and sodification, with sodification being more dominant. This is to a large degree shown by the Exchangeable Sodium Percentage (ESP) values of over 10% recorded in 2008 in the weak solonetz soils. There was a repeated detection of an apparent change of week solonetz soil to solonetz soil, or the first sodification level to the medium sodification level, respectively.

In terms of the risks associated with the formation, distribution and development of saline soils characterised by chemical composition of ground water, such risks are most probable in the lower territory of the Žitný ostrov area, in the Zlatná na Ostrove - Komárno zone. This is shown by higher values of electric conductivity (>200 $mS.m^{-1}$), high degree of ground water mineralization (>1 000 $mg.l^{-1}$), high sodium content (Na^+ > 250 $mg.l^{-1}$), and high content of hydrocarbonate ions (HCO_3^- > 500 $mg.l^{-1}$), which indicates real conditions for the development of soda salinisation.

Medium and high mineralized ground water of the Podunajská plane with water evaporation of soils in the conditions of the ongoing climate warming represents a potential desertification threat to the territory.

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 No. 188/2003 Coll. on application of sewage sludge and river bed sediments to soil**, **and on amendment to Act No. 223/2001 Coll. on waste and amendments to certain laws as amended.**

In 2008, the overall sludge production in the SR was 57 810 tons of dry matter. Of this volume, 38 368 tons (66.4 %) were used in soil processes, 10 766 tones were temporarily stored (18.6 %), and 8 676 tons (15.0 %) were landfilled. In 2008, there was **no direct application of waste water treatment sludge into agricultural soil**. 33 455 tons of sludge dry matter was used for compost production, while 4 913 tons of sludge dry matter were used for soil processes (reclamation of landfills, areas, etc.).

• FLORA AND FAUNA

Implementation of PMS BIOTA

The BIOTA partial monitoring system has long been affected and threatened by inadequate implementation of the Concept of actualisation and rationalization of the environmental monitoring related to the amount of assigned funds. In fact, in 2008 there were no financial means given for its implementation. The State Nature Conservancy of the SR used their own resources to carry out the monitoring of 26 % of all permanent monitoring areas planned for 2008.

The Flora Subsystem. In line with the plan for 2005-2010, there are 150 sites with the occurrence of 37 species of vascular plants of European importance that are monitored annually. However, in 2008 only 11 species in 50 sites were successfully monitored.

The Fauna Subsystem. Of 2 groups and 6 species of animals of the European importance monitored so far, only 4 species were monitored: *Rupicapra rupicapra*, *Lutra lutra*, *Spermophilus citellus*, and *Marmota marmota*, on a limited number of permanent areas.

The **Habitats Subsystem** has not been implemented for a longer time period.

Flora

♦ Endangerment of plant taxons

State of endangerment of plant taxons in 2008

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

Level of **endangerment of non-vascular plants** in Slovakia is presently **17.6 %** (including fungi). Level of **endangerment of vascular plants** is **42.6 %** (for all endangerment categories), or **30.3 %.** (for the CR, EN, and VU categories).

Comparison of the vascular plant endangerment* in selected countries

	Slovakia	Austria	Hungary	Poland	Czech Rep.
Vascular plants (%)	30.3	33.4	19.8	11.0	42.5

Source: OECD Environmental Data Compendium, 2008

* 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 492/2006 Coll., Resolution 638/2007 Coll and Resolution 579/2008 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

	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 V of **Habitats Directive**	-	-	-	2*	3**
In attachment I and II of **CITES**	-	-	-	-	110
In attachment I of **Bern Convention**	-	-	-	8	35

* *Leucobryum glaucum* and the entire genus *Sphagnum* Source: SNC SR
** *Artemisia eriantha, Galanthus nivalis*, including the entire genus *Lycopodium*

In 2008, there was a transfer of 74 plants of the species of *Dactylorhiza sambucina* **within the scheme of transfers, reintroductions, and restitutions** of the endangered plant species.

New **rescue programmes** for the species of *Radiola linoides and Tephroseris longifolia* ssp. *moravica* were developed in 2008. For the species of *Alkanna tinctoria, Liparis loeselii, Colchicum arenarium, Spiranthes spiralis, Herminium monorchis, Drosera anglic and Lycopodiella inundata* the programmes were updated. Implemented were also rescue programmes for *Anacamptis pyramidalis, Carex chordorrhiza, Orchis elegans, Orchis palustris, Pulsatilla pratensis* ssp. *flavescens, Pulsatilla zimmermannii, Drosera anglica, Lycopodiella inundata, Ophrys holubyana, Orchis coriophora* ssp. *coriophora, Rhynchospora alba, Scheuchzeria palustris, Glaux maritima* and *Carex pulicaris*.

Actual problem endangering the diversity of plant species in last years has been becoming **invasive species**. Of the 616 introduced species of plants in Slovakia, 7 are classified as **invasive** pursuant to Regulation 24/2003 Coll., and 89 as potentially invasive plant species. **Number of sites** with the occurrence of invasive plant species has been **rising** every year. No register of invasive species of animals has yet been developed for the territory of Slovakia.

In 2008, **elimination** of invasive plant species was carried out at 72 sites in protected areas of the size of 419,8 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: *Robinia pseudoacacia*, *Ailanthus altissima*, *Negundo aceroides*, *Fallopia japonica*, *Heracleum mantegazzianum*, *Fraxinus americana*, *F. lanceolata*, *F. pennsylvanica*, *Solidago canadensis*, *Impatiens glandulifera*, *Impatiens parviflora*, *Asclepias syriaca*, *Solidago gigantea*, *Stenactis annua*, *Aster lanceolatus* a *Helianthus tuberosus*.

Outside the protected areas, eliminated were 4 invasive, 1 expansive, and 1 occasionally invasive plant species at 59 sites of the size of 85.7 ha: *Fallopia japonica*, *Heracleum mantegazzianum*, *Impatiens glandulifera*, *Rhus typhina*, *Digitalis purpurea* – occasionally invasive taxon, *Calamagrostis epigeios* – expansive taxon.

Fauna

- **Endangerment of animal species**

State of endangerment of the particular invertebrate taxons

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

* without the category of NE

Source: SNC SR

Level of endangerment of invertebrates in Slovakia is presently 8.5 %.

State of endangerment of the particular vertebrate taxons

Taxons	Number of taxons		Categories of endangerment (IUCN)							Total	%
Group	World [1]	SR	EX	CR	EN	VU	LR	DD	NE		
Lampreys		4	-	-	1	1	1	-	-	3	75.0
Pisces	25 000	79	4	-	6	9	40	-	-	59	74.7
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

[1] Source: UNEP – GBO Source: SNC SR

[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

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.
Invertebrates	5.3	-	> 0.9	-	13.1
Pisces	24.1	50.6	43.2	21.0	41.5
Amphibians	44.4	60.0	27.8	-	61.9
Reptiles	38.5	64.3	33.3	33.3	72.7
Birds	14.0	27.7	14.5	7.8	55.0
Mammals	21.7	22.0	37.8	13.5	20.0

Source: OECD

[1] "endangered" taxons include species under categories: CR, EN, and VU under IUCN
Austria) invertebrates: *insecta, decapoda, mysidacea* and *mollusca*, birds: only nesting birds
Czech Rep.) data refer to autochthonous species and EX including, birds: only nesting birds, pisces: including lampreys
Hungary) birds: all species recorded in Hungary since 1800
Poland) pisces: including lampreys.

♦ 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. 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

	Invertebrates	Pisces	Amphibians	Reptiles	Birds	Mammals
In annex II of **Habitats Directive**	53	23	5	1	-	24
In annex IV of **Habitats Directive**	50	1	10	9	-	46
In annex I of **Birds Directive** [1]	-	-	-	-	114	-
In annexes I and II **of CITES**	2	2	-	1	53	5
In annexes II and III of **Bern Convention**	33	38	19	12	357	65
In annexes II and III of **Bonn Convention**	-	3	-	-	209	24
In annex of **AEWA***	-	-	-	-	129	-

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

[1)] – including migratory birds

Rescue programmes (RP) in 2008 were processed for the following taxons: *Castor fiber*, *Mustela lutreola* and butterflies of *Maculinea* genus. Realized were RP for *Parnassius apollo, Umbra krameri, Bison bonasus, Aquila chrysaetos, Aquila pomarina, Falco cherrug, Falco peregrinus* and *Marmota marmota*.

In **rehabilitation stations** operated by the nature and landscape protection organizations there were **adopted** in 2008 altogether **440** injured individuals or otherwise disabled animals. Back to wild nature there were **released** altogether **234** individuals and there was spent more than 264.3 thous. SKK.

No animals were bred (and released) in maturation facilities in 2008.

There was provided **the guarding** of 122 nests of 7 bird of prey species (*Aquila chrysaetos, A. pomarina, A. heliaca, Haliaeetus albicilla, Falco peregrinus, F. vespertinus, Circus pygargus*) - information only for the organization organs of SNC SR. There were successfully **brought up 128 nestlings**, which is in average 1 brought up nestlings per nest and there were spent about 186 thous. SKK.

In term of in situ animal preservation in 2008 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 – *Spermophilus citellus, Marmota marmota latirostris, Umbra krameri, Castor fiber* and *Amphibia* and there was spent more than 238 thous. SKK.

Within the **improvement of nesting and living conditions** of animals, there were realized more than 400 actions, while there was invested more than 905 thous. SKK.

In concern of preventing the collisions of **migrating Amphibians** with the car transport, in 2008, transfers of amphibians were carried out and foil barriers were installed in total length of 27.7 km within the protected areas, as well as in open nature. There was invested more than 125 thous. SKK.

♦ Game stock and hunting and fishing

To 31st March 2008, 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	2005		2006		2007		2008	
	stock	hunting	stock	hunting	stock	hunting*	stock	hunting*
Deer	39 738	14 030	41 105	12 888	41 287	15 185[1)]	44 316	16 889[1)]
Fallow deer	8 425	2 529	8 010	2 208	8 125	2 890[1)]	9 068	3 210[1)]
Roe deer	85 124	20 659	87 324	17 313	89 439	22 723[1)]	92 680	24 704[1)]
Wild boar	27 116	22 551	27 175	17 820	27 124	25 758[1)]	29 290	29 700[1)]
Brown hare	199 226	36 511	208 946	17 560	202 724	39 892[1)]	203 123	34 470[1)]
Grey partridge	17 293	484	15 579	10	13 285	535[1)]	13 453	462[1)]

Pheasant	181 374	143 373	187 139	110 113	182 287	160 126[1)]	190 279	135 332[1)]
Chamois	625	12	665	8	645	10[1)]	661	12[1)]
Bear	1 483	35	1 577	16	1 739	25	1 939	34
Wolf	1 165	74	1 219	91	1 322	123	1 563	121
Otter	343	0	380	0	480	0	680	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 **2 734 t** in 2008. The waters were **stocked** by **42 474 852 pieces of setting**.

Fishing for the economic and sport purposes in 2008 (t)

Fish species	2004		2005		2006		2007		2008	
	total	of this SFA*	total	of this SFA*	total	of this SFA*	total	of this SFA*	total	of this SFA*
Fish total Of these:	**2 783**	1 565	**2 652**	1 663	**2 979**	1 697	**2 871**	1 659	**2 734**	1 639
Carp	1 360	988	1 281	1 092	1 597	1 169	1 430	1 146	1 430	1 166
Trouts	878	52	800	49	837	49	939	54	833	52
Crucians	80	75	76	71	117	71	8	66	94	62
White amur	28	28	33	24	39	33	45	40	41	36
Bighead carps	8	5	12	6	12	4	8	4	10	3
Sheat fish	36	35	37	35	34	33	40	39	37	36
Maskalonge	66	60	74	67	62	60	58	55	55	54
Sand-eel	78	76	83	82	65	64	68	60	63	63
Grayling	9	8	13	7	8	7	12	6	7	6
Huchen	1	1	1	1	1	1	0,2	0,2	0,7	0,7
Breams	98	98	106	105	95	94	76	75	70	69
Torgoch	0	0	9	1	2	1	3	1	2	0
Chevins	21	21	16	16	16	16	17	17	14	14
Other fish species	120	117	111	107	94	95	168	96	78	76

*SFA – Slovak Fishing Association Source: SO SR

Implementation of the CITES in 2008

In 2008, there was a change in the implementation of the CITES convention in Slovakia through a novelised Slovak National Council Act 15/2005 Coll. on protection of the EU wildlife animals and plants, regulation of their trade, and on the amendment to other laws as amended by Act 672/2006 Coll. - a new **Slovak National Council law 452/2007 Coll.** was adopted.

Scientific body of the SR, pursuant to the national and EU legislation in 2008, commented 30 applications filed by the Ministry of Environment of the Slovak Republic (MoE SR) to import of individual animals belonging to the species listed under the CITES convention, 10 applications of the MoE SR to export such animals, and 15 applications of the MoE SR for consultation regarding the origin of individual animals at issuing certificates. Further, the body produced, upon the request of the MoE SR, circuit environmental offices, custom offices, and police other 109 position papers that relate to the area of the CITES convention.