

# The Emissions situation in the Slovak Republic

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## Emisná situácia v Slovenskej republike

V Slovenskej republike na bilanciu emisií znečisťujúcich látok, ale aj ako informačný systém o zdrojoch znečisťovania ovzdušia slúži Register emisií a zdrojov znečisťovania ovzdušia (REZZO). Databázu REZZO spravuje Slovenský hydrometeorologický ústav v Bratislave od roku 1985. V článku sú popísané jednotlivé kategórie REZZO, vývojový trend základných znečisťujúcich látok v SR ako aj verifikácia údajov.

**Key words:** EAPSI - The Emissions and Air Pollution Sources Inventory, basic pollutants, particulate matter, sulphur dioxide, oxides of nitrogen, carbon monoxide.

## Introduction

The Emissions and Air Pollution Sources Inventory (EAPSI) is a data base system for the emission inventory. The emission inventory is based on the data on particular sources which are further aggregated. This mode of the inventory making is internationally denoted as the „bottom up approach“ and requires besides sets of good quality data on particular sources, their complex evidence as well. In contrast, „top down approach“ works with aggregated statistical data which are spatially disaggregated using further the so called auxiliary statistical and demographic data. A necessary prerequisite for the success of the „bottom up approach“ is the willingness or obligation of the sources to provide the necessary data. It is the legislation of the Slovak Republic, the existence of the network of Environmental Offices throughout Slovakia and the system of EAPSI, which has a long tradition, that enable to make the emission inventory by this approach on a relatively high level (the Report

on the ambient air quality and the contribution of individual sources to air pollution 1993, 1994).

## Emission and air pollution source inventory

The Slovak emission monitoring system is currently represented by the Emission and Air Pollution Source Inventory (EAPSI). The emission inventory is divided according to the output, size and type of sources into 4 parts:

<b>EAPSI 1</b>	Stationary sources of the heating output over 50 MW and selected technologies
<b>EAPSI 2</b>	Stationary sources of the heating output 0.2 - 50 MW
<b>EAPSI 3</b>	Stationary (local) sources of the output below 0.2 MW

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**EAPSI 4**

Mobile sources, regardless of the output

- EAPSI 1** EAPSI 1 data base presents a coherent set of data since 1985. At the present time 1 013 operators of air pollution sources, i.e. the territorial administrative units defined according to the organization inventory number, are registered in EAPSI 1. For each of these, the data about quality, type and quantity of fuel consumed, technical and technological parameters of the combustion and separation technique, are updated. Using these data, the emissions of CO, NO<sub>x</sub>, SO<sub>2</sub> and particulate matter are calculated for individual sources by using of emission factors. Emission data from technologies are provided by the individual sources on the base of their own findings. Emissions from combustion processes and technologies of individual sources are further summarized at the level of territorial administrative units. For the source, registered in EAPSI 1, geographical coordinates are also assigned that enable their representation in the geographical information system.
- EAPSI 2** Updating of the EAPSI 2 data is carried out in a multi-year cycle. The Inventory and data acquisition from individual sources has been carried out continuously. Summarizing was executed in 1985 and 1989. However, number of sources registered in EAPSI 2 increased enormously so that the data are not comparable. At present, the third updating is under way in cooperation with the Offices of Environment.
- EAPSI 3** EAPSI 3 data base is updated annually. Local furnaces are evaluated as the area sources at the district level. Emissions are calculated upon the base of emission factors and data of fuel consumption by retail consumers.
- EAPSI 4** EAPSI 4 data base is updated according to the requirements of the Ministry of Environment of the Slovak Republic. The emission calculation is conducted by the COPERT method, recommended to the participants of the UN ECE Convention on the long range transboundary transport of air pollution. It considers the number of individual types of cars, amount of kilometers driven and the consumption of individual fuel types. Apart from the road traffic, EAPSI 4 comprises the railway, air and shipping traffic.

The procedure of the source inventory and data set, registered for individual sources, do enable to use the national emission monitoring system EAPSI, as a supporting data base for international emission inventories, for compilations of special emission inventories, too.

### Trends of the development in the basic pollutants emissions

Trends of development in the basic pollutants emissions are listed in Tab.1. It may be stated, that the trend remains unchanged generally (Sedlák et al., 1995).

Tab. 1 Trends of development in basic pollutants emissions in the Slovak Republic [thous. tons] (Air pollution in the Slovak republic 1994, 1995).

PM emissions								
	1988	1989	1990	1991	1992	1993	1994	1995
EAPSI 1	212.065	226.925	208.075	153.59	110.545	79.925	52.335	55.770
EAPSI 2	*36.425	*36.425	36.425	*36.425	*36.425	*36.425	**17.097	**17.097
EAPSI 3	59.536	57.641	54.868	39.593	30.511	26.968	17.869	16.111
<b>Total</b>	<b>308.026</b>	<b>320.991</b>	<b>299.368</b>	<b>229.608</b>	<b>177.481</b>	<b>143.318</b>	<b>87.301</b>	<b>88.978</b>
SO <sub>2</sub> emissions								
	1988	1989	1990	1991	1992	1993	1994	1995
EAPSI 1	460.991	447.784	421.981	347.083	296.034	246.411	182.746	188.589
EAPSI 2	*37.509	*37.509	37.509	*37.509	*37.509	*37.509	**27.091	**27.091
EAPSI 3	86.551	83.729	79.487	57.298	44.091	39.255	25.926	20.706

Total	610.268	569.022	538.977	441.189	377.634	323.175	235.763	236.386
<b>NO<sub>x</sub> emissions</b>								
	1988	1989	1990	1991	1992	1993	1994	1995
EAPSI 1		146.800	146.474	135.389	127.454	122.169	111.615	118.039
EAPSI 2		*4.961	4.961	*4.961	*4.961	*4.961	**5.193	**5.193
EAPSI 3		6.610	6.783	5.352	4.639	4.218	3.692	5.203
EAPSI 4		*68.521	68.521	66.278	54.655	52.515	*52.515	*52.515
<b>Total</b>		<b>226.622</b>	<b>226.739</b>	<b>211.980</b>	<b>191.709</b>	<b>183.863</b>	<b>173.015</b>	<b>180.950</b>
<b>CO emissions</b>								
	1988	1989	1990	1991	1992	1993	1994	1995
EAPSI 1		162.699	162.047	160.591	132.874	160.112	168.561	165.715
EAPSI 2		*27.307	27.307	*27.307	*27.307	*27.307	**11.409	**11.409
EAPSI 3		150.022	143.633	103.121	78.846	70.107	46.712	42.594
EAPSI 4		*151.000	155.711	148.091	143.244	150.819	*148.000	184.921
<b>Total</b>		<b>491.028</b>	<b>488.698</b>	<b>439.110</b>	<b>382.271</b>	<b>408.345</b>	<b>374.682</b>	<b>404.639</b>

\* data obtained by a professional estimate \*\* preliminary information

#### Particulate matter and sulphur dioxide

Emissions of the particulate matter and sulphur dioxide are decreasing continuously. Apart from the production and energy, consumption decreases. It is caused first by the change in the fuel base, using high-grade fuels and improving their quality. In addition, the enhancement of separation techniques, improving its efficiency, takes part in the particulate matter emission reduction as well.

#### Oxides of nitrogen

Emissions of oxides of nitrogen show a slight decrease since 1989 and this trend is unchanged.

#### Carbon monoxide

A decreasing tendency in the carbon monoxide emissions since 1989 was caused mainly by the decrease in the fuel consumption and the change of the fuel composition, in the sphere of retail consumers (EAPSI 3). Carbon monoxide emissions from combustion processes of major sources are slightly decreasing, as well. Iron and steel industry participates significantly total carbon monoxide emissions from major sources. Carbon monoxide emissions decreased in 1992 due to the decrease of iron and steel production. In 1993, when iron and steel production increased, to reach the level of 1989, carbon monoxide emissions were proportionally increased, too.

#### Verification of the results

- A Verification of the data, found by the emission inventory, was carried out by comparing :
- up-to-date data the data within previous years and by verifying reasons of their changes (e.g. change of the fuel base, fuel quality features, technology, separation technique, etc.)
  - data listed in EAPSI 1 questionnaires to the data provided by Offices of Environment (differences were mostly in fuel quality features and this can significantly affect the amount of emissions calculated, in dependence on the amount of fuel consumed: the data of measurements for combustion processes were not taken into consideration when updating because of technical reasons).
  - values found by the aggregation of the data from individual sources the (inventory procedure „bottom up“) to the values found on the base of statistical data and emission factors (the inventory procedure „top down“).

#### Conclusion

The unfavourable development along with the alarming growth of ecological damages speeded up an international cooperation. In 1979 the UN ECE Convention on Long Range Transport of Air Pollution was signed in Geneva, of which Slovakia is the successor. Protocols of the

Convention to reduce sulphur dioxide emissions (Helsinki 1985, Oslo 1994), emissions of oxides of nitrogen (Sofia 1988) and limit volatile organic compound emissions (Geneva 1991), include the first measures to reduce emissions of anthropogenic pollutants playing a role in the long range transport of pollutants in Europe. A commitment from the first sulphur Protocol represented a reduction of European sulphur dioxide emissions of about 30 % by 1993, as compared to 1980. The Slovak Republic has already fulfilled this commitment. A reduction of European emissions has been positively manifested by the precipitation acidity decrease over the territory of Slovakia. In compliance with the second sulphur Protocol, the European sulphur dioxide emissions should be reduced by ca 60 % in 2000, by ca 65 % in 2005 and by ca 72 % in 2010, as compared to 1980.

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