Dust (TSP)

Maps 5.3 - 7 shows computed concentration distribution of dust for the year 1998. The dust concentration may exceed the ambient air quality standards at particular localities, eg Station Sasova.

According to the modelling results, the dust concentration on the regional level is contributed 38.5 % by domestic heating / hot water production, 32.7 % by transboundary pollution, and 28.8 % by combustion and technology sources. In Banska Bystrica, the contribution of domestic heating / hot water production is 27.8 %, transboundary pollution at 23.6 %, and combustion and technology sources at 48.6 %. Other possible sources may include exposed soil and dust on the ground.

5.3.3 CURRENT AIR QUALITY MANAGEMENT

(1) National Policy for Improvement of Air Quality

The National Environmental Policy (NEP) sets long-, medium- and short-term objectives for various sectors including the air pollution sector. Among number of those objectives in the air quality sector, the following are of particular relevance in preparation of the current REMP for the Hron Basin.

General long-term strategic objective

- Reduction of environmental pollution to acceptable levels (within the set limits)

Long-term strategic objectives for the air quality sector

- 80 % reduction in SO_2, NOx, and dust emissions, reduced emissions of volatile organic compounds (VOCs), persistent organic pollutants (POPs), heavy metals, CO_2, and other greenhouse gas emissions, in accordance with international conventions
- More accurate evaluation and more rational utilisation of coal in connection with minimising coal combustion
- Greater reliance on alternative fuels and means of transportation reducing environmental pollution (gas, electricity, unleaded gasoline, trains, bicycles)

Medium-term objective (2000 - 2010) for the air quality sector

- Reduction of SO_2, emissions by more than 50 % (from 438 000 tonnes in 1991 to 216 000 tonnes in the year 2000), of NOx emissions by more than 35 % (from 233 000 tons in 1991 to 152 000 tonnes in the year 2000), of solids by 65 % (226 000 tonnes in 1991 to 80 000 tons in the year 2000), and of other emissions of substances (CxHy, dioxines, etc.) harmful to to the atmosphere.

Short-term objectives for the air quality sector

- Substantial reduction in the emissions of basic substances polluting the atmosphere (SO_2, NOx, CO, CxHy, solids) and concentrating on the worst polluters and twelve areas mostly affected by pollution

The NEP is put into effect by regulatory measures, and supportive measures such as operator programmes and economic instruments. Slovakia subscribes to the polluter pays principle, whilst also providing financial support from the State Environmental Fund (SFZP) for environmentally sound and desirable activities such as renewable energy use and fuel switching to natural gas.

(2) Legislative and Regulatory Framework

Currently, following legal documents relevant to air protection are valid:

- Act No. 309/1991 on Air Protection Against Pollutants
- Act No. 134/1992 on State Administration in Air Protection
- Act No. 311/1992 on Charges for Air Pollution
- Regulation of the Ministry of Environment No. 111/1993 on issuing expert opinions in the matters of air protection, appointing persons authorised to prepare such opinions and verifying their professional abilities
- Regulation of the Ministry of Environment No. 112/1993 on specifying areas requiring special air protection and on operation of smog warning and regulatory systems.
- Governmental Order No. 92/1996 regarding emission standards, categorisation of pollution sources and list of the polluting substances
- Regulation of the Ministry of Environment No. 299/1995 regarding conditions for appointing persons authorised to carry out emission and ambient air quality measurements
- Regulation of the Ministry of Environment No. 208/1996 on emission reduction programmes
- Regulation of the Ministry of Transport, Posts and Telecommunications No. 265/1996 on Control of Road Vehicles Emissions
- Regulation of the Ministry of Environment No. 41/1997 on emission measurement
- Regulation of the Ministry of Environment No. 268/1997 on fuel quality requirements

Regulatory measures and economic instruments utilised for the management of air quality include the following:

Regulatory measures	Economic instruments
Ambient air quality standards *Fuel quality standards* *Emission standards*	*Emission charges ,taxes and fines* *Subsidies*

There are a number of legal instruments in Slovakia for the management of air quality. The principal of these is the Act on Air Protection Against Pollutants, which gives the basic obligations for emission sources to use the Best Available Technology Not Entailing Excessive Costs (BATNEEC) and to apply emission limit values. An amendment is being introduced to provide for emission quotas. MZP sets emission quotas of SO_2 and NOx to each Okres who allocates the quotas to the emission sources in the area.

Government regulations made under the Act lay down the source categories covered, ambient air quality standards, and general and specific emission limit values.

The Act on State Administration in Air Protection allocates responsibilities to different levels of the State administration.

The Act 311/1992 provides emission charges imposed on stationary sources. The recently renewed basic rates are as follows:

Pollutant	**Charge (SK/ton)**	
Particulate	5 000	
SO_2	2 000	
NO_x	1 500	
CO	1 000	
Σ C	4 000	
Class I substances	40 000	(8 substances specified)
Class II substances	20 000	(29 substances specified)
Class III substances	10 000	(35 substances specified)
Class IV substances	2 000	(46 substances specified)

These are multiplied according to the state of compliance/non-compliance with the emission limits and emission quotas.

The use of the BATNEEC is required by the Act 309/1991 for new sources and in the case of substantial reconstruction or modernisation. There are no specific technology requirements, but emission limit values are set at a level that implies a certain level of technology. New sources have the most stringent emission limit values. Existing sources were required to comply with the regulation by 1 January 1999. But significant portion of the existing plants was not able to meet this deadline, so the Act on Air Protection Against Pollutants has been

amended. The amendment enables them to operate beyond the deadline, potentially until the end of 2006. But a rapid increase in the rate of emission charges for such sources should motivate the operators of such sources to reach the compliance before the end of 2006.

Particular technologies for vehicles are not required. Emission limit values for new and imported vehicles are set at a level which can be met only if the vehicle is fitted with a three-way catalytic converter.

The Regulation of the Ministry of Environment 208/1996 on emission reduction programmes requires that each source of air pollution be obliged to issue his own emission reduction programme and pass it over to the responsible Okres authority. The fulfilment of the programme is supervised and regularly evaluated by the authority based upon the yearly report on emissions of which each source is obliged to submit.

There are also a national programme on NMVOC emissions reduction and the Action Plan on Phasing-out ODS Consumption, since Slovakia is a party to the Vienna Convention for the Protection of the Ozone Layer as well as the Montreal Protocol on ODS together with the London and Copenhagen Amendments.

(3) Institutional Framework for Air Quality Management

The Act on State Administration in Air Protection allocates responsibilities to different levels of the State administration. Following institutions having the following tasks are involved in the air quality management:

Ministry of the Environment of the Slovak Republic (MZP) - Department of Air Protection

- Development of air protection strategy, policy and legal instruments
- Administrative supervision of the implementing institutions
- Responsibility for the international treaties and their implementation into the national legal system
- Responsibility for monitoring and reporting on the national level

Environment Protection Inspectorate (SIZP)

- Inspection control over compliance of the environment pollution sources with the air protection legislation
- Supervision of implementation of operation parameters as specified in the operation permits
- Supervision of implementation of restoring programmes and programmes for air quality protection after accidents
- Closely co-operates with the Kraj and Okres offices

8 Kraj Offices - Departments of Environment Protection

- Implementation of the environment protection legislation on the local level, in particular translation of the environmental protection strategy from national level into the respective Okres offices

  Setting of emission limits for existing large sources

- Setting of regulations concerning smog alert and management of smog situations in the area included in more than one Okres
- Prescribing close down or production reduction of air pollution sources in the case of severe violation of the air protection legislation or immediate endangering of the environment
- Reporting about air quality in the particular Kraj and the contribution of particular air pollution sources to the air pollution.

79 Okres Offices - Department of Environment Protection:

- Approving building permissions for large and middle-sized sources
- Approving installation of monitoring devices
- Approving significant changes in air pollution sources, which may lead to change in air pollution
- Approving measures regarding smog-alert and regulation system
- Setting charges, fees and penalties against air pollution and violation of air protection legislation
- Setting emission limits for existing middle-sized sources
- Collecting data about air pollution sources and their emissions on the yearly basis

Municipal offices of environment protection:

- Within their jurisdiction are the small air pollution sources.

(4) Programmes of Air Pollution Abatement

In accordance with Section 7 of the Regulation of the Ministry of Environment No 112/1993, a programme for air pollution abatement (Program na obmedzenie znecistovania ovzdušia) has to be elaborated for each specified area requiring special air protection (called "non-attainment area"). In the Study Area, there are two areas specified as non-attainment area: okres Banska Bystrica and okres Ziar nad Hronom. The air pollution abatement programmes in these areas are outlined below.

1) Programme of Air Pollution Abatement in the Non-attainment Area Ziar nad Hronom

The non-attainment area Ziar nad Hronom is located in a large valley, characterised by relatively bad dispersion conditions. The annual mean wind speed at 1.8 m/s is only 1/3 of that of the Bratislava area. Prevailing wind direction is east and north-west. Windless

situations appear at a frequency of about 40 - 50 %. Also the atmospheric inversion occurs frequently.

The air quality has been dominantly influenced by the aluminium plants-complex. In general, however, the air quality improved significantly after the recent reconstruction of the complex.

The programme for air quality improvement is divided into 3 steps:

i) 1 January 1997 to 31 December 1998
ii) 1 January 1999 to 31 December 2004
iii) 1 January 2005 to 31 December 2009

The programme concerns with large and middle sized point sources as well as small sources of air pollution.

Small sources are considered in a way of possible connection to natural gas pipelines of selected localities. According to the Regulation No. 208/1996, following 6 sources were obliged to elaborate air pollution reduction programmes:

i) CITO s.r.o. Ziar nad Hronom - chem. cist.textilu
ii) Kerko a.s. Košice - tazba a sprac.perlitu
iii) Pohronské strojárne a.s. Hliník n/Hr.- výroba ocele
iv) Spektrum s.r.o Hliník nad Hr. - spracovanie dreva
v) Xénia s.r.o. Zvolen - spracovanie dreva
vi) ZSNP a.s. Ziar nad Hronom - výroba hliníka

The Programme is based upon these particular programmes and their expected impact. Air pollution abatement measures for about 273 million SK are envisaged until 2009, out of which about 204 million SK concerns the aluminium plants complex, being the dominant air pollution source in this region.

However, the total amount of emissions is expected to rather increase due to the expected increase of aluminium production. The expected emission trend in Ziarska kotlina non-attainment area as assessed in 1998 is shown below.

Unit: t/yr

Pollutant	1997	1999	2005
Particulate	336.758	265.448	265.876
SO2	2 592.606	3 187.041	3 187.041
Nox	422.204	465.703	465.718
CO	10 646.492	13 985.384	13 985.334
Others	109.188	135.834	135.834
Together	14 107.248	18 039.410	18 039.803

Source: Program of Air Pollution Abatement in the Non-attainment Area Ziar nad Hronom

According to the measurement of the state hygiene service and SHMU, the main polluting substances in the area are the fluorides. Their concentration decreased significantly in the latest years due to the reconstruction of the aluminium plant and the introduction of abatement measures. The yearly average concentration is below the ambient air quality standard (1 $\mu g/m^3$).

The Programme concluded that the Ziar area was expected to remain problematic in the future from the air pollution point of view.

2) Programme of Air Pollution Abatement in the Non-attainment Area Banska Bystrica

Non-attainment area Banska Bystrica is located in the northern part of the Zvolen hollow. Due to the geo-morphological properties of the surrounding terrain the atmospheric inversion occurs very often. In the last 5 years the inversion with vertical thickness up to 100 m occurred in 208 days and the inversion with vertical thickens up to 300-400m in 107 days. Large factories, local heating boilers using low-quality brown coal, and rapidly increasing traffic are contributing to the air pollution situation. According to the Regulation No. 208/1996, following sources were obliged to elaborate air pollution reduction programmes:

i) Stredoslovenská Cementáren, Banská Bystrica,
ii) Smrecina Holding a.s., Banská Bystrica,
iii) Hospital F.D. Roosevelt, Banská Bystrica,
iv) Biotika a.s., Slovenská Lupca
v) Fermas s.r.o, Slovenská Lupca

The Programme for air pollution abatement is based on these programmes.

Most significant air pollution source, Stredoslovenska Cementaren already achieved significant emission reduction through introduction of extensive abatement measures for particulate matter as well as reduction in cement production. Total planned cost until 2009 is 31.5 million SK.

Measures mainly aimed to reduce pollution by organic solvents were partly introduced in Smrecina holding and Biotika Slovenská Lupca. Further measures are envisaged in the future for total investment costs 48.5 million SK in Smrecina and 411 million SK in Biotika.

The Roosevelt hospital reconstructs its hazardous waste incineration plant. The new plant will meet all air quality standards. The total reconstruction cost is 50.16 million SK.

Under very unfavourable dispersion conditions, this area may remain as a non-attainment area in the future, unless additional abatement measures are taken to reduce emissions from medium to small sources such as local heating boilers and road traffics.

5.3.4 AIR QUALITY ISSUES AND RECOMMENDATIONS

(1) Summary of the Existing State

From the foregoing discussions, the situation concerning the air quality in the Study Area can be summarised as follows.

1) Ambient Air Quality

   a) In general, the air quality in the Study Area has improved significantly during the 1990s according to the results of the automatic air quality monitoring at 5 local stations in the Study Area: 2 stations in Banska Bystrica area and 3 in Ziar nad Hronom area.

   b) However, concentrations of NOx did not meet the short-term (daily and half-hour) ambient air quality standards by 1998 in the town of Banska Bystrica, although the annual average concentration met the standard in 1998 for the first time.

   c) Also, the annual average concentration of TSP in 1998 exceeded the standard at one station in Banska Bystrica.

   d) As far as is known from the results of the regular monitoring and particular monitoring projects or studies, no other pollutants, in the last few years in the Study Area, exceeded the ambient air quality standards or relevant norms and guidelines. These include SO_2, CO, volatile organic compounds (VOCs), persistent organic compounds (POPs), heavy metals and fluorides.

2) Air Pollution Sources

   a) In comparison with the year 1990, pollutant emissions in the Study Area decreased drastically by 1998: the emission of SO_2 in 1998 was 24 % of that in 1990, NOx 30 %, PM 36 %, and CO 79 %. These reductions were mostly realised at stationary pollution sources. However, there seems to exist a number of plants, including large ones, that are still not able to meet

the emission standards.

b) To the total emissions of above-mentioned pollutants, the contribution of large stationary sources is still high in the Study Area: 33 % for NOx, 74 % for SO_2, 31 % for PM, and 38 % for CO in 1998. But these ratios are lower than those in whole Slovakia; the contribution ratios of middle to small stationary sources in the Study Area are higher than the national averages.

c) Of the total emission of NOx in the Study Area, mobile sources account for 56 %, while the Slovak average is 35 %. According to the result of air quality modelling, the contributions to the ambient concentration of NOx in the centre of Banska Bystrica are 39 % from road transport, 28 % from combustion and technology sources, 24 % from rail transport, and 9 % from others. The contribution of road transport has been increasing at the national and regional levels.

d) According to the results of modelling on TSP in Banska Bystrica, the contributions to the ambient TSP concentration are 49 % from industries, 28 % from domestic heating / hot water production, and 24 % from sources outside the Study Area including foreign countries. Possible sources not considered in the modelling may include exposed soil and dust on the ground.

e) Emissions of other pollutants such as fluorides, heavy metals and polycyclic aromatic compounds also decreased drastically during the 1990s, although it is said that their accumulation in soil has not decreased.

3) Air Quality Management Systems

a) The legal and institutional systems developed under the national environmental policy seem to have worked well for improving the air quality of the Study Area. Although this improvement may be partially attributed to decline in industrial activities associated with the switch to the market economy, efforts made by the government and industries should be duly appreciated. These efforts are continuing.

b) Existing stationary pollution sources were to comply with the current stringent emission standards by 1 January 1999. But since a significant number of the existing plants were not able to meet this deadline, it has been postponed until the end of 2006. However, the provision of rapid increase of emission charges should motivate plant operators to comply with the standards before the end of 2006.

c) There are two areas, one each in Banska Bystrica Okres and Ziar nad Hronom Okres, which are specified by a Government Resolution as non-attainment areas of air pollution, and each Okres is required to prepare a programme for air pollution abatement. Although these programmes will contribute much in reducing pollutant emissions from stationary sources, they do not deal with the issue of traffic emissions, control of which is of growing importance in achieving further improvement of the air quality.

d) The local air quality monitoring network in Slovakia started its operation in

1993 with 32 monitoring stations. Due to the budgetary shortage, the number of actually operating stations decreased to 24 in 1999. Out of 5 stations operated in the Study Area by 1998, 3 stations became inoperable in 1999.

(2) Identification of Air Quality Issues

Although the ambient air quality of the Study Area has improved to nearly acceptable levels, the following are identified to be the major issues:

Issue A1 A number of plants are still not able to meet the emission standards.
Issue A2 The NOx concentration exceeds the short-term air quality standards in the town of Banska Bystrica and heavy traffic roadside areas.
Issue A3 The TSP concentration exceeds the long-term air quality standard in certain areas in the town of Banska Bystrica.
Issue A4 The number of operable air quality monitoring stations is decreasing due to the budgetary shortage.

(3) Objectives, Targets and Recommended Measures

The objectives, targets and recommended measures for the issues as identified above are shown in Table 5.3 - 12. The goal of all recommendations is to improve the ambient air quality so as to meet all the air quality standards in the whole area of the Hron Basin.

The Slovak Republic is tackling various environmental issues in order to comply with international agreements and to meet requirements for joining EU. These include, for example, the reduction of emissions of major pollutants by 80 % from the levels of 1990 in Slovakia. A number of regulatory and economic measures to achieve such goals are already in force. Measures A1.1 and A1.2 are part of such efforts being pushed forward by the Government and being implemented by industries. The efforts should be continued with the highest priority.

A majority of the recommended measures, in addition to the above 2 measures, for Issues A2 and A3 have been selected from those already proposed in the Environmental Action Programmes (SR, Kraj, Okres) and/or the Territorial Development Plan but which have not been implemented, according to the information from the Okres of Banska Bystrica. Other measures (A2.5 and A3.2) have been newly proposed.

Expansion of gas supply (A2.1 = A3.1) in place of low-quality fuels such as brown coal are effective for reductions of both NOx and PM, and is in line with a long-term strategic objectives of the national environmental policy. Its implementation is highly recommended.

Expansion of trolley-bus system (A2.2) is included in the environmental action programmes as a high priority of the Okres, and electrification of rail road (A2.3) is included in the territorial development plan as well as the Okres environmental action programme with a high priority. Both measures are also in accord with a long-term strategic objective of the national environmental policy, but would not appear to be justified on air quality grounds alone. A feasibility study for Measure A2.3 is said to be completed and its cost being estimated at 890 million SK.

Construction of the road bypass (A2.4) is included in the territorial development plan and is a priority of the Okres. Construction of a tunnel is also being considered as an alternative. These measures will have an effect of reducing noise levels in the downtown area as well. However, since these will incur large costs, and may bring about various impacts on the environment, a comparative feasibility study on these options including the environmental impact assessment should be conducted, if not done yet, to examine the economic validity taking into account its role in regional development and to minimise any negative impacts on the environment; this traffic bypass cuts the Rudlova - Sasova housing area. Then, the implementation of the more advantageous option should be ensured.

The Study Team has only limited information on NOx removal in the Cement Works (A2.5) regarding the status of the project. The cost for the installation of the de-NOx system employing the selective non-catalytic reduction (SNCR) method is said to be 1,310,000 ECU (SHMU, Ref. 8 -11). Although it is reported (Ref. 1 - 22) that the pollutant emissions from the Cement Work did not exceed the emission limits partly because of decreased cement production, implementation of this measure is also recommended if the production is to increase again.

The measure of planting exposed soil (A3.2) is not included here as a possibility. Since there has been no information obtained concerning such areas, investigations are necessary. When exposed soils are found to be a significant source of TSP in the area of Banska Bystrica, implementation of this measure is highly recommended.

Under the current financial situation, a substantial and immediate increase of the budget for air quality monitoring from the current level may be difficult. However, it is necessary to maintain air quality monitoring at an appropriate level so that any changes in air quality, which may have negative effects on human health, can be monitored and necessary actions can be taken promptly. The preparation of such a plan (A4.1) should focus on the optimum

distribution of monitoring stations based on the current and expected future state of significant air pollution sources. A certain level of improvement may be possible without large cost. Consideration should be given also to short-team spot monitoring, as required to supplement the continuous automatic monitoring, in co-operation with other agencies such as the State Institute of Health (SZU). In such supplementary monitoring, possibility of introducing mobile monitoring stations should be considered.

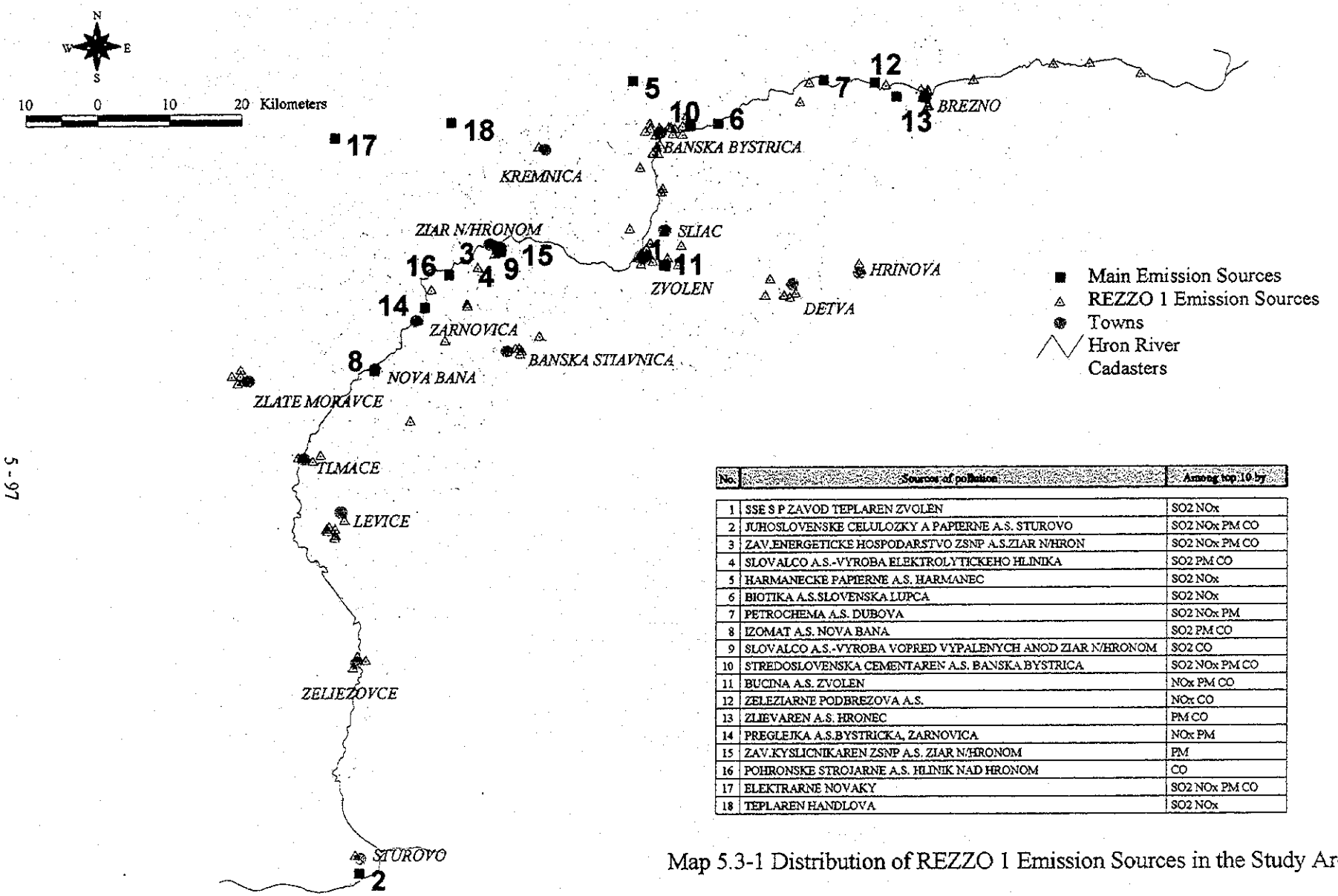
Table 5.3 - 12 Recommended Measures

Goal: To improve the ambient air quality in the Hron Basin so as to meet all the national air quality standards.

Issue	Objective	Target	Recommended Measures	Key Agency
(A1) A number of plants are still not able to meet the emission standards	Reduction of pollutant emissions from stationary sources not complying with the emission standards	All stationary sources to comply with the emission standards by 2006	(A1.1) Enforcement of the emission standards and emission charges to facilitate adoption of the Best Available Technology Not Entailing Excessive Costs by plant operators.	MZP SIZP Kray offices Okres offices Industries
			(A1.2) Implementation of the existing "Programmes of Air pollution Abatement" in Okres Banska Bystrica and Ziar nad Hronom	MZP SIZP Okres offices Industries
(A2) The NOx concentration exceeds the short-term air quality standards in the town of Banska Bystrica and heavy traffic roadside areas.	Reduction of ambient NOx levels in the town of Banska Bystrica and heavy traffic roadside areas	To achieve all the ambient air quality standards for NOx (annual, daily, half-hour)	(A1.1) and (A1.2)	
			(A2.1) Complete gas supply to Banska Bystrica Mesto and surrounding Obec (*)	Municipalities Heating plants
			(A2.2) Expansion of the trolley-bus system in Banska Bystrica Mesto (**) (*)	SAD-BB
			(A2.3) Electrification of the rail section between Banska Bystrica and Zvolen (+) (**) (#)	Slovak Railways
			(A2.4) Comparative study on the construction of the north traffic bypass (+) (*) (#) and a polyfunctional tunnel, and implementation of the more advantageous option	MDPT
			(A2.5) De-NOx of exhaust gas at the cement factory	Cement Works, BB

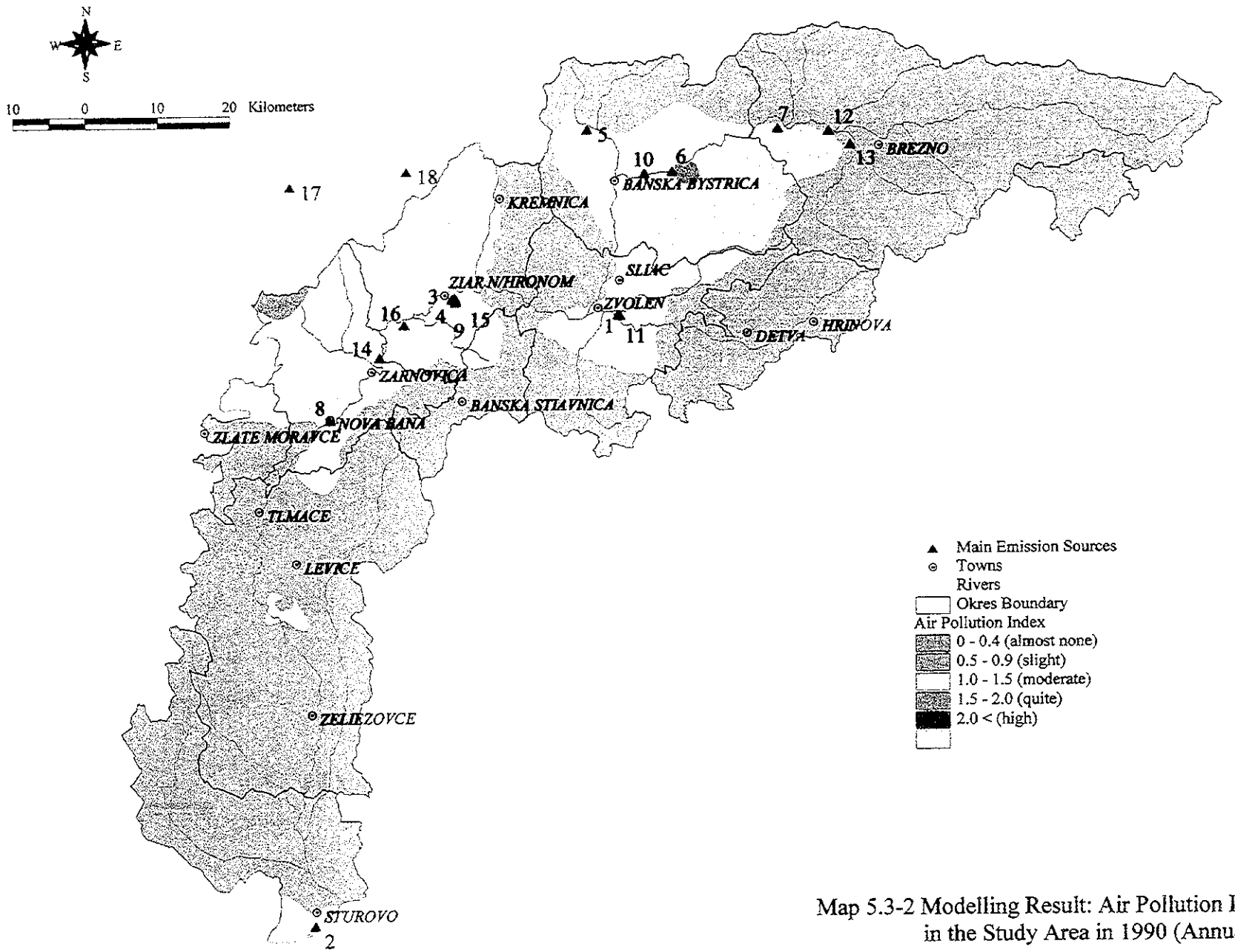
(A3) The TSP concentration exceeds the long-term air quality standard in certain areas in the town of Banska Bystrica.	Reduction of ambient dust levels in the town of Banska Bystrica	To achieve all the ambient air quality standards for TSP (annual, daily, half-hour)	(A1.1) and (A1.2)	
			(A3.1) Same as (A2.1) (*)	Municipalities Heating plants
			(A3.2) Planting of exposed soil areas	Municipality
(A4) The number of operable air quality monitoring stations is decreasing due to the budgetary shortage	To monitor any changes in the air quality that may be have negative effects on the human health	To establish a most desirable and realistic air quality monitoring scheme by 2005	(A4.1) Preparation of a phased monitoring plan for the whole country based on the review of the current state of air quality, present and expected future emission sources (stationary and mobile). The plan includes considerations on short-team spot monitoring , e.g. by mobile stations, as a supplement to continuous monitoring.	MZP SHMU SAZP SZU
			(A4.2) Implementation of the plan in order of urgency	MZP SHMU SZU

Note: (**) Included in the national, Kraj and Okres environmental action programmes.
(*) Priority in the Okres environmental action programme.
(+) Included in the Territorial Development Plan and a priority of Okres.
(#) Feasibility study including environmental impact assessment is necessary, if not done yet; these projects have not been justified on air quality grounds alone.

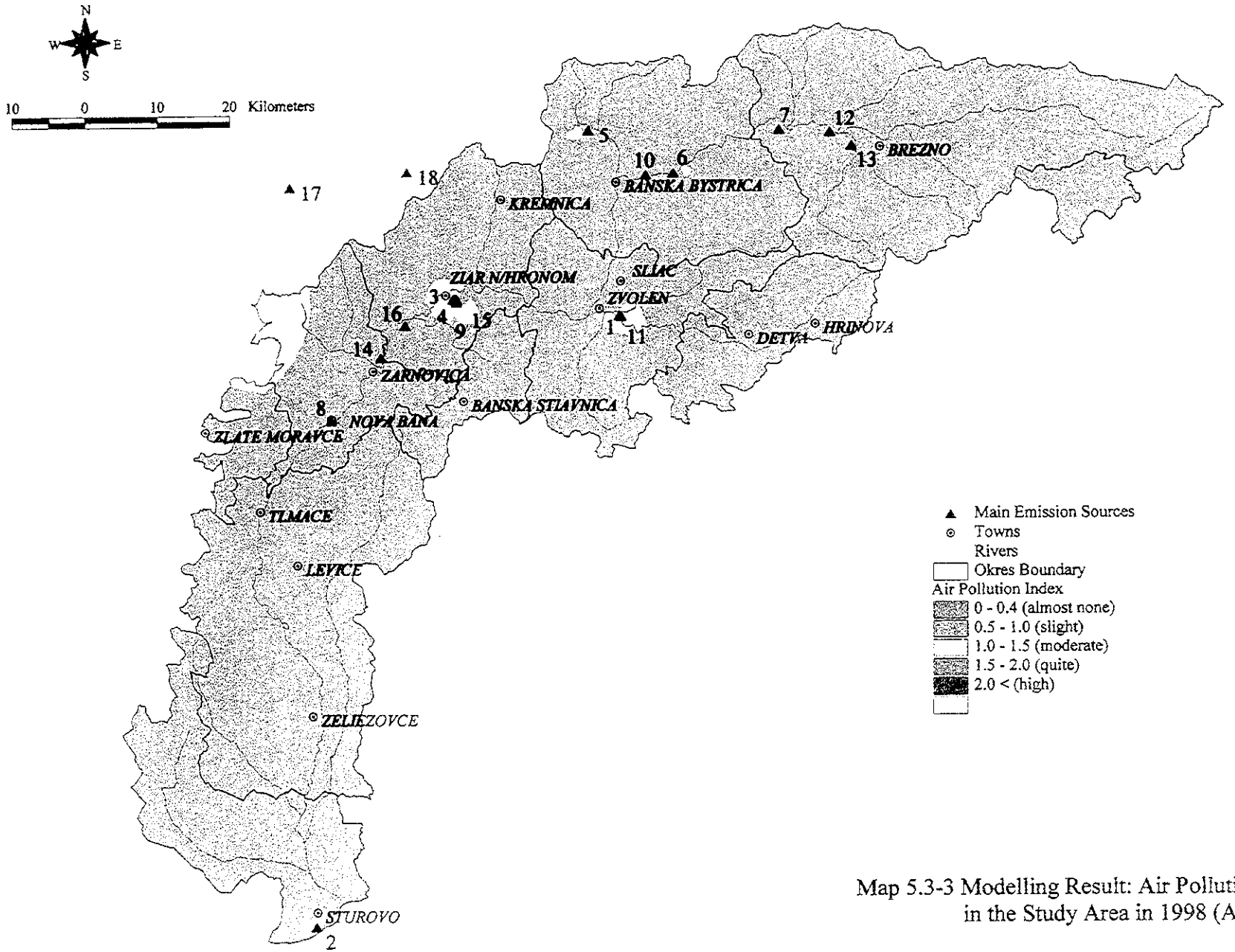


No.	Source of pollution	Among top 10 by
1	SSE S P ZAVOD TEPLAREN ZVOLEN	SO2 NOx
2	JUHOSLOVENSKE CELULOZKY A PAPIERNE A.S. STUROVO	SO2 NOx PM CO
3	ZAV.ENERGETICKE HOSPODARSTVO ZSNP A.S.ZIAR N/HRON	SO2 NOx PM CO
4	SLOVALCO A.S.-VYROBA ELEKTROLYTICKEHO HLINIKA	SO2 PM CO
5	HARMANECKE PAPIERNE A.S. HARMANEC	SO2 NOx
6	BIOTIKA A.S.SLOVENSKA LUPCA	SO2 NOx
7	PETROCHEMA A.S. DUBOVA	SO2 NOx PM
8	IZOMAT A.S. NOVA BANA	SO2 PM CO
9	SLOVALCO A.S.-VYROBA VOPRED VYPALENYCH ANOD ZIAR N/HRONOM	SO2 CO
10	STREDOSLOVENSKA CEMENTAREN A.S. BANSKA BYSTRICA	SO2 NOx PM CO
11	BUCINA A.S. ZVOLEN	NOx PM CO
12	ZELEZIARNE PODBREZOVA A.S.	NOx CO
13	ZLIEVAREN A.S. HRONEC	PM CO
14	PREGLEJKA A.S.BYSTRICKA, ZARNOVICA	NOx PM
15	ZAV.KYSLICNIKAREN ZSNP A.S. ZIAR N/HRONOM	PM
16	POHRONSKE STROJARNE A.S. HLINIK NAD HRONOM	CO
17	ELEKTRARNE NOVAKY	SO2 NOx PM CO
18	TEPLAREN HANDLOVA	SO2 NOx

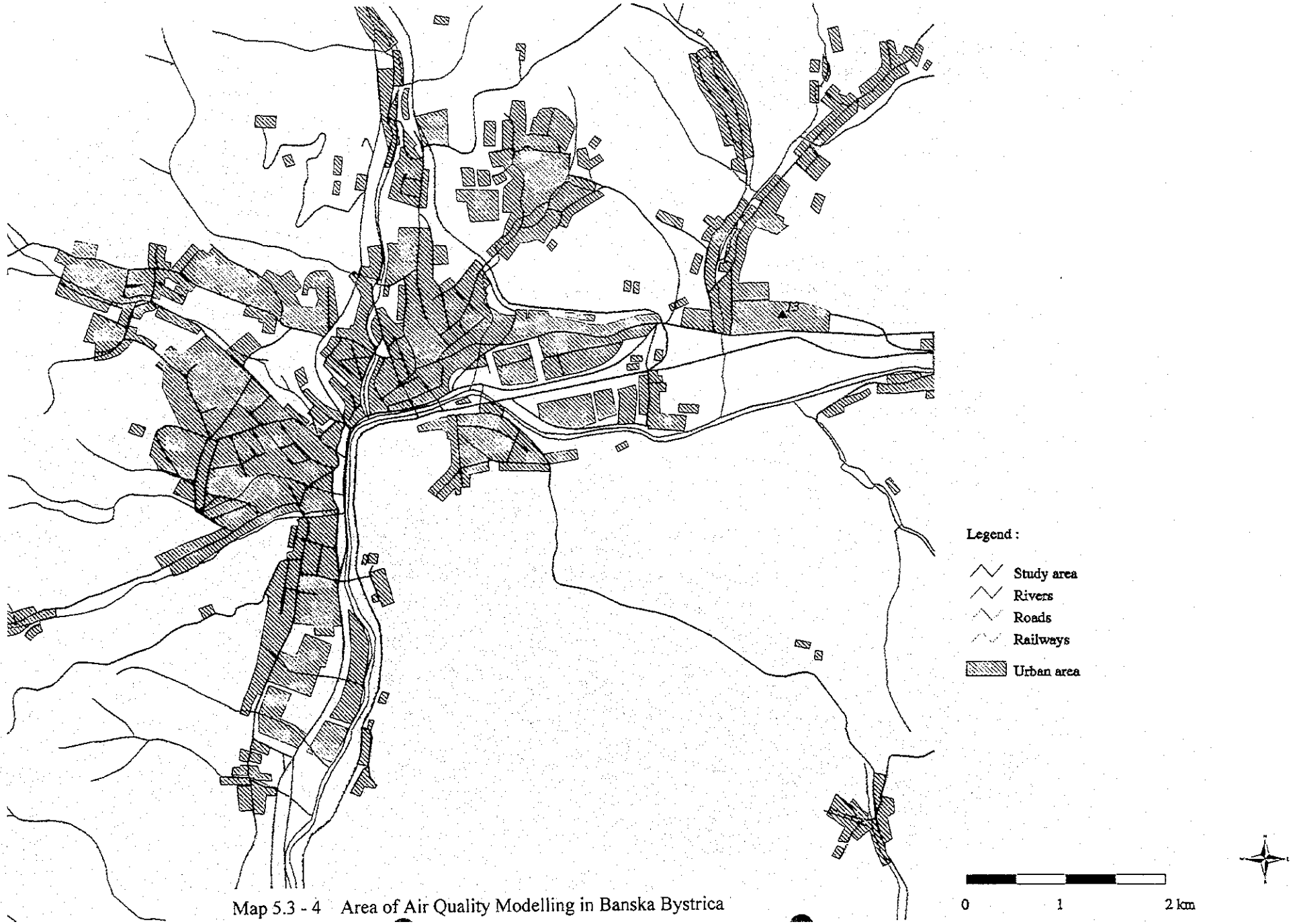
Map 5.3-1 Distribution of REZZO 1 Emission Sources in the Study Area



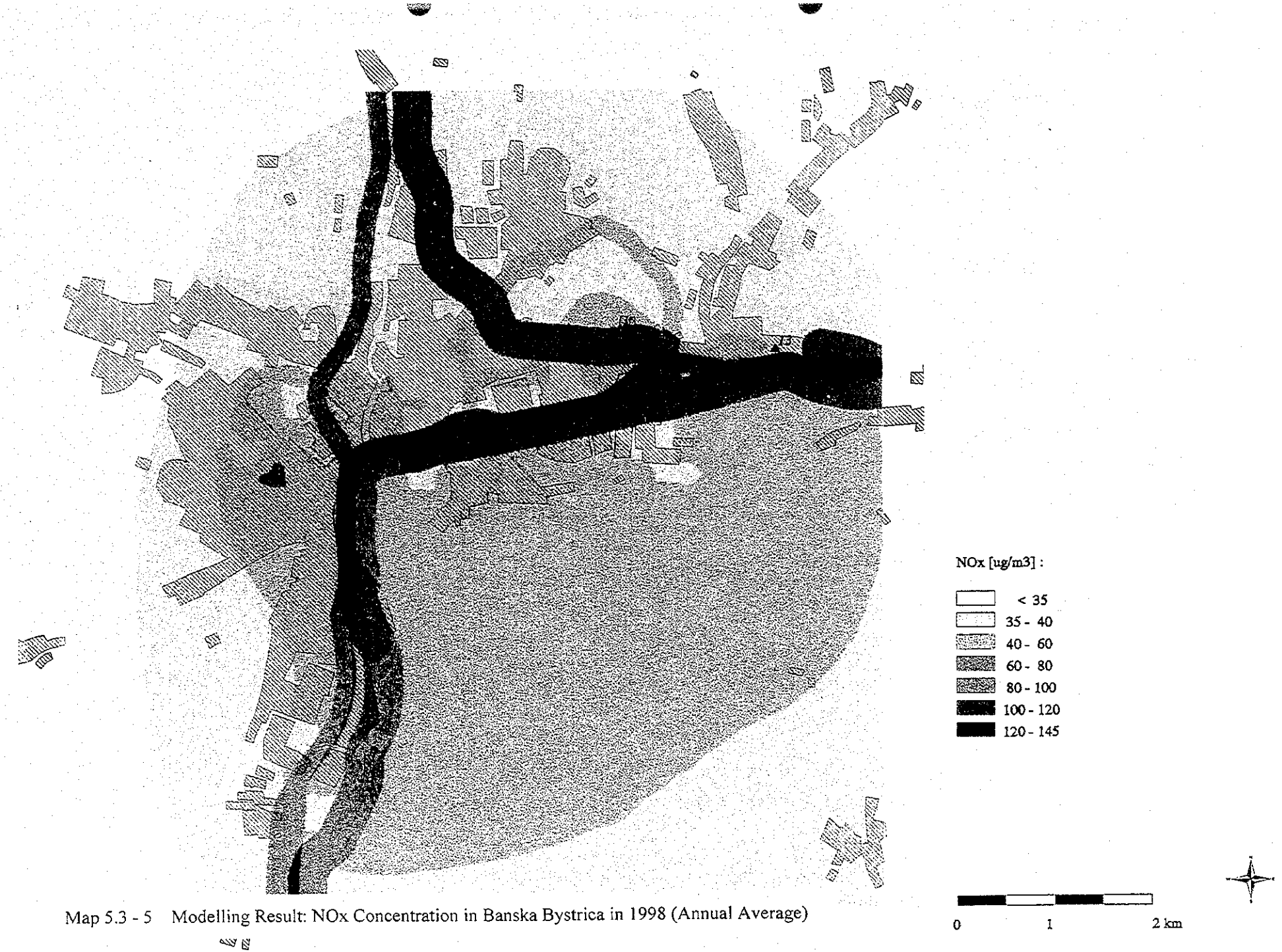
Map 5.3-2 Modelling Result: Air Pollution Index in the Study Area in 1990 (Annual Average)



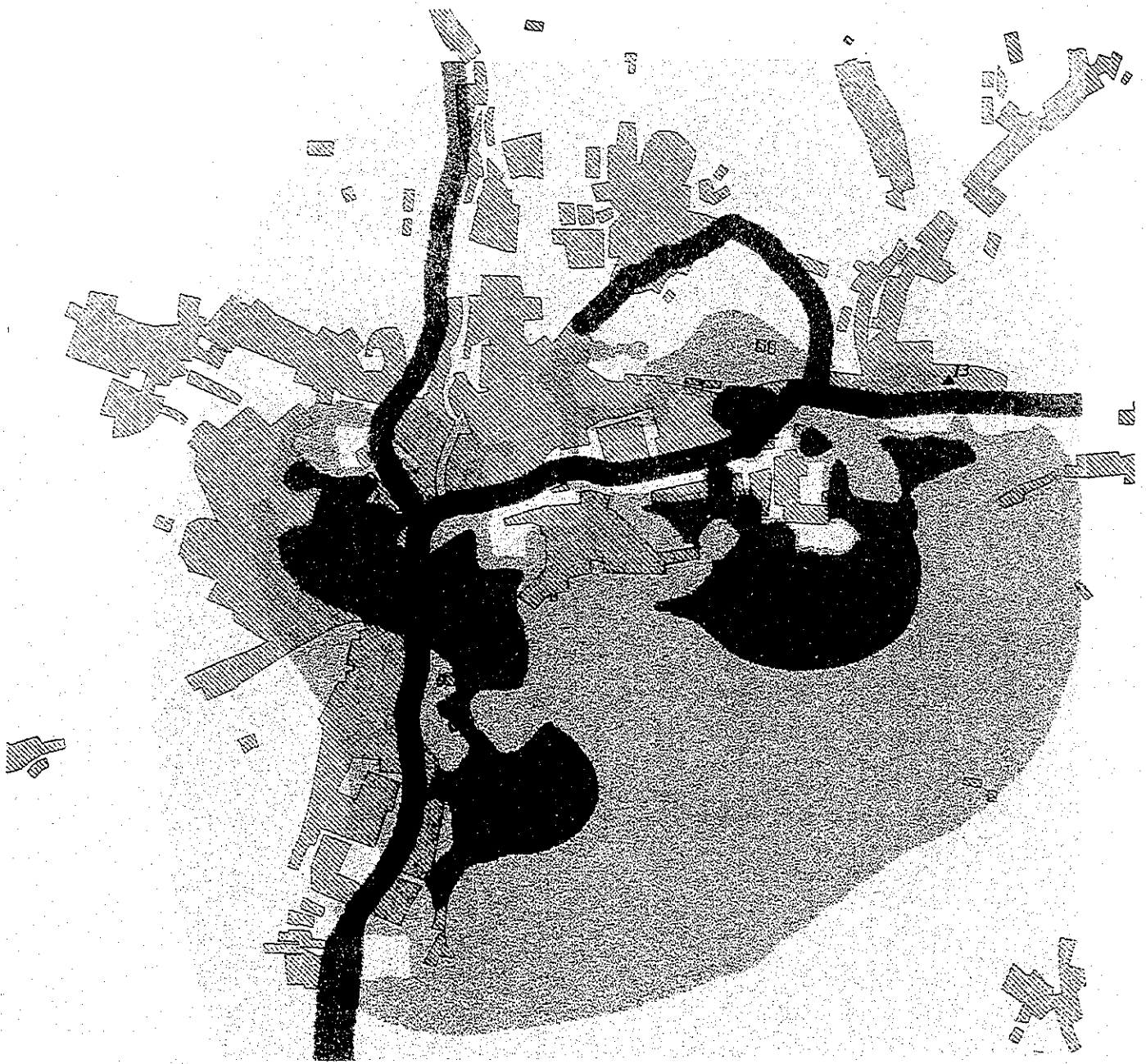
Map 5.3-3 Modelling Result: Air Pollution Index
in the Study Area in 1998 (Annual Average)



Map 5.3 - 4 Area of Air Quality Modelling in Banska Bystrica



Map 5.3 - 5 Modelling Result: NOx Concentration in Banska Bystrica in 1998 (Annual Average)



Following reduction measures were concerned :

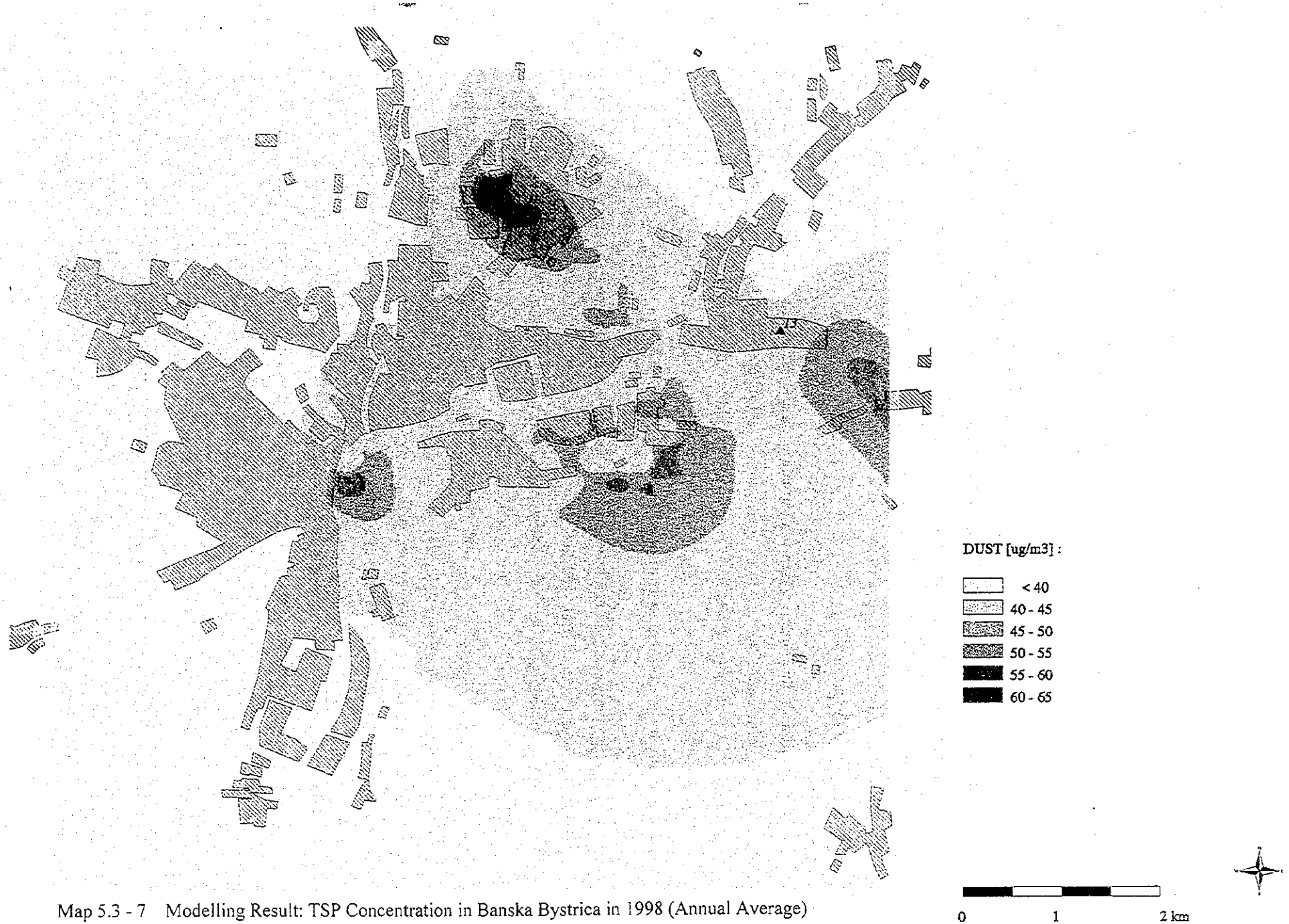
- electrification of rail-section between Zvolen and Banska Bystrica (-100%)
- traffic by-pass in Banska Bystrica (-50%)
- instalation of SNCR in the cement plant in Banska Bystrica (-66%)

NOx [ug/m3] :

- < 8
- 8 - 15
- 15 - 20
- 20 - 30
- 30 - 40
- 40 - 50
- 50 - 60

0 1 2 km

Map 5.3 - 6 Modelling Result: NOx Concentration with Emission Reduction Measures (Annual Average)



Map 5.3 - 7 Modelling Result: TSP Concentration in Banska Bystrica in 1998 (Annual Average)

5.4 SOLID WASTE

5.4.1 WASTE PRODUCTION AND DISPOSAL MANAGEMENT

(1) General

The significance of waste is understood by all municipalities, with waste related factors being rated 1st and 3rd in the ranking of most significant environmental issues in the Study Area. This is based upon the Environmental Questionnaire returns obtained during the early part of the study (Supporting Report, Annex L.2). It is therefore important to try to reflect upon waste generation and disposal in the Study Area and examine how the situation might require to be managed in the future.

This section of the report presents information on the quantities and types of solid waste, together with issues relating to its management and disposal, for the areas within the Hron Basin. Considerable efforts have been made to address the comments and criticisms made about the topic in the Interim Report (Ref. 3-12), with respect to the quality of the data used, especially for identifying waste disposal sites (See Section 5.4.2).

A more thorough analysis has been made of the waste statistics available for SAZP's Waste Management Centre (COH) and the Statistical Office of the Slovak Republic (SOSR), both centred in Bratislava. Detailed discussions have been held with both offices and reference has also been made to the Waste Divisions in the Environmental Departments of Banska Bystrica and Nitra Kraj offices. In addition, waste questionnaires have been sent to all the Okres offices in the Study Area during May 1999, requesting information on many aspects of waste disposal. Responses have been obtained and some meetings held with these offices, allowing for improvements in the database, to assist in understanding the Hron Basin more thoroughly.

Reference has also been made once more to the national Waste Management Plan (Ref 15.1), to cross-check the proposals made at the Regional WMP level. All such proposals seem to follow the National WMP, so there is little variation appearing from such sources.

(2) Types of Waste

The SAZP (COH) collects statistics from Municipality offices around Slovakia, incorporating the data into a database of waste production figures, presented in the RISO (Regional Waste Information System). The SOSR collects data from a network of 7 173 information sources, these having been established in the mid-'90s with a detailed questionnaire, with responses

continuing since the original survey at a 95-98% return rate.

It should be noted that the database of types of waste, upon which the RISO is founded, could accommodate 9 major classifications of waste, but it appears that only 7 are in use, namely:

(Cat. 1) Waste from Animals and Vegetables;
(Cat. 3) Mineral Waste, including Waste from Mineral Treatment Processes;
(Cat. 4) Waste from Waste Treatment ;
(Cat. 5) Waste from Chemical Processes;
(Cat. 7) Waste containing Radio-active Substances;
(Cat. 8) Waste from Water Treatment;
(Cat. 9) Municipal Waste (Domestic, Trade, Office etc).

Within all the classifications, there are 130 major groups containing 750 different types of wastes, each with a unique code. These codes are shown in the database in the Supplementary Report (Table H1.1 in Annex H 'Solid Waste – Supplementary Information'). Each type is assigned to one of the following three major categories:

- Hazardous;
- Special;
- Other Waste

A key issue of concern is the complications inherent in the existing waste classification system. The system was introduced as an essential move to provide a framework for tracking all types of wastes from a very wide range of sources, where no such system existed previously. However, subsequently it has been shown somewhat cumbersome and difficult to manage. A level of uncertainty has been introduced by having so many types of waste, which has led to confusion over the actual quantities of waste arising from household, commercial or industrial sources. It appears, for example, that large quantities of waste are accounted for in the figures, which never actually get into the "waste stream" as such, because they are recycled (eg agriculture wastes). Some clarification on this issue, with refinement of the waste classification and recording system, will be beneficial in avoiding this confusion and removing unnecessary levels of bureaucracy.

There have already been some modifications to improve the situation. The new waste catalogue (Decree No.19/1996), for example, no longer considers all forms of agricultural by-

product to be waste. For example manure (dung mixed with straw) and straw are no longer classified as waste. These modifications to the classification of wastes have, in themselves, a significant implication when estimating the quantity of waste that has to be disposed of within the study area.

Details of the 20 types of waste with the largest production in the Study Area, are given in Table 5.4-1. Waste obviously covers a range of materials from a wide number of sources. Household waste constitutes a major element of the waste produced and this is important, since its disposal requires the construction of major, controlled and managed landfills. However, the two major items of waste produced in the study area are animal manures, notable from pig and cattle breeding, which are usually reused as organic fertiliser, rather than being disposed of as waste. Further rationalisation of the categories may result in more reductions in the types of materials classified as waste, which will have implications for waste statistics.

(3) Quantity of Waste

1) General

As indicated above, there are two organisations collecting data on waste production rates in Slovakia, namely SAZP (COH) and SOSR. It is the SAZP RISO system figures that form the basis of the main reported information, released as part of the SAZP Partial Monitoring System. However, these data are based solely on Hazardous Waste and Special Waste categories. By comparison, the data collected by SOSR takes account of 'Other Waste' material, by virtue of the detailed questionnaires issued by the SOSR. The respondents mostly continue to provided information on an annual basis, although SOSR have aggregated the figures on an Okres basis, as opposed to the Municipal level used by SAZP. The accuracy of the SOSR approach may be questioned due to the level of detail, but the inclusion of 'Other Waste' is a major advantage, since for the Study Area, up to 34% of waste produced is in this category.

2) SAZP (COH) Derived Data

Information derived from the RISO system is presented first, with Table 5.4-2 identifying the quantity of Hazardous and Special Waste produced in the Study Area, based upon 1997 figures. These are the latest data available from SAZP at the time of report preparation. As can be seen, virtually 30% of the waste (542 260 t) arises from livestock breeding, with a small amount coming from animal slaughter (Waste Type [WT] 13).

Table 5.4 - 1 List of 20 Types of Waste with the Largest Production within the Study Area

	Waste type / In English	Waste type / In Slovak	Waste number	Category	Amount [t]
1	Liquid manure from pig breeding	Hnojovica z chovu ošípaných	13702	Z	279,374.66
2	Liquid manure from cattle breeding	Hnojovica z chovu hovädzieho dobytka	13703	Z	231,400.69
3	House waste from household	Domový odpad z domácnosti	91101	Z	215,491.13
4	Waste of communal waste character	Odpad charakteru komunálneho odpadu	93104	Z	156,866.00
5	Cinder, slag, ash from coal and coke burning	Škvara, troska a popol zo spaľovania uhlia, koksu	31307	Z	136,333.89
6	Flue, dust and soot	Popolček, prach a sadze	31301	N	131,713.26
7	Waste similar to house waste from municipalities	Odpad podobný domovému odpadu z obcí	91102	Z	119,626.04
8	Red and brown sludge from aluminium oxide production	Červený a hnedý kal (lúženec) z výroby oxidu hlinika	31608	N	110,193.00
9	Other oil mixtures with water	Ostatné zmesi olejov s vodou	54408	N	89,802.37
10	Stabilised sludge	Stabilizovaný kal	82502	Z	41,889.29
11	Waste from mineral wool polluted with contaminants	Odpad z minerálnych vlákien znečistený škodlivinami	31430	N	34,605.10
12	Voluminous waste from municipalities	Objemný odpad z obcí	91302	N	29,846.32
13	Waste from sinks from agriculture	Odpad zo žúmp z poľnohospodárstva	81101	Z	27,039.12
14	Waste from septic tanks and sinks from municipal economy	Odpad zo septikov a žúmp z komunálneho hospodárstva	91104	Z	26,785.02
15	Waste acid, acid mixture, acid pickling bath	Odpadové kyseliny, zmesi kyselín, moriace kúpele (kyslé)	52102	N	24,395.47
16	Voluminous waste from households	Objemný odpad z domácnosti	91301	N	15,334.31
17	Waste concentrates and solution with metal salt content	Odpadové koncentráty a roztoky s obsahom solí kovov	52716	N	12,135.45
18	Liquid manure from other animals breeding	Hnojovica z chovu iných zvierat	13704	Z	12,094.80
19	Organic distillation remains	Organické destilačné zvyšky	59706	N	10,377.22
20	Slag and raked remains from industrial water cleaning not polluted with contaminants	Kaly a zhrabky z čistenia priem.odpad. vôd neznečis. Škodlivinami	82602	Z	9,538.35
	Total from first 20 waste types				1,714,841.50

Categories – N: Hazardous Waste; O: Other Waste; Z: Special Waste, 1 tonne [t] = 1 Mg = 1 000 kg
Source: RISO (1997)

Mineral wastes form the next largest group of material to be disposed of, with a production of 446 077 t. The material includes cinder, slag and ash from coal and coke burning (WT 31307 – 131 334 t), flue dust and soot (WT 31301 - 131 713 t) and red and brown sludge from aluminium oxide production (WT 31608 – 110 193 t). Such industrially associated wastes tend to be disposed of in dedicated sites, which may be close to the points of production, being the responsibility of the specific industrial organisation/producer.

The third main category in Table 5.4-2 is that of municipal waste, with 407 108 t disposed of in the Study Area. This type of waste (WT 91) consists of six sub-types, namely:

- household waste (WT 91101);
- waste similar to household waste from municipalities (WT 911202);
- specific household waste with contaminant content (WT 91103);
- waste from septic tanks and sumps from municipal sources (WT 91104);
- valuable household waste (WT 91301);
- valuable municipalities' waste (WT 91302).

Table 5.4 - 2 Hazardous and Special Waste Production per Waste Types

Waste group	Waste group title / in Slovak	Waste group title / in English	Subtotal [t]	Percent [%]
11	Odpad z potravín, pochutín a krmív	Foodstuf, fooder waste	475	0.03%
12	Odpad z rastl. A živočíšnych tukových produktov	Vegetable and animal fat waste	1,333	0.07%
13	Odpad z chovu, zo zabíjania a spracovania zvierat	Waste from livestock breeding and slaughter	542,260	29.26%
14	Odpad koží, kožiek a usní	Leather waste	15	0.00%
15	Rastlinný odpad	Vegetable waste	2,681	0.14%
17	Odpad z dreva	Wood waste	1,081	0.06%
18	Odpad z celulózy, papiera a lepenky	Pulp, paper and cardboard waste	2,212	0.12%
31	Odpad minerálneho pôvodu	Mineral waste	446,077	24.07%
35	Odpad s obsahom kovov	Waste containing metal	5,745	0.31%
39	Iný odpad minerálneho pôvodu	Other mineral waste	56	0.00%
41	Odpad z mechanickej úpravy	Waste from mech. Treatment	20	0.00%
42	Odpad po fyzikálno-chemickej úprave	Waste from physical-chemical treatment	2	0.00%
51	Oxidy, hydroxidy, soli	Oxides, hydroxides, salts	924	0.05%
52	Kyseliny, hydroxidy, koncentráty	Acids, hydroxides, concentrates	43,017	2.32%
53	Odpad prostriedkov na ochranu rastlín	Pesticide waste	9,621	0.52%
54	Odpad zo spracovania ropy, zušľachťovania uhlia	Oil processing and coal upgrading waste	113,812	6.14%
55	Organické rozpúšťadlá, náterové hmoty, lepidlá	Organic solvents, paints, glues	8,588	0.46%
57	Odpad z plastov a gumy	Plastics and rubber waste	254	0.01%
58	Textilný odpad	Textil waste	579	0.03%
59	Ostatný odpad z chemických procesov	Other chemical process waste	10,564	0.57%
81	Kvap.odpad zo zariadení na nakladanie s odpadmi	Waste liquid from disposal plant	30,490	1.65%
82	Odpad z čistiarní odpad.vôd a prevádzky kanal. siete	Waste from sewage disposal plants and public sewerage	65,924	3.56%
83	Odpad z úpravy vody a z prevádzky vodných tokov	Waste from water works and watercourses	8	0.00%
91	Komunálny odpad	Municipal waste	407,108	21.97%
93	Odpad špecifický pre zdravotnícke zariadenia	Specific hospital waste	160,223	8.65%
Total hazardous & special waste produced in studied area [t]			1,853,071	100.00%

Source: RISO SAZP (COH) 1997
1 tonne [t] = 1 Mg = 1 000 kg

Table 5.4-3 shows the breakdown of five of the above six sub-types, relating to domestic and municipal refuse or wastes, but excludes septic tank and sump emptyings, as these are handled largely as sewage, rather than requiring landfilling. As a result, the quantity of municipal waste production by Okres in the Study Area, (Table 5.4-3), is only 376 379 t, compared to the larger figure in Table 5.4-2. The Banska Bystrica WMP (Ref. 15.2), however, notes the higher figure includes the waste (sub-type 19104), and includes it in their overall calculations. They also note that it represents a wet content of 162 786 t (24 420 t dry matter, given that SAZP allows for 15% dry matter from sludges). Subtracting the latter figure from the overall figure does not provide the 376 379 t of municipal waste (minus sub-type 91104) given in Table 5.4-3. This is a small point, but it illustrates that there are still a number of anomalies in the presented

waste statistics, which make it difficult to develop a clear picture of true waste production figures.

Table 5.4 - 3 Municipal Waste Production by District in the Study Area

District	Waste total [tonnes] according to the waste sub-type					
	91101	91102	91103	91301	91302	Total [tonnes]
Banska Bystrica	89,603	37,477		1,106	6,278	134,464
Banska Štiavinica	5,299	768				6,067
Brerzno	551	1,335		36	472	2,394
Detva	3,595	1,289			63	4,947
Levice	42,666	25,220	6	3,573	2,876	74,341
Nove Zamky	523	319			10	852
Revuca	240	44		8	3	295
Zlate Moravce	2,946	2,254		2,926	1,918	10,044
Zvolen	44,131	17,529		4,750	1,827	68,237
Ziarnovica	12,618	9,220		535	382	22,755
Ziar and Hronom	12,623	23,528		832	14,999	51,981
Total [t]	214,797	118,984	6	13,766	28,827	376,379

Source: RISO, SAZP (CHO) 1997
Data are adjusted to reflect the Study Area
1 tonne [t] = 1000 kg = 1 Mg

Details of the facilities where the wastes are disposed of are presented in Section 5.4.2 below. Details of how all hazardous and special wastes from the Study Area are disposed of, are presented in Table 5.4-4. This indicates that nearly one million tonnes of waste were disposed of to landfill in the Study Area, representing 52.77% of all Hazardous and Special waste produced, including approximately 400 000 t of municipal wastes (Type 91).

The RISO figures do not provide an easy cross-reference between the waste types and how each is disposed of, only how each category of waste is dealt with. Nevertheless, this still demonstrates that over half of all wastes (excluding Other Waste) are landfilled, and a further 33.32% is reused or recycled. The majority of the waste (86.09%) is therefore accounted for by these disposal methods. A further 11.62% is account for by treatment (biological, physico-chemical, 'other' or 'unspecified'). Storage (1.32%), or incineration (0.97%) accounts for the remaining 2.29%.

Although the percentages of waste that are incinerated are quite small, they still represents nearly 18 000 t, including medical waste and oil processing material. Of greatest concern is the inadequate facilities available for the effective incineration of medical wastes, a topic which is discussed in more detail in the following section.

The impression obtained from discussions with Kraj and SAZP personnel is that the quantity of waste produced in the Study Area has fallen considerably and continues to do so. This is largely due to the effects of recession, resulting in the closure of a range of industries. However, the implication is also that there has been a reduction in the quantity of municipal waste produced. Due to the changes in the categorisation of waste that has taken place in the last few years, and due to the fact that there are only a limited database extending from 1992, it is not clear how much confidence can be placed in this statement. Nevertheless, within the limits of the data, tables have been prepared for the two main regions of the Study Area, namely relevant areas covered by the Banska Bystrica and Nitra kraj offices. These data are presented in Table 5.4-5

The table is based upon information from the RISO statistics (1997), together with the information provided by the Banska Bystrica EAP (Ref. 1-5) and the Nitra Kraj Territorial Plan (TP), (Ref. 5-6), for the 1992 and '95 data. Given that the latter data-sets should be based upon the RISO statistics, it is considered viable to make this comparison, but an element of caution must be introduced as the interpretation can be open to question, as noted above.

Within the limits of the data noted above, the figures do not support the suggestion that production of hazardous and special wastes is falling in the Banska Bystrica Kraj, but it does concur with the view for Nitra Kraj. The change in municipal waste production for Banska Bystrica represents a 35.5% increase between 1995 and 1997 (46.9% if waste sub-type 91104 is included), 19.6% increase for hazardous waste and 56.4% increase for special wastes. The Nitra figures by comparison, show reductions of 7.5%, 87.5% and 14.7% respectively for the three categories of waste.

As indicated, too much accuracy cannot be attached to the above figures, due to the various changes that have occurred to their collection during the limited period since 1992. There is no reliable database upon which to make meaningful comparisons, which also means that there is difficulty in making predictions about future requirements for waste disposal capacity in landfill sites. It is therefore important that a standardised method of data collection is developed as soon as possible, to supply the information required by the municipal authorities, in planning their future requirements for waste disposal.

Table 5.4 - 4 Treatment of Hazardous and Special Waste Production by District

District	Waste	Treatment		Other	Non specified	Landfilled	Stored		Incinerated		Reuse / Recycle	Total
	Categories	Biological	Physic.-chem.					Energy production	Non specified	Waste burning		
Banska Bystrica	H	5,578	1,990	4,685	0	5,455	8,912	1,416	5,018	310	8,762	42,127
BB	S	4,021	0	1,405	0	304,397	56	0	9	0	19,456	329,343
	H + S	9,598	1,990	6,090	0	309,852	8,969	1,416	5,026	310	28,217	371,469
Banska Stiavnica	H	0	1	5	0	43	1	0	10	8	838	907
BS	S	125	0	5	0	6,156	0	0	0	0	29	6,314
	H + S	125	1	10	0	6,199	1	0	10	8	867	7,221
Brezno	H	31	24,260	247	0	327	2,519	1	3,908	58	618	31,970
BR	S	316	616	704	0	7,625	508	0	94	0	38,352	48,215
	H + S	348	24,876	951	0	7,952	3,028	1	4,002	58	38,970	80,185
Detva	H	22	8,542	352	0	15	50	39	85	1	49	9,155
DT	S	111	0	518	4	5,100	14	0	1	0	9,750	15,498
	H + S	134	8,542	870	4	5,116	64	39	86	1	9,799	24,653
Revuca	H	0	0	0	0	0	0	0	0	0	0	0
RA	S	0	0	0	0	295	0	0	0	0	2	297
	H + S	0	0	0	0	295	0	0	0	0	2	297
Zarnovica	H	4,415	300	552	1	35,356	52	38	26	978	122	41,839
ZC	S	503	0	2	4	23,947	64	0	0	4	1,983	26,506
	H + S	4,918	300	554	5	59,303	116	38	26	981	2,104	68,346
Ziar nad Hronom	H	383	4	410	19	111,082	4	5	362	346	20,058	132,672
ZH	S	1,613	0	40	0	149,071	1	0	0	0	97,016	247,741
	H + S	1,997	4	450	19	260,153	5	5	362	346	117,073	380,413
Zvolen	H	3,590	74,215	9,402	0	134,012	303	400	7	1,336	539	223,803
ZV	S	3,493	0	7,073	0	90,998	4	382	0	8	311,069	413,027
	H + S	7,083	74,215	16,474	0	225,010	307	782	7	1,344	311,608	636,830
Banska Bystrica (H+S)		24 202	109 929	25 400	28	875 879	12 488	2 281	9 520	3 048	508 640	1 569 415
Levice	H	459	10,601	312	10	1,641	582	387	631	1,255	592	16,469
LV	S	17,734	0	1,380	20,334	86,916	4,704	0	393	4	59,169	190,632
	H + S	18,193	10,601	1,692	20,344	88,557	5,285	387	1,024	1,259	59,761	207,101
Nove Zamky	H	4	5	102	169	2	126	2	0	233	152	793
NZ	S	7	0	0	32	2,926	5	0	0	13	43,730	46,713
	H + S	11	5	102	200	2,928	132	2	0	245	43,881	47,506
Zlate Moravce	H	3,139	23	20	3	423	13	50	0	72	221	3,965
ZM	S	1,144	1	229	0	12,083	6,623	0	0	0	5,004	25,084
	H + S	4,283	25	249	3	12,505	6,637	50	0	72	5,225	29,049
Nitra (H+S)		22 487	10 631	2 043	20 547	101 990	12 054	439	1 024	1 576	108 867	283 656
Hron River Basin	H	17,621	119,942	16,088	202	288,356	12,562	2,338	10,046	4,596	31,950	503,701
[t]	S	29,068	618	11,355	20,373	689,513	11,980	382	497	28	585,557	1,349,371
	H + S	46,689	120,560	27,443	20,575	977,869	24,542	2,720	10,544	4,624	617,507	1,853,071
Hron River Basin	H	0.95%	6.47%	0.87%	0.01%	15.56%	0.68%	0.13%	0.54%	0.25%	1.72%	27.18%
[%]	S	1.57%	0.03%	0.61%	1.10%	37.21%	0.65%	0.02%	0.03%	0.00%	31.60%	72.82%
	H + S	2.52%	6.51%	1.48%	1.11%	52.77%	1.32%	0.15%	0.57%	0.25%	33.32%	100.00%

Source: RISO, SAZP (CHO) 1997

Table 5.4 - 5 Solid Waste Production in Banska Bystrica and Nitra Kraj for the years of 1992, 1995 and 1997

Category of Waste	Kraj	Quantity of Waste ('000 tonnes)		
		1992[1]	1995[1]	1997[2]
Municipal	BB N	359.4 187.1	214.8 92.1	291.1[3] /315.5[4] 85.2[3]
Hazardous	BB N	1 179.6 1 155.1	403.3 169.5	482.5 21.2
Special	BB	1 771.3 1365.5	695.1 307.7	1 086.9 262.4

Source: (1)– data respectively from BB EAP and Nitra TP;
(2)- data from RISO SAZP (COH) statistics
(3)- excludes category 91104 waste syb-type;
(4) includes category 91104 from BB Okres data

Some of the changes are certainly due to the modifications in the classification of wastes, notably for the 1992 to 1995 figures. Subsequent redefining may explain some of the Nitra reductions, as might rationalisation to industry, including plant closure. However, there is a distinct impression that waste in the Banska Bystrica region is increasing. This may be due to better recording of waste statistics, since the opening of major controlled landfills in the area. It may also be a sign of improved economic performance in the region leading to increased waste production, or falling success in waste recycling schemes, for which there is evidence, may be influential. The exact cause cannot be given, however, as the data are too unreliable.

One specific case where there has been a recorded increase in waste production is for sub-type 31608 (red and brown sludge from aluminium oxide production). According to Banska Bystrica Kraj and SAZP COH figures, the quantity of waste produced has risen from 57 310 t in 1995 to 110 193 t in 1997, (Ref. 15-2) namely a 92% increase. It should be noted that this material has also been reclassified from the 'Other Waste' category to 'Hazardous Waste', so that will also have affected the recorded amount of waste produced in the Hazardous Waste category.

3) SOSR Derived Data

Data derived from the SOSR information is presented in Tables 5.4-6 through 5.4-9, identifying the quantities of Special, Hazardous, Other Wastes and Total Waste, respectively. The data are then compared to the information from the RISO statistics, in Table 5.4-10. The variations in the basis for the two sets of data has been noted previously, and as such, the report is not comparing like for like. However the data are included to illustrate both the sometimes wide variation that occurs in disposal statistics, and the close similarities that are also evident on

some occasions. The main point is that no one data source is reliable for all categories of waste, which is a situation that needs to be resolved at a national as well as regional level.

Table 5.4 - 6 Quantity of Special Waste Produced in 1997 from SOSR Data

District / *Region*	Special Waste Total [t]	Disposal Method				
		Reused / Recycled	Stored	Landfilled	Incinerated	Other
Levice	181,939.5	135,240.2	38,949.7	6,492.4	78.2	1,179.0
Nové Zámky	578,174.2	552,997.6	7,116.3	13,136.0	9.0	4,915.3
Zlaté Moravce	133,112.8	97,592.8	9,508.0	5,173.2	18.0	20,820.8
Nitra Region	*893,226.5*	*785,830.6*	*55,574.0*	*24,801.6*	*105.2*	*26,915.1*
Banská Bystrica	142,919.9	119,656.3	534.8	6,236.0	0.0	16,492.8
Banská Štiavnica	10,248.7	9,471.8	3.9	757.0	0.0	16.0
Brezno	226,256.2	218,963.8	35.8	5,365.8	183.9	1,706.9
Detva	22,515.1	21,919.9	0.0	516.4	16.3	62.5
Zvolen	297,927.6	183,294.7	79.1	3,630.9	165.5	110,757.4
Zarnovica	7,106.6	6,337.3	3.2	690.5	0.0	75.6
Ziar nad Hronom	54,585.7	25,086.1	22.3	29,387.3	4.0	86.0
Banská Bystrica Region	***761,559.8***	***584,729.9***	***679.1***	***46,583.9***	***369.7***	***129,197.2***
Study Area [%]	***100.00%***	***82.82%***	***3.40%***	***4.31%***	***0.03%***	***9.43%***
Study Area [t]	***1,654,786.3***	***1,370,560.5***	***56,253.1***	***71,385.5***	***474.9***	***156,112.3***

Table 5.4 - 7 Quantity of Hazardous Waste Produced in 1997 from SOSR Data

District / *Region*	Hazardous Waste Total [t]	Disposal Method				
		Reused /Recycled	Stored	Landfilled	Incinerated	Other
Levice	13,400.8	232.1	1,147.6	862.2	87.7	11,071.2
Nové Zámky	15,139.2	997.1	662.6	3,839.7	433.4	9,206.4
Zlaté Moravce	5,314.1	146.0	22.0	2,093.3	136.7	2,916.1
Nitra Regiont	*33,854.1*	*1,375.2*	*1,832.2*	*6,795.2*	*657.8*	*23,193.7*
Banská Bystrica	26,075.6	9,210.7	814.4	11,932.2	289.2	3,829.1
Banská Štiavnica	718.4	356.1	50.7	131.4	7.8	172.4
Brezno	31,788.0	763.5	2,511.3	285.9	3,925.1	24,302.2
Detva	8,856.9	6,600.9	30.5	10.2	62.0	2,153.3
Zvolen	4,091.3	936.3	41.8	382.2	50.1	2,680.9
Žarnovica	18,172.5	292.3	19.0	17,691.2	25.9	144.1
Žiar and Hronom	40,521.7	1,752.4	34.4	37,110.6	52.4	1,571.9
Banská Bystrica Region	***130,224.4***	***19,912.2***	***3,502.1***	***67,543.7***	***4,412.5***	***34,853.9***
Study Area [%]	***100.00%***	***12.97%***	***3.25%***	***45.31%***	***3.09%***	***35.38%***
Study Area [t]	***164,078.5***	***21,287.4***	***5,334.3***	***74,338.9***	***5,070.3***	***58,047.6***