DANUBE POLLUTION REDUCTION PROGRAMME

NATIONAL REVIEWS 1998
SLOVAKIA

EXECUTIVE SUMMARY

MINISTRY OF ENVIRONMENT

in cooperation with the

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Preface

The National Reviews were designed to produce basic data and information for the elaboration of the Pollution Reduction Programme (PRP), the Transboundary Analysis and the revision of the Strategic Action Plan of the International Commission for the Protection of the Danube River (ICPDR). Particular attention was also given to collect data and information for specific purposes concerning the development of the Danube Water Quality Model, the identification and evaluation of hot spots, the analysis of social and economic factors, the preparation of an investment portfolio and the development of financing mechanisms for the implementation of the ICPDR Action Plan.

For the elaboration of the National Reviews, a team of national experts was recruited in each of the participating countries for a period of one to four months covering the following positions:

- Socio-economist with knowledge in population studies,
- Financial expert (preferably from the Ministry of Finance),
- Water Quality Data expert/information specialist,
- Water Engineering expert with knowledge in project development.

Each of the experts had to organize his or her work under the supervision of the respective Country Programme Coordinator and with the guidance of a team of International Consultants. The tasks were laid out in specific Terms of Reference.

At a Regional Workshop in Budapest from 27 to 29 January 1998, the national teams and the group of international consultants discussed in detail the methodological approach and the content of the National Reviews to assure coherence of results. Practical work at the national level started in March/April 1998 and results were submitted between May and October 1998. After revision by the international expert team, the different reports have been finalized and are now presented in the following volumes:

Volume 1:	Summary Report
Volume 2:	Project Files
Volume 3 and 4:	Technical reports containing: - Part A : Social and Economic Analysis - Part B : Financing Mechanisms - Part C : Water Quality - Part D : Water Environmental Engineering

In the frame of national planning activities of the Pollution Reduction Programme, the results of the National Reviews provided adequate documentation for the conducting of National Planning Workshops and actually constitute a base of information for the national planning and decision making process.

Further, the basic data, as collected and analyzed in the frame of the National Reviews, will be compiled and integrated into the ICPDR Information System, which should be operational by the end of 1999. This will improve the ability to further update and access National Reviews data which are expected to be collected periodically by the participating countries, thereby constituting a consistently updated planning and decision making tool for the ICPDR.

UNDP/GEF provided technical and financial support to elaborate the National Reviews. Governments of participating Countries in the Danube River basin have actively participated with professional expertise, compiling and analyzing essential data and information, and by providing financial contributions to reach the achieved results.

The National Reviews Reports were prepared under the guidance of the UNDP/GEF team of experts and consultants of the Danube Programme Coordination Unit (DPCU) in Vienna, Austria. The conceptual preparation and organization of activities was carried out by **Mr. Joachim Bendow**, UNDP/GEF Project Manager, and special tasks were assigned to the following staff members:

- Social and Economic Analysis and Financing Mechanisms: **Reinhard Wanninger**, Consultant
- Water Quality Data: **Donald Graybill**, Consultant,
- Water Engineering and Project Files: **Rolf Niemeyer**, Consultant
- Coordination and follow up: **Andy Garner**, UNDP/GEF Environmental Specialist

The **Slovakian National Reviews** were prepared under the supervision of the National Focal Point Coordinator, **Mr. Boris Minarik**. The authors of the respective parts of the report are:

- Part A: Social and Economic Analysis: **Ms. M. A. Petrikova**
- Part B: Financing Mechanisms: **Mr. David Luptak**
- Part C: Water Quality: **Ms. Anna Zekeova**
- Part D: Water Environmental Engineering: **Mr. Juraj Namer**

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Table of Contents

List of Tables

1. Executive Summary

1.1. The State of the Danube Environment in the National Context

Slovakia, as many other countries in the twentieth century has been characterized by frequent, extensive socio-economic and political changes unfavorably impacting all aspects of the environment. The area of the Danube catchment is 47.064 km^2 that means 96% of territory of the Slovak Republic. From viewpoint of long term average 3328 m^3/s waters flow through Slovak rivers, including tributaries from neighboring countries. 398 m^3/s waters of this amount spring on Slovak territory. Monitored Danube and its tributaries, except for upper part of the rivers and their tributaries belong to water quality category IV (highly polluted water) and V (very highly polluted water). Pollution is caused mainly by microbiological determinants. Main problems caused by human activities are point and diffuse pollution sources, water pollution caused by manipulation with waste, air pollution, acidification of environment, unreasonable use of water and natural sources, etc. The situation of environment is gradually improving because decrease of economy in last years and many of legislative and practical measures focused on environment protection.

Population affected by water pollution

In 1997 on the territory of Slovakia there have been living 5.387.650 inhabitants in 2908 municipalities with an average density of 109 people per km^2. Deterioration of water quality is limiting water use in the country. In Slovakia ground water resources are predominantly used for drinking water supply (78,9% in 1996). Water used for drinking water purposes must fulfill criteria of the Slovak Technical Standard 75 7111 “Drinking Water”. Limit values were exceeded in 0,41% of all analysis (1996). Raw water, that means water before purification process, for drinking water supply, exceeded mainly limit values of Fe and non polar extractable substances. Surface water for drinking water supply is taken mainly from upper part of watercourses and reservoirs. Areas, to which belong drinking water sources, reservoirs etc., have set up protected zones. With regard to control and protection of drinking water sources there are not any important problems related to drinking water consumption. In case of some other water uses also exist relevant standards, e.g. water quality for irrigation etc.

Water quality and impact on ecosystems

Human activities - exploitation of natural sources – together with long term insufficient environment protection laws and measures, low public awareness in past have had strong negative impact on environment. This fact is documented by results of monitoring networks of surface and ground water quality as follows:

National surface water sampling sites in national monitoring network are located in areas effected by different types of anthropogenic activities. Therefore, in the last evaluated period (years 1996-97) there was no sampling site, in which water quality had satisfied requirements for I. or II. class of quality; 5,6 % of evaluated river length were in III. class (polluted water), 35,2 % in IV. class (highly polluted water) and 59,2 % in the worst – V class of quality (very highly polluted water). The most of evaluated rivers corresponded to IV. and V. class of quality caused mainly by microbiological determinants.

Cases of groundwater monitoring exceeding allowable concentration for at least one determinant has been found in 229 sampling points during 1997, which represents 78,6 % from all sampling sites. The concentrations have been most frequently exceeded by Fe (239 times), Mn (182 times) and non-polar extractable substances (116 times).

Regarding to changed approach to environment protection in last years and new environment protection legislation, there are set up conditions for improvement of the state of environment and ecosystems.

Hot spot analysis

Before the elaboration of the List of hot spots in the Part C: WATER QUALITY REPORT, the review of relevant documents, studies and projects performed up to now in the framework of the Danube Environmental Programme, such as National Review, Strategic Action Plan (SAP), Strategic Action Plan Implementation (SIP), Slovak National Action Plan (NAP) etc. was carried out. On the basis of relevant information analysis, a specific procedure for evaluation of individual hot spots was used. The list of hot spots in Slovakia in the Danube River basin includes top ten from the list of municipal sources of pollution and top ten from the list of industrial pollution sources. They represent emission sources, which should have been solved preferentially in dependence on accessible technical and financial sources because they are important pollution sources from both, the national and transboundary impacts on the water quality.

Actual foreseen pollution measures

The national targets for Water Pollution Reduction for the Danube River Basin have already been set up in the Slovak National Action Plan (NAP). NAP focuses on these three problems: high load of N and P nutrients and eutrophication, changes in the regimes of the sediments flow and transport, contamination with harmful substances, including the oil substances. According to NAP the following measures will be necessary taken in Slovakia: revitalization of the streams and wetlands, management of their development, to maximize their accumulation effects for the N and P nutrients, and at the same time maintain their natural health state and biodiversity.

Planned projects and Investment portfolio

The prepared list of hot spots supported by Project Files indicates the actual problems in the fields of municipal wastewater and industrial wastewater including partially the problems of waste disposal (landfills and lagoons).

The list of municipal hot spots using multi-criteria analysis is as follows: *high priority*: WWTP Košice, WWTP Nitra, *medium priority:* WWTP Malacky, WWTP Banská Bystrica, WWTP Michalovce, WWTP Svidník, Sewerage Trenčín right side, WWTP Humenné, *low priority*: WWTP Ružomberok, WWTP Topoľčany, WWTP Liptovský Mikuláš, WWTP Ilava, WWTP Rožňava. All these projects are structural. WWTP Košice and WWTP Malacky have been identified as the most important municipal sources of transboundary pollution.

In the same way the list of the following industrial hot spots have been again prepared: *high priority*: NCHZ Nováky, Bukocel Hencovce, *medium priority*: PCHZ Žilina, Istrochem Bratislava, SH Senica nad Myjavou, Chemko Strážske, *low priority*: AssiDoman Štúrovo, Bučina Zvolen, Biotika Slovenská Ľupča, Koželužne Bošany.

2. Description of the State of the Danube Environment

2.1. Water Resources

Surface water

From viewpoint of long term average 3328 m^3/s waters flow through Slovak rivers, including tributaries from neighbouring countries. 398 m^3/s waters of this amount spring on our territory. For most of Slovak rivers is characteristic unfavourable high water level fluctuation.

Surface water sources capacity during dry period is 90 m^3/s. After subtraction of water discharges, which are necessary in river from ecological viewpoint, 36,4 m^3/s of water is available for using (without Danube, Morava and Tisa). It is possible to improve this amount up to 90,3 m^3/s by construction of the reservoirs. Surface water intakes represented 794.296.000 m^3/s in year 1996.

Ground water

From 127,0 m^3/s documented ground water sources 74,3 m^3/s represent useable sources. 37.135 m^3/s of those water are verified stocks and on the basis of hydrological knowledge and are classified into four categories. Ground water resources are used predominantly for drinking water supply (78,9 % of all intakes in year 1996).

2.2. Eco System and Biological Resources

Slovakia's natural biological diversity is influenced by three main factors: altitude, diversity of geological conditions and availability of water, which influences the character of ecosystems in all vertical zones and on every geological substrate. In Slovakia forests cover 1.930.000 ha, which represents 40,8% of the country´s total area. Of these forests, 40 to 45 % are semi-natural, but what sets them apart is that they have a composition of species that only slightly differs from the original forests. This is very special compared to most of the countries of central and Western Europe. There are also over 70 fragments of natural and virgin forests with a total area of 20.000 ha.

Wetlands and inland water ecosystems, the occurrence of which is undermined mainly by the accessibility of water, can be found from the lowlands to the alpine zone. Main types of wetlands include: willow-poplar forests, oak-elm-ash forests, riparian alder wood, ecosystems of stagnant and slow flowing water, tall-herb floodplains, bogs and fens.

Meadows, except for alpine and floodplain meadows, are secondary-man made-ecosystems. If appropriately managed some mountain meadows are among the species diverse European ecosystems.

Alpine and subalpine ecosystems encompasses a varied palette of biotopes including alpine meadows, rocky walls and cracks, snow beds and dwarfed pine growth. They were less affected by human activities in the past because of their inaccessibility and harsh climatic conditions.

2.3. Human Impact and Key Issues of Environmental Degradation due Water Pollution

Main problems caused by human activities are:

point and non point pollution sources from municipal and industrial sources, water pollution (in some cases air pollution as well) caused by manipulation with waste and by waste disposal, acidification of environment (soil, surface and ground waters), decreasing of ground water level, unreasonable use of water sources, surface water eutrophication, erosion.

3. Population Development and Water Sector Relevant Characteristics

The territory of the landlocked Slovak Republic with its 5,36 million inhabitants, has an area of 49 thousand km^2. Out of the total area of the Slovak Republic the agricultural land is 24.456 km^2, which is approximately 50,2 % (30,8% classified as arable land), the forested area represents 19.878 km^2, which is 39,9 %, other areas are 4655 km^2, which makes up 9,5 % - the waters constitute 1,9 %, built areas 2,6 % and the rest are other areas.

In 1997 on the territory of the Slovak Republic there were 5.387.650 inhabitants living in 2908 municipalities with an average density of 109 people per km^2. According to the last Census in 1991 there was 5.274.300 people living in the territory of Slovakia. In 1996 it was 5.378.900 which represents an increase of 104,6 thousand people in five years (1,9%). The official prognosis for the planning horizon of the year 2010 is approximately 5.430.000 inhabitants. 1.344.000 people, 25 % of the whole population, live in municipalities with more than 50.000 citizens. In the municipalities with more than 5000 citizens, 57 % of the whole population is found, which is statistically a relatively high rate of urbanization.

Sections of economic activity in the Slovak Republic are represented by a high rate of employment in the secondary and primary sections and by a lower rate of the employment in the tertiary section. In the structure according to the size of enterprises, large enterprises still prevail, giving a monostructural base of the regions' economies, and at the same time bringing heavy pollution and negative impacts to the living environment in the regions. Currently, in the process of economic transformation, the ecological criteria concerning production and economy of the regions are missing.

There were 563 water-pumping stations built in order to bring water and provide irrigation. Impact of the construction of different multipurpose reservoirs and ponds is manifested in flow regulation, and recently only 15% of flows have a natural unregulated regime. About 202 weirs were built for discharge regulations, utilization of hydro-energy potentials and for ground water regime in the adjacent areas. In the Slovak territory of the Danube River basin, the ground water is the main source supplying citizens, industry and agriculture with drinking water. Utilization of the groundwater resources of Slovakia is proportionally high, and at present covers about 85% of the drinking water needs. The investigated utilized quantity of the groundwater along with assumed quantities reaches 74 m^3/sec for the whole territory of Slovakia, out of which the utilized quantity for the Danube River basin is 72 m^3/sec, which makes up 97,6 % of the total utilized quantity of the groundwater in Slovakia.

Consumption of water has decreased dramatically since 1989 as a consequence of restructuralization and pressure to economize. If one of the goals of the Strategy of Water Management Policy of the Slovak Republic was to diminish the specific water consumption in the year of 2000 to 270 l/capita/day, this goal was fulfilled already in the year 1995 when the average water consumption dropped down to 226 l/capita/day and in households to 140 l/capita/day though the original goal was 167 l/capita/day.

In 1996 the number of citizens supplied with drinking water from the public water supply system reached 4.288.000 citizens, 79,7 % of the total population. Public water supply systems have been built in 1876 municipalities, which is 64,5 % of the total number of municipalities in the Slovak Republic. Production of drinking water in the year 1996 was 461 mill.m^3 - which is the raw water demand. Water charged to customers reached 354 mill.m^3, the losses in the water supply systems were 107 mil.m^3 (23,2%).

In the planning horizon of 2010 the share of population connected to the public water supply system should increase from 79,4 % to 91-92%, which will lead to a slight increase in water withdrawals compared to the present state. The withdrawals of water for industry and agriculture are also expected to rise, after overcoming a 3 year drop from 1990 - 1993 in production. This was followed by an increase of water consumption in these sectors but in the planning horizon of 2010 it still will not reach the volume of water consumption that was used before 1989.

Increase in public sewerage systems is behind the public water supply systems. In 1995 more than one quarter of the population used centralized water supply systems without putting generated wastewater into public sewerage systems for purification in Wastewater Treatment Plants. Only 53 % of the Slovak municipalities are connected to public sewerage systems. The worst situations are in the river basins of Morava, Danube and Nitra and along the rivers in Eastern Slovakia where the share of population connected to public sewerage system is lower than 30 %, and also in the Hornad River basin and in the vicinity of Košice where it is only 18 %. In the dwellings and houses connected to public sewerage systems, the expected increase in the planning horizon of 2005 is from 53 to 57 %.

In the territory of Slovakia water transport is only found in the Danube River basin. The Danube River is the main water route in Slovakia. In 1997 the Tisa River was also opened to shipping. As a consequence of national economy restructuralization after 1989, the volume of goods delivered in all transport systems decreased. In water transport, it was a decrease by 65 %.

The most pressing issues related to social and economic impacts have been identified as the following:

- pollution of surface water by discharge of industrial and municipal wastewater
- pollution of surface and groundwater by agriculture (polluted soil and local wastewater discharge)
- decreased natural ability of land-surfaces to accumulate rainwater and to stabilize discharges.

Another problem is disparity between the number of municipalities supplied by drinking water pipeline systems and the number of municipalities with public sewerage systems and WWTP. The Slovak municipalities are incapable to resolve the lack of these facilities due to their limited budgets in the current economic situation.

4. Analysis of Actual and Expected Impact of Economic Activities on Water Demand and Potential Pollution of Aquatic System

4.1. Industrial Activities

In the State Water Management Balance evidence (year 1996) 238 industrial point sources of pollution were listed.

Amount of discharged wastewaters represented 577.900.980 m^3, which contained 8.369,53 t BOD-5, 27.024,05 t COD-Cr, 18.517,05 t suspended solids, 966,773 t N-NH4 and 268,242 t non-polar extractable substances.

Main polluters: chemical production and oil processing, pulp and paper production, metal industry, extraction and processing of ores.

4.2. Municipal Discharges

53 % of population (2.850.000 inhabitants) was connected to public sewerage system (year 1996). Public sewerage in the State Water Management Balance evidence discharged into rivers in Danube river basin 524.564.740 m^3 wastewater, of which 90 % were treated at mechanical biological WWTP.

In the Slovak Republic local industry, mainly food industry, is connected to public sewerage. Amount of discharged pollution was as follows: 16.704,79 t BOD-5, 43.911,48 t COD-Cr, 20.062 t suspended solids, 4.523,38 t N-NH4 and 312,66 t non-polar extractable substances.

It is now very difficult to predict expected impact of economic activities on water demand and potential pollution of aquatic system with regard to transformation of economical and political sphere.

4.3. Agricultural Activities

Agricultural activities decreased rapidly after year 1989/1990, e.g. cattle decreased from 1.182.000 in 1992 to 892.000 in 1996. Similar trend is concerning pigs, but number of poultry increased.

In the consequence of economic transformation waste management of animal production was changed. Animal concentration at farms has decreased as well.

In plant production applied amount of industrial fertilizer decreased as well. Consumption of clean nutrients (N, P, K) decreased from 251,6 kg/ha arable soil in 1986/87 to 63,9 kg/ha in 1991/92 and 48,9 kg/ha in 1995/96.

Pesticide consumption (fungicide, herbicide, insecticide) represents together 3.890,9 tons in 1996.

Irrigation system was built on 309.675 ha of soil, of which functioning system is extended on 293.609 ha. 493 irrigation pumping station are in operation and length of irrigation channels represents 204,3 km. For irrigation purpose 20,670 millions m^3 water was used.

4.4. Solid Waste Disposal and Possible Soil and Ground Water Contamination

Regulation of the Ministry of Environment of the SR No. 19/1996 Z. z., which came into force in 1996, sets up new waste categorization. Also the Catalog of Waste was issued. In consequence of this fact, waste balance regarding to individual categories was changed (harmonization with EU Directives and OECD indicators).

Whole waste production balance in 1996 was 20,2 mil. tons.

"Waste Management Programme of the Slovak Republic till 2000 " approved by Slovak Government (No. 799/1996) requests budget 8.500 mil. SK. Measures are focused on:

- provision of regular handling with hazardous waste
- construction of municipal and hazardous waste incineration plants
- increase in waste recycling
- rescue of old landfills

The most extended manner of waste disposal is **landfilling:**

In 1996 538 landfills were in operation in Slovakia. Only 114 of them met the technology and legal requirements. About 2 % waste is being disposed to illegal landfills.

Incineration: There are 78 incineration plants in Slovakia, 39 of which are used for waste incineration from health facilities.

Waste utilization: 51 % of special and municipal waste are utilized. Agriculture waste utilization is high. Waste recycling in some branches is on a good level.

Illegal and technical insufficient landfills are mainly sources of soil and ground water contamination.

5. Analysis of Water Quality Data and Description of Environmental Impact on Ecosystem and Human Quality of Life

5.1. Water Quality Data Critical to the Transboundary Analyses (Danube Water Quality Analyses)

The Slovak Hydrometeorological Institute is responsible for monitoring and assessment of water quality and quantity.

In year 1996 surface water quality was monitored in 224 basic and 6 special profiles (9 profiles of those do not belong to the Danube River basin). It is relevant to 4956 km of rivers and streams, 3782 km of which were assessed.

Synchronous measuring of water quality and discharges is not performed satisfactory (in many cases discharges are calculated). Range of measured parameters was between 20 - 80.

Surface water quality is assessed on the basis of norm STN 75 7221 „Classification of surface water„ (complete standard is available in report). Classification system includes 5 classes.

Danube water quality upstream of Bratislava (r. km 1877,3) is worst from viewpoint of:

- Volatile phenols, from 7 monitored metals - mercury and Coli bacteria (IV-V class purity).
- Higher concentrations of iron and manganese, N-NH4 and organic nitrogen, non-polar extractable substances (UV) and total phosphorus classify water into III class purity.
- Other parameters, e.g. organic pollutants (BOD-5, COD-Cr), heavy metals, total cyanide, saprobic index and other belong to I or II class purity, that means clean or very clean water.

In last Danube profile on Slovak territory - Štúrovo (r. km 1718,80)- following parameters are worse (one class of purity: from class III to class IV): non-polar extractable substances (UV) and pH. Improvement was observed at organic pollution COD-Cr (from II class to I class), total iron and manganese (from III to II). Nutrients nitrogen and phosphorus did not change class purity (III). Whole Slovak Danube part is bacteriologically polluted (IV class purity), that means water is strongly polluted.

5.2. Concentration and Loads of Nutrients and Other Pollutants in the Danube River and Its Tributaries

Nutrient concentrations in last Danube profile on Slovak territory Štúrovo in 1996 were as follows: N-NH4 0,33 mg/l, N-NO2 0,042 mg/l, N-NO3 2,44 mg/l and total phosphorus 0,11 mg/l.

From tributaries, in profiles close to confluence with Danube or before outflow of our territory, the highest concentration of nitrogen compounds and total phosphorus were found in Morava River, follows Váh, Ipeľ and Hron Rivers.

Average values of phosphorus in Morava were 0,42 mg/l, in Hron, Ipeľ and Váh in range 0,24-0,26 mg/l.

N-NH4 concentration was the highest in Váh 0,63 mg/l, in Morava 0,58 mg/l, in Ipeľ 0,48 mg/l and Hron 0,46 mg/l. In other rivers nutrient concentration represented about half of mentioned values (0,22-0,27 mg/l).

N-NO3 average value in Morava was found 4,07 mg/l, in Bodva 4,19 mg/l. In others rivers values were e.g. from 2,91 mg/l in Ipeľ up to 1,79 mg/l in Slaná.

Latest data concerning load of Danube by nutrients from Slovak territory are not available. The Final Report „ Nutrient Balance for Danube Countries" published following data concerning SR: 59 kt of nitrogen and 5 kt of phosphorus.

Metal average values in Danube (stretch Bratislava - Štúrovo) and in last checking profiles on its tributaries are mostly in I class purity, except mercury and zinc.

Mercury concentrations do not exceeded 0,5 microgram /l (III class purity). Concentration in all tributaries are lower than 0,2 microgram/l (II class purity). In inflow and outflow of Danube River and Morava average values were 0,32 microgram /l. Cadmium belongs to I class purity (lower than 3 microgram per liter), except Bodva River in II class purity. Lead belongs to I class purity as well (lower than 10 microgram /l), its the highest measured concentration was 6,95 microgram/l in Bodva and 5,05 microgram/l in Bodrog.

Average values of AS, Cu, Cr and Ni met criteria of I class purity.

Zinc concentration upstream of Bratislava, in Morava and Vah was in II class (lower than 50 microgram per liter). The highest values were measured in Bodva, 150 microgram/l (V class purity).

Specific pollution is not classified into class purity, because it is not measured systematically (every year) and in the same range. It is more screening, and its updating is based on changes at pollution sources in river basin.

Found specific pollutants in Danube River and its tributaries are mainly pesticides p-p DDT, HCB, gama HCH, heptachlorine and newer, which are applied for plant protection e.g. atrazine, prometrin, prometon, simazine and other.

In some tributaries, e.g. in Vah chlorobenzene, chloroform and PCB in Bodrog were analyzed.

5.3. Transboundary Effects of Pollution

Process of selection of municipal and industrial pollution sources - hot spots - includes many factors, e.g. size of source, pollution, impact on downstream water quality and its use, mainly intakes for water supply, ecological criteria etc. In detail this is described in report, including multicriteria analysis, which was used for selection. On the basis of this process and updating data of selected point sources priority lists with 10 municipal and 10 industrial point sources were elaborated.

From those point sources of pollution, hot spots with transboundary impact were selected:

***municipal sources of pollution with transboundary impact to water quality**:* WWTP Košice, WWTP Malacky

***industrial sources of pollution with transboundary impact to water quality**:* Instrochem Bratislava, ASSI DOMAN Štúrovo, Bukocel Hencovce, Slovenský hodváb Senica, Chemko Strážske

In the Slovak Republic agricultural hot spots were not selected, because animal concentration at farms has decreased and application of fertilizers as well as pesticides has dropped. Their escape into waters is consequence of inconvenient management.

6. Identification and Evaluation of Pollution Reduction Measures

6.1. National Targets and Instruments for Reduction of Water Pollution

Since 1990, political, economic and social changes in Slovakia have influenced almost every element of socio-economic life, including water management. The ongoing economic transition has also affected the generation and quality of wastewater as well as the receiving water.

The sewerage is constantly behind the development of water supply systems in Slovakia. Only 12,96 % of settlements have complete sewer systems, which is about 53,03 % or 2.850.000 inhabitants of the total Slovak population. The level of wastewater treatment also lags behind western standards. Only about 90% of all collected wastewater is treated in 363 municipal wastewater treatment plants (WWTPs). Most WWTPs consist of mechanical and biological treatment. In Slovakia the smaller plants prevail. Due to the demographic situation of the Slovak population and due to the more realistic local investment possibilities it is expected, that the small plants will be those most frequently designed and constructed also in the near future. Upgrading and expansion of existing WWTPs is typical for towns and cities beyond 20.000 inhabitants.

The transformation of the water industry is based on Government Resolution N^{o}. 621/1995 and Acts of the National Council SR N^{o}s. 481/1992 Dig. and 192/1995 Dig., and to accelerate this process the Slovak Government approved Resolution No.657/1996. Resolution No.6327/1997 set the timetable of the transformation. In 1998 607 municipalities applied for the transfer of waterworks assets. Water and sewage works have already prepared five privatized projects and a few of them are now under implementation process.

The national targets for Water Pollution Reduction for the Danube River Basin have already been set up in the Slovak National Action Plan (NAP). NAP focuses on these three problems, which are: high load of N and P nutrients and eutrophication; changes in the regimes of the sediments flow and transport; contamination with harmful substances, including the oil substances. According to NAP the following measures will be necessary to provide in Slovakia: revitalization of the streams and wetlands; management of their development to maximize their accumulation effects for the N and P nutrients, and at the same time to maintain their natural health state and biodiversity.

In Slovakia the priority of present goals is to reduce municipal emissions, which often contribute dominantly to the total load of the catchment. The point sources are relatively easier to reduce because of easily defined and known polluter survey. On the other hand, the reduction of diffuse pollution needs comprehensive measures in legislation, cross-sectional co-ordination, in the setting of priorities of national economy and environmental policy, etc. In addition it is very complex to introduce all of these extensive measures during socio-economic transformation of post-communist country. Due to these problems as well as the temporarily sharp decreasing of industrial fertilizers consumption in agriculture (only about 49 kg/hec of agriculture soil/year in 1996) the technical measures leading to the reduction of diffuse pollution is difficult to accelerate.

Water quality management in Slovakia is based on the Water Act and government directives, further supported by technical standards. The present Water Act is based on the former Czechoslovak Water Act No.138 from 1973 and is currently being revised. The Government Decree No.242/1993 is a legislative norm for the effluent standards. It was prepared with the aim to correspond with European legislation, especially with Directive 91/271/EEC. It represents a fusion of ambient water quality standards and (end-of-pipe) effluent standards common in European countries. An important feature of this decree is the step-wise approach of setting effluent standards: till December 31, 2004 and more stringent after January 1, 2005. In Slovakia the majority of watercourses are very sensitive due to their low dilution rate.

In spite of this fact that the SR is only an affiliated member of the European Commission for Standardization (CEN) there is a tendency to take over the European Standards (ES) and incorporate them into Slovak Technical Standards (STN) in the field of water and wastewater management. It is expected that the significant cost implications on water management in SR will have the implementation of the EU Urban Wastewater Directive 91/271/EEC. The big cost implications of the Directive concerns the requirements to ensure the construction of sewerage for the settlements with more than 15.000 inhabitants till 31.12.2000 and after 31.12.2005 also for the settlements from 2000 to 15.000 inhabitants. Most treatment plants, due to the fact that the Slovak territory is predominately sensitive, will have to be designed with nitrogen removal and larger ones with biological or even biological-chemical nutrient removal. All these treatment lines require the higher volumes of tanks, the higher level of automation and control and more sophisticatedly trained operators. Therefore not only the investment costs, but also operation and maintenance costs will dramatically increase.

6.2. Actual and Planned Projects and Policy Measures

The list of hot spots have been prepared with close co-operation with the *Water Quality National Expert* taking into consideration the list of hot spots presented in Strategic Action Plan and National Action Plan for the Danube Basin of the Slovak Republic. The projects and programmes identified actions for monitoring water pollution and water quality, wastewater treatment, protecting water resources, preventing environmental degradation, etc. The prepared list of hot spots supported by *Project Files* indicates the actual problems in the fields of municipal wastewater and industrial wastewater including partially the problems of waste disposal (landfills and lagoons).

The list of municipal hot spots using multi-criteria analysis are as follows: high priority: WWTP Košice, WWTP Nitra, medium priority: WWTP Malacky, WWTP Banská Bystrica, WWTP Michalovce, WWTP Svidník, Sewerage Trenčín right side, WWTP Humenné, low priority: WWTP Ružomberok, WWTP Topolčany, WWTP Liptovský Mikuláš, WWTP Ilava, WWTP Rožňava. All these projects are structural. WWTP Košice and WWTP Malacky have been identified as the most important municipal sources of transboundary pollution.

The group is presented mainly from the existing WWTP or WWTP under construction, upgrading and/or expansion. Their construction is often postponed for several years already, due to the lack of financial funds. Most of these plants are serving larger towns and cities. The efficiency of the plants is designed according to Gov. Decree 242/93. This fact has the great impact on the type of treatment line applied and thus on the reduction of point sources of nutrient discharges. Therefore most of them will be operated with nitrification and denitrification and the limited number with biological phosphorus removal. The small treatment plants are usually design as an extended aeration.

In the same way the list of the following industrial hot spots have been again prepared: *high priority*: NCHZ Nováky, Bukocel Hencovce, *medium priority*: PCHZ Žilina, Istrochem Bratislava, SH Senica nad Myjavou, Chemko Strážske, *low priority*: AssiDomän Štúrovo, Bučina Zvolen, Biotika Slovenská Lupča, Koželužne Bošany.

The project files show that there are two types of structural projects: the aims of the first group of projects plans to implement the measures in the processes of industrial production of the company (e.g. the reduction of water consumption, energy or chemicals savings, etc), the second one sets the measures reducing the discharge pollution to surface receiving water or groundwater. This group contains the upgrading of existing treatment plant (a new aeration systems, expansion of biological treatment stage, re-arrange of activation tanks to nitrification-denitrification, etc), improving the state of existing sewer systems, connecting sewer systems to treatment plants or construction of basins to control the spills of chemicals to groundwater, etc.

The obtained results and the summary of recommended projects for landfill hot spots are presented as follows: Krompachy - municipal and industrial landfill, Power plant Nováky-Kostoľany - final lagoon Chalmová, VSŽ Košice - reconstruction of wet waste tip, VSŽ Košice - reconstruction of dry waste tip and waste liquidation, Bukocel Hencovce - reconstruction of industrial landfill, Chemko Strážske - industrial landfill.

Most of these projects cover the protection of groundwater against the contamination with heavy metals and/or micro pollutants extracted from the site of landfill. The reconstruction of the landfill and/or their rehabilitation are also the typical measures included in the *Project Files.*

Only a small number of non-structural *Project Files* were obtained. Most of them are based on research and institutional programmes. Generally more than *40 Project Files* were analyzed.

6.3. Expected Results of Planned Measures and Projects with Particular Attention to Transboundary Effects

According to the effluent standards introduced by Gov. Decree N°.242/1993 in many cases "hi-tech" treatment systems will have to become a standard technology in Slovakia. Because of the high loading of the biological stage in majority of the larger treatment plants nutrient removal processes are ineffective at present. Most of the existing municipal wastewater treatment plants are mechanical-biological. They are able to remove only easily biodegradable substrates (carbon substances). The present efficiency of nutrient removal in term of TN is about 25 % and TP about 35 %.

This fact reflects the designed treatment line in the most of *Project Files* obtained. Practically all the projects assume the treatment line with pre-denitrification and nitrification and a part of them include also the biological phosphorus removal. The upgrading of the existing treatment plants has to be considered with the nutrient removal to be able to reach the requirements of Gov. Decree 242/93. It was estimated, if the projects were implemented, that the reduction of BOD_5 could be improved up to 35 % more, SS to 30 % and $N\text{-}NH_4^+$ about 10-15 % more. The reduction of TN and TP is very difficult to estimate, but if we assume that nowadays the efficiency of TN removal is about 25 % and TP is about 37% we may assume that after pre-denitrification and nitrification the removal rate of treatment plant will be 60 - 70 % and in case of biological phosphorus removal (luxury-uptake) the concentration of TP could be reduced to 20 - 25 % of total. If we assume that the total emission in terms of TN and TP discharged from the Slovakia territory drained to the Danube River basin is about 59 KtN/year and 5 KtP/year, respectively, one may assume that after the implementation of the projects (including the municipal, industrial point sources and wetland projects) the total impact of nutrients will be reduced to 55.374 tN/year and 4755 tP/year.

The more significant impact on the reduction of nutrients can be pointed out if we only look on the reduction of point-source load in Slovakia. In this case the nutrient load would reduce from 20 ktN/year to 16.374 tN/year (reduction about 20%) and 3 ktP/year to 2755 tP/year (reduction about 10 %). It is clear that the more significant reduction of nutrient pollution could be obtained if the problem of diffuse pollution was solved in Slovakia. Due to the fact that practically the total mass of pollution discharge to receiving water is flowing to Hungary the indicated reduction of nutrients will have the significant impact on transboundary effect, as well.

As far as the industrial pollution is concerned the reduction of nutrients could be similarly estimated as for municipal. However the significant impact on the aquatic environment would have the reduction of micro-pollutants, and hazardous substances such as caprolactam, methymethaclylate, hydroxylamin, ammonium, phenols, oil material, etc. From this point of view the important project (NCHZ Nováky) is the advanced treatment of the discharged wastewater contaminated by chlorinated hydrocarbons. The expected reduction is from 300 to 500 t/year. The present situation of many industrial sewer systems could be improved by their reconstruction, which are often defective; not only infiltration but also exfiltration should be considered.

There are five industrial plants having significant impacts on the transboundary pollution. They are Istrochem Bratislava, Slovhodváb Senica, Chemko Strážske (chemical factories), AssiDomän Packaging Štúrovo (paper industry), Bukocel Hencovce (wood company). All these plants (except Slovhodváb Senica) are covered by the projects defined in *Project Files*.

WWTP Košice and WWTP Malacky have been identified as the most important municipal sources of transboundary pollution.

The theoretical estimation of discharged pollution and its reduction could be likely higher if the by-pass of many plants, even during dry period, was excluded. The increasing of the treatment plant capacities, especially biological treatment stage, could increase the portion of total treated wastewater collected in public or industrial sewer network.

The necessary measures in agriculture can reduce the transport of ammonium and phosphorus from manure and slurry to surface water. Over fertilization is a smaller problem in Slovakia.

The compilation of investment costs of the projects estimated in *Project Files* has revealed the huge requirements for investment costs in millions, as follows: municipal sector (10 projects) - 105.512 US$, non-secured 53.278 US$, industrial sector (15 projects) - 101.662 US$, non-secured 85.461 US$, landfills (6 projects) - 43.501 US$, non-secured the same, non-structural (3) projects - 1.176 US$, non secured 1.102 US$.

It is expected that the privatization of water management, especially the transformation of water and sewage works, will also have significant impact on the pollution discharge to surface water. The second expected influence on water quality will be the implementation of more stringent effluent standards set by Gov. Decree 242/93 after January 1, 2005, but the most important issues would be the approving of the new Water Act No.138, which is currently being revised.

7. Analysis of National Financing Mechanism

7.1. Policies for Funding of Water Sector Programmes and Projects

The total number of inhabitants connected to public water supply networks in 1996 increased by 33.600 inhabitants, as compared with 1995. The proportion of supplied population is 79,8 %. The number of municipalities connected to public water supply system in 1996 was 1815, i.e. about 63,2 % of the total number of municipalities and cities of Slovakia. The number of public water supply systems was 1414, of which 308 were combined water supply systems.

Specific water consumption 414.2 l per capita, per day has been maintained on a similar level since 1985 for consumers of water and sewage works, and 157,4 l per capita per day for consumers – municipalities. In municipalities the specific household consumption in 1996 was 83,3 l cap/day, i.e. a slight increase as compared with 1990, when it was 80,9 l cap/day. Thus the specific water consumption, compared with European countries (147,0 l cap/day) is seriously below the average and is close to the hygienic minimum (80,0 l cap/day). The long-term decrease of drinking water consumption is going on. Invoicing of drinking water showed a decrease by 13,1 mil.m^3, i.e. 3,8 % and in case of drained water a decrease by 13,0 mil.m^3, i.e. 3,7 % compared with 1995 year.

The delivery of charged surface water has been decreasing since 1990 over the whole Slovak territory, though in 1996 an increase in deliveries was recorded by 24.179.000 m^3 to 794.296.000 m^3, as compared with 1995. The delivery of water in 1996 decreased approximately by 41,5 % as compared with 1990, mostly in the Hron River basin by 57,5 %, least decrease being achieved in the Bodrog and Hornád river basin by 24,5 %. Water withdrawals for public water supply networks in the period 1990-1993 showed slightly increasing trend, however in comparison with 1990 they decreased in 1995 by 17,8 %, and in 1996 only by 15,6 %. Water withdrawals for irrigation substantially decreased by 87,0 % as compared with 1995, in spite of the circumstance the river basin authorities were prepared to provide these withdrawals for irrigation. Water withdrawals for industry and other consumers decreased by 29,7 % as compared with 1990.

Number of inhabitants connected to public sewerage systems increased by 32.200 in 1996 and the present state is 2850 thousand inhabitants (53,0%) of population. Number of residents inhabiting houses connected to pubic sewerage managed by the enterprises water and sewage works increased by 17.700 and reached 2.756.000 inhabitants.

The length of sewage networks managed by water and sewage works increased in 1996 by 152 km and is 5352 km long. The length of sewage networks managed by municipalities is 437 km. The volume of water discharged into watercourses was reduced by 7,5 mil.m^3 as compared with 1995. The number of wastewater treatment plants increased to 204 in administration of water and sewage works and 77 in administration of municipalities. Wastewater treatment plants capacity was 1.917.600m^3 in 1996.

The volume of wastewater treated in wastewater treatment plants managed by water and sewage works in 1996 was 504,4 mil.$m^{3,}$ i.e. by 3,3 mil.m^3 more than in 1995. In wastewater treatment plants managed by municipalities 3,7 mil.m^3 of wastewater were treated. In 1996 were discharged 543,7 mil.m^3 water and conveyed by sewerage systems into watercourses, of which 93,5 % treated wastewater. From this volume 6,3 mil.m^3 of wastewater were conveyed through public sewerage systems managed by municipalities.

Improvement of existing situation can be attained by construction of new wastewater plants, or reconstruction of existing facilities.

7.2. Funding Mechanism for Water Sector programmes and Projects

The State Environmental Fund SR has been established by the Act No. 128/1991, Coll. of Acts. A purpose of the fund is to concentrate financial sources and spend them for the environment. An economic mission of the Fund is to mobilize the capital of individual investors to solve ecological problems and create more favorable conditions on the investment market for ecological investment, and thus to spend up and facilitate their implementation.

The Fund sources in the quality protection and water quantity area and their rational usage are especially:

- charges for wastewater discharges to surface waters,
- penalties imposed by the state administration bodies in the water management,
- contribution from the State Budget SR.

The State Water Management Fund SR has been established by the Act No. 318/1991 Coll. of Acts. The Government SR by its provision No. 589 of October 22, 1991 accepted the statute of the State Water Management Fund. The Fund is used to cover concrete developmental water management constructions, hydro-geological research, removal of accidents in water structures, development of sciences and technologies. The Fund provides non-investment subsidies for settling activities of water management enterprises, which are not covered from other sources and have public-benefit nature.

The State Water Management Fund sources are as follows:

- charges for groundwater consumption,
- subsidies from the State Budget SR,
- loans from financial institutions,
- interests from the Fund sources,
- gifts and contributions by legal and physical entities.

State Subsiding Fund of Agriculture and Food Processing SR established by the Act of the Slovak Parliament No.40/1994 Dig. as to enhance renewal and development of technical and technological conditions of entrepreneurs within the branch of agriculture, thus ensuring the task of population subsistence, development of enterprising activities in forest and water management in accordance with the conceptual plans. The establishment Act regulates the task of the Fund. Ministry of Soil Management SR issued the instruction on granting means from the Fund. According to methodological directive this may be realized by means of loans, pledged interest, settlement of a part of interests, or by combining warrants and loans, and warrants and settlement of a part of interests and a part of credits.

State Fund of Conservation and Reclamation of Agricultural Land. Fund SR was established by Act No. 307/1992 on protection of agricultural land fund. The Statute of the Fund was approved by the Decree of the Slovak Government No.76/1993 Dig., modifying the conditions and mode of granting means from this Fund. In accordance with this regulation the directive of Ministry of Soil Management No. 35/1997 has been issued, declaring the purpose and mode of granting means from this Fund.

The means of this fund may be used for new construction, completion of structures, reconstruction, and updating of hydromelioration facilities, operation, maintenance and repair of major reclamation facilities owned by the state, maintaining the water regime.

The standardized funding mechanisms are a combination of sources investors with the commercial loans and loans and grants from before clarified funds.

Typical sources of investment are co-financing:

- the sources of municipality (budget the municipality),
- grants from the State Environmental Fund,
- commercial loans.

The sources in State Environmental Fund are limited, very problematic is to obtain the loans from the commercial banks. Special loan programme for water management project does not exist now.

Typical sources of investment fund for industrial and commercial wastewater treatment/pre-treatment are co-financing:

- the sources of industrial companies, water treatment plants,
- grants from the State Environmental Fund,
- commercial loans.

Grants can be obtained from the State Environmental Fund and State Water Management Fund.

For implementing development goals, included in the Conception of Water Management Policy Slovak Republic by 2005, allocation of means amounting to 4 billion Sk is required. Participation of the state, vital for financing water engineering structures, was reduced in the last years to 1 bill. annually. This amount covers 25 % of the annual aggregate invested capital in water management. Major part of investments is financed by water management enterprises from their capital and reserves and remaining investments are financed by combined resources. Participation of state funds in financing investment construction has been negligible hitherto, and did not cover in the last years even a half percentage of the volume of investments in water management. Construction of the System of River Power Gabčíkovo and Žilina has been financed by means foreign credit guaranteed by state.

Table 7.1. Review of subsidies from national budget (mil. Sk)

	1995	1996	1997	1998
Investment subsidies total	741	947,0	773	813,6
of which: .....individual	464	435,5	330	290,6
.....systematic	277	511,5	443	523,0
Non-investment subsidies	167	138,6*	200*	200*
Subsidies total	908	1 085,6	973	1 013,6
State bonds	57	0	0	0
Means for WM allocated from the State Budget	965	1085,6	973	1 013,6

** solved by means of transfer through the State Water Management Fund SR.*

7.3. Actual Cost and Price Policy

The price for drinking water and drained water is determined by the Ministry of Finance SR. The determined maximum drinking water price for households is lower than the actual average total cost per m^3. Similarly the determined maximum price is lower than the average total own costs per m^3. Costs for drinking water increased to 9,27 Sk/ m^3 and for drained water to 5,78 Sk/ m^3 in 1997. For other consumers of drinking, process and drained water contract prices are in force.

On the level of respective state enterprises water and sewage works cross subsidization occurs from two points of view. Because the maximum prices of drinking and drained water for households are determined in such a way, that they do not cover even the level of total own costs, a continuous growth of contract prices for other consumers takes place. Deliveries for households and for other consumers are approximately in the ratio 60 : 40, however the ratio in revenues is opposite.

The development of total output costs, drinking water deliveries, and drained waters and of average total output costs per $1m^3$ in enterprise water and sewage works is presented in following figures.

Table 7.2. Drained water

	1994	1995	1996
Total costs (mil.Sk)	1 516	1 57	1 722
Volume of drained water (thousand m^3)	372 03	343 547	330 521
Average total costs ($Sk.m^{-3}$)	4,07	4,62	5,21
Average price ($Sk.m^{-3}$)	4,53	5,21	6,07

Table 7.3. Drinking water

	1994	1995	1996
Total costs (mil.Sk)	2 246	2 412	2 630
Drinking water delivery (thousand m^3)	377 361	345 100	331 900
Average total costs ($Sk.m^{-3}$)	5,95	6,86	7,77
Average price ($Sk.m^{-3}$)	5,72	6,40	7,09

Level of actual cost coverage

Table 7.4. Drinking water

	1993	1994	1995	1996	1997
	included VAT	included VAT	included VAT	included VAT	included VAT
average total cost	5,22 Sk/ m^3	5,95 Sk/ m^3	6,79 Sk/ m^3	7,77 Sk/ m^3	9,52 Sk/ m^3
households	4,00 Sk/ m^3	4,00 Sk/ m^3	4,00 Sk/ m^3	5,00 Sk/ m^3	6,00 Sk/ m^3
other consumers	8,48 Sk/ m^3	9,68 Sk/ m^3	10,76 Sk/ m^3	12,16 Sk/ m^3	14,81 Sk/ m^3

Table 7.5. Drained water

	1993	1994	1995	1996	1997
	included VAT	included VAT	included VAT	included VAT	included VAT
average total cost	3,45 Sk/ m^3	4,07 Sk/ m^3	4,61 Sk/ m^3	5,21 Sk/ m^3	5,78 Sk/ m^3
households	3,00 Sk/ m^3	3,00 Sk/ m^3	2,98 Sk/ m^3	3,01 Sk/ m^3	4,00 Sk/ m^3
other consumers	5,30 Sk/ m^3	6,58 Sk/ m^3	7,90 Sk/ m^3	9,68 Sk/ m^3	11,08 Sk/ m^3

(Report on Water Management in the Slovak Republic 1997)

7.4. Actual and Planned Public and Private Investments for Water Quality and Wastewater Management Projects

Using the information obtained in Projects Files, the requirement on finance resources can be defined.

Table 7.6. Summary of the cost estimation of the proposed programmes and projects in municipal sector

					National Funding Sources				total requested or non-secured	
No. of project	Wastewater treatment plant Locality	Ranking of the projects	Total Capital costs	Total capital costs	Equity of Owner	National Envir. Fund	Water Manag. Fund	Public loans Centr.+ Reg.		
		[priority]	[MNC]	[MUS$]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MUS$]
1- M	Košice	high	900,000	26,087	30,000	100,000	30,000	130,000	290,000	8,406
2- M	Nitra	high	552,000	16,000					373,676	10,831
4- M	Banská Bystrica	medium	593,461	17,202			38,000	131,106	169,106	4,902
5- M	Michalovce	medium	114,000	3,304	10,000	20,000		25,000	55,000	1,594
6- M	Svidník	medium	410,000	11,884	16,000	86,000		110,000	212,000	6,145
7- M	Trenčín right side	medium	267,000	7,739					257,000	7,449
8- M	Humenné	medium	597,806	17,328	35,000	100,000		200,000	335,000	9,710
10- M	Topoľčany	low	34,298	0,994	28,298				28,298	0,820
13- M	Rožňava	low	91,605	2,655	16,000	30,000			46,000	1,333
14- M	Liptovský Mikuláš	low	80,000	2,319	22,000	20,000	30,000		72,000	2,087
	Total		3640,170	105,512	157,298	356,000	98,000	596,106	1838,080	53,278

Table 7.7. Summary of the cost estimation of the proposed programmes and projects in industrial sector

No. of project	Plant Locality	Ranking of the projects	Total capital costs	Total capital costs	National Funding Sources						Commerc. Bank Loans	total requested or non-secured	
					Equity of Owner	National Envir. Fund	Water Manag. Fund	Public grants Centr.+ Reg.	International				
									Loans	Grants			
		[priority]	[MNC]	[MUS$]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MUS$]
1a -I	NCHZ Nováky	high	12	0,348		1	1			3		5	0,145
1b -I	NCHZ Nováky	high	30	0,870	3	2	5	5	5	5	5	30	0,870
2 -I	Bukocel Hencovce	high	200	5,797								200	5,797
3a -I	PCHZ Žilina	medium	21,93	0,636							21,93	21,93	0,636
3b -I	PCHZ Žilina	medium	68,681	1,991							66,481	66,481	1,927
3c -I	PCHZ Žilina	medium	57,464	1,666							55	55	1,594
3d -I	PCHZ Žilina	medium	28,809	0,835							27,509	27,509	0,797
6a -I	Chemko Strážske	medium	2415	70,000	483	1207,5			724,5			1932	56,000
6b -I	Chemko Strážske	medium	16	0,464	8	8						8	0,232
6c -I	Chemko Strážske	medium	15,05	0,436	7,5	7,5						15	0,435
6d -I	Chemko Stážske	medium	100	2,899	50	50						100	2,899
7 - I	AssiDomän Packaging Štúrovo	low	317,7	9,209								317,7	9,209
8 - I	Bučina Zvolen.	low	94	2,725								94	2,725
9 - I	Biotika Slovenská Lupča	low	50	1,449	10	15			25			50	1,449
10 - I	Tannery Bošany	low	80,702	2,339	8,8	17						25,8	0,748
	Total		**3507,336**	**101,662**	570,3	1300,5	6	5	754,5	8	175,920	**2948,420**	**85,461**

Table 7.8. Summary of the cost estimation of the proposed programmes and projects for landfills

No. of project	Landfill or Lagoon / Locality	Ranking of the projects	Total capital costs	Total capital costs	total requested or non-secured	
		[priority]	[MNC]	[MUS$]	[MNC]	[MUS$]
1 - L	Kovohuty Krompachy	High	N/A	N/A	N/A	N/A
2 - L	Power plant Nováky-Kostoľany	Medium	335,160	9,715	335,160	9,715
3 - L	VSŽ Oceľ Košice	Low	212,550	6,161	212,550	6,161
4 - L	VSŽ Oceľ Košice	Low	503,062	14,582	503,062	14,582
5 - L	Bukocel Hencovce	Low	50,000	1,449	50,000	1,449
6e -I	Chemko Strážske	Low	400,000	11,594	400,000	11,594
	Total		1500,772	43,501	1500,772	43,501

Note: MNC - millions in national currency - Slovak crowns
MUS$ - millions in US$
exchange rate used: 34.5 Sk = 1 US$

The National Environmental Fund and Water Management Fund are supposed to be mostly used for financing the investment. Second group of expected sources are public loans. In industry the equity of owner and commercial loans is the most significiant source.

8. Development of National Pollution Reduction Programme and Investment Portfolio

8.1. Project Identification, Description and Cost Estimation

Investment portfolio for priority projects (hot spot ranking)

Table 8.1. Municipal sector

					National Funding Sources					
No. of project	Waste-water treatment plant Locality	Ranking of the projects	Total capital costs	Total capital costs	Equity of Owner	National Envir. Fund	Water Manag. Fund	Public loans Centr.+ Reg.	total requested or non-secured	
		[priority]	[MNC]	[MUS$]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MUS$]
1- M	Košice	high	900000	26,087	30,000	100,000	30,000	130,000	290,000	8,406
2- M	Nitra	high	552000	16,000					373,676	10,831
	Total		1452000							4,902

Table 8.2. Industrial sector

					National Funding Sources								
No. of project	Plant Locality	Ranking of The projects	Total capital costs	Total capital costs	Equity of Owner	National Envir. Fund	Water Manag. Fund	Public grants Centr.+ Reg.	International		Commerc. Bank Loans	total requested or non-secured	
									Loans	Grants			
		[pririty]	[MNC]	[MUS$]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MNC]	[MUS$]
1a -I	NCHZ Nováky	High	12	0,348		1	1			3		5	0,145
1b -I	NCHZ Nováky	High	30	0,870	3	2	5	5	5	5	5	30	0,870
2 -I	Bukocel Hencovce	High	200	5,797								200	5,797
			242	7,015							21,93	21,93	0,636

Table 8.3. Landfills

No. of project	Landfill or Lagoon / Locality	Ranking of the projects	Total capital costs	Total capital costs	total requested or non-secured	
		[priority]	[MNC]	[MUS$]	[MNC]	[MUS$]
1 - L	Kovohuty Krompachy	High	N/A	N/A	N/A	N/A

Annexes

List of Ongoing and Planned Projects (based on the *Project Files* database)

Table 9.1. Summary of the ongoing and planned projects for municipal hot spots

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
HIGH PRIORITY						
WWTP Košice & Hornád & Košice	The expansion of the capacity of biological treatment stage & to reach the effluent standards according to Gov.Decree 242/93	High	Košice- expansion of wastewater treatment plant 2nd stage of construction & structural	The construction and expansion of the existing treatment plant, 90 % of civil structures are completed, the aeration system of activated sludge system will have to be installed, the implementation of nitrification - denitrification is considered.	The implementation of the project would reduce the pollution of the Hornád river and thus it would positively effect transboundary pollution transported to Hungary. The upgrading of treatment line to biological nutrient removal will reduce the discharge of the mass loading of TN to surface water and partially also TP.	East Slovakian Water and Sewage Works, the municipality of Košice city
WWTP Nitra & Nitra & Nitra	To complete the construction of a new treatment plant, to treat the total amount of discharged municipal wastewater during dry period, the project can not be completed due to the lack of finances.	High	Nitra- wastewater treatment plant & structural	The construction of the new treatment plant, about 40 % of civil structures are completed, the project of biological treatment step has been re-designed with possible utilization of the structures of the old existing plant. The treatment line consist of nitrification-denitrification and biological phosphorus removal	The main benefit of the project would be the reduction of pollution discharged to highly polluted the Nitra river. The absence of treatment of the large portion of discharged wastewater is the limit of the development of the Nitra city. The new treatment line would reduce the total mass loading of the Nitra river not only in terms of carboneus pollution but also in terms of nutrients.	Municipality of Nitra city, West Slovakian Water and Sewage Works

Table 9.1. continued

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
MEDIUM PRIORITY						
WWTP Banská Bystrica & Hron & Banská Bystrica	The expansion of existing treatment plant with the capacity able to cover the wastewater conveyed by main sewer «A». The existing treatment plant is mass and hydraulic overloaded ,therefore the effluent standards set for the plant are not fully reached.	Medium	Expansion of wastewater treatment plant Banská Bystrica & structural	Expansion of existing treatment plant with the capacity of 1500 l/s. The treatment line will be with capacity for 110 000 P.E. The treatment line will change to the pre-denitrification - nitrification and biological phosphorus removal with possible chemical precipitation.	The implementation of the project will improve the total efficiency of treatment line on 30 % more and it will remove also the nutrients (TP 90- 95 %, $N\text{-}NH_4^+$ 90 - 95 %). The chemical precipitation of phosphorus is considered, as well.	The Central Slovakian Water and Sewage Works, the municipality of Banská Bystrica
WWTP Michalovce & Laborec & Michalovce	The existing treatment plant is mass and hydraulic overloaded, therefore a part of discharged municipal wastewater cannot be treated. The upgrading started in 1993, but the lack of finance is the limit to completing the ongoing project.	Medium	Upgrading of wastewater treatment plant Michalovce & structural	The expansion and upgrading of existing treatment plant Michalovce would cover the increased wastewater production and the required effluent standards. The existing treatment plant would be enlarged from the capacity 133 l/s to 350 l/s in two consecutive stages.	The project will implement the treatment line with pre-denitrification and nitrification. The existing activated sludge tank will serve as an regeneration tank. The designed capacity of the treatment plant will be able to cover the total production of discharged municipal wastewater, therefore the significant reduction of pollution also in terms of TN is assumed.	The Eastern Slovakian Water and Sewage Works, the municipality of Michalovce city

Table 9.1. continued

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
WWTP Svidník & Ondava & Svidník	Collection of wastewater of municipal wastewater of Svidník city and adjacent settlements. At present the city and these settlements do not have any treatment plant. The wastewater discharge to the Ondava river have the significant impact on the river water quality.	Medium	Svidník - sewer network and wastewater treatment plant & structural	The construction of sewer network and mechanical-biological treatment plant. The treatment line is designed as a regeneration denitrification and nitrification with anaerobic stabilisation of sludge. The capacity of treatment line will cover the production of wastewater not only from Svidník city, but also from adjacent settlements.	The wastewater generated in the territory of Svidník city are not treated at present and therefore the impact on the water quality of the Ondava river is very negative. The implementation of the project would significantly reduce the discharged pollution to the river and also will protect the main water resource serves for Svidník public water supply distribution system..	The Eastern Slovakian Water and Sewage Works, the municipality of Svidník city
WWTP Trenčín right side & Zlatovský creek & Trenčín	At present the right side of city does not have any treatment plant. The wastewater discharge to the Váh river basin has the significant impact on the river water quality.	Medium	Trenčín - sewer system and wastewater treatment plant & structural	The construction of a new treatment plant with mechanical biological treatment line has been designed for the capacity of 41 830 P.E. The capacity of mechanical and biological treatment line is 200 l/s. The implementation of the project will construct a new treatment plant which covers the treatment of total production of wastewater on the right side of Trenčín .	The wastewater generated in the right side of Trenčín city are not treated at present and therefore the impact on the water quality of the Váh river basin is very negative. The implementation of the project would significantly reduce the discharged pollution to the Zlatovský creek. The present situation also limits the development of the locality The designed treatment line will reach the requirements of Slovak Gov.Decree 242/93 and EU effluent standards.	The municipality of Trenčín city

Table 9.1. continued

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
WWTP Humenné & Laborec & Humenné	The present capacity and the level of treatment of the existing plant is not sufficient. The project started in 1987, but the production of wastewater during its implementation has significantly changed and therefore the designed project has had to be re-designed.	Medium	Expansion of wastewater treatment plant Humenné & structural	The existing treatment plant is mass and hydraulic overloaded. The expansion of the treatment line was corrected according to new situation with respect to decreasing of wastewater production. In 1996 the capacity of treatment plant was estimated 380 l/s. The treatment line is designed as nitrification denitrification.	The main goal of the project is to improve the effluent quality parameters, to reduce pollution impact of treated wastewater discharged to the river Laborec. The impact of discharged pollution has also the transboundary effect. (Hungary). The locality may be classified as sensitive because this region is utilized for the public water supply, as well (there are two water resources for the settlements Strážske and Michalovce).	The Eastern Slovakian Water and Sewage Works, the municipality of Humenné city
LOW PRIORITY						
WWTP Topoľčany & Nitra & Topoľčany	The present capacity of existing treatment plant is not sufficient and the treatment line is not able to reach the required effluent quality. The treatment plant is in poor conditions with old and defective installations. The upgrading of plant has already started (12/96) however the lack of finances is the limit of completing the project	Low	Topoľčany - wastewater treatment plant upgrading & structural	The upgrading of the treatment plant will be implemented in two subsequent stages. The treatment line is designed as a pre-denitrification and nitrification system.	The main goal of the project is to reach the Slovak and EU effluent standards because of highly polluted receiving water - the Nitra river. All collected wastewater by sewer system will be treated in wastewater treatment plant after implementation of the project during the dry period.	The West Slovakian Water and Sewage Works, the municipality of Topoľčany city

Table 9.1. continued

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
WWTP Rožňava & Slaná & Rožňava	The capacity of 63 l/s of the existing treatment plant is not sufficient to ensure the required effluent quality. The present flow rate is from 140 to 160 l/s. The construction of a new treatment plant was started with the capacity of 162 l/s.	Low	Rožňava - expansion of wastewater treatment plant & structural	The new treatment plant with capacity of 162 l/s has already been constructed however only 1/3 of the total capacity of plant is in operation due to lack of finances necessary for technology supply. The civil part of the project is practically completed. The treatment line is represented by carrousel.	The main goal of the project is to complete the whole treatment plant and to improve the effluent quality and in this way to reduce the discharged pollution to the Slaná river. At present this reduction represents about 10 t/year less than before in terms of BOD_5 and SS. This region is very sensitive because of covering the protected region Slovenský Kras including the protected natural sources of water. The transboundary pollution plays a important role in this case, too.	The East Slovakian Water and Sewage Works, the municipality of Rožňava city
WWTP Liptovský Mikuláš & Váh & Liptovský Mikuláš	The existing treatment plant does not reach the required effluent standards. The existing biological treatment line is not able to manage the treatment of the mass loading and to reduce the nutrients in effluent.	Low	Liptovský Mikuláš - reconstruction of wastewater treatment plant 2^{nd} stage & structural	The project covers the reconstruction of aeration system with fine bubbles, pumping station for sludge recycling , upgrading of biological step to pre-denitrification and nitrification and expansion of the capacity of final clarifiers.	The implementation of the project will help to reach the required effluent standards, reduce the discharged pollution to the Váh river and sensitive region nearby the Liptovský Mikuláš - reservoir Liptovská Mara. This fact will have a positive impact on aesthetic, recreational and fishing characteristics of Liptovská Mara reservoir.	The North Slovakian Water and Sewage Works, the municipality of Liptovský Mikuláš city

Note:

WWTP Malacky and WWTP Ružomberok are not included in Table 3- 3 in spite of the fact that they are included in the list of municipal hot-spots. *Please see the explanation in the part C - Water Quality.*

Table 9.2. Summary of ongoing and planned projects for industrial hot spots

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
HIGH PRIORITY						
Novácke chemické závody Nováky & Nitra & Nováky	The most important industrial point source of pollution in the Nitra River Basin. In 1992 the construction of new mechanical -biological WWTP has started. The changes in production programme have required the redesign of plant. The construction of WWTP was not accomplished because of financial constraints.	High	Management of wastewater in NCHZ Nováky. a.s., Removal of chlorinated hydrocarbons in the production of propylen oxide & structural	The aim of the project is to develop the water pollution control model and to set up the optimal warning system of un-controlled flow of particular organic substances to the sewer system. The second project will reduce the discharge of chlorinated hydrocarbons generated in the production of propylen oxide.	The reduction of possible risk of accidents in company's sewer system and the acute pollution of the river. It is estimated that the reduction of chlorinated hydrocarbons would be from 300 to 500 t/year less.	NCHZ, a.s. Nováky
Bukocel Hencovce & Ondava & Vranov	The existing treatment plant is in poor conditions (it was constructed in 1956) with old fashion treatment line. The reconstruction of sewer system to collect and treat all the wastewater generated in the territory of company is considered, too. At this time a part of wastewater is discharged to the receiving water without any treatment.	High	Reconstruction of wastewater treatment plant in Bukocel, a.s. & structural	The project has already started in 1992 however because of lack of investments it was stopped. The project implements the construction of pumping station, settling and thickening and dewatering of suspended solids and sludges, respectively. The reconstruction of sewer system to collect and lift a part of wastewater to the treatment plant is planed in this project, as well.	The main goal of the project is to reduce the pollution discharged to the Ondava river from the present 305.5 t BOD_5/year to 203.1 t BOD_5/year. In addition all collected wastewater in the territory of company will be treating on the existing treatment plant. The reduction of pollution will positively improve the fish management, hygienic and water quality of irrigation system under the effluent discharge point.	Bukocel, a.s. Hencovce

Table 9.2. continued

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
MEDIUM PRIORITY						
Považské chemické závody Žilina & Váh & Žilina	The present state of holding tanks for chemicals does not achieve the requirements of groundwater protection. These problems deal with barrelling, pumping or handling of chemicals and there is a low protection against the possible accidents. The age of these tanks is about 30 years. The reconstruction of the existing treatment plant is focused on the reduction of nutrients (TN) due to the construction of a new water dam Žilina.	Medium	Reconstruction of ammonium storehouse Varín, Reconstruction of caprolactam holding tanks, Reconstruction of methylmethacrylate holding tanks, Reconstruction of treatment plant & all these projects are structural	Reconstruction of holding tanks for chemicals and storehouse Varín intends to improve groundwater protection and to ensure the higher level of reduction against possible risk of spill accidents. These projects will construct the water pollution control basin under the existing holding tanks as well as under the barrelling stations. Reconstruction of wastewater treatment plant will reduce the emission of nutrients using nitrification-denitrification processes. The project includes the following measures : reconstruction of existing activated sludge tanks, expansion of their volumes, reconstruction of aeration system to fine bubble one, re-arrange of existing treatment line to denitrification-nitrification.	The projects will reduce the groundwater pollution and subsequently the Váh river contaminated by hazardous organic and inorganic substances. The projects will reduce the possible risk of accidents caused by spills. There is a risk of pollution of contamination by cyclohexanon, trichlorethylen, caprolactam, sulphur ammonium, hydroxylamin, ammonium and etc. The present situation is more complex than before because of constructing the Žilina water dam. The water dam will change the present receptor to very sensitive receiving water especially with respect to nutrients, chemicals and micropollutants. This problem (in case of nutrients reduction) is solved by the project of the reconstruction of wastewater treatment plant as well.	Považské chemické závody Žilina

Table 9.2. continued

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
Istrochem Bratislava, a.s. & Dunaj & Bratislava	Existing wastewater treatment plant has only mechanical-chemical treatment line. There is a need of upgrading of treatment to biological treatment system. Istrochem has already started the implementation of the project of biological treatment plant however at this time is re-evaluated due to the significant changes in process technology of company.	Medium	Upgrading of wastewater treatment plant with biological treatment step & structural			Istrochem, a.s. Bratislava
Chemko Strážske & Ondava & Strážske	The present mass and energy consumption in the process technology is very high with an impact on the environment. The dominant role plays the production of cyclohexanon. In addition the protection of the sites where the barrelling the chemicals (Phenols, NaOH) is taking place and the reduction of the leakage to the groundwater is considered. The existing activated sludge tanks are in poor conditions therefore the reconstruction of them is necessary. The existing combined sewer system is necessary to upgrade, as well.	Medium	Project 2000. Barrelling the chemicals for production, Reconstruction of activated sludge tanks of wastewater treatment plants, Reconstruction of sewer system & structural	The project 2000 will replace the oxidation process of cyclohexanon production to non oxidation one. The project for barrelling of chemicals assumes to construct a new basin under the site where the manipulation with chemicals is provided to collect and reuse the spills and/or leakage. A new pumping station and holding tanks will have to be constructed. Upgrading of treatment plant is planned to install the fine bubble aeration system to improve the operation of present carrousels. Reconstruction of sewer system includes the separation of sewage from the combine sewer system, the construction a new sewer system for collecting sewage flowing from the old part of company and pumping station to lift these wastewater to the existing treatment plant.	The project 2000 will improve the safety factor of this process, reduce energy requirements, production of wastewater and wastes. Barrelling the chemicals will improve the protection of groundwater contamination. The economic benefit of wastewater plant upgrading is possible to estimate in terms of energy savings - 1600 MWh/year. The effluent parameters of treatment plant will be improved, as well. The reconstruction of sewer system will decrease the amount of pollution discharge to the Laborec river - 18.85 kg BOD_5/h.	Chemko Strážske, a.s.

Table 9.2. continued

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
LOW PRIORITY						
AssiDomän Packaging Štúrovo & Obidský channel & Štúrovo	The existing mechanical - biological treatment plant is not able to reach the required effluent standards. The necessity of upgrading of combine sewer system is considered, too.	Low	The reduction of discharged wastewater pollution to the Danube river & structural	The project is planned to implement in 3 stages. The upgrading of treatment plant and collecting of wastewaters includes the expansion and reconstruction of activation, the replacement of aeration system to fine bubble one, the upgrading of final clarifiers, connecting the existing combine sewer to treatment plant, construction of stormwater tank.	The main target of the project is to reduce of effluent pollution to reach the effluent standards set by Gov. Decree 242/93. This is very important issue because of the problem of transboundary pollution. At the site of the company the Danube creates the natural border between Hungary and Slovakia. The sensitivity of the Danube will improve if the waterworks Gabčíkovo-Nagymaros would be completed.	AssiDomän Packaging Štúrovo
Bučina Zvolen & Hron, Slatina, Zolná & Zvolen	The existing sewer network in Bučina Zvolen is not complete and some parts of it are in poor conditions or even defective. A part of collecting wastewater are not connected to treatment plant and are discharging to receiving water without any treatment. The upgrading and expansion of the existing treatment plant is considered, as well. The reduction of groundwater and soil contamination is assumed, too.	Low	Construction of wastewater treatment plant with reconstruction and expansion of sewer network & structural	The project should cover the reconstruction the old sewer network (separation of sewage) with the connection to biological treatment plant, expansion and completing storm and sewage sewer network in the northern part of company with the connection to the biological treatment plant, expansion of biological treatment step to treat wastewater after the pre-treatment at the electroflotation unit.	The project helps to improve the water quality in the creeks Zolná and Slatina and finally in the Hron river. The final solution could improve situation in groundwater and soil contamination in the territory as well as in the vicinity of the company.	Bučina, a.s. Zvolen

Table 9.2. continued

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
Biotika Slovenská Lupča & Istebník creek – Hron & Slovenská Lupča	The existing treatment plant was upgraded during the last four years, however the age of civil constructions is more than 25 years. The part of these old structures in poor conditions and aeration system of activation. There are also odor problems.	Low	Wastewater treatment plant reconstruction & structural	The reconstruction of aerobic part of biological treatment step will increase the present water level in tanks, it will change the aeration system to fine bubble one, and it will reduce the odour problems by covering the tanks and treatment the air in biofilters.	The project will improve the situation in aerobic part of treatment plant. The present efficiency of the first two tanks is low due to the critical state of mechanical aerators. The effluent quality will improve (BOD_5 form 210 to 50 mg/l) situation in the Hron river .	Biotika Slovenská Lupča
Koželužne Bošany & Nitra & Bošany	At present the sludges generated at treatment plant are highly contaminated by chrome. The high consumption of wastewater in the process and their contamination by heavy metals is due to the old fashion process technologies used.	Low	Centralise the collection and treatment of wastewater polluted by chrome & structural	Optimisation of tannery processes, the reduction of water consumption and contamination of wastewater and sludges is considered in the project. The aim is to collect wastewater polluted by Cr3+ and treat with the change of pH to precipitate and separate Cr in the form of Cr(OH)3. This product will be recycled and utilized in the plant processes.	Implementation of the project will enable to solve the problem of sludge utilisation in agriculture. At present the disposal of sludge is the tremendous problem and it is a regional problem. It is supposed the reduction of operational costs, reduction of material use and Cr^{3+}, reduction of water consumption and finally reduction of energy requirements.	Koželužne Bošany, a.s.

Note:

The Project Files are enclosed in Annexes. In addition there are the Project Files of HP Harmanec and VSŽ Košice ranking of the problems with low priority.

Table 9.3. Summary of ongoing and planned projects for landfill hot spots

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
Kovohuty Krompachy & Hornád & Krompachy	Protection of the groundwater by contamination with heavy metals coming from the landfill and the revitalisation of the site of landfill	High	Reduction of contamination of groundwater and revitalisation of landfill Krompachy & structural	protect the site of landfill and to reduce contamination of groundwater and river Hornád	Reduction of the risk of contamination of the Hornád river by polluted groundwater	Municipality of Krompachy, Kovohuty Krompachy, a.s.
SE Zemianske Kostoľany & Nitra & Chalmová	Ensuring the sufficient capacity of landfill site for residual ash produced by thermal power plant, to control the groundwater and soil contamination by leachate water.	Medium	Final landfill Chalmová - VI. construction & structural	The treatment of slurry - its thickening. The slurry flows from the power plant with the ratio 1:20 (ash: water) and then it is thickening to the ratio 1: 2 with utilisation of pumping station in the site of power plant.	The primary effect is to eliminate the leakage of leachate to groundwater from the landfill and to protect the landfill site and finally the Nitra river against contamination.	SE, a.s. Elektrárne Nováky, o.z. Zemianske Kostoľany
Chemko Strážske, & Laborec, Ondava & Strážske	Disposal of PCB wastes	Low	Disposal of wastes from the PCB production & non-structural	The development of general methodology of PCB waste disposal for the whole territory of Slovakia.	Reduction of possible impact on the environment of this type of waste, the results of this project will have effect for the whole territory of Slovakia and CEE countries.	all producers of this type of waste, Chemko Strážske, a.s., Ministry of Environment
Bukocel & Ondava & Hencovce	The reconstruction of the existing industrial landfill	Low	Reconstruction of industrial landfill & structural	The solidification of the dam with the length 400m and the height 8 m. It is necessary to carry out geological survey, draining of the landfill and solidifying the dam.	The protection of groundwater and surface water quality against the impact of pollution coming from the landfill.	Bukocel, a.s. Hencovce

Table 9.3. continued

Hot Spot Name & River & Location	Parameters & Values which Define the Problems	Ranking of the Problem	Name & Type of Project	Project Strategy & Targets	Parameters & Values which Define Project Benefits	Project Beneficiaries
VSŽ oceľ, Ltd. Košice &groundwater & Košice	The disposal the wastes and by-products from furnace with the aim to eliminate the groundwater pollution	**Low**	Reconstruction of dry waste tip and waste liquidation &structural	The elimination of the secondary dustiness, the effective utilisation of the existing dump, the protection of the groundwater quality.	The existing lagoon will be sealed by geomembranes. The run-off will be collected and transported to neutralisation station. The construction of the hydrosealing and sealing walls is considered.	VSŽ Oce1,Ltd. Košice.
VSŽ oceľ, Ltd. Košice &groundwater & Košice	The reconstruction of slag-ash mixture lagoon to protect groundwater.	**Low**	Reconstruction of wet waste tip & structural	The sealing of existing lagoon, construction of waste dump for slag and ash with the sealing system.	The existing lagoon will be protected by sealing wall with the length of 1650 m. The sealing will be made from the plastic geomembranes.	VSŽ Oce1,Ltd. Košice.