Chapter 5

WATER RESOURCES MANAGEMENT AND WATER QUALITY ASPECTS

5.1 Water resources and quality

Slovenia is a country rich in water resources. Rainfall during an average year amounts to 1,500 mm, reaching 3,000 mm in the west and 800 mm in the east. From a total average precipitation of 32.2 billion m^3/year, about 18.7 billion m^3 drain into the rivers (of which approximately 80% flow to the Danube and almost 20% to the Adriatic Sea). The remaining precipitation infiltrates groundwater or evaporates.

Water abstraction data are included in table 5.1. Surface water abstractions include cooling water required in electricity generation.

Table 5.1: Water abstraction [million m^3/y]

	1980	1985	1990	1993	1994
Surface water	65943	66210	50461	-	65087
Groundwater	160	175	166	176	176
Other water	45	89	8	9	13
Total abstraction	66148	66475	50635	-	65253

Source: ECE/IEDS database.

Groundwater and springs

The water abstracted from groundwater aquifers and springs is used for public supply. Water balances for individual aquifers are not available. The used aquifers are mostly shallow and located in the gravel beds along the valleys, where urbanization, industry and agriculture are concentrated. A large quantity of water from rainfall and runoff infiltrates the Karstic aquifers.

Groundwater in gravel bed aquifers is located in the proximity of water users and easily tapped. The disadvantage of these sources is their exposure to the effects of urbanization, and to other environmental impacts which are difficult to control. These aquifers are located in geological formations of the Miocene to Quaternary era. They are mostly unconfined, with a relatively shallow water level. They replenish directly through the unsaturated zone and also by direct infiltration along rivers.

The south-western part of Slovenia (about 44% of the total territory) is geologically composed of carbonate rock, i.e. limestone and dolomite, the Karst region. Large underground flows occur in its fractured formations. High fluctuations of the water-table, particularly in dry periods, severely restrict direct pumping from these aquifers for water-supply. Thus, any use of water from these aquifers occurs from spring discharges, flowing along faults. Aquifers are explored by the Slovene Geological Survey, which keeps most of the information concerning their characteristics, water balances and potential uses.

The main aquifers used in Slovenia are:

Eastern part along Drava and Mura rivers: Mursko, Dravsko, Ptujsko, and Prekmursko fields, Vrbanski plateau;

Central part along Savinja and Sava river: Celjsko field, Lower Savinja Valley, Krško field, Bre iško field, Hudinja Valley, Sorško field, Kranjsko field, Vodiško field, Kamniška Bistrica Valley, Ljubljansko field;

Western part along the Vipava and Soča rivers: Vipava Valley and Soča Valley, Valley of Bolska Dolina.

Quality of groundwater

The monitoring of water quality is carried out by the Hydrometeorological Institute. The programme operates 84 sampling points in 18 different water-tables. The results show that:

- In the eastern part (Mursko and Dravsko fields), agricultural activities directly influence the quality of water. NO_3 concentrations are between 31 and 242 mg/l, and some pesticide concentrations are high, exceeding EU drinking-water standards. Potassium and zinc concentrations are increasing in the Dravsko field.

- In the centre of the country, except for the Ljubljansko field, water quality is affected by agriculture: in the Celjsko field, NO_3 exceeds 50 mg/l, and the water contains pesticides; by industry: the Sorško and Kranjsko fields are polluted with phenol compounds and chlorinated solvents; the Kammiška Valley is highly polluted with halogenated organic solvents; and the Krško-Bre iško field is affected by intensive agricultural practices.
- In the western part (Vipava Valley), the underground water quality is relatively good.

The connections between the unconfined aquifers and surface activities and runoff are immediate. Therefore, groundwater quality has degraded for years. Unsaturated zones serving as a buffer for all kinds of pollutants, water quality will continue to be exposed to pollution during the coming years. According to official statements, the pollution has not yet spread to all aquifers. Thus, although there are exceptions, the water of most aquifers is still appropriate for drinking, according to European standards. Pollution is concentrated in zones where important industrial and agricultural activities or landfills are located.

Spring water quality in the Karstic area is also sensitive to human activities. A limited knowledge of groundwater flows in this region makes it difficult to discover the specific sources of pollution, but it is clear that landfills and untreated sewage are major polluting sources. In the Alpine hinterland, springs are much cleaner and used as a major source for domestic water supply.

Surface water

Slovenia has seven transboundary rivers: the Mura (from Austria to Croatia); the Drava (from Austria); the Sava (to Croatia); the Kolpa (to Croatia); the Sotla (to Croatia); the Vipava (to Italy) and the Soča (to Italy). 16,500 km^2 of the territory are drained into the Black Sea (part of the Danube drainage basin), and 3,750 km^2 to the Adriatic Sea. The Slovene share in the Danube river basin covers about 81% of the country, and hosts about 80% of the total Slovene population. The main characteristics of the river basins are set out in table 5.2.

In the eastern part, the Mura river discharge is 157 m^3/s, and the Drava river 268 m^3/s. The average discharge of the Sava river, in the central part of the country, amounts to 290 m^3/s. In the south, the Kolpa and Sotla rivers flow at 74 m^3/s and 9 m^3/s respectively, and the western rivers Vipava and Soča have discharge rates of 18 m^3/s and 96 m^3/s, respectively. The Sava river basin drains 12.3 billion m^3/year in 58% of Slovene territory. Sixty per cent of the total population lives in this basin, in which 10% of the labour force is employed in agriculture and 37% in industry. The western river basin (Soča and Primorska) drains 4.2 billion m^3/year and the eastern river basin (Mura and Drava) drains 2.1 billion m^3/year, and 57% of their population is employed in agriculture.

Table 5.2: Main characteristics of river basins

Rivers	Precipitation [$10^6 m^3$, mm]	Flood plains [ha]	Drainage [$10^6 m^3$/y, mm,%]	Population [% of nat. total]	Agriculture [% of nat. total]	Industry [% of nat.total]
Mura	1197 , 861	18,700	340, 245, 28	7.0	23.7	6.0
Drava	3671 , 1125	16,000	1832, 561, 50	20.9	24.3	20.7
Sava	20773, 1757	31,700	12294, 1040, 59	59.8	45.0	62.0
Total Danube Basin	25641, 1556	66,400	14466, 878, 56	87.7	93.0	88.7
Soča	5469 , 2278	2,900	3812, 1588, 70	6.4	4.6	6.8
Primorske region	1070 , 779	2,200	394, 287, 37	5.8	2.4	4.5
Total Adriatic Sea	6539, 1732	5,100	4206, 1114, 64	12.3	7.0	11.3
Total Slovenia	**32180, 1589**	**71,500**	**18672, 922, 58**	**100.0**	**100.0**	**100.0**

Source: Compiled from various sources.

To provide protection against frequent and devastating floods, about 10% of low land water - i.e. 2,490 km of river stretch - has been regulated. 800 km of water streams are protected as natural heritage, and 23,310 km preserve their natural appearance.

Slovenia participates in international projects for the protection and use of the Danube River, and signed bilateral agreements on water management cooperation with Austria, Croatia, Hungary and Italy (see chapter 2).

Surface water quality

Surface waters are monitored by the Hydrometeorological Institute at more than 100 sampling points along the main rivers. Monitoring is carried out according to a programme that was recommended by international organizations, following national, ISO and United States Environmental Protection Agency (US/EPA) standards. The sampling is done in different seasons, two to six times a year at each measurement point. The parameters which are considered to be the most important pollution indicators are oxygen content, chemical oxygen demand (COD), biochemical oxygen demand (BOD), phenols, nitrogen compounds, detergents, formaldehyde, and mineral oil.

Surface water quality is classified into 4 classes. The first-quality class covers raw water that can be used as such for drinking-water supply. Water in the second class needs pre-treatment preparing it for drinking-water supply. The third-quality class includes water polluted with degradable compounds, e.g. domestic sewage, which does not necessarily preclude its use in agriculture or as industrial cooling water. The fourth class is reserved for polluted water that is not suitable for any direct use. A description of the state and changes of water quality along the Mura river from 1989 to 1994 shows that the water quality improved to quality classes 2 to 3. This improvement can be accounted for by the rehabilitation measures taken in Austria. The situation is similar in the Drava river. The decreasing industrial pollution during recent years is considered to be the principal cause. The quality of the Sava river has also improved greatly over the past three years, but it is still between classes 2 and 3. The river Soča, like water in its entire drainage basin, is classified in classes 1 or 2.

Nitrogen balance research was undertaken at both national and regional levels in 1991 and 1994. In 1991, 569,400 ha of arable land and grassland were investigated, while the 1994 programme was carried out at the farm level and covered 152 private farms, 16 State farms and 16 small farms in the Karstic region. The comparison of nitrogen inputs from mineral fertilizers, organic manure and nitrogen depositions with outputs through harvested material and losses to the atmosphere indicated serious leaching problems throughout the territory. The range of the net balance is between 19 and 114 kg/ha (table 5.3). The high surplus in the Pomursko (100 kg/ha) and Mariborsko (114 kg/ha) regions is due to intensive agriculture and livestock breeding (four pig farms with a total of about 65,000 pigs). The adverse effects of agriculture on water resources and particularly on groundwater quality are the most noticeable in the Drava and Mura basins.

Table 5.3: Regional nitrogen balances 1991 [kg N/ha]

Region	Input atmosphere	Input mineral	Input liquid	Input total	Nitrogen uptake	Net balance
Pomursko	17	64.7	122.4	187.1	86.5	100.6
Mariborsko	17	62.5	137.8	200.3	86.4	113.9
Korosko	17	44.9	100.7	145.7	69.7	76
Celjsko	17	56	103.1	159.1	83.4	75.7
Zasavsko	17	30.8	93.4	124.2	51.7	72.5
Posavako	17	43.8	74.2	118	81.2	36.8
Dolenjsko	17	35.9	51.9	87.6	55.2	32.6
Sirse	17	43.4	79.6	123	63.5	59.5
Zgornje	17	28.2	59.4	87.6	52.8	34.8
Notranjsko	17	20.9	54.2	75.1	42.8	32.2
Gorisko	17	36.5	53.2	89.6	59.6	30
Obalno-Krasko	17	30.6	38	68.6	49.6	19
Slovenia	**17**	**47.2**	**89.8**	**137**	**70.8**	**66.2**

Source: Water pollution by nitrate in Slovenia future standards and policy instruments. HRVAT.VODE,4 1996, 15. 111-117.

Table 5.4: Water use [million m^3]

	1980	1985	1990	1994
Surface water				
Public water supply	7	9	5	11
Electricity production	65943	66210	50461	65087
Manufacturing industry	104	65	77	47
Agriculture	0.2	3.9	2.9	3.2
Groundwater				
Public water supply	99	121	132	147
Electricity production	19	15	1	6
Manufacturing industry	42	39	32	23
Agriculture	0	0	1	0.2

Source: ECE/IEDS database.

The total average flow rate of the main Slovene rivers in the Danube river basin is in the range of 715 to 805 m^3/s. The corresponding export of nutrients from Slovenia reaches 41,197 tonnes of nitrogen per year and 2,927 tonnes of phosphorus per year. Industry as a whole contributes 60% of pollution of toxic substances (i.e. metals, pesticides, organic compounds), whereas municipal discharges account for 10% and agricultural sources for 30%.

5.2 Water use and waste water

Water uses

Surface water is the dominant source of cooling water in electricity generation, while groundwater is the major source for the public supply. Overall, domestic use of water from both underground and surface resources increased between 1980 to 1994 by approximately 21%. In 1994, domestic water use totalled 87 million m^3, and consumption per head stood at some 37.3 m^3/year, i.e. around 100 litres/day.

Manufacturing and agriculture also use more surface than groundwater. In manufacturing, there was a reduction of some 50% between 1980 and 1994, which was almost equally shared by surface and groundwater sources. In agriculture, water use increased slowly, particularly from surface waters. Table 5.4 includes relevant data for selected years in the period 1980 to 1994.

Water supply

An important factor affecting water supply is the scattered supply system. Seventy-seven per cent of the water is distributed from public networks, 14% from private wells, 5% from rainwater reservoirs, and 4% from other sources. Approximately 47% of the total amount of piped drinking-water is used by households, 39% by industry and the manufacturing sector, while 8% are supplied to livestock farms, 5% to the tourist industry, and 1% to all other purposes.

Statistical data on water supply indicate a gradual increase in water losses along the supply network over time (table 5.5). The extent and physical distribution of this phenomenon is not fully described. However, most of the losses can probably be ascribed to the technical conditions of the mains and distribution network.

Table 5.5: Water losses in distribution [million m^3]

	1980	1985	1990	1993	1994
Water losses	**71**	**77**	**80**	**112**	**115**

Source: ECE/IEDS database.

Waste water

The sources of water pollution are industry, agriculture and urbanization. Measurements of the quantity of waste water generated by the different polluting sources and its material composition are not fully controlled by municipalities. Polluters do not generally monitor effluents. In regions without public supply, the problem is much more acute, as uncontrolled pollution is a potential threat to the water resources. Pollution from urbanized areas along the rivers is especially severe, while pollution caused by industry has decreased over recent years - partly as a result of reduced economic activity in certain key sectors. For example, many of the polluting heavy metal industrial companies have disappeared since 1990 (see chapter 9).

Between 1990 and 1994, the total generation of waste water followed a mild, but clearly recognizable, downward movement - to speak of a trend is perhaps too strong. This observation tallies with the equally slight reduction in water use over the same period. If manufacturing industry was mainly responsible for

Table 5.6: Waste-water generation and treatment [million m^3]

	1990	1991	1992	1993	1994
Total generation	292.0	263.8	256.8	242.8	236.5
Total without treatment	184.5	165.4	147.8	115.2	109.5
Total with treatment	107.5	98.4	109.0	127.6	127.0
Public mechanical	18.1	10.3	39.9	52.7	40.2
Industrial mechanical	22.3	24.6	20.6	26.8	22.8
Public biological	6.3	8.2	7.4	4.2	5.0
Industrial biological	1.1	0.8	0.7	0.9	0.8
Public advanced	25.3	27.7	23.5	30.7	30.0
Industrial advanced	34.4	33.9	28.4	23.2	20.7

Source: ECE/IEDS database.

the decrease in water use, it can be expected that industrial waste-water treatment also went down over the period of observation. The figures included in table 5.6 confirm this expectation. They also show a clear downward trend in the discharge of untreated waste water. However, the overall treatment performance is rather low, as secondary (biological) and tertiary treatments are not extensively developed. There are no data available on the pollution load generated, nor on the pollution eliminated in the waste-water treatment facilities.

5.3 Objectives and implementation of water policy and management

Objectives

The Environmental Protection Act (EPA) of 1993 and the national water resources strategy are the two fundamental statements of objectives for water policy and management. The EPA - including its implementing regulations - concentrates on the control of water pollution from point sources. It sets out the principles of control by State organs, local authorities and polluters, of liabilities for pollution and damage, and of public access to relevant information.

The national water resources strategy is to be prepared by the MoEPP and will be part of the national water programme. It will aim at ensuring sufficient water supply for all users. Drinking-water supply is a priority. The programme is expected to be completed in 1997. Its main strategic directions will be:

- Formulation of a sustainable water policy;
- Implementation of integrated water management;
- Creation of regional institutions and enterprises to manage water quantity and quality;
- Development of a financial system for the support of the strategy;
- Development of the inspection and control system;
- Development of an information system on the water economy.

The drinking-water quality standards that have so far been applied are those of the former Yugoslavia. New national standards are being drawn up. They will take into account WHO standards and the EU standards (see chapter 13).

A general law on water is currently under preparation. It might be enacted in 1997. Regulations required by the EPA focus on emission limits for waste-water discharges and all aspects of monitoring. They were adopted in 1996. The intention is to regulate discharges along rivers in agreement with the EC water quality directive. Regulations on the amounts and calculations of charges and fees and on EIA are also required. So far, there is no master plan for sewage and waste-water treatment.

To improve water quality, EU standard emission limit values and best available technology are the guiding principles for the MoEPP. However, it is not clear to what extent these principles currently are, or can be, enforced. The efficiency of inspection should be assessed, once the recent organizational changes have stabilized, and the organizational arrangements and resources available for inspection become clear. Efficient economic incentives or market tools to stimulate compliance with regulations require the drafting of more regulations.

Institutional set-up

The MoEPP is responsible for the overall water management in Slovenia, and, consequently, for establishing regional plans on all water aspects. The MoEPP acts to solve wider water problems, not only at the national but also at the river-basin level. The Ministry has seven institutes (see chapter 1, fig. 1.1), including the Nature Protection Authority and the Hydrometeorological Institute. The Nature Protection Authority includes in particular the water management department, which is divided into six sectors on planning, consents and permits, concessions, public services, investments and the water fund. The monitoring of groundwater sources, springs and surface waters is done by the Hydrometeorological Institute. However, according to the EPA, polluters are obliged to monitor the quality and quantity of their effluents, but not many do so.

Regarding water management, the Slovene territory is divided into eight subdivisions. They do not constitute a separate ‘regional’ level of administration. The inspectorates of the MoEPP are responsible for the implementation of water protection laws and serve as coordinators between the municipalities and the Nature Protection Authority. In each subdivision, the municipal authorities are responsible for exploiting, supplying and developing the water resources. Possibilities for connecting water distribution networks between different localities within the same subdivision are limited, and between different subdivisions non-existent.

The Institute of Public Health tests the quality of water in the supply system. The methodological procedures are modern and carried out according to international standards. Monitoring is done twice a year. In most cases, the measured concentrations of the selected pollutants do not exceed the maximum permitted levels. During recent years, progress has been made in harmonizing methods for measurements, types of parameters, measurement points, preparation of the monitoring database, and enforcement of decisions after accidents.

Implementation

The MoEPP decides on investments in water-supply, sewerage, waste-water treatment and technology. Since 1991, investment expenditures have amounted to DM 15 to 25 million per year and are gradually increasing. In 1996, DM 10 million were invested in clean industrial technology, DM 2.8 million in water-supply, and DM 5.7 million in waste-water treatment. The main difficulties are in financing both investments and operating costs. Therefore, water prices will probably have to be raised in the future. A full assessment of funding needs, financing requirements and the scope of possible supply price changes for water has to wait until a master plan for waste-water sewerage and treatment has been drawn up.

The level of water-supply prices is based on the Order on Water Use Payments, issued in 1995. Payments are applied to water use (distinguishing between energy and other industries) and water pollution. The pollution charges levied by municipalities differ between the subdivisions, and between water use categories (industry, agriculture and households) within them. Taxes on sewage depend on the quality and quantity of discharges.

In 1995, a regulation introducing a waste-water tax was adopted. The tax is either applied to the volume of waste water discharged, or, in the absence of appropriate measurements, to the water-supply. In the first case, the polluter pays directly to the State budget. In the second, the tax is collected by the water-supply company. The tax is proportional to the pollution loads of the waste water. It is set to cover both investment and operating costs for a technology reducing pollution loads of effluents to permitted levels. The legal provisions have not yet been fully implemented.

The MoEPP has initiated an action plan in order to manage effluents from sources of pollution. The following projects have started:

- Construction of central waste-water treatment facilities in Ljubljana, Maribor and Rogaska Slatina for the treatment of point source emissions into the Sava and Drava rivers (project cost ECU 120 million);
- Environmental recovery of the Moste reservoir to solve the waste disposal problem of the Jesenice iron factory (project cost ECU 10 million);
- Reconstruction of the waste-water treatment plant of the Medvode paper industry (project cost ECU 2.2 million);
- Second phase of the central waste-water treatment plant for the city of Ljubljana (project cost ECU 45 million).

All these projects are located within the Danube basin and benefit from international financial support (amounting to DM 25.3 million in 1996) through the Danube Environmental Programme (see chapter 2). Slovenia is willing to cover 70% of investments with domestic funds.

5.4 Conclusions and recommendations

Conclusions

The authorities of Slovenia, in particular the MoEPP, are aware of the importance of encouraging and developing tools to deal with water management. The decision to draft and enact the “Water Law” was particularly appropriate. In the light of the arrangements made to date, the law will be a comprehensive legal framework for water management. Accordingly, it will lay the ground for the necessary managerial decisions concerning water abstraction, water-supply, preservation of water resources, water uses, and water-related taxes and other payments. The law will also prepare the ground for regulations to protect water against pollution with fuel, waste, sewage, etc. It is planned - and important - to develop all administrative tools foreseen by the forthcoming law with priority.

The most important tasks of water management in Slovenia are to ensure safe water-supply, suitable water quality in rivers and groundwaters, and water treatment facilities throughout the country. From 1980 to 1994, the domestic use of water increased by 23%. It is foreseeable that in the coming years the economy will develop. It is therefore important to develop supply systems so that safe water will be available when and where needed.

Groundwater being the main source for drinking-water supply to households, the gradual decrease in its quality is likely to become a serious concern, if countermeasures are postponed for too long. Priorities and action plans should begin to concentrate on preserving groundwater resources for drinking-water. Due to the increasing degradation of the currently exploited aquifers, it is important that deeper aquifers that are environmentally better protected should be sought, appropriately protected and managed. Planning future water resources needs a strategic programme and policy guidance, in order to direct and set up action plans. Amongst the potential protection measures, the increase in waste-water treatment performance should be a priority in order to reduce the pollution burden on freshwaters.

The overall vision for long-term water management issues is perceived as the Government’s responsibility. To establish a long-term programme it is important to identify goals, priorities and budgets. One way of preparing a coherent overall strategy could be to specify (a) a national water planning programme, (b) a national master plan for water resources and sewage treatment, (c) general plans for groundwater resources, and (d) general plans for runoff basins. None of these exist today, but it is expected that the outline of the national water planning programme will be prepared - as part of the national water resources strategy - and submitted to the Government in 1997. While the national master plan should be considered a top priority, the benchmarks of the other plans would need to be used in its preparation.

The national master plan for water resources and sewage treatment could include the supply situation from natural water resources and sewage water, forecasts of demand for water by user group, statements about resource management and development policies, specified for each groundwater and river basin, regional water balances, obligations stemming from the relevant international agreements, sewerage forecasting, networks and treatment policy, and should result in action plans (development of resources, of supply networks, sewerage networks, current and optional treatment installations, economic instruments).

Groundwater basin plans could be a tool for the preservation of existing, and the development of new resources in deeper layers. The plan could in its conclusive parts be composed of a modelling section (simulating and calibrating aquifer flows), a pumping plan (evaluation of scenarios regarding pumping development, based on the calibration of aquifer flows), and an investment programme.

Groundwater and surface water could be managed together in an integrated river basin management approach. The central part of the runoff basin management plan could concentrate on runoff in relation to groundwater resources, sewage sources and discharges, reservoirs and dams, flood assessment, pollution prevention and treatment, and development of recreation and nature protection.

In the absence of an approved national strategy regarding water management, solutions to eliminate waste-water pollution from municipal and industrial sources are implemented locally on a case-by-case basis. The Water Management Department in the MoEPP has not yet established an appropriate organization and administrative scheme to improve the planning in and coordination of the eight subdivisions, helping to coordinate actions at the local levels. Water management planning has to consider also trends in supply needs. Therefore, regular research, the collection and analysis of data with the help of an integrated database, systematic monitoring of all water resources, their quantities and quality, supply systems and user characteristics ought to be undertaken in a dynamic set-up.

The development of an adequate legal and political framework for water management has to be complemented by sufficient organizational measures. For example, despite the existence of the (regional) subdivisions, coordination between the national and the local level is difficult. It may be beneficial also to water management, if a formal regional level of administration could be established. The Planning Division of the MoEPP is not strong enough to coordinate procedures either with the other MoEPP institutes or with each of the eight subdivisions.

The Planning Division of the Water Management Department of the MoEPP should be strengthened, as it will have to take on the task of giving guidance in the priorities for plans and investments, and identify alternatives. It should be the driving force for translating the future strategic plan and the policy of the MoEPP into practical programmes. It should thus be staffed with experts in groundwater resources, runoff basin planning, water-supply and sewage treatment networks and information systems. This division should also be able to rely on advisers for strategic plans, economists and specialists for any kind of problems related to water.

In general, the MoEPP could benefit from the allocation of more budgetary funds for research. These funds could best be earmarked for the compilation of data, the presentation of critical views regarding current priority issues as well as plans for the future. It is also necessary to develop forecasting tools like modelling, as well as methods for water treatment. The establishment of a small unit inside the MoEPP for coordination with internal and external research institutes may also be fruitful.

The data needed for water management include a wide range of information aspects. At present, some of these data are collected by the Hydrometeorological Institute and the other sections of the MoEPP, and some by other ministries and municipalities. A reliable information system which includes all the needed data is necessary for the MoEPP to function successfully. A computing division, responsible for data collection, database development, data editing and analysis could serve all the MoEPP institutes and divisions. The database systems to be developed should be geo-referenced.

Monitoring is another area requiring development. So far, monitoring - including the provisions for effluent monitoring by polluters - was mostly used to show and record point sources of pollution. It should be extended to both individual and public supply systems, to help detect leakages and prevent quality incidents. The monitoring data should be used more systematically in analysis and for action plans.

Regarding the organization of monitoring activities, the linkages between the Hydrometeorological Institute, which is responsible for monitoring the natural water resources, and the Nature Protection Authority, responsible for the monitoring network through the Water Management Department, should be strengthened. The driving force for the analysis of monitoring data and the concomitant further development of the monitoring system should be the Nature Protection Authority.

Although water-supply systems have to be seen in a long-term perspective, it is necessary to take immediate action to solve acute problems that endanger the safety of drinking-water supply. More than 20% of the water-supply systems in Slovenia are not ‘organized’. Therefore, accidents of water-supply in the networks have to be prevented through particular schemes. It seems that supply systems are not functioning well for lack of maintenance. This results in water losses during distribution, and direct exposure to pollution. It is therefore necessary to evaluate the corresponding situation in each of the eight regional subdivisions, identifying major accidents that have occurred in both public and ‘unorganized’ water-supply systems. The analytical criteria that can be used in this analysis are the quality of the water, the sensitivity to environmental pollution and water losses in the networks.

Recommendations

Recommendation 5.1:

All legal instruments that are necessary for a full implementation of the provisions of the new ‘Water Law’ (expected to be enacted in 1997) should be developed with high priority. Establishing a national strategy on water management is a matter of priority. It should include measures to prevent and reduce pollution from point sources and diffuse sources.

Recommendation 5.2:

The MoEPP should decide to extend the national water resource strategy (expected to be approved in 1997) into a comprehensive long-term water management programme, including specification of mechanisms for funding expenditures. The enforcement of all relevant legal instruments should be seen as indispensable in the implementation of the water resource strategy.

Recommendation 5.3:

Water conservation measures should be defined with regard to both industrial and municipal water use. The setting of water prices at levels covering abstraction costs is a strategic objective in this connection.

Recommendation 5.4:

In the near future, the allocation of available funds to the upgrading of existing and the construction of new waste-water treatment facilities, which clearly improve treatment efficiency, should be given priority over alternative uses of funds.

Recommendation 5.5:

The regulation implementing effluent monitoring by polluters should be prepared and enforced with priority.

Recommendation 5.6:

Increased research funds should be allocated to the evaluation of water management practices as well as the formulation of alternative options. The Planning Division of the MoEPP should be put in a position enabling it to play the leading role in the specification of water management plans and related investment programmes. If the creation of a formal regional level of administration is impossible, the Water Management Department of the MoEPP should implement regional water management.

Recommendation 5.7:

Monitoring activities (regarding 'immissions') should be systematically extended to cover all existing water-supply systems, not only the public supply systems.

Recommendation 5.8:

Monitoring data (regarding 'immissions') should be more extensively and systematically used in programme analysis and for the preparation of action plans.