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Toward Improved Water Quality Management in Central and Eastern Europe

Susanne M. Scheierling

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Abstract

Water quality management has become a core environmental issue in the transition countries of Central and Eastern Europe (CEE). Based on illustrative examples, this article outlines the state of water quality in the pre-transition period and analyses the impacts of the transition process on water quality. It also assesses the current reform efforts in water quality management and identifies issues which need to be addressed in the short- and longer-term for sustaining or extending water quality improvements. The focus is on five CEE countries: Bulgaria, the Czech Republic, Hungary, Poland and Slovakia. Other countries in the region, which may have followed a different transition path, are likely to face similar challenges in water quality management in the near future.

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Toward Improved Water Quality Management in Central and Eastern Europe

Susanne M. Scheierling[1]

WATER QUALITY IN THE PRE-TRANSITION PERIOD

Water quality has become a major environmental concern in many parts of the world (1, 2), including the region of Central and Eastern Europe (CEE) (Figure 1). After an increasing deterioration in water quality under the old communist regime, the CEE countries now view the maintenance of acceptable levels of water quality as a key issue in environmental management (3). Since the late 1980s when the political and economic transition was initiated, evidence about the CEE region's water quality problems became increasingly available. It was found that the pollution levels in the centrally-planned economies had been many times higher than in the far richer western economies, and also higher than in economies of comparable income level in other parts of the world (4). For example, waste water pollution measured as cubic meters released into the environment per $1,000 (US) GDP was estimated as being more than three times higher in the CEE-6 (which, in addition to the five countries considered in this article, includes the former German Democratic Republic and Romania) than in the European Community (5). However, it was also pointed out that even though there were areas in CEE with extremely high environmental pollution levels, they were not necessarily representative of the general situation. Moreover, the problems in these areas were not unique but in many respects were similar to the situation which many heavily industrialized regions of Western Europe and North America experienced 30 to 40 years ago (6).

Water Quality Trends

During the 1970s and 1980s water quality in CEE's surface and ground waters continually worsened. The major pollutants were organic matter (usually measured in terms of biological oxygen demand, BOD), nutrients (mainly nitrogen and phosphorus), and toxic substances. High pollution levels impaired drinking water supplies, reduced productivity in the economies, and resulted in losses to aquatic life in many areas. In Poland water pollution became particularly severe. From 1967 to 1986 river water classified as drinkable (class 1) decreased from 33 percent to 4 percent of the country's total river length, and so-called non-classifiable water which is virtually unusable even for industrial purposes increased from 23 percent to 42 percent (7, 8). Ground water pollution was also common in Poland. In 1989, about 65 percent of the residential wells in villages and more than half of the wells on the outskirts of urban areas yielded poor quality (undrinkable) water (9).

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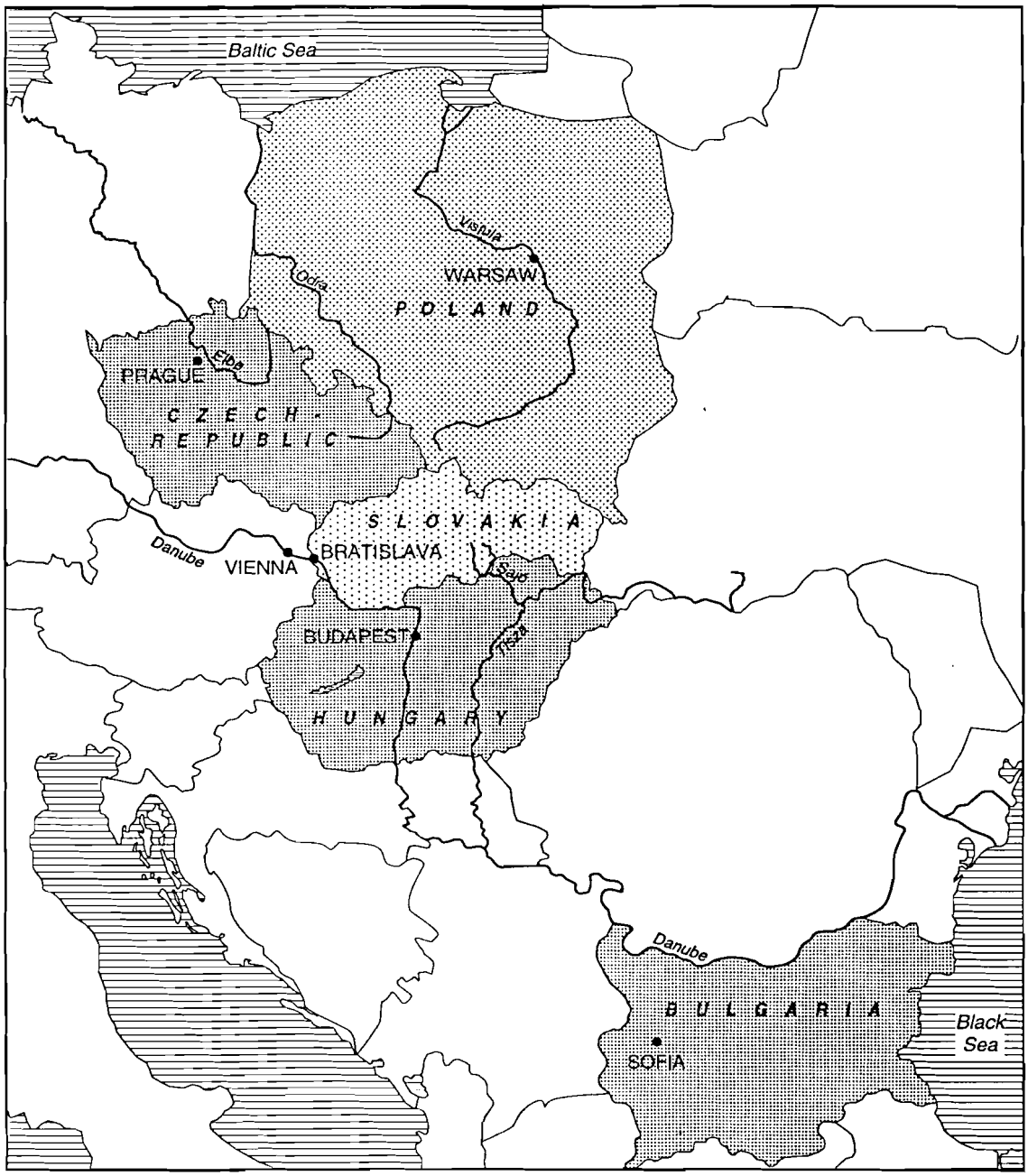

Figure 1. The CEE region, emphasizing the countries discussed.

Likewise, water quality in Hungary deteriorated. Since the 1960s there was a large decrease in the number of river stretches of the highest class while, especially in the Tisza River system, the number of sections of poor quality significantly increased (10). Of particular concern was the deteriorating quality of ground water which supplied more than

80 percent of the country's drinking water supplies. At the end of the 1980s, nitrate pollution became so severe that about 75 percent of the ground water required treatment before utilization (11). In Bulgaria water quality was also was very poor; at the end of the 1980s the middle and lower reaches of most large rivers were either biologically dead or in the process of becoming so (12). Similarly, in the former Czechoslovakia a third of the rivers were so polluted that they could not support fish life (13).

Since the waters from the five CEE countries drain either into the Baltic Sea or the Black Sea, a large proportion of their pollution load is carried into these water bodies. During the 1980s the degradation of the Baltic Sea and Black Sea became an increasing international concern. Eutrophication was widely considered to be the most significant problem. The effluent load of the Polish rivers was one of the major factors behind the worsening pollution of the Baltic Sea, a shallow water body which has only very limited exchange of water with the global ocean. At the end of the 1980s, the share of Poland in the overall discharge of coastal rivers was about 40 percent for phosphorus, 35 percent for nitrogen, and 20 percent for BOD (9). The problems in the Black Sea also originated primarily with increased nutrient inputs from inflowing rivers (14). The main source of eutrophication were urban effluents. It was estimated that total urban effluents amounted to about 13 billion tons per year, accounting for an annual discharge of about 400,000 tons of nitrogen into the Black Sea (15).

Main Emission Sources

Pollutants came primarily from domestic sources, both municipal and rural, and from industrial and agricultural sources. As in other parts of the world, expansion of municipal water supply systems surpassed growth in sewage collection and treatment capacity. A survey of towns with more than 25,000 inhabitants in the five CEE countries by the World Bank showed that at the end of the 1980s the level of water supply was generally quite good, with an average of 90 percent of the population receiving domestic water supply (16). About 70 percent of the population was served with sewerage, but the level of treatment was poor. On average, less than 50 percent of the waste water collected received secondary treatment. Treatment efficiency was often low and the problem of sludge disposal unresolved. The situation concerning sewerage technology was even less satisfactory in smaller towns and rural areas where around 30 percent of the population in CEE live. Overall, the level of water use and waste water generation in CEE was relatively high due to heavily subsidized water supply and sewerage services. For example, the amount of domestic water consumption in Prague amounted in 1988 to 533 liters $capita^{-1}$ day^{-1} whereas in Vienna it was only 270 liters (17).

Industries were another major emission source. Under central planning high priority was given to traditional heavy industry and the energy sector which exert the greatest pressures on the environment (18). The pollution effects were intensified by the underpricing, and therefore overuse, of inputs such as energy and water. With limited environmental investments, many plants used outdated, inherently polluting technologies and lacked adequate pretreatment facilities. Industrial waste water was often discharged into municipal sewerage systems. Due to the toxicity of some industrial wastes, this practice often created hazard to sewer and biological treatment systems (16). Even where plants had treatment facilities similar to those in western European countries, they were rarely operated at their design efficiency due to poor maintenance and operating practices.

Agricultural emissions also contributed to the water pollution problem. They included point sources such as discharges from concentrated animal operations and nonpoint sources such as runoff from nutrient and pesticide applications, with the latter dominating in CEE (3). Large-scale mechanization and intensification of agriculture was emphasized in the CEE region since the 1960s. As a result, fertilizer and pesticide use increased strongly but, on average, never reached the level of some of the western European countries. In 1988, for example, nitrogen fertilizer use ranged from 8 to 10 tons km^{-2} agricultural land in the CEE countries (Figure 2), whereas 13 tons km^{-2} tons were applied in western Germany and 23 ton km^{-2} in the Netherlands (21).

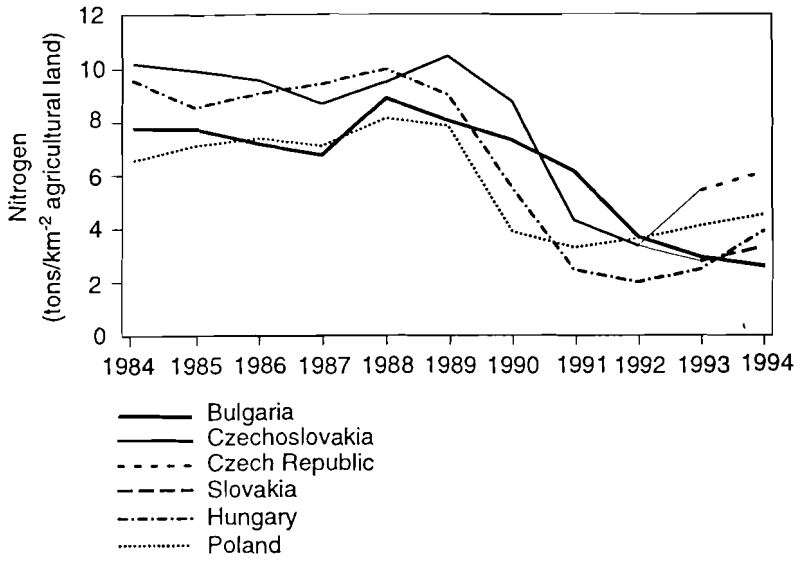

Figure 2. Rates of nitrogen fertilizers applied on agricultural land during the period 1984-1994. Based on FAO data on nitrogen fertilizer consumption (19) and land use (20).

Management of Water Quality

Under central planning the CEE countries had extensive legislation and policies for managing water quality in place. The basic legislation was usually an environmental protection act issued in the 1960s or 1970s, in the framework of which other regulations dealing in more detail with specific issues had been enacted (22). Legislation concerning water resources protection typically imposed a licensing system for waste water discharge and set effluent standards. It also provided for charges on emissions to surface water which included user charges for sewerage and sewage treatment and waste water effluent charges. Non-compliance fines could be imposed on users whose discharge exceeded the effluent standards set by the legislation. Additional regulations established, among others, ambient water quality standards for different uses and surface water classification schemes. Policies for controlling water pollution were thus a mixture of regulatory and incentive-based measures.

Although standards were sometimes even stricter than their equivalents in OECD countries, they often failed to control or prevent water pollution (23). A basic problem for effective pollution control was the particular role which the state played under central planning. It was responsible for both production and regulation without the necessary checks and balances between these functions. The achievement of output targets had priority over all other considerations within the planning process. Environment ministries often lacked the power, resources and know-how to execute their functions. Charges and non-compliance fines were set at such low levels that production ministries preferred to accept the penalties as a running cost, rather than to make the more expensive investment in pollution control equipment. Furthermore, enforcement and penalties for violations were in most circumstances inadequate to nonexistent.

The main source of financing for environmental protection was through the state budget. Within state budgets, environmental investment was generally given a low priority, and investment targets in state plans were often not achieved. In some countries a substantial backlog of environmental investment was accumulated. In Bulgaria, for example, only 55 to 65 percent of the planned investments were actually made (24). Other sources of financing were environmental funds which derived revenues from environmental charges and fines. However, many projects financed with these funds were poorly planned and implemented. Project identification was dominated by political priorities, and the soft budget constraint gave little incentives to seek cost-effective solutions (25).

The absence of democratic institutions insulated economic decision-making from public pressure and prevented public involvement in the development of environmental organizations. For many decades there was a marked lack of awareness in the general populations of the causes of, or remedies for, environmental problems (24). This situation changed in the 1970s when the increasing visibility of environmental degradation began to obstruct economic development and started to provoke public resistance. In the early 1980s the first non-governmental environmental organizations were formed to protest the ineffectiveness of environmental policies and the lack of access to environmental information. Water pollution issues often played a major role in the creation of these organizations. Examples include the EcoBaltic Foundation in Poland (26) and the Danube Circle in Hungary (27). Since public opinion tended to link the crisis of the environment with the political system, environmental organizations played an important role in bringing about the transition (28).

WATER QUALITY TRENDS IN THE TRANSITION PERIOD

Since 1989 a wide range of macroeconomic reforms and structural and institutional changes were adopted which aimed at providing the framework for the development and operation of a market system. They led to fundamental transformations in the economy, including in those sectors which were main water polluters in the pre-transition period, and at least in the short-term contributed to improvements in water quality.

Although the individual reform programs adopted by the new governments differed in detail (29), there are some core features which are common in all five CEE countries. One core feature is the withdrawal of governments from price setting. This resulted in large adjustments in relative prices and improvements in resource allocation. Reductions in subsidies caused charges for water supply and sewerage and sewage treatment to rise

significantly, and provided incentives for decreasing water consumption (30). Most special assistance for intensive livestock operations was discontinued (3) and subsidies for fertilizers were canceled (31). This helped to diminish nutrient runoff by encouraging the use of less intensive agricultural practices.

Another important feature is the restructuring and privatization of state-owned assets and enterprises. Since 1989 substantial progress has been made, particularly with privatizing small- and medium-scale enterprises. In 1995 private sector output as a share of GDP ranged from 35 percent in Bulgaria to almost 70 percent in the Czech Republic (18). The privatization process and the entry of new private firms led in significant sectors of the economy to the (re)establishment of private property rights as well as incumbent responsibilities to society which are preconditions for effective pollution control. Privatization, together with competitive markets and hard budget constraints, also provided for more rational use of resources and made firms more responsive to incentive-based measures such as pollution charges (4).

A further core feature is the creation of effective governments at more decentralized levels. In the Slovak and the Czech Republic decentralization resulted in only two remaining levels of government, the Republic and the municipalities, both with responsibilities in the environment sector (32). Municipalities were authorized to provide a variety of environmental services, including waste water management. They were also allowed to regulate small pollution sources and to allocate their shares of water use and emission charges and non-compliance fines. The establishment of more decentralized governments that are accountable to their citizens, rather than merely to a central government, was a dramatic change towards improving public participation in environmental as well as general decision-making (4).

Sectoral Changes

The reform programs, together with the breakdown of traditional trade relations in the aftermath of the disintegration of the Soviet Union, caused a sharp output fall in the initial years of the transition. Figure 3 shows the changes in gross domestic product (GDP), and gross agricultural and gross industrial production for the five CEE countries from 1989 to 1995. Poland was the first country to implement a comprehensive reform program in the beginning of 1990 (29), and experienced a decline in GDP by almost 12 percent in same year. This experience was repeated in the other countries as they began introducing their reform programs in 1991. Growth resumed in Poland in 1992 and in the other CEE countries in 1993 and 1994. Industrial output contracted even more than GDP. In Poland gross industrial production fell by 24 percent in 1990. In the other countries the strongest decline occurred in 1991, ranging from 17 to 25 percent. Gross agricultural production in all five countries had its sharpest fall in 1992, ranging from 12 percent in Bulgaria to 20 percent in Hungary. Many CEE countries switched from the traditional export surplus to an import gap situation. However, growth resumed in Poland in 1993 and in Bulgaria and Hungary in 1994.

Associated with this sharp fall in production levels was a reduction in input use. In the Czech Republic, for example, water use in all sectors declined since the beginning of the 1990s. From 1990 to 1992 alone, industrial water use decreased by about 17 percent (34). In Slovakia water consumption capita^{-1} day^{-1} decreased from 430 liter in 1990 to 340 liter in 1994 (35). The use of nitrogen fertilizers also fell dramatically in the years following 1989 (Figure 2). Percentagewise, nitrogen fertilizer use declined even more than gross

agricultural production. From 1989 to 1993, for example, the consumption of nitrogen fertilizer in Bulgaria diminished by almost 65 percent and in Hungary by more than 70 percent. In the recent two or three years, nitrogen use has grown again in all countries except Bulgaria.

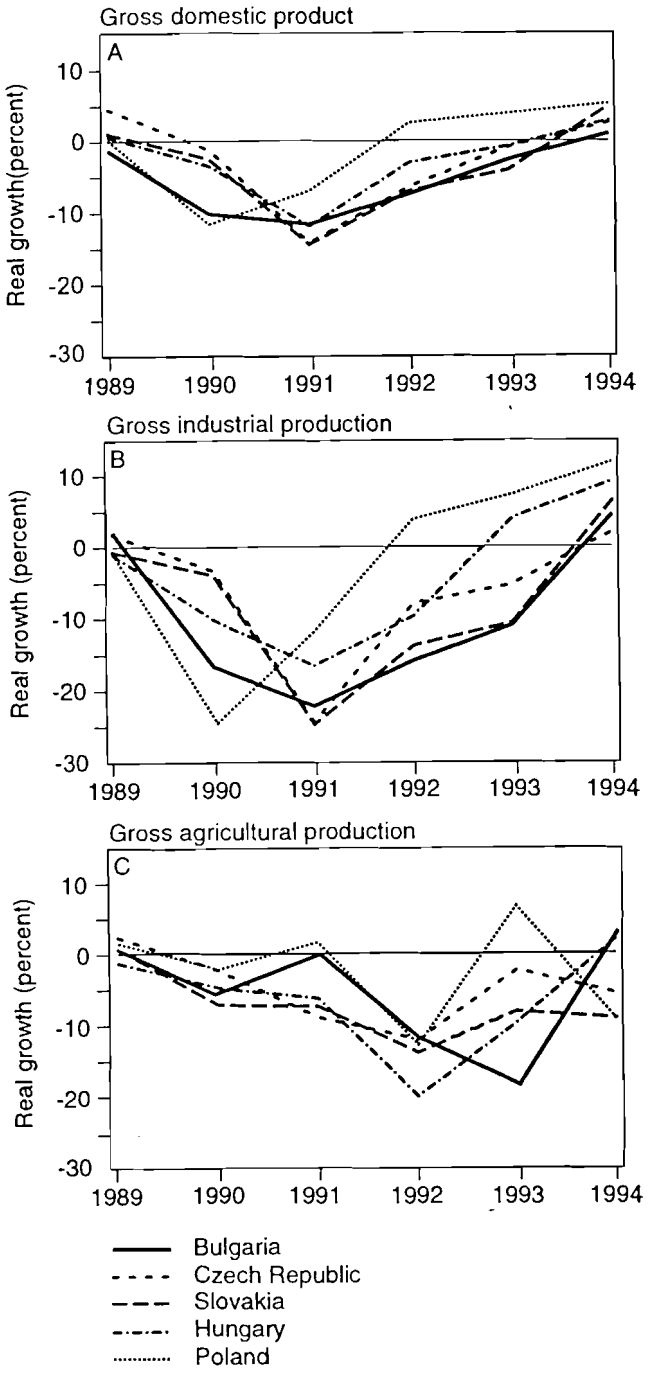

Figure 3. Real percentage growth in gross domestic product (A), gross industrial production (B), and gross agricultural production (C) in selected CEE countries for the period 1989-1994 (33).

The decline in output levels, together with changes in production processes such as reduced input usage per unit of output, resulted in a substantial reduction of emissions into water bodies. Figure 4 presents as an example the changes in emissions from the two main sources in Poland, industry and municipalities. In the initial transition years from 1990 to 1992, total waste water discharges dropped by 15 percent from 4.1 to 3.5 billion cubic meters. About two thirds of this change was caused by reductions in industrial discharges and one third by reductions in municipal discharges. The pollution load was further reduced by improvements in waste water treatment. During the same period the amount of waste water treated with biological methods increased from 27 to 33 percent, and the amount of waste water discharged without treatment declined from 33 to 29 percent.

Impacts on Water Quality

With water quality being a function of the level of emissions, there were signs of water quality improvements in many areas of CEE (35, 37, 38). Data show improvements particularly with regard to conventional pollutants such as BOD and nutrients; little data, however, are available for changes in other pollutants including heavy metals, organic micropollutants, viruses and bacteria. The positive effects on water quality were mainly caused by the clear decline in industrial and agricultural emission loads. Except for changes in flow as a result of higher water prices, emissions from domestic sources were much less affected by the transition process. Some water quality improvements occurred where the amount of industrial discharges treated in municipal treatment plants decreased or where plants were upgraded or newly built. Examples for water quality changes in three river basins are presented below.

Figure 5 shows trends in water quality indicators for the Sajó River which enters Hungary from the north and later joins with the Tisza River. The primary pollution source of the Sajó River in Hungary was industry which in the pre-transition period was oriented towards supplying the former Soviet Union (39). Since the mid-1980s industrial production and emissions declined substantially. This contributed to falling BOD and ammonia nitrogen levels in the river. The drop in the difference between the values measured at the two stations indicates the decreasing impact of the Hungarian part of the basin on the river's water pollution.

Changes in average annual nitrate concentrations in the Tisza, the second largest river in Hungary, are presented in Figure 6. Agriculture is by far the country's major source of nitrogen loading, with inorganic fertilizers accounting for 57 percent and organic manure for 18 percent of total nitrogen emissions in 1989 (40). Since the end of the 1980s Hungary's contribution to the nitrate concentration in the Tisza (indicated by the difference between the in- and outflow values) decreased consistently, and outflow values show large improvements. The main reason is the dramatic fall in nitrogen fertilizer use.

Figure 7 shows monthly data for flow and ammonia nitrogen concentrations in the Odra River near Wroclaw in Poland from 1989 to 1995. The trend in measured ammonia nitrogen concentrations is clearly declining. Given the measured flow, the mass loading of ammonia nitrogen also diminished over the shown period. The ammonia nitrogen concentrations in the river stretches above and below Wroclaw show similar decreases (41). This is thought to be a consequence of a number of factors, including the reduced pollution load from municipalities.

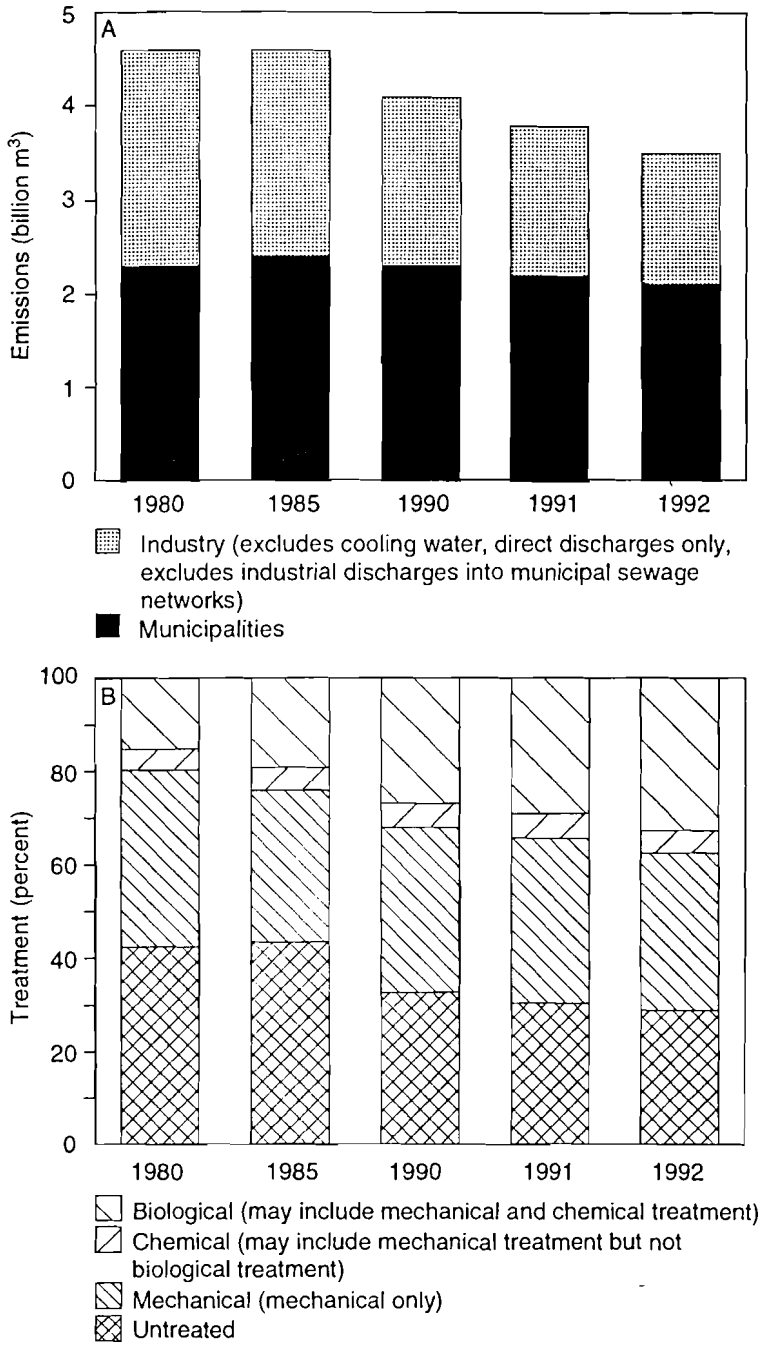

Figure 4. Emissions from industrial and municipal sources into surface water (A) and treatment improvement (B) in Poland between 1980 and 1992 (36).

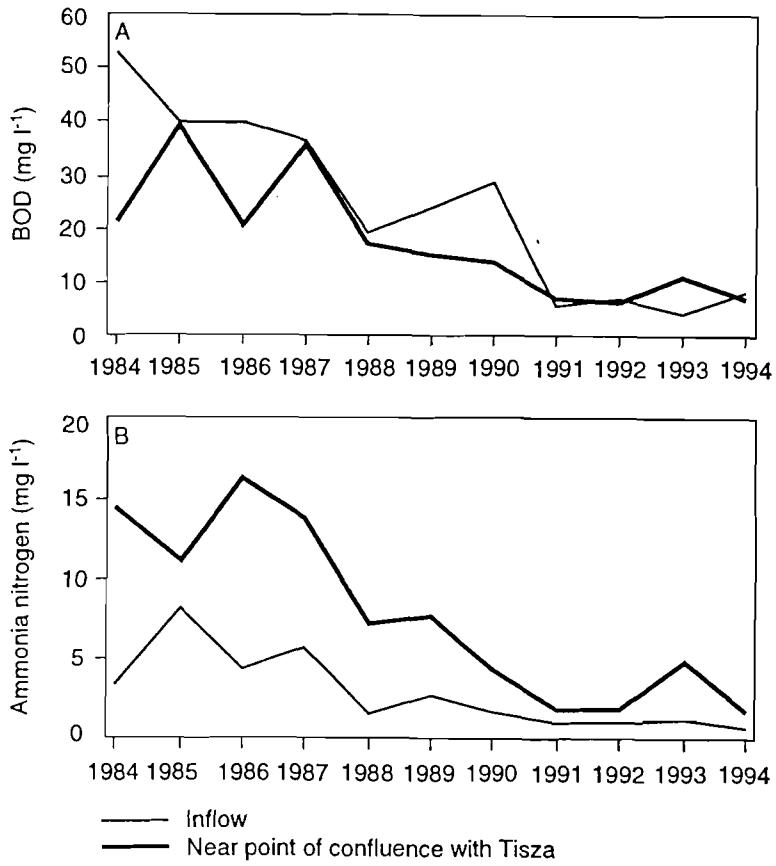

Figure 5. Average annual concentration of BOD (A) and ammonia nitrogen (B) in the Sajó River, Hungary, during the period 1984-1994. Based on data from the Hungarian National Water Quality Monitoring Program.

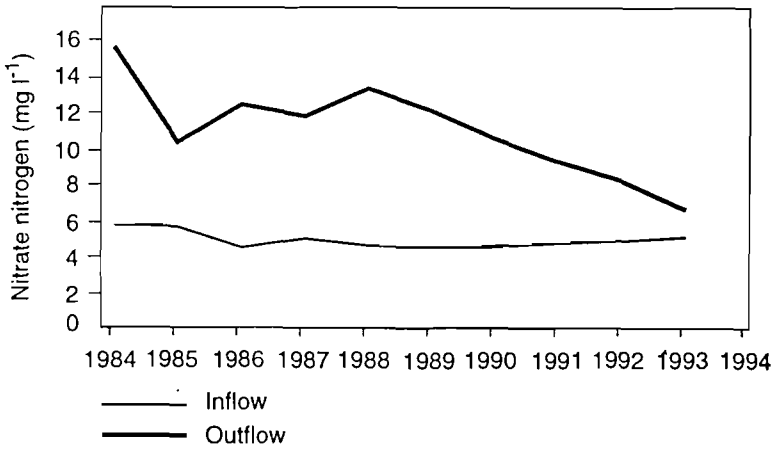

Figure 6. Average annual concentration of nitrate in the Tisza River, Hungary, during the period 1984-1993. Based on data from the Hungarian National Water Quality Monitoring Program.

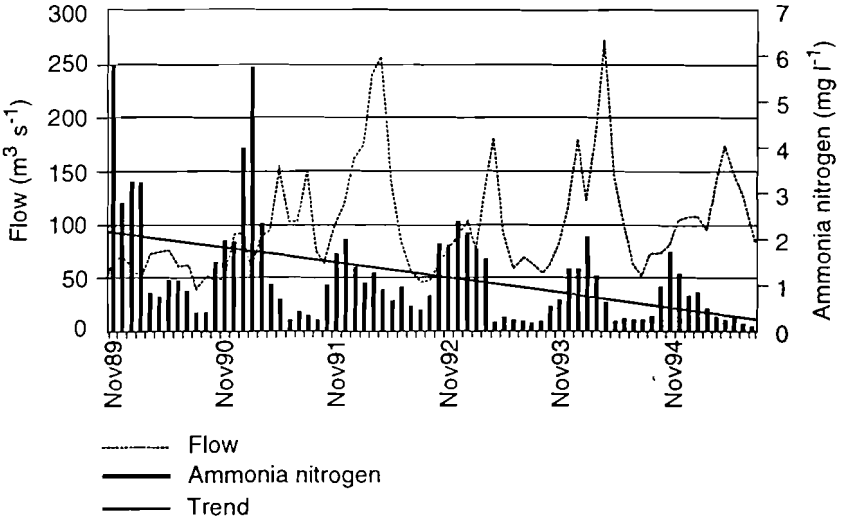

Figure 7. Monthly water flow and ammonia nitrogen concentrations in the Odra River, Poland, during the period November 1989 - August 1995 (41).

Even though the initial transition years resulted in improvements in water quality, it is unlikely that this positive trend will "by itself" continue into the medium- or longer-term. With economic growth recovering, the trend in emissions will depend to a large extent on the pace of reform. Of particular importance will be the changes in level, composition and resource requirements of the major sectors affecting water quality. Although a forecast in quantitative terms is difficult, some broad issues regarding the nature of these changes can be identified.

In the industrial sector private and public demand is moving away from heavy industry, energy and investment goods to consumption goods and services (3). As a consequence of the decline in industrial output and the process of restructuring, much of the old capital equipment is being scrapped and replaced by modern, more efficient and less polluting technologies. This will enable firms to produce more final output for the same volume of inputs, thereby reducing the generation of residuals (42). As a result of these structural changes, industrial emissions might stabilize or even decrease.

In the agricultural sector private property rights for land are being established and farm sizes and structures are being reformed to allow greater flexibility in responding to market conditions (43). In the last two years agricultural production began to recover in most CEE countries. The speed of further recovery will depend on a number of factors, including the completion of privatization, the availability of inputs and loans, the development of domestic purchasing power and access to foreign commodity markets. In the medium- and especially in the long-term, the potential for expanding agricultural production in the CEE countries is large (44), and emissions from agricultural activities can be expected to rise again.

The continuing elimination of subsidies in the municipal waste water sector is likely to lead to a further fall in domestic water use and sewage generation, and gradually levels similar to western European countries may be approached (34). At the same time there is

the risk that, concomitant with the recovery of the industrial sector, increasing amounts of industrial discharges will flow directly into municipal sewers and sewage treatment plants not equipped to handle such wastes (3). With firms being split up or privatized, at least initially managers may perceive the cost of industrial pre-treatment to be high. Overall, therefore, total municipal emissions will stabilize or gradually increase.

In the light of these likely developments in the main water polluting sectors, it can be expected that overall emission levels will start to increase again in the medium- to longer-term. To sustain or further improve water quality in CEE, it is therefore vital that the economic reforms are accompanied by an effective strategy for controlling water pollution.

Implications for Managing Water Quality

The transition and the associated sectoral changes offer a unique chance to introduce an improved approach for water quality management. Governments at central and local level are being reorganized and new legislation is being adopted. In the industrial sector economic adjustments have resulted in the restructuring of the remaining industries, and new small and medium size firms are appearing. There is also an impressive growth in the number of private farmers. In the municipal water and waste water sector, many utilities are now being transferred to local authorities. These new firms and owners can adapt to a newly introduced strategy for managing water quality in the process of the ongoing restructuring.

However, the political and economic transition process has also led to an acute scarcity of resources (45). The output fall in the years following 1989 was so dramatic that in 1995 the CEE countries still had not yet fully regained their GDP level of 1989 (18). Many farms are now in a poor financial situation. Industries, most of them fighting for survival in the new market environment, find it difficult to allocate significant resources for pollution control. Municipalities face an uphill battle in raising enough resources to cover expenses for the various services they are supposed to provide. With traditional sources of revenue collapsing, governments often find themselves in a fiscal crisis. Governmental spending on pollution control is under great pressure due to the competition from high priority investment needs in other sectors. Furthermore, the mobilization of credit resources from bilateral and multilateral financial agencies is constrained by macroeconomic concerns and the high cost of repayment.

Since in the foreseeable future the available resources will continue to fall far short of needs, they need to be invested as effectively as possible. This implies that a strategy for improved water quality management should focus on low cost/high gain measures. In addition, emphasis needs to be given to water quality issues that will be of growing importance in the medium- to long-term. Otherwise, scarce resources may be wasted on unnecessary measures. Furthermore, the strategy should involve putting in place a framework of appropriate policies and institutions which will ensure that resources are invested such that they yield the largest possible return. Overall, therefore, a mix of complementary measures in the area of policy reform and institution building as well as investments is required.

Policies and Institutions

A first step would be to determine water quality standards related to desired uses of particular water bodies or parts thereof. Preferably they should be determined based on

economic criteria, but in practice this is difficult due to the intangible nature of most water quality benefits (46). Once water quality objectives are established, policy measures need to be chosen which are likely to achieve these objectives. These measures can range from advisory measures (such as education and training) to regulatory measures (such as effluent standards, ambient quality standards, process standards, or product standards) and incentive-based measures (such as emission charges or transferable discharge permits). Regulatory measures are frequently used and often combined with fines for non-compliance. The reason is that they achieve pre-determined emission limits with relative certainty, provided there is effective enforcement, and usually are regarded as easier to implement (47). One of the advantages of incentive-based measures, such as emission charges, is that in many cases they will achieve some level of discharge reductions with less cost than regulatory measures (48). The CEE countries with their severe financial constraints should therefore consider incentive-based measures whenever possible. In most circumstances, however, cost-effectiveness will not be the only criterion when pollution control measures are decided upon. Other criteria which influence decision-making may include risk reduction, administrative simplicity, equity, and acceptability (49). No single measure scores well on all criteria, and tradeoffs have to be made. An effective policy for water quality management may therefore include a mix of measures depending on, among others, the particular nature of pollution sources, pollutants, and abatement options.

Industrial emissions, for example, tend to contain high levels of heavy metals and toxic chemicals which are relatively costly to monitor and may pose severe environmental risks. The range of control costs is usually relatively small (3). In this case a regulatory approach, such as standards requiring firms to install certain kinds of process or end-of-pipe treatment, may be most appropriate. Agricultural nonpoint source pollution is difficult to monitor because it occurs over a wide area and is highly variable. Control measures are limited and often need to rely on approaches that affect farmers' land use and production decisions. Agricultural policy, which directly influences these decisions, and the policy for controlling agricultural pollution therefore need to be coordinated and pursued with the same goals in mind (50). Municipal waste water treatment plants, on the other hand, are relatively large point sources which can be monitored at reasonable cost. Many conventional pollutants discharged by them may be controlled with incentive-based measures, such as emission charges determined on the basis of water quality objectives.

Independent of the particular mix of policy measures, it is necessary to have laws in place which set the institutional, regulatory and executive framework for water quality management. Institutional capacities need to be available for, among others, identifying objectives, developing policy measures, operating monitoring systems, ensuring compliance, managing finances, and providing access to environmental information. Since there is much evidence that scarce investment resources are most effectively used if project planning is not limited to individual sources or pollutants, but is carried out at the river basin level (51, 52, 53), institutions also need to be able to coordinate policy measures and integrate different local and sectoral interests.

Investments

Investments in less polluting capital equipment are another component of an effective strategy for managing water quality. Investment requirements differ between the main polluting sectors. In industry the ongoing capital replacement, especially in large plants, is expected to induce pollution reductions. Specifically targeted investments may be needed

in the case of medium and smaller plants. Particularly where waste water with high levels of heavy metals or hazardous organic wastes is discharged to watercourses or to municipal sewers, investments in pretreatment facilities should be carried out (3).

With the large potential for expanding agricultural production in CEE, rising problems with agricultural water pollution are to be expected. Experience of western European countries shows that once water supplies are polluted, the supply of drinking water with acceptable quality can become difficult because the removal of nutrients and pesticide residuals is very costly (54). To avoid high abatement costs in the future, investments should be considered now to explore and disseminate sustainable agricultural practices.

Enormous investments would be required to significantly reduce municipal emissions which have not been greatly affected by the transition. However, measures such as rehabilitating and upgrading existing sewage treatment systems, repairing leaks in water distribution systems, and reducing storm water inflows, ground water infiltration as well as industrial discharges into sewer systems could help decrease investment needs (45). Funds earmarked for municipal sewage treatment plants should not necessarily be used to install best-available technologies. Appropriate phasing of standards, upgrading and construction can lead to a more effective use of resources. For taking into account an entire river basin, investment planning requires comprehensive studies which deal with technical as well as financial, economic, and institutional issues (3). Water quality management models can be an important aid in the planning exercise (55).

CURRENT REFORMS IN WATER QUALITY MANAGEMENT

The CEE countries have used the opportunity which the transition and the associated structural adjustments offer to introduce a variety of reforms in water quality management. Several factors facilitated the adoption of reform measures. One factor was public opinion which in the aftermath of the changes in 1989 considered action on environmental protection and pollution control as imperative. For example, polls conducted in the former Czechoslovakia in the beginning of 1990 identified environmental issues as the most important concern of more than 80 percent of the population (56). Governments were responsive to this concern and proclaimed ambitious environmental programs. In Poland, for example, a far-reaching program on national environmental policy was prepared in 1990 and endorsed in 1991. It outlined near-, medium- and long-term goals for improving environmental quality, including targets for water quality improvements, with projected costs of $260 billion (57).

An additional impetus for improving water quality management was the fact that in the years following 1989 many regional activities aimed at fostering cooperation in transboundary water pollution control were initiated. Main areas of concern were the Baltic Sea, the Black Sea, and the Danube River. Considerable progress has been made regarding the Baltic Sea. In 1992 a 20-year action program was approved with an estimated cost of $22 billion. Of that total, about $4.8 billion will be necessary to cover the recommended priority projects in Poland (58).

A further driving force for reforms in water quality management were the "Europe agreements" signed by several CEE countries and the European Union (EU) in 1991. As a preparatory step toward future EU membership the agreements require a gradual

adaptation of the CEE countries' legislation and policies to conform to that of the EU's internal market (59). It is now envisaged that the associated countries will become EU members around the year 2000 (60). This prospect broadly influences environmental policy-making in the CEE countries and will necessitate far-reaching changes in the future (61). In the area of water pollution control large investments will be required if EU water quality standards are to be met in the short- or medium-term (53).

Against this background, the CEE countries have undertaken various steps to improve water quality management at the national and local level. In Bulgaria, the Czech Republic, Hungary, Poland and Slovakia major reforms have occurred since 1991 and are still ongoing. Even though the particular measures differ from country to country, there are broad similarities with regard to the direction of the reforms and their achievements so far.

Policy and Institutional Reforms

All CEE countries have adopted new pieces of legislation on water quality management. It was soon recognized that under changed political and economic circumstances the basic legislative framework which provides overall guidance to the management of water resources needed to be updated, but considerable delays occurred. Bulgaria adopted a new environmental protection act in 1991 which envisaged the entire renovation of regulations concerning water resources. Draft legislation on water resources and supporting regulations has been prepared (62), but adoption is still pending (38). The Hungarian parliament passed an act on the protection of the environment in 1995, but the more detailed regulations for implementing this act in the area of water quality protection are still missing (63). In Slovakia the planned new water act is under revision (35). In Poland a proposal for a new water law with a number of supporting regulations was submitted to Parliament in 1994 but is still under discussion (64).

Most CEE countries set up new ministries of environment with broad responsibilities for environmental management (22). The ministries are usually supported by environmental inspectorates with central and regional or district offices. Their responsibilities include monitoring pollution levels, sampling and analyzing emissions, and ensuring compliance by imposing fines. However, various problems with monitoring and enforcement are still encountered. For example, the necessary equipment for improving the monitoring of synthetic organic and metal contaminants is lacking in many cases so that information about trends in water quality is inadequate. Non-compliance fines are often imposed leniently, in part as a response to the severe financial constraints in firms and households. The ministries themselves tend to be overburdened and have difficulty in meeting their rapidly expanding responsibilities (39).

As a consequence of the "Europe agreements" the CEE countries tend toward introducing water quality regulations which approximate current EU law. For example, the Slovak regulation on effluent standards issued in 1993 was prepared with the aim to correspond with EU legislation (35). Bulgaria's draft legislation on water resources intends to introduce a new classification system for water quality and to set new standards for different types of water use which will largely follow those currently in force in the EU (22). In Poland a gradual harmonization of the effluent standards with the requirements formulated in EU legislation is foreseen (64). It is not certain, however, how the necessary adjustments for complying with these new and, in some respects, relatively strict regulations can be implemented in the near future.

As in the pre-transition period, the basic policy approach continues to be a combination of regulatory and incentive-based measures (30). It comprises a licensing system, charges on emissions to surface water, and fines for effluents exceeding standards. Revenue is accumulated in special national and municipal environmental funds which provide financial support to water and other environmental protection activities. The trend over the past few years has been towards significantly raising the charges and fines. However, many charges and fines still have not yet reached a level to act as significant incentives for pollution reduction. Their main role is to help raise revenue. In many cases user charges for sewerage and sewage treatment do not even cover variable treatment cost nor do they allow for capital replacement or upgrading, and municipalities continue to provide subsidies. Furthermore, charges and fines are often weakly enforced. In several CEE countries the fines are based on self-monitoring, and only a fraction of that due is actually collected.

The river basin approach, which considers river basins or sub-basins as the natural unit for all water management efforts, receives growing attention. The Elbe and Danube-Morava programs in the Czech Republic, which cover a large share of the country's territory, used it for planning purposes when identifying individual water quality management measures (65). Other countries plan to go a step further and adopt the river basin approach for management purposes. Bulgaria's draft legislation on water resources aims at establishing administrative agencies for river basin management, with river basin councils composed of representatives from various water user groups acting as main consulting body. In 1994 the first river basin council was set up on a pilot basis (66). In Poland the proposed water law aims at abolishing the water management system based on counties and replacing it with a system based on river basins or parts thereof. In some areas temporary water basin management councils acting as water parliaments have been established, but they do not yet have any legal authority (64).

It is increasingly recognized that public involvement is necessary to improve pollution control. Bulgaria's new draft legislation on water resources considers it to be important to encourage the participation of individual citizens in the protection of water resources and the environment in general. In Hungary the trend also is to decrease state control and to involve the public to a greater extent in decision-making and financing (22). However, up to now neither the public nor organized citizens groups effectively influence the political decision-making process regarding water quality management (25). In an effort to improve public participation, the Regional Environmental Center was set up in 1990 as an independent, non-profit foundation to provide increasing assistance to non-governmental organizations as well as to local and national governments in CEE (67).

New Investment Programs

Progress has also been made towards increasing investments in water pollution control. In Poland, for example, investment in water protection grew from 1989 to 1994 by more than 60 percent and accounted for about half of the total investment on environmental projects; environmental investment as a share of GDP increased from 0.6 percent to 1.4 percent in the same period (64). This development is remarkable considering the difficult financial situation facing the CEE countries after 1989. State budgets, which have been the traditional sources of environmental financing, often were reduced and increasingly used for other needs. Changes in the fiscal system resulted in uncertain revenue raising capabilities at various government levels. Undeveloped banking systems and capital markets posed additional constraints (25).

In this situation environmental funds, financed mainly through earmarked pollution charges and fines, became an important source for covering environmental expenditures. In 1993 the share of environmental funds in the financing of environmental expenditures ranged from 5 percent in Bulgaria to 46 percent in Poland. Water pollution control was a main spending area, ranging from 11 percent in Hungary to 54 percent in the Slovak Republic (30). It has been pointed out that the use of environmental funds can be associated with a number of disadvantages, especially in the longer-run (25). They may handicap the provision of adequate financial support to the ministries of environment, create vested interests that put political pressure on continued revenue flows and, without procedures based on clear environmental and economic criteria, result in wasteful management. It is expected that as the transition process ends, the need for environmental funds will diminish.

To help cover the enormous investment needs in the CEE countries, international assistance has been made available from a number of sources. However, assistance programs were mainly targeted at supporting economic restructuring and establishing new democratic institutions, and to a much more limited extent at protecting the environment (61). A major international effort has been the "Environment for Europe" process initiated in 1991 to harmonize environmental quality and policies on the European continent (68). An environmental action program for CEE, endorsed in 1993, identified water pollution as one of the most serious problems to be addressed (3). An evaluation of the environmental achievements in 1995 revealed that western credit and grant assistance for environmental projects has been below expectations, accounting for only 5 to 15 percent of the amount spent in CEE countries on environmental reforms and remediation (69).

Investments in all CEE countries were focused on reducing municipal emissions. In Poland, for example, more than half of all expenditures on water protection in recent years was used for constructing municipal waste water treatment plants. Between 1991 and 1994 over 1,300 treatment plants started operation (64). Despite these efforts, national plans for reducing municipal effluents decided upon in the early transition years are now behind schedule due to a lack of funds. Examples include: Bulgaria's program for the development of the sewerage network and municipal waste water treatment of 1989, which aimed at setting up basic facilities to reduce discharges of untreated waste water by specified amounts over five year-stages until 2010 (22); and Poland's program on national environmental policy of 1991 which envisaged a 50 percent reduction in the discharge of untreated sewage and a significant improvement in treatment efficiency until the year 2000 (70).

Municipal financing of investments in improved waste water treatment is still relatively limited. This is because many municipalities are not yet adapted to decentralized responsibilities including planning, implementing, financing, and operating infrastructure facilities (39). Furthermore, legislation is often missing which would allow setting of tariffs, retention of local taxes, incurring of debt, or the privatization of services.

CONCLUDING REMARKS

The political and economic changes of the transition period profoundly influenced water quality trends and the approach to water quality management in the CEE countries. Much has been achieved since 1989, but further reform efforts will be necessary to reach levels of water pollution control similar to those in EU member countries. However, the

experience of western European countries shows that even with rapid economic growth it may take a considerable amount of time and investments to achieve improvements in water quality. In western Europe concerns about deteriorating water quality at the end of the 1960s and beginning of the 1970s led many governments to pay more attention to water pollution control. As a consequence, connection rates to sewage treatment plants continually grew during the 1970s and 1980s . However, it took West Germany about two decades to provide treatment services for an additional third of its population (71). During the 1980s these efforts to reduce municipal emissions, together with progress in abating industrial pollution, led to a marked decline in BOD and phosphorus concentrations in many western European rivers. Yet there was widespread evidence for high and further increasing nitrate levels which to a large extent resulted from agricultural nonpoint source pollution (72, 73).

The CEE countries are aware that the attempt to adopt and implement EU legislation with its emphasis on the use of regulatory measures, such as stringent effluent standards that are uniformly applied and often based on the use of "best available techniques" (74), would not be a feasible in the short- or medium-term. With their severe financial constraints and only about a third of the per capita purchasing power of the EU average (75), they instead opt for more flexible approaches (35, 37, 63, 64). For example, several CEE countries including Slovakia and Poland decided upon a stepwise introduction of more stringent effluent standards. They are also aware that it may not be feasible to base water pollution control policy solely on effluent standards, but that ambient water quality standards need to play a greater role in water quality management. In Poland and Hungary there is currently a debate on how to adjust effluent standards for nontoxic pollutants to different local conditions so that scarce financial resources could be used more effectively. In addition, there are proposals for extending the use of incentive-based measures to include, for example, tradable emission permits, and for improving the design of currently applied measures. This includes the adjustment of emission charges so that they serve not only as a means to raise revenue but also as stimulus for pollution reduction.

It is interesting to note that a recent initiative to fundamentally review EU water policy points in a similar direction. Alarmed by the growing recognition that compliance with existing EU regulations, in particular those on drinking water quality standards and standards for urban waste water treatment (76), will result in enormous financial costs in the near future, the western European countries currently discuss various reform proposals. In a recent document the EU Commission outlined its views on the state of EU water policy and proposed steps for reforming the EU approach to water quantity and quality management (77). It emphasizes that EU water quality objectives need to be achieved in a cost-effective and efficient manner. In particular, EU water policy should take into account the variability of environmental conditions and be sufficiently flexible to avoid the imposition of inappropriate or unnecessarily strict requirements simply for the sake of harmonization. This would imply that water quality objectives and measures are not applied uniformly in all circumstances and places, but that they may vary spatially. In this regard, ambient water quality objectives and effluent standards should be seen not as contradictory but as complementary approaches. River basin management would allow the most efficient use of resources and the most effective planning of water management measures. Transparency and public participation would help ensure that a more flexible approach to water quality management would not lead to a lowering of standards.

Overall, it appears that both eastern and western Europeans see a need to further improve their approach to water quality management. Based on the recent developments, one should not expect to see in the near future the adoption of the same water quality objectives in the CEE as in EU countries, but there are indications that the respective approaches for achieving them will gradually move toward applying the same principles.

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