POINT SOURCE POLLUTION IN THE DANUBE BASIN

SUMMARY

WASH

WATER AND SANITATION
FOR HEALTH PROJECT

USAID
EUROPE BUREAU

JULY 1992

WASH Field Report No. 374

POINT SOURCE POLLUTION IN THE DANUBE BASIN

SUMMARY

Prepared for the Europe Bureau,
U.S. Agency for International Development
under WASH Task No. 271

by
Robert Thomas
Max Clark
Tim Bondelid
Dan Edwards
William Lord
and
Tarik Pekin

July 1992

Water and Sanitation for Health Project
Contract No. DPE-5973-Z-00-8081-00, Project No. 936-5973
is sponsored by the Office of Health, Bureau for Research and Development
U.S. Agency for International Development
Washington, DC 20523

SUMMARY

Project Outline

In the summer of 1991, the U.S. Agency for International Development (A.I.D.) Bureau for Europe funded a wastewater emissions study in the part of the Danube basin in Bulgaria, the Czech and Slovak Federal Republic (CSFR), Hungary, and Romania. The R&D Bureau Office of Health's Water and Sanitation for Health (WASH) Project undertook this study and began the collection of available data in the summer of 1991 and assembled a team of six persons in September 1991 to conduct the studies called for. The team began its field work in late September 1991 and completed it in May 1992.

The Scope of Work of the WASH team had three principal elements:

- Prepare an initial computer-based system to manage data on point-source wastewater emissions and emitters to support reduction of pollution in the Danube basin, and demonstrate the utility of the system in one or more pilot river basins within the Danube basin;
- Identify high-priority, immediate investment needs for which preinvestment studies might be funded and executed by international donors and funding agencies; and
- Evaluate institutional conditions and needs to support the data management system and implementation of wastewater emissions control programs.

During the course of the team's preparatory work, it became clear that the type of data management system that was of the greatest interest to the responsible pollution management personnel was a decision support system that could be used to estimate the impacts of technical, financial, and other potential control policies, not only on emissions and water quality, but also on costs and other concerns.

Two events of key importance in the course of the project were (a) an international Project Planning Workshop, held in Visegrad, Hungary, in December 1991, at which concepts and needs for the decision support system were agreed upon and the name Danube Emissions Management Decision Support Project (DEMDESP) was decided on; and (b) an international Institutionalization Workshop, held in Dubravka, Slovakia, in May 1992, at which the future uses and support needs of the decision support system were identified and some potential pilot projects prioritized in each country.

The study resulted in the following products:

- *Point Source Pollution in the Danube Basin*
  - *Volume I— Report on Data Management, Institutional Studies, and Priority Projects* (this report)
  - *Volume II— Institutional Studies: Bulgaria, the CSFR, Hungary, and Romania*

- *Volume III— Country Technical Reports: Bulgaria, the CSFR, Hungary, and Romania*
- A user manual for DEMDESS (the Danube Emissions Management Decision Support System), completed in July 1992

The basic purposes of this report are to present for general audiences in the four assisted countries, for interested agencies and donors, and for A.I.D. as the client, the methodology, findings, and recommendations of the WASH team; to record the key technical and institutional data that were collected; and to set down for potential DEMDESS users and clients guidelines for the system's application and ongoing use.

The Scope of Work of the project was carefully coordinated with the overall Environmental Program for the Danube River Basin (EPDRB). An important component of the study was the technical contribution made by the U.S. Environmental Protection Agency (EPA) in regard to potential pilot projects.

Findings

- **Background.** During much of the last 45 years, development of industry, agriculture, and public housing was a primary focus in the four participating Danube countries; control of associated water pollution problems was given limited or delayed attention. In the recent period of economic restructuring and democratization, funding for water pollution control has virtually ceased in many cases. Each country has a host of pressing political and socioeconomic problems that have largely been given higher immediate priority by their governments in the belief that environmental problems can be deferred, rather than addressed immediately as an integrated part of overall restructuring. Although environmentalists played a key role in moving the four countries toward democracy, policies the respective governments have adopted in response to economic realities have often prevented rapid resolution of water pollution problems. The lack of understanding by senior policymakers of the economic benefits of immediate water pollution control and the high cost of further delay is constraining economically sound water quality improvements.
- **External assistance.** In the interim, external assistance can be beneficial in preparing national and local water pollution control programs and can hasten their implementation, which can begin as soon as appropriate institutional and financial conditions are achieved.
- **Major pollution problems.** Wastewater emissions from cities and industry have serious environmental and health impacts on receiving waters, most notably in the tributaries of the Danube. Nonpoint-source runoff from rural areas contributes to the pollution, in the form of nutrients (primarily nitrates) from overapplication of inorganic fertilizers, pesticides, and organic waste in the partially treated effluent from large animal feed lots. The Danube River itself provides high dilution of wastewaters entering

it and has a high self-purification capacity with respect to biodegradable organic wastes. Nonetheless, low levels of dissolved oxygen and fish kills occur occasionally in its tributaries. Algal blooms in storage reservoirs during the summer are somewhat more common; these are caused by high nutrient levels and affect the treatment of potable supplies from surface water sources.

Many cities and towns rely on bank-filtered water supplies, which usually consist of tunnels, wells, or infiltration galleries placed in coarse alluvium parallel to the banks of a river. In several areas of the CSFR and Hungary, babies are given bottled water to avoid high nitrate levels found in some bank-filtered supplies. Heavy metals from industrial emissions have the potential to affect the food chain and aquatic biota, and pose risks to the environment and human health in the Danube Delta and Black Sea regions. In Hungary, fuel leaks and spills at former military bases are endangering potable water aquifers. Elsewhere, in several instances, salty and oily industrial residue affect soils and crops in irrigated areas downstream. Bacterial and organic contamination of surface water potable supplies cause odor, taste, and potential health problems, and disinfection of such waters by chlorine may lead to formation of carcinogens.

- **Major point sources of pollution.** All of the older and larger cities in the four countries have combined (this is, wastewater plus stormwater) sewer systems serving a majority of the population. Interceptors and pump stations have been built to receive flows from sewer systems and carry wastewater to treatment sites, but rarely do the interceptors serve all of a city. Biological secondary wastewater treatment plants have generally been designed for the larger cities, and have been built to various stages of completion.

  Effective operation and maintenance of completed wastewater treatment plants has been achieved in only a handful of cities in the four countries. Critical pieces of equipment in treatment plants are often defective or inefficient, and many municipal plants are overloaded. Sludge treatment and disposal is a major problem at essentially all treatment plants. None of the municipal treatment plants encountered in this study was providing disinfection of the treated effluent, and none was designed or equipped for removal of nutrients (nitrogen or phosphorus). Industries in the four countries have been developed on a large scale to produce chemicals, steel, petroleum, processed food, automobiles, and many other products. Technologies for industrial processing, manufacturing, and treatment of industrial wastewater are generally outdated and evolved during an era when environmental protection was not a major concern. Industrial wastewater treatment or pretreatment plants are often primitive and are operated ineffectively. In many cases, large industrial complexes have been developed at locations where available water resources cannot dilute or assimilate industrial emissions.

- **Economic and financial causes of pollution.** Although industrial activity has declined with the imposition of free market conditions, the reduction of former

subsidies, and the movement toward privatization, industrial wastewater emissions remain a major source of water pollution. High unemployment rates in many cases prevent the closing of factories that do not meet water quality standards for emissions, while economic uncertainties and lack of profitability prevent investment in less-polluting technologies or improved wastewater treatment technologies. Many municipal plants have been designed but not completed, due to the lack of national subsidies and user tariffs that are insufficient to fund the remaining construction.

- **Institutional development.** Under the previous centralized system of government, each country had developed a priority list of cities and industrial installations to receive funds for improved wastewater treatment. A system of fines for emissions exceeding allowable standards was also in place, although not always applied and certainly not effective when all institutions were state controlled and state funded. Each country is now in the midst of developing a new institutional structure and system of taxes and fines under which municipalities, privatized industry, and other local institutions will have a much larger role to play in water pollution control.

  All of the countries have at their service dedicated, well-educated, and experienced water pollution control professionals. Thus, our study received significant assistance and cooperation from the ministerial, regional, and municipal levels of government, and (with some exceptions) from representatives of industrial installations.

Conclusions and Recommendations

The conclusions and recommendations developed in this study relate to three topics:

- Priority investment opportunities, regarding which candidate cities and industrial facilities with water pollution control problems have been identified from field visits to a limited number of sites and from discussions with experts in each country.
- Requirements for institutional development, including possible changes in approach and methodology for promoting international cooperation among the Danube countries, for establishing national, regional, and local institutions, and for supporting such functions as setting national policy, water quality standards, stream quality classifications, fees, and sanctions; monitoring and enforcement; basin planning; investment program development; implementation; establishing and collecting user fees; and improved operation and maintenance of facilities.
- Further integration and use of the DEMDESS data base and software in the respective Danube countries, to provide a common computational framework and decision support tool during the current phase of establishing viable water pollution control programs in the four countries.

Investment Opportunities

In many cases, urban areas that include major industrial concentrations already collect both industrial and domestic wastewater. Given the uncertain viability of most industries, however, early capital investment in pollution reduction is likely to be limited. It appears more likely that, pending the introduction of industrial waste reduction through process changes or pretreatment, early reduction of such components as heavy metals could be achieved by municipal treatment. Fees levied against industrial dischargers could be used to fund such treatment.

Regarding Hungary specifically, dumped fuel remains a major pollution problem. Given the country's great use of groundwater and the deleterious effect that the passing of time has on clean-up efforts, this problem demands consideration as a pollution investment priority.

Based on the above, the WASH team concluded that initial external assistance to Bulgaria, the CSFR, Hungary, and Romania would be likely to include projects where (a) urban areas contain heavy concentrations of industry, (b) industrial areas appear economically viable, and (c) groundwater aquifers are contaminated by fuels dumped or leaked at former military installations. Potential projects were identified from discussions and information provided by local experts in each country, and project sites were visited to the extent permitted by time constraints. The locations of potential projects are shown in Figure A.

The potential projects were prioritized in accordance with several criteria: known or potential impact on health; actual or imminent damage to a critical resource, such as potable groundwater aquifers; readiness to proceed; significant human health or economic benefit even if other projects in the same basin do not proceed; large benefit in relation to cost (such as completion of substantially built treatment plants); and inclusion of projects with a range of sizes, types, and costs. Some potential projects were discarded. The remaining projects were assigned to three priority levels, as indicated in Table A.

It should be noted that these early priority projects do not represent an exhaustive list of all high-priority projects in the four countries. In particular the following omissions are apparent: The Hornad basin in eastern Slovakia and the Sajo basin in Hungary, which have significant pollution problems, were under study by others, but were not visited or evaluated due to time constraints; the large portion of northwestern Romania that drains to the Tisza River in Hungary, and the Timis basin in southwestern Romania, which drains into Yugoslavia, were not visited due to time constraints and were not evaluated due to a lack of data. Yugoslavia and its successor states were not included in the scope of work due to the security situation there.

Information on the 15 first-priority projects is summarized in Table B. Eleven of the projects are concerned with treatment of municipal wastewater in cities producing significant industrial wastewater flows and having partially built wastewater treatment plants; 3 are concerned with upgrading industrial wastewater treatment; and a countrywide project in Hungary is to clean up or contain the effects of fuels that were dumped or leaked at 300 former military installations.


FIGURE A
POTENTIAL PRIORITY EARLY PROJECT LOCATIONS IN THE DANUBE BASIN
Approx. Scale: 0 50 100 150 Km
KEY
BASIN BORDERS
DANUBE BASIN BORDER
POTENTIAL PROJECT LOCATION
CSFR
CZECH REPUBLIC
SLOVAK REPUBLIC
POLAND
OSTRAVA
OLOMOUC
BRNO
PRESOV
KOSICE
TRENCIN
NOVAKY
BANSKA BYSTRICA
SENICA
BOSANY
NITRA
HLOHOVEC
BRATISLAVA
VIENNA
AUSTRIA
MISKOLC
DEBRECEN
UKRAINE
IASI
MOSON ISLAND
GYOR
KOMAROM
BUDAPEST
SZOLNOK
ORADEA
CLUJ-NAPOCA
TIRGU MURES
HUNGARY
ROMANIA
SZEGED
ARAD
GALATI
BRASOV
BRAILA
PECS
TIMISOARA
YUGOSLAVIA
RIMNICU-VILCEA
PLOESTI
PITESTI
TURNU-SEVERIN
BUCHAREST
BELGRADE
Danube River
CRAIOVA
SILISTRA
TIRGU MUGURELE
RUSE
PLEVEN
LOVECH
TROJAN
GABROVO
SOFIA
SAMOKOV
BULGARIA
Black Sea

Table A
Potential Priority Early Projects

Country	FIRST PRIORITY		SECOND PRIORITY		THIRD PRIORITY	
	Basin	Project	Basin	Project	Basin	Project
Bulgaria	Iskar	Sofia and Samokov	Osem	Troian and Lovetch	Ogosta	Michailovgrad
	Vit	Pleven	Rusenski Lom	Razgrad		
	Jantra	Gabrovo and Veliko Tornovo	Jantra	Gorno Oriahovitsa and Liaskovetz		
CSFR*	Danube	Istrochem (Bratislava)	Váh	Hlohovec and Leopoldov	Danube	Bratislava, central left bank
	Váh	Trenč ín	Nitra	Koželužne tannery (Bošany)	Dudvah	Senica
	Nitra	Novaky industry	Danube	Bratislava, right bank	Morava	Brno
	Morava	Olomouc				
Hungary*	Danube	Györ and Moson Island	Danube	Budapest, north system	Danube	Komárom
	All	Fuel-contaminated groundwater	Tisza	Szolnok		
			Altalar	Tata		
Romania	Jiu	Craiova	Olt	Rimnicu-Vilcea	Danube	Municipal treatment needs in Braila and Galati
	Olt	Govora (Rimnicu-Vilcea)	Danube	Industries in Braila and Galati		
	Arges	Pitesti and Bucharest				

* The analysis of high-priority basins was one of a number of pieces of information provided to donors in early May 1992, to assist them in deciding on future basin studies involving potential investments. Although the Hornad basin in Slovakia and the Hernad and Sajo basins in Hungary were not addressed in the WASH study, the host government and other environmental experts have determined that they are highly polluted and warrant further analysis and investment. Hence, these basins will be the subject of further assessment during Phase II WASH activities.

Table B
Summary of Top-Priority Projects

Country	Basin	Project	Population	Flow, MLd*	Type of Industries/Project Elements
Bulgaria	Iskar	Sofia	1,200,000	520	Metals, machines, chemicals, textiles, wood, foods/two interceptors, treatment rehab, sludge management
	Iskar	Samokov	47,000	30	Limited industry/further treatment to protect Sofia's water supply reservoir, possible nutrient removal, disinfection
	Vit	Pleven	130,000	108	Animal feed, sugar, oil refinery, slaughterhouse, poultry, dairy, winery, metal finishing/pretreatment, municipal treatment to remove oily waste
	Jantra	Gabrovo	90,000	79	Machines, food, electronics/interceptor for industrial flows, treatment upgrading, sludge management to protect Jantra headwater
	Jantra	Veliko Tornovo	90,000	46	Chemicals (manganese waste)/treatment upgrading, sludge processing equipment
CSFR	Danube	Istrochem	Industrial	21	Rayon, fertilizer, explosives, propylene, polymers/biological treatment added to existing physical/chemical treatment
	Váh	Trenčín	54,000	70	Yeast, alcohol, textiles, building materials, furniture, equipment repair/full treatment of yeast and alcohol waste, new right-bank treatment plant, sludge treatment repair at left-bank plant
	Nitra	Novaky	Industrial	36	Power, PVC plastics/control of arsenic leaching from ash disposal site, restructuring of PVC processing and industrial treatment
	Morava	Olomouc	102,000	53	Food, chemicals, pharmaceuticals/upgrade of existing treatment plant, additional new treatment plant
Hungary	Danube	Györ, Moson Island	120,000	60	Machines, textiles, processed food, alcohol, galvanizing/pretreatment for distillery, completion of Györ and five regional treatment plants to protect groundwater in coarse alluvium
	All	Fuel spills	NA	NA	Dumped or leaked fuels at 300 former military sites/emergency control over migration in aquifers, removal and possible reuse of fuels
Romania	Jiu	Craiova	317,000	500	Chemicals, cars, electrical machinery, food, alcohol, bricks, cement, power/ completion of interceptor and municipal treatment plant, rehabilitation of chemical-plant treatment facilities
	Olt	Govora	Industrial	275	Caustic soda, 70 petrochemicals, machines, power/reduction of brine discharges to the Olt, waste minimization, rerouting of flows or new pretreatment plant for one of three flow streams
	Arges	Pitesti	175,000	150	Oil refinery for fuels and plastics, dyes, beer, rubber, electric motors, chemicals, furniture, meat, wine, cars/upgrading of refinery's treatment, nutrient removal at city's treatment plant
	Arges	Bucharest	2,300,000	1500	Paints, beer, furniture, leather, drugs, textiles, machines, food, trams, electronics, power/completion of 2,000 Mld treatment plant

* Dry-weather wastewater flow or treatment capacity; 3.78 Mld (megaliters per day) = 1 mgd (million U.S. gallons per day)

Institutional and Policy Issues for Investment in Pollution Reduction

Each country must improve its management of the water pollution control sector before entering into expensive capital investments, particularly if large commitments are to be made with international hard-currency loans. Preinvestment studies should focus on both institutional and structural needs. Institutional issues that must be addressed include cost recovery from users, the level of subsidy from national governments, reduction of industrial wastes in concert with end-of-pipe treatment, improvements in staffing and equipment for operation and maintenance, and the development of management systems and procedures (e.g., for setting standards, stream classifications, discharge permits, public participation in basin water quality planning, design criteria and equipment specifications, supervision of construction, monitoring requirements, and personnel training for operation and maintenance).

The key areas for continued sectoral improvement in the four countries are as follows.

- **Appropriate national laws, sanctions, and enforcement policies.** The four countries are in various stages of revising sectoral laws and policies. These positive efforts have been supported with technical assistance from the EPA and other entities. A positive use of the experience gained to date would be to provide mechanisms for sharing ideas and experiences among the four countries; the Visegrad and Dubravka workshops on the conceptual design and institutionalization of DEMDESS were seen by the participants as rare, and very welcome, opportunities for open discussion of the common problems the four countries face.

- **Economic incentives and financial reform.** Tariffs for water and wastewater service are generally insignificant in the four countries, and are rarely sufficient to cover even the operating expenses. As the former state subsidies on food, housing, public utilities, and other consumer goods and services are reduced, salaries of workers will increase and inflation may continue for several years at its recent rapid pace. During this complex economic evolutionary process, it may prove necessary to increase the prices for water and sewer service frequently, and in concert with rehabilitation programs to reduce water losses, to conserve water wasted by industry and consumers, and to improve metering of customer water use. While water must remain affordable to users, prices must begin to reflect its true financial cost.

  Tariff studies must be undertaken in each country as part of the feasibility studies prior to investment, to establish feasible tariffs for each type of user (domestic, industrial, commercial, institutional) and possible cross-subsidization of domestic users by higher industrial fees. Studies on organization and management must also be undertaken, since privatization of semi-autonomous municipal or metropolitan water and wastewater agencies may prove necessary to ensure financial self-sufficiency, and to prevent bureaucratic stifling of local initiatives. Such decisions at the municipal level require decisions at the national level on subsidies and fairness between communities.

- **Water conservation.** In the past, many industries in the four countries have been irresponsible in their use of water; therefore, water conservation measures must be

included in the modernization of industry, equipment, and management programs to improve industrial economic efficiency. Consumer plumbing fixtures are of low quality and are poorly maintained due to the low price of water; the resulting waste of water from drips and leaks can substantially increase the wastewater flows requiring treatment. Higher tariffs will reduce waste, and other more direct programs could bring about the desired reduction in water use more quickly.

- **Industrial pretreatment.** Industrial pretreatment can be defined as treatment that allows wastewater to be put into municipal sewers without damaging sewer materials and without interfering with the operation of municipal wastewater treatment plants. In combination with water conservation and waste reduction in industry, more attention must be given to industrial pretreatment, to ensure the effective operation of municipal biological treatment processes and to reduce contaminants in sludge that prevent its agricultural reuse. In addition to improved monitoring and enforcing of pretreatment requirements, it may be desirable in some cases to subsidize industrial redevelopment when building pretreatment facilities that serve large industrial complexes. The economic viability of individual factories may be in doubt, such that early investment in pretreatment facilities for them would be risky. For an industrial complex as a whole, however, the composition and magnitude of flows to be treated should be more predictable, and hence the financial risk more manageable.

- **Human resources development in water quality management.** Training programs specifically designed to meet the management and planning needs of the sector in Central and Eastern Europe should be designed and implemented. Such programs should focus on management practices and decision support systems; the collection of reliable and appropriate information; procedures that include public participation by citizens, industry, and agencies in the planning processes; and training programs that provide skills in cost management.

- **Role clarity and sectoral coordination.** Each of the four countries should carefully reexamine decisions relating to agency roles and responsibilities that have been made under the transitional pressures of the past two years. Institutional analyses are needed to define optimal ways to set up coordination mechanisms, eliminate overlapping of roles, and provide clear mechanisms to issue and monitor discharge permits and coordinate activities in water quality control. Alternatives should be put forth and decided on in each country for the involvement of all interested parties (industry, municipal agencies, private citizens, ministries) in the management of river basins. The objective should be to find a model that does not duplicate efforts and that allows for coordinated actions that work.

- **Laboratories and monitoring programs.** Efforts are under way within the donor community to provide enhanced laboratory and monitoring equipment to each of the four countries. Building laboratory capacity and improving the overall quality and reliability of available data is a necessity. The EPDRB working group on data management should specify basic frequencies of sampling, the types of laboratory

tests, and the water quality parameters that are needed, from which the dimensions of need can be estimated, and measures taken to ensure appropriate basic capacity.

- **Data requirements for DEMDESS.** The usefulness of the DEMDESS software and data base depends partly on the quantity and quality of data from laboratories and monitoring programs, and also on institutional cooperation to obtain the broad variety of information needed in water pollution control planning and policy analysis. In several of the countries, transfer of information between ministries or institutes is inhibited, particularly for institutes that must sell data in order to survive. More freedom of access to data collected using public funds is needed in such countries.

The Decision Support System

The Danube Emissions Management Decision Support System (DEMDESS) consists of a data base and software that have been developed and applied to a pilot river basin in Bulgaria, the CSFR, Hungary, and Romania. The DEMDESS software and data bases, which were developed using Paradox® and Quattro Pro® computer programs, have the following uses:

- Providing the information needed by decision makers in the four countries to enable them to develop effective and coordinated strategies and policies for reduction of polluting emissions by
  - Quantifying and forecasting the environmental and economic effects of emissions control options;
  - Making forecasts of emissions of specific pollutants under various scenarios of population and economic growth and industrial technology and development;
  - Estimating the effects of river basin management strategies at various levels of aggregation (e.g., by tributary, type of industry, or political subdivision);
  - Evaluating the effects of industrial restructuring and policy options affecting industry, such as economic incentives, emissions-based discharge fees (taxes) and fines, and pretreatment criteria;
  - Identifying the cost-effectiveness of applying controls to specific "hot-spots" or population concentrations; and
  - Providing information on the institutional and financial implications of policy options, such as user tariffs; manpower needs for planning, design, and operations; training requirements; and funding needs.
- Providing the basis for the development and funding of programs for the collection of emissions data and the monitoring needed to support effective pollution reduction.

The DEMDESS effort was described as a very good first step by most of the country representatives in the Institutionalization Workshop. This assessment was based on the following factors:

- A system design is in place that includes data compatibilities programmed to interface, both nationally and internationally, with most existing data bases in the four countries.
- DEMDESS stores information in an interchangeable, standardized format and operates on personal computers, the most common computer platform in Eastern Europe. It can perform the tasks of data storage and manipulation for multiple uses and multiple users in each country.
- DEMDESS can be used to conduct cost, institutional, and other analyses that facilitate responding to questions about the impacts of various possible interventions.

Other DEMDESS advantages include the following:

- Use of DEMDESS as a tracking tool for enforcement imposes no major institutional constraints. As mentioned above, DEMDESS takes full advantage of existing emissions-related data bases. Most of the system's data are taken from current administrative routines. Additional data that DEMDESS needs can be reasonably gathered from paper reports; such data includes standards, taxes, and fines.
- DEMDESS includes the primary components necessary for emissions management and decision support: information on existing emissions, water quality, waste treatment effects, costs of treatment, regulations, and institutional relationships.
- DEMDESS integrates the above data in a format that is specifically designed for diagnostic evaluation, alternative emission scenario analysis, and policy support. It is important to note that in most cases, such critical data integration had not previously existed operationally.
- No other systems currently available for Eastern Europe perform the operational integration and analysis that DEMDESS does.
- DEMDESS is designed with the future in mind: the system is open to the use of new information, new analysis techniques, and new technologies as they become available. For instance, GIS can link with DEMDESS.
- DEMDESS is primarily based on water quality and emissions management techniques and principles that have evolved over the past 20 years in the United States. DEMDESS adapts some of these techniques to meet Eastern Europe's particular emissions management requirements in a straightforward and logical manner.

The above features provide a basis for data management, even if DEMDESS is not used as a planning tool. Testing DEMDESS with real data from demonstration basins showed that DEMDESS can answer the questions it was designed to answer. Because the system is data driven, improving the first attempt at data entry and expanding data collection beyond the

demonstration basins are very important for establishing DEMDESS as an operational tool that can adequately reflect real-world issues. Testing and proving the accuracy of the system will require substitution of additional, updated, and verified data to complete the initial activity in each country.

Institutional Measures for DEMDESS Implementation

The basic institutional structure and capacity now exist for DEMDESS implementation in each of the four countries. Improvements are needed, however, in various institutions regarding decision analysis, coordination, communication among entities, and the capability to collect and evaluate data. If the DEMDESS program is to work as a management tool, an information system, and a decision-analysis tool, it must become understood and integrated into the normal administrative routines of institutions. At the policy level, there must be an understanding of the system's capabilities and potential applications. Orientation will therefore be required for decision makers in how to use decision support tools such as DEMDESS.

The current status of implementation in the four countries is summarized below.

- **Bulgaria** is fully committed to DEMDESS as a key data management, reporting, and policy tool. This support extends to the regional inspectorate level for the entire country. The Ministry of Environment has made significant resource commitments, including staff time, office space, equipment support, and briefings to the minister. The Danube "focal point" and staff have devoted substantial efforts in support of the system. In fact, total cooperation has been provided at all levels. The high level of support and existing technical capability virtually assures the institutionalization of DEMDESS, especially with continued A.I.D. support.

- **Slovakia** has all of the conditions necessary to institutionalize DEMDESS. Top-level management views DEMDESS as a potentially key policy tool for the COE (Slovak Commission on the Environment). The COE has been able to coordinate, access, and cooperate effectively with the Water Research Institute, the Hydrometeorological Institute, and the regional water authorities. Additionally, Slovakia has excellent existing administrative routines for supporting the DEMDESS data requirements. Preliminary technical "buy-in" in the institutes has occurred through well-attended technical presentations. Institutionalization of DEMDESS will occur if it is used as a key tool in the prefeasibility studies and development of policy-level analyses for the COE. On a technical level, DEMDESS is bringing together several independent, well-developed national data bases.

- **Hungary** has bought into DEMDESS to the extent that the Ministry of the Environment and Regional Planning (MERP) has spent money to develop the Altalar Pilot Basin demonstration; MERP paid Vituki for the technical support. Vituki has tentatively bought into DEMDESS as a valuable technical analysis tool.

Institutionalization of DEMDESS is certainly possible; it depends upon management and financial support from MERP or others.

- **Romania** has provided an institutional home at REIE (the Research and Engineering Institute for Environment). There are many changes taking place in the Ministry of Environment, but REIE will probably remain a stable, powerful supporter. Romania in general is very short of resources, but valuable commitment of staff time has been generously provided by the institute in support of DEMDESS. Institutionalization of DEMDESS is possible with steady support and tangible demonstration of use in the prefeasibility studies.

At the moment of turnover to the countries involved, DEMDESS will have an immediate use as a data base for monitoring pollution control and the application of sanctions. Additionally, the decision-analysis elements of the system can become significant if users learn to make use of them for this purpose.

Eventual broader use of DEMDESS will require a coordinated effort and a management structure for its maintenance. This process will require an interaction between management and operators in which uses of the system are specified and scenarios are programmed for analysis. Some options-analysis scenarios have been programmed, but the need for others will emerge during the first year of use.

Within the next year of DEMDESS operation, each country ideally should have accomplished the following:

- Expanded DEMDESS to cover all, or most, river basins as a part of a national data base system and harmonized it with existing information networks;
- Incorporated DEMDESS as a part of its national monitoring, sanctions, administrative, and management routines at the level of various operational users, such as river basin authorities and environmental inspectorates;
- Used the system at higher levels for options analysis and decision support for short- and long-range planning; and
- Developed a national network of user and client groups, coordinated by a primary user at the national level.

In addition, it is hoped that international donors and EPDRB will find DEMDESS useful as a way of forging international linkages for data management. Widespread adoption, however, will depend on the speed with which EPDRB's task force on data management accepts DEMDESS or recommends alterations or alternatives to it.

Future needs for DEMDESS fall into six categories of activity:

- Bridging to initial use,
- Operating DEMDESS in selected priority river basins,
- Incorporating DEMDESS, in a staged manner, into operational routines for data base management at inspectorate and operational offices,

- Expanding DEMDESS to all basins in each country and to full operational and decision/policy use,
- Establishing country- and basinwide system maintenance and improvement, and
- Developing international uses and linkages.

The following steps are recommended for the international donor community in support of the above activities:

- A one-year bridging activity should be undertaken by an international donor to support DEMDESS installation, debugging, validation, and initial use.
- A.I.D. should encourage the use of DEMDESS in prefeasibility work it sponsors as part of the next round of EPDRB activities.
- Multilateral lenders considering the funding of pilot projects under the EPDRB should also encourage the use of DEMDESS as a standard data base to support preinvestment studies. If this is done, it will not only assist in the preparation of projects, but will also help define requirements for improved monitoring and data management.
- A donor could consider supporting a small amount of DEMDESS maintenance activity, including periodic updating of DEMDESS manuals and occasional responses to problems encountered with the system during the next two years.
- EPDRB, through its Project Coordination Unit, should continue long-term support of the international coordination of, and communications to improve, the use of DEMDESS.

Alternatives to DEMDESS

Alternatives to DEMDESS should certainly be considered; it is possible that better ways exist to meet Eastern Europe's emissions management and decision support needs. Alternatives to DEMDESS must perform essentially the same functions as DEMDESS, however, or they will fail to meet these needs.

DEMDESS has been built using a set of requirements developed by the WASH team in conjunction with the host country requirements. If the requirements for emissions management change significantly, DEMDESS should be reevaluated along with other alternatives.

Some alternatives to DEMDESS are not emissions management systems. For instance, GIS is not an emissions management tool; rather, it is a system for displaying and analyzing geographical information. GIS can provide data to a decision support system and can help display such information, but it is not an emissions management/decision support system in itself.