DISTRIBUTED DATABASE SYSTEMS IN THE MANAGEMENT OF ENVIRONMENTAL AND WATER RESOURCES PROBLEMS IN EASTERN EUROPE, RUSSIA AND CIS (ALBANIAN CASE)

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Abstract

Albania is the richest country in water resources per capita in the Central and Eastern Europe. However, only one percent per year of those resources are withdrawn for utilization in the major water sectors — drinking, imgation and drainage, intustry, and mining. The management of waters is closely connected to the collection, processing, and distribution of data related to available water resources, their uses, and level of pollution. Until recently, the information on quantity and quality of waters has been the responsibility of several scientific institutions such as the Institute of Hydrometeorology, the Research institute of Chemical Technology, and the Institute of Public Health, as well as several governmental agencies, for example, the Cornminee of Environmental Protection, Ministry of Public Health, and the Ministry of Food and Agriculture. Data produced by these entities cannot be accessed without much difficulty by the general public and even by the scientific community, thus restricting the flow data to decision makers. Data that is made available is often of poor quality, hampering the effectiveness of good policy making. In 1996 the Albanian Parliament approved a new water law which made the National Water Council (NWC) the highest decision making body responsible for the administration anf management of water resources in Albania. By strengthening the powers of the NWC the Parliament has made it the pivotal unit in the network of water data. This study argues that Albania's involvement in several international projects (e.g. Coastal Monitonng Area Program within the frame of MED POL Project) requires the application of Quality Assurance and Quality Control (QA/QC) procedures and also offers some recommendations for the establishment of a better data storage and disseminating system and the institutional strengthening of procedures.

Key Words

Data, information, quality, polluiton, monitoring, environment, water, networks,

1.0 General Data on Albanian Water Resources and Their Quality

1.1 Introduction

DRAFT

Albania is a small country covering 28,748 km^2 along the eastern coast of the Ionian and Adnatic Seas. It has a population of 3.2 million inhabitants, 25% of the temtory is land, 35 % forest, 15% pasture, 4% is covered by lakes, and the remaining two thirds of Albania consists of mountains. Albania has a coastline which is 476 km in length, and along this coastline, covering the western part of the country, lies a small plain with a maximum width of 60 km. Agiculture and forestry together contribute more than 55% to the GDP. The rest is made up of light and heavy industry, food production, oil, mining, the energy sector, and other activities.

Albania's per capita water resources, at a little more than 3000 m^3 (or expressed as specific discharge is 28.1 1/sxkm), are the most abundant in the Central and Eastern Europe (almost equaling Switzerland's). The hydrographic basin of Albania covers a surface of 43,305 km^2 and includes eight large rivers, about 150 small catchments with a surface of more than 50 km^2, and the lakes of Shkodra, Ohrid, and Prespa. There are also a great number of small lakes including the 82 lakes of Dumre, the 12 Lakes of Lura, and the Lakes of Allamani, Gramozi, and Klenije. There are also more than 150 springs with a discharge over 120 liters per second (l/s). [1] Until recently, only one percent per year of those resources are withdrawn for utilization in the major

water sectors — drinking, imgation and drainage, intustry, and mining. only 1% per year of water Only two water purification plants exist in the entire country: in Durres (the Pjeshkeza plant on the Erzen River), and Tirana (the Brari on the Tirana River), both built some fifty years ago. Both plants have a treatment capacity of 35 liters/second, while in Tirana the average flow ranges between 1450 and 2100 liters/second and in Durres the flow is about 720 liter/second. Drinking water disinfection is done manually with hypochlorite, but a shortage of hypochiorite has contributed to a detenoration of drinking water quality throughout the country.

1.2 The Pollution of Rivers

Albania's rivers are subject to both point and non-point sources of pollution. Non-point sources stem chiefly from agncultural activities because pesticides and fertilizers have been used intensively in Albanian agriculture in order to increase productivity in conditions of limited arable land. Besides agricultural activities, another major contribution to water pollution is the waste discharge from different industries (point sources of pollution). The water quality ofKiri, Tirana, Shkumbini, Gjanica, and Dunavec Rvers receive the greatest harm from these discharges because many industrial facilities and several cites are located on or near their banks. (Several charactenstics of discharge from some main industrial activities in the country are presented at Appendices I and 2.) After 1991, owing to the radical political changes in Albania, many industries interrupted their activities. Because of these circumstances, the deterioration of these rivers has been checked and it is just possible that their general quality has improved; however, this statement must be confirmed by research.

1.3 The Pollution of Coastline Waters

Both point and non-point sources contribute to the pollution of these waters as well. At the end of 1994, the UNEP, with a view to conducting an inventory of land-based sources of pollution in the four coastal districts of Durres, Lezha, Saranda, and Vlora, distributed questionnaires to Albanian authorities. The questionnaires concerned: (a) liquid domestic oischarges; (b) industrial discharges containing selected substances listed in Annexes I and 11 of the land based sources protocol within the frame of the MED POL program; and (c) industrial discharges of petroleum hydrocarbons. For this latter category, sub-questionnaires on discharges from oil-refineries and reception facilities respectively were included. These questionnaires were repeated in early 1995. These particular areas were chosen because of their highest possible impact on coastal waters (including estuaries) through industrial discharges or agricultural activities. (The results obtained are tabulated and graphed in Appendix 2.) The prinicpal findings of the survey are:

— Discharges from municipalities and industry occur off the immediate coastline.

— Protective submarine structures are lacking.

— No treatment facilities exist for either sewage or industrial waste water

— No analytical data on the constituents of the waste water are reported

— Mostly untreated industrial water is mixed with sewage thereby aggrevating the pollution at the points of discharge

— Untreated wastewaters are discharged mostly into the sea (see graph 2 Appendix 2)

1.4 Existing Surface Water Monitoring Efforts

Since 1948, surface waters (mainly rivers) in Albania have been assessed for hydrometnc parameters, since 1966 for hydrochemical parameters, for estuarine pollution since 1993, and for several other pollutants since 1994. There are 100 hydrometric stations in rivers and lakes which study the spatial and time distribution and other charactenstics of water resources. There are two categories of stations, class A and class B. In class A stations four kind of observations are made: water level (H), discharge (O), sedimentation (S), and water temperature (T); at some of the class

A stations, water samples for chemical analyses (C) are also taken. In class B stations, generally two kind of observations are made: water Ic-cl dischargcs and sedimentation/water temperature.

The hydrochemical analyses to which rivers and lakes are subjected are for pH, Ca, Mg, Na, K, HCO^3, CO^3, Cl^-, $S04^{2-}$, NO_{2-}, NO_{3-}, SiO_2, P_2O_5, and Fe. They are measured at 45 stations with a frequency of more than 5 samples/year. Samples are generally taken at the hydrometric sampling stations. Between 1984 and 1988 the number of hydrometric stations increased from 10 to 31 making it possible to measure more rivers twice a year for such pollutants as pH, BOD, COD, NO_2^-, NO_3^-, NH_4, P_2O_5, SiO_2, Zn, Cr, Mn, and Fe. The Tirana and Shkumbini nvers, because of the great amount of effluent discharges they receive from industries, are supposed to be sampled once monthly; however, measurements have been irregular, especially during the 1990s.[1]

An agreement has been made on the National Monitoring Program (NMP) Between the Albanian Government as the contracting party to the Convention for the Protection of the Mediterranean Sea against Pollution and its related Protocols, and UNEP as the Secretariat to the Convention. Since 1992, within the frame of the Pollution Monitoring and Research Programme (MED POL), Albania has started a monitoring program, for the first time, for estuarine, bathing areas, and pollution sources (industrial and urban discharges and agricultural activities). The Albanian MED POL National Monitoring Program includes 73 sampling stations. Twenty-four are located in the main estuarine areas, nine cover main sources of pollution, and the remaining forty are located at bathing areas. (The estuarine sampling network is mapped in Appendix 3.)

Since the project began in 1993, only one set of results — those for 1994 — have heen produced. In May 1996, the UNEP published the following results in its *Report on results of Coastal Areas Management Program (CAMP) for Albania*:

(TABLE 1 and Table 2 go here)

UNEP specialists drew some rough conclusions from these results. Based on the data in Table 1, they state that the estuaries are not influenced by the discharges of various communal sources. From the data in Table 2, they concluded that the levels of heavy metals in the majority of samples taken are comparable to values in other less polluted areas of the Central Adriatic[3]

The UNEP conclusions provide only a rough explanation of the water quality situation at these particular sites for following reasons:

a) Water quality trends could not be detected through NMP because it is designed only for background monitoring. This design was determined by the lack of general data on the quality of these waters.

b) Of the three planned data sets, only one has been produced and even in that one the results were incomplete. In these conditions the water quality situation and quality trends are impossible to determine

c) A lack of institutional co-ordination and legislative requirements has hindered the full implementation of the monitoring program.

d) Like other monitonng efforts undertaken in Aibania, this program lacks clearly defined monitoring objectives.

e) A clear plan for effectively communicating results to those who have need of the data is absent from the program.

2.0 Present Water Uses in Albania

The chief water suply uses in Albania are for drinking, mining and industry, irrigation and drainage, hydropower, and other non-consumptive uses such as tounsm, recreation, aquatic life, fisheries, and flood mitigation.

2.1 Drinking Water Supply

Drinking water supply is a national prionty because this service involves the well-being of the entire population and requires improvements. Drinking water supply is responsibility of the Ministry of Public Works, Territory Adjusment, and Tourism (MPWTAT). In the main urban areas 80% of the population is connected to the network of water distnbution, but this service can be used only a few hours a day. The pipes, which are made of steel and cast iron, were installed some 20 or 30 years ago. The lack of preventive and routine maintenance has resulted in their becoming severely corroded. In general the sources of drinking water are of good quality but the tap water may be contaminated by contact with chemical and bacteriological agents in the soil. There is a lack of information concerning rural water supply. The 1995 UN Human Development Report on Albania states that only 5% of the rural population has access to in-house water pipe connections. Also, according to the same report 98% of the rural population rely on water near their homes which is piped or extracted trom shallow wells where water is of good quality.

2.2 Mining and Industria Water Uses and Discharges

Mining and Industry have been very important users of Albania's water resources during the last 30 years. However, since 1991, a period of political and economic transition, mining and heavy industrial activities have decreased. Although the quantity of untreated water discharged by these industries into the environment has diminished, the effects of their previous dumping are still evident, especially in the large urban areas ofTirana, Fier, Korca, and Durres. The main point sources of pollution for surface and ground water are the extraction of chromium near Dnni and Mati, copper extraction near Dnni, Mati, and Seman, oil extraction near the Vjosa River, wherever the chemical industry produces such procucts as fertilizer, paints, oil products, and the metallurgic industry, paper industry, textile and leather industries etc. (Figures for the discharges of Albanian industries are given in Appendix I.) The information concerning the quality and quantity of water used by industries and mining activities is so poor as to be almost lacking altogether.

2.3 Irrigation and Drainage

As Albania is an agricultural country (about 55% of GDP comes from agricultural activities), since the beginning of this century, great attention to irrigation and drainage works. The rate of investments made in the agricultural sector between 1950 and 1975 significantly increased irrigation capacity. The following table summarizes figures from 1993:

(TABLE 3 goes here)

Albanian specialists have estimated that owin to the social upheavals following the 1991 fall ot communism in Albania, 14,400 ha of the country's irrigation systems and 15,300 ha of the drainage systems were severely damaged. Moreover, according to rough estimates, the present water diversions satisfy only 25% of the irrigation needs. The improvement of the irrigation and drainage systems is imperative if there is to be a food supply adequate to meet demands of both the population and the food processing and export industries.

2.4 Hydropower

Large resources in surface waters and high river bed slopes have favored Albani with a large potential for hydropower. The current installed capacity is 1446 MW, the annual production is capacity is 5220 Gkh, and the water storage capacity is approximately 4x109 m^3. There are a total of 12 hydropower plants located situated on several rivers: three on Dini River, two each on the Mati and Bistrica Rivers, one each on Erzeni, Bogova, Osumi, and Shushica Rivers, and one under construction on the Devolli River. The Drini cascade in northern Albania contributes 350

MW, or 93% of total energy production. The dams at the hydropower plants are designed mainly for hydropower generation. The first multipurpose dam, currently under construction on the Devolli River will enbale irrigation in the Plain of Semani. Other non-consumptive uses of water in Albania are aquatic life and fisheries, tourism, recreation, navigation, and flood mitigation. Some of these activities cause limitations on both consumptive uses and upstream discharges because of the water quality they require.

3.0 Institutional Aspects of the Curreent Water Data Information System

3.1 Environmental Administration

Environmental information systems in Albania, including the water data information system, have been in a state of evolution since 1991. In that year the Committee of Environmental Protection (CEP), which is based in the Ministry of Public Health but under the jurisdiction of the Council of the Ministers, was created. The CEP is the central body for all environmental issues. Part of its functions is to organize the monitoring of environmental (and water) pollution and, in cooperation with National Water Council to define what actions are to be taken for the protection of water resources. Another reaponsibility of CEP is to approve the legal standards and criteria for hazardous discharges, in both solid and liquid forms, into the country's waters. There are three Directorates in the CEP, one for water and air quality, another for natural resources protection and the management of hazardous materials, and a third for a national information system and impact assessments.

In 1996, the Albanian Parliament passed legislation the made the National Water Council (NWC) the highest decision making body responsible the administration and management of water resources in Albania. The NWC is appointed by the Council of Ministers and the Prime Minister is the NWC chairman. The National Water Council's chief responsibilities are:

— the development and management of a national water strategy

— the preparation of water resources plans for drainage basins

— issuing of regulations for the implementation of the Water Law and nationl water strategy

— research concerning the efficient use of water resources in Albania

— organization and application of an administration for the implementation of water law

The approval of the water law has lead to some uncertainties about future responsibility for some related activities; for example, the publication of regular reports on water quality. In addition to CEP, there are several ministries that deal with various issues related to water management, e.g., the Ministry of Public Works, the Ministry of Territorial Adjustments and Tourism, the Ministry of Food and Agaculture, the Ministry of Transport, the Ministry of Industry and Energy, and the Ministry of Public Health. Currently, owing to a shift towards a market economy, the CEP and other governmental agencies related to water issues are losing some of their control and management functions. The consequence for data collection and mangement is that instead of having data controlled exclusively by the central authority, data must now be requested from private enterprise and individuals.

The question of financing the collection and distribution of water information is partly related to the implementation of the Polluter-Pays-Principle (PPP), by which the costs of water pollution monitoring is to be borne by the polluter. In situations where the polluters cannot be identified (e.g. non-point sources of pollution), water data gathering is to be publicly financed. However, the regulations governing PPP are not strongly implemented in Albania. Circumstances do not tavor the application of a modern system of fines and taxes against the polluters.

3.2 The Role of Institutes

There are in Albania several scientific institutions that cooperate with CEP and the ministries matters of water resources management. As part of the privatization of the economy, many such institutes have become administratively and financially separate, semi-independent organizations. The principal water-related institutes in Albania are:

— The Institute of Hydrometeorology of the Academy of Science which conducts water research and monitors water quality

— The Institute of Public Health which investigates and controls at the national and local levels the quality of water for domestic supply and establishes regulations and guidelines for maximum levels of toxic substances which may be tolerated in domestic water use

— The Faculty of Natural Sciences which conducts research on water treatment and is also involved in several projects dealing with water quality assessment in some areas of Albania

— The Research Institute of Chemical Technology inventories urban and industrial water discharges throughout the country

The most dynamic and well-equipped institutes are attempting to establish themselves as the focal points of intemational information networks. Until the CEP began functioning and after the legislation of the Water Law, there was a tendency for projects to be undertaken based on their attractiveness to external funders rather than on real national needs. This tendency has been minimized by the influence of CEP and the new water law.

4.0 Technical Aspects of the Water Data and Information System

4.1 The Selection of Analytical Methods and Quality Assurance/Quality Control Procedures

In Albania, as elsewhere, the availability of analytical equipment has influenced the choice of analytical methods. Albanian specialists have always been eager to use the most up-to-date analytical techniques in order to ensure high reliability of data. The Institute of Hydrometerology of the University of Tirana and the Institute of Chemical Technology are among the institutions which now appear to be well-equipped due to govemmental and intemational funding from such UN agencies as UNEP and UNESCO. This circumstance has made it possible at these two institutes to select optimal analytical methods based on their sensitivity, specificity, response-time, ease of operation, ease of calibration, cost and reliability, and accuracy. Until recently, there have been virtually no general quality control or quality assurance procedures implemented. Under the requirements of MED POL projects, the laboratories involved are assessed for their accuracy and precision only through intercalibration exercises.

4.2 Data Storage, Reporting, and Dissemination Issues

Untii now, collected water data are stored in hardcopy form. A computerized system of storage is under development. Because of a lack of funding for omputerization, only in specific cases are data put into computerized files, but systems for processing them are not yet installed. Current methods of storing water quality data make access to them difficult for the scientific community and general public alike, and hindering the flow of data to decision makers. These "hidden data" have lead to duplication of efforts and studies on water quality issues by various institutions or interested parties .

The reporting of water quality data is the duty of the Committee for Environmental Protection which is required to submit to the parliament each January water quality findings as part of annual report Until recently it has been quite diffficult for the CEP to collect all the data on the quality of the environment generated by the different institutions, even though it is required by Article 33 of the Albanian Environmental Law:

In these circumstances, it has not been possible to coordinate monitoring efforts which has created difficulties for the CEP in in fulfilling its reporting obligations. To correct this situation, the Albanian government issued a decision (No. 541) on September 25,1995. Article 6 of this edict mandated that several responsible ministries, institutions, officials, and others entities submit monitored data each January to the CEP.

According to the Article 34 of the Environmental Law, the above designated institutions are also obliged to make the infommation they own accessible to the general public, but until the present, they have failed to comply with this rule. The normal format for reporting are standard yearbooks or reports. The most regular scientific publications have been issued by the Institute of Hydrometeorology including the biannual *Journal of Hydrology*. Other forms of publication — booklets, newsletters, specialized reports on various specific issues, environmental campaigns on TV and other media — are quite rare, often produced only when an intemational organization funds or requires them, e.g., the *Albanian Environmental Strategy Report* (World Bank, 1993), *Reports on the Results of Coastal Areas Management Program (CAMP) for Albania* (UNEP, 1996). The frequency and dissemination of these reports depends on the requirements of the respective projects.

4.3 The Relevance of Environmental and Water Information for Decision Making

There are two main conditions necessary for making environmental and water information relevant to decision makers. First, the infommation should adapted to the type of decision to be taken at various levels, e.g., the project level, for environmental auditing, budget and planning, or for reporting on the general state of the environment. Second, the information should match the type of decision maker, that is, whether the decision-maker is someone in the a private sector or in the public sector, e.g., the CEP.

There is general dissatisfaction among the chief governmental institutions with the quality and relevance of the environmental information available from the CEP. Within individual Albanian ministries and other government entities, established channels for the flow of information from providers to users exists. These institutions have their own sources for most types of environmental information which they use for their own internal policy decisions. For example, the Ministry of Mining, Industry, and Energy has created the following internal structures through which necessary information is transmitted throughout its own units.

(DIAGRAM 1 Goes here)

Consequently, in the absence of a rational system for an inter-governmental exchange of infomation, difficulties arise when information is needed by other ministries and government agences. The work of decision makers is, thus, seriously hampered. There are no quality or relevancy checks on information that does pass from one agency to another. Nor is there a central coordinating unit such as a National Statistical Office that could collect, process, and manage information for all government and private sector units ensuring that the best and most relevant information reaches the decision makers who need it in a timely fashion.

5.0 Conclusions

1. At present, water data and information in Albania is very difftcult to collect and share because they are scattered among many many ministries, agencies, and institutes, and much of the data are still treated as being secret. It is virtually impossible forf the general public to access this information.

2. In general, data related to water issues are considered by individual specialists and scientific institutions as private preserves and their delivery is conditional upon payments of money. Even the flow of infommation between governmental agencies is often subject ot the same conditions.

3. An improved water database system will allow better management of the nation's water resources, lead to more rational and efficient policy choices such as how to improve the water supply, the treatment of urban and industrial wast water and where best to discharge it.

4. Improvement of current situation of data issues will require:

a) establishment of computerized data storage systems.

b) hard-copy data need to be computerized

c) data nomenclature and definitions need to be standardized

d) ametadata system that describes the content, quality, nature, and other characteristics of data should be employed

e) a combination of centralized and distributed database networks

f) Extensive use of the Internet and World Wide Web for data sharing g

Although the advantages of computerized data storage and retrieval systems are obvious, it is very important for developing countries to conduct a careful cost-benefit analysis before implementing such systems. The diagram 2 shows factors that must be considered in order to make the best choices:

5. The following general recommendations are offered for the improvement of reporting and the dissemination of data and information:

a) the format and frequency of dissemination should be determined during the design phase of water mangagement systems

b) reports should be aimed particular constituencies

c) reports should be formatted in conformity with the requirements of public or private sector decision makers or of the general public

d) graphs, diagrams, and tables should be an integral part of the reports, especially when they are addressed to the general public

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Abstract

Albania is the richest country in water resources per capita in the Central and Eastern Europe but until now only 1% per year of those resources are withdrawn for different purposes (drinking water, irrigation and drainage, mining and industry etc.). Management of waters is greatly connected to the collection, processing and distribution of data related to water resources available, their uses and level of pollution. Until recently the information on quantity and quality of waters has been the responsibility of several scientific institutions (Institute of Hydrometeorology, Research institute of Chemical Technology, Institute of Public Health, etc.) and of several governmental agencies (Committee of Environmental Protection, Ministry of Public Health, Ministry of Food and Agriculture etc.). Data produced from the aforementioned entities are difficult to be accessed by the general public and even by the scientific community, hindering their flow to the tables of decision makers. Also in many cases seems that decision makers are not satisfied with the quality of information relevant to particular policy question. In 1996 is approved by the Albanian Parliament the Water Law which recognizes the National Water Council (NWC) the highest decision making body responsible for the administration and management of water resources in Albania. Strengthening of the NWC will turn it to a focal point for the network of water data. This paper gives some recommendations for institutional strengthening and establishment of a better data storage and disseminating system. In addition, involvement of Albania in several international projects (e.g. Coastal Monitoring Area Program in the frame of MED POL Project etc.) requires the application of Quality Assurance Quality Control (QA/QC) procedures in order to make possible generating data relevant to international standards and at the same time facilitating their flow to the interested parties.

1. General data on water quality and water recourses in Albania

1.1 Introduction

Albania is a small country covering 28,748 km square along the eastern coast of Ionian and Adriatic seas. It has a population of 3,2 million inhabitants . 25% of the territory is land, 35 % forest, 15% pasture and 4% is covered by lakes. The mountainous part of the country covers 2/3 of the territory. Albania has a 476 km long coastline. Along this coastline a small plain with a maximum width of 60 km covers the western part of the country. Agriculture and forestry probably contribute to more than 55% of the GDP. The rest is made up of general industry, food production, heavy industry, oil and mining, the energy sector and other activities.

Albania has the most per capita water resources in the Central and Eastern Europe with 3,08 thousand cubic meters/capita or expressed as specific discharge is 28,1 l/sxkm (almost the same as Switzerland). The hydrographic basin of Albania covers a surface of 43305 km^2 and includes 8 big rivers, about 150 small catchments with a surface of more than 50 km^2 and the lakes of Shkodra, Ohrid and Prespa. A great number of small lakes also exist including the 82 lakes of Dumre, the 12 Lakes of Lura, the Lakes of Allamani, Gramozi and Klenije. There are also more than 150 springs with a discharge over 120 l/s (BCEOM, 1995). Until recently only 1% per year of water resources are withdrawn for different purposes (drinking water, industrial water, irrigation etc.).
In the whole country only two plants for water treatment exist: in Durres (Pjeshkeza plant, on the Erzen River), and Tirana (Brari, on the Tirana river) built some fifty years ago. Both plants have a treatment capacity of 35 liters/second, while in Tirana the average flow is ranging between 1450 and 2100 liters/second and in Durres is about 720 liter/second. Drinking water disinfection is done manually with hypochlorite, but lack of

hypochlorite has contributed to a deterioration of drinking water quality throughout the country.

1.2 Pollution of rivers

Rivers are subject to both point and non-point sources of pollution. Non point sources of pollution are mainly due to agricultural activities. Pesticides and fertilizers have been used intensively in Albanian agriculture in order to increase the productivity in conditions of limited arable land. Besides agricultural activities, a major contribution to their pollution are discharges from different industries (point sources of pollution). The Kiri, Tirana, Shkumbini, Gjanica and Dunavec rivers receive the greatest impact on their water quality from these discharges as a result of many industrial facilities and several cites located on their banks or near to them. Several characteristics of discharge from some main industrial activities in the country are presented at Appendix 1 and 2. After 1991, due to the radical political changes in Albania, many industries interrupted their activities. Because of these circumstances the deterioration of rivers has been stopped and maybe their conditions have improved. However, research must be done to confirm this.

1.3 Pollution of coastline waters

Both point and non-point sources contribute to the pollution of these waters. UNEP distributed a set of questionnaires to different Albanian authorities at the end of 1994 in order to make an inventory of land based sources of pollution for four coastal Districts: Durres , Lezha, Saranda, Vlora. The questionnaires concerned : (a) liquid domestic discharges; (b) industrial discharges containing selected substances listed in Annexes I and II of the land based sources protocol in the frame of MED POL program;

(c) industrial discharges of petroleum hydrocarbons, including sub-questionnaires on discharges from oil-refineries and reception facilities respectively. These questionnaires were returned in early 1995. The obtained results are tabulated and graphed in Appendix 2. These areas are chosen because of their highest possible impact on coastal waters (including estuaries) through industrial discharges or agricultural activities. According to the results of the survey the main findings are:

- Discharges from municipalities and industry take place off the immediate coastline. Outfall submarine structures are lacking.
- No treatment facilities exist for both sewage and industrial waste water
- No analytical data on the constituents of the waste water are reported
- Mainly untreated industrial water is mixed with sewage water aggravating the pollution at the points of discharge.
- Untreated wastewaters are mainly discharged into the sea (see Graph 2, Appendix 2).

1.4 Existing surface water monitoring efforts

Surface waters (mainly rivers) are assessed through time in Albania for hydrometric parameters (since 1948), hydrochemical parameters (since 1966), for several pollutants (since 1984) and for estuarine pollution (since 1993). There are 100 hydrometric stations in rivers and lakes which study the spatial and time distribution and other characteristics of water resources. There are two categories of stations: class A and class B. In class A stations four kind of observations are made: water level (H), discharge (Q), sedimentation (S) and water temperature (T) . From some of them water samples for chemical analyses (C) are taken. In class B stations generally two kind of observations are made: water level/discharges and sedimentation/water temperature.

Since 1966 rivers and lakes are assessed for hydrochemical parameters. Analysis are done for pH, Ca, Mg, Na, K, HCO_3, CO_3, Cl^-, SO_4^{2-}, NO_2^-, NO_3^-, SiO_2, P_2O_5, Fe. They are measured at 45 stations with a frequency of more than 5 samples/year. Samples are generally taken at the hydrometric sampling stations. Since 1984, starting with ten stations than enlarging their number to 31 in 1988, rivers have been assessed for their pollution measuring pH, O_2, BOD, COD, NO_2^-, NO_3^-, NH_4, P_2O_5, SiO_2, Zn, Cr, Mn, Fe. The frequency of sampling has been twice per year. The Tirana and Shkumbini rivers, because of the great amount of discharges they receive from industries, are aimed to be sampled once per month. In general the measurements have been irregular, especially during the '90s (see BCEOM, 1996).

Between the Albanian Government as contracting party to the Convention for the Protection of the Mediterranean Sea against Pollution and its related Protocols and UNEP as the Secretariat to the Convention, have been established the agreement on the National Monitoring Programme for Albania. Since 1992, in the frame of the Pollution Monitoring and Research Programme (MED POL), Albania has started a monitoring program (the first one) for estuarine, bathing areas and pollution sources (industrial and urban discharges, agricultural activities).

The Albanian MED POL National Monitoring Program includes 73 stations of sampling. Twenty-four of them are located at the main estuarine areas and nine cover sources of pollution while the remaining forty are located at bathing areas. The estuarine sampling network is presented by the map in Appendix 3.

In the three years of the ongoing project (since 1993) only one set of results has been produced (during 1994). UNEP published the following results in its "Report on results of Coastal Areas Management Program (CAMP) for Albania" in May 1996:

TABLE 1: AVERAGE VALUES FOR SOME CHEMICAL POLLUTANTS*

Index (mg/l)								
Location	O2	NBO	LST	NO2	NH4	NO3	PO4	P total
Lezha	6.95	0.85	8.4	0.002	none	none	none	none
Durres	7.05	0.39	4.2	none	none	none	none	none
Lushnja	7.30	1.05	6.4	0.001	none	0.002	none	none
Fier	8.32	0.37	10.0	0.005	none	0.060	none	none
Vlora	8.02	0.50	6.0	0.004	none	0.006	none	none
Saranda	7.04	1.48	1.0	0.001	none	0.092	none	none

TABLE 2: AVERAGE VALUES OF THE HEAVY METALS OF THE MARINE SEDIMENTS*

Index (mg/kg dry weight)									
Location	Hg	Cd	Pb	Cu	Cr	Zn	Ni	Mn	Fe
Lezha	0.070	0.136	11.4	255.1	401.1	134.9	310.7	975	61.2
Durres	0.129	0.445	29.3	100.7	263.0	65.9	189.9	614	24.2
Lushnja	0.079	0.251	14.9	63.1	283.0	95.4	376.0	470.0	57.8
Fier	0.053	0.186	14.5	31.6	298.0	122.0	303.0	499.0	44.5
Vlora	0.773	-	-	33.6	314.0	47.6	-	512.0	35.1
Saranda	0.041	0.272	-	47.1	215.0	108.0	216.0	410.0	33.3

*Source: UNEP (1996)

From these results some rough conclusions have been obtained by UNEP specialists. Judging on the results of table 1 they state that the estuaries are not influenced by the discharges of different communal sources. Also judging from the results obtained in table 2 they state that the levels of heavy metals in the majority of samples are comparable with values in other less polluted areas of the Central Adriatic (see Report on the Results of CAMP in Albania, 1996).

The above conclusions explain roughly only the water quality situation in those areas because:

a) Water quality trends can not be detected through this monitoring program as it is designed for background monitoring. This choice is justifiable as general data on the quality of these waters were lacking.

b) Only one set of data has been produced out of three planned. In such conditions water quality situation and trends are impossible to be determined (even the produced results are not complete).

c) A lack of institutional co-ordination and legislative requirements has hindered the full implementation of this monitoring program.

d) Like other undertaken monitoring efforts in Albania, this program lacks clearly defined monitoring objectives.

e) A designed plan for effectively communicating monitoring findings to the predefined audience is also lacking.

2. Present water uses in Albania

The main water uses in Albania are for drinking water supply, mining and industry, irrigation and drainage, hydropower and other non-consumptive uses (tourism/recreation, aquatic life/fishery, flood mitigation)

2.1 Drinking water supply

Drinking water supply is a national priority because this service is directly connected to the whole population and it needs improvement in future. Drinking water supply is responsibility of the Ministry of Public Works, Territory Adjucement and Tourism (MPWTAT). In the main urban areas 80% of the population is connected to the network of water distribution, but this service can be used only a few hours a day. The pipes are made of steel and cast iron and they are installed some 20 or 30 years ago. The lack of maintenance and preventive protection has favored their severe corrosion. In general the sources of drinking water are of good quality but the tap water may be contaminated through the conducts of chemical and bacteriological agents in the soil. There is a lack of information concerning rural water supply. 1995 - UN Human Development Report on Albania states that only 5% of the rural population have access to in-house connection. Also, according to the same report, 98% of the rural population rely on safe water near their homes for their use which is piped or extracted from shallow wells where water is of good quality.

2.2 Mining and Industry water uses and discharges

Mining and Industry have been very important users of water resources in the last 30 years. Since 1991, due to the transition period, mining and heavy industry activities have decreased. At the same time the quantity of untreated water discharged into the environment is diminished but the effects caused for a long time of activity are evident especially in the large urban areas (Tirana, Fier, Korca, Durres). The main sources of pollution for surface and ground water are the extraction of chromium (near Drini and Mati river), copper extraction (near Drini, Mati and Seman river), oil extraction (near Vjosa river), chemical industry (fertilizer, paints, oil refinement etc.), metallurgic industry, paper industry, textile and leather industry etc. Some figures about the discharges of aforementioned industries are presented at the Appendix 1. The information concerning the quality and quantity of water used by industries and mining activities is poor and almost lacking.

2.3 Irrigation and drainage

As Albania is an agricultural country (around 55% of GDP comes from agricultural activities), it is paid a great attention to irrigation and drainage works since the beginning of this century. The rate of investments carried out between 1950 and 1975 drastically increased the irrigation capacity. The following table summarizes some figures from 1993:

TABLE 3: LAND RESOURCES*

Agricultural land			*Irrigation capability*	
Thousand ha	as % of land area	persons/ha	Total in thousands ha	as % of agricultural land ratio
1993	1993	1993	1993	1993
7.4	7.1	6	6.6	89.3
6.3	7.3	8	1.2	18.2
33.1	26.7	11	14.5	43.8
17.7	15.6	3	13.2	74.6

*Source: UNDP, (1996)

The Albanian specialists estimate that as a result of the socials upheavals following the falling of communism in 1991, the irrigation systems were severely damaged on 144000 ha and the drainage systems on 15300 ha. In addition, according to some other rough estimations, the present diversion satisfy only 25% of the irrigation needs. The improvement of the irrigation and drainage system is an imperative duty in order to better satisfy population food supply and the requirements for food processing and export activities.

2.4 Hydropower

Large resources in surface waters and high river bed slopes have favored the Albanian large potential for hydropower. The current installed capacity reaches 1446 MW, the

annual production capacity is 5220 Gkh and the storage water capacity reaches around $4x10^9$ m^3. There are 12 Hydropower plants located on Dini river (3), on Mati river (2), on Erzeni river (1), on Bogova river (1), on Osumi river (1), on Shushica river (1), on Bistrica river (2) and on Devolli river (1 - under construction). The Drini cascade in North of Albania has the greatest contribution (350 MW or 93%) to the total energy production. The dams at the hydropower plants are mainly designed for hydropower generation. The first multipurpose dam will be on Devolli river which will help irrigation in the plain of Semani. Except hydropower, other non-consumptive uses of water in Albania relate to aquatic life/fishery, tourism and recreation, navigation and flood mitigation. They cause limitations on both consumptive uses and upstream discharges because of the water quality they require.

3. Institutional aspects of the existing water data information system

3.1 Environmental administration

The environmental information systems including water data information system in Albania are in the state of evolution since 1991. In that year is created Committee of Environmental Protection (CEP), based in the Ministry of Public Health and under the Council of the Ministers. It is the central body for all the environmental issues. Besides other areas it organizes the monitoring of pollution and in cooperation with National Water Council defines steps for the protection of water resources. Another duty of CEP

is to approve the legal standards and criteria for the solid, liquid and hazardous discharges in the waters. Within the CEP exist three Directorates, for water and air quality, natural resources protection and hazardous management, and national information system and impact assessment.

In 1996 is approved by the Albanian parliament the Water Law which recognizes the National Water Council as the highest decision making body responsible for the administration and management of water resources in Albania. The Council is appointed by the Council of Ministers and the Prime Minister is its chairman. The main duties of the Water Council are the followings:

- management of National Water Strategy and the preparation of drainage basins water resources plans.
- issuing of regulations that make possible the implementation of Water Law and National Water Strategy.
- studies and research concerning the efficient use of water resources in Albania
- organization of the administration responsible for the implementation of water law

The approval of water law has lead to some uncertainties about future responsibility for some activities, for example the publication of regular reports on water quality.. Except CEP there are several ministries which are dealing with different issues related to water management e.g. Ministry of Public Works, Territory Adjucement and Tourism, Ministry

of Food and Agriculture, Ministry of Transport, Ministry of Industry and Energy and Ministry of Public Health.

Currently, due to shifting towards the market economy, the CEP and other governmental offices related to water issues are loosing some of their control and management functions. It means that a considerable amount of data do not emerge as a result of central control of the information; instead many data must be requested from individuals or private enterprises.

The question of financing water information is partly related to the implementation of the Polluter-Pays-Principle (PPP) which states that the costs of pollution monitoring in waters should be beard by the polluter. In case the polluters could not be identified (e.g. non-point sources of pollution), water data gathering should publicly financed. The regulations that support PPP are not strongly implemented in Albania. This situation does not favor the application of a modern system of fines and taxes against the polluters.

3.2 Role of institutes

In Albania do exist several scientific institutions that cooperate with CEP and other ministries concerning management of waters. In course of the privatization of the economy the institutes are now mainly semi-independent organizations which are administratively and financially separate.

The main institutions concerning water issues in Albania are:

- The Institute of Hydrometeorology of the Academy of Science. It does conduct research and monitoring concerning water quality.
- The Institute of Public Health investigates and controls at the national and local levels the quality of water for domestic supply and proposes regulations and guidelines concerning the levels of toxic substances reaching those waters.
- The Faculty of Natural sciences conducts research on water treatment and also is involved in several projects dealing with water quality assessment in some areas of Albania.
- The Research Institute of Chemical Technology carries out inventories on urban and industrial water discharges throughout the whole country.

The most dynamic and well-equipped institutes are attempting to establish themselves as the focal points related to international information networks. It has been the risk that the projects could be allocated due to the attractiveness to the external funders rather than to the real needs of the country. But due to the coordination of the CEP and after issuing of the Water Law this risk seems to be minimized

4. Technical aspects of the existing water data information system

4.1 Selection of analytical methods, Quality Assurance/Quality Control (QA/QC) procedures

In Albania (and not only there), the availability of the analytical equipment has influenced the choice of the analytical methods of analysing. Albanian specialists have always been eager to use the most up-to-date analytical techniques in order to ensure high reliability of data. The Institute of Hydrometerology, the University of Tirana, and the Institute of Chemical Technology are among the institutions which now seem to be well-equipped due to governmental or international (UNEP, UNESCO) funding. This situation has created the preconditions for the selection of the optimal analytical methods based on their sensitivity, specificity, response-time, ease of operation, ease of calibration, cost and reliability and accuracy. Until recently there has been no evidence of a general application of the QA/QC procedures. Under the frame of MED POL projects, the laboratories involved are assessed for their accuracy and precision only through intercalibration exercises.

4.2 Data storage, reporting and disseminating issues

Until now water parameters measured are stored in hardcopy forms. A computerised system of storage is under development. Only in specific cases are data put into computerized files, but systems for processing them are not installed yet . This situation is explained by the lack of funding allocated for such computerized systems. Current methods of storing the water quality data make them difficult to be accessed by the general public or even by the scientific community hindering their "flow" to the tables of

decision makers. These "hidden data" can lead to situations of redundant duplicate studies by various institutions or interested parties on water quality issues.

Reporting of data concerning water quality is the duty of the Committee of the Environment. Water quality findings should be included at the annual report submitted in January to the Albanian Parliament. Until recently it has been quite difficult for the Committee of the Environment to collect all the data generated by different institutions regarding the quality of the environment, even while this is required by Article 33 of the Albanian Environmental Law:

Article 33: The information on the environmental situation shall be received and stored by the Committee of Environmental Protection and its regional agencies, by other ministries and central institutions, and councils of communes, municipalities or districts according to the relevant territorial units.
Natural and legal persons shall be obliged to forward information on the environmental situation within two week from the date the request is received. The information must be forwarded to the competent authorities in accordance with procedures defined by the Minister of Health and Environmental Protection.

As a result of this situation, the undertaken monitoring efforts have been uncoordinated and have created difficulties for the Committee in disseminating its regular reports. To overcome this situation on 25th of September 1995, the Albanian government issued a decision (no. 541) which puts several responsibilities on ministries, institutions, juridical and natural persons about monitoring the environment. Due to Article 6 of this decision these institutions are annually obliged to submit their monitoring results in January to the Environmental Committee.

According to the Article 34 of the Environmental Law, the above pointed institutions are obliged to make the information they own accessible to the general public. Until now this approach has not functioned as reports for the general public are not produced.
The usual formats of reporting are standard yearbooks or reports. The most regular scientific publications have been issued from the Institute of Hydrometeorology including the biannual Journal of Hydrology. Other forms of publication (booklets, newsletters, specialized reports on different specific issues, environmental campaigns in media or TV) are quite rare, often only produced when an International Organization funds or requires them, e.g. the Albanian Environmental Strategy Report (World Bank - 1993), Reports on results of Coastal Areas Management Program (CAMP) for Albania (UNEP - 1996). Frequency of dissemination for these reports depends on the requirements of the respective projects.

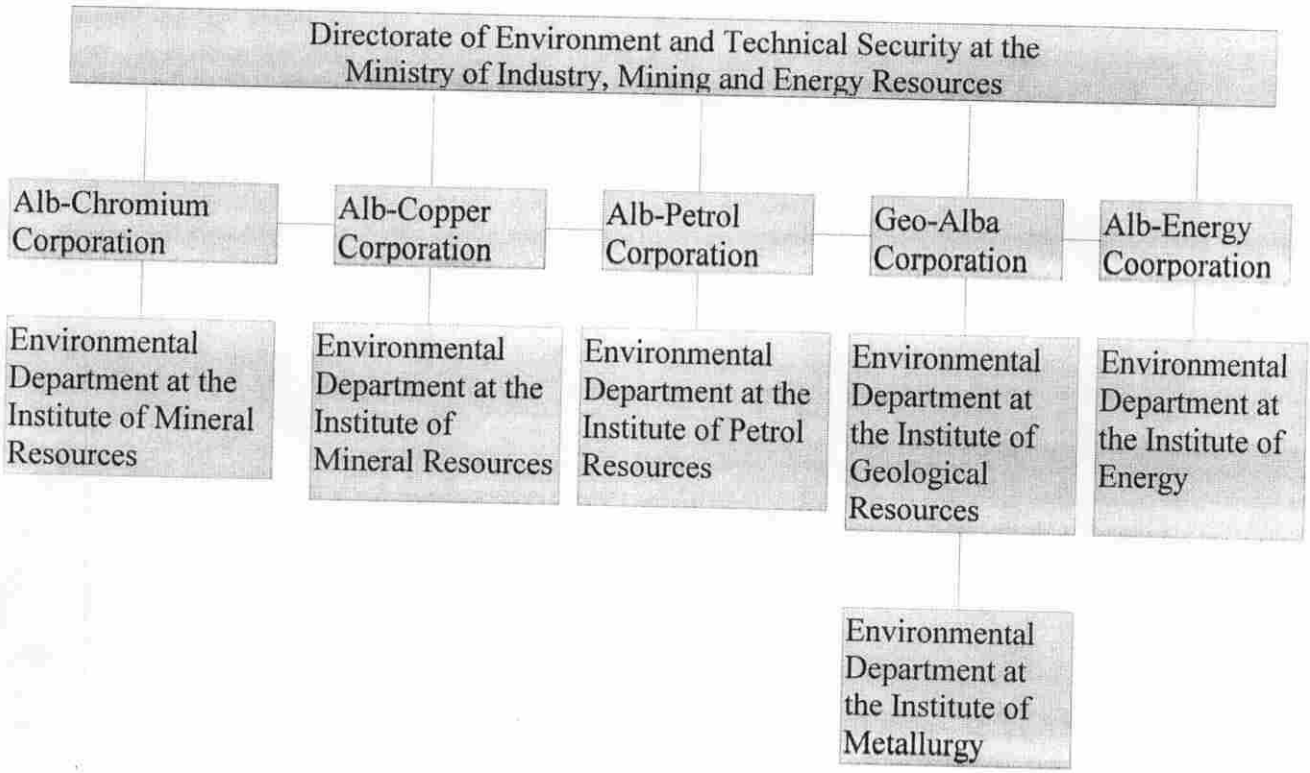
4.3 Relevance of environmental and water information for decision making

There are two main conditions to be fulfilled for the environmental and water information in order to be relevant to decision makers. First, the information should adopt to the type of decision taken, at the project level, for environmental auditing, within budget and planning decision or for reporting on the general state of the environment. Second, the information should match the type of decision maker, i.e. the decision-maker is a private one (e.g. from industry, business), or whether he is a public decision-maker (e.g. from the Committee of Environmental Protection).

In general exists dissatisfaction expressed from the main governmental institutions about the quality and relevance of environmental information available from the Committee of

Environmental Protection. In Albania within a single ministry or other governmental unit do exist established channels for information flow from the providers to the users. These institutions have their own sources for the most types of environmental information which they use for its own policy decisions. For example Ministry of Mining, Industry and Energy has created the following own structures which enable passing of the necessary information throughout all its own sectors.

DIAGRAM 1: ENVIRONMENTAL NETWORK ESTABLISHED AT THE MINISTRY OF MINING, INDUSTRY AND ENERGY RESOURCES



The difficulties raise when the information should flow within different ministries or other governmental institutions. In such case it is not clear whether decision makers are

satisfied with the quality of information relevant to particular policy questions. There is not evidence for existing of a coordination unit e.g. a Statistical Office which could collect and manage the information from different sources in order to match it to the needs of various types of decision makers.

5. Conclusions

1. At present the information related to different water uses in Albania is very difficult to be collected because it is located at several scientific institutions, ministries and many times it is still considered state secret. It is almost impossible for the general public to access this information. In general data related to water issues are considered by the specialists and scientific institutions like a private business and their delivery is conditioned to payment. Even the flow of information between governmental agencies is many time result of the aforementioned mentality. Improvement of water database distribution systems will support a better management of water resources in order to have the right choices between different sources of water, where to discharge wastewater, the improvement of water supply efficiency and the treatment of urban and industrial wastewater.

2. Improvement of current situation of data storage will need:

a) Establishment of computerized data storage systems.

b) Data archived in hard-copy forms needs to become available in computerized-readable form to make them widely accessible and usable.

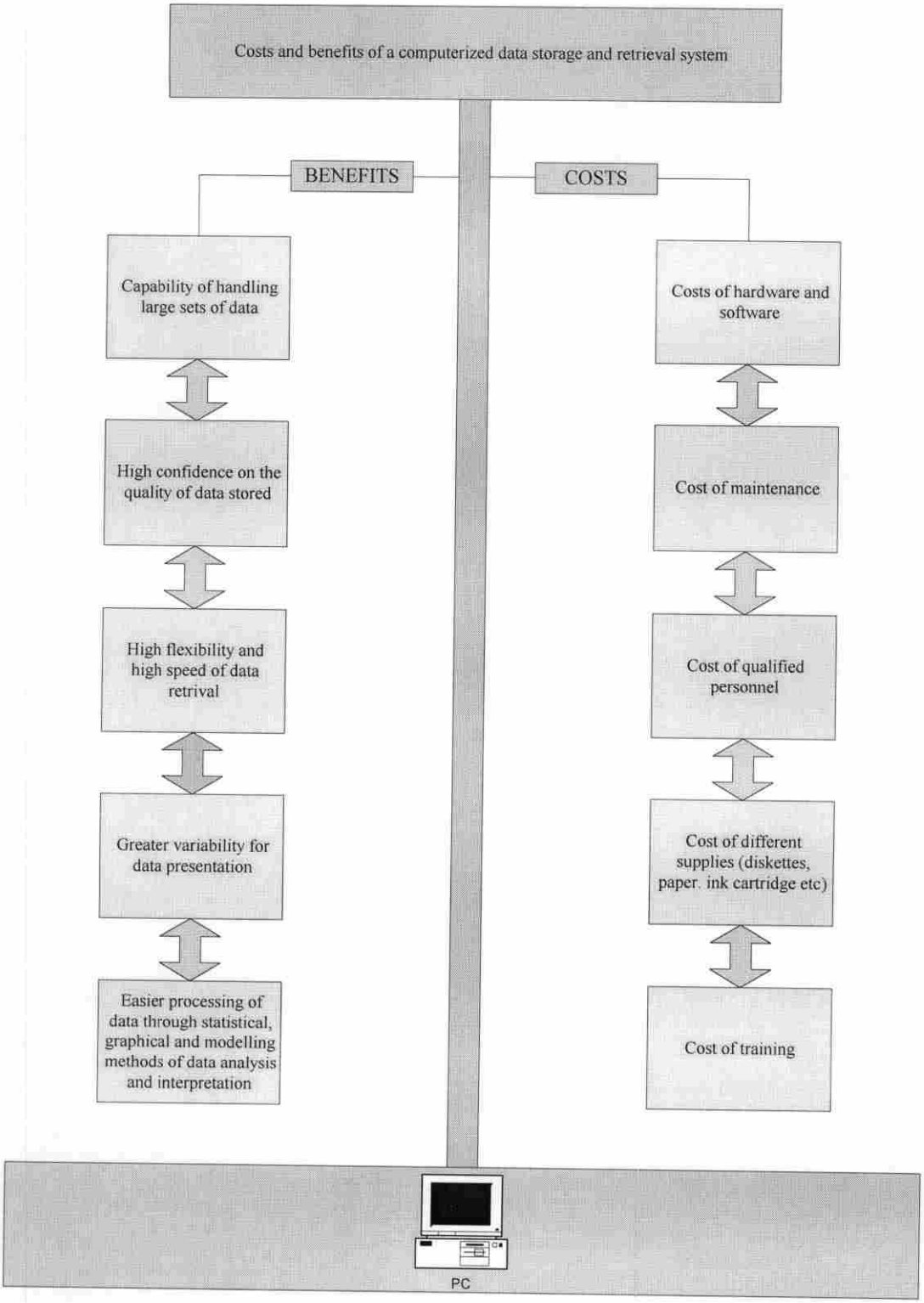
c) To make data available and understandable, common data-element names and definitions need to be developed. Besides data values, it is recommended to use a metadata system that describes the content, quality, conditions and other characteristics of data.

d) Centralized water quality databases are a necessity for Albania. At the same time networked distributed databases need to be developed.

e) Sharing of data will be facilitated by the establishment of standard export formats and query systems such as INTERNET, INTRANET etc.

f) Although the advantages of a computerized data storage and retrieval system seem to be clear, a careful cost-benefit analysis should be performed before proceeding to implement such systems. This process is very important for developing countries. The following diagram shows the main points which should be considered in order to have the best choice:

DIAGRAM 2: EVALUATION OF COSTS AND BENEFITS FOR CHOOSING A COMPUTERIZED DATA STORAGE AND RETRIEVAL SYSTEM*



*Source: Based on the information presented from UNESCO/WHO/UNEP, 1992.

3. To improve the situation on reporting and dissemination of information the following general recommendations can be followed:

a) During the design of water management systems, determination of format and frequency of dissemination should be taken into consideration.

b) The reports should be published for various types of reader depending on their level in the constituency.

c) From the beginning it must be recognized that the reports require specified formats for decision makers (private or governmental) or for the general public.

d) Graphs, diagrams and tables should be an integral part of the reports, especially when they are addressed to the general public.

APPENDICES

APPENDIX 1:

SOME CHEMICAL POLLUTANTS DISCHARGED FROM MAIN INDUSTRIAL SOURCES IN ALBANIA*

Main constituents	Some major industrial activities					
	Pesticides factory in Durres	Chemical factory in Tirana	Leather processing factory in Korca	Textile compound in Tirana	Oil processing compound in Ballsh	Effluent standards (mg/l)
SO_4^{2-}		15 g/l				500
F^-						251
As						0.5
Cl^-	30 gr/l					1500
TSS			1200-2800 mg/l	78 - 515 mg/l		100
Total chromium			14 - 16.2 mg/l			3
Cr^{6+}	23.8 gr/l					0.5
S^-	15 gr/l					5
Phenol						40
Formaldehyde		7 mg/l				2
Benzene		2 mg/l				
BOD_5			1000-1600 mg O_2/l	19 - 315 mg O_2/l		15
COD			4900-7200 mg O_2/l	200-1000 mg O2/l		50
Discharge	Adriatic sea	Tirana river	Dunavec river	Tirana river	Gjanica river	
Quantity		$2m^3$/hr	$500m^3$/day	3500 m^3/day	3000000 t/yr	

*Source of data: BCEOM (1996), *National Water Strategy for Albania - Inception Report,* BCEOM, p. 35.

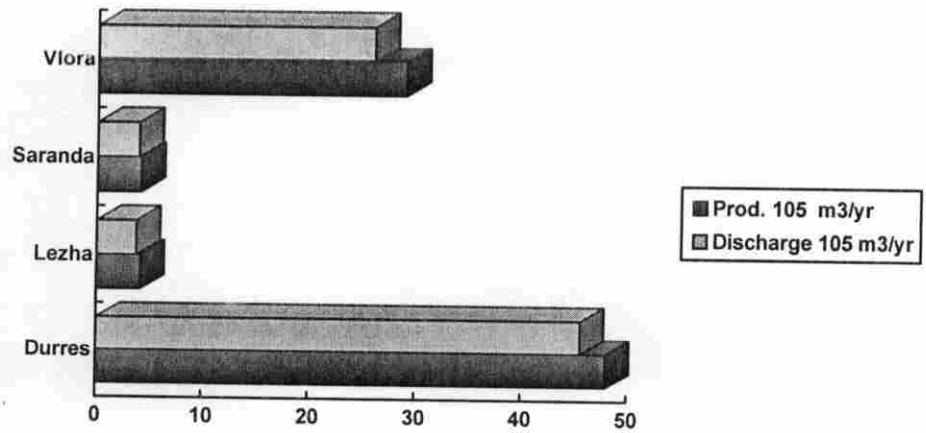
APPENDIX 2:

RESULTS OF SOME SURVEYS IN ALBANIA*

TABLE 1 - POPULATION, WATER CONSUMPTION AND WASTEWATER QUANTITY

District	Population		Water consumption in m^3/month		Wastewater		
	Normal	Seasonal increase	Normal	Peak	Production 10^6 m^3/yr	Discharge into sea or river 10^6m^3/yr	%
Durres	75000	35000	500000	500000	4.80	4.56	95.00
Lezha	12000	2500	40000	40000	0.41	0.37	90.24
Saranda	12000	3500	40000	40000	0.41	0.39	95.12
Vlora	75000	25000	300000	300000	2.90	2.60	89.66
Total	174000	66000	880000	880000	8.52	7.92	92.96

District	Prod. 10^5 m3/yr	Discharge 10^5 m3/yr
Durres	48	45.6
Lezha	4.1	3.7
Saranda	4.1	3.9
Vlora	29	26

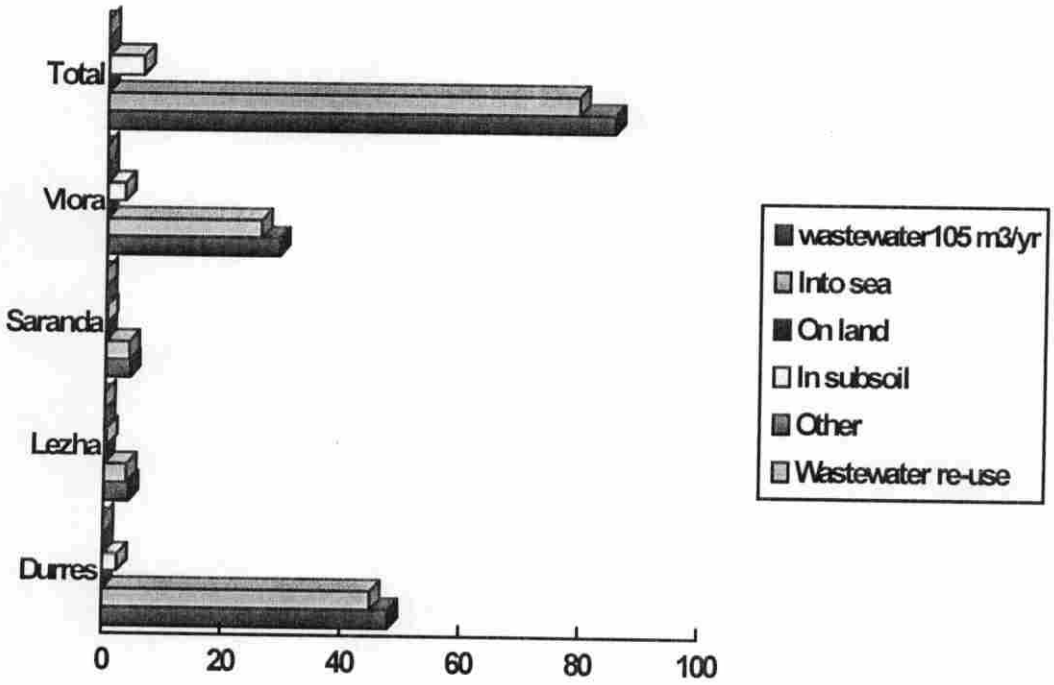


Graph 1: Ration between total wastewater production and total amount discharge per year for four districts

TABLE 2 - MUNICIPAL WASTEWATER DEPOSITION

District	Total urban wastewater x 10^6 m^3/yr	Estimated annual discharge in million m3/year				Wastewater re-use
		Into sea (municipal sewage system)	On land	In subsoil	Other	
Durres	4.80	4.56	0	0.24	0	0
Lezha	0.41	0.37	0	0.04	0	0
Saranda	0.41	0.39	0	0.02	0	0
Vlora	2.90	2.60	0	0.30	0	0
Total	8.52	7.92	0	0.60	0	0

District	wastewater 10^5 m^3/yr	Into sea	On land	In subsoil	Other	Wastewater re-use
Durres	48.0	45	0	2.4	0	0
Lezha	4.1	3.7	0	0.4	0	0
Saranda	4.1	3.9	0	0.2	0	0
Vlora	29	26	0	3	0	0
Total	85.2	79.2	0	6	0	0



Graph 2: Municipal wastewater methods of discharge per district surveyed

TABLE 3 - TYPES OF WASTEWATER FROM INDUSTRY AND METHOD OF DISCHARGE
GLOBAL AMOUNTS FOR WHOLE COASTAL ZONE SURVEYED

Type of wastewater						
	Process wastewater		Cooling water		Domestic water	
Method of discharge	Untreated m3/year	Treated m3/year	Untreated m3/yr	Treated m3/yr	Untreated m3/yr	Treated m3/yr
Municipal system	13050000	0	N/A	0	8880000	0
River	900000	0	N/A	0	0	0
On shore	1200000	0	N/A	0	0	0
Other	0	0	N/A	0	0	0
Total	15150000	0	N/A	0	8800000	0

TABLE 4: TYPES OF WASTE WATER FROM INDUSTRY AND METHOD OF DISCHARGE AMOUNTS PER DISTRICT SURVEYED

District	Type of industry	Total waste water	Domestic waste water	Process wastewater discharge		
		in m^3/day	municipal system	municipal system	river	on shore
Durres	16, 28,33.45	40000	17000	23000	0	0
Lezha	22	7800	1300	3500	3000	0
Saranda	10	2300	1300	1000	0	0
Vlora	19,25,34, 47	30000	10000	16000	0	4000
Total		80100	29600	43500	3000	4000

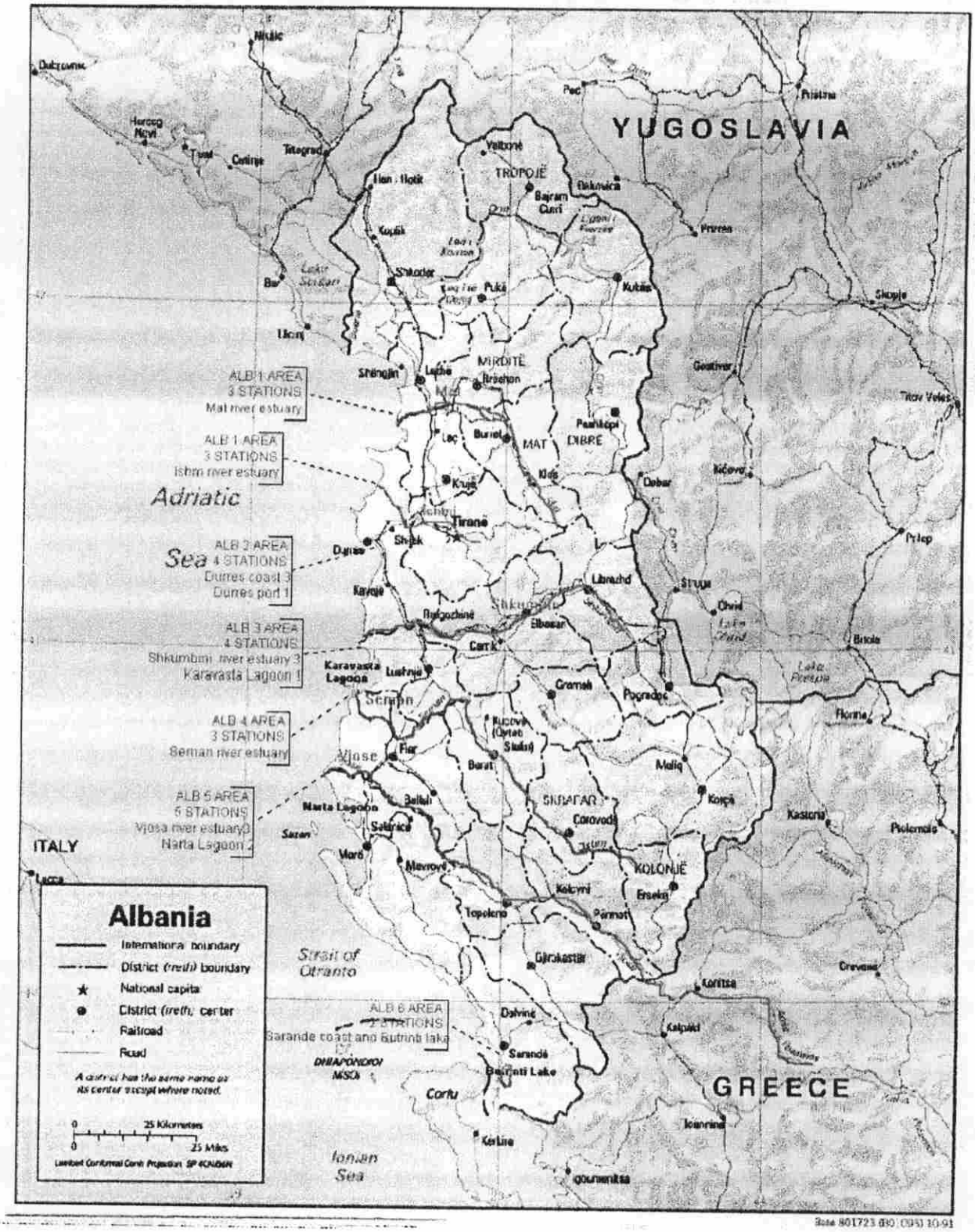
Note: Industry types:

10 Bakery
16 Brewery, distillery, pharmaceutical
19 Tannery
22 Pulp and Paper
25 Acid
28 Naval Stores
33 Pesticides
34 Plastics and Resins
45 Rubber
47 Cement

*Source of the tables: UNEP, (1996). *Report on the results of Coastal Areas Management Program (CAMP) in Albania*. UNEP-Athens p.45.

APPENDIX 3

MAP OF ALBANIAN ESTUARINE AND COASTAL MONITORING LOCATIONS



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