Environmental Monitoring Strategy

Technical Report

Знаеш ли колку си зелен?

Strengthening the Capacity of the Ministry for Environment and Physical Planning
An EU funded project managed by the European Agency for Reconstruction

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Technical Report:

Environmental Monitoring Strategy

Project result 15

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List ofAbbreviations

AMS	Air Monitoring Station
AQFD	Air Quality Framework Directive [
BAT	Best Available Techniques
BCR	Community Bureau of Reference
BMUNR	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit / (German) Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
CARDS	Community Assistance for Reconstruction, Development and Stabilization
CBD	Convention on Biological Diversity
CIHP	City (or Regional) Institute for Health Protection
CMEPP	Strengthening the Capacity of the Ministry of Environment and Physical Planning (project)
CRMs	certified reference material(s)
DGENV	European Commission, General Direction Ent
DQO	Data Quality Objectives
EAWAG	Swiss Federal Institute for Environmental Science and Technology
EC	European Community
EEA	European Environment Agency
EIONET	European Environment Information and Observation Network
EMEP	European Monitoring and Evaluation Program Note: The EMEP has been established in the framework of the UN/ECE Convention on Long-Range Transboundary Air Pollution
EMEP-CCC	Chemical Coordinating Centre
EN	European Standard
ETC-AQ	European Topic Centre on Air Quality
ETCIW	European Topic Centre on Inland Waters
EU	European Union
FFHD	Directive on the Conservation of Natural Habitats and of Wild Fauna and Flora
GEF	Global Environment Facility

HBI	Hydrobiological Institute, Ohrid
HMA	Hydrometeorological Administration
IEC	Internationa Electrotechnical Commission
ICP	International Cooperative Program
IPPCD	Directive on Integrated Pollution Prevention and Control [1996/61/EC]
ISO	International Organization for Standardization
ISO/FDIS	Final draft international standard
JICA	Japan International Cooperation Agency
LRTAP	long-range transmission of air pollutants
MAFWE	Ministry of Agriculture, Forestry and Water Economy
MEIC	Macedonian Environmental Information Centre
MEPP	Ministry of Environment and Physical Planning
NEAP	National Environmental Action Plan
NEAP	National Environmental Action Plan
NILU	Norwegian Institute for Air Research
OECD	Organisation for Economic Co-operation and Development
PHARE	Technical Assistance Program for EU Accession countries
PSU	Project Support Unit
QA	quality assurance
QC	Quality Control
RAMSAR	Convention on Wetlands
RIHP	Republic Institute for Health Protection
RIZA	(Dutch) Institute for Inland Water Management and Waste Water Treatment
RIMSYS	River Monitoring System Project
SDC	Swiss Agency for Development and Cooperation
SOP	Standard Operating Procedures
TSP	total suspended particulates
UBA	Umweltbundesamt / (German) Federal Environmental Agency
UN	United Nations

UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
VDI	Verein deutscher Ingenieure / Association of German Engineers
WFD	Water Framework Directive [2000/60/EC]
WHO	World Health Organization

List of Technical Abbreviations

BOD5	Biochemical oxygen demand within 5 days
BTX	Benzene, toluene, xylene
COD	Chemical oxygen demand
HCH	Hexachlorocyclohexane
Na, Mg, Ca, Cl K	Sodium, magnesium, calcium, chloride, potassium
NH4	Ammonium
NO, NO2, Nox	Nitrogen monoxide, nitrogen dioxide
O3	Ozone
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PCT	Polychlorinated terphenyls
PM10 / PM2,5 / PM1	Suspended particulate matter < 10 / 2,5 / 1 µm
SO2	Sulphur dioxide
T	Temperature
TOC	Total organic carbon
TSP	Total Suspended Particulates
VOC	Volatile organic compounds

Chapter 1 Executive Summary

Environmental monitoring has probably been the most advanced area of environmental protection in the country. FYR Macedonia has a long tradition of monitoring environmental quality, particularly in the fields of water and ambient air. As a consequence, monitoring had received high priority attention by the national authorities and donors since the first National Environmental Action Plan of 1996. In this period, some of the participating national institutions have been strengthened significantly in terms of equipment by various donor programmes established under participation of European, Swiss, French and Japanese organisations. Beneficiary bodies have been strengthened. The MEPP itself through the ongoing provision of air quality monitoring stations, the HMA through the delivery of analytical equipment, the ongoing provision or upgrading of water monitoring stations as well as the extension of the analytical laboratory, and the Central Laboratory through the delivery of analytical equipment.

But even though significant resources have been invested in monitoring in terms of equipment, the sector has had problems with actual performance of monitoring and with institutional issues. The monitoring responsibilities in FYR Macedonia have been a result of the existing legislation, institutional heritage and recent changes in the public administration and its related bodies (public enterprises, agencies, offices etc.). Structural changes in the FYR Macedonia in the recent decade have given rise to overlaps concerning the responsibilities for monitoring and the activities of different institutions. Many activities are regulated by laws that are more than 30 years old. The monitoring responsibilities have varied for different environmental media. Since there was no overall national strategy or institution that integrated and coordinated the monitoring activities, the responsibilities and activities have been split between different Ministries or other institutions. Still, there were altogether 69 persons working professionally on monitoring, which is almost the same number as the whole Ministry of Environment and Physical Planning apart from the monitoring staff.

There has been a lack of coordination concerning the activities related to environmental monitoring at the state level and the tasks related to environmental monitoring, data processing, presentation and dissemination haven't been clearly defined and organised.

The national legislation and its provisions entailed many of the encountered problems:

Institutional issues. There are overlaps regarding the institutional responsibilities and activities for some of the environmental media and gaps for others. Many of the institutional obligations were based on a completely different organisation of the public administration and its related bodies.

Specification of the monitoring methods and parameters. On many occasions, the applied methods and measured parameters were not in accordance with the national needs and appropriate international standards and recommendations. In some cases (e.g. drinking water, air) international recommendations have been adopted that were not covered by the existing legislation.

Reporting obligations. According to the Law on Environment and Nature Protection, the MEPP has had the legal obligation to report to national

and international institutions and bodies as well as to the public. However, many existing laws define different obligations.

Major overlaps exist in the monitoring of air quality (HMA, MEPP-MEIC, RIHP/CIHPs) and surface water quality (HMA, RIHP/CIHPs). Conversely, obligations have been greatly divided in the fields of lake water monitoring (Hydrobiological Institute), air emission control (Central Laboratory) and wastewater control (Central Laboratory).

Both the Central Laboratory and the Air Monitoring Service within the MEIC have been integral parts of the MEPP. The Air Monitoring Service has been physically located inside the MEPP, while the Central Laboratory has been located on the outskirts of Skopje. In contrast, the HMA and the RIHP possessed a relative degree of independence from their parent bodies, the MAFWE and the Ministry of Health. Both bodies have managed their own budgets –however insufficient these may have been - and the RIHP has introduced a cost-calculation system enabling it to charge for its services.

The coordination between separate environmental monitoring networks for the same environmental media has been weak in several aspects: quality and type of the measuring equipment, distribution of the measurements points, common measurement standards and methodologies and the frequency of sampling. The monitoring goals and objectives have also been different.

The Terms of Reference for the project included the objective **to streamline the MEPP's tasks in the field of environmental monitoring** which the Environmental Monitoring Strategy was intended to fulfill. During the course of the project this objective was extended to include the **design of a monitoring system that would comply with the EU requirements regarding monitoring and reporting**.

The development of the Environmental Monitoring Strategy was based on the Assessment of Current Monitoring Systems and Assessment of Current Data Management Systems that was developed after the inception phase of the project. After the Assessment, a gap and deficiency analysis of environmental monitoring and data management systems was conducted at the request of the beneficiary, in conjunction with the transposition of EU monitoring requirements in the environmental legislation drafted in the framework of Component 1. The analysis demonstrated that there is no single EU model for a monitoring system – these systems vary significantly between the EU members states in terms of their density and institutional logic, but are all in compliance with the EU legislation. The differences can be attributed to the institutional history of the monitoring services, the geographic characteristics of the countries and most of all past and present environmental policy objectives.

Based on EU member states experience, it is not possible to present a meaningful vision of a 'final design' of any monitoring system or programme at the present stage, as such a blueprint would necessarily be founded upon an unacceptable number of assumptions regarding future developments and policies. A strategy for environmental monitoring must, however, specify those *activities* which need to be pursued in order to develop effective and cost-efficient environmental monitoring.

Monitoring is an essential task in the framework of environmental management and a tool on the way to improve the quality of the environment. Monitoring results shall lay the basis for future decisions and, after all, contribute to improve the state of the environment. Monitoring, in order to be cost-efficient, has to be firmly linked to an environmental goal. But in FYR Macedonia, monitoring was sometimes seen as a goal itself, not least because of the international

requirements for reporting. This has lead to significant investment into environmental monitoring by the donors and the country. This investment will only be justified in future, if it has the desired impact on the environmental improvement in the country and if the equipment provided by the donors is utilised to its full capacity.

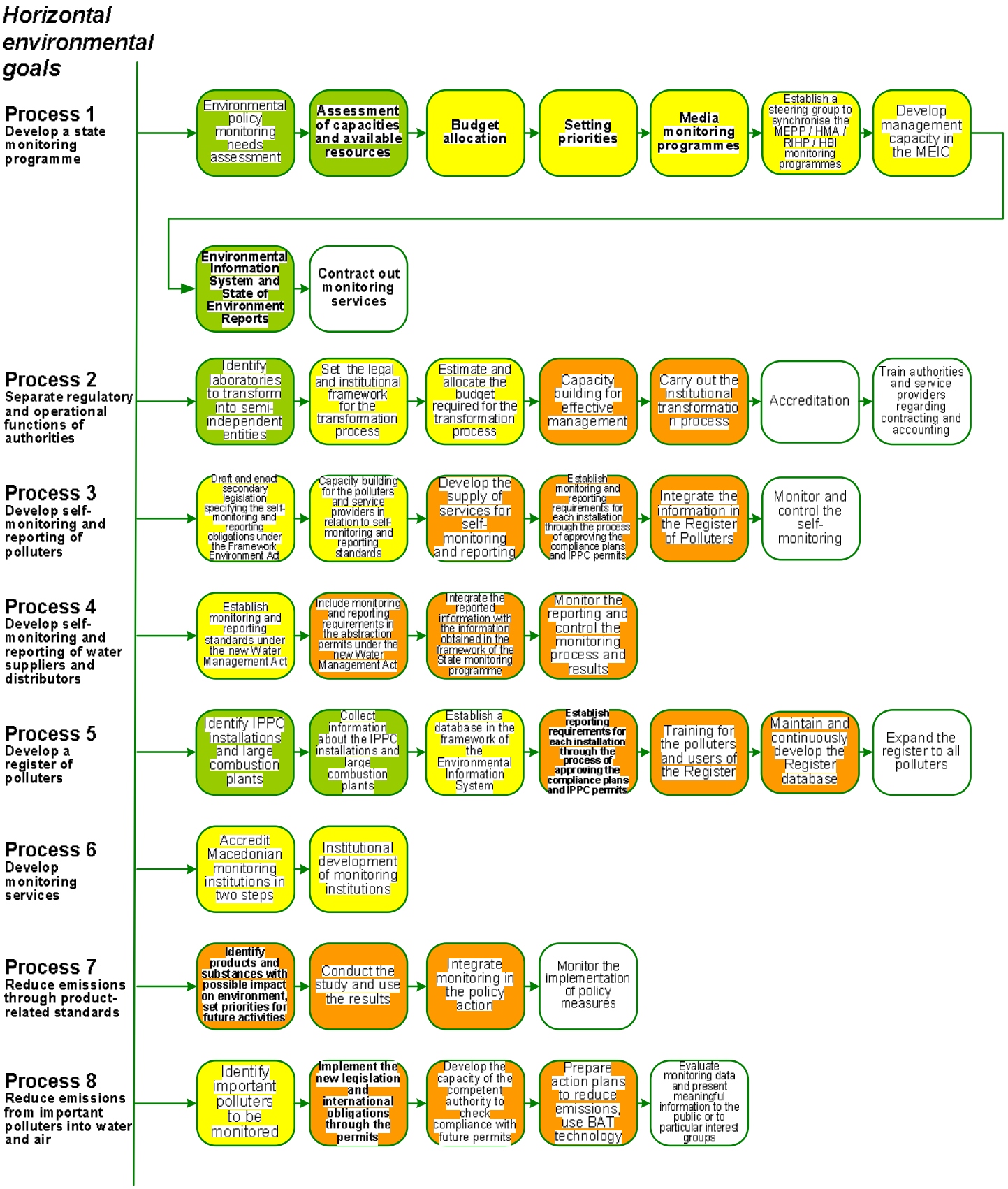
Monitoring activities have many times been seen just as the technical measurements of ambient quality, which forms just as part of the internationally accepted DPSIR (driving forces, pressures, state, impact, response) model that is also used by the European Environmental Agency. This is why the Strategy is also dealing with the self-monitoring and reporting requirements, as well as with the establishment of the environmental information system that is elaborated in more detail in the Environmental Data Management Strategy.

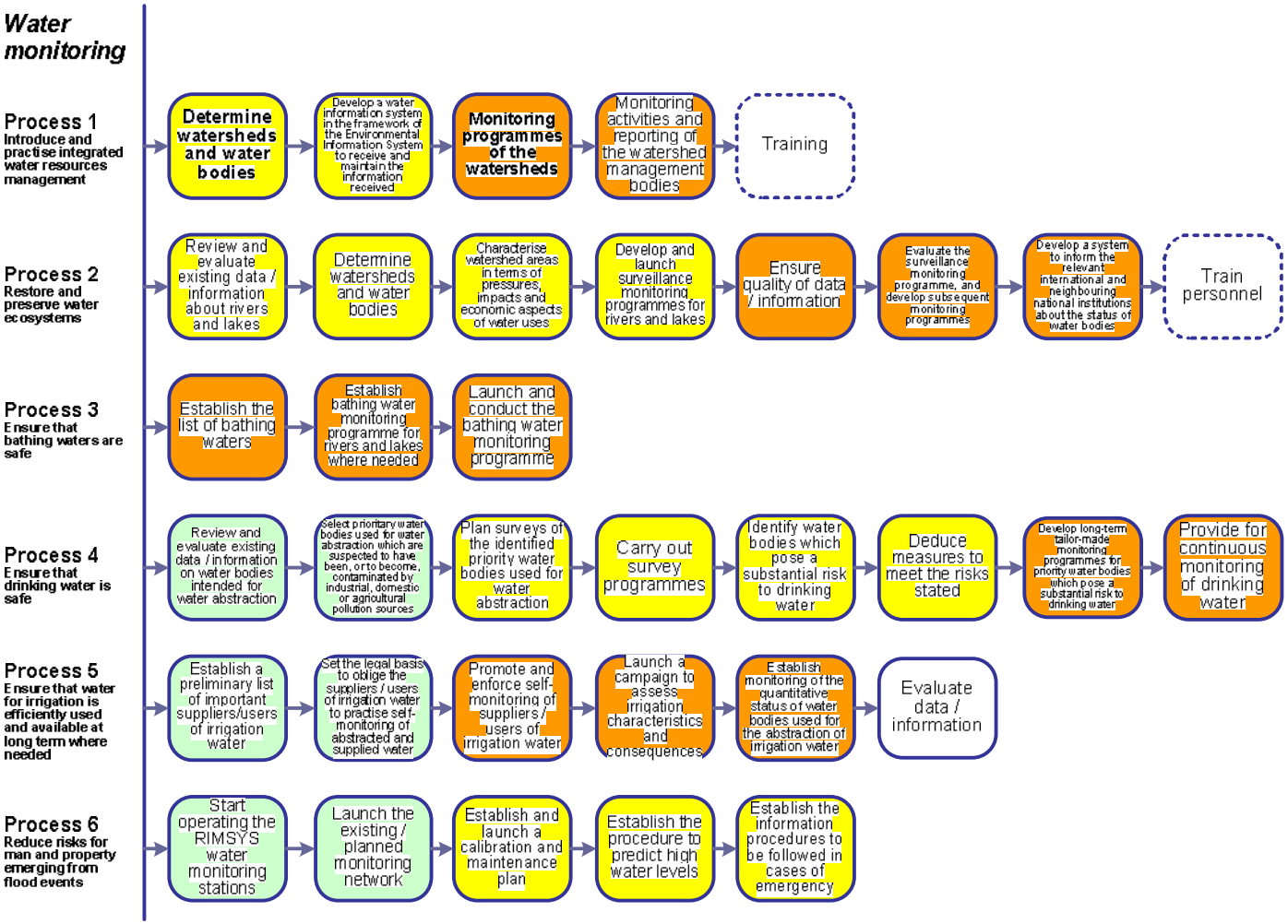
Based on this approach the Environmental Monitoring Strategy is presented here, that is not an implementation plan wherein the final system design would be defined in detail. It highlights the concept of goal-oriented monitoring. It presents planning schemes to develop the monitoring of environmental quality (water, air, biosphere, noise, nature, soil) and the monitoring of emissions, in particular wastewater, exhaust air and waste. It puts monitoring into the respective framework of legal, institutional and technical issues, and provides guidance to references. However, the core pieces of the present Strategy are modules which specify important environmental goals for all environmental media. The purposes and objectives of monitoring are identified, aiming at the specified goal, and, the required activities are deduced.

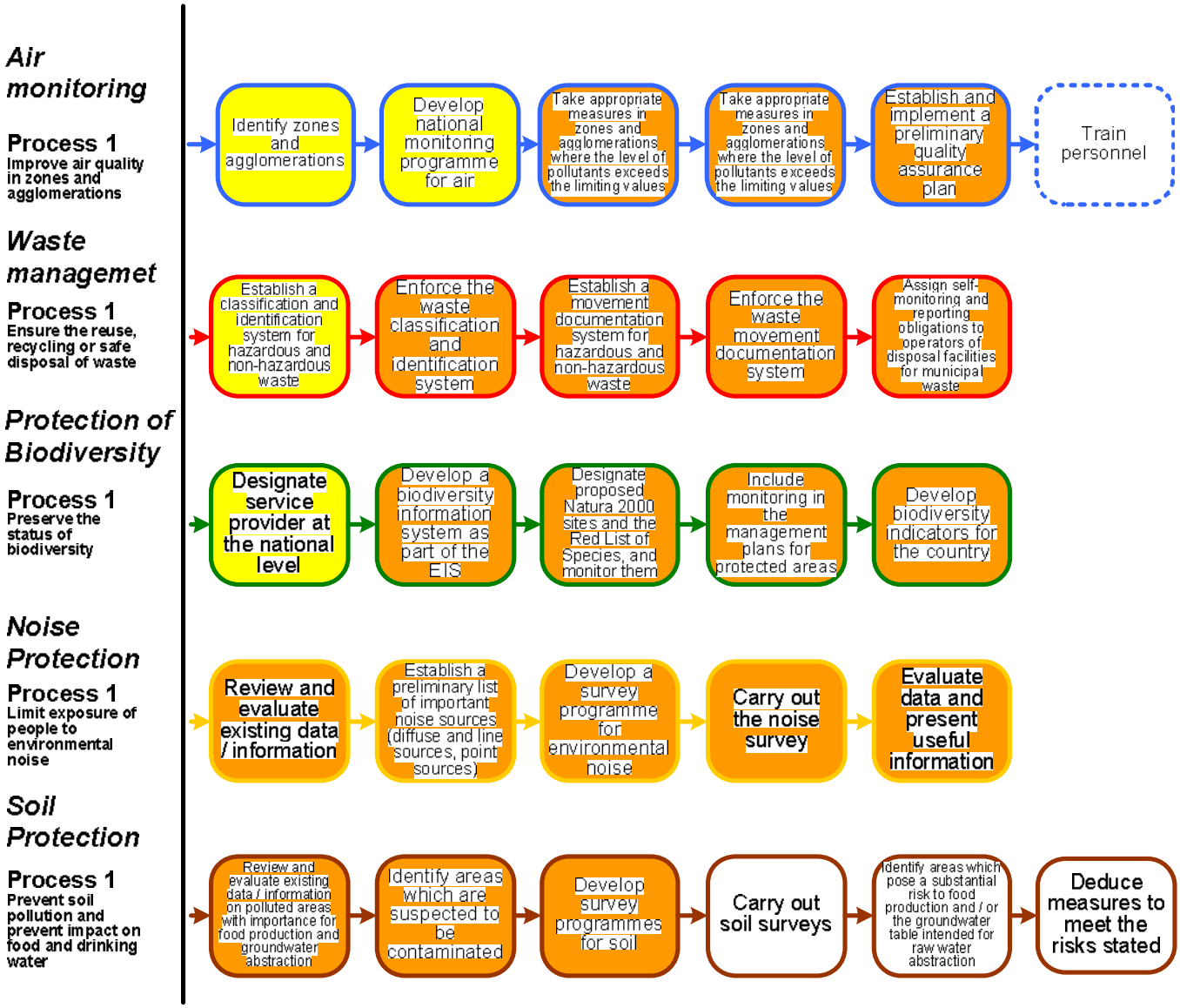
The priority processes of the Strategy and their modules are presented in the three graphs below.

Graph 1: Priority processes linked to horizontal environmental goals

(green: already accomplished, yellow: short term action starting in 2005, orange: mid term action starting in 2006 – 2008, white: action starting after 2008)


Horizontal environmental goals
Process 1
Develop a state monitoring programme
Environmental policy monitoring needs assessment
Assessment of capacities and available resources
Budget allocation
Setting priorities
Media monitoring programmes
Establish a steering group to synchronise the MEPP / HMA / RIHP / HBI monitoring programmes
Develop management capacity in the MEIC
Environmental Information System and State of Environment Reports
Contract out monitoring services
Process 2
Separate regulatory and operational functions of authorities
Identify laboratories to transform into semi-independent entities
Set the legal and institutional framework for the transformation process
Estimate and allocate the budget required for the transformation process
Capacity building for effective management
Carry out the institutional transformation process
Accreditation
Train authorities and service providers regarding contracting and accounting
Process 3
Develop self-monitoring and reporting of polluters
Draft and enact secondary legislation specifying the self-monitoring and reporting obligations under the Framework Environment Act
Capacity building for the polluters and service providers in relation to self-monitoring and reporting standards
Develop the supply of services for self-monitoring and reporting
Establish monitoring and reporting requirements for each installation through the process of approving the compliance plans and IPPC permits
Integrate the information in the Register of Polluters
Monitor and control the self-monitoring
Process 4
Develop self-monitoring and reporting of water suppliers and distributors
Establish monitoring and reporting standards under the new Water Management Act
Include monitoring and reporting requirements in the abstraction permits under the new Water Management Act
Integrate the reported information with the information obtained in the framework of the State monitoring programme
Monitor the reporting and control the monitoring process and results
Process 5
Develop a register of polluters
Identify IPPC installations and large combustion plants
Collect information about the IPPC installations and large combustion plants
Establish a database in the framework of the Environmental Information System
Establish reporting requirements for each installation through the process of approving the compliance plans and IPPC permits
Training for the polluters and users of the Register
Maintain and continuously develop the Register database
Expand the register to all polluters
Process 6
Develop monitoring services
Accredit Macedonian monitoring institutions in two steps
Institutional development of monitoring institutions
Process 7
Reduce emissions through product-related standards
Identify products and substances with possible impact on environment, set priorities for future activities
Conduct the study and use the results
Integrate monitoring in the policy action
Monitor the implementation of policy measures
Process 8
Reduce emissions from important polluters into water and air
Identify important polluters to be monitored
Implement the new legislation and international obligations through the permits
Develop the capacity of the competent authority to check compliance with future permits
Prepare action plans to reduce emissions, use BAT technology
Evaluate monitoring data and present meaningful information to the public or to particular interest groups


Water monitoring
Process 1
Introduce and practise integrated water resources management
Determine watersheds and water bodies
Develop a water information system in the framework of the Environmental Information System to receive and maintain the information received
Monitoring programmes of the watersheds
Monitoring activities and reporting of the watershed management bodies
Training
Process 2
Restore and preserve water ecosystems
Review and evaluate existing data / information about rivers and lakes
Determine watersheds and water bodies
Characterise watershed areas in terms of pressures, impacts and economic aspects of water uses
Develop and launch surveillance monitoring programmes for rivers and lakes
Ensure quality of data / information
Evaluate the surveillance monitoring programme, and develop subsequent monitoring programmes
Develop a system to inform the relevant international and neighbouring national institutions about the status of water bodies
Train personnel
Process 3
Ensure that bathing waters are safe
Establish the list of bathing waters
Establish bathing water monitoring programme for rivers and lakes where needed
Launch and conduct the bathing water monitoring programme
Process 4
Ensure that drinking water is safe
Review and evaluate existing data / information on water bodies intended for water abstraction
Select prioritary water bodies used for water abstraction which are suspected to have been, or to become, contaminated by industrial, domestic or agricultural pollution sources
Plan surveys of the identified priority water bodies used for water abstraction
Carry out survey programmes
Identify water bodies which pose a substantial risk to drinking water
Deduce measures to meet the risks stated
Develop long-term tailor-made monitoring programmes for priority water bodies which pose a substantial risk to drinking water
Provide for continuous monitoring of drinking water
Process 5
Ensure that water for irrigation is efficiently used and available at long term where needed
Establish a preliminary list of important suppliers/users of irrigation water
Set the legal basis to oblige the suppliers / users of irrigation water to practise self-monitoring of abstracted and supplied water
Promote and enforce self-monitoring of suppliers / users of irrigation water
Launch a campaign to assess irrigation characteristics and consequences
Establish monitoring of the quantitative status of water bodies used for the abstraction of irrigation water
Evaluate data / information
Process 6
Reduce risks for man and property emerging from flood events
Start operating the RIMSYS water monitoring stations
Launch the existing / planned monitoring network
Establish and launch a calibration and maintenance plan
Establish the procedure to predict high water levels
Establish the information procedures to be followed in cases of emergency



The Environmental Monitoring Strategy is closely linked with the Environmental Data Management Strategy. The two strategies are mutually supportive and mutually dependent and will thus require simultaneous implementation. Certain elements are referred to in both documents and this is illustrative of the close links between the two strategies.

The specified processes which will have to be performed in order to establish or develop monitoring have technical, financial, institutional, organisational or other implications for those institutions involved. The implications are stated in the framework of the respective processes. Some of the implications are:

1. The future national monitoring programmes shall be based on a realistic assessment of the available financial and personnel resources, and also on a transparent procedure to set priorities accordingly. Monitoring shall in any case provide useful information which is needed to develop the environmental policy.
2. Future monitoring activities shall adapt to the existing or expected capacities in terms of budget and staff. It is by far preferable to perform a

complete monitoring cycle with a limited scope, providing useful information, than to start with a comprehensive monitoring programmes, which gets stuck in the middle.

3. The approach to focus on specific environmental problems, even with a very limited scope, appears to be without reasonable alternative. Severe environmental problems exist in the fields of surface water, groundwater, air and waste. However, the number of environmental issues which have to be addressed within these fields exceeds the currently available resources by far. Actions and interventions (which also imply monitoring activities) aiming to improve the environmental quality therefore have to be ranked according to what is socially accepted and the most beneficial on economic and environmental terms. The result of such a setting of priorities will be a limited number of (partly already existing) projects with clear environmental goals. Monitoring programmes shall be firmly linked to such goals.
4. Self-monitoring and reporting requirements will have to be enforced on polluters as well as water suppliers. Enforcement requires the authorities to issue legally sound and technically feasible permits.
5. Monitoring institutions shall develop in several ways. Firstly, it is proposed to merge the HMA water and air monitoring departments with the MEPP Central Laboratory and the MEIC Air Monitoring Division to form a strong centre of competence and to reduce frictions between the existing institutions. Secondly, the thus merged institution and other monitoring institutions shall be transformed in a long-term approach from fixed-budget operation to performance-based operation. Authorities and evolving service providers will need to develop contracting and accounting capabilities. Thirdly, monitoring institutions will have to establish quality systems and to aspire accreditation within a time frame of approximately 5 to 8 years. It is proposed to facilitate the accreditation process in a phased approach including a first phase, where institutions are accredited within the state of Macedonia, and a second phase based on accreditation in accordance with international standards.
6. Monitoring programmes carried out by different institutions will have to be synchronised in order to become cost-efficient, and to avoid a waste of resources. A steering committee composed of members of the respective institutions shall be put in charge.
7. Emission monitoring shall start with the large polluters, in particular IPPC installations and large combustion plants. Compliance plans, IPPC permits, self-monitoring and reporting requirements shall be negotiated with / imposed on large polluters. The polluters' register shall equally focus on large polluters for the time being. Most probably there will be a need to set priorities amongst the large polluters until the administrative and technical procedures have been settled.
8. Regarding air quality monitoring, it is seen as a challenge to operate the 14 installed / planned fixed automatic monitoring station with the existing personnel and financial resources. For a limited time period it may be necessary to focus on selected stations, or selected monitoring parameters. The preliminary assessment as demanded by the Air Quality Framework Directive still has to be accomplished.
9. The water resources management process is the most complex media-related process, as it includes a large number of specific issues according to the origin (rivers, lakes, groundwater) and uses (drinking water, tourism, irrigation, bathing …) of water. Moreover, the governing Water Framework Directive and the IPPC Directive lay the basis for new legal

concepts as there are goal-orientation and integrated approach, which are new for the authorities inside the EU as they are in Macedonia. It is expected that the established six water-related processes clarify the implications related to the required monitoring activities.

10. The data measured have to be comparable between all institutions involved in monitoring, and over the whole monitoring period which may strech to years and decades. Data comparability begins with the agreement upon the methods which will be applied in the upcoming monitoring programme, particularly amongst those institutions involved in monitoring. The methods have to be carefully selected. Monitoring on a legal basis mostly require European or international standard methods.
11. Quality Assurance programmes are to be launched within the monitoring institutions in order to provide for / prove the quality of monitoring data, and to prepare for future accreditation. First measures in this context shall be
    - the stepwise introduction of European and ISO standard methods,
    - the clear and unambiguous identification and documentation of the methods applied,
    - calibration plans to make sure that the results can be traced back to the reference standards,
    - the introduction of quality control charts for selected methods and parameters,
    - participation in inter-laboratory proficiency testing at the European scale.
12. Future international donations shall be examined in the light of whether they fit into the Macedonian environmental priority issues as established beforehand, rather than priorities being set through the donations granted. They shall, moreover, be examined with respect to their affordability regarding the future running costs to be expected.
13. It is expected that the revision of the legal framework for the environment through the CMEPP project which has by now yielded a number of conclusive law proposals (Law on Environment, Laws on Waters, Law on Waste Management, Law on Nature Protection) will solve many problems in this area, such as synchronisation within and between the responsible institutions and adoption of international standards.

At the moment, the budget resources dedicated to monitoring are barely sufficient to cover the salaries for the staff, but not for the material costs associated with regular performance of the monitoring activities. This leads to very low utilisation rates for the laboratories and certain equipment. There are two main approaches to solve this problem: one is to secure adequate budget funds to cover the full cost of monitoring services for the national monitoring programme and the second is to increase the demand for monitoring services on the market.

The short and mid term recommendations of the Monitoring Strategy have already been integrated in the Functional Analysis and Institutional Development Plan of the Ministry of the Environment and Physical Planning. Their implementation will largely depend on the approval of this plan by the government and the allocation of the resources required. Many of the recommendations are also supported by the new legal provisions, such as the requirements for self monitoring of the polluters.

But with the legal and budgetary framework set, the success of the Strategy will largely depend on the professional ambition and high quality work of the

providers of monitoring services. The following recommendations should help with the next steps:

Carry out initial characterisation: Based on the available information, the initial characterisation according to EU directives of air and water media should be carried out in the next years, leading to definition of zones and agglomerations for air and water bodies for waters. Cost effective future permanent monitoring programmes compliant with the EU requirements can be designed based on this characterisation, taking into account the state and the pressures on the environment.

Establishment of the budget programme: In order to secure long term environmental monitoring, a new budget programme should be established in 2005. This programme should initially cover the operation and maintenance of the existing monitoring networks for air and water that include equipment and monitoring stations provided by various donors. Some of these networks and laboratories are currently operated inside the Ministry and other by the Hydro-meteorological Administration and other organisations. Later the monitoring programme should extend also to other environmental media. The mid term objectives of the programme should be:

- Establishment and functioning of the national environmental monitoring networks
- Assurance of quality of monitoring services through accreditation, and capacity building for service providers
- Development of market based monitoring services

Outsourcing: In 2007/2008 the services currently provided inside the Ministry should be outsourced. From then on the staff and operational costs inside the Ministry will only be dedicated to planning of monitoring, contracting and supervision of service providers. The services could be provided by a merged HMA and the existing laboratory, by any other state institutions that may emerge in the process or by private or international service providers. The service providers will be required to obtain appropriate accreditation and will receive performance based contracts for services.

Donors should focus on performance not on equipment: The monitoring equipment that has already been supplied or is in the process of procurement by the various donors is sufficient to cover the needs of the country in the mid term. In the next years, the donor assistance in the field of monitoring should focus on improving the performance in using the equipment provided and on subsequent accreditation of the monitoring service providers.

Chapter 2 Introduction

2.1 WORKING GROUP 6 IN THE GENERAL CONTEXT OF THE PROJECT

The European Union (EU) has funded an 18 month project entitled 'Strengthening the Capacity of the Ministry of Environment and Physical Planning'. The goals of the project are: to adapt Macedonian environmental legislation to the Aquis Communautaire (the existing body of EU legislation); to raise environmental awareness; to improve communication; to develop environmental monitoring and data management; and to provide environmental training programmes.

The objectives of the project have been:

- To improve the quality of current environmental legislation and draft other subordinate acts which will supplement the Act on Environment, thereby supporting the Ministry's efforts to adapt its current legislation to the Acquis Communautaire
- To establish an adequate permit and enforcement structure
- To improve the level of functioning and efficiency of the MEPP and thus enhance the MEPP's overall performance
- To strengthen the Ministry's position vis-à-vis other Ministries
- To improve communication between stakeholders in the field of environmental management
- To reinforce institutions responsible for environmental-awareness raising
- To streamline the MEPP's tasks in the field of environmental monitoring

In order to achieve these objectives, the project has been organised in three components:

Component 1 has encompassed the approximation of legislation in four areas: horizontal legislation; water resources management, including wastewater issues; waste management, including hazardous waste management; and nature conservation. Accordingly, responsibility for work on these four areas has been assigned to four interdisciplinary and inter-ministerial Working Groups (WGs). The work of the four WGs has been allocated as follows:

WG1 'environmental horizontal legislation', including subgroup WG1/2 'the master plan on phasing out leaded petrol'
WG2 'water framework legislation'
WG3 'waste and hazardous waste legislation'
WG4 'nature conservation'

Component 2 has encompassed environmental awareness raising; improvement of environmental communication; environmental monitoring; and data management.

WG5 'awareness raising strategies and environmental communication'

WG6 'environmental monitoring and data management'

Component 3 has encompassed a variety of training and training-related activities arising from project components 1 and 2, and formal training interventions.

In the course of the project, the three components have produced the following results:

Overall

Result 0: The Project is managed, coordinated and implemented by the Project Management Office in Skopje

Component 1

Result 1: Draft framework Law on Environmental Protection produced, incorporating the general rules on EIA, SEA, IPPC. Access to public information made available

Result 2: Draft regulations on EIA/SEA made available

Result 3: Draft regulations on IPPC made available

Result 4: Draft regulations on access to environmental information and public participation in decision-making made available

Result 5: Recommendations for compliance with sectoral legislation made available

Result 6: Draft framework law on spatial planning made available

Result 7: Draft framework law for water management made available

Result 8: Draft framework law for waste management made available

Result 9: Draft regulations for hazardous waste management made available

Result 10: Draft framework law on nature protection made available

Result 11: Master Plan for phasing out leaded petrol made available

Component 2

Result 12: Short-term and Medium-term Environmental Awareness Strategy developed (2003-2006)

Result 13: Short-term strategies for improvement of public awareness implemented in 2003

Result 14: Horizontal and Vertical Environmental Communication Strategy developed

Result 15: Environmental Monitoring Strategy developed

Result 16: Environmental Data Management Strategy developed

Component 3

Result 17: Training Programmes designed and implemented

This report constitutes Result 15: Environmental Monitoring Strategy. This report has been produced in the framework of Working Group 6.

2.2 SCOPE OF WORK OF WORKING GROUP 6

The task assigned to Working group 6, under Component 2 of the project, was that of development of draft strategies for environmental monitoring and data management. In the course of the project it was further agreed that support to the institutional development of MEPP should be provided through the tendering of advice on the organizational restructuring of MEPP and on meeting the needs of human resources. This support was provided in close coordination with Component 1.

Working Group 6 was tasked to produce the following three project results:

Result 15: Environmental Monitoring Strategy is developed

Result 16: Environmental Data Management Strategy is developed

These three results have been realised through the adoption of two strategies - the Environmental Monitoring Strategy (this report)-, and the Environmental Data Management Strategy, two assessments – Assessment of Current Monitoring Systems and Assessment of Current Data Management Systems, Gap and Deficiency Analysis of Environmental Monitoring and Data Management Systems as well as through several supporting studies and documents related to the environmental monitoring and data management activities. By adopting this approach, environmental monitoring and data management have already been improved during the lifetime of the Project through cross-component activities involving representatives from a wide range of stakeholders from each Working Group. Moreover, this approach has benefited the development and finalisation of formal strategies formulated in the later stages of the project, thus taking into account the hands-on experience gained through activities already implemented.

2.3 WG MEMBERSHIP AND RULES OF PROCEDURE

The Working Groups were established as the main working methods of the project in order to ensure broad stakeholder participation and dialogue. Such broad participation and dialogue was seen as essential in ensuring that the development of a legal draft and strategies would correspond to the particular circumstances prevailing in Macedonia and that the results would later be implemented. Each Working Group consisted of a *core* group and a larger *advisory* group.

The objective assigned to the core group was that of performing the Project activities on a continuous basis in accordance with the Work Plan, i.e. the assembly of materials, the review of drafts, etc.

The composition of the core group has included staff members of the MEPP and representatives -as required-,from other governmental institutions. The core group has also included senior and junior experts, recruited both internationally and locally.

The objective assigned to the larger, advisory group within each Working Group was that of providing commentary and advice pertaining to the work of the core group.

The composition of the advisory group has included staff of the MEPP and other governmental institutions as well as representatives from non-governmental institutions and organisations. The Working Group members were nominated by the Project Management, the MEPP and other Ministries concerned, as well as by governmental institutions or other organizations. They were appointed with the official approval of the MEPP. The list of the members of the larger Working Group 6 is presented in Annex 3.

No remuneration has been given to members of Working Group 6 on the basis that these members served the Working Group in the capacity of official representatives of the respective institutions from which they were drawn. The reimbursement of travel expenses for those members travelling from outside of the city of Skopje has been granted by the Project, however, in cases where the institutions from which such members were drawn proved unable to bear the travel costs.

In accordance with the Rules of Procedure as presented in Annex 2, the core group has held meetings on a weekly basis, while meetings of the larger Working Group have been held per milestone of the project.

The composition of the secretariat of the Working Group has consisted of senior and junior technical experts employed by the Project. It has been the task of the secretariat to organize meetings of the core group and the larger Working Group: preparing agenda, producing minutes of meetings and ensuring communication within and between the core group and the advisory group. The secretariat has also been charged with responsibility for keeping the records and documentation of the Working Group. Minutes of all meetings have been drafted, finalised, and made available to the group members.

The Working Group has been assisted by international experts in accordance with their respective Terms of Reference and in line with the Project Work Plan and Schedules. International experts have provided advice based on their knowledge and experience of relevant communication, monitoring and data management techniques in EU member states and other accession candidate countries.

The language of everyday communication of the Working Group has been Macedonian, with translation provided in English for the international experts. Important documents that were not originally produced in English have been translated into Macedonian to the extent that translation resources have allowed. Working documents reflecting the progress of the core groups have been made available to the members of the larger group. The core group has presented a report on the progress of the project in each meeting with the larger group.

2.4 METHODOLOGY AND PROCESS

The development of the Environmental Monitoring Strategy has followed the general methodological approach of the Project in seeking the involvement of stakeholders. By this means, it is intended that these stakeholders will assume ownership of the strategy after the Project has been completed and that they will

ensure the implementation of the Project results. This approach reflected the following two main objectives, adopted in order to secure the quality of results:

- That the strategy should respond to the needs of the stakeholders based on up-to-date information about the situation in the environmental sector in the country
- That the implementation of the strategy should be made possible through genuine stakeholder commitments and input

To achieve these objectives, the development process of the Environmental Monitoring Strategy involved regular consultation inside and outside the core group; direct communication with stakeholders inside and outside the MEPP; and involvement of core group members in drafting of the strategy itself. Domestic and international experts supported this process by drafting the interim and result documents and by facilitating dialogue among the various participants in the process.

The Environmental Monitoring Strategy is closely linked with the Environmental Data Management Strategy. The two strategies are mutually supportive and mutually dependent and will thus require simultaneous implementation. Certain elements are referred to in both documents and this is illustrative of the close links between the two strategies

The preparation of the two Strategies was lead by Dr. Wolfgang Krinner, International Monitoring and Data Management Expert from the beginning of the project to April 2003. Mr. Krinner was then replaced by Dr. Ulrich Osberghaus, International Monitoring Expert, who worked between May and December 2003. An overview of the process of development of the Monitoring Strategy and of the methods employed in this process is provided in Table 1.

A detailed list of all meetings and workshops held in the course of the project is presented in Annex 3.

Table 1: Process of Development of the Environmental Monitoring Strategy and Environmental Data Management Strategy

Time	Main Activities	Methods employed
June – September 2002	Project inception: definition of scope and stakeholder groups	Consultation with stakeholders.
September 2002	Component 2 Strategy workshop.	Plenary and breakout group discussion of the approach.
September – December 2002	Preparation of the ToR for the Stakeholder.	International expert input.
October – December 2002	Mobilisation of international and local experts.	International expert input.
November 2002 – March 2003	Development of the two assessments: assessment of current	Interviews with stakeholders.

	monitoring systems and assessment of current data management systems.	
January 2003	First meeting of Working Group 6.	Presentation and discussion of main findings of the two assessments: assessment of current data management systems and assessment of current monitoring systems.
February - May 2003	Development of Gap and Deficiency Analysis of Environmental Monitoring and Data Management Systems.	International expert input.
February 2003	Second meeting of Working Group 6.	Presentation and discussion of the gap analysis
March - June 2003	Development of the environmental legislation in the field of monitoring and data management in the following sectors: horizontal legislation, and legislations for waters, nature conservation and waste and hazardous waste.	Coordination of local experts in Components 1 and 2.
May – June 2003	Working on the draft strategies for environmental monitoring.	International and local expert input
July 2003	Third meeting of Working Group 6.	Presentation and discussion of the framework approach to the strategy
July - October 2003	Draft strategy	International expert input
November 2003	Comments and improvement of the draft strategies for environmental monitoring and data management	Local experts input.
December 2003	Final report on Strategy for data management	Summary of results.
June 2004	Final report on Strategy for Environmnetal monitoring	Summary of results.
July 2004	Prepared project fishes for Air and Water monitoring resulting from the Strategy for environmental monitoring	Summary of results.

The following documents were produced in the process of the development of the ECS:

- Assessment of Current Data Management Systems
- Assessment of Current Monitoring Systems
- Gap and Deficiency Analysis of Environmental Monitoring and Data Management Systems
- Working Draft: Environmental Data Management Strategy
- Draft Environmental Data Management Strategy
- Working Draft: Environmental Monitoring Strategy
- Draft Environmental Monitoring Strategy
- Logical Framework tables and other texts from the workshops
- Minutes of meetings of the Working Group and Core Group

Chapter 3 Background

3.1 INTRODUCTION

Macedonia has a long tradition of monitoring environmental quality, particularly in the fields of water and ambient air. Monitoring of biosphere, waste, soil and noise are in the initial stages. The most important institutions involved in monitoring are the Ministry of Environment and Physical Planning (MEPP), the Hydometereological Administration (HMA), the Republic Institute for Health Protection (RIHP) and the corresponding regional bodies, the City Institutes for Health Protection (CIHPs).

In recent years, some of the participating national institutions have been strengthened significantly in terms of material by various donor programmes established under participation of European, Swiss, French and Japanese organisations. Beneficiary bodies, amongst others, have been the MEPP itself through the ongoing provision of air quality monitoring stations, the HMA through the delivery of analytical equipment, the ongoing provision or upgrading of water monitoring stations as well as the extension of the analytical laboratory, and the Central Laboratory through the delivery of analytical equipment.

3.2 LEGAL AND INSTITUTIONAL ASPECTS

Under the Law on Environment and Nature Protection and Promotion [Official Gazette 51/2000, amendments in 2000 and 2002], the general monitoring obligations for air, water, soil, nature, noise and waste, as well as the definition of the monitoring requirements, types and formats of monitored data belongs to the Ministry of Environment and Physical Planning. However, due to historical reasons and recent reorganizations of the public administration, several monitoring activities are carried out by other ministries or government institutions.

In the existing legislation, the monitoring requirements for the different environmental media are not clearly defined and coordinated within and between the responsible institutions. Many elements of subsidiary legislation are based on laws that have changed several times creating a different institutional framework.

The monitoring responsibilities in Macedonia are a result of the existing legislation, institutional heritage and recent changes in the public administration and its related bodies (public enterprises, agencies, offices etc.). Structural changes in the Republic of Macedonia in the recent decade have given rise to overlaps concerning the responsibilities for monitoring and the activities of different institutions. Many activities are regulated by laws that are more than 30 years old. Also, the Law on Organization and Competence of the Public Administration, on which many other laws and regulations are based has changed several times. Consequently, there is a current lack of coordination at the national level regarding the monitoring activities in the country.

The monitoring responsibilities vary for different environmental media. Since there is no overall national strategy or institution that integrates and coordinates the monitoring activities, the responsibilities and activities are split between different Ministries or other institutions.

The number of personnel working in different monitoring fields is indicated in table 1.

Table 1: Number of staff working in the different fields of monitoring

Institution	Department	Staff / Qualification	Comments
MEPP	MEIC	14 / University Degree	4 - Air 2 - Water 1 - Noise 4 - IT Support 3 - Other
MEPP	Central Laboratory	11 / University Degree / High School Degree	Air, Water, Noise, Soil
HMA	Environment Protection	8 / University Degree 8 / High School Degree	Air & Water
HMA	Hydrology	8 / University Degree 14 / High School Degree	Surface & Ground Water
HMA	Laboratory	2 / University Degree 7 / High School Degree	Air, Water, Soil

There is a lack of coordination concerning the activities related to environmental monitoring at the state level. The responsibilities for monitoring are determined by recent changes of legislation and institutional arrangements.

The current national legislation and its provisions entail many of the encountered problems:

- **Institutional issues**. In the current legislation, there are overlaps regarding the institutional responsibilities and activities for some of the environmental media and gaps for others. Many of the institutional obligations are based on a completely different organisation of the public administration and its related bodies.

- **Specification of the monitoring methods and parameters**. On many occasions, the applied methods and measured parameters are not in accordance with the national needs and appropriate international standards and recommendations. In some cases (e.g. drinking water, air) international recommendations have been adopted that are not covered by the existing legislation.

- **Reporting obligations**. According to the Law on Environment and Nature Protection, the MEPP has the legal obligation to report to national and international institutions and bodies as well as to the public. However, many existing laws define different obligations.

It is expected that the revision of the legal framework for the environment through the CMEPP project which has by now yielded a number of conclusive law proposals (Law on Environment, Laws on Waters, Law on Waste Management, Law on Nature Protection) will solve many problems in this area, such as synchronisation within and between the responsible institutions and adoption of international standards.

Regarding the media air and water, major obligations in the field of monitoring have been summarised in table 2. It can be seen from this summary that monitoring obligations are partly shared within the same environmental media and are performed in a largely uncoordinated manner between two or three institutions.

Table 2: Major obligations in the field of monitoring

Obligation	HMA (manuel)	MEPP-MEIC (automatic)	Central Lab (MEPP)	RIHP CIHPs (manuel)	HBI - Ohrid
Air Quality Monitoring	X	X		X	
Air Emission Control			X		
Surface Water Monitoring	X			(X)[2)]	(X)[3)]
Groundwater Monitoring	(X)[1)]			(X)[2)]	
Wastewater Control			X		

1) at present only quantity

2) only quality

3) focus on lakes and tributaries

Major overlaps exist for the monitoring of air quality (HMA, MEPP-MEIC, RIHP/CIHPs) and surface water quality (HMA, RIHP/CIHPs). Conversely, obligations are greatly divided in the fields of lake water monitoring (Hydrobiological Institute), air emission control (MEPP - Central Laboratory) and wastewater control (MEPP - Central Laboratory).

Both the Central Laboratory and the Air Monitoring Service within the MEIC are integral parts of the MEPP. The Air Monitoring Service is physically located inside the MEPP, while the Central Laboratory is located on the outskirts of Skopje. In contrast, the HMA and the RIHP possess a relative degree of independence from their parent bodies, the MAFWE and the Ministry of Health. Both bodies manage their own budgets (however insufficient these may be at present) and the RIHP has introduced a cost-calculation system enabling it to charge for its services.

The coordination between separate environmental monitoring networks for the same environmental media is weak in several aspects: quality and type of the

measuring equipment, distribution of the measurements points, common measurement standards and methodologies and the frequency of sampling. There are also different monitoring goals and objectives.

3.3 ASPECTS RELATED TO SPECIFIC ENVIRONMENTAL MEDIA

Air

The Law on Air Quality Protection has been prepared and is harmonised with the relevant EU directives and is currently in a parliamentary procedure.

Macedonian bodies currently involved in the monitoring of air *quality* include the MEPP-MEIC, the HMA and the RIHP/CIHPs. Objectives, parameters and methods vary between institutions. Air monitoring sites and programmes are not synchronised.

Air *emissions* are primarily measured by the MEPP Central Laboratory, by some official organizations and a few private firms.

The *MEPP-MEIC* runs an air quality monitoring network which is currently enlarged. The air quality monitoring stations are designed to measure the parameters SO_2, NO, NO_2, SPM, O_3, CO, wind velocity, temperature, solar radiation on a continuous basis. Samples may be automatically collected for subsequent BTX and heavy metal analysis. The monitoring stations have been financed under different programmes: JICA, PHARE, CARDS. The monitoring stations are listed in table 3, below, with reference to their location, type, category, status and donor.

Table 3: Status of the Air Monitoring Stations operated by the MEPP-MEIC

No.	Site	Type	Category	Supply / donor	Status
1	Skopje	fixed	City	JICA	Installed 1998, upgraded 2004
2	Skopje	fixed	City	JICA	Installed 1998, upgraded 2004
3	Skopje	fixed	City	JICA	Installed 1998, upgraded 2004
4	Skopje	fixed	City	JICA	Installed 1998, upgraded 2004
5	Skopje	mobile	City / Traffic	CARDS	May 2004
6	Kumanovo	fixed	City	PHARE	installed 2002
7	Kicevo	fixed	City	PHARE	installed 2002
8	Kocani	fixed	City	PHARE	installed 2002
9	Lazaropole	fixed	Remote / background (transboundary air	CARDS	Installed 1977, upgraded 2004

No.	Site	Type	Category	Supply / donor	Status
			pollution) - EMEP		
10	Veles	fixed	City	CARDS	Installed 2004
11	Veles	fixed	suburban	CARDS	Installed 2004
12	Bitola	fixed	City	CARDS	Installed 2004
13	Bitola	fixed	City	CARDS	Installed 2004
14	Tetovo	fixed	City	CARDS	Installed 2004
15	Ohrid, Kavadarci, Prilep, Negotino, Strumica, and others	mobile		CARDS	Installed 2004

The *HMA* runs a network of 20 air quality monitoring stations, all of which are operated manually. The parameters measured generally comprise SO_2 and soot, though concentration of NO_2 and O_3 are also measured at three of the sites, in Skopje, Bitola and Lazaropole.

The *RIHP/CIHPs* run a large air quality monitoring network which is also operated manually. The main parameters measured are SO_2, soot and dust. The main monitoring sites are located in and around Skopje and Veles. Dust is measured at 66 locations in cities and towns throughout the country. Other parameters, such as CO and heavy metals, are measured only at a limited number of sites.

The *MEPP Central Laboratory* focuses on emission control. This is mostly undertaken at the request of the State Inspectorate for Environment and performed in approximately 20 companies. Data arising from these measurements is regularly sent to the MEPP-MEIC.

More than 20 companies perform self-monitoring of exhaust gases.

A comprehensive proposal has previously been put forward [CMEPP 2003g,h] regarding the specific design of an air quality monitoring network based on 15 Air Quality Monitoring Stations (AMSs) to be run by the MEPP. The proposal opts for a further extension of the air monitoring network to a total of 26 sites.

The present paper recommends a different structure, as agreed upon by Working Group 6. The approach adopted here also differs in that it advocates goal-oriented monitoring and a step-by-step procedure in line with the stipulations of the Air Quality Framework Directive.

Water

The Law on Water and its amendments have been issued in 1998-2000 with a book of regulations for the classification of surface and bathing waters and an outdated book of regulation for drinking water quality parameters. Laboratory methods are also described.

The final proposal on the new Law on Waters, in accordance with EU legislation, is prepared by the CMEPP project and is in adoption phase.

The monitoring of **drinking water** is covered by the RHPI and the corresponding CHPIs. The number of measured parameters is higher for drinking water in urban areas than in rural zones. Some of the parameters are measured according to WHO recommendations, but there is no coverage in the current national legislation.

Bathing waters are monitored by the RHPI at the tree biggest natural lakes, Ohrid, Prespa and Dojran and at some watersheds.

No **wastewater monitoring** programme is in place. Only two companies regularly monitor their discharges and send data to the MEPP.

Artificial lakes are not covered by any kind of monitoring activity.

The creation of a cadastre of water polluters is ongoing (about 50% of the estimated total number polluters are registered). There is a need for a clear organization of the updating process as soon as the initial cadastre is created.

Surface water monitoring – Surface water monitoring of rivers in Macedonia is performed by the RIHP/CIHPs and the HMA. While the RIHP/CIHPs focus more on parameters of sanitary importance, namely microbiological parameters, the HMA focuses on hydrological as well as water quality parameters.

The *existing hydrological network* run by the HMA comprises a total of 110 monitoring stations. However, less than half of these stations are actually operational. Indeed, many of the non-operational stations are either poorly maintained or have fallen into disrepair. Amongst the active monitoring stations, not all measurements are always performed. At these stations, only hydrological data -water level, temperature, flow and sedimentation- is measured. This data is largely measured and transmitted by 'observers', who work on a part-time basis and are paid accordingly. The data is used primarily for the purposes of flood control and flood warning.

The *River Monitoring System Project (RIMSYS)* is a collaborative project undertaken by Switzerland and Macedonia. Key RIMSYS bodies on the Macedonian side include: the MEPP; the MAFWE; the public water management enterprise, VODOSTOPANSTVO; and the HMA. Key bodies on the Swiss side include: the Swiss Agency for Development and Cooperation (SDC); a consulting firm to be contracted as a Project Support Unit (PSU); and the Swiss Federal Institute for Environmental Science and Technology (EAWAG).

The overall objective of RIMSYS is to *provide a sound basis for water protection measures in Macedonia*. This objective includes the long-term assessment of water quality and discharges as well as the establishment of an effective forecasting and alarm system.

The specific objective is to *document long-term changes at 18 locations in the most important rivers in Macedonia*.

The expected results are that

- 18 monitoring stations are in operation
- RIMSYS monitoring is practised, data are published
- the river monitoring system can rely on trained personnel.

The RIMSYS water monitoring stations each possess an automatic sample collection device. Auto-analysers are not installed and the project is therefore also providing new laboratory space and contributing to the procurement of new laboratory equipment.

Table 4: RIMSYS river monitoring stations

No.	Monitoring Station	River
1	Radusa	Vardar
2	Sveta Bogorodica	Treska
3	Granica / Border	Lepenec
4	Bardovci / Vliv Lepenec	Lepenec
5	Taor (PHARE)	Vardar
6	Pelince	Pcinja
7	Trnovec	Kriva Reka
8	Katlanovska Banja	Pcinja
9	Nogaevci	Vardar
10	Kocani / Balvan	Bregalnica
11	Ubogo	Bregalnica
12	Brod	Eleska
13	Skocivir	Crna Reka
14	Vozarci / Palikura	Crna Reka
15	Demir Kapija (PHARE)	Vardar
16	Gevgelija	Vardar
17	Novo Selo	Strumica
18	Spilje	Crni Drim
19	Boskov Most	Radika
20	Basino Selo	Vardar

In addition to RIMSYS, the PHARE Cross Border Cooperation Programme has already provided two automatic monitoring stations that currently monitor the parameters water level, dissolved oxygen, temperature, electric conductivity, toxicity, nitrate, nitrite, ammonium, TOC and phosphate, without measuring the discharge. These two stations are scheduled to become part of the RIMSYS monitoring network, thereby yielding a total of 20 automatic monitoring stations. RIMSYS will complement the PHARE contribution, notably through the provision of hydrometric equipment.

The *Hydrobiological Institute in Ohrid* is involved in the monitoring of lakes, specifically Lake Ohrid and Lake Prespa. In 1994, the World Bank, in cooperation with the Republics of Albania and Macedonia, began preparations for a Global Environment Facility (GEF) grant to fund the incremental costs of a Lake Ohrid Conservation Project. A Memorandum of Understanding was concluded in 1996 between the governments of Albania and Macedonia. The project began in late

1998 and early 1999, with a projected duration of three-years. The project was then extended by 18 months to mid-2003. The objective of the project was to conserve and protect the natural resources and biodiversity of Lake Ohrid by developing and supporting effective cooperation between Albania and Macedonia for the joint environmental management of the watershed. The project includes an institutional strengthening component, a participatory watershed management component, a public awareness component and monitoring component.

Groundwater monitoring – Seven aquifers have been identified in Macedonia according to the EEA metodology.

Groundwater monitoring is performed by the HMA, the Department for Hydrology, and the RIHP/CIHPs. Even though 80% of drinking water is supplied from ground water, HMA monitoring activities are confined to the assessment of groundwater level and temperature. The HMA has performed groundwater monitoring since 1949. The total number of groundwater monitoring stations installed is 115; however, only 30 % of these are operational. Groundwater monitoring is also performed by a network of 'observers', who measure and transmit values regularly throughout the country.

Soil

The current legislation does not cover soil monitoring. According to the Law on Agricultural Land, the Ministry for Agriculture, Forestry and Water Supply should define the substances that are harmful to the agricultural land and their maximum allowed concentration in the soil. However, the corresponding book of regulation has not been prepared.

Soil monitoring is done within different projects, but without coordination between the projects.

Erosion and geological maps exist for the whole country. The erosion map is new (1993) and exists in digital format. The geological map was produced in 1975 and exists only in a printed version.

Biosphere

The legislation regarding the biosphere is related to specific elements of biosphere. There is coordination at the state level. The legal responsibilities of the MEPP are not applied in practice.

The project "Strategy of the Biodiversity" carried out by the MEPP has two main goals, namely to create a national strategy for biodiversity, including an action plan, and to establish a clearing house mechanism (biodiversity database).

The CORINE Biotopes Project is completed (1998) but the results (biotopes database) are not used.

The forestry maps, produced by P.E. Macedonian Forests and the Department of Forestry at the MAFWE, are a source of information for many forestry related issues. The digitalisation of the printed maps and related documentation which would allow a better utilisation of the existing information on forestry is still pending.

Waste

The current legislation does not cover the monitoring of municipal, hazardous and non-hazardous waste. The CMEPP project has elaborated the proposal of a draft law on waste management meeting the requirements of the corresponding EU legislation.

Hazardous waste is currently not monitored in Macedonia. The waste generators are supposed to maintain a register and to look after the disposal of hazardous waste. There is no landfill for hazardous waste and no Public Communal Enterprise responsible for the transport.

The only source of information regarding the amounts of waste are the official landfills and the PCEs. Additional problems are that

- many of the PCEs are not operating or capable of collecting waste,
- in many municipalities private communal organizations exist that do not have the obligation to measure the amounts of waste, and
- there is no register of illegal landfills and the amounts and types of waste discharged.

A cadastre for waste water and solid waste generators is currently being established. About 50% of the estimated total numbers of waste generators are registered. There is a need to organise the updating process once the initial cadastre has been created.

Noise

The Law on the prevention of harmful noise [Official Gazette of SRM 21/84, 10/90 and Official Gazette of RM 62/93] provides only general obligations but no clear institutional obligations. The permissible noise levels for different categories of urban areas is defined in the Official Gazette of RM 64/93 and is based on the Law on offence against public order and peace [Official Gazette 25/72, last amendment 26/93].

Resources for noise monitoring exist in the Central Laboratory of the MEPP, the Public Health Institutes.

Since there is no noise-monitoring programmme, measurements are generally based on individual requests from people or legal entities.

The CIHPs in Skopje and Bitola assess the harmful impact of municipal noise on exposed population. The CIHP in Skopje carries out 50 measurements a year at 14 measuring points, whereas the CIHP in Bitola measures noise at 4 measuring points.

In 2002, the MEPP-MEIC has prepared an operational programme for noise monitoring based on EU directive 2002/49/EC which gives the basic principles regarding the noise monitoring and management, as well as other directives that regulate specific issues, such as road traffic, airplanes and railroads. The programme aims at noise caused by motor vehicles and airplanes in 13 cities in the Republic of Macedonia. According to this programme, the envisaged maximum period of measurement at each measuring point is 15 minutes during day and 15 minutes at night. Due to the shortage of financial resources, the implementation of the Operational Programme has not yet started.

Chapter 4 Environmental Monitoring: Concept, Planning, Strategic Goals and Objectives

4.1 CONCEPTS OF ENVIRONMENTAL MONITORING

The term *environmental monitoring* (or, simply, *monitoring*, within the present context,) may be variously defined. Two outstanding definitions are presented in box 1:

Box 1: Monitoring as defined by UN/ECE and EEA

'Monitoring is the process of repeated observing, for defined purposes, of one or more elements of the environment according to pre-arranged schedules in space and time and using comparable methodologies for environmental sensing and data collection. It provides information concerning the present state and past trends in environmental behaviour.' [UNECE 2000a,b]

'Monitoring is a combination of observation and measurement for the performance of a plan, programme or measure, and its compliance with environmental policy and legislation.' [European Commission, 1999. From: EEA glossary, http://glossary.eea.eu.int/EEAGlossary]

Monitoring of environmental media

The UNECE definition is what we may call the classical definition of monitoring. It reflects the perspective of the receiving body as commonly understood by the terms *water quality* or *air quality*. Monitoring in this sense is a tool with which to examine the state of the environmental media; these being: water, air, soil and biosphere.

Monitoring as understood by the EEA

The EEA definition of monitoring (box 1), which will subsequently provide the general framework for monitoring in Macedonia, is very broad in scope. Monitoring, by this definition, is understood from the perspective of the receiving body as embracing all aspects of emission -as may be found in emission sources such as wastewater, exhaust gas, polluted sites, and waste- where 'emission' is to be understood in a broad sense. Moreover, this definition takes monitoring to include the entire sector of product control and material storage and handling, as it is in these areas that future emissions may occur. Any such observation, if combined with measurement, is thus understood to constitute monitoring so long as it follows a plan and serves to examine compliance with environmental policy and legislation.

The term 'environmental monitoring', therefore, needs to be supplemented by further definition in order to clarify its meaning. Accordingly, one may usefully distinguish between *environmental quality monitoring,* i.e. the monitoring of the state of ambient water, air, soil and biosphere; *emission monitoring*, which is essentially the monitoring of wastewater, exhaust gas and waste; and *material and product related monitoring,* which deals with the handling of materials and the quality of products.

Emission monitoring and environmental quality monitoring represent two different aspects of the same environmental problem: that of the source and that of sink,

the receiving body. The two monitoring activities, moreover, possess different administrative status. *Emission monitoring* refers either to the external control of a discharger in the framework of an inspection or to the self-monitoring of a discharger. Failures or excesses detected in the process of emission monitoring may be penalised in the form of fines, taxes and other charges. *Environmental quality monitoring,* on the other hand, does commonly not imply the power to effect any of these penalties.

The present paper relates both to environmental quality monitoring and emission monitoring.

The DPSIR framework

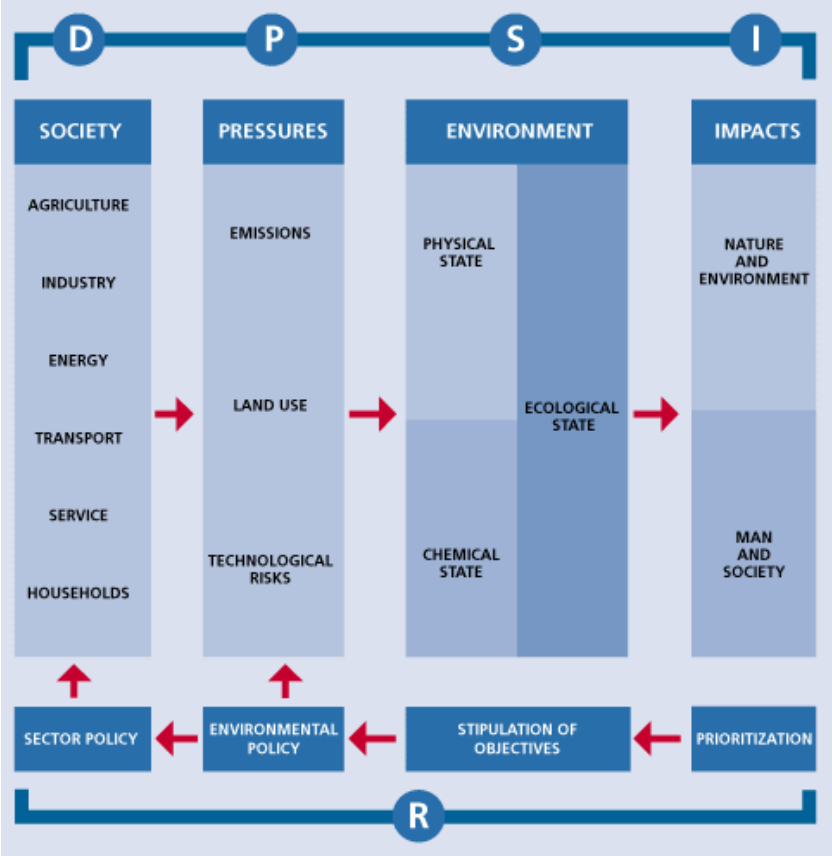
The European Environment Agency (EEA) has adopted the DPSIR model as a basic concept for its work. The capital letters of the acronym refer to:

a basic concept for its work. The capital letters of the acronym refer to:

- **D**riving forces affecting environmental deterioration; which may include expanding population, increasing consumption of natural resources and intensification of industrial and agricultural activities
- **P**ressures on the Environment through emissions (exhaust air, wastewater, waste) as well as land use
- the **S**tate of the Environment (e.g. the quality of air, water, soil and biosphere)
- its **I**mpact on nature and the environment as well as on man and society (e.g. the extinction of natural species, or the migration of people following the depletion of groundwater resources)
- **R**esponses which may be provided by the environmental policy in aiming to reduce the driving forces as well as the pressures on the environment

The DPSIR concept is presented in the form of a flowchart in figure 1.

Figure 1: The DPSIR concept



Within the DPSIR framework, the primary aim of *environmental quality monitoring* is understood -in line with the UN/ECE definition- as being that of assessing the state (S) of the environment. The resulting data is to be aggregated and further processed in order to provide useful information that will serve as a basis upon which to initiate adequate and practical responses (R).

The EC approach to *emission monitoring* and *material and product related monitoring* conceives both activities as being aimed at controlling pressures (P). These activities play a role in the enforcement of standards through *inspection* or other control measures, including cases where these measures are executed by the polluting body itself in a self-monitoring capacity.

The monitoring cycle

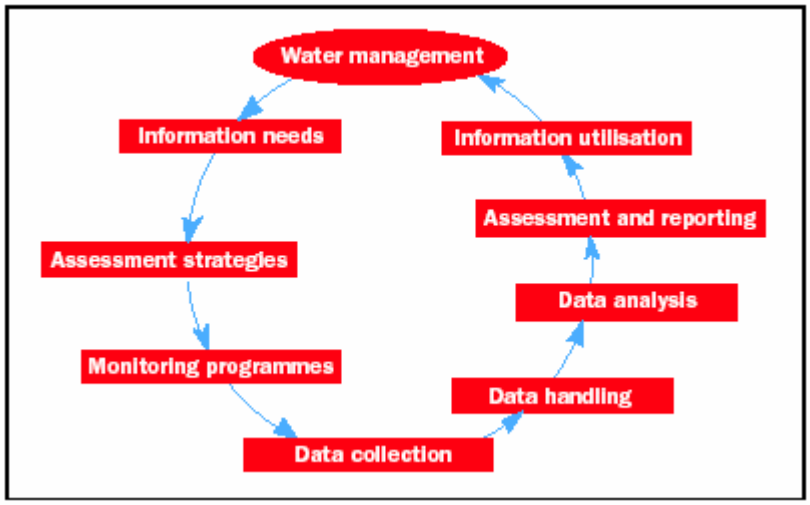
The process of assessment and monitoring must be seen as part of a sequence of related activities that begins with the specification of information needs and ends with the use of the information product. The cycle of activities is shown in figure 2. The evaluation of the acquired information may lead to new or redefined information needs, thus inducing a new sequence of activities in the monitoring cycle. In this way, the monitoring process will continually adapt to information needs.

This 'monitoring cycle' model, as adapted from the Guidelines on Monitoring and Assessment of Transboundary Rivers and the Guidelines on Monitoring and Assessment of Transboundary Groundwaters [UNECE 2000a,b], may be traced back to a 1997 RIZA publication [RIZA 1997]. Though designed for application to

water monitoring, the model applies equally well to the monitoring of other environmental media, such as air, soil and biosphere.

The UNECE publications [UNECE 2000a,b] are of general relevance in the monitoring of all environmental media and are recommended for further study.

Figure 2: The Monitoring Cycle [UNECE 2000a,b]



The monitoring cycle applies equally well to *emission monitoring* and *environmental quality monitoring.* Indeed, the model may serve as a general guide whenever drawing up a monitoring programme.

Monitoring plays an essential role within the framework of environmental management and constitutes an important tool in the process of improving the quality of the environment. Monitoring must proceed from initial identification of information sources and information needs. These sources and needs are typically unclear at the outset of a project and need to be established through a step-by-step approach in the assessment phase.

Monitoring results must meet the information demands as initially stated. They form the basis of future decisions and, finally, contribute towards improving the state of the environment. Monitoring, in this sense, will always be a means to an end and cannot be seen as an end in itself. It is crucial, then, that information requirements be clarified before proceeding to the next stage.

Monitoring programmes, as part of the entire concept, must be agreed upon beforehand by the monitoring partners. Data, information and decisions constitute part of a strategy. Such monitoring programmes are the outcome of communication between the experts involved in designing such systems together with the decision-makers (or the population) making use of the information. Monitoring programmes aim to yield relevant information at reasonable costs.

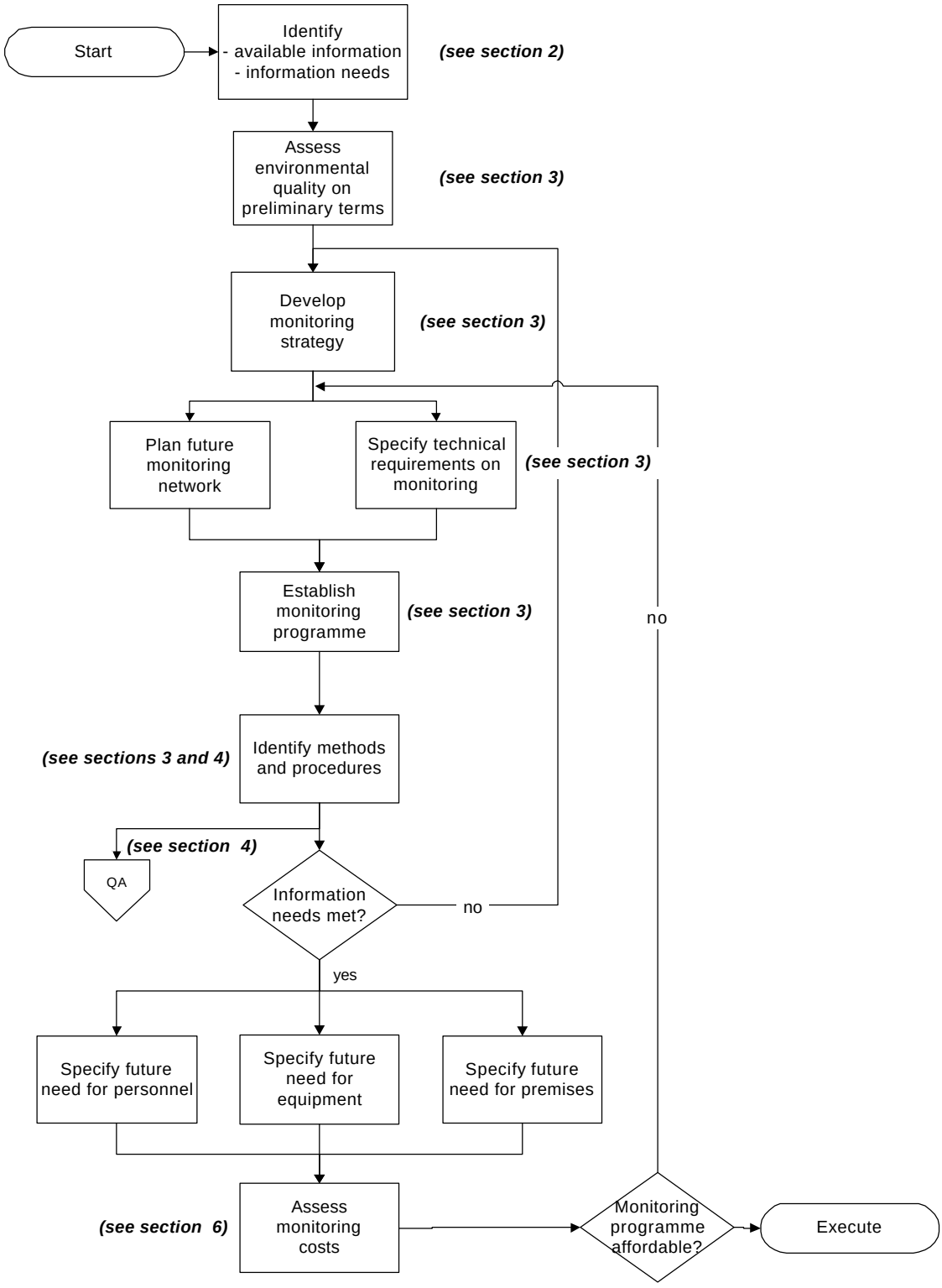
4.2 PLANNING ENVIRONMENTAL MONITORING

The general scheme to be followed in setting up an environmental monitoring system is presented as a flowchart in figure 3. The scheme highlights some details of the abovementioned monitoring cycle.

The scheme applies equally to both the monitoring of environmental quality -e.g. the quality of ambient air, freshwater and soil- and to the monitoring of emission sources, such as wastewater and exhaust air.

The target body of this flowchart is the network operator, i.e. the body in charge of running the monitoring programme. The network operator may be the authority in charge of a surface water monitoring network, for example, or may be the operator of an industrial plant obliged to perform self-monitoring.

Figure 3:General planning scheme for environmental monitoring



The planning of environmental monitoring begins with the identification and specification of information needs arising from project goals, legal demands, public demands, and so forth. Information sources are also to be identified. Information sources will take the form of inventories (allowing that these may be

incomplete at the outset): for example, a cadastre of polluters and – if water is the target medium – a cadastre of water consumers.

Information needs are then utilised as the design basis for a programme intended to assess environmental quality. This phase also possesses an investigative character; as the environmental issue to be monitored is approached, step by step, through measurements (chemical analyses, for example) and other information sources. At this stage, the identification of methods is of only secondary importance. This first assessment step is also described in the EU legislation, where it is addressed as *preliminary assessment [1996/62/EC]* and *surveillance monitoring [2000/60/EC]*, respectively.

In the next stage, the monitoring sites and certain technical requirements (such as sampling frequency) are identified, resulting in the production of a monitoring programme that specifies the parameters to be measured as well as the frequency of sampling and measurement.

Methods and procedures are then identified. At this stage, there is a cross-reference to a quality assurance flowchart (represented by the pentagonal symbol, see figure 3) which will be presented and discussed further below.

Provided that all information needs have been addressed, the implications of the monitoring programme on personnel, equipment and space may be assessed at this stage, enabling the future network operator to assess monitoring costs. If the programme is estimated to be affordable, it will be executed; if not, there will be a feedback report on the monitoring programme.

Prerequisites to monitoring

Monitoring must follow upon a prior identification of information needs and a preliminary assessment of the sate of the environment in the region concerned. A step-by-step approach is recommended.

The Ambient Quality Framework Directive [1996/62/EC, Art. 5] demands a *preliminary assessment* as a first step wherever representative measurements are not available; this step is to be followed by the 'true' *assessment* [1996/62/EC]. The Water Framework Directive, in an even more comprehensive approach, demands the *initial characterisation* of the relevant water bodies and subsequent *surveillance monitoring* [2000/60/EC, Art. 5 and 8, annexes] to be followed by *operational monitoring* [2000/60/EC].

The term 'preliminary assessment' employed in this paper corresponds approximately to what is elsewhere termed 'survey', 'preliminary assessment' (AQFD) or 'surveillance monitoring' (WFD).

4.3 EMISSION MONITORING IN THE FRAMEWORK OF ENFORCEMENT

The Council Directive on Integrated Pollution Prevention and Control [1996/61/EC] aims at the introduction of measures to prevent or reduce emissions of all kinds into air, water and land. The IPPC directive, as well as the transposed Macedonian Law on Environment in its 3rd draft version [CMEPP 2003d], articles 99 to 115, provide for emission monitoring to be performed by the operating bodies themselves.

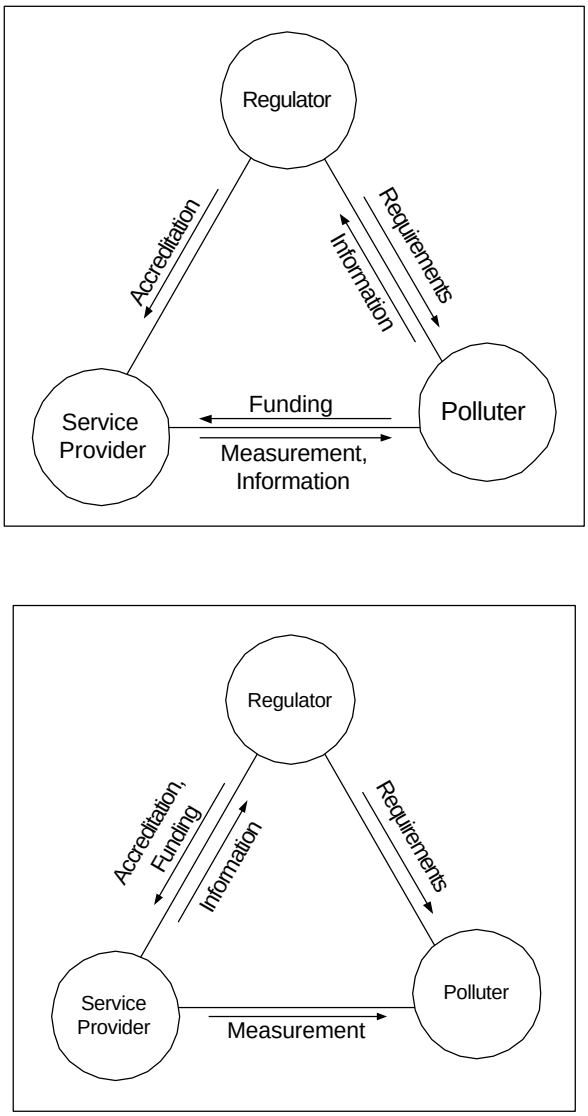
Emission monitoring is an instrument of enforcement which exists in two forms,

- as external monitoring to be carried out under responsibility of the competent authority, and
- as self-monitoring to be carried out under responsibility of the operator (polluter).

Self-monitoring requires a legal basis provided by secondary law and imposed by means of a permit.

For example, emission monitoring *under responsibility of the competent authority or the operator* does not imply that the one or the other must monitor by himself. Provided the (secondary) legal basis has been laid accordingly, both the competent authority and the operator may contract a service provider, typically a laboratory, which has to fulfill certain requirements (e.g. accreditation in the respective field) as laid down in the secondary law. In any case it is recommendable to avoid conflicts of interest where one and the same service provider is under contract with the authority and the operator. The authority can impose that through the contract conditions. Figure 4 further clarifies the two forms of emission monitoring.

Figure 4: Enforcement through self-monitoring (top) and external monitoring (bottom)



In either case, the regulator (the state authority) sets the requirements which the polluter has to meet by means of an operation permit. The regulator also sets the frame conditions within which the service provider obtains his accreditation. The accreditation may be issued based on a Macedonian accreditation system by the state itself, or – in the framework of an internationally recognised accreditation system following the ISO 17025 laboratory requirements – through an independent or semi-independent (not necessarily Macedonian) accreditation body.

In the case of external monitoring, the regulator (e.g. the MEPP) may contract a laboratory to monitor the polluter. The laboratory sends the monitoring results to the regulator who checks whether the results comply with the requirements as set through the permit.

In the case of self-monitoring, the polluter is fully responsible to carry out measurements as fixed in the permit. The polluter may contract a laboratory which will then send the monitoring results to him. If the conditions have been laid down in the permit accordingly, the polluter will be obliged to send the results to the competent authority.

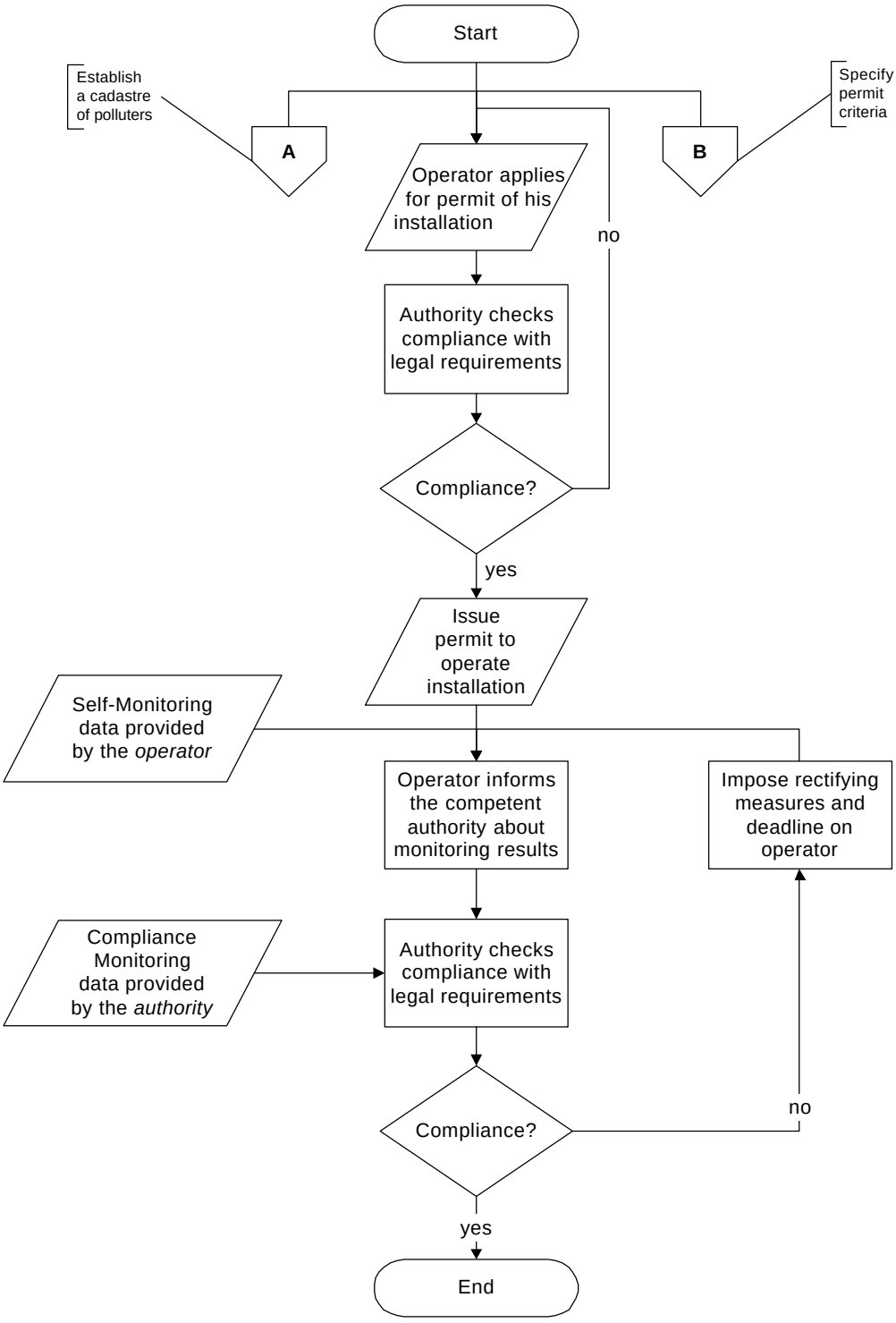
The major workload in terms of monitoring efforts (e.g. monitoring frequency and volume) is commonly taken over by the operator, while external monitoring may take place more rarely, for instance in the framework of annual inspections.

The place of emission monitoring within the enforcement procedure is illustrated in figure 5. The general scheme will apply to all types of emissions, such as wastewater, exhaust gas, waste and noise. The issue of waste, with its very particular disposal rules and regulations, is further referred to in section IX.1.

As may be seen, emission monitoring requires the fulfilment of a number of important prerequisites before 'true' monitoring can commence. Two important and extensive preconditions must be fulfilled, represented by the two pentagonal boxes: these being:

- the establishment of a cadastre of polluters and polluting materials in order to guarantee a systematic and unbiased approach
- the specification of the permit criteria as outlined in the Law on Environment [CMEPP 2003c].

Figure 5: Emission monitoring in the framework of enforcement



Once the tasks described above have been completed, the competent authority will be in a position to accept and proceed applications for permits from the respective plant operators. The permit to be issued by the competent authority will specify all the operating conditions and emission-limiting values with which the operator is obliged to comply. In respect of emission monitoring, the permit will need to specify the following factors for each emission path (gaseous, liquid and solid emissions):

- the sampling site
- the sample collection method
- the analytical method
- the frequency of sample or data collection
- the evaluation procedure
- the limiting values in conjunction with the (sampling/analytical) methods to be applied.

The operator will be obliged to carry out self-monitoring under the conditions of the permit and to inform the competent authority on a regular basis of the results of the monitoring of emissions (Figure 5). Any incident or accident significantly affecting the environment must be reported without delay.

Inspections carried out by the competent authority will typically include monitoring activities (Figure 5) – also referred to as external monitoring – and these activities will yield emission data which may serve as a means of checking the results provided by the operator, or which provide the basis for future environmental taxes and charges.

The monitoring data symbolized by the two parallelograms are the result of the monitoring programmes as planned according to figure 3.

4.4 LINKING MONITORING OBJECTIVES TO ENVIRONMENTAL GOALS

In project planning terminology, a *goal* is defined as being greater than a number of *objectives*. A goal may be broken down into several objectives. Environmental monitoring must be firmly bound to both environmental goals and objectives in order to ensure effectiveness and cost-efficiency. For example, a prominent goal has recently been laid down in the Water Framework Directive [2000/60/EC] demanding the attainment of 'good status' for all water bodies within the EU by a certain deadline.

Environmental *goals* need not cover the whole of Macedonia from the outset; they may focus on distinct subjects or regions. What is essential is that monitoring does not appear passive and static but is clearly seen as a tool in the process of achieving a goal.

In order to set up sustainable and goal-oriented monitoring programmes, the projects to be identified (or which have already been identified) shall meet the following requirements:

- the projects shall be cost efficient, i.e. yield maximum economic and environmental benefit for a given financial input
- the environmental problem and the corresponding project goal must be subject to objective verification by means of appropriate monitoring programmes
- the major stakeholders are to be known and able to be integrated into the project

- the problem to be addressed must solvable by means which are appropriate in respect of administrative, technical and/or socio-cultural grounds and solvable within a timeframe of reasonable length: typically up to 10 years.

- The available financial and personnel resources are probably available at long term to run the respective monitoring programmes.

Exemplary project goals, into which suitable monitoring programmes could be integrated, are listed in the table below.

Exemplary goal	**Exemplary objectively verifiable indicator implying monitoring**
Air quality in the city of Skopje has improved significantly	The annual average concentrations of SO_2, NO_x and soot have decreased by at least 25 % each
The discharge of industrial wastewater from the district of Veles into the river Vardar has decreased significantly	The annual discharge loads of COD (or TOC), cadmium, lead and zinc have decreased by at least 50 % each
Use and natural recharge of groundwater resources in the Lake Doiran region are shifting towards a sustainable balance	surface water and groundwater levels start to increase within the chosen project period (e.g. 10 years)
Waste is disposed of in the Skopje landfill under controlled conditions	Waste classes as well as their origins and amounts are known and reported for ≥ 80 % of the total waste input

Objectives of environmental monitoring may be, for example,

- to assess exposure and damage, creating an information basis by which to assess the damage caused by environmental pollution to human health, natural ecosystems and materials, with the final goal being that of supporting the development of cost-effective abatement strategies

- to check compliance with national or international standards; namely, the EC directives

- to inform the public about environmental quality and to feed alert systems in view of short-term abatement actions to reduce episodic high concentrations

- to develop environmental policy and provide objective input for the purposes of environmental management (e.g. traffic and land-use planning)

- to identify and apportion pollution sources

The monitoring goals and objectives will determine the shape of the future monitoring network and programme. Monitoring goals and objectives also lay the basis for the environmental monitoring strategies as presented in this Technical Report (sections VI to IX).

4.5 LEGAL AND OTHER BINDING OBLIGATIONS

Compliance with legal obligations need not be seen only as a goal in itself; it can also be seen as one of the necessary objectives to be achieved in the process of reaching a greater environmental goal. The setting and meeting of legal obligations may even be seen as a means to achieving that greater goal.

Whichever perspective is taken, the paramount character of legal and other binding obligations is beyond doubt.

Following the Stabilization and Association Agreement between the Republic of Macedonia and the European Communities and their Member States, Macedonia is contract-bound to approximate its national legislation to the relevant EC legislation. This process of approximation includes approximation to a large number of EC legal obligations in the environmental sphere.

Monitoring, in the comprehensive EC sense of the word, plays an important role in most of the relevant environment-related EC directives as well as the transposed Macedonian draft laws. A selection of priority EC directives and transposed Macedonian legal drafts are to be found in table 5.

Table 5: Priority legal documents in the fields of water, air, waste, biosphere, noise and soil

Area	EC Directive no.	related to	transposed into Macedonian draft law
Horizontal	1985/337/EC (amended) 1997/11/EC	Assessment of the effects of certain public and private projects on the environment	Law on Environment [CMEPP 2003c]
	2001/42/EC	Assessment of the effects of certain plans and programmes on the environment	ibid.
	1996/61/EC	Integrated pollution prevention and control	ibid.
	2003/4/EC repealing 1990/313/EC	Public access to environmental information Freedom of access to information on the environment	ibid.
	1991/692/EC	Standardizing and rationalizing reports on the implementation of certain Directives relating to the environment	ibid.
Water	2000/60/EC	Establishing a framework for Community action in the field of water policy	Law on Waters [CMEPP 2003f]

Area	EC Directive no.	related to	transposed into Macedonian draft law
	91/271/EC	Urban waste-water treatment	ibid.
	1998/83/EC	Quality of water intended for human consumption	ibid.
	1991/676/EC	Concerning the protection of waters against pollution caused by nitrates from agricultural sources	ibid.
	1976/160/EC	Quality of bathing water	ibid.
Waste	1975/439/EC	Disposal of waste oils	Law on Waste Management [CMEPP 2003d]
	1999/31/EC	Landfill of waste	ibid.
	75/442/EC, amended by 91/156/EC	Waste	ibid.
	94/67/EC	Incineration of hazardous waste	ibid.
	1996/59/EC	Disposal of polychlorinated biphenyls and polychlorinated terphenyls (PCB/PCT)	ibid.
	1991/689/EC	Hazardous Waste	ibid.
Nature	1979/409/EC	Conservation of wild birds	Law on Nature Protection [CMEPP 2003e]
	1992/43/EC	Conservation of natural habitats and of wild fauna and flora	ibid.
Air	1992/72/EC (amended) 2002/3/EC	Air pollution by ozone Ozone in ambient air	(not transposed)
	1996/62/EC	Ambient air quality assessment and management	(not transposed)
	1999/30/EC	Limit-values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air	(not transposed)
	2000/69/EC	Limit-values for benzene and carbon monoxide in ambient air	(not transposed)
	2002/3/EC	Ozone in ambient air	(not transposed)
	1999/13/EC	Limitation of emissions of VOC due to the use of organic solvents in certain activities and installations	(not transposed)

Area	EC Directive no.	related to	transposed into Macedonian draft law
	2001/80/EC	Limitation of emissions of certain pollutants into the air from large combustion plants	(not transposed)
Noise	2002/49/EC	Assessment and management of environmental noise	(not transposed)
Soil	–	(no directive aiming directly at soil)	–
	86/278/EC	Prevention of soil contamination and water pollution from heavy metals, nitrate and phosphate from sewage sludge	(not transposed)

Table 5 reflects only a fraction of the legal requirements on monitoring as imposed by EC directives. An overview may be obtained through the *Handbook for Implementation of EU Environmental Legislation* [DGENV 1999] which represents the legal situation as of1999.

A number of legal requirements on monitoring will be evaluated, by way of example, in the context of the water and air supplements.

Chapter 5 Technical Aspects of Monitoring

5.1 NETWORKS, PARAMETER AND METHODS

Parameters and indicators

Monitoring shall be restricted to a core set of truly relevant parameters and to sites agreed upon by all stakeholders. Indicators themselves constitute such parameters; or constitute values derived from primary parameters. Indicators are closely linked to the purpose of monitoring. Some common examples are given below.

In the field of *air monitoring*, the parameters indicating traffic are PM_{10}, NO_2, hydrocarbons (essentially benzene) and lead. SO_2 may serve as an indicator for example from power plants.

In the field of *groundwater monitoring*, the most common indicator for groundwater quantity is the groundwater level. The impact of nitrogen from inorganic fertilizers is indicated by nitrate or – if liquid manure plays an important role – the sum concentration of nitrogen from nitrate and ammonium.

In the field of *surface water monitoring,* the most important parameters indicating the impact of degradable organic compounds are TOC (or COD), BOD_5 and dissolved oxygen.

Where *polluted industrial sites* are to be monitored, the parameters which indicate the pollution of soil and groundwater may not be evident and frequently need to be assessed by collecting information about the production process, the compounds which have been used, etc.

Methods

The methods applied may vary according to the step to be taken. During the preliminary assessment stage, when the water bodies, the contaminated site or the ambient air are characterized or surveyed in order to create a first picture (or the first comprehensive picture) of their environmental state, methods are of lesser importance. Indeed, there is no compelling reason not to make use of so-called *rapid methods* employing ready-to-use test kits (as offered by several producers and distributors in the fields of water, air and soil testing, e.g. Hach, Merck, Dr. Lange.).

As soon as regular *operational monitoring (WFD)* or *assessment (AQFD)* commences, however, methods become of paramount importance.

The methods to be applied in determining the selected parameters or indicators must be carefully selected and agreed upon beforehand amongst those institutions involved in monitoring. Characterisations such as ‘photometric method’, ‘gas chromatography’ or ‘atomic absorption spectrometry’ will not suffice. All methods must be specific and agreed upon in entirety.

The proposed methods shall be tested in practice before the monitoring programme commences. That the quality of results increases significantly through practice is a widely confirmed phenomenon which applies to any laboratory

All measured data must be *comparable*; a term which applies equally to analytical operators as to the monitoring period.

Firstly, measured data must be amenable to comparison *between all institutions* involved in monitoring. Such comparability must be assured within the project itself as well as between projects in order to achieve maximum value for money.

Secondly, the measured data must be *comparable throughout the whole monitoring period,* which may extend to ten years or more.

Whenever a given method is to be altered, the results of the current method must be compared -based on a large data pool and following a distinct evaluation method- with the new method to be applied.

Monitoring sites

Monitoring sites must be *representative* in respect of the environmental situation to be monitored. The evaluation of *representativeness* will depend upon the objectives of monitoring:

- in the case of a low-range contaminated industrial site, it may be useful to identify soil areas containing peak concentrations of the identified pollutant
- in the case of long-range transport of airborne pollutants, the task will be to identify long-range concentration levels
- in the case of city air pollution levels, it may be of value to reflect the health risk for high-risk population groups
- in the case of rivers, representativeness will also relate to the distribution of a compound along the river cross-section

The extent of area or space to be represented thorough monitoring, therefore, must be determined in advance

5.2 QUALITY MANAGEMENT

Introductory remarks

Quality Management comprises a quality policy and a quality system. The objective of quality management in monitoring may be defined as the provision, to the fullest possible extent and at the lowest possible cost in finance and personnel, of information relevant to the information requirements identified at the outset of the project. [UNECE 2000a, modified].

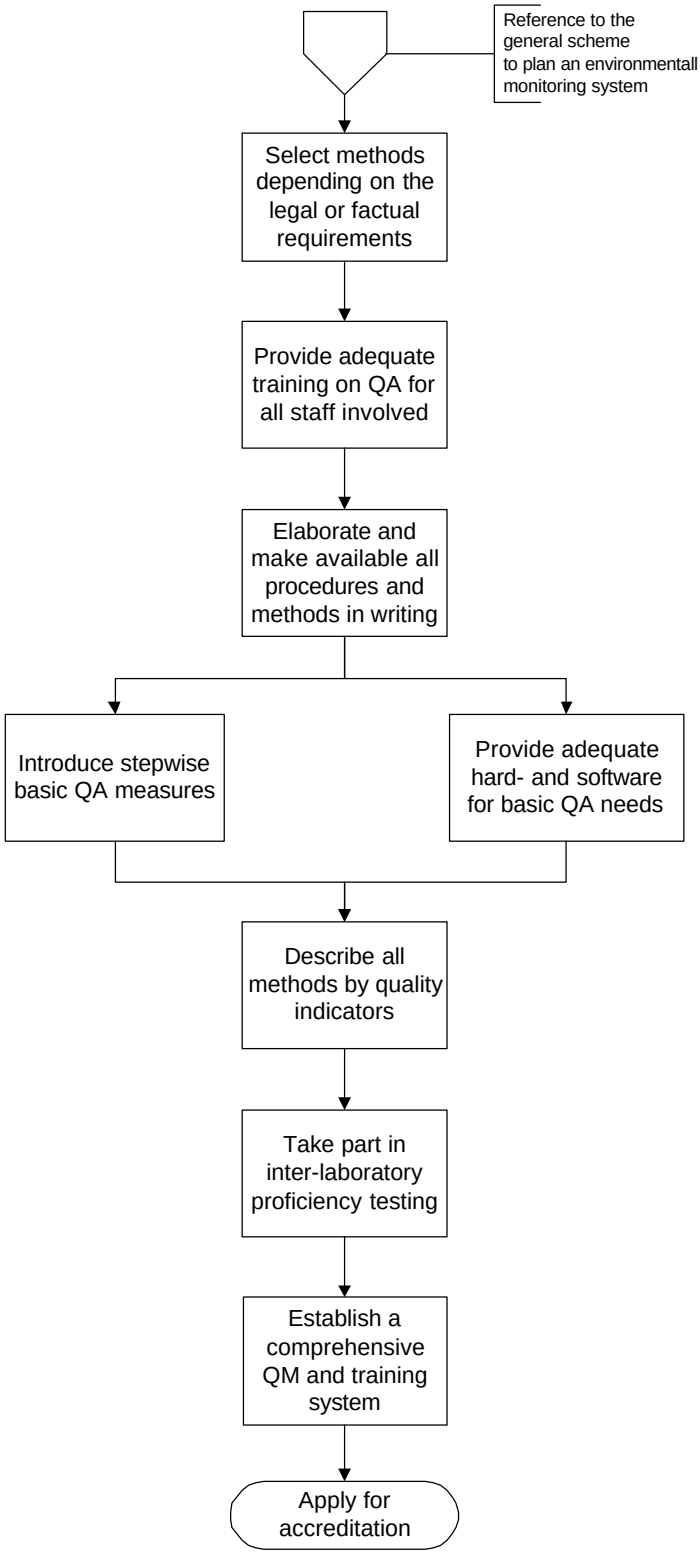
Box 2 Laboratory quality system as defined in ISO 17025 : 2000 (Extract)

The laboratory shall establish, implement and maintain a quality system, appropriate to the scope of its activities. The laboratory shall document its policies, systems, programmes, procedures and instructions to the extent necessary to assure the quality of the test … results. The system's documentation shall be communicated to, understood by, available to, and implemented by the appropriate personnel.

The laboratory's quality system policies and objectives shall be defined in a quality manual (however named). The overall objectives shall be documented in a quality policy statement. The quality policy statement shall be issued under the authority of the chief executive …

Figure 6 presents a proposal of how to start quality assurance in the field of data acquisition.

Figure 6: Scheme to start QA in data acquisition



The quality system begins with the clear, comprehensive and unambiguous identification of the methods to be used, where 'method' relates to sample collection as well as measurement. Standard methods, preferably European standard methods, shall be applied wherever feasible. As previously mentioned, characterisations such as 'photometric method', 'gas chromatography' or 'atomic

absorption spectrometry' do not suffice. In water analysis, a typical method of identification would be, for instance, *determination of biochemical oxygen demand after 5 days according to EN 1899-1*. 1998.

As standard methods cannot specify all details to be followed, the identified method must be further elaborated and laid down in writing, taking into account all important details. As this is a time-consuming undertaking, such elaboration shall first be applied to a manageable number of methods and, subsequently, one by one, be extended to all of the methods to be employed.

Only one version of each selected method shall exist in a limited (and known) number of copies that are readily accessible to the head of the laboratory and the operators.

All staff involved in activities related to the quality of the generated data need to be trained in the various aspects of quality assurance.

All methods, be they standard methods or otherwise, must be practised and characterized prior to their professional application. Again, it is recommended that this process be applied initially to a manageable number of methods. Regarding physico-chemical analysis, characterization typically includes assessment of the following factors:

- the working (concentration) range
- the linear working (concentration) range
- the (lower) limit of detection or limit of determination (along with an identification of the underlying statistical procedure)
- the procedural standard deviation

Such characterization, in order to be effectively practised in routine laboratory work, must be supported by commonly shared hardware and software.

Over the long term, the *uncertainty of the result*, following the *guide to the expression of uncertainty in measurement* [ISO 1993], will become the most important quality indicator. This indicator comprehends all factors which may contribute to the overall uncertainty of the result throughout the entire analytical process.

The use of non-standardised methods shall be avoided as far as possible. Where the application of a non-standardised -or substantially modified standard- method is necessary, however, this must be validated in order to ensure that the results which the method yields comply with expectations. Regarding physico-chemical analysis, validation may include, in addition to the aforementioned quality indicators, assessment of the following factors:

- the selectivity of the method
- the repeatability of the method
- the ruggedness of the method in respect of external influences (matrix effects, operator, pH, etc.)

- compliance with external requirements

Box 3: Validation as defined in ISO 17025: 2000

'Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled'

The head of the laboratory, or the operator, will periodically seek to verify whether the final result which has been assessed is in line with a reference value derived from certified reference materials (CRMs) through participation in inter-laboratory proficiency ('round-robin') tests.

CRMs may be purchased from several producers, one of which is the Community Bureau of Reference (BCR) in Brussels. Several thousand CRMs are available on the subjects of waters, sediments, soils, food and other matrices. Depending on the specific CRM, concentrations of heavy metals, non-volatile chlorinated hydrocarbons, pesticides, polycyclic aromatic hydrocarbons and many other compounds have been certified and may be used as a reference within the laboratory.

Round-robin tests are performed repeatedly by numerous European or Member State organisations as well as professional bodies.

Laboratory accreditation is a long-tem objective.

At the laboratory level, accreditation in the sense of the international standard EN ISO/IEC 17025: 2000 assumes a comprehensive quality system to be established and laid down in writing in a quality manual, and a quality policy approved by the laboratory management. Such accreditation requires a (national or international) accreditation body which is in the position to audit a laboratory and examine its compliance with the requirements of EN ISO/IEC 17025: 2000.

At the state level, a strategy is required to introduce an adequate accreditation system in Macedonia (see section VI.6).

Chapter 6 Strategies in Horizontal Priority Processes

6.1 OVERVIEW

Following the concept of goal-oriented environmental monitoring (see section IV), superior environmental goals are defined which imply monitoring (and other) activities. The sum of all activities to be specified constitute a process. The related processes are directed towards the respective environmental goal.

Horizontal processes are those which are beyond the scope of one individual medium, and which concern two or more environmental media. Horizontal processes are found in institutional development, laboratory services and monitoring programmes, self-monitoring, registration and reporting.

Eight important horizontal processes have been identified (table 6) and are subsequently elaborated in terms of purposes, objectives, institutional responsibilities and required activities.

Table 6: Processes linked to horizontal environmental goals

Process 1	Develop a state monitoring programme
Process 2	Separate regulatory and operational functions of authorities
Process 3	Develop self-monitoring and reporting of polluters
Process 4	Develop self-monitoring and reporting of water suppliers and distributers
Process 5	Develop a register of polluters
Process 6	Develop monitoring services
Process 7	Reduce emissions through product-related standards
Process 8	Reduce emissions from important polluters into water and air

6.2 PROCESS 1: DEVELOP A STATE MONITORING PROGRAMME

Horizontal Approach Process 1: Develop a state monitoring programme	
Why?	
- Create transparency in the field of monitoring regarding objectives, costs and programmes - Create a common understanding of the national monitoring needs - Ensure monitoring programmes which are in line with the available public resources - Avoid overlap of monitoring activities between different institutions, make use of synergies - Ensure the feedback of monitoring results on the national environmental policy	
What are the objectives?	
- Provide for funding of the different monitoring activities according to commonly set priorities - Assess the budgetary implications of monitoring in different fields - Enable the participating authorities to adapt monitoring activities to the budget / funds available - Ensure the repeated review of monitoring programmes according to the information needs - Make monitoring more cost-efficient - Clarify responsibilities for all national monitoring activities	
Who is in charge?	
Ministry of Environment and Physical Planning	- Establish the national environmental monitoring programme
Ministry of Health	- Establish the national health-oriented monitoring programme related to environmental issues
other Ministries as required	- Establish other national monitoring programmes related to environmental issues
Local self-government	- (optional:) Establish the local environmental monitoring programme
Service provider	- Provide the necessary expertise and information to enable the authorities to establish and review the national monitoring programmes
How to achieve the objectives?	

1 Environmental policy monitoring needs assessment

The country already has several environmental policy documents that will be overhauled in 2004 with the adoption of the new environmental legislation and the planned new National Environmental Action Plan. An important element of the new legislation is the responsibility of polluters to perform self monitoring, which will be further elaborated in the secondary legislation.

The existing and new policies will be assessed from the point of view of monitoring needs. This means identifying all the provisions that require some form of monitoring either as part of self monitoring or the state programme. To a large extent this assessment is already implicit in the present strategy.

2 Assessment of capacities and available resources

The existing capacities for monitoring and the human, fiscal, hardware and software resources for the monitoring purposes have also been assessed to an extent in the framework of this project (see annex, Assessment of Current Monitoring Systems and Requirements). They need to be compared with the needs for monitoring arising from the new legislation and NEAP. It is also important to assess the available budget funds in the future and the ability of the industry and local communities to pay for monitoring activities under their responsibility.

In this assessment any major gaps or overlaps in monitoring services will be revealed, as well as the deficit of overall resources available.

3 Budget allocation

Based on the existing budget allocations and the possible increase, a longer term budget allocation for the Monitoring programme will be made, within which the activities will have to fit.

4 Setting priorities

It is most probable that not all monitoring needs can be covered by the available budget allocation or by the existing capacity. Because of this priorities will have to be set. The priorities will be related to the overall policy priorities, but also to the existing possibilities for monitoring. The criteria for setting priorities could be:

- Severity of environmental problem in terms of impact on human health, irreversibility of the impact and economic damage caused
- Support for existing or planned programmes of environmental improvement
- Existing monitoring networks and maintenance of long term time series

In addition to these criteria, the activities that will be performed by the polluters in the framework of self –monitoring will be identified. These activities can supplement and in some cases replace state monitoring, but at the same time provisions for control of self-monitoring have to be made in the state programme.

5 Media monitoring programmes

Taking into account the priorities and available resources, media specific monitoring programs will be developed. In general they will include two phases:

- Initial assessment, where the ecosystems and pollution pressures are identified, and the long term monitoring network is designed.
- Long term monitoring activities according to the programme developed in the first phase.

More details about the media realted monitoring programmes are described under the media related processes.

6 Establish a steering group to synchronise the MEPP / HMA / RIHP / HBI monitoring programmes

Cost-efficient monitoring programmes are based on environmental goals and clearcut priorities. They avoid useless overlaps of monitoring activities for which different monitoring institutions are responsible. Coordination of monitoring programmes is therefore required.

A steering group will be established by executives in senior positions from the relevant Ministries (Environment, Health, Agriculture). The steering group will be composed of staff representatives from the bodies involved in monitoring. The obligation and competence of the proposed steering committee will be that of synchronising existing and future monitoring programmes and methods as far as possible and of ensuring that data provided by all participating bodies is efficiently employed.

The steering group will establish their rules of procedure.

7 Develop management capacity in the MEIC

In order to manage the monitoring programme that will be performed by service providers, the existing media specialists in the MEIC will need to be strengthened and further trained. The training will specifically focus on:

- Links between policy, monitoring, environmental information and reporting
- Fiscal planning
- Monitoring and reporting standards and their implementation
- Planning of monitoring services
- Procurement of monitoring services
- Quality assurance and control including accreditation
- Information and data management

The staff trained will be actively involved throughout the development of the monitoring programme, so that they will be able to implement it in the practice.

8 Environmental Information System and State of Environment Reports

The data and information gathered through monitoring activities will be integrated in the Environmental Information System managed by the MEIC according to the Environmental Data Management Strategy developed within this project. They will also be used for the regular State of Environment Management Strategy developed within this project. They will also be used for the regular State of Environment reports required by the new legislation.

9 Contract out monitoring services

Once the Monitoring Programme is accepted and the conditions in terms of independence of service providers are fulfilled, the monitoring services required for the State Monitoring Programme will be contracted out to the service providers. In the initial phase this will be done by multi-annual performance based contracts with the nationally accredited providers. After the providers obtain international accreditation, the services will be contracted out on a competitive basis.

6.3 PROCESS 2: SEPARATE REGULATORY AND OPERATIONAL FUNCTIONS OF AUTHORITIES

Horizontal Approach
Process 2: Separate regulatory and operational functions of authorities

Why?

- Enable service providers which are currently owned by the state to offer their monitoring services in an evolving market
- Enable private clients to contract service providers which are currently owned by the state
- Enable perfornance-based contracting of service providers
- Enable the MEPP to focus on its regulatory core functions
- Give providers of monitoring services a long-term perspective

What are the objectives?

- Give management and financial independence to currently state-owned laboratories
- Develop the capacity of the MEPP to contract monitoring services
- Increase the efficiency of environmental monitoring
- Transform laboratories from fixed-budget operation to perfornance-based operation in a phased approach

Who is in charge?

Ministry of Environment and Physical Planning, Ministry of Agriculture, Ministry of Health	- Set the legal framework - Give existing laboratories an appropriate legal identity - Develop the own capacity to contract monitoring
Local self-government	- (optional, in the case of local monitoring☺ Develop the own capacity to contract monitoring
Service provider	- Introduce and operate management tools for cost control and data quality control

How to achieve the objectives?

1 Identify laboratories to transform into semi-independent entities

There are a number of laboratories under various forms of state ownership that provide services related to environment, including:

- Hydrometeorological Institute (ambient air, water)
- Central laboratory of the MEPP (emissions)
- Hydrobiological Institute Ohrid (lymnology)

- Republic Health Protection Institute (health related monitoring)
- Regional Health Protection Institutes (health related monitoring)

The existing legal status and performance of these and possibly other laboratories will be reviewed from the point of view of:

- possibility to deliver services for the state monitoring programme under performance based contracts
- possibility to be contracted by the polluters to provide self-monitoring related services
- requirements of independence under international accreditation standards.

Based on this review, the institutional vision for these laboratories will be developed in dialogue between the laboratories themselves and the relevant ministries.

2 Set the legal and institutional framework for the transformation process

The necessary legal changes will be made to accommodate the long term institutional vision in the Law about the State Organs ("Official gazette of R.Macedonia no. 58, year LVI)and the relevant sectoral legislation.

As part of the implementation of the new environmental legislation, the monitoring field will be regulated to encourage the provision of services by independent service providers in the long term. It is especially important to develop the monitoring standards and the rules regarding accreditation so that they accommodate the process of developing independent, market based supply of services.

3 Estimate and allocate the budget required for the transformation process

For the institutional transformation it is important to secure sufficient funding for the survival and development of the centres of expertise that already exist in the various institutions.

The first step in doing this is to identify and assess the past and current budgetary expenditure for the purpose of environmental monitoring. At the same time it is important to assess the existing cost structure of the institutions and services. Based on this information, preliminary business plans will be prepared for those institutions that will become more independent. These business plans will specify:

- The long term vision and objectives
- The quantity and quality of services that can be provided with existing and planned capacity
- The possibility of providing services to the government and the private sector (market analysis)
- The breakeven point for cost recovery under performance based payments
- Funds and other resources needed to achieve sustainablity with cost recovery
- Transition period required to be able to function fully in market conditions
- Determine demand by the State Monitoring Programme, by enforcement activities and by polluters

Based on the information from the business plans, the State Monitoring programme and available budgetary resources, a mid term allocation of budget resources needed for the State programme and enforcement will be made and guaranteed. In the intial period, this allocation will also include investment in improving management capacity , monitoring equipment, marketing and accreditation according to international standards (a project for this purpose is

already planned by the EAR).

4 Capacity building for effective management

The management and staff of the institutions that will be made more independent will be provided training and consulting support related to:

- Buiness administration
- Cost accounting and formation of prices
- Marketing
- Quality assurance
- Effective and efficient use of modern equipment
- Information and data management

This support will be provided on a continuous basis over several years of the transformation process.

5 Carry out the institutional transformation process

Once the legal framework is developed, the status of the institutions will be changed and the funding will be switched from direct budgetary funding to performance based payment according to a contract between the Ministry as a client and the service provider. Preferably, this will be a multi-annual contract to give the institution a certain degree of certainty about income. The contract will specify the scope of the monitoring programme, the quantity of measurements and quality assurance. At least a part of payments will be made only against proof of successfull performance.

6 Accreditation

(see horizontal process 6, “develop moring services”)

7 Train authorities and service providers regarding contracting and accounting

The authorities and service providers involved in monitoring, information management and enforcement will be trained in procurement of monitoring services from service providers. The training will include:

- Effective project management and objective based planning
- Cost of service calculation
- Preparing Terms of Reference and cost estimates
- Management of tenders and applications according to national and EU rules
- Negotiation skills
- Quality assurance and control

Along with the training, a procurement manual for the authorities will be developed, including standard prices for services in EU countries and actual prices in the country.

6.4 PROCESS 3: DEVELOP SELF-MONITORING AND REPORTING OF POLLUTERS

Horizontal Approach Process 3: Develop self-monitoring and reporting of polluters	
Why?	
- Encourage self-responsibility of polluters regarding their environmental performance - Provide frequent control of relevant emissions from important polluters, supplement information provided through state monitoring - Allow the state to reduce its monitoring activities - Create openness and transparency for the authorities and the public	
What are the objectives?	
- Priority polluters (IPPC installations) practise self-monitoring of relevant emissions (wastewater, exhaust air, waste, noise) and report monitoring data to the competent authorities - Reduce monitoring costs for the authorities - Check compliance with the permit of operation conditions and emissions - Make polluters apply reliable and legally sound measuring techniques - Make polluters regularly report on the results	
Who is in charge?	
Ministry of Environment and Physical Planning	- Set the legal framework, set standards to be met - Issue permits imposing self-monitoring - Check whether polluters comply with the legal obligations
Local self-government	- (no obligations)
Operator	- Responsibility to perform self-monitoring - Send data to the competent authority, or make data available on demand
Service provider	- Carry out measurements on behalf of the polluter (optional)

How to achieve the objectives?

1 Draft and enact secondary legislation specifying the self-monitoring and reporting obligations under the Law on Environment

In the process of the implementation of the IPPC and the state monitoring programme, self-monitoring and reporting standards need to be established by secondary legislation. These include parameters to be measured and reported, methods to be used, accreditation of service providers and formats and frequencies of reporting. These standards will be developed in dialogue with the industry, NGOs and service providers. They will be disseminated early, so that the polluters can take them into account when developing their compliance plans.

It is important that in the early period, these standards require only activities that can actually be performed by the industry and service providers in the country. Once the activities are established, the scope of monitoring and quality standards will gradually be harmonised with the EU by the time of accession.

2 Capacity building for the polluters and service providers in relation to self-monitoring and reporting standards

As the monitoring and reporting standards are developed, capacity building will be organised for the experts working with the polluters, service providers and relevant government bodies. The objectives of the capacity building are:

- Develop the understanding of the need for, principles and methods of self-monitoring and reporting,
- Standardise the methods used,
- Inform the industry about the availability of monitoring services,
- Motivate rapid compliance with the new requirements,
- Share experience in environmental management in general.

These capacity building will take place on a regular basis and could be performed in cooperation with activities supporting cleaner production.

3 Develop the supply of services for self-monitoring and reporting

Among the existing state owned laboratories those that could provide services to the industry will be identified. One such laboratory is the existing MEPP laboratory. These laboratories will be made more independent, so that they can provide their services on the market.

In order to achieve this, the management capacity and the monitoring equipment will be strengthened, and the laboratories will undergo a process of accreditation according to international standards (a project for this purpose is already planned by the EAR).

Until the market of monitoring services develops and stabilises, the MEPP will accredit a limited number of laboratories (state owned, industrial) to perform self-monitoring services. This accreditation will be based on the current status of the laboratories for a limited period, with a clear objective that by the time of accession to the EU, the laboratories will be accredited internationally. For this pupose also interim objectives and benchmarks could be set.

The Ministry will also procure services from the accredited laboratories in order to support their development, to control their quality and to secure their professional independence from industry.

See horizontal process 6, “develop monitoring services”, for further information

regarding the accreditation issue.

4 Establish monitoring and reporting requirements for each installation through the process of approving the compliance plans and IPPC permits

When negotiating the permits with the operators of IPPC installations, the permitting authority within the MEPP will include monitoring the self-monitoring and reporting requirements in the environmental permits, so that these are transparent and can later be monitored and enforced. The individual requirements will be coordinated with the monitoring and information system experts in teh Ministry.

The environmental provisions of permits and reporting requirements will be entered into the polluters register and thus made public.

5 Integrate the information in the Register of Polluters

The information from self-monitoring will be included in the Register of polluters as specified under Process 5: Develop a register of polluters.

6 Monitor and control the self-monitoring

The self-monitoring and reporting will itself be monitored and controlled on several levels.

The first level is controlling the timeliness, regularity and fullness of the reports. This can be done simply by formally comparing the reports with the requirements specified in the Register of Polluters. Automatic alarms can be set to remind the polluter and the authority about the deadlines.

The second level is control of consistency and plausibility of the received information, which can be done by comparing the data within time series or with information about ambient quality received from the state monitoring programme. This control can be performed by the Ministry experts for specific media and technologies.

The third level is the control by parallel sampling or by monitoring performed independently from the polluter. This method requires a bigger effort and will be applied where inconsistencies are discovered at the first two level, and by random checking a certain percentage of polluters according to an annual programme.

6.5 PROCESS 4: DEVELOP SELF-MONITORING AND REPORTING OF WATER SUPPLIERS AND DISTRIBUTERS

Horizontal Approach
Process 4: Develop self-monitoring and reporting of water suppliers and distributers

Why?

- Encourage self-responsibility of water suppliers and distributors
- Motivate water suppliers to practise provisional monitoring throughout the relevant water bodies
- Provide for safe drinking water
- Allow the state to reduce its monitoring activities
- Create openness and transparency for the authorities and the public

What are the objectives?

- Provide for frequent and regular control of the relevant water bodies (groundwater, surface water), raw water and drinking water, supplement information from state monitoring programmes
- Assign comprehensive monitoring responsibilities to water suppliers and distributors
- Report regularly on the results to the MoH, report on demand to consumers

Who is in charge?

Ministry of Environment and physical planning	- Provide all information from current monitoring programmes to the water supplier
Ministry of Health	- Inspect water suppliers and distributors, - responsibility for state monitoring of drinking water
Local self-government	- (no obligations)
Service provider	- Carry out raw water and drinking water monitoring programmes - Carry out surveys of the relevant water bodies - Advise the water supplier in hydro-geological questions

How to achieve the objectives?

1 Establish monitoring and reporting standards under the new Law on waters

In the process of the implementation of the Law on waters and the state monitoring programme, self-monitoring and reporting standards need to be established by secondary legislation in cooperation with the Ministry of Health. These include parameters to be measured and reported, methods to be used, accreditation of service providers and formats and frequencies of reporting.

These standards will be developed and disseminated early to water suppliers and distributers, so that they can take them into account when developing their infrastructure and activities.

2 Include monitoring and reporting requirements in the abstraction permits under the new Water Management Act

The monitoring and reporting requirements will be integrated into the water abstraction / water use permits that will be required under the Water Management Act. The permits will be issued by the permitting authority within the MEPP. Self-monitoring and reporting requirements will be clearly stated in the environmental permits and can later be checked and enforced.

Special attention needs to be dedicated to reporting emergency situations either in terms of quality or quantity, the procedures for informing the relevant authorities and the public as well as for the emergency response plans.

The environmental provisions of permits and reporting requirements will be entered into the water book and the database of water resource use, described under Water Management Process 1.

3 Integrate the reported information with the information obtained in the framework of the State monitoring programme

The information collected through the reporting mechanisms will be integrated and compared with the information collected in the framework of the state monitoring programme. This process involves checking consistency and plausibility of information, that may lead to further investigation and enforcement action, and quality control. Once the information is deemed of sufficient standard, it will be used to supplement the information from the state monitoring and thus improve the level of information about water bodies.

4 Monitor the reporting and control the monitoring process and results

The monitoring and reporting will be subject to regular inspections and from time to time checked also by parallel sampling and other similar methods. Failure to submit reports will trigger priority enforcement action.

6.6 PROCESS 5: DEVELOP A REGISTER OF POLLUTERS

Horizontal Approach
Process 5: Develop a register of polluters

Why?

- Provide information on important polluters regarding the production process and major emissions
- Lay the basis to apply the PRTR protocol

What are the objectives?

- Collect and update relevant information on important polluters
- Allow easy access to information about emissions from point sources
- Allow effective inspections of polluters by the relevant authorities
- Ensure that relevant emissions from important polluters are continuously/regularly monitored, following objectively set priorities

Who is in charge?

Ministry of Environment and physical planning	-	Responsible to establish and maintain the register of polluters
Local self-government	-	(no obligation)
Operator	-	Provide all information according to the relevant EU directives (IPPC directive, LCP directive)
Service provider	-	(optional:) Establish and maintain the register of polluters under contract with the MEPP

How to achieve the objectives?

1 Identify IPPC installations and large combustion plants

Prepare a list of installations that are subject to the IPPC and LCP directives in accordance with the new Framework Environment Law. Base the list on the existing information, the inspection visits to the various sites and supplementary information sources. The IPPC and LCP plants are a priority because they cause most of the industrial pollution in the country and because the implementation of the IPPC and LCP directives is expected to be a priority in the EU negotiations.

2 Collect information about the IPPC installations and large combustion plants

A simple questionnaire for the polluting installations will be developed to collect the information required by the directives and the Law on Environmental, including:

- Location
- Legal entity
- Existing permits and their conditions
- Description of technologies
- Use of resources – water, space, energy, minerals
- Emissions into air, water, soil and of waste in terms of concentrations and quantities
- Emergency response plan (Seveso directive)
- Description of main environmental issues

Before the questionnaire is used, the commercial confidentiality issues will be resolved by legally specifying what information can be confidential, the procedure for declaring information confidential and treatment of such information by state authorities.

A team of experts qualified in environmental audit, preferably in coordination with environmental inspectors, will visit all the installations from the list and fill in the questionnaire together with the operators.

3 Establish a database in the framework of the Environmental Information System

The questionnaires will be entered into a database in the framework of the Environmental Information System managed by the MEIC. While taking into account the rules regarding commercial confidentiality, the register will be accessible to the public.

The database design will allow for gradual development as more information becomes required and available, as well as for different uses.

4 Establish reporting requirements for each installation through the process of approving the compliance plans and IPPC permits

In the process of the implementation of the IPPC and the state monitoring programme, self-monitoring and reporting standards need to be established by secondary legislation. These include parameters to be measured and reported, methods to be used, accreditation of service providers and formats and frequencies of reporting.

These standards will be developed and disseminated early, so that the polluters can take them into account when developing their compliance plans. They will be applied by the permitting authority within the MEPP when negotiating the permits with the installations, so that their self-monitoring and reporting requirements are clearly stated in the environmental permits and can later be monitored and enforced.

The environmental provisions of permits and reporting requirements will be entered into the polluters' register.

5 Training for the polluters and users of the Register

Throughout the process, capacity building workshops will be organised for all those involved with the Register, including:

- Ministry staff working with the register
- Service providers (laboratories, cleaner production experts…)

- Polluters
- Other ministries and interested public

In these workshops the new standards will be presented and discussed, experience with their application shared and feedback on the quality obtained.

6 Maintain and continuously develop the Register database

The Register will be maintained by the MEIC, but the regular input needs to be provided from the polluters, the permitting authority and the inspectorate. As new information becomes available, the register will gradually be developed into a fully fledged dynamic PRTR.

7 Expand the register to all polluters

Once the IPPC installations and LCPs are included in the register and their permitting situation is cleared according to the Framework Environmental Act, all other legal entities causing pollution will gradually be included in the register. For this purpose, simpler monitoring and reporting standards need to be established. The polluters will be given a transition testing period, in which they can develop the capacity and structures for monitoring and reporting. The register can also gradually be built up through installations that have passed the process of EIA and/or location permit.

Depending on their responsibilities in terms of enforcement and physical planning, the local self governments will also be included as users and information providers in the Register.

6.7 PROCESS 6: DEVELOP MONITORING SERVICES

Horizontal Approach Process 6: Develop monitoring services	
Why?	
- Provide institutions with a “critical mass” of experts and ensure the development of environmental expertise - Ensure that Macedonian laboratories are competitive in the future	
What are the objectives?	
- Shield the existing laboratories from the international market for a limited period of time - Make laboratories competitive through merger and qualification (“economy of scale”, competence) - Create a basic demand for monitoring services through public spending and orders from polluters - Establish basic Quality Assurance systems in the relevant institutions, prepare for future accreditation	
Who is in charge?	
Ministry of Environment and Physical Planning, Ministry of Agriculture, Ministry of Health	- Set the legal framework - Give existing laboratories an appropriate legal identity - Secure the budget for the national monitoring programme
Local self-government	- (no obligation)
Service provider	- Take part in preparation efforts for accreditation
European Agency for Reconstruction	- Support the concept of phased accreditation - Provide technical assistance - Fund the accreditation process
How to achieve the objectives?	
1	**Accredit Macedonian monitoring institutions in two steps**
1.1	In order to secure their position on the private sector market, the MEPP will initially accredit the existing laboratories for a limited time period as the only ones to perform monitoring services in the country. This intermediate accreditation will be valid only at a national level, and not be related to the international accreditation system related to ISO 17025. The time period will be determined on the basis of the business plans established in the laboratories, and their ability to obtain international accreditation. This period will not extend beyond the date of

	accession to the EU.
1.2	In the second step, the laboratories will be encouraged and supported to obtain international accreditation according to ISO 17025. A project with this objective is already planned by the EAR. Future accreditation provides a long-term perspective and a guideline for all laboratories. ISO 17025 prescriptions demand a clear organisational structure, substantial independence from possible influences from the parent institution, and the competence and resources to establish a quality system Set the appropriate legal basis which is needed in connection with ISO 17025 accreditations via secondary law. Take into account – to develop the future laboratory accreditation system, – to set legal accreditation requirements for monitoring institutions Support the monitoring institutions through consultancy, training and financial resources in their efforts to comply with ISO 17025 requirements.
1.3	Accreditation follows a process to assess the accredibility of a laboratory which is normaly done by a national accreditation body. For the time being, the existing Macedonian Institute for Accreditation (IARM) is not yet in the position to perform such assessments. Involve an accreditation agency from another country to assess national monitoring institutions for a limited period of time (e.g. 5 to 8 years). Upgrade the Macedonian Institute for Accreditation (IARM) to assess laboratories in the future (e.g. within 5 to 8 years) according to the international accreditation system
1.4	Once the laboratories are accredited, the regulations will be changed in order to open the market and enable Macedonian service providers to also market their services in other EU or non-EU countries.
2	**Institutional development of monitoring institutions**
2.1	Merge the Central Laboratory and the MEPP Air Monitoring Division with parts of the HMA Laboratory to form a competent and comprehensive monitoring institution. Give the resulting institution an appropriate legal identity which meets ISO 17025 organisational requirements Reasons are as follows: The Central Laboratory and the HMA Laboratory have complementary functions. Both laboratories can jointly offer more complete analytical services and make more efficient use of the state-of-the-art analytical hardware. The Air Monitoring Service, presently located inside the MEPP, is a classic operative task that currently overlaps with –and distracts from- the core regulatory tasks of the Ministry; namely, the development and design of environmental policy in Macedonia. Organisational demarcation and physical separation would prove beneficial to both institutions. The institutional merger of the HMA (or HMA Laboratory) with the Air Monitoring Service currently located in the MEPP-MEIC will facilitate the merger of both air monitoring networks into a unified and coherent entity.
2.2	Transform laboratories into semi-independent entities (see horizontal process 2)

6.8 PROCESS 7: REDUCE EMISSIONS THROUGH PRODUCT-RELATED STANDARDS

Horizontal Approach
Process 7: Reduce emissions through product-related standards

Why monitor?

- Eliminate or reduce the negative impact of certain substances and products on the quality of ambient air, water and soil

What are the objectives of monitoring?

- Identify substances and products which have a negative impact on air quality during the process of their production and use
- Set priorities for policy action based on sound analysis of situation
- Inform the public
- Enact and implement policies and legal instruments to reduce the negative impact
- Monitor the implementation, compliance and impact of the measures

Who is in charge?

MEPP in collaboration with other relevant ministries (Ministry of Economy, Ministry of Health, Ministry for Internal Affairs)	- Initiate studies / monitoring - Set priorities for studies / monitoring - Contract service provider - Inform the public about study results where useful and legally feasible
Local self-government	- (optional☺ Carry out product study of local importance
Service provider	- Carry out product studies

How to achieve the objectives?

1 Identify products and substances with possible impact on environment, set priorities for future activities

Products and substances that have an unacceptable negative impact on the environment or human health are identified in different ways, such as:

- Through scientific research
- Through initiatives of authorities and NGOs to address certain environmental problems
- Through enforcement activities of environmental authorities and others
- Through unexpected events such as industrial accidents.

These problems may be identified anywhere in the world and it is usual that the countries, NGOs and industries share experience with these issues

internationally in order to prevent the occurrence of the same problem elsewhere.

In order to identify the products and substances that may have a significant negative impact in Macedonian circumstances, the Ministry needs to follow the scientific, NGO and policy debate at the global level, in the EU and inside the country. Based on the information gathered in such a way, the Ministry will identify those priority products and substances that warrant policy action in the country. The criteria for the priority setting include:

- Impact on human health in terms of number of people affected and severity of impact
- Impact on species and ecosystems health in terms of irreversibility and severity of impact
- Amount of economic damage caused by the environmental impact
- Compliance with EU directives and international conventions (Air framework directive, Lead phaseout strategy, Montreal protocol, Kyoto protocol, Chemicals directive, Stockholm Convention on persistant organic polluting materials - POPs)

Priority setting can also be conducted by applying comparative risk assessment. Examples of priority products and substances include: leaded petrol, second hand vehicles without catalytic converters, fossil fuels, CFCs, Methyl bromide, pesticides etc. Based on the priority setting, the Ministry will decide with which products and substances it will take policy action in a certain time period.

An example of the process of dealing with such a product is the Strategy to Phase out Lead from Petrol that was developed within the project and also includes monitoring provisions.

2 Conduct the study and use the results

Once the decision is taken to tackle a product or substance related environmental problem, the Ministry will initiate a study that will determine:

- The knowledge about the nature of the problem in the country and in the world,
- The magnitude and mechanism of the problem in the country,
- The quantity and quality of impact on human health, environment, ecosystems and economy with measurements and indicators
- Possible solutions to the problem.

The Ministry will dedicate a certain amount in the budget for such studies. The study will be commissioned by the Ministry, but conducted by the best qualified experts and laboratories in the country or, if necessary, internationally. The results of the study will be made public.

Based on the results of the study, the Ministry will initiate the appropriate awareness raising and policy action and at the same time specify additional information needs and decide about whether and when to repeat or extend the study.

3 Integrate monitoring in the policy action

As the policy action to reduce the environmental impact is planned in dialogue with the relevant stakeholders, monitoring provisions will be included into the strategy or legal document developed. Monitoring will be designed in such a way that it will enable effective assessment of the implementation of the policy and its impact on the environment. Monitoring activities such as the following will be planned:

- Assessment of market share of the product

- Control of product quality by qualified laboratories. Ensure that the relevant methods have been established and are followed. Ensure that quality assurance measures have been established and are followed.
- Existing or additional ambient quality monitoring to indicate the impact of the policy
- Studies to confirm the changes in quantity and quality of impact

Whenever possible, monitoring and reporting will be the obligation of the producer or the seller of the product, or of the product owner, as in case of vehicles.

4 Monitor the implementation of policy measures

The planned monitoring activities will be conducted as long as the environmental impact remains significant and the policy objectives relevant. The results of the monitoring and reporting will be made available to the public through the Environmental Information System and publications related to the specific environmental problem.

6.9 PROCESS 8: REDUCE EMISSIONS FROM IMPORTANT POLLUTERS

Horizontal Approach
Process 8: Reduce emissions from important polluters

Why monitor?

- Provide information on emissions from important sources
- Control emissions to prevent the excession of limiting values
- Check compliance of operation conditions and emissions with the permit
- Establish a basis to charge for environmental levies

What are the objectives of monitoring?

- Set priorities for future strategies to abate pollution
- Priority polluters practise self-monitoring of relevant emissions and report monitoring data to the competent authorities
- Priority polluters apply reliable, cost-effective and legally sound measuring techniques
- Ensure application of the PRTR protocol
- Provide a quantitative basis for the modelling of ambient air and surface water quality

Who is in charge?

Ministry of Environment and Physical Planning (in parts: Ministry of Economy, Ministry of Health)	- Set the legal framework, set standards to be met, ensure that the requirements of the Protocoll on "Pollutant Release and Transfer Register" are met - Issue permits - Responsibility to carry out external monitoring - Check compliance of performance / construction with the permit
Local self-government	- Inform the public on demand about the permits issued to large polluters
Operator	- Responsibility to perform self-monitoring - Send data to the competent authority, or make data available on demand
Service provider	- Carry out measurements on behalf of – the MEPP (in case of contract with the MEPP) – the polluter (in case of contract with the polluter)

How to achieve the objectives?

1 Identify important polluters to be monitored

See also horizontal process 5, "develop a register of polluters"

1.1 Identify important polluters (IPPC installations, large combustion plants), starting

	with the existing cadastre of polluters. Take into account IPPC and LPC requirements. Inform the public on demand about the permits issued to large polluters.
1.2	Identify the polluters and pollutants in accordance with the requirements of the PRTR protocol
2	**Implement the new legislation and international obligations through the permits**
2.1	Review existing permits, develop new permits relating to IPPC and LCP requirements
2.2	Establish guidelines for legally sound permit procedures and compliance checks
2.3	Identify the characteristics of self-monitoring and the procedures to collect and transmit data to the competent authority "Characteristics of self- monitoring" means the parameters to be monitored, the methods to be used for sampling and measurement, monitoring site and frequency and the limiting values to comply with. Monitoring method and limiting value must be specified unambiguously to provide a legally sound basis for both the operator (who has to invest into equipement) and the authority (which must control compliance with the permit). Monitoring characteristics are imposed through the permit which shall also include the operator's obligation to maintain the monitoring equipment. The legal prerequisites to change existing permits have to be taken into account.
2.4	Ensure that the requirments set by the permit are compliant with the PRTR protocol
3	**Develop the capacity of the competent authority to check compliance with future permits**
3.1	Identify and establish the relevant monitoring methods for external monitoring (emission monitoring preferably through accredited bodies) Monitoring methods must include sample collection and measurement. Monitoring methods shall comply with the requirements of the directives, which normally means that they must be based on EN and ISO Standard methods. Monitoring methods are different for emission monitoring and ambient air monitoring, and may be different for self monitoring and for external monitoring.
3.2	Procure new equipment for external monitoring if needed, following to the requirements of the monitoring methods identified
3.3	Set up and implement an initial Quality Assurance (QA) Plan Establish standard operation procedures (SOPs) for all monitoring methods applied
3.4	Test the new methods for external monitoring, starting with selected IPPC installations and large combustion plants
4	**Prepare action plans to reduce emissions, use BAT technology**
6	**Evaluate monitoring data and present meaningful information to the public or to particular interest groups**

Chapter 7 Water Monitoring

7.1 LEGAL BACKGROUND

Overview on the existing legislation at the European level

Water is one of the most comprehensively regulated areas of EU environmental legislation. The first wave of legislation to be adopted began with the 1975 Surface Water Directive and culminated in the 1980 Drinking Water Directive. This first wave of water legislation included water quality standard legislation on fish waters (1978), shellfish waters (1979), bathing waters (1976) and groundwaters (1980). In the field of emission-limit value legislation, the Dangerous Substances Directive was adopted in 1976 and its Daughter Directives, covering various individual substances, were adopted between 1982-6.

A second wave of water legislation followed upon a review of existing legislation and an identification of necessary improvements and shortcomings to be addressed. This phase of water legislation included the Urban Waste Water Treatment Directive (1991) and the Nitrates Directive (1991). Other elements identified in the review resulted in revisions to the Drinking Water and Bathing Water Directives in order to bring them up to date (adopted in 1994 and 1995 respectively); the development of a Groundwater Action Programme; and a proposal in 1994 for the adoption of an Ecological Quality of Water Directive. In 1996, the IPPC Directive was adopted, covering water pollution in relation to large industrial installations..

The existing legal instruments are summarised in box 4 below.

Box 4: Legislation in the Water Protection Sector [**DGENV 1999, complemented by the WFD**]

Water Framework Directive and Priority Substances Decision:

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy
Official Journal L 327 , 22/12/2000 P. 0001 - 0073.

Decision 2455/2001/EC of the European Parliament and of the Council of 20 November 2001, establishing the list of priority substances in the field of water policy and amending Directive 2000/60/EC.

Water Quality oriented:

Bathing Water Directive (76/160/EEC).

New Drinking Water Directive (98/83/EC).

Directive on Surface for Drinking Water Abstraction (75/440/EEC as amended by Directives 79/869/EEC and 91/692/EEC).

Freshwater Fish Directive (78/659/EEC) as amended by Directive 91/692/EEC).

Shellfish Water Directive (79/923/EEC as amended by Directive 91/692/EEC).

Emission-Control oriented:

Urban Waste Water Treatment Directive (91/271/EEC, as amended by Directive 98/15/EC) and related decision 93/481/EEC.

Nitrates Directive (91/676/EEC).

Ground Water Directive (80/68/EEC as amended by Directive 91/692/EEC).

Dangerous Substances Directive (76/464/EEC)2).

Directive on Discharges of Mercury from the chlor-alkali electrolysis industry (82/176/EEC).

Directive on Discharges by Cadmium (83/513/EEC).

Directive on Discharges of Mercury from other sources (84/156/EEC).

Directive on Discharges of Hexachlorocyclohexane (84/491/EEC).

Directive on Discharge of List I Substances (Directive 86/280/EEC as amended by Directives 88/347/EEC and 90/415/EEC).

Monitoring and Reporting

Directive on the Measurement of Surface (Drinking) Water (79/869/EEC as amended by Directive 81/855/EEC).

Common Procedures for Exchange of Information (Decision 77/795/EEC as amended by Decisions 84/422/EEC , 86/574/EEC and 90/2/EEC).

In the framework of the CMEPP project, a comprehensive Law on Waters has been elaborated by a joint Working Group of Macedonian and international legal experts. The Law on Waters is a framework law which currently exists in a version dated November 2003 as a proposal for adoption by the Macedonian Parliament.

The Law on Waters transposes, amongst others, the Water Framework Directive, the Urban Wastewater Treatment Directive, the Drinking Water Directive, the Nitrate Directive and the Bathing Water Directive into Macedonian framework legislation (see table 5).

Legal requirements on monitoring set by the Water Framework Directive (WFD)

The Water Framework Directive is the most important and the most comprehensive Directive in the water field amongst all the transposed European Directives.

The Water Framework Directive [WFD;2000/60/EC] has set challenging and comprehensive goals in the field of water policy (box 5). Monitoring is clearly perceived as a tool in the process of achieving *good status* for all surface waters and ground waters.

Box 5: Goals in the field of water policy as set by the WFD [2000/60/EC]

Article 4, Environmental objectives

1. In making operational the programmes of measures specified in the river basin management plans:

(a) for surface waters

(i) Member States shall implement the necessary measures to prevent deterioration of the status of all bodies of surface water ...

(ii) Member States shall protect, enhance and restore all bodies of surface water ... with the aim of achieving good surface water status at the latest 15 years after the date of entry into force of this Directive ...

(iii) Member States shall protect and enhance all artificial and heavily modified bodies of water, with the aim of achieving good ecological potential and good surface water chemical status at the latest 15 years from the date of entry into force of this Directive ...

(iv) Member States shall implement the necessary measures ... with the aim of progressively reducing pollution from priority substances and ceasing or phasing out emissions, discharges and losses of priority hazardous substances ...

(b) for groundwater

(i) Member States shall implement the measures necessary to prevent or limit the input of pollutants into groundwater and to prevent the deterioration of the status of all bodies of groundwater ...

(ii) Member States shall protect, enhance and restore all bodies of groundwater, ensure a balance between abstraction and recharge of groundwater, with the aim of achieving good groundwater status at the latest 15 years after the date of entry into force of this Directive ...

(iii) Member States shall implement the measures necessary to reverse any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order progressively to reduce pollution of groundwater ...

(c) for protected areas

(i) Member Staes shall achive compliance with any standars and objectives at the latest 15 years after the date of entry into the force of this Directive….

The WFD [2000/60/EC] is a new and comprehensive tool with which to establish a management structure for future European water policy. The main objectives of this Directive are as follows:

- to expand the scope of water protection to all waters, surface waters and groundwater
- to achieve 'good status' for all waters by a certain deadline
- to implement water management based on river catchment areas
- to adopt a 'combined approach' of emission-limit values and quality standards
- to reflect true costs in charges for water and wastewater
- to achieve more active involvement of citizens
- to streamline legislation

The provisions of several items of legislation dating from 1975 to 1980 will be integrated into the WFD in such a way as to allow for these to be repealed in a phased approach. Legislation from which provisions are to be integrated include, amongst others: the Directive 75/440/EEC on Surface Water for Drinking Water Abstraction; the Dangerous Substances Directive 76/464/EEC and its daughter directives; the Directive on Measurement and Sampling of Surface Waters 79/869/EEC: and the Groundwater Directive 80/68/EEC.

The Framework Directive complements and completes other key pieces of water-related legislation; specifically, the Urban Waste Water Treatment Directive [1991/271/EC]; the Nitrate Directive [1991/676/EC]; the body of rules governing the authorisation and use of pesticides and biocides; and the Directive on Integrated Pollution Prevention and Control [IPPC Directive; 1996/61/EC].

All monitoring activities are related to the major goal specified in Article 4: the achievement of 'good status' for all water bodies.

Monitoring requires a preliminary assessment of the water body under consideration. Article 5 of the WFD (see box 6) prescribes that an assessment of the river basin district be undertaken in a comprehensive manner. Article 5 relates to annex II, which sets out detailed requirements for the *initial characterisation* of different water bodies; namely, rivers, lakes, transitional waters, coastal waters and groundwaters. This initial characterisation is to be complemented by an *identification of pressures* and an *assessment of the impact* on the respective water body.

Box 6: The WFD, Article 5

Characteristics of the river basin district, review of the environmental impact of human activity and economic analysis of water use

1. Each Member State shall ensure that for each river basin district or for the portion of an international river basin district falling within its territory:

– an analysis of its characteristics

– a review of the impact of human activity on the status of surface waters and on groundwater, and

– an economic analysis of water use

is undertaken according to the technical specifications set out in Annexes II and III and that it is completed at the latest four years after the date of entry into force of this Directive.

2. The analyses and reviews mentioned under paragraph 1 shall be reviewed, and if necessary updated at the latest 13 years after the date of entry into force of this Directive and every six years thereafter.

The requirements on monitoring are set in Article 8, relating to the more detailed prescriptions of annex V (see box 7).

Box 7: The WFD, Article 8

Monitoring of surface water status, groundwater status and protected areas

1. Member States shall ensure the establishment of programmes for the monitoring of water status in order to establish a coherent and comprehensive overview of water status within each river basin district:

— for surface waters such programmes shall cover:

(i) the volume and level or rate of flow to the extent relevant for ecological and chemical status and ecological potential, and

(ii) the ecological and chemical status and ecological potential

— for groundwaters such programmes shall cover monitoring of the chemical and quantitative status

— for protected areas the above programmes shall be supplemented by those specifications contained in Community legislation under which the individual protected areas have been established.

2. These programmes shall be operational at the latest six years after the date of entry into force of this Directive unless otherwise specified in the legislation concerned. Such monitoring shall be in accordance with the requirements of Annex V.

3. Technical specifications and standardised methods for analysis and monitoring of water status shall be laid down in accordance with the procedure laid down in Article 21.

Annex V.1 of the WFD sets requirements on the process of determining *surface water status*. This annex specifies quality elements in the classification of the ecological status of rivers, lakes, transitional waters and coastal waters (annex V.1.1); defines the classification of the ecological status in a normative manner (annex V.1.2); and sets requirements on the method of monitoring the ecological and chemical status of surface waters (annex V.1.3) and the classification and presentation of results (annex V.1.4) related to the ecological and chemical status.

The Directive indicates(Annex V. 1.4.2) that ecological status classification of a water body is represented by the lower of the values for the biological and physicalchemical monitoring results for the relevant quality elements. The normative defenition (AnnexV.1.2) indicate that for good status in rivers (for example) temperature, oxygen balance, pH, acid neutralising capacity and salinity must not reach levels outside the range established so as to ensure the functioning of the type specific ecosystem and the achivment of the values specified for the biological quality elements, and nutrient contrecations do not exceed the levels established so as ensure the functioning of the ecosystem and the achievment of the values specified for the biological quality elements.

Box 8: Requirements for the monitoring of surface waters as set by the WFD, annex V

Monitoring of ecological status and chemical status for surface waters

Design of surveillance monitoring

- *Objective*
- *Selection of monitoring points*
- *Selection of quality elements*

Design of operational monitoring

- *Objectives*
- *Selection of monitoring sites*
- *Qquality elements*

Design of investigative monitoring

- *Objectives*
- *monitoring sites*
- *Qquality elements*

Frequency of monitoring

Additional monitoring requirements of protected areas

The monitoring programs requred above shall be supplemented in order fulfil the following requirements:

- *Drinking water abstaction points*
- *Habitat and species protection areas*

Standards for monitoring of quality elements

Methods used for the monitoring of type parameters shall conform to the international standards listed below or such other national or international standards which will ensure the provision of data of an equivalent scientific quality and comparability.

– *Macroinvertebrate sampling*

– *Macrophyte sampling*

– *Fish sampling*

– *Diatom sampling*

– *Standards for physico-chemical parameters*

– *Standards for hydromorphological parameters*

Note: Quality elements are indicators of biological quality, hydromorphological quality, physico-chemical quality, priority list pollutants and other pollutants which are discharged into the river basin or sub-basin.

Annex V.2 of the WFD sets requirements on how to determine the *groundwater status*. It specifies quality elements by which to classify the quantitative and chemical status of the groundwater (annex V.2.1 and 2.3). It also sets requirements on the method adopted in monitoring the quantitative and chemical status of groundwater (annex V.2.2 and 2.4) and on the method of presenting the results (annex V.2.5).

Box 9: Requirements for the monitoring of groundwaters as set by the WFD, annex V

Monitoring of groundwater quantitaive status

- Grounwater level monitoring network

- Density of monitoring sites

- Interpretation and presentation of groundwater quantitaive status

Monitoring of groundwater chemical status

Groundwater monitoring network

Surveillance monitoring

- *Objective*
- *Selection of monitoring sites*
- *Selection of parameters*

Operational monitoring

- *Objective*
- *Selection of monitoring sites*
- *Selection of parameters*

Frequency of monitoring

Identification of trends in pollutants

Interpretation and presentation of groundwater chemical status

The WFD strictly distinguishes between initial characterisation, surveillance monitoring, and operational monitoring. In respect of both surface waters and groundwater, the WFD states (annexes V.1.3 and V.2.4) that: '*on the basis of the characterisation and impact assessment carried out in accordance with Article 5 and Annex II, Member States shall for each period to which a river basin management plan applies, establish a surveillance monitoring programme. The results of this programme shall be used to establish an operational monitoring programme to be applied for the remaining period of the plan*.' The conceptual model informing this stipulation is closely related to the monitoring cycle previously addressed in the General Approach of this paper. objective in itself.

Monitoring is a cross-cutting activity within the Directive and as such there are important interrelationships with other Articles and Annexes of the Directive. A key Article in relation to monitoring and the design of appropriate programmes for surface waters and groundwater is Article 5, Figures 7 and 8 summarise the relationship between articles 5 and 8 for surface waters and groundwater, respectively. Article 5 requires river basin districts to be characterised and the environmental impact of human activities to be reviewed in accordance with Annex II. An illustration highlighting the interfaces between initial characterisation, surveillance monitoring and operational monitoring may be found in the form of two flowcharts related to surface water (Figure 7) and surveillance monitoring and quntitavive monitoring may be found in the form of two flowcharts related to groundwater (Figure 8) taken from the guidance document [MON 2003])..

Figure 7:Relationship between the WFD's Article 5 and Article 8 requirements on the design of *surface water* monitoring programmes [MON 2003]

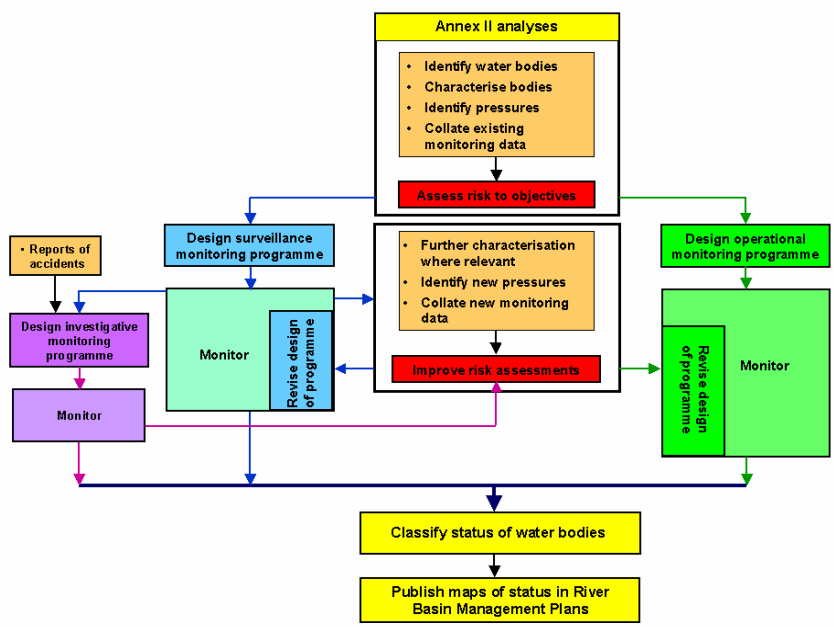
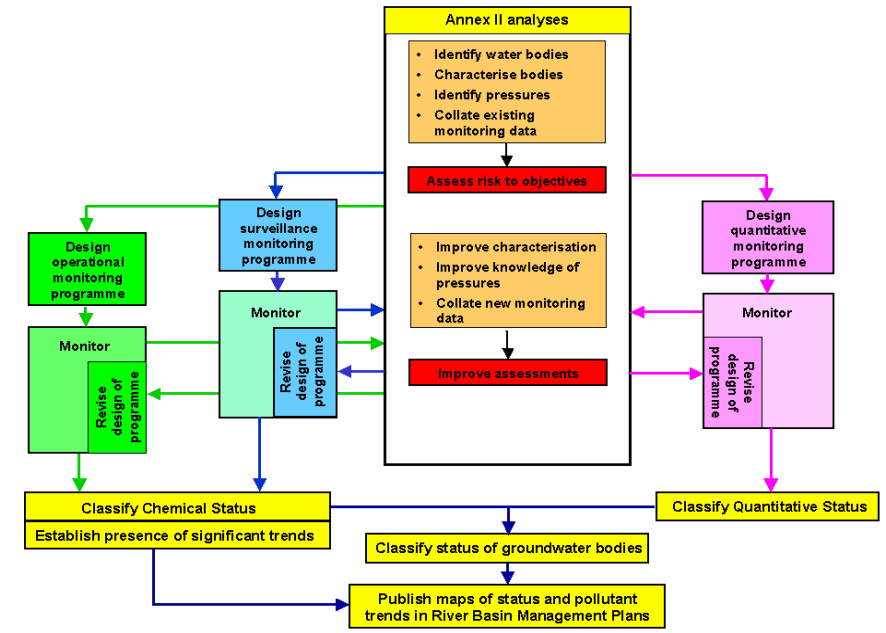


Figure 8:Relationship between WFD's Article 5 and Article 8 requirements on the design of *groundwater* monitoring programmes [MON 2003]



A comprehensive overview of the distinct concepts of *surveillance monitoring* and *operational monitoring* in relation to surface waters and ground waters is provided in a paper issued by the ETC-Water [ETC-Water 2001]. This overview takes into account the relevant aspects of objectives: the water bodies covered, the location of monitoring points, the duration of the monitoring programme, the quality elements and the frequency of monitoring.

The Water Framework Directive and emission control

Within the framework of the River Basin Management Plans required by Article 4 (see box 5), water quality monitoring and emission control are firmly bound to one another. The WFD, in a 'combined approach', targets emissions from point sources and diffuse sources which need to be monitored and limited according to Article 10 (box 10). The WFD directly refers to three important directives in this field: the IPPC Directive [1996/61/EC]; the Urban Waste Water Treatment Directive [1991/271/EC]; and the Nitrates Directive [1991/676/EC]. The IPPC Directive will be explored in greater detail by way of example.

Box 10: Requirements for emission control as set by the WFD, Article 10

The combined approach for point and diffuse sources

1. Member States shall ensure that all discharges referred to in paragraph 2 into surface waters are controlled according to the combined approach set out in this Article.

2. Member States shall ensure the establishment and/or implementation of:

(a) the emission controls based on best available techniques, or

(b) the relevant emission limit values, or

(c) in the case of diffuse impacts the controls including, as appropriate, best environmental practices set out in:

– Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (1),

– Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (2),

– Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (3), ...

- the Directives adopted to Article 16 of this Directive,

- the Directives listed in annex IX

- any other relevant Community legislation

3. Where a quality objective or quality standard, whether established pursuant to this Directive, in the Directives listed in Annex IX, or pursuant to any other Community legislation, requires stricter conditions than those which would result from the application of paragraph 2, more stringent emission controls shall be set accordingly.

The IPPC Directive

Another significant governing directive is that of the Council Directive concerning Integrated Pollution Prevention and Control [1996/61/EC]; commonly called the IPPC Directive. The IPPC Directive is one of the most important directives in the field of emission control. Although the IPPC Directive does not itself set uniform, Community-wide emission-limit values, it does allow for the application of emission-limit values as set by other EU directives and provides for new emission-limit values to be set where needed. Existing emission-limit values are taken as minimum requirements within the IPPC Directive.

The purpose of the Directive is to achieve an integrated system of pollution prevention and control for a range of specified industrial activities, including measures concerning waste. The aim of the integrated system is to prevent or reduce emissions into air, water and land (including waste) and to achieve a high level of protection of the environment as a whole. 'Emission' is understood in a comprehensive sense as referring to *the direct or indirect release of substances, vibrations, heat or noise from individual or diffuse sources in the installation into the air, water or land* (Article 2).

The Directive requires Member States to establish an integrated system of permits that contain specific operation conditions, including emission-limit values and the application of BAT.

Box 11: Requirements on monitoring as set by the IPPC Directive

Article 6: Applications for permits

1. Member States shall take the necessary measures to ensure that an application to the competent authority for a permit includes a description of:
… - measures planned to monitor emissions into the environment.

Article 9: Conditions of the permit

… 5. The permit shall contain suitable release monitoring requirements, specifying measurement methodology and frequency, evaluation procedure and an obligation to supply the competent authority with data required for checking compliance with the permit.

Article 14: Compliance with permit conditions

Member States shall take the necessary measures to ensure that:
… - the operator regularly informs the competent authority of the results of the monitoring of releases and without delay of any incident or accident significantly affecting the environment,
- operators of installations afford the representatives of the competent authority all necessary assistance to enable them to carry out any inspections within the installation, to take samples and to gather any information necessary for the performance of their duties for the purposes of this Directive.

Article 15: Access to information and public participation in the permit procedure

… 2. The results of monitoring of releases as required under the permit conditions referred to in Article 9 and held by the competent authority must be made available to the public.
3. An inventory of the principal emissions and sources responsible shall be published every three years by the Commission on the basis of the data supplied by the Member States. The Commission shall establish the format and particulars needed for the transmission of information in accordance with the procedure laid down in Article 19.
In accordance with the same procedure, the Commission may propose measures to ensure inter-comparability and complementarity between data concerning the inventory of emissions referred to in the first subparagraph and data from other registers and sources of data on emissions.

The competent authority must ensure that monitoring is undertaken in order to verify compliance with the permit conditions. The permit shall contain conditions specifying the self-monitoring to be performed by the plant operator, including the parameters to be monitored, analytical techniques to be used and the frequency and recording format to be adopted. The competent authority shall undertake periodic and partly unannounced inspections to ensure that the permit conditions are complied with and that monitoring is undertaken correctly.

WFD implementation and guidance

The implementation of the WFD is a challenge for all executives in the ministries and subordinate public bodies that deal with water policies and programmes. The WFD implementation process requires interpretation and support.

Guidance documents were elaborated by multinational groups of experts in the period 2001 to 2002. These guidance documents were completed and issued between 2002 and 2003.

As a means of providing and developing a common understanding of WFD issues and of meeting the numerous transposition and implementation challenges in a co-ordinated way, the European Commission, Member States and Norway have agreed upon a Common Implementation Strategy (CIS) associated with the WFD. Two of the key issues covered by the CIS include:

- development and guidance on technical issues
- information and data management.

Within the CIS, more than 15 European expert and working groups have been established. Major work programmes commenced in May/June 2001. Initially, these groups were assigned to produce guidance documents to assist in WFD transposition and implementation processes. These groups include experts from across Europe, drawn from such bodies as stakeholders (including industrial stakeholders), environmental NGOs, EU institutions and industry.

The following groups (abbreviations in brackets) were formed to consider the following WFD subjects:

- Analysis of Pressures and Impacts (IMPRESS)
- Heavily Modified Waterbodies (HMWB)
- Reference Conditions for Rivers and Lakes (REFCOND)
- Typology, classification and references conditions for transitional and coastal waters (COAST)
- Intercalibration (IC)
- Economic Analysis (WATECO)
- Monitoring (MON)
- Groundwater - tools for assessment and classification (GW)
- Best Practices in River Basin Planning (PROCLAN)
- Geographic Information Systems (GIS)

The aim of this strategic document is to allow, as far as possible, a coherent and harmonious implementation of the framework directive. Most of the challenges and difficulties arising will inevitably be common to all Member States and many of the European river basins are shared, crossing administrative and territorial borders, where a **common understanding and approach** is crucial to successful and effective implementation. A common strategy could limit the risks of bad application of the Directive and subsequent dispute.

Focus is on methodological questions related to a common understanding of the technical and scientific implications of the Water Framework Directive. The aim is to clarify and develop, where appropriate, supporting technical and scientific information to assist in the practical implementation of the Directive. Guidance documents, advice on for operational methods and other supporting documents may be developed for this purpose. However, such documents will have an informal and non-legally binding character and will be placed at the disposal of Member States who wish to use them on a voluntary basis.That mines that this document is not obligatory. In the same time what is so importan to explaine is that Starategy is still life metter, which every day improves.

In the present context, the most important document directly concerned with monitoring is the ‘Guidance on Monitoring for the Water Framework Directive’, issued by Working Group 2.7 within the CIS. This and other relevant guidance documents produced under the CIS and available at the time of writing (October 2003) are listed in table 7:

Table 7: Guidance documents related to monitoring under the Common Implementation Strategy

Quotation Index within this Paper	Title
IMPRESS 2002	Water Framework Directive Common Implementation Strategy, Guidance for the Analysis of Pressures and Impacts in Accordance with the Water Framework Directive. 22 November 2002.
IC 2002	Water Framework Directive Common Implementation Strategy, Working Group 2.5 Intercalibration Towards a guidance on establishment of the intercalibration network and on the process of the intercalibration exercise. 20 December 2002.
MON 2003	Water Framework Directive Common Implementation Strategy, Working Group 2.7 Monitoring Guidance on Monitoring for the Water Framework Directive. Final version 23 January 2003.
PROCLAN 2003	Water Framework Directive Common Implementation Strategy, Best Practices in River Basin Planning. Work Package 2: Guidance on the Planning Process. Version 4.3, May 2003.
GW 2001	Water Framework Directive Common Implementation Strategy, Working Group 2.8 Statistical Aspects of the identification of groundwater pollution trends, and aggregation of monitoring results. Final Report December 2001.

In the following sections, reference will not always be made to the specified guidance documents.

7.2 TECHNICAL ASPECTS OF WATER MONITORING

MONITORING PROGRAMMS

Monitoring Networks

Initial characterisation (WFD Article 5 and annex II) and surveillance monitoring (WFD Article 8 and annex V) are closely linked and interdependent activities. Although initial characterisation is logically the first activity to be undertaken, the results of the surveillance monitoring programme will serve to supplement and validate the impact assessment procedure which forms part of the initial characterisation.

The surveillance monitoring programme will yield the input information necessary to establish a long-term, sensible, targeted and cost-efficient operational monitoring programme.

Surface Waters

General

The design of the monitoring networks is determined, above all, by the water bodies (ie. brooks, streams, rivers, ponds, lakes) and the geographical area (i.e.. country, river system, etc.). Two types of networks may be identified: (1) an *extensive* network comprising many sampling sites, few annual samples, analyses limited to only a few variables, and a time-period for sampling limited to several years or less; (2) an *intensive* comprising sampling sites with detailed investigations, many annual samples or measurements of many variables, and many years of observations. Many monitoring networks are, in fact, both intensive and extensive. They may include, for example, a sub-network consisting of many extensive sampling sites with few variables combined with a sub-network including relatively few, but intensive sampling sites with frequent sampling and several variables measured [ETCIW 1996].

In particular, river sampling networks may be composed of two or more sub-networks, e.g. a few intensive sampling sites located in major rivers and numerous basic sampling sites located at less important tributaries and river reaches.

Lake sampling networks adopt a strategy of select sampling sites which are closely linked to the monitoring objective or the environmental problem to be surveyed (i.e. eutrophication or acidification). [ETCIW 1996].

Criteria for the siting of surface water monitoring stations in Germany have been laid down in a comprehensive document [LAWA 1997]

Existing network densities in Europe

Monitoring activities related to surface water quality have been surveyed in the countries belonging to the European Environment Agency area (i.e.. 15 European Union Member States and Iceland and Norway) [ETCIW 1996]. The European river monitoring networks -aiming to generally characterize the quality of rivers and streams in the participating countries- boast an area density of sampling sites which varies from one sampling site per 10,000 km^2 to more than five sampling sites per 1,000 km^2. 1-2 sampling sites per 2,000 km^2 are commonly being found. The number of sampling sites per million inhabitants varies between 2 and 50. In many of the monitoring networks (e.g. the British UK-R2), several sampling sites are located along the main course of the major rivers. In the Spanish network (ES-R1), approximately 10 sampling sites are situated along the main courses of each of the eight major rivers, while only one sampling site is to be found on less important rivers. In the Danish (DK-R1) and the British network (UK-R1), there is only one sampling site per river [ETCIW 1996]. In this way, Republic of Macedonia cooperate with EEA, collect the date, process and desiminate to Eurpean Topic Centre of water. But, is importan to underline that this metodolugy for selecting the monitoring points has been applied in the country in order to perform reporting to the EEA regarding the rivers in fYR of Macedonia.

WFD requirements

The WFD does not prescribe any definite number of monitoring stations. Nor does it prescribe a required density of sites within monitoring networks. The WFD merely sets frame conditions within which monitoring networks must be established and operated. And while it is clear that the level of confidence and precision achieved with regard to the status of the water body will increase in line with the network density it is also the case that the monitoring network must be affordable over the long term. It is important, therefore, to take into account the

costs involved when setting a desired level of confidence and precision; i.e. to assess the cost-effectiveness of the monitoring programme.

Surveillance monitoring. The key question raised in the monitoring guidance document [MON 2003] applies to risk assessments as well as to surveillance monitoring, namely:

What is the acceptable level of risk for a water body to be wrongly classified?

The WFD requires that a sufficient number of water bodies be included in the surveillance monitoring programme in order to provide an assessment of the overall surface water status within each catchment area and sub-catchment area within the river basin district. This implies that a greater number of water bodies will need to be assessed (i.e. through initial characterization, assessment of anthropogenic pressures) in a *heterogeneous* river basin district than in a more *homogenous* catchment area. Statistically representative sub-samples are regarded as adequate.

nitially, surveillance monitoring may need to be more extensive in terms of the water bodies included, the number of monitoring stations per water body and the number and range of quality elements. This is because:

- initially there will probably be a lack of appropriate existing monitoring information and data
- the WFD requires Member States to consider a different range of quality elements and a different range of pressures than previous Directives have stipulated

The Directive also stipulates that monitoring shall be carried out at sites:

- where the *water flow rate* is significant within the river basin district as a whole; including points on large rivers where the catchment is greater than 2 500 km^2
- where the *water volume* is significant within the river basin district, including large lakes and reservoirs
- where significant *water bodies cross* a Member State's *boundaries*; and
- which have been identified under the *Information Exchange Decision* [1977/795/EC].

The size typology given in the WFD Annex II (System A) implies that rivers with catchment areas larger than 10 km^2 and lakes larger than 0.5 km^2 in surface area constitute water bodies deemed to be subject to the requirements of the WFD and may thus need to be included into the assessment and monitoring of the water status.

Operational monitoring. The objectives of operational monitoring (WFD annex V.1.3.2) are:

- to establish the status of those bodies identified as being at risk of failing to meet their environmental objectives
- to assess any changes in the status of such bodies resulting from the programmes of measures

Operational monitoring will be used to establish or confirm the status of bodies considered to be at risk. Therefore, it is operational monitoring that will produce the environmental quality ratios to be used for status classification for those water bodies included in operational monitoring. Operational monitoring is highly

focused on those parameters indicative of the quality elements most sensitive to the pressures to which the water body (or bodies) are subject.

As in the case of surveillance monitoring, the key question to be raised in respect of operational monitoring [MON 2003] is, again:

What is the acceptable level of risk for a water body to be wrongly classified?- ovoj naslov e povtoruvenje na predhodniot (podobro e da se izbrise)!

The acceptable level of risk of a water body being wrongly classified shall be determined according to the consequences of a classification of failure to meet environmental quality objectives. If the consequence of such failure involves the application of relatively expensive measures, then a correspondingly high degree of certainty will be needed in classifying a water body's failure to meet the quality objectives. Conversely, where the consequences of failure are relatively inexpensive, the degree of certainty required in classification need not be so high. Because the implications of misclassification could be serious for water users, there shall be a high level of confidence in the estimates produced from operational monitoring data. In some cases, failing objectives can be serious for water users. In other cases, however, the implementation of unnecessary measures (as a result of misclassification) can have more serious consequences for the community, and therefore it is important to judge whether or not a water body is fulfilling its objectives.

The degree of confidence required in establishing the status of a water body will be highest, then, where the implications of a misclassification to 'below good status' are most serious; with costs potentially being wrongly imposed on a water user. It is equally imperative that water bodies of 'less than good' status are not misclassified as being of 'good' status.

In short, a high level of confidence will be required when classifying water bodies as being of 'good/moderate' status.

The scale of operational monitoring will increase in line with the number of water bodies that have been identified as being at risk of failing to achieve an environmental objective In other words, the more significant pressures there are upon the water environment, the more monitoring will be required to provide the information for managing those pressures. Generally, it proves easier to achieve high levels of confidence in status classification at sites where the pressure is very high and well-identified, as compared to sites which lie close to the 'good/moderate' status boundary.

Operational monitoring must be undertaken for all water bodies which have been identified –through surveillance monitoring results and/or through a review of the environmental impact of human activities (WFD annex II) - as either having failed or as being at risk of failing the relevant environmental objectives set by Article 4 of the WFD.

Operational monitoring must also be carried out for all bodies into which priority substances are discharged. This does not imply that operational monitoring is required for *each individual* water body, however, as the WFD allows for *similar* water bodies to be grouped and representatively monitored.

If only one source of pollutant is present in a water body included in the operational monitoring programme, the monitoring station shall be selected according to what is judged to be the most sensitive location. If there are several sources of pollution or other pressures, it might be desirable or necessary (from the management perspective) to allow the operational monitoring system to discriminate between the different pressures and sources. This might assist,, for example, in the apportionment of reduction measures relative to the impact of the pressures. Thus more than one monitoring station and different quality elements

might be considered. It is also noted that in many cases it will not be possible to measure the impact of *each* source of pressure and that, where this is the case, the impact of *groups* of pressures will need to be considered.

Groundwater

General

A groundwater monitoring network comprises a set of measuring stations established for a particular purpose and utilised according to a common monitoring programme.

In the field of groundwater monitoring, a distinction is commonly drawn between the following types of monitoring networks:

The *basic monitoring network* is owned and run by the state on a national scale. It serves both to establish and evaluate groundwater quality and quantity for national purposes and to fulfil reporting obligations to the European Union. It may also be useful here to draw a distinction between *reference monitoring stations* and *trend monitoring stations*: the former reflect the geodetic groundwater compositions or levels while the latter serve to identify long-term changes in groundwater compositions or levels.

Networks may differ to some extent according to whether they have been set up to monitor groundwater *level* or groundwater *quality*.

Raw water monitoring stations / networks are typically installed and run by public water suppliers, though sometimes also by private groundwater users such as breweries or dairies. These networks are set up in accordance with criteria of groundwater demand and supply potential.

Emission monitoring stations / networks are installed and operated in order to identify possible sources of pollutants that may endanger groundwater quality. *Diffuse emission sources* are those that affect wide areas and are frequently to be identified in the form of -for example- agriculture, settlements and polluted surface waters. *Point emission sources,* on the other hand, are often identified in the form of –for example- landfills, contaminated sites or depots.

Table 8 provides an overview of the different monitoring networks, their measuring targets and some criteria for the location of monitoring stations.

Table 8: Characteristics of monitoring networks

Monitoring network	Subgroup	Targets	Location
Basic monitoring network	Reference monitoring stations	Assess the geogenic groundwater composition or level	Areas of little anthropogenic impact
	Trend monitoring stations	Observe anthropogenic changes of groundwater composition or level	Areas of groundwater formation with different types of landuse
Raw water monitoring network	Raw water monitoring stations	Control raw water composition with respect to public drinking water supply or private use	Sources or wells used for the production of drinking water

Monitoring network	Subgroup	Targets	Location
Emission monitoring network	Point emission sources monitoring stations	Assess the risks arising from contaminated sites (industries, landfills, depots)	Close to point sources, depending on groundwater flow direction
	Diffuse emission sources monitoring stations	Assess the risk arising from activities or conditions affecting large areas (agriculture, traffic, settlements, infiltration from surface waters	Affected areas, upper groundwater table, depending on groundwater flow direction

When setting up a groundwater monitoring network, it must be ensured that:

- the selected locations are representative for the aquifer under concern (flow, composition)
- the selected locations reflect the possible or real impact on the aquifer (trend monitoring, emission sources monitoring)
- the monitoring stations are accessible and protected
- the locations are available at long term

The characteristics of sampling sites must be known and documented. Information regarding the aquifer –the groundwater body being sampled or monitored- is particularly important in the case of multi-aquifer systems or where quality varies strongly with depth.

The monitoring network shall be based on a balanced spatial distribution as well as a balanced mixture of different types of sampling sites in order to give representative information on the mean quality of a groundwater body.

A monitoring network within which one specific type of sampling site is prevalent risks yielding results which are not representative of the region. For example, drinking water wells are typically situated in unpolluted areas. Therefore, the purpose of a sampling site (rawwater, irrigation water etc.) which is part of the monitoring network must be taken into account when the data is evaluated.

Existing network densities in Europe

The *monitoring network density* depends on the uniformity or versatility of the hydrogeological conditions. In aquifers affected by intensive exploitation or anthropogenical impacts, the network density shall be higher. Network densities in other European countries may provide a preliminary orientation (Table 9):

Table 9: Densities of basic groundwater level and groundwater quality networks in some European countries [UNECE 2000]

Country	Average groundwater level network density		Average groundwater quality network density	
	Number of sites per 100 km^2	Area (km^2) per site[1]	Number of sites per 100 km^2	Area (km^2) per site[1]
Sweden	**0,11**	**909**	**0,04**	**2.500**
Finland	**0,02**	**5.000**	**0,02**	**5.000**
Denmark	**0,15**	**667**	**0,26**	**385**
United Kingdom (England & Wales)			**0,40**	**250**
Netherlands	**10,70**	**9**	**1,07**	**93**
Belgium/Flanders	**1,61**	**62**	**1,61**	**62**
Germany/Bavaria	**1,00**	**100**	**0,47**	**213**
Germany/New States			**0,33**	**303**
Hungary	**2,27**	**44**	**0,55**	**182**
Spain	**1,95**	**51**	**0,22**	**455**

Network densities commonly also depend on the size of the groundwater bodies.

A pilot study was carried out by the European Topic Centre on Inland Waters, where one of the objectives had been to test the EUROWATERNET groundwater guidelines [ETCIW 2000]. 12 European countries participated, providing data on 34 groundwater bodies. It was found that most of the groundwater bodies fell into the area class 100–1 000 km². Within this area class, the sampling site density was found to be generally lower than 30 km²/site. Much lower sampling site densities (typically up to 200 km^2/site) were to be found in the groundwater body area class of 1000 to 10.000 km^2.

According with this proposed methodology, Republic of Macedonia, select seven groundwater bodies, for which reported annual basic and pressure date to ETC/W.

[1] calculation based on left row values

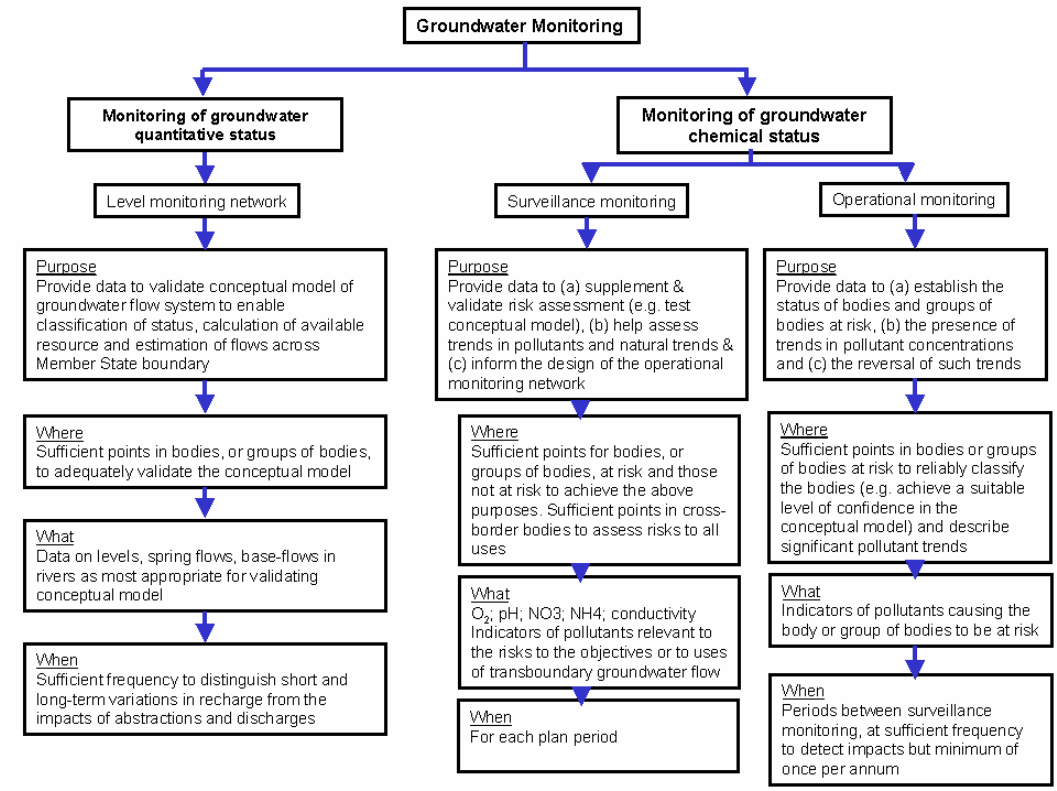
WFD requirements

In respect of ground water bodies, the WFD does not prescribe any definite number of monitoring stations; nor does it prescribe the required degree of network density. In determining the degree of confidence and precision to be aimed for in the monitoring programme, consideration must be given to the costs likely to be incurred in achieving higher or lesser degrees of confidence and precision. In short, the cost-effectiveness of the monitoring programme must be assessed.

The WFD sets out requirements for the different groundwater monitoring programmes in Annex V (2.2 and 2.4). It also specifies certain criteria for determining what, where and when to monitor with respect to these purposes. Figure 9 summarises these requirements [MON 2003].

The Figure 9 exactly explained what is mentioned in Box 9

Figure 9:Overview on monitoring purposes and requirements according to the WFD Annex X [MON 2003]



The monitoring programmes must include:

A *groundwater level monitoring network.* The purpose of establishment of this kind of network is to supplement and validate the Annex II characterisation and risk assessment procedure with respect to the risks of failing to achieve good groundwater quantitative status in all bodies -or groups of bodies- of groundwater. Good groundwater quantitative status requires that: (a) the available groundwater resource for the body as a whole is not exceeded by the long-term annual average rate of abstraction; (b) abstractions and other anthropogenic alterations to groundwater levels have not caused, and are not such as will cause, significant diminution in the status of associated surface water bodies or significant damage to directly dependent terrestrial ecosystems; and (c)

anthropogenic alterations to flow direction have not caused, and are not likely to cause, saltwater or other intrusions.

A *surveillance monitoring network*: The purpose of establishment of this kind of network is (a) supplement and validate the Annex II characterisation and risk assessment procedure with respect to risks of failing to achieve good groundwater chemical status; (b) establish the status of all groundwater bodies, or groups of bodies, determined as not being at risk on the basis of the risk assessments; and (c) provide information for use in the assessment of long-term trends in natural conditions and in pollutant concentrations resulting from human activity. Surveillance monitoring shall be undertaken in each plan period and to the extent necessary to adequately supplement and validate the risk assessment procedure for each body or group of bodies of groundwater. The programmes shall be operational from the beginning of the plan period where necessary to provide information for the design of the operational monitoring programmes, and may operate for the duration of the planning period if required. The programmes shall be designed to help ensure that all significant risks to the achievement of the WFD's objectives have been identified. Where confidence in the Annex II risk assessments is inadequate, parameters indicative of pressures from human activities -which may be affecting bodies of groundwater but which have not been identified as causing a risk to the objectives- shall be included in the surveillance monitoring programmes in order to supplement and validate the risk assessments.

An *operational monitoring network*: the purpose of establishment of this kind of network is (a) establish the status of all groundwater bodies, or groups of bodies, determined as being at risk; and (b) establish the presence of significant and sustained upward trends in the concentration of any pollutant. Operational monitoring must be carried out in intervals between surveillance monitoring. In contrast to surveillance monitoring, operational monitoring is highly focused on assessing the specific, identified risks to the achievement of the WFD's objectives.

SELECTION OF PARAMETARS

Surface Waters

General

Water quality variables may be grouped into the following broad categories [ETCIW 1996]:

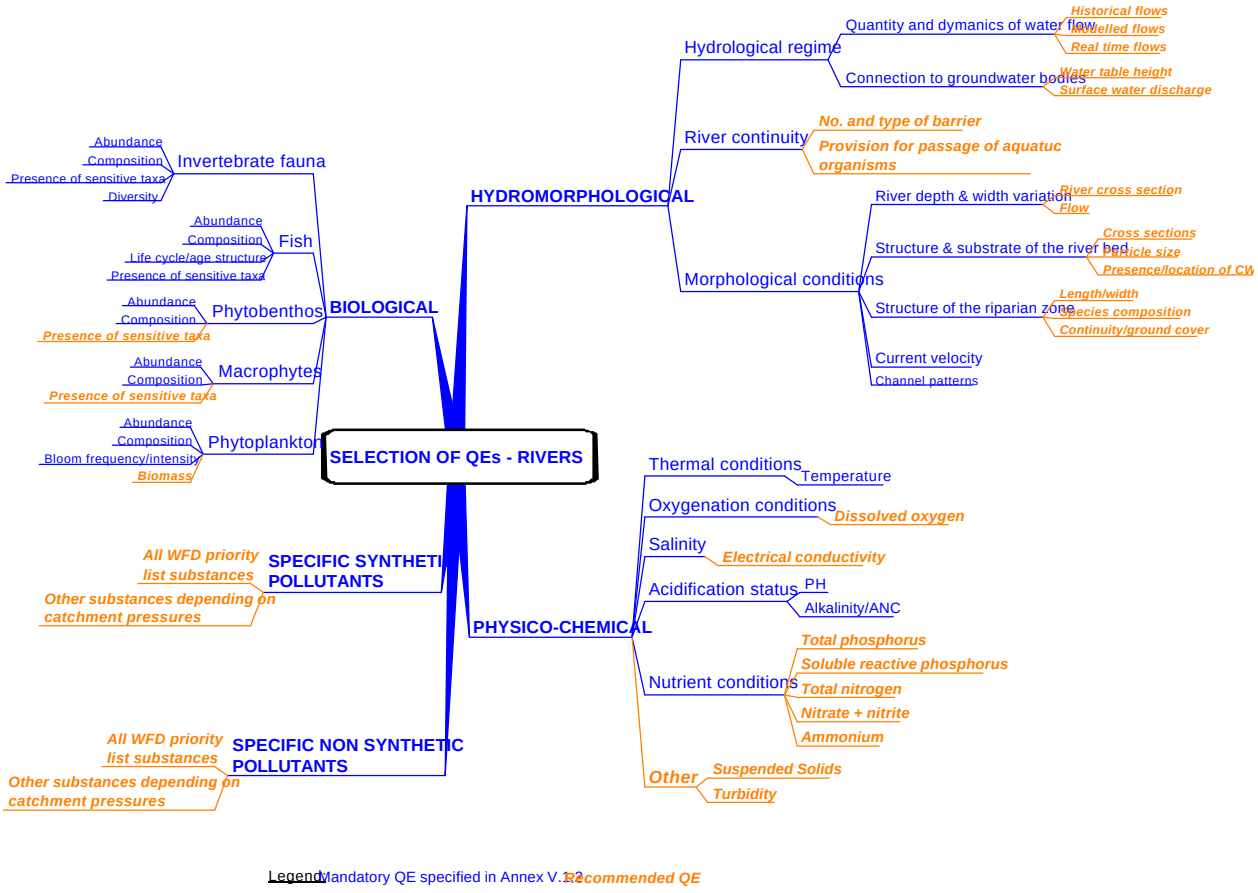
- Basic variables (e.g. water temperature, pH, conductivity, dissolved oxygen, and discharge) used in the general characterization of water quality
- Suspended particulate matter (e.g. suspended solids, turbidity and organic matter (TOC, BOD and COD))
- Organic pollution indicators (e.g. dissolved oxygen, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and ammonium)
- Indicators of eutrophication: nutrients (e.g. nitrogen and phosphorus), and various biological effect variables (e.g. chlorophyll a, Secchi disc transparency, phytoplankton, zoobenthos)
- Indicators of acidification (e.g. pH, alkalinity, conductivity, sulphate, nitrate, aluminium, phytoplankton and diatom sampling)
- Specific major ions (e.g. chloride, sulphate, sodium, potassium, calcium and magnesium) as essential factors in determining the suitability of water

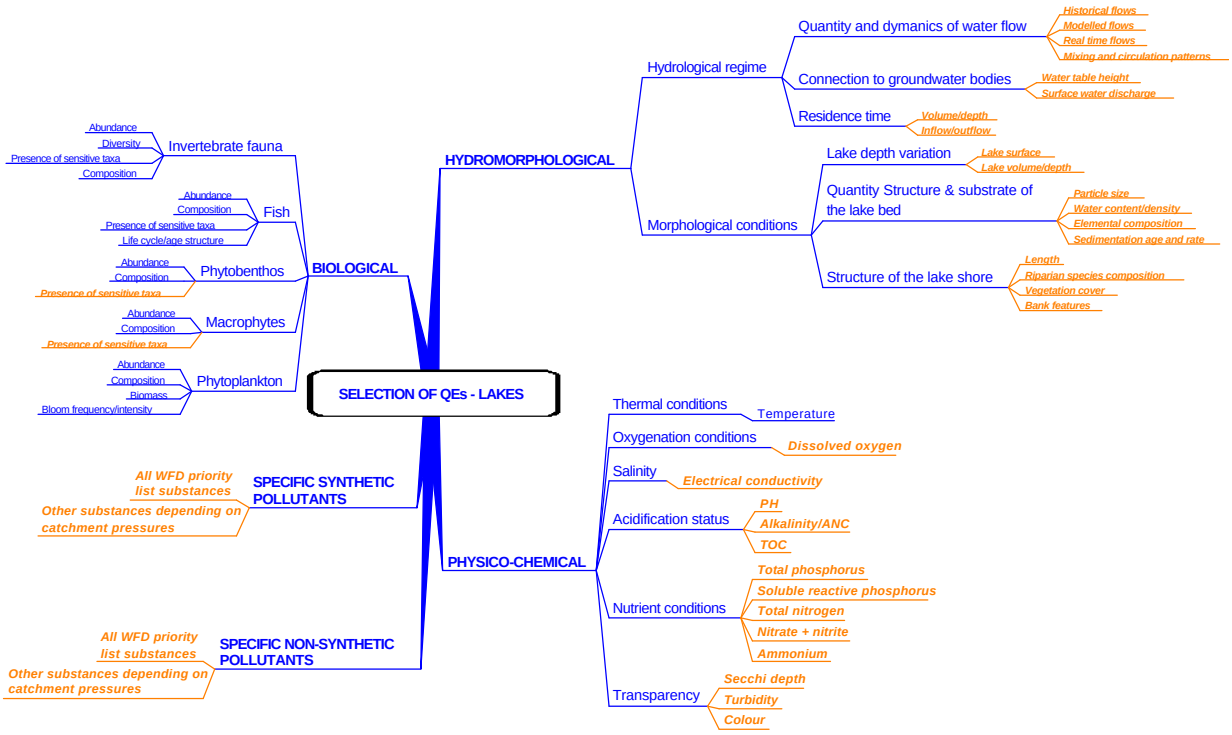
for most uses (e.g. public water supply, livestock watering and crop irrigation)

- Metals (e.g. cadmium, mercury, copper and zinc)
- Organic micropollutants such as pesticides and the numerous chemical substances used in industrial processes (e.g. PCB, HCH, PAH)
- Microbiological indicator organisms (e.g. total coliforms, faecal coliforms and faecal streptococci bacteria)
- Biological indicators of the environmental state of the ecosystem (e.g. phytoplankton, zooplankton, zoobenthos, fish, macrophytes and birds and animals related to surface waters)

Criteria for surface water monitoring programmes in Germany have been laid down in a comprehensive document [LAWA 1997].

The selection of quality elements and parameters for rivers and lakes are summarised in next Figures . These figures show the quality elements as specified in Annex V, and additional recommended quality elements which have been identified by Member States for that particular water body type





WFD requirements

The WFD approach to the assessment of the status of a surface water body is comprehensive and includes (annex V.1.1) all *quality elements* that describe the status of the surface water in physico-chemical, biological and hydromorphological terms.

For *surveillance monitoring*, Member States must monitor – at least for a period of one year– parameters which are indicative of all biological, hydromorphological and general physico-chemical quality elements. The relevant quality elements for each type of water are given in Annex V.1.1.

Biological quality elements. For rivers, the biological parameters selected as being indicative of the status of each biological element -such as the aquatic flora, macro-invertebrates and fish- must be monitored. The WFD indicates that the monitoring of biological quality elements must be conducted at a sufficiently thorough taxonomic level so as to achieve adequate confidence and precision in the classification of the quality elements. This applies equally to the three types of surface water monitoring.

Physico-chemical quality elements. The WFD, in annex X, establishes a list of *priority substances* (presented in box 12) Priority substances must be monitored if they are known to be discharged into the river basin or sub-basins. This requires profound knowledge about potential pollution sources, be it from point emission sources or diffuse emission sources [IMPRESS 2003].

Box 12: LIST OF PRIORITY SUBSTANCES IN THE FIELD OF WATER POLICY [2455/2001/EC]

LIST OF PRIORITY SUBSTANCES IN THE FIELD OF WATER POLICY (*)

	CAS number (1)	EU number (2)	Name of priority substance	Identified as priority hazardous substance
(1)	15972-60-8	240-110-8	Alachlor	
(2)	120-12-7	204-371-1	Anthracene	(X) (***)
(3)	1912-24-9	217-617-8	Atrazine	(X) (***)
(4)	71-43-2	200-753-7	Benzene	
(5)	not applicable	not applicable	Brominated diphenylethers (**)	X (****)
(6)	7440-43-9	231-152-8	Cadmium and its compounds	X
(7)	85535-84-8	287-476-5	C_{10-13}-chloroalkanes (**)	X
(8)	470-90-6	207-432-0	Chlorfenvinphos	
(9)	2921-88-2	220-864-4	Chlorpyrifos	(X) (***)
(10)	107-06-2	203-458-1	1,2-Dichloroethane	
(11)	75-09-2	200-838-9	Dichloromethane	
(12)	117-81-7	204-211-0	Di(2-ethylhexyl)phthalate (DEHP)	(X) (***)
(13)	330-54-1	206-354-4	Diuron	(X) (***)
(14)	115-29-7	204-079-4	Endosulfan	(X) (***)
	959-98-8	not applicable	(alpha-endosulfan)	
(15)	206-44-0	205-912-4	Fluoranthene (*****)	
(16)	118-74-1	204-273-9	Hexachlorobenzene	X
(17)	87-68-3	201-765-5	Hexachlorobutadiene	X
(18)	608-73-1	210-158-9	Hexachlorocyclohexane	X
	58-89-9	200-401-2	(gamma-isomer, Lindane)	
(19)	34123-59-6	251-835-4	Isoproturon	(X) (***)
(20)	7439-92-1	231-100-4	Lead and its compounds	(X) (***)
(21)	7439-97-6	231-106-7	Mercury and itrs compounds	X
(22)	91-20-3	202-049-5	Naphthalene	(X) (***)
(23)	7440-02-0	231-111-4	Nickel and its compounds	

	CAS number (1)	EU number (2)	Name of priority substance	Identified as priority hazardous substance
(24)	25154-52-3	246-672-0	Nonylphenols	X
	104-40-5	203-199-4	(4-(para)-nonylphenol)	
(25)	1806-26-4	217-302-5	Octylphenols	(X) (***)
	140-66-9	not applicable	(para-tert-octylphenol)	
(26)	608-93-5	210-172-5	Pentachlorobenzene	X
(27)	87-86-5	201-778-6	Pentachlorophenol	(X) (***)
(28)	not applicable	not applicable	Polyaromatic hydrocarbons	X
	50-32-8	200-028-5	(Benzo(a)pyrene),	
	205-99-2	205-911-9	(Benzo(b)fluoranthene),	
	191-24-2	205-883-8	(Benzo(g,h,i)perylene),	
	207-08-9	205-916-6	(Benzo(k)fluoranthene),	
	193-39-5	205-893-2	(Indeno(1,2,3-cd)pyrene)	
(29)	122-34-9	204-535-2	Simazine	(X) (***)
(30)	688-73-3	211-704-4	Tributyltin compounds	X
	36643-28-4	not applicable	(Tributyltin-cation)	
(31)	12002-48-1	234-413-4	Trichlorobenzenes	(X) (***)
	120-82-1	204-428-0	(1,2,4-Trichlorobenzene)	
(32)	67-66-3	200-663-8	Trichloromethane (Chloroform)	
(33)	1582-09-8	216-428-8	Trifluralin	(X) (***)

Other pollutants (annex VIII WFD; see box 13.) also need to be monitored if they are discharged in significant quantities into the river basin or sub-basin. No definition of 'significance' is provided, but any quantities which might compromise the achievement of any of the Directive's objectives will clearly be considered significant. By way of example, one may assume that a discharge which impacted a Protected Area, or exceeded any national standard (as set under Annex V 1.2.6 WFD) or which caused a biological or ecotoxicological effect in a water body, would be expected to be significant.

Box 13: **INDICATIVE LIST OF THE MAIN POLLUTANTS according to the WFD, ANNEX VIII**

1. Organohalogen compounds and substances which may form such compounds in the aquatic environment
2. Organophosphorous compounds
3. Organotin compounds
4. Substances and preparations, or the breakdown products of such, which have been proved to possess carcinogenic or mutagenic properties or properties which may affect steroidogenic, thyroid, reproduction or other endocrine-related functions in or via the aquatic environment.
5. Persistent hydrocarbons and persistent and bioaccumulable organic toxic substances
6. Cyanides
7. Metals and their compounds
8. Arsenic and its compounds
9. Biocides and plant protection products
10. Materials in suspension
11. Substances which contribute to eutrophication (in particular, nitrates and phosphates)

12. Substances which have an unfavourable influence on the oxygen balance (and can be measured using parameters such as BOD, COD, etc.)

With regard to *operational monitoring*, Member States are required to monitor those biological and hydromorphological quality elements which have been identified as being most sensitive to the pressures to which the body or bodies are subject. For example, if organic pollution is a significant pressure on a river, then benthic invertebrates may prove to be the most sensitive and appropriate indicator of that pressure. In the absence of other pressures, therefore, it may prove unnecessary to monitor aquatic flora and fish populations in those bodies of water. However, the monitoring and assessment system must still be based on the concept of ecological status and not simply reflect degrees of organic pollution without relating these to the appropriate reference conditions. This is because the ecological status of the water body must be defined.

The use of non-biological (notably physico-chemical) indicators to estimate the condition of a biological quality element may *complement* the use of biological indicators, but cannot replace them. This does not exclude the use of physicochemical parameters when these are operationally appropriate; for example when measures to reduce pressures such as discharges from Urban Waste Water Treatment Works are related to specific physicochemical parameters (e.g. total organic carbon, BOD or nutrients). In such a case it may be appropriate to monitor non-biological indicators and biological indicators (e.g. macrozoobenthos) at different frequencies, with the results from the physicochemical monitoring being periodically validated by the results of biological monitoring. This validation would be necessary because we do not have perfect knowledge of cause-effect relationships, pressures, the effects of pressure combinations etc. within a particular water body.

If a body is not identified as being at risk because of discharges of priority substances or other pollutants, no operational monitoring for these substances is required. The WFD defines a pollutant as *any substance liable to cause pollution; in particular those listed in Annex VIII*. By this definition, nutrients and substances that have an unfavourable influence on oxygen balance must also be considered as pollutants, together with metals and organic micro-pollutants. Operational monitoring must use parameters relevant to the assessment of the effects of the pressures placing the body at risk.

Sampling frequency

The actual confidence and precision achieved by monitoring at any particular monitoring site will depend in part upon the variability –arising from natural and man-made causes- of the determinant being measured, and in part upon the frequency of monitoring. Some monitoring might be required to obtain sufficient levels of confidence and precision about a water body's status. There will inevitably be cost implications for Member States undertaking the required monitoring. The degree of confidence and precision to be aimed for in the monitoring programme will need to take account of the costs involved and, therefore, an assessment of the cost-effectiveness of the monitoring programme may need to be undertaken.

Member States target their monitoring to particular times of year in order to allow for variability arising from seasonal factors.

The WFD allows Member States to tailor their monitoring frequencies according to the conditions and variables prevailing within their own waters. These

frequencies are likely to differ greatly from determinant to determinant, from water body type to water body type, from area to area and from country to country. The WFD thus recognises that a frequency adequate for the monitoring purposes of one country may not be adequate for another. The invariable requirement, however, is that a reliable assessment of the status of all water bodies is able to be achieved and that the reliability of that assessment in terms of confidence and precision is assured.

Lower monitoring frequencies –and, in certain instances, the cessation of monitoring- may be justified where monitoring has revealed that concentrations of substances are currently below detection limits and that these concentrations are either declining or stable and there exists no obvious risk of their increase. For example, an increase in concentration is unlikely to occur where the substance is not used in the catchment area and there is no atmospheric deposition.

Surveillance Monitoring. Surveillance monitoring must be carried out for each monitoring site for a period of one year during the period covered by a River Basin Management Plan for parameters indicative of all biological quality elements, all hydro morphological quality elements and all general physicochemical quality elements. Annex V provides tabulated guidelines in terms of the minimum monitoring frequencies for all the quality elements. The suggested minimum frequencies are generally lower than currently applied in some countries.

More frequent sampling will be necessary to obtain sufficient precision in supplementing and validating the Annex II assessments in many cases; for example in the case of phytoplankton and nutrients in lakes. Less frequent samples for the general physicochemical quality elements are permissible if these frequency rates are technically justified and determined by expert judgement.

Not all quality elements need to be monitored during the same year. Phased monitoring from year to year is allowed, providing that all relevant quality elements are monitored at least once over a year throughout the duration of the River Basin Management Plan.

One objective of surveillance monitoring is that of assessing long-term changes in natural conditions and long-term changes resulting from widespread anthropogenic activity. The minimum frequencies set by the WFD may prove inadequate for the achievement of an acceptable degree of confidence and precision in such long-term assessment. It may prove necessary, therefore, to increase the frequencies of at least some surveillance monitoring parameters and to monitor more than once every sixth year at those surveillance sites designed to detect long-term changes.

Operational monitoring. Member States are required to adopt monitoring frequencies that will allow for a reliable assessment of the status of the relevant quality element. What has been stated above in respect of minimum monitoring frequencies for surveillance monitoring also applies to operational monitoring. Again, more frequent monitoring may prove necessary in many cases, while less frequent monitoring will be justified where based on technical knowledge and expert judgement.

The statistical interpretation of results derived from monitoring is an important factor in ensuring a reliable assessment of the status of –or trends prevailing within- a water body. The statistical method to be applied will depend upon the nature of the sampling programme. Samples may be collected in regular (e.g. monthly) intervals, for example, or they may be collected on a more irregular basis within a more targeted approach in operational monitoring. The statistical analysis of the results arising from these different sampling programmes will thus need to be designed accordingly. Statistical issues pertaining to the assessment

of the status of a water body and the identification of pollution trends are further discussed in the guidance documents on monitoring [MOR 2003]. Statistical aspects of the identification of groundwater pollution trends are discussed in [GW 2001].

Groundwater

General

A monitoring programme is designed for a specific objective. A monitoring programme includes a network of monitoring stations, a selection of parameters to be monitored and a decision as to the monitoring frequency.

Groundwater level monitoring requires a set of parameters as well as additional information in order to yield data which may be properly interpreted and used, namely:

- precipitation levels, including annual distribution
- information on the hydrogeological conditions (receiving bodies, flow direction and velocity, slope of the groundwater table, permeability of the aquifer)
- altitude and latitude coordinates of the groundwater monitoring station
- information on the type of covering layer

Groundwater quality monitoring requires sets of physico-chemical parameters well- adapted to the problem to be addressed. While the parameters specified in the basic monitoring programme are practically universal, the parameters of additional programmes are to be applied only after careful analysis of the problem; as these require high investment of time and money. Answers will need to be provided to the following questions before such parameters are adopted:

- Which pesticides are commonly applied in the region? (if pressures from agriculture are to be monitored)
- What has been the production line, and what can be the possible impact on the groundwater body? (in the case of a contaminated site)

WFD requirements

Where surveillance monitoring is required, the WFD requires that a core set of parameters be monitored. These parameters are oxygen content, pH value, conductivity, nitrate and ammonium. Other parameters to be monitored for both surveillance and operational monitoring purposes must be selected on the basis of (a) the purpose of the monitoring programme (b) the identified pressures, and (c) the risk assessments undertaken with the application of an appropriate conceptual model of the groundwater system and the fate and behaviour of pollutants in it.

For example, the principal purpose of surveillance monitoring is to supplement and validate the Annex II risk assessments. To achieve this purpose, the predictions of risk calculated through the Annex II assessments must be tested. Such testing shall involve consideration of:

- the predicted effects of pressures identified during the Annex II risk assessment procedure
- the possible existence of significant effects arising from pressures which have not been identified during the Annex II assessment procedure.

In the case of last point above, the guidance document [MON 2003] recommends that Member States select monitoring parameters which, if present, would indicate effects associated with different types of human activity. Some examples of indicators relevant to different activities that may be present in the recharge area of bodies- or groups of bodies- of groundwater are provided in the following table 10.

Table 10: Examples of parameters that may be used in monitoring programmes to indicate that a particular human activity may be affecting groundwater quality [**MON 2003**]

Parameter(s)	Source
Nitrate	Agriculture
Ammonia	urban areas, agriculture, land-fill
Phosphorous	Agriculture
Pesticides	Agriculture, traffic areas (rail tracks)
Sulphate	Agriculture, atmospheric depositions (acid rain), urban areas
pH-value	Atmospheric deposition (acid rain)
Chloride	traffic (de-icing salt, road salt), agriculture, urban areas
Tetrachloroethene and Trichloroethene	housing area, small trade (e.g. dry cleaner), industry,
Micro-biological parameters	Animal or human waste disposal

Table 10 provides examples of pollutants typically associated with different human activities, and which may therefore be appropriate to consider in monitoring programmes depending on the conceptual model of each country and the likely risks to the objectives. And what is so importan to say that other chemical parameters may need to be sampled for quality assurance purposes.

Methods

The WFD stipulates, in Article 8(3), that *technical specifications and standardized methods for analysis and monitoring of water status shall be laid down in accordance with the procedure laid down in Article 21.* In the WFD Annex V.1.3.6 ('Standards for Monitoring of Quality Elements'), the WFD specifies several international standards pertaining to water sampling, biological sampling and biological river classification. The objective stated therein is *to ensure the*

provision of data of an equivalent scientific quality and comparability. Further methods are related to as *any relevant CEN/ISO standards*.

The IPPC Directive refers to methods only in the context of the permit (Article 9(5)) which must specify *measurement methodology and frequency, evaluation procedure and an obligation to supply the competent authority with data required for checking compliance with the permit*.

A number of standard methods existing in the field of freshwater and wastewater are presented in table 11.

Table 11: Parameters and European / ISO methods in water and wastewater (examples)

Parameter or Subject	Method ID	Title
Sampling	ISO 5667-10:1992	Water quality - Sampling - Part 10: Guidance on sampling waste waters
Sampling	ISO 5667-11 : 1993:	ISO 5667-11: 1993: General guide to the sampling of groundwater.
Sampling	ISO 5667-14:1998	Water quality - Sampling - Part 14: Guidance on quality assurance of environmental water sampling and handling
Selected elements	ISO 15587-2:2002 EN ISO 15587-2:2002	Water quality – Digestion for the determination of selected elements in water – Part 2: Nitric acid digestion
General information	ISO 8466-1:1990	Water quality - Calibration and evaluation of analytical methods and estimation of performance characteristics -- Part 1: Statistical evaluation of the linear calibration function
Quality control	ISO/TR 13530:1997	Water quality - Guide to analytical quality control for water analysis
pH	ISO 10523:1994	Water quality - Determination of pH
Phosphorus (P)	ISO 6878:1984	Water quality - Spectrometric determination of phosphorus using ammonium molybdate
Arsenic (As)	ISO 11969: 1996 EN ISO 11969: 1996	Water quality - Determination of arsenic - Atomic absorption spectrometric method (hydride technique)
Br-, CL-, NO3-, NO2-, PO43-, SO42-	ISO 10304-2:1995 EN ISO 10304-2:1996	Water quality - Determination of dissolved anions by liquid chromatography of ions - Part 2: Determination of bromide, chloride, nitrate, nitrite, orthophosphate and sulphate in waste water
Chromium Cr(VI)	ISO 11083:1994	Water quality - Determination of chromium(VI) - Spectrometric method using 1,5-diphenylcarbazide
Mercury (Hg)	ISO 5666:1999 EN1483: 1997	Water quality - Determination of mercury

Parameter or Subject	Method ID	Title
Cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), cadmium (Cd) and lead (Pb)	ISO 8288:1986	Water quality - Determination of cobalt, nickel, copper, zinc, cadmium and lead - Flame atomic absorption spectrometric methods
Organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes	ISO 6468:1996 EN ISO 6468:1996	Water quality - Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes - Gas chromatographic method after liquid-liquid extraction
Highly volatile halogenated hydrocarbons	EN 10301: 1997 ISO 10301: 1997	Water quality - Determination of highly volatile halogenated hydrocarbons - Gas-chromatographic methods
Benzene and some derivatives (BTEX)	ISO 11423-2: 1997	Water quality - Determination of benzene and some derivatives - Part 2: Method using extraction and gas chromatography
TOC, COD	EN 1484:1997 ISO 8245 :1999	Water analysis – Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (COD)
Permanganate index	ISO 8467:1993 EN ISO 8467:1995	Water quality - Determination of permanganate index
COD	ISO 6060:1989	Water quality - Determination of the chemical oxygen demand
BODn (seit 2003 ISO geteilt in 1 und 2)	ISO 5815-1:2003 (neu) EN 1899-1: 1998	Water quality - Determination of biochemical oxygen demand after n days (BODn) - Part 1: Dilution and seeding method with allylthiourea addition
Hydrocarbon oil index	ISO 9377-2:2000 EN ISO 9377-2: 2000	Water quality - Determination of hydrocarbon oil index - Part 2: Method using solvent extraction and gas chromatography

7.2.1 Quality Management

Methods

As has been stated before, a quality system begins with a clear, comprehensive and unambiguous identification of the methods to be employed, where 'method' equally relates to the collection of water samples or biological samples, physico-chemical measurements or the assessment of hydromorphological parameters. Standard methods, preferably European standard methods shall be applied wherever feasible.

A large but not exhaustive number of standardised methods covering physico-chemical measurements have been quoted in table 11.

For rivers, lakes and groundwaters, the UNECE Working Group on Monitoring and Assessment has prepared monitoring guidelines.

Comparability

In order to assure comparability of results throughout Europe, laboratories shall document their programme of quality assurance/quality control and participate regularly in proficiency testing programmes. A requirement of the WFD is that all monitoring shall conform to the relevant standards at national, European and international level in order to ensure the provision of data of equivalent scientific quality and comparability. All biological and physico-chemical assessment systems must therefore comply with the relevant international and national standards wherever these exist.

In Annex V.1.4.1, the WFD stipulates the measures to be adopted in order to achieve comparability of biological monitoring results. Intercalibration exercises between Member States is the essential feature of these measures (box 14). A number of monitoring sites will be selected to form an intercalibration network which will provide the basis for external Quality Assurance between Member States.

Box 14: Intercalibration activities stipulated in the WFD, annex V

Comparability of biological monitoring results

...

(iii) Each Member State shall divide the ecological quality ratio scale for their monitoring system for each surface water category into five classes ranging from high to bad ecological status, as defined in Section 1.2, by assigning a numerical value to each of the boundaries between the classes. The value for the boundary between the classes of high and good status, and the value for the boundary between good and moderate status shall be established through the intercalibration exercise described below.

...

(v) As part of this exercise the Commission shall facilitate an exchange of information between Members States leading to the identification of a range of sites in each ecoregion in the Community; these sites will form an intercalibration network. The network shall consist of sites selected from a range of surface water body types present within each ecoregion. ...

(vi) Each Member State monitoring system shall be applied to those sites in the intercalibration network which are both in the ecoregion and of a surface water body type to which the system will be applied pursuant to the requirements of this Directive. The results of this application shall be used to set the numerical values for the relevant class boundaries in each Member State monitoring system.

(vii) Within three years of the date of entry into force of the Directive, the Commission shall prepare a draft register of sites to form the intercalibration network ...

(viii) The Commission and Member States shall complete the intercalibration exercise within 18 months of the date on which the finalized register is published.

(ix) The results of the intercalibration exercise and the values established for the Member State monitoring system classifications shall be published by the Commission within six months of the completion of the intercalibration exercise.

Scope of Quality Assurance

QA measures shall be implemented for each monitoring institution as well as for data collection centres and shall encompass all operational facets of a monitoring programme, including:

- field sampling and sample receipt
- sample storage and preservation
- laboratory analysis.

Experimental evidence must be supplied and documented in the selected and elaborated methods to ensure that:

- all methods possess the sufficient level of sensitivity, selectivity and specificity for the intended purpose
- method accuracy and precision meet the requirements for each monitoring programme developed for the implementation of the WFD
- analytical detection or determination limits allow for the assessment of compliance with quality objectives or decisions regarding 'good' or 'moderate' status

Presentation of Results

Monitoring results shall be presented in the form of a report which meets the requirements of EN ISO/IEC 17025: 2000 (section 5.10), indicating:

- name and address of the laboratory
- unique identification of the report
- name and address of the client
- identification of the method used
- the date of receipt of the test items and the date of test performance
- the test results with an appropriate number of significant figures and units of measurement
- the names, functions and signatures of persons authorising the test report

7.3 STRATEGIES IN PRIORITARY PROCESSES RELATED TO WATER RESOURCES MANAGEMENT

7.3.1 Overview

Following the concept of goal-oriented environmental monitoring as before (section IV), a number of superior environmental goals are defined which imply monitoring activities. The related processes are directed towards the respective environmental goal.

Processes *related to water resources management* are those within the scope of water resources. Water may be characterised and specified according to uses (e.g. bathing / drinking / irrigation water), functions (e.g. water ecosystems), threats (e.g. flood events) and specific management tasks. The subject of wastewater has been integrated into the horizontal processes (process 6, emission control), because at least two media (water, air) are affected.

Six important processes have thus been identified (table 12) and are subsequently elaborated in terms of purposes, objectives, institutional responsibilities and required activities.

Table 12: Processes related to water resources management

Process 1	Introduce and practise integrated water resources management
Process 2	Restore and preserve water ecosystems
Process 3	Ensure that bathing waters are safe
Process 4	Ensure that drinking water is safe
Process 5	Ensure that water for irrigation is efficiently used and available at long term where needed
Process 6	Reduce risks for man and property emerging from flood events

7.3.2 Process 1: Introduce and Practise Integrated Water Resources Management

Water Resources Management Process 1: Introduce and practise integrated water resources management	
Why?	
- Maintain the water balance in the country - Secure or restore good quality of waters in the country - Preserve waters as functioning ecosystems - Secure water services: drinking water, irrigation, energy, bathing, biodiversity… - Minimize flood damage - Fulfil international obligations	
What are the objectives?	
- Coordinate monitoring programmes which take into account all water uses and functions on the basis of river basins and water bodies - Assign monitoring and reporting responsibilities to water users - Develop an emergency response system - Support the water management by suitable monitoring information - Provide monitoring information to the public and water users	
Who is in charge?	
Ministry of Environment and Physical Planning	- Set the legal framework for its competances - Overall charge for the integrated water resources management - Report to the public
Ministry of Health	- Set the legal framework for its competances - Responsibility for health aspects in water monitoring - Stakeholder in the integrated water resources management
Ministry of Agriculture, Forestry and Water Economy	- Set the legal framework for its competances - Responsibility for agricultural aspects in water monitoring - Stakeholder in the integrated water resources management

Local self-government	-	Responsibility for local aspects in water monitoring
	-	Stakeholder in the integrated water resources management
Service provider	-	Carry out water monitoring
	-	Stakeholder in the integrated water resources management

How to achieve the objectives?

1 Determine watersheds and water bodies

Based on the Water Management Act in accordance with the EU framework directive the watersheds and water bodies will be determined. A study will be commissioned by the ministry with the objectives to:

- Establish exact boundaries of watersheds as a basis for determining the administrative boundaries of the watershed management bodies
- Establish the boundaries of water bodies including rivers, lakes and underground aquifers, taking into account their location, connectivity, ecology, and management.

Based on this study, the watersheds and water bodies will be determined by an act of secondary legislation under the Water Framework Act. This classification will, among others, be used for planning, implementation and reporting of the water monitoring activities.

2 Develop a water information system in the framework of the Environmental Information System to receive and maintain the information received

In the framework of the Environmental Information System managed by the MEIC (see Environment Data Management Strategy developed under this project), a water information system will be developed in order to store, organise, analyse and present the information related to water, in particular coming from water monitoring activities,

An important part of this system will be a database of water rights and users (Water Book), which in addition to information about water rights will accept, maintain and make available the information collected from self monitoring of the polluters, water suppliers and distributors. The database will include:

- Location
- Water body(ies) being used
- Legal entity
- Water rights
- Existing permits and their conditions
- Description of abstraction, distribution and discharge
- Quantity of use
- Water quality parameters in the water body before abstraction, raw water, drinking water (in case of waterworks), discharge, water body after discharge in terms of concentrations and quantities
- Emergency response plan
- Description of main water management issues

This register will be maintained by the MEPP and shall be accessible to the public. The database design will allow for gradual development as more

information becomes required and available, as well as for different uses. All relevant authorities (Ministries of health, agriculture, economy and defense, river basin management authorities, municipaities etc.) will be connected to this database.

3 Monitoring programmes of the watersheds

Watershed management bodies will be established for each watershed. One of the roles of these bodies will be to coordinate and design a monitoring programme for the watershed taking into account monitoring of :

- water ecosystems, bathing waters, drinking water, water for irrigation, flood events and hydropower stations
- reporting by polluters, water suppliers and distributors

These programmes will be coordinated at the national level and integrated in the National Monitoring programme.

4 Monitoring activities and reporting of the watershed management bodies

The watershed management bodies themselves will intervene in the water environment and the water regime with their management activities according to their water management plans. They will monitor their activities in terms of:

- Level of implementation of the water management plans
- Purpose, location, quantity and quality of physical interventions in water environment,
- Impact of physical interventions,
- Conservation, control and enforcement activities
- Income from water charges and expenditures

The results of monitoring will be presented through annual reports that will be made available to the public and integrated in the Environmental Information System.

5 Training

In order to support the institutional development in the water sector and harmonize methods used and information coming from the watersheds, training will be provided for the experts working in the MEPP, the watershed management bodies, service providers and other stakeholders in water management on the following topics:

- Objective based planning
- Ecosystem based management of water resources
- Participatory decision making
- Monitoring activities according to new standards
- Reporting
- Data management and information systems
- GIS

7.3.3 Process 2: Restore and Preserve Water Ecosystems

Water Resources Management
Process 2: Restore and preserve water ecosystems

Why monitor?

- Restore and preserve rivers and lakes as functioning ecosystems
- Provide for the long-term use of rivers and lakes in tourism and fishery

What are the objectives of monitoring?

- Develop relevant and cost-efficient indicators describing the status of rivers and lakes, based on biological, hydromorphological and physico-chemical quality elements
- Inform the public about the status of water bodies
- Develop a system to inform the relevant international and neighbouring national institutions about the status of water bodies
- Give reasons for / justify expensive water protection measures, success control

Who is in charge?

Ministry of Environment and Physical Planning in agreement with the **Ministry of Agriculture, Forestry and Water Economy**	- Set the legal framework, set standards to be met - Responsibility to operate the river monitoring network*) - Responsibility to operate the lake monitoring network - Provide information to the public and to international and transboundary stakeholders
Local self-government	- (optional:) Operate local monitoring network
Service provider	- Carry out surveys / assessment studies - Operate the monitoring network under contract with the Ministry of Environment and Physical Planning according to the standards set*) - Report to the client (MEPP)

*) According to the actual proposal on the Law on Waters (Art. 140), the HMA has been charged with the responsibility to implement, operate, maintain and develop the state monitoring network, and to perform all monitoring of water bodies within the state network.

How to achieve the objectives?

1 Review and evaluate existing data / information about rivers and lakes

1.1 Review and evaluate existing data / information about rivers and lakes in terms of water quality and the hydrological regime

1.2	Review and evaluate existing data / information on point sources (effluent discharges) and diffuce sources of pollutants, abstraction of rawwater and irrigation water
2	**Determine watersheds and water bodies**
	Based on the Water Management Act in accordance with the EU framework directive, the watersheds (river basins) and water bodies will be determined. This classification will, among others, be used for planning, implementation and reporting of the water monitoring activities. See horizontal process 1 for further explanations.
3	**Characterise watershed areas in terms of pressures, impacts and economic aspects of water uses**
3.1	Collect information on the significant anthropogenic pressures in the identified water bodies: Industries and related impacts; settlements; contaminated areas which may have an impact on surface waters; agriculture which may be a diffuce source of pollution (use of pesticides, fertilisers, manure); hydropower units (barriers, dams); surface water abstractions (rawwater, irrigation water) and artificial recharges
3.2	Start with the assessment of hydromorphological quality elements and visible effluent discharges, which may be done rather easily and comprehensively and at rather low cost, as there is only manpower coming in. Assess, for instance: – quantity and dynamics of water flows, – structure of the riparian zone (river bank fortifications, composition of plant species, ground cover, shadow zones), – barriers / dams in the water course, proviosion for passage of aquatic organisms; – variation of river depth and width, – point discharges (industry, settlements, agriculture)
3.3	Evaluate water uses in economic terms: What are the real costs – of water abstractions for drinking / irrigation water? – of electricity production from hydropower?
3.4	Present all data and information in a way which provides an overview and fast understanding, preferably as GIS-based maps.
4	**Develop and launch surveillance monitoring programmes for rivers and lakes**
4.1	Review and evaluate the existing state monitoring programme (sites, parameters, monitoring frequencies) in terms of: information provided, cost/benefit relationship
4.2	Identify water bodies (rivers and lakes) of prime importance regarding the surveillance monitoring programme. Criteria to state prime importance are, for instance, water bodies used for drinking water abstraction, bathing waters, tourism and protected areas. Include – transboundary water flows and – type-specific reference water bodies of presumable high ecological status into the surveillance monitoring programme.
4.3	Select suitable biological quality elements for rivers and lakes of prime importance and reference water bodies

Biological quality elements include fish, invertebrate fauna, phytobenthos, macrophytes, phytoplankton.

The choice of “suitable” biological quality elements depends on the assessment coming from the characterisation of the river basins. In the surveillance monitoring phase, more than one biological quality element will be necessary. Wherever wastewaters dominate the status of the water body, the saprobia index is a suitable indicator. Certain fish species (in terms of abundance, composition, age structure, presence od sensitive taxa) which stand at the end of the food chain reflect many different (hydromorphological, physic-chemical) pressures on the water body and will thus be suitable biological indicators for the water status.

4.4 Select suitable physico-chemical quality elements for water bodies of prime importance and reference water bodies

The basic physico-chemical monitoring programme must include temperature, pH value, dissolved oxygen, electric conductivity, alkalinity and nutrient (phosphorus, nitrogen) compounds

Select other physico-chemical parameters according to the catchment pressures identified.

4.5 Set priorities with respect to
– monitoring sites,
– quality elements to be considered,
– monitoring frequencies (for each quality element),
so that the planned surveillance monitoring programme matches with the monitoring resources in terms of staff, equipment, budget

5 Ensure quality of data / information

5.1 Specify methods for sample collection, field and laboratory measurements

Follow European and international methods and standards as far as available when monitoring biological or physico-chemical indicators

Elaborate all methods step by step as standard operation procedures (SOPs). Make sure that only one authorised SOP exists in a defined number of copies.

Characterise methods by means of the working (concentration) range, the limit of detection / determination, the procedural standard deviation etc.

Characterise results by means of quality indicators as accuracy, precision, uncertainty.

5.2 Take part in intercalibration programmes

The purpose of intercalibration is to define and specify what is a “good status” water body, and to distinguish “good status” from “high” and “moderate” status.

Take part in the establishment of an intercalibration network (particular with neighbour states) with selected sites representing specific surface water body types

Practise intercalibration of the ecological status classification systems, in particular with neighbour states

Envisage intercalibration of physico-chemical methods with neighbour states and EU Member States

6 Evaluate the surveillance monitoring programme, and develop subsequent monitoring programmes

6.1	Report on the results of the surveillance monitoring programme. Provide for understandable information (preferably in form of GIS-based maps) for the public as well as the expert community.
6.2	Depending on the volume and the results of the surveillance monitoring programme, the surveillance monitoring programme may have to be supplemented (by sites, quality elements or frequency) before entering the operational monitoring programme
6.3	Develop the operational monitoring programme The operational monitoring programme makes use of those indicators (biological, physico-chemical) which have proved to be most sensitive to anthropogenic pressures in the surveillance monitoring programme.
7	**Develop a system to inform the relevant international and neighbouring national institutions about the status of water bodies**
8	**Train personnel**

7.3.4 Process 3: Ensure that Bathing Waters are Safe

Water Resources Management Process 3: Ensure that bathing waters are safe		
Why monitor?		
- Prevent diseases caused by bathing in polluted water - Motivate action to improve quality of bathing waters		
What are the objectives of monitoring?		
- Monitor the quality of bathing waters according to the bathing water directive - Inform the public about the actual quality of bathing waters without delay		
Who is in charge?		
Ministry of Environment and Physical Planning	-	Integrate bathing water concerns in water and environmental legislation
	-	Coordinate the management of bathing waters with the MoH and Local Governments
Ministry of Health	-	Transpose bathing water directive
	-	Carry out the bathing water monitoring programme in coordination with other water monitoring programmes
	-	Provide information to the public
	-	Enforcement of bathing bans in case of non-compliance
Local self-government	-	(optional:) Operate local monitoring network and programme
Service provider	-	Carry out the bathing water monitoring programme under contract with the client (MoH)
	-	Report to the client (MoH)
How to achieve the objectives?		
1 Establish the list of bathing waters A national list of bathing waters will be developed in accordance with the bathing water directive. This list will be prepared based on the statistics of tourism related to bathing waters (especially lakes), urban agglomerations and desirability of water bodies in relation to bathing. All the officially designated beaches will be included in the list.		

2 Establish bathing water monitoring programme for rivers and lakes where needed

The monitoring programme will be developed by the Republic Health Institute in cooperation with the Ministry of Environment. The programme will be based on the requirements of the bathing water directive. A priority list for monitoring will be developed by comparing the list of bathing waters with the epidemiological information. According to these priorities the frequency of sampling and relevant monitoring parameters related to public health will be determined for the various types of waters.

Responsibilities for bathing water monitoring will be set in such a way that a baseline (national) monitoring will be the responsibility of the state, while the more frequent (local) monitoring will be the responsibility of the operators of the beaches (tourism companies, municipalities).

The qualified laboratories for bathing water monitoring will be accredited. These will most probably be the Public Health Institutes.

3 Launch and conduct the bathing water monitoring programme

The bathing water monitoring programme will be enacted through secondary legislation to the Water Management Act, specifying the list of bathing waters, responsibilities for monitoring and information of the public, parameters and sampling methods and accredited service providers.

In the first year of the programme, an awareness campaign will be conducted to inform the public about the fact that the waters are being monitored and about the issues related to bathing water quality. One possibility will be to introduce the EU Blue Flag programme to mark the beaches with good bathing water quality.

Sanitary inspectors will follow the results of the monitoring programme and take enforcement action in cases when bathing water is of inadequate quality or monitoring is not conducted as planned.

7.3.5 Process 4: Ensure that Drinking Water is Safe

Water Management Process 4: Ensure that drinking water is safe	
Why monitor?	
- Protect people against health risks caused by the consumption of contaminated water - Reduce costs to treat raw water	
What are the objectives of monitoring?	
Joint objectives: - Develop problem-related and cost-efficient monitoring programmes for all water bodies intended for water abstraction - Assign monitoring and reporting responsibilities to the suppliers and distributers of drinking water - Develop a response system to meet short-term threats (surface water) and long-term pressures (groundwater) on water bodies intended for water abstraction - Monitor groundwater quantity and quality at the abstraction points and in the catchment areas - Monitor surface water quantity and quality at the abstraction points and upstream (rivers) - Monitor the quality of drinking water according to the standards set by the drinking water directive - Inform consumers on demand about drinking water quality	
Who is in charge?	
Ministry of Environment and Physical Planning	- Set the legal framework with respect to environmental issues in the framework of its competances - Issue permit to the water supplier and distributer - Provide easy access to relevant information about point emissions - Provide easy access to monitoring data from the state monitoring programme - Provide easy access to information about contaminated sites in the catchment area Provide easy access to information about diffuse emission sources
Ministry of Health	- Set the legal framework in the framework of its competances - Inspect water suppliers and distributers
Local self-government	(no obligations)

Drinking water supplier and distributer	-	Responsibility to run the necessary monitoring networks and programmes for groundwater and surface water related to water abstraction
	-	Responsibility to carry out surveys of potentially contaminated sites in the respective catchment areas
	-	Responsibility to carry out drinking water monitoring
	-	Inform the RIHP and the River Basin Management Body about the abstracted amounts of water and its quality
	-	Inform consumers on demand about drinking water quality
Service provider	-	Run the necessary monitoring networks and programmes under contract with the water supplier and distributer
	-	Carry out surveys of potentially contaminated sites under contract with the water supplier and distributer
	-	Carry out drinking water monitoring under contract with – the Ministry of Health – the water supplier and distributer
	-	Report to the client

How to achieve the objectives?

1	**Review and evaluate existing data / information on water bodies intended for water abstraction**
2	**Select prioritary water bodies used for water abstraction which are suspected to have been, or to become, contaminated by industrial, domestic or agricultural pollution sources**
2.1	Identify water bodies used for the abstraction of raw water
2.2	Identify potential pollution sources of industrial, domestic or agricultural origin, and specify the risk for the water body
2.3	Develop GIS-based maps of water abstraction regions informing about landuse and potential threats (contaminated sites, infiltration of domestic sewage, use of pesticides in agriculture, etc.)
3	**Plan surveys of the identified priority water bodies used for water abstraction**
3.1	Identify the compounds from different sources which may pose a risk for the water body
3.2	Establish a survey programme including the necessary physico-chemical and biological survey parameters and the siting of the (surface water, groundwater) survey stations
3.3	Develop quality standards for the water quality of water bodies intended for abstraction

3.4	(Groundwater body within / underneath a contaminated layer of soil☺ Develop quality standards for soil
4	**Carry out survey programmes**
	Identify tasks to be tendered (e.g. drilling of groundwater wells), tender the tasks identified
	Collect water samples (and soil samples if need be) under defined conditions, analyse samples according to the survey programme
5	**Identify water bodies which pose a substantial risk to drinking water**
	Evaluate the results, state short-term or long-term risks for water bodies used for raw water abstraction, report to the client.
6	**Deduce measures to meet the risks stated**
	Possible measures are – to stop water abstraction, – to introduce further raw water treatment steps – to impose effective measures of pollution control on polluters, – to establish a long-term monitoring and warning system (see point 7)
7	**Develop long-term tailor-made monitoring programmes for priority water bodies which pose a substantial risk to drinking water**
	The monitoring and warning system must be adequate, – in the case of abstractions from surface water, to provide fast reaction to accidential pollution (close down surface water abstraction abstraction immediately in cases of emergency) – in the case of abstractions from groundwater, to provide a long-term warning period (alarm monitoring stations to be sited beween the pollution source and the abstraction well)
8	**Provide for continuous monitoring of drinking water**
	Monitor drinking water in accordance with the directive on the quality of water intended for human consumption [1998/83/EC]

7.3.6 Process 5: Ensure that Water for Irrigation is Efficiently Used and Available at Long Term where Needed

Water Resources Management
Process 5: Ensure that water for irrigation is efficiently used and available at long term where needed

Why monitor?

- Secure sufficient supply of irrigation water from surface waters and groundwaters
- Motivate the efficient use of irrigation water

What are the objectives of monitoring?

- Assign monitoring and reporting responsibilities to the suppliers and distributers of irrigation water
- Monitor the amounts of irrigation water abstracted from surface waters and groundwaters
- Monitor the amounts of irrigation water supplied to users
- Monitor the quantitative status of water bodies (surface waters, groundwaters) used for the abstraction of irrigation water
- Lay the basis to levy cost-effective charges for the use of irrigation water
- Assess the areas irrigated, the purpose of irrigation and the irrigation techniques used
- Assess the potential to save irrigation water, lay the basis to reduce consumption of irrigation water
- Inform the users of irrigation water about the results

Who is in charge?

Ministry of Environment and Physical Planning	- Set the legal framework of its competances - Prescribe the manner, conditions and procedures related to the monitoring of abstracted or used water (in agreement with the Ministry of Agriculture, Forestry and Water Economy) - Issue permit to supply and distribute irrigation water - Responsibility to monitor water bodies used for the abstraction of irrigation water - Inform the public
Ministry of Agriculture	- Set the legal framework of its competances - Responsibility to assess the areas irrigated, the purpose of irrigation and the irrigation techniques used
Local self-government	(no obligations)

Irrigation water supplier and user	- Responsibility to monitor abstracted / supplied / impounded irrigation water by quantity and quality - Report monitoring data to the MEPP and to the River Basin Management Body
Service provider	- Assess the areas irrigated, the purpose of irrigation and the irrigation techniques used - Monitor water bodies used for the abstraction of irrigation water - Study possible effects of modifications / alterations of the currently used irrigations systems

How to achieve the objectives?

1 Establish a preliminary list of important suppliers/users of irrigation water

Establish a system to register the important suppliers / users of irrigation water. Envisage to set, via secondary law, lower threshold values of annual abstraction / supply / consumption to leave minor end users out of the register for the time being.

2 Set the legal basis to oblige the suppliers / users of irrigation water to practise self-monitoring of abstracted and supplied water

Obligation has been established in the proposed law on waters. This obligation, if issued as proposed, still has to be transposed into secondary law in order to be applicable. Specify technical requirements on self-monitoring, transition periods granted and penalties imposed with respect to the requirements set.

3 Promote and enforce self-monitoring of suppliers / users of irrigation water

3.1 Launch a campaign to create awareness with respect to the new regulations concerning self-monitoring of irrigation water.

3.2 Ensure that at least the major suppliers / users of irrigation water meet the technical requirements on monitoring. Apply penalties if necessary.

4 Launch a campaign to assess irrigation characteristics and consequences

Assess the areas irrigated, the purpose of irrigation, irrigation techniques used, the amount of water used per unit area

5 Establish monitoring of the quantitative status of water bodies used for the abstraction of irrigation water

Develop long-term monitoring particularly in areas (water bodies) which are heavily affected by water abstractions

6 Evaluate data / information

6.1 Assess the *need* to reduce water consumption for irrigation purposes

6.2 Assess the *potential* to reduce water consumption for irrigation purposes

6.3 Assess the *feasibility* to reduce water consumption via modification / alteration of currently used irrigation techniques

6.4 Report to the MEPP

7.3.7 Process 6: Reduce Risks for Man and Property Emerging from Flood Events

Water Resources Management
Process 6: Reduce risks for man and property emerging from flood events

Why monitor?

- Minimise flood damage
- Develop an emergency response system
- Enable emergency planning

What are the objectives of monitoring?

- Monitor water levels and flows in major tributaries of River Vardar, and in River Vardar
- (optional☺ Monitor precipitation in catchment areas of major tributaries of River Vardar, and in River Vardar
- Establish a method to evaluate water levels and flows with respect to high water prognosis
- Develop a system to inform the relevant state bodies and neighbouring national bodies in cases of emergency
- Lay a data basis for future high water modelling

Who is in charge?

Ministry of Environment and Physical Planning in agreement with the **Ministry of Agriculture, Forestry and Water Economy**	- Responsibility to operate the river (optional also: precipitation) monitoring network*) - Provide timely information to the relevant stakeholders in cases of emergency
Ministry of Agriculture, Forestry and Water Economy in agreement with other Ministries	- Set the legal framework with respect to flood precautions, flood forecast and flood warning - Set the legal framework with respect to preventing / remedial / emergency measures - Set up an operational plan for protection and defence against flood
Local self-government	- Transmit information to relevant stakeholders in cases of emergency
Service provider	- Operate the river (optional also: precipitation) monitoring network under contract with the Ministry of Environment according to the standards set*) - Report to the client (MEPP)

*) According to the actual proposal on the Law on Waters (Art. 140), the HMA has been charged with the responsibility to implement, operate, maintain and develop the state monitoring network, and to perform all monitoring of water bodies within the state network.

How to achieve the objectives?	
1	**Start operating the RIMSYS water monitoring stations**
2	**Launch the existing / planned monitoring network**
3	**Establish and launch a calibration and maintenance plan** Plan and carry out regular visits to calibrate and maintain all water monitoring stations. Establish routine procedures in writing. Attribute duties to trained staff.
4	**Establish the procedure to predict high water levels** Base predictions of high-water events, as far as possible, on experiences with the old water level and flow monitoring system. Observe the hydrological regime with the new RIMSYS system. Try to intercalibrate between both systems. Develop crucial water levels / flows on distinct RIMSYS monitoring stations for high-water predictions. Deduce a clear procedure to predict high-water levels. Collect and store data in view of possible future high-water modelling Denominate responsible staff to state a high-water risk
5	**Establish the information procedures to be followed in cases of emergency** Establish a link to the information chain to launch the high-water alert. Establish written procedures to be followed.

Chapter 8 Air Monitoring

8.1 LEGAL BACKGROUND

EC air quality legislation comprises a large number of Council Directives and Council Decisions. These instruments relate to:

- product control and material handling
- ambient air quality standards (limit-values and guidelines)
- air quality assessment
- air quality management
- air quality monitoring and
- information exchange.

Box 15 contains an overview of existing legislation in the air sector [DGENV 1999], as completed by the three Daughter Directives [1999/30/EC; 2000/69/EC; 2002/3/EC] recently issued under the Air Quality Framework Directive (AQFD).

Box 15: Legislation in the Air Sector
[DGENV 1999, complemented by directives 2000/69/EC and 2002/3/EC]

Ambient air quality assessment and management:

The Air Quality Framework Directive, 96/62/EC

Ambient air quality standards (limit values and guidelines):

The Directive on Sulphur Dioxide, Nitrogen Dioxide and Oxides of Nitrogen, Particulate Matter and Lead in Ambient Air, 99/30/EC. This Directive repeals:

– The Sulphur Dioxide Air Pollution Directive, 80/779/EEC;

– The Lead in Air Pollution Directive, 82/884/EEC; and

– The Nitrogen Dioxide Air Pollution Directive, 85/203/EEC.

The Directive on Limit Values for Benzene and Carbon Monoxide in Ambient Air, 2000/69/EC

The Directive on Ozone in Ambient Air, 2002/3/EC. This Directive repeals

– Directive 92/72/EC

Product control and material handling:

The Directive on emission of VOCs due to use of organic solvents, 99/13/EC;

The Directive on to the Quality of Petrol and Diesel Fuels 98/70/EC;

The Directive on Emissions from Engines to be Installed in Non-Road Mobile Machinery 97/68/EC;

The Directive on the Sulphur Content of Liquid Fuels, 93/12/EEC, as amended by 99/32/EC;

The Directive on VOC Emissions resulting from Storage and Distribution of Petrol, 94/63/EC; and

The Council Decision on the Montreal Protocol (Depletion of the Ozone Layer), 88/540/EEC.

Monitoring and information exchange:

The Council Decision on Monitoring of CO2 and other Greenhouse Gases, 93/389/EEC; and

The Council Decision on the Protocol on Long-Term Financing of EMEP, 86/277/EEC.

Attention must also be drawn to the Integrated Pollution Prevention and Control Directive [1996/61/EC], which constitutes one of the most important directives in the field of emission control, addressing *emission* in the broader sense as it relates to exhaust air, wastewater, waste and other types of emission.

The AQFD and its Daughter Directives, as well as the IPPC Directive, will be evaluated in relation to monitoring requirements further on in this document.

The Air Quality Framework Directive and its Daughter Directives

The Air Quality Framework Directive [AQFD; 96/62 EC] sets a framework for the assessment and management of ambient air quality. It lays down the following basic principles to be adopted in forming a common strategy:

- to define and set objectives for ambient air quality in order to avoid, prevent or reduce harmful effects on human health and the environment
- to assess ambient air quality in the Member States and to inform the public, notably by means of alert thresholds

The Member States are themselves held responsible for implementation of the Directive.

The AQFD focuses on the maintenance and improvement of air quality with respect to the following thirteen pollutants and groups of pollutants:

- sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead
- benzene and carbon monoxide
- ozone
- polycyclic aromatic hydrocarbons, cadmium, arsenic, nickel and mercury

Ambient air quality must be assessed[2] throughout the territory of the Member States. Different approaches may be taken for this purpose: measuring, mathematical modelling, a combination of the two, or estimates. Assessment is mandatory in built-up areas with more than 250 000 inhabitants and/or in areas where concentrations of pollutants in air are close to the limit values.

Where limit values have been exceeded, Member States are required to launch a programme designed to bring emissions back within limit values by a fixed deadline. The programme, which must be made available to the public, will contain -at minimum- the following information:

- the name of the location where the pollution is excessive
- a description of the nature -together with an assessment- of the pollution
- an identification of the origin of the pollution

Member States are required to draw up a list of ‘zones’ and ‘agglomerations’ where pollution levels exceed the limit values. The zones and agglomerations are defined in the Framework Directive 96/62/EC.

Where alert thresholds have been crossed, Member States must inform the inhabitants and forward to the Commission any relevant information as may be the pollution level recorded, duration of the alert, etc.

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2 The AQFD defines ‘assessment’ as *any method to measure, calculate, predict or estimate the level of pollutant in the ambient air, which includes monitoring.*

The Directive contains provisions on how to forward information and reports on pollution levels and the areas affected.

The AQFD has been complemented by three Daughter Directives, namely:

- The Sulphur Dioxide, Nitrogen Dioxide and Oxides of Nitrogen, Particulate Matter and Lead in Ambient Air Directive [1999/30/EC]
- the Benzene and Carbon Monoxide in Ambient Air Directive [2000/69/EC]
- the Ozone in Ambient Air Directive [2002/3/EC] repealing the Tropospheric Ozone Pollution Directive [1992/72/EC].

The Daughter Directives set numerical limits or threshold values for each of the respective pollutants.

The AQFD and its Daughter Directives seek to harmonize monitoring strategies, measuring methods, calibration and quality assessment methods throughout Member States in order to achieve comparable measurements throughout the EU and in order to facilitate the provision of sufficient information to the public.

The AQFD establishes a clear distinction between the *preliminary assessment* and the *assessment* of ambient air quality. The requirements on both types of assessment are set in Articles 5 and 6 (box 16.)

Box 16: Requirements on monitoring as set by the AQFD

Article 5

Preliminary assessment of ambient air quality

Member States which do not have representative measurements of the levels of pollutants for all zones and agglomerations shall undertake series of representative measurements, surveys or assessments in order to have the data available in time for implementation of the legislation referred to in Article 4 (1).

Article 6

Assessment of ambient air quality

1. Once limit values and alert thresholds have been set, ambient air quality shall be assessed throughout the territory of the Member States, in accordance with this Article.

2. In accordance with the criteria referred to in Article 4 (3), and in respect of the relevant pollutants under Article 4 (3), measurement is mandatory in the following zones:

- agglomerations as defined in Article 2 (10),

- zones in which levels are between the limit values and the levels provided for in paragraph 3, and

- other zones where levels exceed the limit values.

The measures provided for may be supplemented by modelling techniques to provide an adequate level of information on ambient air quality.

3. A combination of measurements and modelling techniques may be used to assess ambient air quality where the levels over a representative period are below a level lower than the limit value, to be determined according to the provisions referred to in Article 4 (5).

…

5. Where pollutants have to be measured, the measurements shall be taken at fixed sites either continuously or by random sampling; the number of measurements shall be sufficiently large to enable the levels observed to be determined.

Member States which do not already possess representative measurements of the levels of pollutants in ambient air are obliged to perform a *preliminary* assessment before proceeding to the 'real' assessment programme in those zones where limit or threshold values have been exceeded or where these values might be exceeded.

This proceeding shall provide for a targeted and cost-efficient approach. Air quality is initially to be assessed according to Article 5 on a broad scale; employing simple and cost-effective equipment and taking into account both diffuse emission sources (e.g. traffic) and point emission sources (e.g. industries). The future assessment strategy will then be elaborated; to be based solely on measurement within the identified 'hot zones', while a combination of measurement and modelling is allowed outside these zones.

In general, monitoring sites shall include a mixture of different types of sites; encompassing –for example- urban, rural and industrial zones.

It is not necessary for *all* pollutants to be monitored at *all* stations. The monitoring of priority pollutants may be considered sufficient. By way of example, priority pollutants for *traffic* are NO_x, PM_{10}, benzene and lead, while priority pollutants for *thermal power plants* are those of SO_2 and PM_{10}. Other pollutants may be monitored at a selection of sites. The minimum number of sampling points required for each zone or agglomeration is given in the Daughter Directives.

More specific requirements are set by the three Daughter Directives under the AQFD.

The *Sulphur Dioxide, Nitrogen Dioxide and Oxides of Nitrogen, Particulate Matter and Lead in Ambient Air Directive [99/30/EC]* sets detailed requirements on limit values, alert threshold values and assessment threshold values as well as setting requirements pertaining to the location and minimum number of sampling points. It also sets quality objectives for the measurement of data -i.e. accuracy, minimum data capture and minimum time coverage- and specifies the reference

methods needed to assess the concentrations of the abovementioned components in ambient air (box 17).

Box 17: Overview of the requirements of the Sulphur Dioxide, Nitrogen Dioxide and Oxides of Nitrogen, Particulate Matter and Lead in Ambient Air Directive as specified in its 9 annexes

annex I:
Limit values and the alert threshold for sulphur dioxide

annex II:
Limit values for nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x) and the alert threshold for nitrogen dioxide

annex III:
Limit values for particulate matter (PM_{10})

annex IV:
Limit value for lead

annex V:
Determination of requirements for assessment of concentrations of sulphur dioxide, nitrogen dioxide (NO_2), and oxides of nitrogen (NO_x), particulate matter (PM_{10}) and lead in ambient air within a zone or agglomeration

annex VI:
Location of sampling points for the measurement of sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air

annex VII:
Criteria for determining minimum number of sampling points for fixed measurement of concentrations of sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and oxides of nitrogen (NO_x), particulate matter and lead in ambient air

annex VIII:
Data quality objectives and compilation of results for air-quality assessment

annex IX:
Reference methods for assessment of concentrations of sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter (PM_{10} and $PM_{2,5}$) and lead

The Benzene and Carbon Monoxide in Ambient Air Directive [2000/69/EC] supplements the AQFD by introducing specific limit values for two pollutants: benzene and carbon monoxide. The limit value for benzene is set at 5 µg/m³, effective as of 1 January 2010. The limit value for carbon monoxide is set at 10 µg/m³, effective as of 1 January 2005. The Directive stipulates that Member States must routinely inform the public about concentrations of these two substances in ambient air. Member States must comply with the Directive by no later than 13 December 2002. Similarly to Directive 1999/30/EC, the Directive sets requirements on the location and minimum number of sampling points. It also sets quality objectives for the data to be measured, addressing the factor of '*uncertainty' (*defined elsewhere [ISO 1993]) and specifying the respective reference methods.

The *Ozone in Ambient Air Directive [2002/3/EC]*, repealing the *Tropospheric Ozone Pollution Directive [1992/72/EC]*, is the third Daughter Directive to the AQFD. The purpose of this Daughter Directive is to set long-term objectives and target values (Annex I) as well as information and alert threshold values (Annex II) for concentrations of ozone in ambient air. The long-term objectives set by the Directive comply with the World Health Organisation's guidelines on ozone. Where these target values are not met by a Member State, that Member State is required to draw up action plans to reduce ozone in ambient air.

As above, the Ozone in Ambient Air Directive establishes methods and criteria by which to aggregate data and assess concentrations of ozone in ambient air. This Directive imposes requirements on the location and classification of sampling points and sets criteria by which to determine the acceptable minimum number of sampling points. Article 9(3), moreover, states the requirement that *at least one measuring station to supply data on concentrations of the ozone precursor substances listed in Annex VI is installed and operated in its territory*.

The Ozone in Ambient Air Directive likewise sets quality objectives for data measurement; again taking into account the factor of *uncertainty* (as defined elsewhere [ISO 1993]) and specifying the respective reference methods.

The EEA has published a *Guidance Report on Preliminary Assessment Under EC Qualitative Directives [EEA1999]*.

The Large Combustion Plants Directive

The recently amended Large Combustion Plants Directive or LCP Directive [2001/80/EC] replaces the 1988 directive [88/609/EC, amended by 94/66/EC]. As the repealed LCP directive, it sets the limit emission standards for sulphur dioxide, nitrogen oxides and dust. It applies to combustion plants running on solid, liquid or gaseous fuels with a thermal input of 50 MW or more.

Existing plants are subject to total national emission ceilings with phased reductions and with different emission limits for different Member States. Member States had to draw up programmes for the progressive reduction of total annual emissions of SO_2 and NO_x from existing plants in accordance with these ceilings.

The LCP Directive also defines emission limits for SO_2, NO_x and dust applicable to individual authorisations for new plants.

Member states shall achieve significant reduction of total annual emissions (Article 3) from existing plants by ensuring that

(a) all licences for the operation of existing plants demand compliance with the emission limit values set,

(b) existing plants are subject to the national emission reduction plan

Member States are obliged to draw up programmes for the progressive reduction of total annual emissions from existing plants. Total annual emissions of sulphur dioxide and nitrogen oxides from combustion plants must be determined (Article 3).

Emissions from combustion plants must therefore be monitored. Member States may require that such monitoring is carried out at the operator's expense (Article 12). Operators must inform the competent authorities about the monitoring results and the examination of the measuring equipment (Article 13).

The IPPC Directive

The Council Directive concerning Integrated Pollution Prevention and Control [1996/61/EC], commonly referred to as the IPPC Directive, constitutes one of the most important directives in the field of emission control. Although the IPPC Directive does not itself set uniform, Community-wide emission-limit values, it allows for the application of emission-limit values as set by other EU directives and provides for new emission limit values to be set where needed. Existing emission-limit values are taken as minimum requirements. Under the IPPC Directive, stricter limits must be applied if Best Available Techniques (BAT) so require.

The purpose of the IPPC Directive is to achieve an integrated system of pollution prevention and control for a range of specified industrial activities, incorporating measures related to the control of waste. The aim of the integrated system is to prevent or reduce emissions (including waste) into air, water and land and to achieve a high level of protection of the environment as a whole. The term 'emission' is here understood in a comprehensive sense as referring to *the direct*

or indirect release of substances, vibrations, heat or noise from individual or diffuse sources in the installation into the air, water or land (Article 2).

The Directive requires Member States to establish an integrated system of permits containing specific operation conditions, including emission-limit values and the application of BAT.

Box 18: Requirements on monitoring as set by the IPPC Directive

Article 6: Applications for permits

1. Member States shall take the necessary measures to ensure that an application to the competent authority for a permit includes a description of:
- measures planned to monitor emissions into the environment.

Article 9: Conditions of the permit

… 5. The permit shall contain suitable release monitoring requirements, specifying measurement methodology and frequency, evaluation procedure and an obligation to supply the competent authority with data required for checking compliance with the permit.

Article 14: Compliance with permit conditions

Member States shall take the necessary measures to ensure that:
… - the operator regularly informs the competent authority of the results of the monitoring of releases and without delay of any incident or accident significantly affecting the environment,
- operators of installations afford the representatives of the competent authority all necessary assistance to enable them to carry out any inspections within the installation, to take samples and to gather any information necessary for the performance of their duties for the purposes of this Directive.

Article 15: Access to information and public participation in the permit procedure

… 2. The results of monitoring of releases as required under the permit conditions referred to in Article 9 and held by the competent authority must be made available to the public.
3. An inventory of the principal emissions and sources responsible shall be published every three years by the Commission on the basis of the data supplied by the Member States. The Commission shall establish the format and particulars needed for the transmission of information in accordance with the procedure laid down in Article 19.
In accordance with the same procedure, the Commission may propose measures to ensure inter-comparability and complementarity between data concerning the inventory of emissions referred to in the first subparagraph and data from other registers and sources of data on emissions.

The competent authority must ensure that monitoring is undertaken in order to verify compliance with the permit conditions. The permit shall contain conditions specifying the self-monitoring processes which are to be performed by the plant operator; including the parameters to be monitored, the analytical techniques to be employed, as well as the frequency and the format of data recording. The competent authority shall perform both periodic and unannounced inspections in order to ensure that the permit conditions are complied with and that monitoring is being undertaken correctly.

UNECE Convention on Long-Range Transboundary Air Pollution

The UN Economic Commission for Europe (UNECE) established a *Convention on Long-Range Transboundary Air Pollution* in 1979. Since its entry into force in 1983, the Convention has been extended by the addition of eight protocols (box 19) which identify specific obligations or measures to be taken by the Parties to the Convention.

Box 19: Protocols extending the Convention on Long-Range Transboundary Air Pollution

The 1999 Protocol to Abate Acidification, Eutrophication and Ground-level Ozone; 31 Signatories and 5 ratifications.

The 1998 Protocol on Persistent Organic Pollutants (POPs); 36 Signatories and 16 ratifications. Will enter into force on 23 October 2003.

The 1998 Protocol on Heavy Metals; 36 Signatories and 14 ratifications. Not yet in force.

The 1994 Protocol on Further Reduction of Sulphur Emissions; 25 Parties. Entered into force 5 August 1998.

The 1991 Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes; 21 Parties. Entered into force 29 September 1997.

The 1988 Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes; 28 Parties. Entered into force 14 February 1991.

The 1985 Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent; 22 Parties. Entered into force 2 September 1987.

The 1984 Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP); 40 Parties. Entered into force 28 January 1988.

The *UNECE* or *LRTAP Convention* is obligatory upon the Parties to the Convention under international law. The UNECE Convention now has 49 Parties. Macedonia ratified the UNECE Convention on 30 December, 1997.

Under the UNECE Convention, environmental monitoring tasks are to be fulfilled in the framework of six *International Cooperative Programs (ICPs)* executed within the Working Group on Effects (box 20), and the *Cooperative Program for Monitoring and Evaluation of the Long-Range Transmissions of Air Pollutants in Europe (EMEP)* executed by the EMEP Steering Body.

Box 20: International Cooperative Programs in the framework of the LRTAP Convention

ICP Forests – International Cooperative Program on Assessment and Monitoring of Air Pollution Effects on Forests

ICP Materials – International Cooperative Program on Effects of Air Pollution on Materials, including Historic and Cultural Monuments

ICP Freshwater – International Cooperative Program on Assessment and Monitoring of Acidification of Rivers and Lakes (ICP Freshwater)

ICP Crops – International Cooperative Program for Research on Evaluating Effects of Air Pollutants and other Stresses on Agricultural Crops and Non-woody Plants

ICP Integrated Monitoring – International Cooperative Program on Integrated Monitoring of Air Pollution Effects on Ecosystems

ICP Critical Loads and Levels – Mapping Critical Loads and Levels and Areas where they are Exceeded

European Monitoring and Evaluation Program (EMEP)

The *European Monitoring and Evaluation Program (EMEP)* is a Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe. EMEP was initiated in 1977 as a special programme under the United Nations Economic Commission for Europe (UNECE). It has operated under the LRTAP Convention since the Convention entered into force.

The EMEP mandate is to provide sound scientific support for the Convention, in particular in the areas of atmospheric monitoring and modelling; emission inventories and emission projections; and integrated assessment modelling.

EMEP focuses upon long-term trends in space and time and upon the verification of the success of international abatement strategies for atmospheric pollutants.

Since 1977, Macedonia has operated an EMEP station at Lazaropole at an altitude of 1332 m above sea level.

8.2 TECHNICAL ASPECTS OF AIR MONITORING

8.2.1 Monitoring Networks, Parameters and Methods

Preliminary assessment

Two excellent guidance reports intended to support Member States in the implementation of the AQFD requirements have been issued by the EEA.

The 'Guidance Report on Preliminary Assessment under EC Air Quality Directives' [EEA 1999c] serves to guide Member States through the preliminary assessment process as stipulated by Article 5 of the AQFD.

It is understood that the preliminary assessment, as stipulated by Article 5 of the AQFD, is still pending at the time of writing. A preliminary assessment shall be completed before embarking upon regular air monitoring.

The existing AMSs shall be used in this preliminary assessment as part of a more investigative approach towards establishing future monitoring needs.

The preliminary assessment shall also take into account the comprehensive and valuable database which has already been created by the participating institutions on the air quality side, i.e. the MEPP, the HMA and the RIHP/CIHPs. Proceeding from this existing knowledge base, and following the recommendations given by the EEA guide, it is recommended that the preliminary assessment be approached from three aspects, namely through:

- air quality measurements
- an emission inventory
- appropriate air pollution modelling

Air quality measurements in preliminary assessments

With regard to air quality measurements, the EEA Guide focuses on screening techniques based on (1) the diffusive sampling technique or other manual methods and (2) the use of mobile laboratories. Measurements are to be performed at locations where maximum concentrations may be expected from either existing measurements, from information from similar zones, from emission inventories or modelling studies.

Diffusive samplers are relatively cheap and allow for the assessment of concentrations within the region under concern at a high spatial resolution. They may also be used to further delimit a zone suspected of having exceeded –or of being in

danger of exceeding- the limit or threshold value. Diffusive samplers require that a subsequent determination step be undertaken through colorimetry or gas chromatography. It must be noted, however, that diffuse samplers yield data with a high degree of uncertainty of measurement. Consequently, given that fixed AMSs do already exist, it would be of particular advantage to employ a combination of both fixed AMSs and diffuse samplers.

The use of *mobile laboratories* or transportable measurement stations serves to identify maximum concentration levels of pollutants within a previously identified zone of high concentration. The fixed AMSs which have already been delivered shall be employed in the preliminary assessment.

It is essential to aggregate and map all existing and future data in order to obtain an overview of areas potentially exceeding limit and threshold values and to identify those sites where future monitoring will need to be continued in accordance with Article 6 of the AQFD.

It is further recommended that the *total uncertainty* of the estimated concentrations be assessed in order to determine the degree of confidence and precision with which a classification of 'excess' may be declared.

Emission inventories

The EEA guide [EEA 1999] recommends the use of emission inventories as part of a supplementary assessment. The primary objective of such inventories is that of producing an emission map of the zone under consideration. This map will provide basic information pertaining to the air pollution situation within the zone and further supply the information needed to run simple models for the calculation of air pollutants concentration. The specifications of the emission inventory must follow the input requirements of the model employed.

A standard methodology, harmonised at the European level, has been developed and applied in the CORINAIR project and documented in the EMEP / CORINAIR Atmospheric Emission Inventory Guidebook (now published in its 3rd edition [EEA 2001]). According to this methodological approach, it is not mandatory to measure all emission data; as the different emission sources may be taken into account through tabulated emission factors. However, emission factors shall be checked against more specific Macedonian information.

Air pollution modelling

Air pollution modelling may be understood as a method of providing information on air quality on the basis of what is known about emissions and about the atmospheric processes that lead to pollutant dispersion, transport, chemical conversion and removal from the atmosphere by deposition. Air pollution models are tools in the process of air quality assessment.

Information regarding state-of-the-art modelling, models and model applications is available in various EEA publications prepared by the European Topic Centre on Air Quality.

Modelling is undertaken on the basis of an appropriate modelling programme by reference to the available emission data, air quality data, and meteorological and topographical data. Results are then compared with the available air quality data; at which stage it may be necessary to revise the model. Model outputs are mapped and they provide an excellent overview of the air quality in the region under concern.

Selection and classification of sites

The AQFD [1996/62/EC] draws basic distinctions between city, industrial and rural zones. The Ozone in Ambient Air Directive [2002/3/EC], meanwhile, classifies station types according to their *urban, suburban, rural* or *rural background* character.

Air monitoring stations may serve several objectives and operate more than one monitoring programme. A 'rural' monitoring site (according to the AQFD) may equally be employed for EMEP [WHO 2000].

The criteria for stations measuring natural background (remote stations) and rural background (regional stations) were adopted in EUROAIRNET from EMEP requirements [EMEP 2001].

Information regarding networks and stations within the European Union has been presented in the Decision on Exchange of Understanding [1997/101/EC]. This Decision includes a classification of stations according to 'station type', 'zone type' and 'zone characterisation'. This classification (box 21) provides the basis for the general characterisation contained in EUROAIRNET [EEA 1999b].

Box 21: Classification of Air Quality Monitoring Stations [1997/101/ EC]

Subject	classification		sub-classification
Type of station	traffic	T	
	industrial	I	
	background	B	- remote - regional/rural background - near city background - urban/suburban background
Type of zone	urban	U	
	suburban	S	
	rural	R	
Characterisation of zone	residential	R	
	commercial	C	
	industrial	I	
	agricultural	A	
	natural	N	

The WHO criteria for air monitoring site classification (box 22) are largely compatible with the criteria set by the Exchange of Information Decision [WHO 2000]. Environmental air monitoring stations may also be used for health impact assessment as long as certain requirements on the network design are taken into account [WHO 1999].

Box 22: Air monitoring site classification [WHO 2000]

City/Urban centre: an urban location representative of general population exposure in towns or city centres, e.g. pedestrian precincts and shopping areas

Urban background: an urban location distanced from sources and therefore broadly representative of city-wide background

Suburban/residential: a location type situated in a residential area on the outskirts of a town or city

Kerbside/near road: a site sampling within 1 to 5 metres of a busy road

Industrial: an area where industrial sources make an important contribution to long-term or peak concentration

Rural: an open countryside location distanced as far as possible from roads, populated and industrial areas

Other: any special source-oriented or micro-environment site, or one located at a targeted receptor point, e.g. school or hospital

EMEP has published criteria by which to select monitoring sites in its EMEP Manual for Sampling and Chemical Analysis [EMEP 2001].

Number of sites

The legal requirements pertaining to the required number of fixed monitoring sites for EU Member States and the required density of air monitoring networks are specified in the three Daughter Directives under the AQFD [1999/30/EC; 2000/69/EC; 2002/3/EC]. The Directives set distinct numbers of fixed air monitoring stations (AMSs) for *agglomerations*, i.e. conurbations with more than 250.000 inhabitants. The prescribed number is determined by the population level of the agglomeration and the concentration of pollutants detected in other zones of the country.

In the case of the agglomeration of Skopje, comprising 444.000 inhabitants [FISCHER 2002], the Directives cited above specify:

- 2 fixed sampling points each for SO_2, NO_2, NO_x, PM_{10} and Pb, benzene and CO, assuming that concentrations exceed the upper assessment threshold values
- One fixed sampling point for O_3, plus one rural background station per 50.000 m^2 as an average density for the entire country

The Directives also stipulate the numbers of monitoring stations for those *zones* where the concentration levels of pollutants are considered to be at risk of exceeding certain threshold values. The number of such zones -and consequently the number of air monitoring stations which will be legally required- cannot be stated at the present time. These are decisions that must be derived from the preliminary assessment as demanded by the AQFD.

In order to compare the German and Macedonian air monitoring networks, the numbers of AMSs in both countries have been related to area and population. The results are presented in table 13.

Table 13: Number of fixed Air Monitoring Stations in some German Federal States as compared to the planning figures for Macedonia*

State	Area (km^2)	Population	AMS sites	Population per AMS	Area (km^2) per AMS
GER/Schleswig-Holstein	15.770	2.777.000	16	173.563	986
GER/Nordrhein-Westfalen	34.078	18.000.000	56	321.429	609
GER/Thüringen	16.172	2.449.000	26	94.192	622
GER/Hessen	21.115	6.052.000	36	168.111	587
MACEDONIA*	25.333	1.945.923	14*	138.995	1.809

* Number of planned fixed automatic AMSs, not counting the existing manual AMSs run by HMA (19 AMSs) and RIHP/CIHPs (around 66 AMSs)

The density of the planned automatic air monitoring network in Macedonia -not including the large number of existing manual AMSs- is comparable to the density of air monitoring networks in Germany.

It is pertinent to note here that the Gross National Product of Germany (25.605 US $ per capita) exceeds the GNP of Macedonia (1.660 US $ per capita) by a factor of 15 [FISCHER 2002].

Monitoring methods according to the Air Quality Framework Directive

The AQFD [1996/62/EC] -together with its three Daughter Directives- sets requirements on the parameters to be measured as well as the reference methods to be applied for each pollutant in the processes of sampling, calibration and analysis. The reference methods defined to date are presented in table 14. The application of other methods is permitted, providing that results are comparable with respect to the reference method and that a distinct statistical procedure is followed.

Table 14: Parameters and reference methods according to the Daughter Directives under the AQFD. Numbers correspond to the AQFD sequence. S, Sampling; A, Analysis or measurement

No.	Component		Reference Method
1.	Sulphur dioxide	S+A	ISO/FDIS 10498 (standard in draft): Ambient air - determination of sulphur dioxide - ultraviolet fluorescence method
2.	Nitrogen dioxide and oxides of nitrogen	S+A	ISO 7996:1985, Ambient air - determination of the mass concentrations of nitrogen oxides - chemiluminescence method.
3.	Suspended particulate matter (PM_{10} fraction)	S+A	EN 12341:1999, Air quality. Determination of the PM_{10} fraction of suspended particulate matter. Reference method and field test procedure to demonstrate reference equivalence of measurement methods
4.	Suspended particulate matter ($PM_{2,5}$ fraction)	S+A	'The Commission will produce guidelines … for an appropriate provisional reference method for the sampling and assessment of PM2,5 by 19 July 2001' [1999/30/EC]
5.	Lead	S	EN 12341:1999, Air Quality – Field Test Procedure to Demonstrate Reference Equivalence of Sampling Methods for the PM_{10} fraction of particulate matter
	Lead	A	ISO 9855: 1993 Ambient air. Determination of the particulate lead content of aerosols collected in filters. Atomic absorption spectroscopy method.
6.	Ozone	S+A	Analysis method: ISO FDIS 13964 (UV photometry); calibration method: ISO FDIS 13964, VDI 2468 Bl. 6
7.	Benzene	S+A	in the process of standardisation by CEN [2000/69/EC]
8.	Carbon monoxide	S+A	in the process of standardisation by CEN [2000/69/EC]

Monitoring methods according to the Large Combustion Plants Directive

The Large Combustion Plants Directive or LCP Directive [2001/80/EC] sets emission standards for sulphur dioxide, nitrogen oxides and dust. Emissions from combustion plants must be monitored. Monitoring has to follow procedures and methods laid down in annex VIII. Annex VIII classifies between continuous and discontinuous measurements of SO_2, NO_x and dust.

Continuous measurements (which shall also include the relevant process parameters) shall be made in accordance with CEN standards. Continuous measuring systems shall be subject to controls by means of parallel measurements with the reference methods at least every year.

Discontinuous methods must be verified and approved by the competent authorities. Reference is made to the relevant CEN methods.

Standardised European and international measuring methods are presented in table 15.

Monitoring methods according to the IPPC Directive

Article 9 of the IPPC Directive stipulates that *the permit shall contain suitable release monitoring requirements, specifying measurement methodology and frequency*.

Source emission monitoring of gases and particle-bound substances – carried out through self-monitoring or compliance monitoring – requires the application of methods for measurement and sample collection which differ from those applied in air quality monitoring. Discontinuous and continuous methods are available according to the compound to be measured. A comprehensive collection of methods has recently been compiled and evaluated in 2001 [UBA 2001], providing an overview of different sampling and measuring techniques as well as their respective advantages and disadvantages.

The number of available methods, or methods under preparation, has increased significantly ever since. Examples of methods and method proposals are presented in table 14.

Table 15: Parameters and European / ISO methods in source emissions (examples)

Parameter or Subject	Method ID	Title
Sulphur dioxide	ISO 7934:1989	Stationary source emissions - Determination of the mass concentration of sulphur dioxide - Hydrogen peroxide/barium perchlorate/Thorin method
Sulphur dioxide	ISO 7935:1992	Stationary source emissions - Determination of the mass concentration of sulphur dioxide - Performance characteristics of automated measuring methods
Dust (general)	ISO 9096:2003	Stationary source emissions - Manual determination of mass concentration of particulate matter

Parameter or Subject	Method ID	Title
Sampling (gen.)	ISO10396:1993	Stationary source emissions - Sampling for the automated determination of gas concentrations
Volume flow	ISO10780:1994	Stationary source emissions - Measurement of velocity and volume flow rate of gas streams in ducts
Nitrogen monoxide and nitrogen dioxide	ISO10849 :1996	Stationary source emissions - Determination of the mass concentration of nitrogen oxides - Performance characteristics of automated measuring systems
Polycyclic aromatic hydrocarbons -Sampling	ISO 11338-1: 2003	Stationary source emissions - Determination of gas and particle-phase polycyclic aromatic hydrocarbons - Part 1: Sampling
Polycyclic aromatic hydrocarbons – Sample preparation	ISO 11338-2: 2003	Stationary source emissions - Determination of gas and particle-phase polycyclic aromatic hydrocarbons - Part 2: Sample preparation, clean-up and determination
Nitrogen oxide	ISO 11564:1998	Stationary source emissions - Determination of the mass concentration of nitrogen oxides - Naphthylethylenediamine photometric method
Dust	ISO 12141: 2002	Stationary source emissions - Determination of mass concentration of particulate matter (dust) at low concentrations - Manual gravimetric method
Hydrocarbons	EN 12619	Stationary source emissions - Determination of the mass concentration of total gaseous organic carbon at low concentrations in flue gases - continuous flame ionization detector method
Dust	EN12341:1999	Air quality. Determination of the PM_{10} fraction of suspended particulate matter. Reference method and field test procedure to demonstrate reference equivalence of measurement methods
Dust	prEN 13284-2	Stationary source emissions - Determination of low range mass concentration of dust - Part 2: Automated measuring systems
Quality assurance	prEN 14181	Stationary source emissions - Quality assurance of automated measuring systems
As, Cd, Cr, Co, Cu, Mn, Ni, Pb, Sb, Ti and V	prEN 14385	Air quality - Stationary source emissions - Determination of the total emission of As, Cd, Cr, Co, Cu, Mn, Ni, Pb, Sb, Ti and V
Sulphur dioxide	prEN 14791	Stationary source emissions - Determination of mass concentration of sulphur dioxide - Reference method

Parameter or Subject	Method ID	Title
NO_x	prEN 14792	Stationary source emissions - Determination of mass concentration of nitrogen dioxides (NO_x) - Reference method - Chemiluminescence
Validation	prCEN/TS 14793	Stationary source emissions – Intra-laboratory validation procedure for the comparison of an alternative method to a reference method

Monitoring methods according to EMEP

EMEP has published a measurement programme for components in different states: in gas phase, in particles, and in precipitations. The measurement programme includes measurement periods, measurement frequencies, field sampling and laboratory methods. Sampling and laboratory methods are specified in detail in the same manual [EMEP 2001].

As far as particulate matter is concerned, the EMEP manual on $PM_{2.5}$ and PM_1 will to a large extent follow the forthcoming reference method of the European Community; as it does for PM_{10}. CEN is working on a reference method for $PM_{2.5}$ which is not expected to be finalized before 2004. For PM_1, no CEN group has yet been established by which to decide on a reference method.

8.2.2 Quality Management

Significant decisions must be made on the basis of measurements and assessments of ambient air quality (produced by direct monitoring or by modeling) and of measurements of emissions. These decisions may relate to expenditure on further monitoring or assessment and, more significantly, on air pollution abatement or prevention at the planning -or later- stages.

The criterion of objectivity is essential; and this may be satisfied to a certain extent through the independence of an evaluation. Objectivity is essential in order to ensure that the public -together with the owners and operators of potential sources of pollution as well as other Member States- retain its confidence that EC and national legislation is being fairly and consistently applied.

It may be helpful to appoint a third party (e.g. an independent expert organisation) to verify the monitoring methodology and to provide independent consultancy and accreditation regarding the assessment -modelling, sampling and analytical- techniques employed.

The Quality System, comprising Quality Assurance and Quality Control (QA/QC), is concerned with all of the activities required to ensure that a measurement meets defined standards of quality. The quality terms relevant for QA/QC procedures and criteria are presented in box 23:

Box 23: Definition of quality related terms [ISO 8402 : 1994]

Quality is the totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs.

Quality Assurance involves the management of the entire process which includes all the planned and systematic activities which are needed to assure and demonstrate the predefined quality of data, to provide adequate confidence that an entity will fulfill requirements for quality.

Quality Control comprises the operational techniques and activities that are undertaken to fulfill the requirements for quality.

Quality Assurance activities cover all pre-measurement phases; ranging from definition of data quality objectives to equipment and site selection and personnel training. The Quality Control operational functions directly address activities connected to measurements; such as routine checks, calibration and data handling.

Following the establishment of the air quality measurement network and stations, the application of Quality Assurance may also be viewed as 'external quality control'. These are the activities performed on a more occasional basis, typically by persons who are not engaged in normal routine operations; for example, through independent audits (see above). Inter-laboratory proficiency tests (round-robin tests) constitute another element of Quality Assurance.

The Quality system of a monitoring network must explicitly define the responsibility and authority for each of the activities which may contribute to data quality. The monitoring network shall employ a designated *Quality Assurance Manager* to be responsible for implementing the Quality System and for other activities aimed at improving the quality of data.

Data Quality Objectives (DQO) are to be derived from the monitoring objectives. DQOs must be established in order to ensure that the data collected is of sufficient and adequate quality to satisfy the purposes –as set by the monitoring objectives- for which that data has been produced. DQOs will thus be different for different air monitoring networks. DQOs may guide QA programmes.

DQOs may be defined in terms of the following parameters: *precision, accuracy, uncertainty, representativeness, minimum data capture,* and *minimum time coverage*. DQO values are provided by the Daughter Directives under the AQFD [1999/30/EC; 2000/69/EC; 2002/3/EC]. A selection of DQOs from the Daughter Directives is presented in table 15.

Table 16: Data Quality Objectives according to the three Daughter Directives of the AQFD

Directive	Com-pound	Type of measurement	DQO	Type
1999/30/EC	SO_2, NO_2, NO_x	continuous indicative	15 % 25 %	Accuracy
	PM_{10}, Pb	continuous indicative	25 % 50 %	Accuracy
2000/69/EC	Benzene	fixed indicative	25 % 30 %	Uncertainty
	CO	fixed indicative	15 % 25 %	Uncertainty
2002/3/EC	O_3	continuous fixed indicative	15 % 30 %	Uncertainty

The respective Daughter Directives also set DQOs for modelling accuracy/uncertainty, for minimum data capture and for minimum time coverage.

Data Quality Objectives are different for the EUROAIRNET monitoring programme.

The minimum QA/QC plan, as specified by the EEA Technical Report [EEA 1999b], includes -amongst other matters- the aspects presented in box 24.

Box 24: Elements of a minimum QA/QC plan for air quality monitoring

DQOs are set on a minimum basis regarding
– Accuracy and precision (or uncertainty),
– data capture,
– time coverage.

The measuring methods must be either reference or reference equivalent according to EU legislation and/or internationally accepted standards.

A documented calibration program along with an instrument performance checking program. This will include at least – for automatic methods and for each measuring device:
Regular zero-span checks, multi-point calibrations, and precision-checks
– for manual methods and for each measuring device:
flow and leak checks, routine calibration procedures in the laboratory, precision-checks with collocated identical samplers, and determination of the method's accuracy on a regular basis.

The frequency of the above mentioned procedures will be set according to the network manager's experience and in any case assure, in an unambiguous way, that the DQOs are met. All calibration activities shall be logged and reported.

Data validation procedures complying with the EoI Decision [1997/101/EC].

All the above mentioned QA/QC procedures can be performed by the networks'/ stations' operators and maintenance personnel, under the condition that they have the proper equipment, which typically includes:
– certified reference material approved-traceable to official primary and secondary standards (e.g. calibration gases, permeation tubes), mostly for the implementation of the inter-calibration procedure;
– operational (secondary or transfer) standards for routine procedures, for example calibration, precision check, zero-span check;
– proper technical equipment;
– sampling and analysis Standard Operating Procedures (SOPs).

World Health Organisation

The WHO Office for Europe recommends the adoption of comprehensive Quality Assurance and Quality Control (QA/QC) programmes at national and international level in order to ensure that measurements are accurate, reliable and appropriate to their declared purpose [WHO 1999]. Data must be comparable at an international level. This requires developed and harmonized QA/QC programmes with respect to the methods of data acquisition, data validation and data reporting.

Quality Assurance and Quality Control (QA/QC) operations -as recommended by the WHO[WHO 1999]- comprise:

- regular QA/QC-related operations on site (e.g. calibration, change of filters, checking and cleaning of the sampling systems),
- regular audits and intercalibrations (e.g. ensure data comparability within the network, investigate systematic measurement anomalies, conduct intercalibrations)
- training measures applied to personnel involved in operations at the central level as well as the subordinate levels

The WHO [1999] recommends, for instance, that automatic monitors (span gas, zero gas) be calibrated every 24 hours, and that site visit operations be

performed at weekly to monthly intervals depending on the type of operation involved. A frequency of at least once a year is recommended for audits. Intercalibrations shall be performed every 3 to 6 months, depending on the network type, in order to establish a direct measurement traceability chain to the primary standards.

The capture rate is defined as the percentage of measurements at a certain station which are judged to be valid measurements within a set time [WHO 2000]. The WHO sets minimum requirements on data capture rates for 1 hour / 8 hour / 24 hour / and annual intervals which must be fulfilled; if these prescribed rates are not adhered to, the average values will be considered valid and may not be used.

EMEP

The purpose of EMEP is that of long-term monitoring in order to detect trends [EMEP 2003]. Although the concentrations to be expected are generally much lower than the air quality limit values, it remains important that they are measured correctly. In order to indicate trends over a period of 5-10 years, the precision of individual measurements shall fall within ±10%, and any systematic change over time shall be less than the expected trend (1% per year). This requirement is far more stringent than the requirements set by the AQFD and its three Daughter Directives.

A pertinent example worth citing here concerns the experience of ozone monitoring in Europe. Only few sites have provided data of sufficient quality to allow for the assessment of trends. Moreover, shortfalls in information with respect to calibrations and equipment changes have emerged as a major problem. The performance of chemical or gravimetric methods has proved less problematic, but procedures and details nevertheless need to be rigorously followed and documented.

in the assessment of long-term trends, quality assurance, high precision and consistency of data are of paramount importance. EMEP has specified measures of quality assurance in its *Manual for Sampling and Chemical Analysis* [EMEP 2001].

Measurement sites shall not be subject either to changes in surroundings or to changes in instrumentation unless the impact of changes has been carefully evaluated and documented. Similarly, any changes in sampling and analysis procedures shall be documented and evaluated. Experience has shown that measurements must be standardized as far as possible in order to obtain data that is comparable and of sufficient quality. In addition, quality assurance must be carried out both at the national and international level in order to ensure satisfactory data quality.

For the majority of the methods, the necessary quality assurance is facilitated by a combination of simple and robust sampling techniques with well-described sampling equipment and the use of synthetic control samples for the chemical analyses.

8.3 STRATEGY IN A PRIORITARY PROCESS RELATED TO AIR QUALITY MANAGEMENT

8.3.1 Overview

As follows from the concept of goal-oriented environmental monitoring (section IV), again a number of superior environmental goals are defined which imply monitoring activities. The related processes are directed towards the respective environmental goal.

Processes *related to air quality management* are those within the scope of the medium of air. The subjects of *exhaust air* as well as *emission reduction through product-related standards* have been integrated into the horizontal processes (processes 6 and 7), because several media (water, air, etc.) may be affected.

Only one important process has thus been identified, which is subsequently elaborated in terms of purposes, objectives, institutional responsibilities and required activities.

8.3.2 Process 1: Improve Air Quality in Zones and Agglomerations

Air Quality Management Process 1: Improve air quality in zones and agglomerations	
Why monitor?	
- Set up one single monitoring system at the state level - Manage and maintain the data base for air quality - Provide information for the management of air quality regarding: 1. air quality control 2. identification of priorities 3. Information of the public about air quality 4. alert situations - Fulfill international obligations	
What are the objectives of monitoring?	
- Provide for systematic monitoring of air quality - Provide data and information to assess the impact of pollution sources on air quality: 1. specify zones and agglomerations 2. assess health risks 3. establish plans to reduce air pollution and improve air quality 4. Use modelling techniques to assess and forecast air quality - Provide data and information on air quality to: 1. inform the public about air quality 2. inform in cases of alert situations regarding health risks 3. inform scientific and expert organisations 4. report to the EU in accordance with the international obligations - Develop a reliable and cost-efficient tool to monitor air pollution in priority zones and agglomerations	
Who is in charge?	
Ministry of Environment and Physical Planning	- Set the legal framework - Designate zones and agglomerations - Responsibility to operate the basic air monitoring network - Provide information to the public and to international and transboundary stakeholders
Local self-government	- Optionally operate additional local monitoring network - Optionally establish additional networks in polluted municipalities of prioritary importance through delegation of competence by MEPP

Service provider	-	Carry out assessment studies
	-	Run the monitoring network under contract with the Ministry of Environment or local self-governance according to the standards prescribed by the competent authority

How to achieve the objectives?

1	**Identify zones and agglomerations**
1.1	Prepare preliminary lists of zones and agglomerations
1.2	Prepare the prelimenary assessment of air quality
1.2.1	Review existing data / information Collect all existing data / information regarding - emission sources - ambient air quality - the siting of the existing / planned AMSs
1.2.2	Aggregate and present existing data / information All available data / informationfrom existing emission inventories, from surveys and regular monitoring practise are to be compiled and aggregated to obtain meaningful and understandable information. Take into account all existing air quality parameters as there are SO_2, NO_2, NO_x, total suspended matter, PM_{10}, benzene, CO, O_3, polycyclic aromatic hydrocarbons, heavy metals, and others Means of aggregation are - to calculate aggregated data on air quality (e.g. average and median values, 10^{th} and 90^{th} percentile), - graphic presentation of aggregated data on ambient air quality (e.g. per monitoring site), - mapping of emission sources and emitted compounds, - mapping of aggregated data on ambient air quality
2	**Develop national monitoring programme for air**
2.1	Identify zones and agglomerations where the concentration of pollutants exceed the limiting values
2.2	Design a monitoring network taking into consideration the existing data and information regarding: - air quality - preliminary assessment - quality assessment - cadastre of polluters - priority zones and agglomerations
2.3	Procure / supplement EN and ISO Standard methods for all relevant parameters and establish them in field measurement and laboratory practise Standard methods have to be transposed into field measurement practise and laboratory practise. Standard operation procedures (SOPs) for all assessment methods (as far as already applied) must be written.

2.4 Operate the 14 installed / planned fixed AMSs as scheduled

The AMSs have been designed to assess the concentration of a number of gases, particulates and particulate-bound compounds. The measurements shall initially be based on all parameters to be assessed automatically, namely NO_2, NO_x, PM_{10}, SO_2, O_3 and CO, as they are required for the preliminary assessment.

Laboratory methods which are necessary for other parameters (Pb and other heavy metals; PAH; benzene) will be focused on in step 11.

In this phase of operation, it is of primary importance to set up and implement a calibration and maintenance plan. Establish this calibration and maintenance plan in writing as an SOP.

2.5 Evaluate results as obtained on 14 AMSs

The objective of this step is to identify the essential pollution indicators for each monitoring site, and to identify other parameters which may be less meaningful at the respective site when compared to the relevant EU reference values.

Less meaningful parameters may eventually be left out in order to reduce monitoring efforts and cost.

Another objective is to find out whether there are, for particular parameters, similar pollution situations at different sites, thus allowing to run only a part of the AMSs in the future. An outcome could be, for instance, that not all 5 AMSs in Skopje must be operated at long term.

2.6 Establish a strategy and a programme to optimise siting of the AMSs

The objective of this step is to optimise the siting of the existing / remaining AMSs in the sense that sites of maximum concentration are identified. Air monitoring sites and parameters of prioritary interest have to be identified for that purpose.

Use the mobile laboratory. At each site investigated, the minimum time coverage of mobile monitoring shall be around 3 months during the summer and 3 months during the winter period.

If the availablity of only one mobile AMS is the limiting factor to complete the air quality assessment, it can be supplemented by the diffuse sampling technique, or the classical methods actually applied.

2.7 Evaluate the results of the monitoring programme and reconsider the monitoring network design and monitoring programme

3 Take appropriate measures in zones and agglomerations where the level of pollutants exceeds the limiting values

In zones and agglomerations where the concentrations of pollutants exceed the limiting values frequently or continuously, there is a need to:

- extend the monitoring network

- establish an action plan aiming to decrease the pollution below the limiting values in acordance with the transposed EU directives for air.

4 Establish and implement a preliminary quality assurance plan

The plan shell aim at / to:

4.1 specify the desired data quality (DQOs)
- data precision and accuracy (or uncertainty),
- data capture,
- time coverage

4.2 establish a suitable procedure to verify DQOs.

4.3 data validation procedures in compliance with the EoI decision.

5 Introduce modelling and simulation techniques for ambient air quality

Select agglomerations and zones for modelling.

Adapt model output to measured air quality data.

As far as no measured emission data exist, use the EMEP/CORINAIR emission inventory.

6 Train personnel

The most important need for training measures is seen in the following fields:

- Aggregation and presentation of data
- Quality Assurance theory and practise, in particular:
  1. how to elaborate SOPs for all methods used,
  2. how to calibrate and maintain the AMSs, and how to elaborate the respective methods as SOPs,
  3. how to establish and verify DQOs,
  4. how to validate data.
- Assessment of trace compounds through laboratory methods (benzene, PAH, heavy metals)
- Modelling of ambient air quality

Chapter 9 Monitoring of Waste, Biociversity, Noise and Soil

9.1 OVERVIEW: STRATEGIES IN PRIORITARY PROCESSES RELATED TO WASTE, BIODIVERSITY, NOISE AND SOIL

As before (section IV), a number of superior environmental goals have been defined which imply monitoring activities. The related processes are directed towards the respective environmental goal.

The environmental goals are related to specific media (waste, biodiversity, noise, soil). Four processes have been defined (table 17) which are subsequently elaborated in terms of purposes, objectives, institutional responsibilities and required activities.

The important legal and technical issues which have to be considered in connection with waste, biodiversity, noise and soil will be explained along with each process.

Table 17: Processes related to waste, biodiversity, noise and soil

Waste Management	
Process 1	Ensure the reuse, recycling or safe disposal of waste
Protection of Biodiversity	
Process 1	Preserve the status of biodiversity
Noise Protection	
Process 1	To control the exposure of people to environmental noise
Soil Protection	
Process 1	To control the soil pollution and prevent impact on food and drinking water

9.2 WASTE

9.2.1 Legal and Technical Issues

The Law on Waste Management entitles the MEPP to issue ordinances on the identification and transport of waste. These ordinances are very important for the monitoring of hazardous and non-hazardous waste.

The forms which will be issued through these ordinaces shall apply to hazardous and – in a simplified manner – non hazardous waste. The reporting of all movements of hazardous and non-hazardous waste enables the ministry to be permanently informed about the state of any particular lot of waste throughout the entire waste disposal procedure.

The waste identification system requires facilities for the disposal (deposit, treatment) of waste. At any point where waste is unloaded, the location and actors must be identified on the form which allows the clear identification of the waste. The forms have to be filled by the waste generator and submitted to the competent authorities of both the source (waste generation) and the sink (waste disposal). Both competent authorities have to approve the movement and the disposal.

During the approval procedure, both competent authorities (which may also be one and the same) are informed about the quantity and composition of the intended waste disposal. As soon as the transport and the transport have been approved, the disposal procedure starts. For that purpose, the movement form must be filled in 5 copies, namely

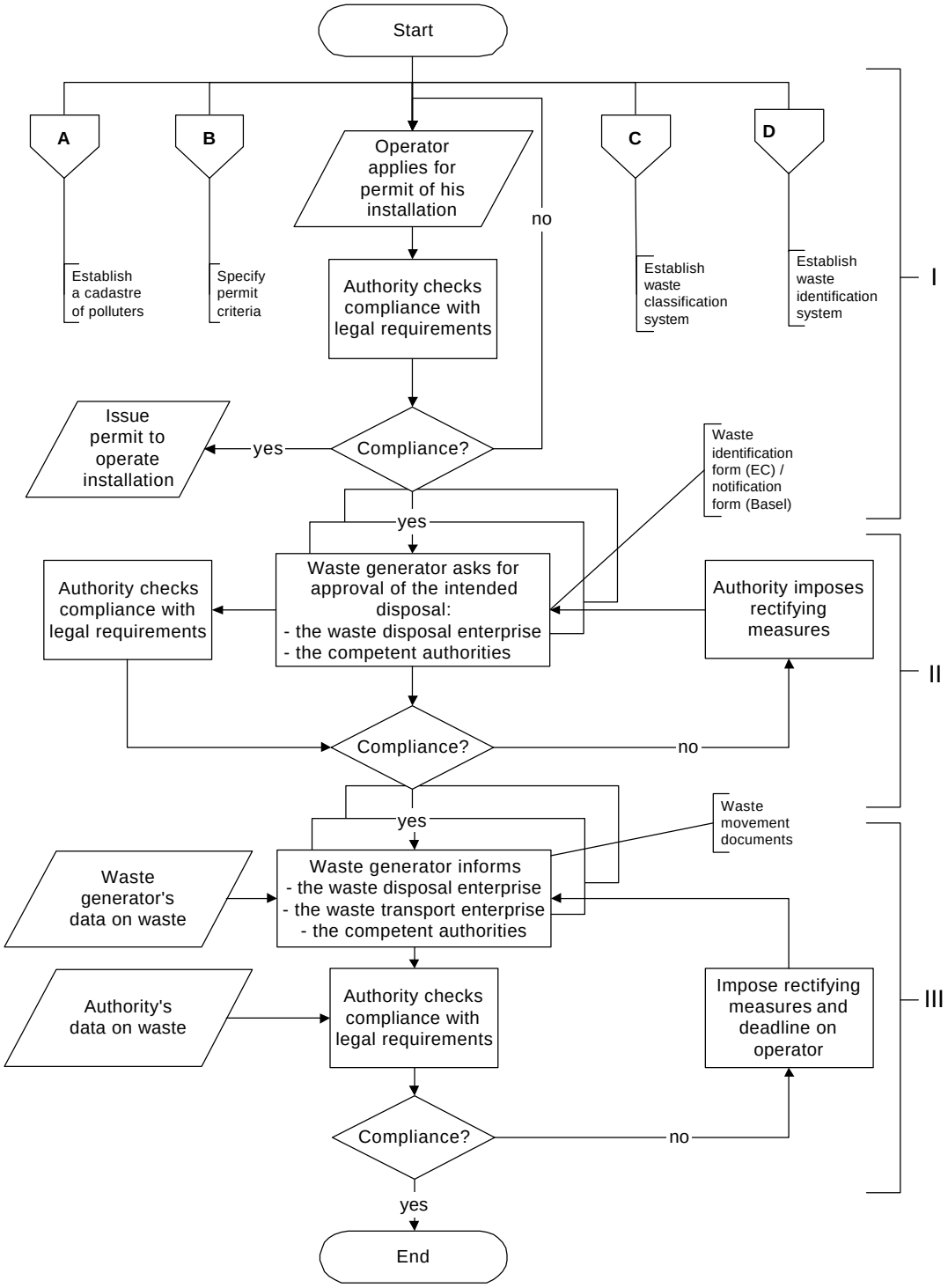
- 1 copy to be filled by the waste generator,
- 1 copy to be sent by the generator to the competent authority,
- 1 copy to be filled by the transporter,
- 1 copy to be filled by the operator of the disposal facility,
- 1 copy to be sent by the operator of the disposal facility to the competent authority.

The described procedure ensures both the documentation of the movement and the documentation of quantity and composition of waste. It has to be applied to all individual movements of hazardous waste. As far as non-hazardous waste is concerned, simplified documentation obligations apply which – in case it is generated regularly – may relate to a certain period, typically one year. Hazardous and non-hazardous waste are both identified according to the European waste catalogue.

The place of waste monitoring within the general proceeding of hazardous and non-hazardous waste disposal is illustrated in figure 10. The flowchart shows the three steps -A, B and C- in the compliance procedure:

- step I (top) the *plant operation permit proceeding* related to the compliance of the waste generating plant to be operated
- step II (middle) the *waste identification (declaration) proceeding* related to the compliance of the intended disposal to be approved *prior* to the disposal of the waste
- step III (bottom) the *waste movement document proceeding* related to the compliance monitoring of the disposal which has been previously performed

Figure 10: **Waste monitoring within the framework of enforcement**



Monitoring of real waste flows occurs mainly in step III of the flowchart: the so-called 'waste movement document proceeding'. The waste has been classified beforehand according to its origin. The waste transporter, together with the operator of the waste disposal facility – which may be one and the same – then certify the transport and disposal of the specified amount.

The designated authority will generally restrict to monitor the waste movement documents for plausibility, as these documents contain all relevant information (box 25).

Box 25: Information needed for the monitoring of hazardous and non-hazardous waste
– Waste classification according to the European waste catalogue
– Waste identification in waste identification and waste movement documents
– Amount of waste (in tons)
– Waste generator
– Waste transporter
– Waste disposal facility

However, the competent authority which has been informed beforehand through the waste identification procedure may also check the whole proceeding 'on site'.

Provided that the waste under consideration has been properly classified and identified, the monitoring of waste essentially means to measure its weight. Thus, every disposal facility (deposit, treatment) shall be equipped with a weighbridge in order to assess the amounts of waste which enter. The officer in charge of the weighbridge has the duty to check if the waste on the truck is identical with the waste declared in the form. He fills both waste amount and identification into his journal and reports the data on a weekly or monthly basis to the operator of the facility. The operator has to hand over these data to the owner who is obliged to report to the competent authority according to the provisions set in the license.

On the contrary, trucks which normally carry municipal waste are merely registered, and it is assumed that they transport municipal waste.

Waste monitoring will generally not entail testing of a chemical analysis nature. Chemical analysis will be restricted to those cases where the classification system (European waste catalogue, Basel convention) requires the contents of certain hazardous compounds to be declared: for example:

- waste oils which may or may not contain PCBs (waste classes 130101 to 130113; 130204 to 130210; and others)

- solid salts and solutions containing cyanide (waste class 060311) or heavy metals (waste class 060313)

The implementation of the waste monitoring system is linked to the implementation of four essential prerequisites symbolised by the respective pentagonal boxes, A to D, of which the first two have already been discussed in the context of self-monitoring and compliance monitoring (box 26).

Box 26: Prerequisites to waste monitoring
– Establish a cadastre of polluters in order to guarantee a systematic and unbiased approach
– Specify the permit criteria as outlined in the Law on Environment [CMEPP 2003d]
– Establish and enforce a waste classification system
– Establish and enforce a waste identification system

9.2.2 Strategy in a Prioritary Process Related to Waste: Ensure the Reuse, Recycling or Safe Disposal of Waste

Waste Management **Process 1: Ensure the reuse, recycling or safe disposal of waste**	
Why monitor?	
- Provide information on the generation and elimination of waste - Secure the safe disposal of waste - Support the reuse and recycling of waste	
What are the objectives of monitoring?	
- Assess and control flows of hazardous and non-hazardous waste disposed of by the waste generators, and specify the disposal paths - Assess the flows of municipal waste collected and disposed of by municipal entities, and specify the disposal paths - Assess existing disposal and recycling facilities in terms of capacity, competence and technical qualification - Enable the Environmental Inspectorate to check compliance of waste generators and waste disposal facilities	
Who is in charge?	
Waste generator (hazardous and non-hazardous waste)	- Identify suitable waste management facility - Inform the competent authorities (competent for the waste generator, competent for the waste management facility) about the intended disposal of waste (waste identification form) - Inform the competent authorities about the ongoing disposal of waste (waste movement form)
Ministry of Environment and Physical Planning	- Set the legal framework - Decide about the intended disposal - Responsibility to monitor flows of hazardous waste - Coordination of assessment / monitoring activities - Coordination and final evaluation of assessed data - Control waste related documents (waste identification, waste movement)
Local self-government	- Responsibility to monitor flows of non-hazardous and municipal waste

Waste management facility (hazardous and non-hazardous waste)	-	Inform the competent authority about the intended disposal
	-	Inform the competent authority about the ongoing disposal
Service provider	-	(optional:) Carry out monitoring of waste flows, report to the client

How to achieve the objectives?

1 Establish a classification and identification system for hazardous and non-hazardous waste

1.1 Establish a waste classification system following the European Waste Catalogue

1.2 Establish a waste identification system including waste generators, waste transporters and operators of waste disposal facilities

1.3 Set the legal prerequisites via secondary law

Set a transition period for all stakeholders (waste generators, waste transporters and operators of waste disposal facilities, authorities) to comply with the new system

2 Enforce the waste classification and identification system

2.1 Assess existing disposal and recycling facilities in terms of capacity, competence and technical qualification

2.2 Issue operation permits / licenses for waste disposal facilities. Grant a transition period to comply with all legal requirements.

2.3 Check waste classification as indicated by the waste generator if need be. Check intended waste disposals with respect to waste characteristics and the (preliminary) license of the waste disposal facility.

Impose rectifying measures as needed.

3 Establish a movement documentation system for hazardous and non-hazardous waste

3.1 Establish a waste movement documentation system

3.2 Set the legal prerequisites via secondary law

Set a transition period for all stakeholders (waste generators, waste transporters and operators of waste disposal facilities, authorities) to comply with the new system

4 Enforce the waste movement documentation system

4.1 Ensure self-monitoring of waste disposal facilities in terms of waste classification and waste amounts

4.2 Check waste classification if need be. Check waste flows by means of the waste movement documents. Verify a complete documentation of all waste movements from source to sink (generator, transporters, intermediate deposit, disposal facilities), based on the specified amounts of identified and classified waste. Impose rectifying measures as needed.

5	**Assign self-monitoring and reporting obligations to operators of disposal facilities for municipal waste**
5.1	Ensure self-monitoring of waste disposal facilities in terms of waste amounts (weighbridge) and correct declaration as municipal waste.
5.2	Ensure reporting of self-monitoring results to the competent authority

9.3 BIODIVERSITY

9.3.1 Legal and Technical Issues

EU legislation

The Birds Directive [1979/409/EC] and the Habitats Directive [1992/43/EC] are the most important legislative instruments in nature conservation within the European Union. The aim of both directives is the protection of species and habitats[3].

Directive on the conservation of wild birds [1979/409/EC]

The Birds Directive deals with the protection of wild bird species. The Member States must maintain sufficient abundance of bird populations and preserve, maintain and re-establish so-called Special Protection Areas (SPAs) as one important measure for the conservation of bird populations.

In article 10 of the Directive it is stipulated that the Member States shall support research and any work required as a basis for protection of the bird populations.

Directive on the conservation of natural habitats and of wild fauna and flora [1992/43/EC]

The aim of the Habitats Directive is the maintenance of biodiversity within the European Union through the conservation of natural habitats and wild fauna and flora of Community interest. Together with the Birds Directive the European Union thus establishes a common framework for the conservation of birds, animals, plants and natural and semi-natural habitats within its territory.

The Natura 2000 network

The joint appliance of the two directives implies forming a network of protected areas called *Natura 2000*, consisting of Special Areas of Conservation (SACs) that cover the habitats and species listed in the Annex I and II of the Habitats Directive, and the Special Protection Areas (SPAs) classified by the Birds Directive. In the course of the EC accession process, Macedonia must establish and propose their SACs and SPAs based on the annexes of the two directives.

Member States are obliged to perform measures to guarantee the conservation of habitats in SACs and avoid their deterioration. Member States shall undertake surveillance of the conservation status of the natural habitats and species with particular regard to priority natural habitat types and priority species.

An important step for the approximation of accession countries towards European Union legislation in nature conservation is to prepare proposals for the modification of the annexes of the Birds and Habitats Directives. The aim of these proposals is to include habitat types and species which are typical for the accession country and which shall be conserved as part of the European nature heritage.

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3 *'Habitat'*, as understood in English literature, is elsewhere synonymously termed *biotope.*

Network Emerald

A pilot project for establishing an Emerald network in fYR of Macedonia was accomplished in the period of February 2002 – Febryary 2003. In the framework of the project, three separte areas with spetial interest for protection were identified: National park Galichica, strictly protected ornithological reserve and monument of nature Dojran Lake. The preparation of the second pfese of the project for establishment of the Emerald network is ongoing.

International biodiversity conventions and agreements

The Convention on Biological Diversity (CBD)

The CBD was adopted at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992.

The three main objectives of the Convention are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the use of genetic resources.

Participating countries must develop national strategies, plans and programmes, identification and monitoring systems of the components of biodiversity.

CBD Article 7 deals with identification and monitoring activities. It establishes that each contracting party shall

- identify components of biological diversity important for its conservation;
- monitor the components of biological diversity;
- identify and monitor the effects of processes and activities with significant adverse impacts on the conservation and sustainable use of biological diversity; and
- maintain and organize, by any mechanism, data derived from identification and monitoring activities.

Macedonia ratified the convention in October 1997. Within the framework of this convention, a First National Report has been elaborated [CBD 2003] which gives an overview on the actual status of biodiversity and ecosystems, the key threats to biodiversity as well as the existing approaches to conserve biodiversity. The following documents have been prepared:

- National Study on the situation of the Biodiversity in fYR of Macedonia (Country study), published in 2003 (in Macedonian and English language);
- National strategy and Action Plan for Biodiversity (NSAP) published in may, 2004 (in Macedonian and English language)
- National report on the biodiversity impact study of fYR of Macedonia, placed on CD, Riga 2002, (English version)
- First annual report on the progrees of development of the national indicators for biodiversity for 2003, (Copenhagen, april 2004)

The Convention on Wetlands

The Convention on Wetlands (Ramsar Convention) is an inter-governmental treaty which provides the framework for national action and international

cooperation for the conservation and sustainable management of wetlands and their resources.

The main four obligations of the contracting parties are to designate at least one site, the sustainable management of wetlands in their territory, the promotion of wetlands conservation through the establishment of natural reserves and training in the fields of wetlands research, management and wardening. Finally the convention prescribes mutual consultations with the other contracting parties about its implementation.

Macedonia has one Ramsar site, Lake Prespa with an area of 18.920 hectares, which has been designated in 1995. The site includes cultivated land, meadows, pastures, reedbeds and forests. The strictly protected ornithological reserve Ezerani, is a part of the Ramsar site designated with a law in 1996.

The Ramsar Convention sets monitoring requirements to assess changes of the ecological status.

Other conventions and agreements

Further conventions of importance with respect to monitoring are:

- the Convention on Migratory Species (Bonn Convention),
- the Convention of the Conservation of European Wildlife and Natural Habitats (Bern Convention), though this largely will be superseded by the EU directives when these will come into force,
- the Convention on International Trade in Endangered Species of Wild Fauna and flora (CITES)
- the Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention), and
- the Pan-European Biodiversity and Landscape Strategy (Council of Europe)

National legislation

The main national laws which prescribe biodiversity monitoring or related activities, are the following:

- New draft law on Nature Protection (final draft CMEPP project 2003),
- Law on Protection of the Ohrid, Prespa and Dojran Lakes (1977),
- Law on National Park Conservation (1980).

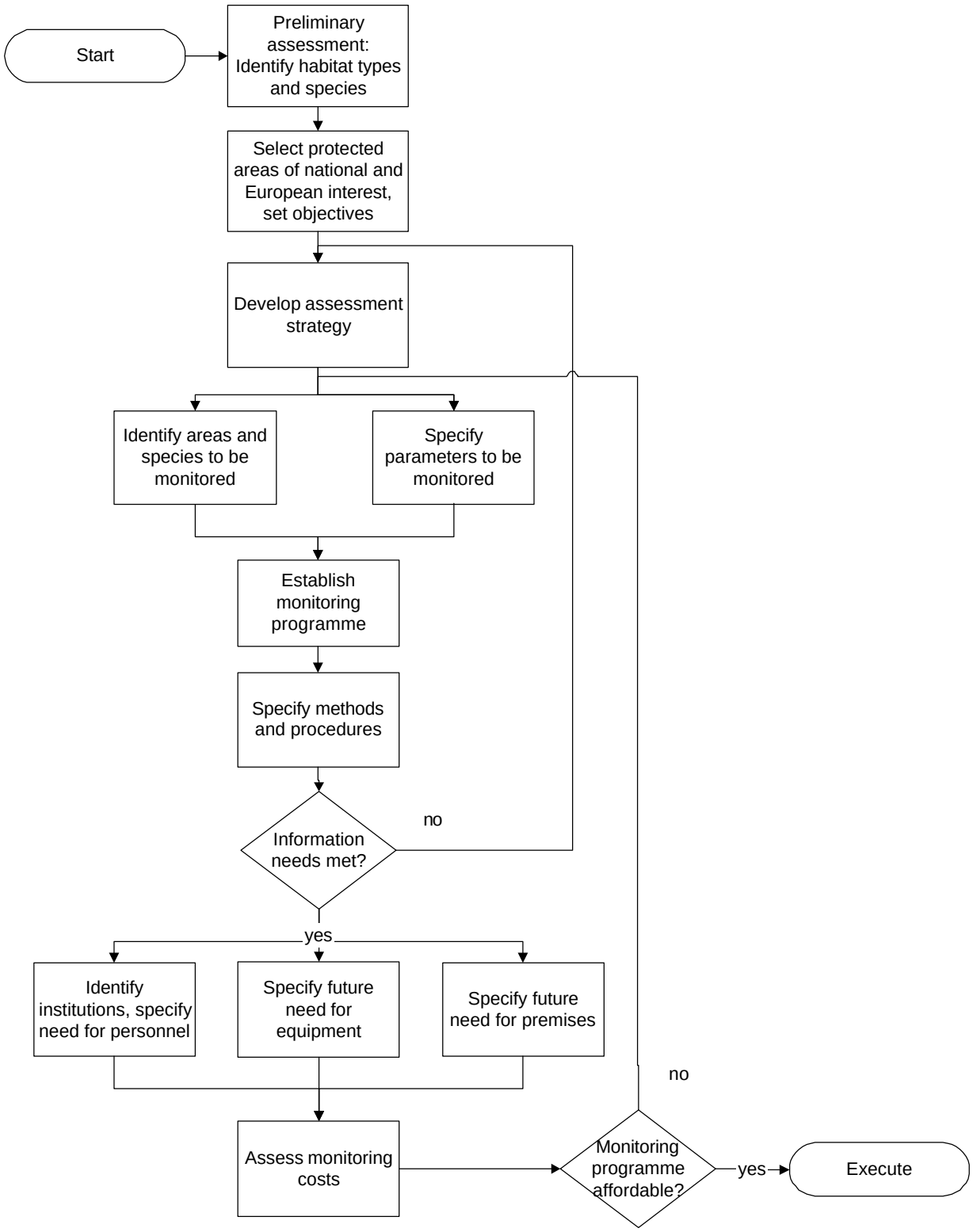
The new draft law on Nature Protection will cause new bylaws and secondary legislation to be formulated in due course after the adoption of the law on Nature Protection. This will create a new regulatory framework for the biodiversity monitoring in Macedonia.

Planning biodiversity monitoring

The overall objective is to obtain assessments of the biodiversity which are largely independent of subjective components, and which can be (more or less) reproduced over the whole monitoring period. This is a crucial point, as future monitoring programmes could well be run repeatedly over decades, with the necessity to compare results which have been obtained within that period.

The general approach to elaborate a programme for biodiversity monitoring is presented in figure 11. It resembles the general scheme as presented before in figure 3, but further specifies the first phase to *identify information needs*.

Figure 11: General planning scheme for biodiversity monitoring



The figure proposes the following process to be initiated when elaborating a programme for biodiversity monitoring.

Step 1

Assessment of all biotope types which exist within Macedonia. The biotopes to be assessed are the ones which are encompassed by the Law on Nature Protection as it will appear after adoption.

Typical Balkans biotope types are not included in the Habitat directive which, of course, applies only to the actual EU Member States. Amendments will be made on the basis of proposals from the Balkan states.

Mapping of the identified biotopes is necessary to allow for proper protection and management schemes to be implemented. Geographical Information Systems are a powerful tool to be utilised in this context, making it possible to easily revise biotope extension and quality at certain intervals, and to assess trends.

Assessment of rare and vulnerable species in Macedonia in need of protection, according to 1) the red list categories given by the Law on Nature Protection as it will appear after adoption, and 2) species mentioned in the annexes of the EU directives on Birds and Habitats.

The EU directives do not consider species specifically on the Balkans and amendments will have to be formulated, based on proposals from the Balkan states.

For this extensive task Macedonia has already collected substantial knowledge, eg. for the CBD reporting [CBD 2003]. The main challenge is to compile the existing data from the various institutions which hold data and information of relevance for a monitoring programme.

This preliminary assessment in Step 1 will, at the same time, create an information basis for future processes in environmental impact assessment and landscape planning.

Step 2

Identification of latent - or candidate - protected areas of 1) national interest, according to the system of protected areas proposed in the draft Law on Nature Protection, and of 2) European interest (the Natura 2000 network of SACs and SPAs as well as the network Emerald). The areas identified in this step will be included in the monitoring programme. Existing protected areas will be assessed on the basis of the stipulations in the law and EU requirements.

Further, this selection step has to take into account – beyond the Natura 2000 areas – areas which comply with the Ramsar Convention, though no areas beyond the present Ramsar site Lake Prespa may meet the terms in the convention.

On the basis of the objectives given in the provisions for the individual areas (the reasons why the area has been protected), the purpose for the monitoring scheme for the areas shall be formulated.

Step 3

Development of a assessment strategy. In this step, the target areas and species will be defined - based on the preceding steps - and the parameters to be

monitored have to be identified, yielding the entire monitoring programme. Biodiversity monitoring requires parameters of the populations and habitats that describe their characteristics in order to assess trends. In the initial stages of a monitoring programme, basic parameters can include:

- Species: Number of (selected) species, number of individuals, productivity;
- Habitats and sites: Size/extent (divided into specific habitat types), fragmentation, occurrence of key species (as indicators of habitat quality).

The basic methodological approach to the monitoring programme shall be the use of indicators, as the monitoring of all species and all components of habitats and sites/protected areas is impossible. Biodiversity indicators are variables, which describe trends in biodiversity characteristics over time. Their suitability in a monitoring programme depends on how easy they are monitored - also on a cost efficiency perspective - and how distinctly they trace impacts to the habitat and ecosystem. Bird species and plant species are often used as indicators because they are comparatively straightforward to survey and because no extensive expertise is required to identify them in the field.

Indicators can be surveyed by means of a large variety of sampling methods. Guidelines exist for sampling methods for individual indicators, whether they are species, physical parameters or other parameters.

Step 4

At this point, institutional aspects, procedures and methods have to be identified and clarified in order to assure long-term quality of monitoring. This entails the following elements:

1. *Institutional analysis*: Assessments of the institutional capacity for taking part in a monitoring programme; assessment of on-going programmes and projects; training needs assessment; institutional responsibilities; institutional co-operation and co-ordination,
2. *Data analysis*: Assessments of gaps in data and information, compilation of existing data; data analysis; setting up data bases;
3. *Elaborating guidelines:* Preparation of an official guideline for the institutional, procedural and methodological elements of a monitoring programme;
4. *Training and capacity building:* Planning and carrying out trainings and capacity building at the involved institutions in order to improve the monitoring programme, including its extension and completeness;
5. *Budgets and finances:* Elaborating a budget for the monitoring programme, including details on financial allocations to the involved institutions; information on allocations for a 10-year monitoring programme. Costs to be covered include man-power (administration and field work), transportation, instutional expenses, equipment, data management (incl. IT) and reporting.

Point 3 above is a comprehensive element and must draw upon specialists in order to set up a monitoring programme which is based on *realistic*, *reliable* and *precise* indicators and parameters, and which is likely to persist over a long-term

perspective. The longevity of a monitoring programme is an important guide to its feasibility and viability. When setting up a monitoring programme it is recommended to set the target for a programme, which can be launched and executed over a long time span, rather than elaborating a detailed and complex programme, which is likely to run out of resources on a short-term basis. Thus, it is recommended to establish a monitoring programme in phases, including a basic programme, which is cost-efficient and simple to instigate and execute. Later, should more resources become available, and when the capacity of the involved institutions have grown, more phases of the programme can be launched.

Follow-up measures

The results of the monitoring programme must be reported and disseminated, adressing both the concerned authorities and the public.

In the framework of a biodiversity management structure to be established, the data and information acquired must be revised at regular intervals in order to examine whether they are still cost-efficient and whether they still meet the needs of nature protection. Inefficient and otherwise inappropriate monitoring programmes shall be adapted accordingly.

9.3.2 Strategy in a Prioritary Process Related to Biodiversity: Preserve the Status of Biodiversity

Protection of Biodiversity
Process 1: Preserve the status of biodiversity

Why monitor?

- To be familiar with the natural heritage of Macedonia
- Know about how biodiversity evolves at long term
- To protect and preserve biodiversity

What are the objectives of monitoring?

- Provide an overview on species and habitats in Macedonia
- Register changes in species and habitats
- Follow biodiversity indicators for long-term monitoring

Who is in charge?

Ministry of Environment and Physical Planning	- Set the legal framework - Decide about the volume of the species and habitats assessment - Launch a pilot study on the identification of biodiversity indicators - Set priorities for future activities in the field
Service provider	- Carry out the pilot study on the identification of biodiversity indicators

How to achieve the objectives?

1 Designate service provider at the national level

The draft Nature Conservation Act designates the body responsible for monitoring the biodiversity in the country. After the Act is adopted, institutional arrangements need to be made to implement the legal provisions. The MEPP will secure budget funding for the activities of the service provider, and the service provider needs to establish the core expert team that will conduct the monitoring of biodiversity.

Initially, the Ministry will sign a performance based contract with the service provider for the setup of the monitoring system that will include

- Collection of existing information
- Inclusion of this information into the Environmental Information System
- Development of Biodiversity indicators for the country

Once these tasks are fulfilled, a new contract will be signed for maintenance of

the information system and monitoring activities at the national level

2 Develop a biodiversity information system as part of the EIS

A biodiversity information system will be developed that will integrate the existing information on biodiversity and make it possible for the future information to be integrated. The system will have two main purposes:

- Monitoring changes in species and habitats and
- Monitoring of biodiversity through indicators

This means that it will focus on monitoring biodiversity at two levels. Monitoring of changes in species and habitats will focus on the endangered species (Red List) and species and habitats of European importance (Natura 2000 network). At the more general level, indicators will be developed to monitor the changes in biodiversity at the national and the regional level.

All the relevant providers and users of information will be involved in the process of development. The system will be based on:

- Scientific research, collections
- Forestry databases
- Land cover
- Reporting of capture and killings of vertebrates
- Monitoring transboundary movement of species
- Monitoring results from protected areas
- other relevant information sources.

Good examples of such systems from other countries will be taken as a model to develop this system. The key elements of the system will be:

- Sources of information
- Main data
- Database creation and management
- Standard methods
- Information technology

The system will form an integral part of the Environmental Information System managed by MEIC and will be administered by the national service provider.

3 Designate proposed Natura 2000 sites and the Red List of Species, and monitor them

Based on the existing information about the species and habitats in the country a first proposal for the national list of species and habitats will be developed according to the EU classification. The needs for further studies will be determined for those species and habitats where insufficient information is available.

Base on the list and the status, the Sites of Community Importance for Conservation will be identified and a proposed list of sites of the Natura 2000 network will be prepared. Macedonian species and habitats possibly new to EU will be identified, in order to be subsequently proposed for inclusion on the EU lists of species and habitats.

Also the Red List of endangered species will be prepared based on the status assessment, according to the IUCN methodology.

A monitoring and study programme will be developed in order to monitor the changes in species and habitats, obtain more information about the species and

habitates where there is insufficient knowledge and to further refine the Natura 2000 list and the Red List. This monitoring programme will be conducted by:

- Protected area management bodies inside protected areas
- The national service provider in areas with no management bodies
- Resource management bodies for resource specific monitoring (forests, wildlife, fish, waters).

4 Include monitoring in the management plans for protected areas

In the process of implementation of the proposed Nature Conservation Act, all protectected areas will develop management plans (currently three National Parks, reserves). The Ministry will make sure that monitoring obligations, as specified in the biodiversity monitoring programme, will be included in the management plans by including this in the secondary legislation determining the scope of management plans.

Subsequently these monitoring obligations will be fulfilled by the management bodies of the protected areas and reported to the Ministry. When new protected areas will be established, monitoring will also be a part of their management plan.

5 Develop biodiversity indicators for the country

A set up of biodiversity indicators, based on species, ecosystems and landscapes, will be developed, that can be applied at different spatial scales such as protected areas, municipalities, watersheds, regions and the country as a whole. These indicators will be based on redily available statistical information and information from the biodiversity information system so that they will be easy to calculate and monitor.

They will be calaculated annualy for the agreed spatial units to demontrate the large scale changes in biodiversity. They will also be used in Strategic Environmental Assessment of policies and programs the national and local level (e.g. spatial plans) in order to assess their impact on biodiversity.

9.4 NOISE

Noise measuring and monitoring are required to verify whether environmental noise levels, in specific areas and under various conditions, remains within the permissible limits, with the ultimate objective to protect public health and welfare. As one of the negative consequences upon environment resulting from the technological development, noise is mainly caused by transport vehicles and machines used in production processes.

9.4.1 Legal and Technical Issues

EU Legislation

At the EU level, the noise related matter is regulated in the following Directives:

Council Directive 2002/49/EC, adopted on 25 June 2002.

This Directive contains the basic principles concerning the environmental noise assessment and management.

There are also separate Directives regulating the noise emitted into the environment from specific noise sources, such as:

Noise caused by road traffic

- Council Directive 70/157/EEC, Motor Vehicles
- Council Directive 97/24/EC, Motor Cycles
- Council Directive 2001/43/EC, Tyres for motor vehicles and their trailers and fitting

Noise caused by aeroplanes

- Council Directive 80/51/EEC, Subsonic aircraft
- Council Directive 89/629/EEC, Subsonic Jet Aeroplanes
- Council Directive 92/14/EEC, Limitation of the Operations of Aeroplanes
- Council Directive 2002/30/EC, Limitation of the operations of the airports in the Community
- Classification of noise from civil subsonic aircrafts (negotiations on the proposal of the Commission COM (2001)74 are in progress)

Noise caused by railway traffic:

- Council Directive 96/48/EC, Interoperability of the Trans-European high speed rail system;
  - Technical specification for interoperability (TSI) relating to high-speed rolling stock - Commisssion Decision 2002/735/EC
  - Technical specification for interoperability (TSI) relating to high-speed rolling infrastructures - Commisssion Decision 2002/732/EC
- Council Directive 2001/16/EC, Interoperability of the Trans-European conventional rail system

Noise caused by various sources

- Council Directive 86/594/EEC, Household Appliances

- Council Directive 2000/14/EC, Noise emission in the environment by equipment for use outdoors
- Recreational craft - 2003/44/EC

In accordance with the Agreement on Stabilization and Association between the Republic of Macedonia and EU, one of the obligations given as the first standard to be complied with is harmonization of R. Macedonia's legislation with that of EU. The Department of European Integration within the Government of R. Macedonia constituted a working group to manage the harmonization of the legislation in RM related to the noise in the environment.

National Legislation

All measurements are performed in accordance with the Decision on identifying the cases in which and conditions under which the peace of the citizens is considered to be disturbed by harmful noise ("Official Gazette of RM" 64/93), Article 3, Table I and Article 4, Table II. These Tables contain the maximum permissible level by facility and purpose of the area.

The matter concerning the harmful noise emitted into the environment in the Republic of Macedonia is regulated by the following legislation:

The Law on Harmful Noise Prevention ("Official Gazette of SRM" No. 21/84; 10/90; "Official Gazette of RM" No. 62/93)

This Law, adopted in 1984, has been insufficiently operational and applicable, as it has not been harmonized with the EU relevant regulations. On the basis of this Law, so far, no secondary legislation has been adopted to regulate the harmful noise depending on different sources of pollution, such as motor vehicles, aircrafts, railway traffic, construction machines, household appliances and other sources of pollution.

Decision on Specification of the Cases and the Conditions in which the Peace of the Citizens is Regarded Disturbed by Harmful Noise ("Official Gazette of RM" No. 64/93)

This Decision has been adopted on the basis of the Law on Public Order and Peace Offenses ("Official Gazette of SRM" No. 25/72, 29/83, 34/83, 51/88, 19/90 and ("Official Gazette of RM" No.26/93).

Order for Compulsory Attestation of Motor Vehicles with at least Four Wheels with regard to the Noise ("Official Gazette of RM" No: 16/97)

The legal grounds for this Order are contained in the Law on Standardization ("Official Gazette of RM" No: 23/95).

The Law on Protection at Work ("Official Gazette of RM" No.13/98, 11/94 and 33/2000)

So far, no secondary legislation has been adopted on the basis of this Law, to regulate harmful noise.

Regulation on the General Measures and Norms for Protection at Work against Noise in Working Premises ("Official Gazette of RM" No: 35/97)

Standards used in the domain of this matter are as follows:

- ISO 3746 - defining the basic terms and measuring methods for noise and its effect on humans.
- ISO R-1999
- DIN 45633
- IEC 179 and 179?

In compliance with the existing legal regulations, the noise level measurement and monitoring data are submitted to the Macedonian Environmental Information Center at the Ministry of Environment and Physical Planning. These are further processed and later reported to EEA, to the public and all interested entities.

Perspectives of noise monitoring

The measurements so far performed by the authorized institutions have indicated that environmental noise exceeds the maximum permissible level at almost all measuring points and mostly over 65 dB, which entails a health risk for people. It is necessary to identify the "hot spots" in order to lay the data basis for appropriate measures of noise reduction.

The obtained results do not comply with the requirements of the relevant EU Directives. The EU Directives set noise level standards according to the number of population and dwellings exposed, depending on the source of the noise. At long term, it is necessary to perform repetitive measurement of the level of noise from various sources on the whole territory of the Republic of Macedonia, with the objectives to

- provide access to clear, understandable and publicly available information on environmental noise,
- identify the exposure on environmental noise by means of strategic maps,
- provide a basis for development of measures for reduction of noise emitted by major sources, especially road and railroad transport, airplanes, equipment used in open air and in industry and mobile machinery,
- prevent and reduce noise where necessary, and especially where the exposure level may provoke harmful effects on people's health and to maintain the quality of noise where it is good, and
- provide the necessary data to be submitted to the EU Commission, in accordance with Annex VI to the Directive 2002/49/EC of the European Parliament and Council.

In order to present the obtained data on noise in a clear, understandable and easily accessible way, the strategic maps must include the following aspects:

- Estimated number of flats, schools and hospitals located in an area exposed to concrete values of a noise indicator
- Estimated number of people located in an area exposed to concrete values of a noise indicator
- the main roads, main railroads, airports, industrial facilities and other sources of noise taken into consideration
- the maximum permissible noise level (MPL) of specific areas in populated places identified in accordance with the Decision
- the aforementioned areas where noise level values exceed the MPL

9.4.2 Strategy in a Prioritary Process Related to Noise: Limit Exposure of People to Environmental Noise

Noise Protection **Process 1: To control the exposure of people to environmental noise**	
Why monitor?	
- Provide information about the levels of environmental noise - To control the nuisance of the public	
What are the objectives of monitoring?	
- Carry out a preliminary survey - Lay the basis to develop a noise monitoring system - Inform the public about noise levels, raise awareness - To take measures for protection from noise	
Who is in charge?	
Ministry of Environment and Physical Planning	- Set the legal framework - Integrate the aspect of noise into the EIA process - Decide about the volume of the survey and the standards to be met - Responsibility to carry out the survey
Local self-government	- Actually not in charge. Depending on the legal framework to be set, local self-government may be in charge in the future - Integrate noise aspects into urban planning and traffic planning
Service provider	- Carry out noise measurements on request of any client (MEPP, local self-government) - Carry out the survey under contract with the Ministry of Environment and Physical Planning (if decided accordingly) - Report to the client (MEPP)
How to achieve the objectives?	
1 Review and evaluate existing data / information Collect all existing data / information regarding - noise emission sources - environmental noise as measured incidentally on particular sites and periods Compile, aggregate and present all available data / information Suitable means of aggregation are	

- graphic presentation of aggregated data on noise
- mapping of emission sources,
- mapping of aggregated data on noise

2 Establish a preliminary list of important noise sources (diffuse and line sources, point sources)

List industrial noise sources and roads which are of particular importance, set priorities according to the available resources

3 Develop a survey programme for environmental noise

3.1 Develop a noise measuring strategy and programme

Specify priority sites and times (day/evening/night)

Develop technical measures to protect the measuring equipment against weather impact, vandalism and theft

Provide for transport facilities

Allocate personnel according to sites and times

3.2 Develop the noise measuring method

Establish a clear written field method about
- how to carry out noise measurements,
- how to maintain the equipment,
- how to calibrate the instrument(s)

Base the field method on the relevant standard methods (ISO 1996-2 : 1987), as far as applicable for the survey.

3.3 Provide training for all staff involved

Inform about the purpose, the objectives and the contents of the noise survey.

Train all staff involved about the technical details.

4 Carry out the noise survey

Fulfill technical requirements for noise monitoring. Implement prerequisites as planned in step 3

Carry out the survey

5 Evaluate data and present useful information

Present data in an aggregated, preferably graphic form, relating to existing reference values.

Means of presentation are, for instance,
- to calculate aggregated data on environmental noise (e.g. average values for day/evening/night),
- graphic presentation of aggregated data on environmental noise (e.g. per monitoring site or in a grid),
- mapping of noise sources,
- mapping of aggregated data on environmental noise.

9.5 SOIL

9.5.1 Legal and Technical Issues

Soil, as a limited and not renewable resource, is as important for man as are water and air. Soils have been shaped in thousands of years in close interaction with climate and groundwater.

Soil productivity is put at risk through landuse, erosion and the input of pollutants. Soil damages appear through erosion or physical or chemical degradation. Expenditures to remedy damaged soil – if remedy is possible – are extremely high. Precautionary measures in soil protection are therefore of utmost importance.

At the EU level, the legal provisions to protect soil are limited to the use of sewage sludge in agriculture. The sewage sludge directive [86/278/EC] aims at the prevention of soil contamination and water pollution from heavy metals, nitrate and phosphate. Sewage sludge as well as the soil on which it is used must be analysed to ensure that concentrations of heavy metals in the sludge and soil do not exceed specified limit values (Art. 9 and Annexes IIA, B and C).

At the national level, the law on agricultural land [Official Gazette 25/98] empowers the Ministry of Agriculture, Forestry and Water Economy to specify the substances which are harmful to agricultural land, as well as their maximum allowable concentrations in soil. This specification is still pending.

Soils are a part of integrated environmental systems including the media of groundwater, surface water and air. Consequently, soil protection is a sector task which demands measures taking into account all these media.

The protection of soil requires to to know its properties and environmental status. Some objectives of soil assessment and monitoring are

- to specify and quantify pollutants in soil,
- to assess trends in soil pollution,
- to measure natural or background levels of pollutants in soil,
- to distinguish polluted from non-polluted areas,
- to support the risk assessment of pollutants in soil concerning their impact on man and the environment (information on substance properties, limiting and guidance values),
- to provide a data basis to advise on the use of polluted soils,
- to support the identification of possible causes of soil pollution (e.g. former uses)

9.5.2 Strategy in a Prioritary Process Related to Soil: Prevent Soil Pollution and Prevent Impact on Food and Drinking Water

Soil Protection
Process 1: Prevent soil pollution and prevent impact on food and drinking water

Why monitor?

- Protect people against the risks arising from contaminated areas
- Provide information about the levels of soil pollution
- Raise awareness, prevent future pollution of soil

What are the objectives of monitoring?

- Identify suspected polluted areas of major importance for food production and groundwater-based raw water abstraction
- Develop a reliable and cost-efficient tool to monitor soil pollution
- Lay the basis to derive protective measures
- Inform the relevant state bodies, water suppliers, farmers and the public concerned about soil pollution

Who is in charge?

Ministry of Environment and Physical Planning, Ministry of Agriculture, Forestry and Water Economy, Ministry of Health	- Set the legal framework, set standards to be met - Decide about the volume of the surveys, decide about the consequences - Responsibility to carry out the surveys - Inform the relevant stakeholders
Local self-government	- (optional:) Launch soil surveys of local interest - Integrate aspects of soil pollution into local construction regulations
Service provider	- Carry out soil surveys on request of the competent Ministry or local self-government

How to achieve the objectives?

1 Review and evaluate existing data / information on polluted areas with importance for food production and groundwater abstraction

2 Identify areas which are suspected to be contaminated

2.1 Select areas used for food production or related to groundwater abstraction which may have been, or which are currently, exposed to industrial, domestic or agricultural pollution sources

2.2 Identify former or current pollution sources of industrial, domestic or agricultural origin, and specify the risk for the soil

2.3 Develop GIS-based maps of suspect areas informing about landuse and potential threats to soil and groundwater quality (airborne pollutants, contaminated sites, industrial sites, etc.)

3 Develop survey programmes for soil

3.1 Set priorities for survey programmes based on the importance of the area
– for food production (plants, livestock)
– for groundwater abstraction

3.2 Identify the compounds which may pose a risk for the soil according to
– the actual or former landuse,
– the actual or former production line of industrial sites,
– neighbouring emission sources of airborne pollutants

3.3 Establish a soil survey programme based on physico-chemical parameters. Choose an appropriate number of sample collection points according to the heterogeneity of the soil pollution. Select the sampling depth according to the expected vertical concentration profile of the pollutants.

3.4 Develop quality standards for soil with respect to target organisms (plants, livestock) or the target body (groundwater intended for water abstraction)

4 Carry out soil surveys

Identify tasks to be tendered (e.g. collection of soil samples from specific depth), tender the tasks identified

Collect soil samples, analyse samples according to the survey programme

5 Identify areas which pose a substantial risk to food production and / or the groundwater table intended for raw water abstraction

Evaluate the results, state short-term or long-term risks for food production and / or groundwater bodies used for raw water abstraction, report to the client.

6 Deduce measures to meet the risks stated

6.1 Measures related to food production:

Possible measures are
– to stop food production in affected areas,
– to change food production to less sensitive / less accumulating organisms,
– to impose effective measures of pollution control on polluters.

6.2 Measures related to groundwater abstraction:

Possible measures are
– to stop groundwater abstraction in affected areas,
– to introduce further raw water treatment steps
– to impose effective measures of pollution control on polluters,
– to establish a long-term monitoring and warning system (see water process 4, “ensure that drinking water is safe”).

Chapter 10 Summary Recommendation of the order of activities in the process of implementation of the Strategy for Environmental Monitoring

Graph 1 gives a general overview of the activities that have to be taken in order to build up a complete monitoring system for the six environmental media: air, water, waste, biodiversity, noise and soil. Each of the environmental media has specific activities that have to be undertaken and that are not generalised in one graphic as the one provided in graph 1. Those specific activities are summarized in graph 2 that includes the number of priority processes (activities) for each of the six environmental media and the general priority processes. Each process is subsequently split into sub processes (sub activities) that are contained in graphs 3, 4 and 5. All activities in graphs 3, 4 and 5 are colored in white, green, yellow or orange colour depending on the time status of the activities.

The green colored boxes present activities that are finished.

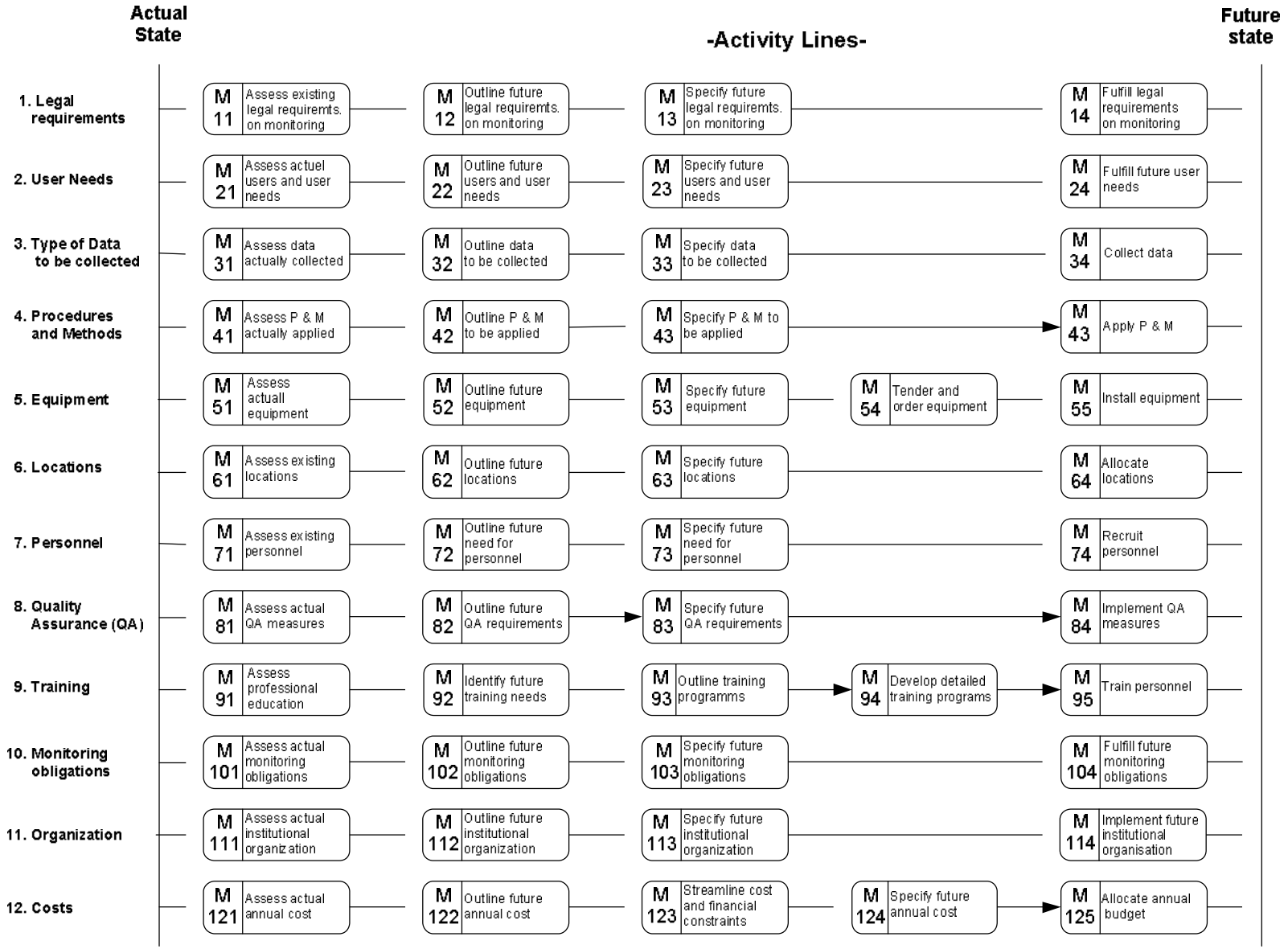
The yellow colored boxes present activities that should start in 2005.

The orange colored boxes present activities that should start after 2005 and before 2008.

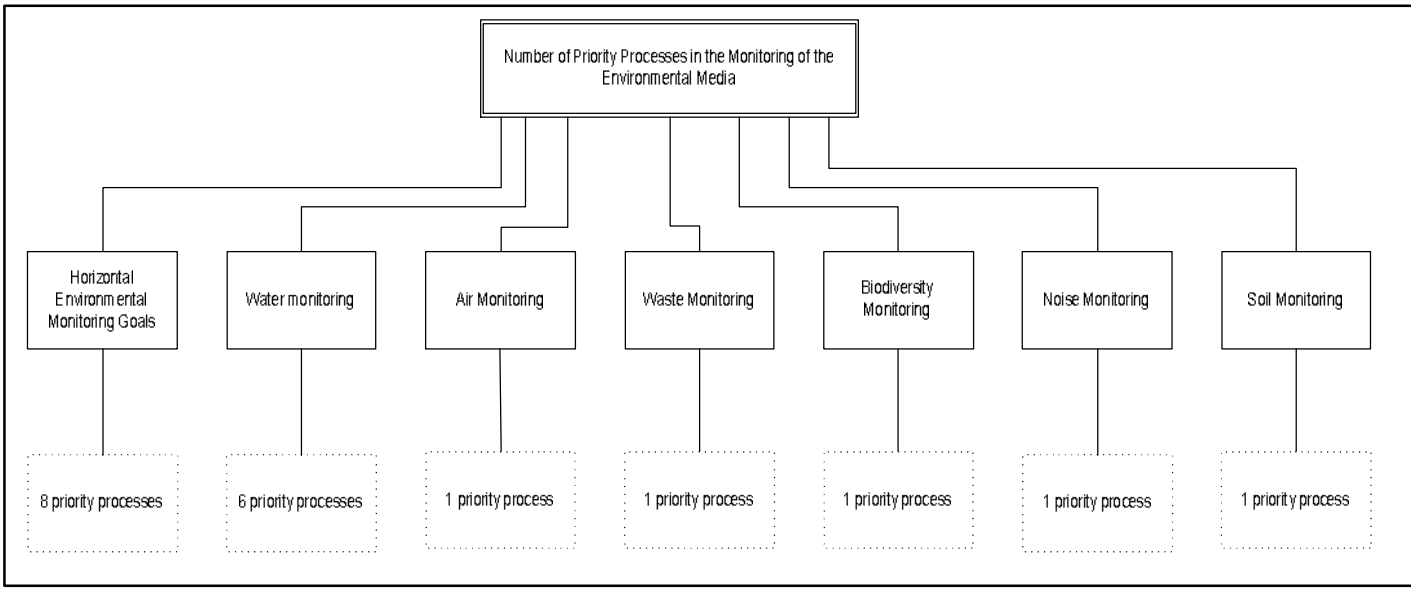
The white colored boxes present long term activities that should start after 2008.

Boxes that are framed with a broken line present activities that should be performed continuously.

Graph 1: Implementation Framework of Environmental Monitoring Activities

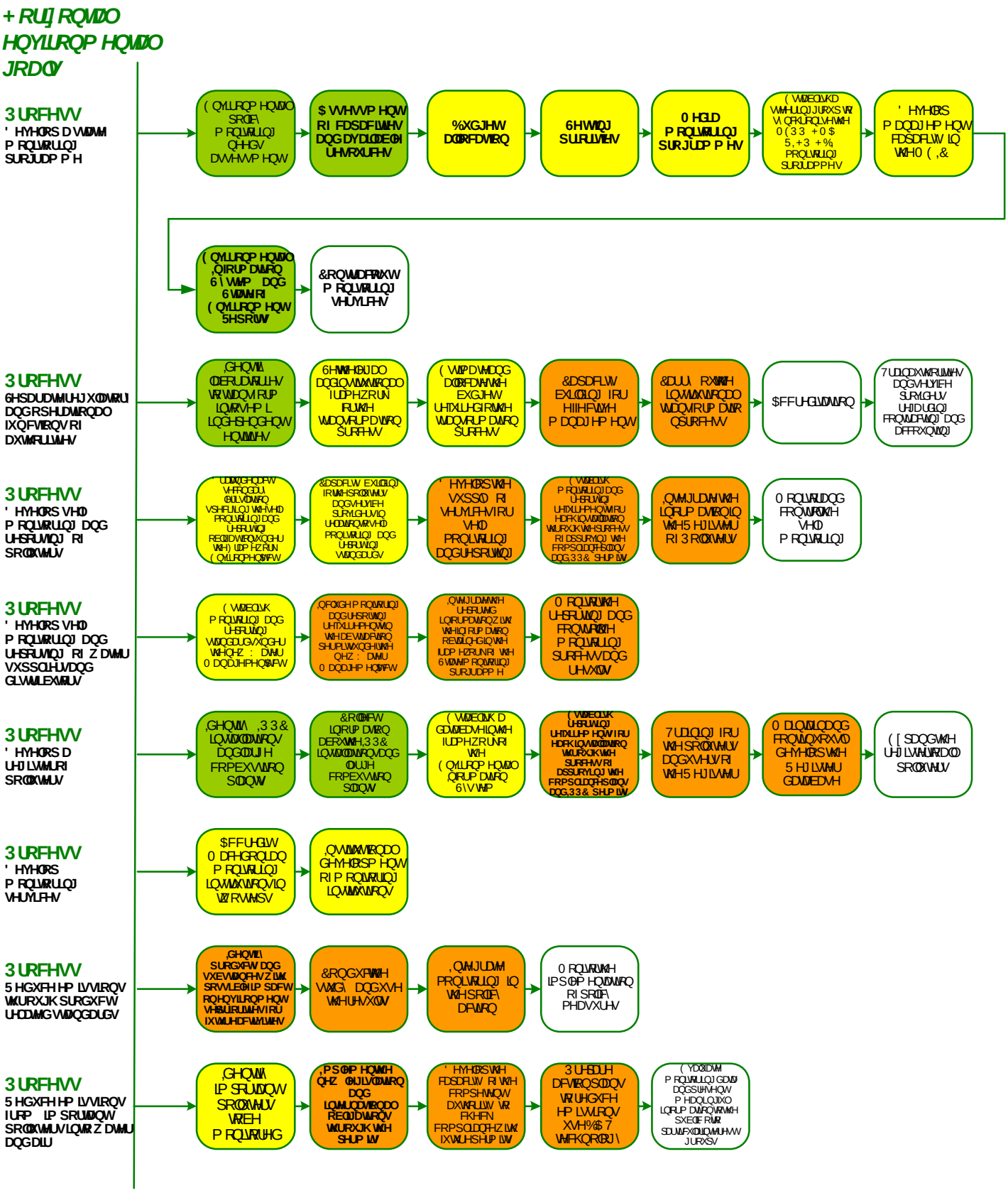


Graph 2: Number of priority processes in the Monitoring of the environmental Media

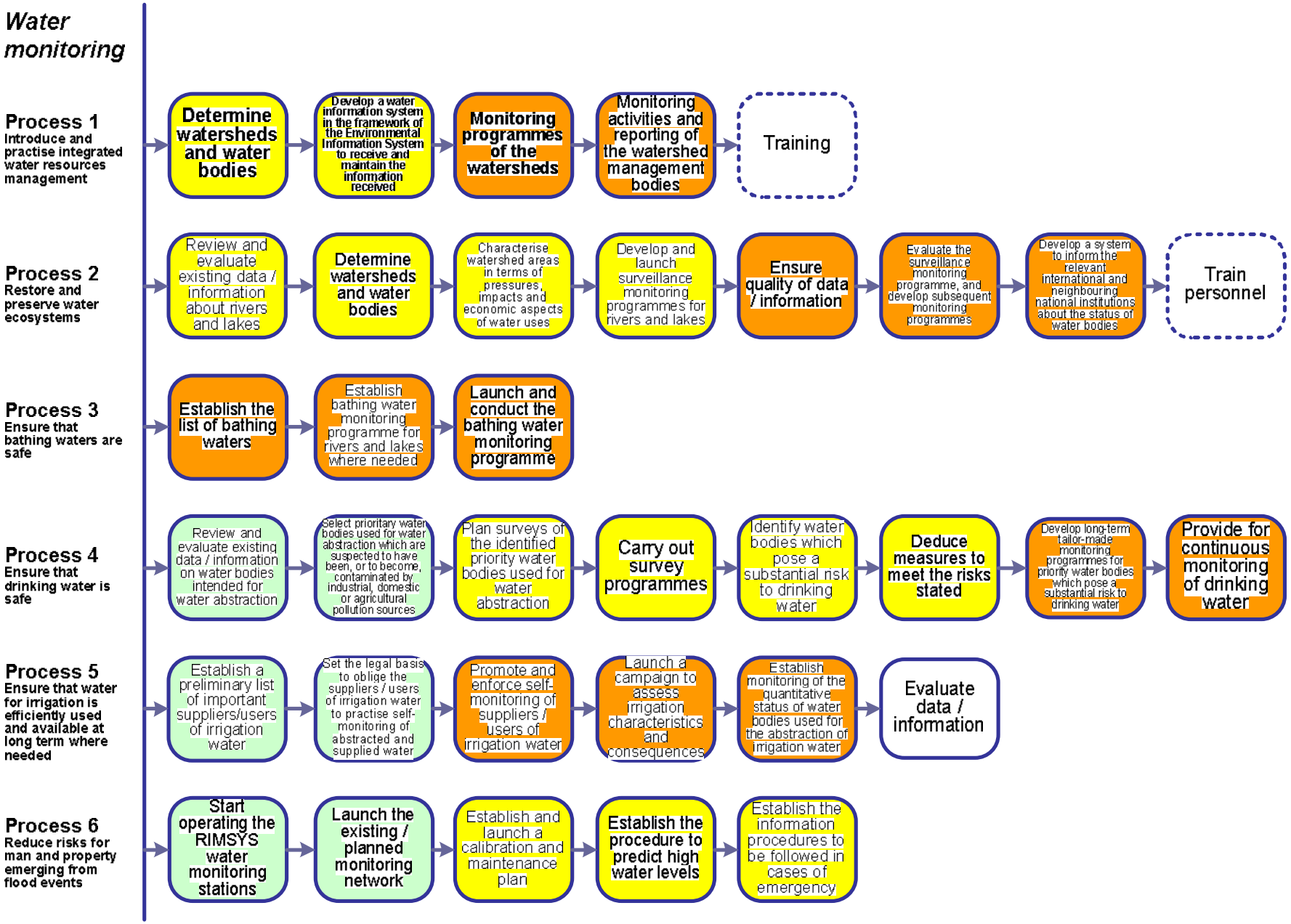


The graph 2 persents the number of the priority processes for environmental monitoring. However, the graph 2 does not present the vertical and horizontal interconnecetion among the different priority processes.

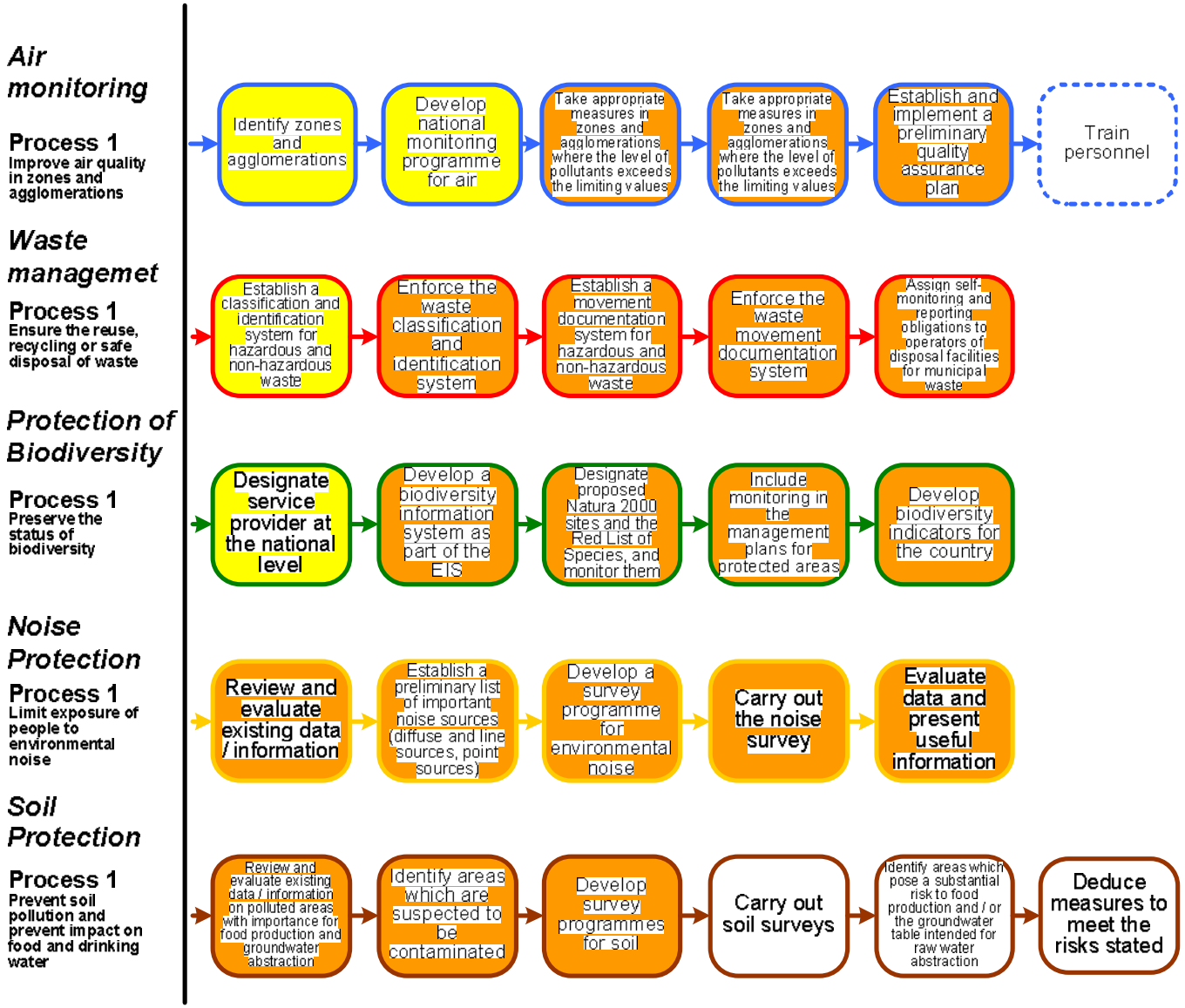
Graph 3: Priority processes linked to horizontal environmental goals



Graph 4: Priority processes related to water resources management



Graph 5: Priority processes related to other environmental media: Air, Waste, Biodiversity, Noise and Soil



Chapter 11 References and supplementary information

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1975/442/EC amended by 1991/156/EC	Council DirectiveCouncil Directive 75/442/EEC of 15 July 1975 on waste Council Directive 91/156/EEC of 18 March 1991 amending Directive 75/442/EEC on waste Official Journal L 078 , 26/03/1991 P. 0032 - 0037
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Chapter 12 Annexes

Annex 1: Contacted institutions

Annex 2: Rules of procedures

Annex 3: List of Core Group 6 and Working Group 6 Meetings and List of WG6 members

Annex 4: Assessment of Current Monitoring Systems

Annex 5: Guidance report on Preliminary Assessment under EC Air Quality Directives and a Guidance on Assessment under the EU Air Quality Directives