

European Topic Centre on Inland Waters



REQUIREMENTS FOR WATER MONITORING

by

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CONTENTS	Page
EXECUTIVE SUMMARY	1
1. INTRODUCTION	5
2. AIMS AND APPROACH	7
3. THE DATABASE	9
3.1 Database structure	9
3.2 Data analysis	12
4. INTERNATIONAL COMMITMENTS	13
4.1 EU legislation and policies	13
4.2 Other international agreements	19
5. MONITORING - BASIC REQUIREMENTS	25
5.1 Groundwater	33
5.2 Fresh surface waters	34
5.3 Salt waters	36
5.4 Quantity monitoring,	37
6. MONITORING - DESIGN REQUIREMENTS	39
6.1 Sampling	39
6.2 Analytical methods	45
6.3 Reporting requirements	49
6.4 Compliance assessment	50
7. IMPROVING MONITORING EFFICIENCY	55
6. CONCLUSIONS	57

APPENDICES	Page
APPENDIX A COPY OF THE QUESTIONNAIRE FORWARDED TO NATIONAL FOCAL POINTS FOR VALIDATION AND LIST OF CONVENTIONS REVIEWED	63
APPENDIX B LIST OF ORGANISATIONS RESPONSIBLE FOR VALIDATING THE QUESTIONNAIRE	77
APPENDIX C THE PROPOSED AND ACTUAL TIMETABLE FOR COMPLETION OF MW1 QUESTIONNAIRE	79
APPENDIX D SUMMARY OF BASIC MONITORING REQUIREMENTS FOR INLAND WATERS	63
APPENDIX E SUMMARY TABLES OF DETAILED MONITORING REQUIREMENTS FOR INLAND WATERS	97
APPENDIX F DEFINITION OF TERMS USED IN DIRECTIVES AND INTERNATIONAL AGREEMENTS	137
 LIST OF TABLES	
Table 4.1 European legislation requiring monitoring of inland waters	14
Table 4.2 Summary of objectives and purposes of European Legislation	15
Table 4.3 Summary of objectives and purposes on international agreements between three or more EEA countries	21
Table 4.4 Summary of international agreements requiring monitoring of inland waters in the EEA area	23
 LIST OF FIGURES	
Figure 3.1 Schematic representation of the major elements of the database structure	10
Figure 3.2 Stages in multivariate analysis (adapted from Clarke and Warwick 1994)	12
Figure 5.1 Cluster analysis dendrogram of the similarity between the monitoring requirements made in EU legislation according to water type, matrix and determinand	27
Figure 5.2 Multi-Dimensional scaling ordination of similarity between the monitoring requirements made in EU legislation according to water type, matrix and determinand	28

Figure 5.3	Venn diagram showing the similarities between the monitoring requirements made in EU legislation	29
Figure 5.4	Cluster analysis dendogram of the similarity between international agreements according to water type, matrix and determinand	30
Figure 5.5	Multi-Dimensional Scaling ordination of similarity between international agreements according to water type, matrix and determinand	31
Figure 5.6	Venn diagram showing the similarities in monitoring requirements made under international agreements	32

EXECUTIVE SUMMARY

The European Topic Centre on Inland Waters was formed in December 1994 to undertake an identified programme of work for the European Environment Agency (EEA). This report is on one of the projects (MW1: Water Resources - quality and quantity, general approach to assessment) undertaken during 1995, and has the overall objective of suggesting possible approaches to co-ordinate and improve monitoring in the EEA area. This entailed the establishment of the detailed monitoring requirements of existing and proposed European Union (EU) legislation, policy and international agreements. At the time of finalising this report, information on monitoring requirements had not been validated by the Walloon and Brussels regions of Belgium.

Within the EEA area, many requirements for monitoring arise from the European Commission. However, there are also many other international commitments which make monitoring requirements and which are also detailed in this report.

EU legislation

Four types of directive have been employed by the EU to control the pollution of water: use-related directives; industry sector directives; substance directives; and, product directives. With the exception of the products directives, most of these directives require the implementation of monitoring, either routine programmes or preliminary investigations. The extent to which the monitoring requirements associated with directives overlap depends on commonalities between the national implementation of directive requirements, and the monitoring undertaken for this purpose will therefore vary from country to country.

The requirements made in the directives have been designed largely independently from each other. The Commission has, however, taken some initiatives to harmonise monitoring and reporting requirements in the Exchange of Information Decision (77/795/EEC as amended by Decision 86/574/EEC) and to harmonise reporting on the implementation of certain directives via questionnaires as specified in Council Decision (92/446/EEC) and laid down in the Reporting Directive (91/692/EEC).

In total four directives and one proposed directive make requirements for ground water monitoring (the requirements made in the Dangerous Substances Directive (76/464/EEC) have been superseded by the Groundwater Directive (80/68/EEC)) and there is no overlap in the current monitoring requirements. With regard to surface waters, all monitoring requirements made in EU legislation which apply to rivers, also apply to lakes and reservoirs. Most directives which apply to freshwaters also apply to salt waters. The Shellfish Directive (79/923/EEC) is the only directive which applies to estuaries and coastal waters but not freshwaters.

Of the 15 directives that require monitoring of fresh surface waters, all include water column monitoring. The Dangerous Substances Directives and the Titanium Dioxide

Directive (82/883/EEC) also require monitoring of sediment and **biota**. The Exchange of Information Decisions make the only requirements for flow **measurements**. There **are** eight international agreements which also require monitoring of water **quantity** - flows and levels.

Barriers to the harmonisation of monitoring **can** be introduced at the sampling, analysis, and reporting stages, and **can** arise either because requirements differ (i.e. **conflict**) or because requirements are not clearly specified (i.e. weakness).

Sampling location

The **most** specific requirements in terms of **named** water bodies and measuring stations are in the Exchange of Information Decisions. These **rivers** are nationally **significant rivers** and lakes and as **such** are **quite** likely to be sampled for **other** national and international obligations (e.g. Rhine and Elbe Conventions). Generally, directives require monitoring in waters designated for specified uses or effected by specified discharges. Thus the **scope** for overlap in terms of sampling locations is dependant on the degree to which **areas** where designated use and the **presence** of specified discharges overlap, which is probably a limited circumstance in **many** states. **Many** of the directives **allow** the **competent** authority of **each** Member State to make **decisions** on **such** aspects as the exact sampling point, the distance from this point to the nearest point where pollutants are discharged and the depth at which the samples are to be taken but the **same** sites and depths should be used in **all surveys**, in relation to physical and temporal conditions.

As the **choice** of sampling location is, for some directives, related to **areas** designated **by** the Member States rather than by the **European Commission**, it is unlikely that, for some directives, a **comparison** of quality **across** Europe of these designated waters **will** give a **complete** picture of quality because the degree of comparability **will depend** on the interpretation of the designation **rules** and national **differences** of how these are implemented. Therefore, the degree of coverage that water quality data encompasses within **each country** **will** be **determined** by national designations and the prevalence of the industries that are required to be regulated.

For international agreements sample location is generally be related to the **purpose** of the agreement **often** being at designated or fixed sites. Other agreements are less specific, with the sampling location being determined by the needs of the signatories or monitoring programme.

Sampling frequency and period

The sampling frequency specified in directives and in international agreements is **very** variable. For some directives, once the fate and behaviour of an effluent is known and the **effects** have been established, and as long as there is no deterioration, then there is **scope** for the Member States to use a lower sampling frequency than specified in the directive. The sampling period is not usually specified or, if it is, the interpretation of its definition **can** give **rise** to **differences**

between countries (for example the definition of the bathing season). These **imprecise** requirements can give rise to different interpretations of results.

It is not apparent from most of the published directives whether there have been any, or if so, what, statistical **considerations** when defining the required sampling frequencies or numbers. These aspects have a significant **effect** on the statistical **precision** and confidence of the monitoring data produced. The required frequency **should be** derived with reference to the quantified risks that some waters **will be misclassified** (against compliance criteria).

Analysis

Sources of error in the overall assessment of a determinand in a water body would include sampling and **analytical** errors. The analytical requirements made in **directives** and in international agreements are generally **very basic**. Most directives **stipulate** analytical requirements in terms of performance criteria (i.e. limits of **detection**, **precision** and accuracy) and/or by method. The degree of definition, **however**, varies greatly from directive to directive. **Many** directives make **very broad** requirements to use '**appropriate methods**' for pre-treatment and analysis. The **performance** criteria are the key requirements with regard to analysis. Despite this **several** directives, for example the Titanium Dioxide Directive and **all the use-related** directives (**except** the 'Surface Water through the Sampling Analysis Directive'), **fail** to establish performance requirements for analysis. In addition the **laboratories** concerned with applying the directives should be free to use '**appropriate** methods' providing they satisfy performance criteria. By **comparison**, **analytical** requirements in international agreements are rarely defined in **terms of** performance criteria, specific methods **may** be laid down, but often no requirements **are made**.

Probably the most significant omission in the requirements for analytical techniques is a **requirement** for analytical quality control (AQC). Increasingly AQC is being **recognised** as **essential** for data from monitoring programmes to be reliable and **comparable**. Microbiological methods should be standardised for efficiency of **recovery** and performance (accuracy, specificity, **precision**) and, for securing **harmonisation** of results between Member States, single reference **procedures** must **be agreed** for **each** determinand.

Compliance Assessment

Another important aspect of directives, particularly when a **comparison** of quality **across** Member States is expressed as a comparison of compliance against limits and **standard** values (e.g. as in the Bathing Waters Directive), is how the **compliance** requirements in the directives are expressed, calculated and **interpreted**. **Differences** in interpretation of these requirements is another significant **barrier** to harmonisation of monitoring and implementation of directives **across** Europe.

Interpretations

As well as the aspects described above, a further **significant** barrier to obtaining valid and quantitative temporal and spatial **comparisons** of water quality **across** Europe is the **differences** in how Member States implement and interpret directives. This issue has not been addressed in this **project**, but it is recommended that **such** an assessment is undertaken.

The Future

There are **European policy** initiatives and proposed new directives that **will** potentially change **and/or** increase the need for national and Europe-wide monitoring. In particular the groundwater action and water management programme (GAP) **will focus** on the monitoring of groundwater **resources**, and the proposed Ecological Directive **will** place more emphasis on biological monitoring in **all** surface waters.

The outputs from **Project MW1** and MW2 (inventories of **current** monitoring networks) have been used in the **next** phase of the Topic Centre's work programme - the design of an **inland** water monitoring network to **meet** the needs of the **European Environment Agency**.

1. INTRODUCTION

The **European** Environment Agency (EEA) was established under Council Regulation No. **EEC/1210/90** and was given a task:

*'to **provide** the Community and the Member States with objective, reliable and comparable **information** at **European level** enabling them to take the measures to protect the environment, to assess the results of measures and to **ensure** that the public is properly informed **about** the state of the environment.'*

To assist in this task, the EEA established five **European** Topic Centres (**ETC**) in December 1994 addressing media-orientated monitoring projects on air quality, air emissions, **inland** waters, marine waters and **coastal** zone management (scoping study only) and nature conservation.

Three projects were originally identified by the **European** Environment Agency (EEA) to be undertaken by the **European** Topic Centre on **Inland** Waters (**ETC/IW**) during 1995.

These are **coded** and entitled as follows:

- . **MW1:** Water **resources** - quality and quantity.' General approach to assessment.
- **MW2:** Inventory of water **resources** monitoring networks.
- **MW3:** Design of freshwater monitoring network for the EEA **area**.

Additional Tasks within projects MW4 and MW5 were subsequently identified by the EEA for the 1994 subvention. The titles of MW4 and MW5 are as follows:

- . **MW4:** Development and establishment of the **European** water quality monitoring network and data bases.
- . **MW5:** Water **resources** evaluation.

The additional specific Tasks relate to the key issues and problems associated with the quality, use and **resource** of lakes and **reservoirs** in the EEA **area**, particularly in **semi-arid** and water scarcity regions.

The Tasks required to achieve the objectives of the **Projects** are described in detail in the technical work programme produced (Task 1) at the end of January 1995 by the Water Research Centre as the **Lead** 'Organisation of the **ETC/IW**. In brief, Task 2 is to review **current** and proposed **European** Union (EU) legislation, **policies** (such as the **Dobriř** assessment, including the identified **Prominent** Environmental Problems related to freshwater **resources**) and international agreements. Monitoring requirements made under these obligations are numerous, and, because they are generally designed to **meet** specific needs, the programmes have been designed largely independently from **each** other. Thus, monitoring requirements for **inland** waters in the EEA **area** have not been drafted in **any** co-ordinated way.

8. CONCLUSIONS

- 8.1 At the time of submitting this report, information on monitoring requirements had not been validated the Walloon and **Brussels** regions of Belgium.
- 8.2 Within the EEA **area**, **many** requirements for monitoring arise from the **European** Commission. However, there are also **many** other international commitments which make monitoring requirements.
- 8.3 Four types of Directive have been employed by the EU to control the pollution of water: use-related directives; industry sector directives; substance directives; and, **product** directives. With the exception of the **products** directives, most of these directives require the implementation of monitoring, either routine programmes or preliminary investigations. The extent to which monitoring requirements associated with directives overlap **depends** on commonalities between the national implementation of directive requirements, and the monitoring undertaken for this **purpose will** therefore **vary** from **country** to country.
- 8.4 The requirements 'made in directives have been designed largely independently from **each** other. The Commission has, however, taken some initiatives to harmonise monitoring requirements and reporting of results in the **Exchange of Information Decision (77/795/EEC** as amended by Directive **86/574/EEC)** and in **the** reporting of implementation of certain directives as specified in the Reporting **Decision (92/446/EEC)**.
- 8.5 In total four directives and **one** proposed directive make requirements for groundwater monitoring (the requirements made in the Dangerous Substances Directive have been superseded by the Groundwater Directive). The only international commitment for groundwater monitoring is the 1992 Convention on Transboundary Water Courses. At present there is no overlap in international monitoring requirements for **groundwater**.
- 8.6 In EU legislation, **all** monitoring requirements which apply to **rivers**, also apply to lakes and reservoirs. Most directives which apply to freshwaters also apply to salt waters. The Shellfish Waters Directive is the only directive which applies to estuaries and **coastal** waters but not freshwaters.
- 8.7 Of the **15** directives that require monitoring of fresh surface waters, **all include** water column monitoring. The Dangerous Substances Directives and the Titanium Dioxide Directive also require monitoring of sediment and **biota**. The **Exchange of Information Decisions** make the only requirements for flow measurements. There are eight international agreements which also require monitoring of water **quantity** in terms of flow and water **level**.
- 8.8 Barriers to the harmonisation of monitoring **can** be introduced at the sampling, analysis, and reporting stages, and **can** arise either because requirements

differ (i.e. **conflict**) or because requirements are not clearly specified (Le. are weak) .

- 8.9 The **most** specific requirements in terms of **named** water bodies and measuring stations are in the **Exchange of Information Decision**. These **rivers** are nationally significant **rivers** and lakes and as **such** are **quite** likely to be sampled for other national and international obligations (e.g. Rhine and Elbe Conventions).
- 8.10 The scope for overlap of sampling locations between directives appears to be limited to **areas** where use and designation overlap, which is probably a limited circumstance in **many** States. **Many** of the directives **allow** the **competent** authority of **each** Member State to make **decisions** on **such** aspects as the exact sampling point, the distance from this point to the nearest point where pollutants are discharged and the depth at which the samples are to be taken but the **same** sites and depths should be used in **all surveys**, in relation to physical and temporal conditions.
- 8.11 For international agreements sample location **will** generally be related to the **purpose** of the agreement often being at designated or fixed sites. Other agreements are less specific **about** sampling location perhaps being determined by the needs of signatories or monitoring programme.
- 8.12 For some directives, once the fate and behaviour of an effluent is known and the **effects** have been established, and as long as there is no deterioration, then there is also scope for the Member States to use a lower sampling frequency than specified in the directive. Sampling period is not usually specified or, if it is, the interpretation of its definition **can give rise** to **differences** between countries (for example, bathing season). These **imprecise** requirements **can give rise** to different interpretation.
- 8.13 The sampling frequency specified in international agreements is **very** variable within agreements and **between** agreements.
- 8.14 As the **choice** of sampling location is, for some directives, related to **areas** designated by the Member States rather than by the **European Commission**, it is unlikely that, for those directives, a **comparison** of quality **across** Europe of these designated waters **will** give a **complete** picture of quality because the **degree** of comparability **will depend** on the interpretation of the designation **rules** and national **differences** of how these are implemented. Therefore, the degree of coverage that water quality data encompasses within **each country** **will be determined** by national designations and the prevalence of the industries that are required to be regulated.
- 8.15 It is not apparent from most of the published directives whether there have been **any**, or if so, what, statistical **considerations** when defining the required sampling frequencies or numbers. These aspects have a significant **effect** on the statistical **precision** and confidence of the monitoring data produced. The required frequency should be derived with **reference** to the quantified risks that

some waters **will** be misclassified (against compliance criteria). Furthermore, for fairness of comparison, the frequency of sampling should be uniform throughout Europe.

- 8.16 Sources of error in the overall assessment of a determinand in a water body **may include** sampling error and analytical error. The analytical requirements made in the directives are generally **very** basic and defined in terms of performance criteria (i.e. limits of **detection**, precision and accuracy) **and/or** by analytical method. The degree of definition, however, varies greatly from directive to directive. **Many** directives make **very** broad requirements to use 'appropriate methods' for pre-treatment and analysis. The analytical requirements made in international agreements are also generally **very** basic and hardly ever defined in terms of performance criteria.
- 8.17 The performance criteria are the key requirements with regard to analysis. Despite this several directives, the Titanium Dioxide Directive and **all** the **use**-related directives (**except** the Surface Water through the Sampling Analysis Directive) **fail** to establish performance requirements for analysis. The laboratories concerned with applying the **directives** should be free to use 'appropriate methods' providing they satisfy performance criteria.
- 8.18 Probably the most **significant** omission in requirements for analytical technologies is a requirement for analytical quality control (AQC). Increasingly AQC is being recognised as essential for data from monitoring programmes to be reliable and comparable.
- 8.19 Microbiological methods should be standardised for efficiency of recovery and performance (accuracy, specificity, precision) and, in order to **secure** harmonisation of results between Member States, single **reference procedures** must be agreed for **each** determinand.
- 8.20 The reporting frequency is variable per directive, as well as the reporting period covered.
- 8.21 Another important aspect of directives, **particularly** when a comparison of quality **across** Member States is expressed as a comparison of compliance against limits and standard values (e.g. as in the Bathing Waters Directive), is how the compliance requirements in the directives are expressed, calculated and interpreted. **Differences** in interpretation of these requirements is another **significant** barrier to **harmonisation** of monitoring and implementation of directives **across** Europe.
- 8.22 In addition to the aspects described above, another **significant** barrier to obtaining valid and quantitative, temporal and spatial **comparisons** of water quality **across** Europe is the different ways in which directives are implemented and interpreted at the Member State level. A particular issue of **primary** importance to the process of harmonisation is the need to standardise definitions for determinands and sampling methodologies. This issue has not

been addressed in this **project**, but it is recommended that **such** an assessment is undertaken.

8.23 The outputs from **Project MW1** and MW2 (inventories of **current** monitoring networks) **will** be used in the next phase of the Topic Centre's work programme for this year - the design of an **inland** water monitoring network to **meet** the needs of the **European Environment Agency**.