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EWPCA

Final Report to the

**European Commission
DG XI B1**

on

**The Comparability
of Quantitative Data
on Waste Water Collection
and Treatment**

CEC Study Contract no.: B4/3040/93/000924/JS/B1
Extension no. 1 (B4/3040/96/000262/MAR/D1)

European Water Pollution Control Association

PREFACE

In 1993, the **European** Commission (EC) initiated a study on "The Comparability of Quantitative Data in **Relation** to the Collection and Treatment of Urban Wastewater". Following a tender, the EC **contracted** the **European** Water Pollution Control Association (EWPCA) to **conduct** the study and work began in April 1994.

A network of technical experts, organized as an EWPCA Task Group, provided information on the situation in their countries. Experts from Greece, **Ireland** and Luxembourg, presently not member countries of EWPCA, have kindly participated by providing information on their countries. A report was prepared in 1995 and published after approval by the EC.

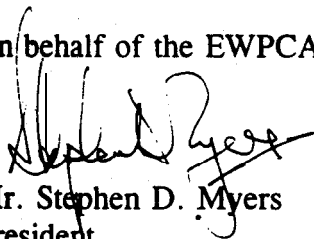
In August 1996, a second phase of the work was **commissioned** to **cover all** 15 EU Member States and to update the original work to represent the situation in **all** countries **current** in 1996. New **chapters have** been included for Belgium, **Finland** and Sweden as well as Russia and the Slovak Republic; 2 **European** countries which although outside the EU are member countries of the EWPCA. The results of the work of this second phase are presented in this report which also **includes** the findings of the **first** phase, updated and amended. However, the summary, **recommendations** and proposals for further study remain unchanged.

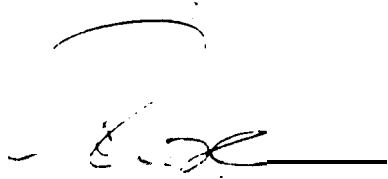
Coordination of the **project** was undertaken by the Water Quality Institute (VKI), of Denmark assisted in the first phase by the Water Research Centre (**WRc**) of the UK. This second phase was coordinated by Dr. B.N. Jacobsen.

Representatives from EUROSTAT, (the statistical bureau of the EC) and the **European**, Environment **Agency** (EEA) have assisted the **EC's** DG XI, the Environment, in monitoring the first phase of the study.

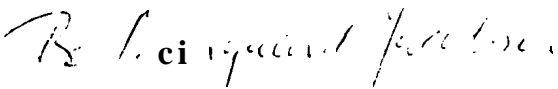
The EWPCA would like to express its gratitude to **all** organizations and persons who have contributed to the implementation of this study. It is our **sincere** hope, the realisation of which would give professional satisfaction to the organizations and individuals concerned, that the results of this work prove useful for the establishment of reliable and comparable information on waste water management and, thereby, the improvement of water pollution control in Europe.

On behalf of the EWPCA,


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President


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1. SUMMARY

The Council Directive on urban waste water treatment (91/271/EEC) provides the legal framework for the regulation of urban waste water collection and treatment at the EU level. The Directive also specifies certain reports to be prepared by the Member States according to the articles 15-17.

In this study, a review was prepared of the existing inventories at the European level on waste water collection and treatment, and sludge production, reuse and disposal. For waste water collection, some discrepancies were observed between different references in the literature. The major reasons are believed to be that statistics are not referring to the same fraction of populations (urban/rural), p.e. loads are defined differently, various types of waste water sources are grouped differently (domestic/industrial) and the p.e. loads are not considered directly comparable with demographic data (resident populations). At the EU level, overviews on waste water treatment plants are limited to design capacities; no inventories are available on actual influent or discharge loads from the WWTPs; only for some Member States such overviews are available from national inventories.

The situation in the EU Member States and other European countries concerning data availability and descriptors used in national inventories has been described in brief. A comprehensive questionnaire has been used for more specific information on definitions, methods used and data availability at various administrative levels. Based on an analysis of the responses, several problems can be foreseen for the future reporting from the Member States to the Commission. Some major issues are that certain key parameters are interpreted differently, and that relevant information for monitoring and control of discharges as well as estimates of actual pollutant loads to the WWTPs and the environment are only available at the local administration levels.

A format for reporting on programmes for the implementation of the Directive (Art. 17) was defined in 1993. This format relies on aggregated data for collecting systems and WWTPs deemed to be in compliance with the Directive.

It is recommended that all the EU Member States establish computerized inventories with data for waste water collection and treatment, as well as sludge production, reuse and disposal. Appropriate parts of such data bases could be downloaded and serve as input to the reporting to the EC DG XI relating to various articles of the Directive (and also other related directives) and could even be made directly available for the EC DG XI. Moreover, such separate files could be made directly available for EUROSTAT and the EEA as input for their reporting and studies. This will allow for a more flexible aggregation and statistical analysis of the data by EC/EEA and at the same time reducing the reporting work load on the Member States. The reporting should include all collecting systems and WWTPs over a certain size. Priority should be given to information on the largest plants first. Proposed data records identifying relevant descriptors have been prepared; some basic data should be considered mandatory and some additional data should be supplied on a voluntary basis. It is proposed to initiate a pilot study for implementation of this strategy. Furthermore, some special studies are proposed to increase the comparability of data from the Member States. It is recommended that the Commission, when collecting information from the Member States, requires the details on the definitions used for the key parameters identified in this report. This would assist for any future standardization of terminology.

2. INTRODUCTION AND OBJECTIVES

The Council Directive (91/271/EEC) on Urban Waste Water Treatment **provides** a legal **framework** for regulations of urban waste water collection and treatment, including some aspects of sludge disposal in the Member States of the **European** Union. Discharges from **waste** water treatment plants (**WWTPs**) have been regulated by sets of **emission** standards.

An overview for some of the key articles in the Directive and corresponding criteria for types of treatment and year of implementation is shown in Figure 2.1 (Wright, 1992).

Several technical aspects of the Directive are to be **specified** into **further** details as part of the implementation. Furthermore, certain requirements for reporting from the Member States to the Commission are included in the articles 15-17. These reports refer to monitoring and control, situation reports and programmes of implementation, respectively. A **so-called** "Article 18 Committee" has been established to assist the Commission for the implementation of the Directive. The Art. 18 Committee has **competence** in setting guidelines for the reporting according to art. 15-17.

The main objectives of the study are:

1. to prepare an inventory of existing specified information related to urban waste water systems
2. to analyse the needs for requirements to future information needed in **consequence** of the adoption of Council Directive **91/271/EEC**
3. to propose an appropriate methodology for the acquisition of data at the national level to allow for **comparisons** with criteria in the Directive

Expressed in other words, the **overall** emphasis of this study is to facilitate the future **reporting** relating to Art. 15-17 from the Member States to the Commission. Furthermore, the aim is to harmonize the data for statistics on the subject and to increase the technical outcome of these reportings. by making the data meaningful and comparable.

The aspects of storm water run-off via discharges from separated collecting systems or **combined** sewer overflows (**CSOs**) are dealt with in another study initiated by the EC DG XI being conducted by the **European** Wastewater Group (EWWG, 1995).

3. TERMINOLOGY

3.1 Introduction

One of the problems in preparing inventories for water pollution control issues is that different terms are sometimes used in different frameworks. This is important, in particular, when comparing aggregated information, i.e., based on data summarized into various categories of certain terms. In some cases, different terms are synonyms; for example, "municipal sewage treatment plant" is considered as a synonym to "urban waste water treatment plant". In other cases, terms with a slightly different meaning are used; for example, "secondary" WWTPs (Directive terminology) are not directly comparable to "biological" WWTPs (OECD/EUROSTAT terminology) since plants with biological nutrient removal are included in the second but not in the first. This may give implications when comparing aggregated data.

3.2 Key terms .

In this section, comparisons are made for some of the key terms on waste water collection and treatment between the Directive and similar terms used in other frameworks. The frameworks referred to are OECD, EUROSTAT, CEN, and EWPCA; an overview is shown in Table 3.1. Only the terms selected to be used consistently in this report are explained. Explanations for the other terms are included in Appendix B.

Definitions adopted directly from the Directive are indicated in *italic* letters and in quotation marks.

Urban waste water;

"Domestic waste water or the mixture of domestic waste water with industrial waste water and/or run-off rain water." (run-off rain water is a synonym to storm water run-off).

Domestic waste water;

"Waste water from residential settlements and services which originates predominantly from the human metabolism and from household activities."

Industrial waste water;

"Any waste water which is discharged from premises used for carrying on any trade or industry, other than domestic waste water and run-off rain water."

Agglomeration;

"An area where the population and/or economic activities are sufficiently concentrated for urban waste water to be collected and conducted to an urban waste water treatment plant or to a final discharge point."

8 , RECOMMENDATIONS

8.1 General

Based on the analysis of the organization, definition and availability of data on urban waste water collection and treatment in the EU Member States and other **European countries**, following **recommendations** are made for the future reporting from the Member States to the Commission relating to the Directive (91/271/EEC):

Definitions

Member States should in their reports clarify the definition of certain key descriptors. In their country. In particular, the definitions used for agglomerations, population equivalent, estuaries and **coastal** waters, and extreme values, heavy rain and **unusual** situations for waste water treatment plants (**WWTPs**) should be specified. The **conformity** of certain methods, **such** as sampling, chemical analysis and compliance criteria, with those of the Directive should be specified.

Data bases

It is recommended that **all** the EU Member States **establish** computerized inventories with data for waste water collection and treatment, as well as sludge production, reuse and disposal. Appropriate parts of **such** data bases **could** be downloaded and serve as **input** to the reporting to the EC DG XI relating to various articles of the Directive (and also other related directives) and **could** even be made directly available for the EC DG XI. Moreover, **such** separate files **could** be made directly available for EUROSTAT and the EEA as **input** for their reporting and studies. This **will** allow for a more flexible aggregation and statistical analysis of the data by EC/EEA and at the **same** time reducing the reporting work load on the Member States.

The data records should be formatted as **one** for **each** waste water treatment plant **over** a certain size, e.g., 10-15,000 p.e.. For Member States who do not have **such** data bases, priority should be given to the largest WWTPs first. Individual data records should be formatted for sludge treatment/disposal centers (**STCs**).

A minimum set of descriptors should be used by **all** Member States, however, additional data for relevant descriptors should be provided on a voluntary basis, if readily available. Proposals for the formats of **such** data records have been specified in Chapter 7. The preparation of further guidelines and **specifications will** be needed for the implementation of **such** data records; this **could** be in the form of an explanatory note.

Further studies

EC/EEA (in this context EC DG XI, EUROSTAT and the EEA) should **initiate** further studies on following topics:

a pilot study implementing a collection of the proposed data in **each** Member State and interpretation by EC/EEA;

special studies on:

- **the definition** of extreme values and unusual situations for **WWTPs** where **emission** standards do not apply;
- **the definition** of agglomerations in urban **areas** not served by collecting systems, and of individual and appropriate sanitation systems in these **areas**;
- statistical characteristics of WWTP discharges.
- the feasibility of reporting capital investments and operating **costs**;

Further details on the rationale of these topics are given in Chapter 9.

8.2 Monitoring and control of discharges (Art. 15)

Waste water discharges

The mandatory fields in the proposed data record (Table 7.3) **will provide** relevant data relating to **the** compliance of WWTP discharges with the Directive. Aggregation of the data **may** be **computed** according to **any** other descriptor mandatorily **filled** in with corresponding WWTP identification numbers.

For **each** WWTP, the mandatory descriptors should **include**:

WWTP ID number and **name**

the year of implementation and the **emission** standard set in the Directive

after the year of implementation, the compliance for **each** parameter should be indicated

method and frequency of sampling .

In cases where the collection system **does** not correspond to an agglomeration, the report should indicate the **procedure** used for identifying the relevant emission standards from the Directive.

It is recommended to **provide** the data in a non-aggregated form to **ensure** that **emission** standards are clearly defined and understood by both the discharger and the environmental authorities. **Any** discussion on the interpretation of WWTP size classes versus agglomeration size classes, and thereby the appropriate **reference** articles in the Directive, should be based on the **actual** cases.

Procedures used for data interpretation for the compliance assessment should be described. In particular **specifications** should be given in case that analyses are not performed or data not included for unusual situations for the WWTP operation.

As additional descriptors voluntarily to **be** reported, other local **emission** standards in the WWTP authorization differing from those of the Directive are recommended. Only parameters for which compliance assessment is regularly performed should be included and compliance assessment method should be described.

Sludge disposed of to surface waters

For sludge discharge to **sea** from **Ireland** and the UK, **comprehensive** and broadly compatible records on the key criteria of **volume** and quality are already made and reported to national authorities. From this information it is straight forward to assess environmental loads. However, this is not the case with discharges of sludge by pipeline to surface waters, and further efforts appear necessary to **ensure** that monitoring and reporting of pipeline discharges are made.

A similar situation appears to occur with the monitoring of the disposal sites. In the case of disposal of sludge by ship, environmental impact is assessed, the frequency and intensity of which tend to be **on** the basis of individual site characteristics. Reports are made, but probably only on a regional basis from time-to-time. There is a need for regular **consolidated** reports at the national level. The occurrence, extent and reporting of monitoring of surface waters into which sludge is discharged by pipeline needs to be evaluated, and appropriate measures established where lacking.

Sludge **can** only be discharged to surface waters until 31 December 1998, and **over** this short period of time, quantities so discharged should progressively **decline**. It is important that data is summarised on an annual basis so that the decrease in surface water loadings **can** be evaluated.

Mandatory information in Table 7.4 **will provide** data on sludge disposal to surface waters.

8.3 Situation reports (Art. 16)

The **decision** on **which** degree of detail should be required in the future situation reports is a political issue to be decided by the Article 18 Committee; it **will depend** on the willingness and ability of the Member States to **provide** relevant data.

It is recommended to **define** certain mandatory descriptors for which data must be reported as a minimum and to **select** relevant additional descriptors which should be reported on a voluntary basis. A **reference** is made to Tables 7.1-4 for recommended descriptors and formats of data records. The recommended mandatory descriptors are, with a few exceptions, equivalent to the degree of detail agreed upon by the Article 18 Committee for the Art. 17 reporting.

Waste water collection and treatment

For **each** collecting system and WWTP, the mandatory descriptors should **include**:

- WWTP (or collecting system) identification number and **name**
- the total nominal p. e. load
- the resident population served
- the type of treatment and design **capacity** (p.e.)
- the type of receiving water, classification according to Art. 4,5 or 6, and river or **sea basin** for the discharge

The resident population in a WWTP catchment **area** is presently not included in national inventories. It is, however, recommended as a descriptor to allow for **comparisons** of population served by collecting systems and WWTPs with other demographic data. The recommended indication of river or **sea basin will** allow for **basin-wise** aggregation of data. **EC/EEA** should **provide** a listing of major river and **sea** basins divided into an appropriate degree of detail, prior to the preparation of Art. 15 reports.

The recommended additional descriptors are:

- the sewerage **area** and/or length of sewerage **lines**
- the type of sewerage system
- the distribution of the nominal p.e. load into domestic and **industry/trade** sources, and further specifications of sum of known industrial point sources and sum of **areas** and specific loadings based on categories of land use
- the **actual** yearly- flow and mass loads of COD, **BOD₅**, SS, total N and total P, and/or average concentrations in influent and effluent based on measurements
- specifications of references to the overall or dry weather conditions only, sampling frequency and integration methods used for yearly load calculations
- the plant process **lay-out** by codes of unit operations
- the geographical position of the WWTP and discharge point by **means** of digital coordinates

Data on these additional descriptors **will provide** situation reports which to a higher degree **reflect** the **actual** situation on hydraulic and pollutant loads rather than nominal loads and design **capacities**. The inclusion of loadings based on measurements **will** allow for analysis of **any** systematic relationships with the resident populations and' unit loadings from **various** land use categories. The specifications **will** increase the **comparability** of data by avoiding aggregation of data with a different meaning.

Sludge production, reuse and disposal

The biennial reporting under Art. 16 **will** be the enduring and **comprehensive** report on sludge production and disposal, **since** the reporting on sludge under Art. 15 and 17 **will** be for only the defined periods. Thus it is important that the reporting criteria and methods are compatible between Member States.

With **reference** to Table 7.5, it is recommended that the minimum reporting descriptors are:

- ID no. of **WWTP** and cross **reference** numbering (Table 7.2) of WWTPs exporting sludge to **treatment/disposal** centre;
- total annual sludge production;
- quantities of sludge reused or disposed of annually to specified outlets (the descriptors should match those used for Art. 17 reporting);
- Heavy metal concentrations: Zn, Cu, Ni, Cd, Pb, Hg and Cr.
- indication of average or median concentration used

It is also recommended that information of a more general, qualitative nature is requested, **such** as the general measures taken to mitigate **effects** of sludge or sludge residues disposed of to different outlets, the problems or difficulties encountered or anticipated, and the

development of new treatment technologies and disposal opportunities. This **will** reveal national difficulties, opportunities and developments that **may** have bearing on other Member States and the Commission.

Consideration should be given to how the reporting requirement under Art. 17 of the Directive **86/278/EEC** on sludge reuse in agriculture, be integrated with Art. 16 for **91/271/EEC**. The **current** situation implies that aspects of agricultural reuse **will** be reported twice, but to differing time frames (3 and 2 years, respectively). **Since** the Art. 16 report is intended to be **comprehensive** of **all** sludge disposal, it is recommended that the Art. 17 reporting for **86/278/EEC** is incorporated into the Art. 16 reporting time frame and formatting .

As additional descriptors voluntarily to be filled in, the following are recommended:

- . sludge treatment by **means** of process-related codes for stabilization and dewatering;
- concentrations of other parameters, **such** as nutrients and organic **contaminants** and indication of number of samples per year.

8.4 Programmes for implementation of the Directive (Art. 17)

Waste water collection and treatment

Formats for reporting of according to Art. 17 have been prepared already (EC, 1993a,b). The formats **include** highly aggregated data for the collecting systems and **WWTPs** "**deemed to be in compliance**" with the Directive. Three principal changes are recommended to these **procedures** for the future reporting.

Firstly, it is recommended to make non-aggregated data available as described in previous sections. As the aggregated data **will** rely on summations of data from individual collection systems and **WWTPs**, the **same** data should be made available in a computerized form. In the long **run**, this **will** simplify the reportings from the Member States and make the aggregations more flexible. It **will** also make the reporting more transparent and give the possibility of spot-checking the data for quality assurance.

Secondly, it is recommended to **provide information** on **all** collecting systems and **WWTPs** over a certain size, e.g. 10-15,000 p.e. and not only to those deemed to be in compliance.

Thirdly, it is recommended not to aggregate the data according to agglomeration classes. The result of **each** Member State's interpretation of agglomeration classes and, in **consequence** of this, which WWTP **emission** standards should apply **will** appear from the recommended reporting to Art. 15. Therefore, the aggregation of data according to the agglomeration classes **will** not bring new information. Also, **since** there is no **common** definition on how to measure the size of an agglomeration, it is most likely that the interpretation differ between the Member States and that data on this descriptor would not be comparable. It is recommended to use **each** WWTP (or collecting system without treatment) as the basis for the statistics.

For **each** collecting system and WWTP, the mandatory descriptors should include for **each** of the years 1992, 1995, 1998, 2000, and 2005:

- WWTP (or collecting system) identification number and **name**;
- indications of “deemed to be in compliance” with Art. 3 and 15 ;
- the total nominal load from collecting system in p.e.
- the WWTP design **capacity (p.e.)**
- the type of receiving water and classification according to Art. **4,5** or 6

The data to be provided for cumulative investment costs for collecting systems and **WWTPs** for the **time** intervals 1993-95, 1993-98, 1993-2000, and **1993-2005** (and optionally for **1970-79** and 1980-92) should be reported on a national basis, only. Data for individual systems **may** be misleading and not comparable **since** physical conditions for the constructions **vary** considerably from **one** WWTP to another and furthermore, total costs **may** have different meanings in the Member States due to accounting and taxation **procedures**. Therefore, data on investment costs on a national basis should **only be** considered as gross estimates of the financial **resources** required for this sector and the distribution **over time** intervals for the Member States.

The feasibility of reporting capital and operating costs should be studied before initiating more detailed reportings of this issue.

Additional voluntary descriptors should include the **same** as mentioned for Art. 16, however, projected to the future years.

Sludge production, reuse and disposal

The mandatory information in the proposed Table 7.4 **will provide** sufficient data to fulfil the requirements of the Art. 17 reporting .

It is recommended that clarification is made whether the heading “soil and agriculture” refers to **all** beneficial use on land or to only that covered by Directive **86/278/EEC**. It is recommended that **the** latter is **chosen**, and that **all** other reuse is given under “other”, preferably with the opportunity for the Member State to specify these other uses.

It is considered that the request for sludge disposal costs, albeit voluntarily, **will not provide** useful or comparable information. This is at best an extremely **difficult** summary to make at the national **level**, and Member States calculate **such** costs in a variety of ways. As for waste water collecting systems and **WWTPs**, it is recommended to study the feasibility of more detailed reporting of the costs; this should **clarify** the preferred approach and request Member States to **describe** the basis of calculation before data be **collected**. Probably, this should **lead** to the preparation of an explanatory note.

9. FURTHER STUDIES NEEDED

Pilot study

The implementation of **the** proposed data records in **connection** with computerized inventories in the Member States should be initiated with priority to the largest WWTPs. A **pilot** study should be initiated, e.g., on size classes involving the **10 - 20** largest WWTPs in **each** Member State. The links between the national inventories and a separate downloaded file, and from these files to **EC/EEA**, should **be** investigated.

The objective of **such** a **pilot** study should be to test the feasibility of this strategy, identify potential practical problems and demonstrate **the** potential uses of **such** a system. Furthermore, it is the aim to give inspiration to the Member States and other **European** countries for design or update of national computerized inventories.

If feasible, an explanatory note should be prepared **with** guidelines and further **specifications** for filling in the data records.

Special studies:

1. Definition of agglomerations

There is a need for a general definition of agglomerations in **urban areas** not served by collecting systems, and of individual and appropriate sanitation systems in these **areas**.

The objective should be to review the **current** practice for definitions in the Member States, to **evaluate** the significance of different or lacking definitions and, if possible, to **provide** clear and applicable definitions for the implementation of Art. 4. The study should also identify appropriate sanitation systems observing standards prepared by the CEN Task Group 165.

2. Definition of extreme values and unusual situations

There is a need for clear and applicable definitions for the compliance assessment of WWTP discharges. The compliance criteria, e.g., if certain samples should be excluded from the data evaluation should be clearly **understood** by the discharger and the environmental authorities.

The objective should be to **provide** clear and applicable definitions based on a technical-scientific analysis of various alternatives. This analysis should **include** the differentiation of the total data population into classes (dry weather, wet weather, operation failures, force majeure events, etc.) and the environmental impacts -of alternative definitions.

3. Statistical characteristics of WWTP discharges

There is a need for analysing the significance of the actual **differences** between data which are considered non-comparable due to different definitions and methods. This should be based on actual monitoring data for selected **WWTPs**.

The main objectives are:

establish empirical relations between data based on different methods for sampling and analysis, different categorization of p.e. loads, different integration routines for calculation of yearly pollutant mass loads, etc. ;

establish a translation key between various compliance criteria currently used in the Member States and those of the Directive.

4. Feasibility of reporting capital investments and operating costs

There is a need for evaluating the use and requirements for information on costs for **implementation** of the Directive.

Provided it is considered feasible to **collect** this information, the study should analyse 'the instruments currently used in the Member States for financing investments and operating costs for waste water collection, treatment and sludge reuse/disposal . Furthermore, **the procedures** used for' inclusion of various **categories** of costs should be analysed aiming at providing methods for making the data comparable.