

REVIEW ON THE APPROACHES TO WATER QUALITY
MONITORING AND ASSESSMENT IN EUROPE

Contractor: WRc

1999

DWI0799

£35.00

Review on the Approaches to Water Quality Monitoring and Assessment in Europe

***Final Report to the Drinking Water Inspectorate -
Department of the Environment, Transport and the
Regions***

REVIEW ON THE APPROACHES TO WATER QUALITY MONITORING AND ASSESSMENT IN EUROPE

Final Report to the Drinking Water Inspectorate - Department of the Environment, Transport and the Regions

Report No: DWI/DETR 4663/2

August 1999

Authors: H Horth, J Casillas

Contract Manager: H Horth

Contract No: 11239-0

DoE Reference No: CWO786

Contract Duration: February to October 1998

Report printed on 100% recycled paper containing 80% post consumer waste

This report has the following distribution:

External: DWI and WHO

Internal: Contract Manager and Authors

Any enquiries relating to this report should be referred to the Contract Manager at the following address:

WRc plc, Henley Road, Medmenham, Marlow, Buckinghamshire SL7 2HD.
Telephone: 01491 571 531

REVIEW ON THE APPROACHES TO WATER QUALITY MONITORING AND ASSESSMENT IN EUROPE

EXECUTIVE SUMMARY

This review has been funded by the Drinking Water Inspectorate (DWI) (Department of the Environment, Transport and the Regions - DETR) to assist in the provision of technical background information to the World Health Organisation (WHO) and the United Nations Economic Commission for Europe (UN-ECE). The review focuses on the provision of drinking water, its control including monitoring of drinking water quality, and problems concerning supply and quality across pan-European countries, and supports the development of an international instrument on the eradication of water-related disease at pan-European level. The study is based mainly on the evaluation of replies to questionnaires returned from 29 countries (questionnaires sent to 53 countries).

Whilst many countries in Europe, particularly in the EU and other Western countries, have high quality drinking water supplies, large numbers of people, mainly in Eastern Europe, do not have access to safe drinking water (low connection rates, discontinuous supply, microbiological contamination). In rural areas across Europe (East and West) there are many private supplies (individual households) and small community supplies which receive little or no treatment; these may be contaminated, but are inadequately monitored. Scarcity of water is rarely the limiting factor; inadequate public supplies and quality are mainly due to lack of financial resources, organisational problems, lack of trained personnel, contamination of raw water sources, poor infrastructure, inadequate water treatment and distribution systems.

Monitoring of drinking water quality and reporting of results is often inadequate, but the most frequently encountered water quality problems include microbiological contamination, nitrate, iron, manganese, and pesticides, and are mainly due to agricultural activities and domestic effluents, natural presence in source waters, and poor state of distribution systems. Other areas of concern include nitrite, ammonia, aluminium, lead (from lead pipes), naturally occurring high levels of arsenic and fluoride, industrial contaminants including heavy metals, disinfection by-products (THMs), and *Cryptosporidium*.

There should be a unified system of drinking water quality monitoring and reporting across Europe to allow comparisons across countries and regions, and setting of priorities for improvement measures. Significant improvements in the infrastructure are needed in many parts of Europe, together with the establishment of institutional mechanisms to monitor drinking water quality, and to enforce drinking water legislation. Priorities must be clearly established to provide a safe drinking water supply (continuous supply, microbiological quality) where this has not already been established. The implementation of source protection schemes will be important in the long term.

CONTENTS	Page
EXECUTIVE SUMMARY	i
1. INTRODUCTION	1
2. OBJECTIVES	3
3. ORGANISATION OF WATER SUPPLY	5
4. CONTROL OF WATER SUPPLY AND QUALITY	7
4.1 Member States of the European Union	7
4.2 Other Western European countries	8
4.3 Central and Eastern European countries	9
5. MONITORING OF DRINKING WATER QUALITY AND REPORTING	11
5.1 Monitoring	11
5.2 Reporting	12
6. PROBLEMS CONCERNING DRINKING WATER SUPPLY AND QUALITY	15
6.1 Water supply	15
6.2 Water quality	15
6.3 Action in case of non-compliance	17
7. CRITICAL ASSESSMENT OF THE SITUATION ACROSS EUROPE	19
8. CONCLUSIONS	23
9. RECOMMENDATIONS	25
BIBLIOGRAPHY	27
 APPENDICES	
APPENDIX A TABLE SUMMARISING INFORMATION FOR 29 COUNTRIES WHICH RETURNED THE QUESTIONNAIRE	29
APPENDIX B SUMMARIES FOR 29 COUNTRIES WHICH RETURNED THE QUESTIONNAIRE	47

1. INTRODUCTION

The potential link between water and health is one of the main concerns of the European Environment Health Committee (EEHC). Following consultation meetings in 1995 and 1996, the EEHC noted that the eradication of water related disease was one of the most pressing issues at pan-European, national and local levels.

With this background, the EEHC decided, at its meeting in Riga in 1996, that an international instrument on the eradication of water related disease should become one of the principal outcomes of the 3rd European Conference on Environment and Health, to be held in London in June 1999.

The World Health Organisation (WHO) and the United Nations Economic Commission for Europe (UN-ECE) were asked by the EEHC to develop and sponsor jointly such a legal instrument (draft protocol now published - WHO 1999). The WHO and UN-ECE organised a preliminary consultation meeting in Kiev, Ukraine, in March 1997 to discuss and agree the way forward with respect to both the legal and technical aspects of the proposed instrument.

In order to provide a firm technical basis for the scope and content of the instrument, a series of technical reviews were required. The WHO requested that the preparation of such reviews would be, where possible, carried out or managed by WHO Collaborating Centres who should ensure that such work was co-ordinated.

The Department of the Environment, Transport and the Regions (DETR) wished to assist in the development of the international legal instrument. This review was funded by the Drinking Water Inspectorate (DWI/DETR) and focuses on the provision of drinking water, its control including monitoring of drinking water quality, and problems concerning continuous supply and water quality. Another review, 'Prevention and Control of Water Related Disease in Europe - Economic Assessment' (Andrews *et al.* 1999), has also been prepared by WRc (funded by UK-Water Industry Research - UK-WIR).

In collaboration with the European Environment Agency (EEA), the EEA Topic Centre for Inland Waters at WRc, and WHO, a questionnaire was prepared and sent to 53 pan-European countries. Section 1 of the questionnaire related to the issues covered in this report, i.e. the responsibilities for water supply and drinking water quality monitoring, monitoring requirements and reporting, problems of supply and quality, and actions in case of non-compliance with standards.

Replies were received from 29 countries; the information provided, and in some cases supplemented by other information, is summarised and evaluated in this report. Summaries have also been provided to WHO for inclusion in the EEA/WHO Monograph on Water Resources and Human Health.

The table in Annex A summarises the information received from all 29 countries that returned the questionnaire; in this table the countries are grouped as follows:

- Member States of the European Union (EU) (9 countries);
- Other Western European Countries (7);
- Central and Eastern European Countries (12 former Soviet Bloc countries and Turkey).

Annex B provides a summary for each of the 29 countries that returned the questionnaire.

Undoubtedly the approach used had its limitations; despite repeated reminders, only just over half the countries replied to the questionnaire and some of the information received was incomplete, or not always entirely clear, sometimes no doubt because of language difficulties and use of terminology, as well as cultural differences. The information on the organisation of water supply and the institutional arrangements for supervision of water quality obtained through the questionnaire was particularly limited, largely because of the necessarily simple design of the questionnaire; however, for some countries this was supplemented by other available information.

Despite these difficulties and limitations, the report tries to present a reasonably balanced picture and should provide a useful overview of the situation across Europe with respect to the organisation of water supply, monitoring and the main problems of supply and quality encountered.

2. OBJECTIVES

The objectives of the project were as follows:

1. To gather information on the organisation of public water supply, and water quality monitoring and assessment programmes in pan-European countries, in line with the requirements of the WHO/UN-ECE legal instrument.
2. To review water quality monitoring and assessment programmes in the pan-European region, highlighting inadequacies and problems encountered with monitoring, provision of supplies and quality of drinking water.
3. To co-ordinate the preparation of the review with the other reviews being carried out in support of the legal instrument and, in particular, with the EEA/WHO Monograph on Water Resources and Human Health.

3. ORGANISATION OF WATER SUPPLY

Water services are organised in a wide variety of ways across pan-Europe; they are mostly fragmented, with responsibilities divided among different levels of administration, but with the focus on local provision of water supply.

Whilst in most countries, responsibilities for the operation and management of water supply lies at local (municipal) level, in a few countries the main responsibilities are with national government departments or state owned companies (Malta, Croatia, Serbia, Slovakia), or the water industry is run wholly or in part through private companies, notably in England & Wales, France, and increasingly in some countries of Central and Eastern Europe (CEE), such as the Czech Republic and Hungary (see below).

Due to the increasing need for investment in, and rationalisation of, water services (sewerage and water supply), not only in CEE countries, but also in Member States of the European Union (EU) and other European countries, there is a growing trend towards privatisation, though only relatively large utilities can usually attract private investment. In some CEE countries where international funding agencies provide significant contributions to investment or loans (for example the European Bank for Reconstruction and Development (EBRD) in Estonia, Lithuania and Latvia) there is additional pressure, imposed by the funding agencies, to manage the services more effectively and impose realistic charges on the users, thereby opening the way to private investment and operation of the utilities.

The main example of a wholly privatised water industry exists in England & Wales, where water supply and sewerage services are run by water service companies covering entire river basin catchments, and with some smaller water companies operating within these catchments. The facilities are wholly owned by these companies. Whilst local authorities have some involvement in the supervision of the service and dealing with consumer complaints, the main supervision is centralised (see Section 4), with the Drinking Water Inspectorate (DWI) at the Department of Environment, Transport and the Regions (DETR) overseeing compliance with quality standards.

France has a high proportion of long established, privately run water services, with 60% of consumers being supplied by private water companies. With the exception of the large Paris water supply company, SAGEP, which is wholly owned and managed by the municipal authority, the remainder are numerous, relatively small community services managed directly by local councils or associations of several municipalities and, in rural areas, there are still many individual private supplies. However, the approach is significantly different from England & Wales. In France, ownership of the facilities remains with the municipality (or joint syndicates of several municipalities) and the ultimate responsibility remains with the local Mayor, whilst time-limited management contracts or concessions are issued to private companies for operation of the facilities and provision of the services. Overall supervision of water quality, technical and administrative matters, on behalf of the State, is the responsibility of the Departmental

Prefects (95 Departmental Directorates) who also carry out or delegate the task of water quality monitoring for the purpose of compliance checking.

In all other countries where privately operated water companies are increasingly being established, the French model or similar arrangements are applied, rather than the UK (England & Wales) approach of transferring all assets.

In general, however, water services are predominantly organised and managed by local, town or district or regional administrations, only in a few cases by national administrations. There are a variety of approaches ranging from direct operation and management by local authorities, to economic enterprises or corporations governed separately by public administrations, or public corporations or co-operatives managed by several municipalities linked together. In some countries, there is increasingly a trend towards delegation of duties to private companies, whilst maintaining public control.

In addition, in rural areas of many countries, including the EU, there are still large numbers of very small community or private, individual household supplies with little or no treatment and often minimal supervision of quality.

Central and Eastern European countries have experienced enormous changes with the recent break-up of the Soviet Union, where formerly all water services were run under government control, often through large, wholly State owned companies. In most of these countries, these companies have been broken up and the services are now run predominantly by local administrations. Major issues still to be addressed are often much more basic than in EU and other European countries; i.e. the provision of continuous supplies of adequate microbiological quality. Due to the need for investment to restore an often neglected infrastructure, pressure to privatise is increasing, particularly the water supply utilities in large towns and cities. The Czech Republic and Hungary have already gone a long way in this direction. However, there is some concern in these countries about insufficiently well established legislation and institutional mechanisms to properly supervise the quality of the water supplied by private companies.

4. CONTROL OF WATER SUPPLY AND QUALITY

National legislation and institutional frameworks to enforce the legislation vary across Europe, and many countries have undergone significant change in the last decade. Clearly, legislation in EU Member States is dominated by EU Directives which have to be transposed into national legislation. Consequently, prescribed drinking water quality standards are similar in all countries, though there are minor differences, i.e. certain stricter and/or additional standards in some countries. Other Western European countries also have broadly similar national standards, and most CEE countries are gradually moving towards basing their standards on the EU Directive, particularly those aiming for EU accession in the near future.

4.1 Member States of the European Union

In the European Union the Drinking Water Directive (80/778/EEC) (CEC 1980) has been providing the framework for drinking water quality standards across Member States. The Directive was issued in 1980 and transposal by Member States was required by 1986. It has recently been revised and has now been replaced by Directive 98/83/EC on the quality of water intended for human consumption (CEU 1998) which was signed/adopted on 3 November 1998 and will require transposal into national legislation by Member States by the end of 2000. The revised Directive (98/83/EC) includes some new health based standards (e.g. bromate, acrylamide, epichlorohydrin, vinyl chloride) and some tighter standards (e.g. arsenic and lead, where the standard has been lowered from the previous $50 \mu\text{g l}^{-1}$ to $10 \mu\text{g l}^{-1}$, although in the case of lead, this is being introduced gradually over 15 years, with an interim standard of $25 \mu\text{g l}^{-1}$).

Issues of the quality of water resources are covered by a variety of Directives (and corresponding national legislation). Some of these will be incorporated into the proposed Water Framework Directive (COM(97)49) which aims to establish a framework for the protection and management of water resources focusing on river basin catchments.

Although there is considerable variety throughout the EU Member States concerning details of transposal of Directives into national legislation and subsequent implementation, as well as the organisation of drinking water supply and the institutional arrangements to control compliance with the standards, there is a common goal to achieve certain standards and the need to report to the European Commission on compliance with these standards.

All 15 EU Member States have transposed the 1980 Drinking Water Directive (80/778/EEC) into national legislation, some with considerable delay and others, relatively new Members of the EU, are still adjusting to EU requirements (e.g. Austria). On the whole, the EU standards have been adopted with minor variations and some additional or stricter national standards which are in place in some countries. Many countries still experience problems in fully complying with certain parameters, and/or are still not fully complying with monitoring requirements and reporting of data.

The ultimate responsibility for legislation and enforcement of the legislation concerning water resources and supply lies at national, ministerial level in most countries, often Ministry of Environment or Ministry of Health (or ministries with similar functions); or there may be shared responsibilities between two ministries, each covering different aspects of water supply. For example, water resources (quality and quantity), licences for abstraction and discharge consents may be under the Ministry of Environment, whilst drinking water quality may be under the Ministry of Health or Foods. However, in some Federal Nations, responsibilities are divided between Federal level and individual Federal State level, as for example in Germany; or the three Regional Ministries in Belgium. Moreover, in practice, the supervision of compliance is often fragmented with much of the responsibilities divulged to regional level (e.g. 95 Departmental Prefects in France) and, more frequently, these lie at local level (e.g. Local Medical Officer in Germany, and local authorities in Austria, Finland, and Sweden).

There does not always seem to be a clear distinction between those responsible for supplying water and those supervising water quality and enforcing compliance with water quality standards.

There are some exceptions, however, notably in England & Wales where the water industry is fully privatised, and centralised controls are in place relating to water supply and quality. The Drinking Water Inspectorate (DWI) at the DETR supervises quality compliance of all water companies which practise self-monitoring; the DWI inspects water treatment plants, laboratories and results of analyses, and requires evidence of analytical quality control procedures which must be in place. The system appears to be successful, as water quality is generally high and has improved over recent years. OFWAT is in charge of the economic/financial aspects and consumer interests, and the DETR and Environment Agency (with regional offices based on catchment areas) are responsible for abstraction and discharge consents. Similar provisions have recently been put in place in Northern Ireland (NI) where the NI - Drinking Water Inspectorate supervises water quality compliance of the publicly owned water suppliers.

Similarly in the Netherlands, though somewhat less centralised in practice, Regional Public Health Inspectors supervise all water service utilities in their respective Regions, whilst one of the Inspectors acts as national co-ordinator to ensure consistency of approach throughout the Regions. The system is relatively informal and incorporates a good deal of collaboration between the regulator and the regulated, but it seems to be effective, perhaps to a large extent because of the openness of the system and the direct accountability to the electorate (at local level) of those ultimately responsible for water supply.

4.2 Other Western European countries

Western European countries which are not members of the EU, such as Switzerland and Norway, have similar legislation in place, with drinking water quality standards based on a combination of EU limits (80/778/EEC, 98/83/EC) and health based WHO Guideline Values (WHO 1984, 1993). As these countries are not subject to the legal requirements of the EU, the approach tends to be more pragmatic and focusing on health based criteria.

Switzerland, for example, has two sets of standards: health based limits which may be higher than EU limits and have to be strictly adhered to, and where necessary, lower non-health based guide or target values (based on EU standards, e.g. pesticides) which are less strictly enforced, but ultimately to be aimed at.

Whilst legal responsibilities for public water supply lie mainly at local level (except Malta where they are with the Ministry, and Liechtenstein where they are shared between Ministry, local authorities and private co-operatives), institutional arrangements for compliance supervision range from Ministerial Departments (Andorra, Liechtenstein, Malta) to local authorities (Norway) and those without separate compliance supervision (Iceland, Monaco, Switzerland).

As in EU countries, there does not always seem to be a clear distinction between the suppliers of water and the supervisors of water quality.

4.3 Central and Eastern European countries

Central and Eastern European countries have experienced many changes with the recent break-up of the Soviet Union. Previous Soviet legislation contained numerous, strict standards for drinking water quality but these were poorly enforced due to lack of institutional mechanisms and resources in most countries (apart from a few exceptions, most notably the Czech Republic). For most parameters, methods of analyses were wholly inadequate and they were never measured. There was no clear distinction between those responsible for provision of services and those responsible for supervision of standards and law enforcement. Moreover, drinking water quality was often severely compromised through intensive industrial activity without any concerns for the environment, and, consequently, wholly inadequate protection of water resources. A lack of investment in treatment and distribution facilities also contributed to significant problems.

Many of these countries are preparing or have recently introduced new legislation closely linked to the WHO Guidelines for Drinking Water Quality (WHO 1993) and/or the EU Drinking Water Directive (1980 Directive 80/778/EEC or the revised Directive 98/83/EC of 3 November 1998), particularly those expecting to join the EU in the near future. However, whilst for example, the Czech Republic formerly had a relatively sound system of legislation and enforcement, including publication of drinking water quality reports, it has delayed adoption of its revised draft legislation, whilst waiting for completion of the revision of the Drinking Water Directive (now complete and adopted - see above) and for progress with the proposed Water Framework Directive (COM(97)49). Meanwhile, privatisation of water supply is going ahead, and there are concerns that there are currently gaps in the legislation and enforcement mechanisms that could be exploited, particularly by newly emerging, inexperienced private water service operators (B Havlík, Scientific Adviser to the Czech Minister of Health, Prague, personal communication).

Similar to the EU Member States, overall responsibilities for water supply lie at a variety of levels, i.e. ministerial, local or shared between different levels of administration. Compliance supervision is also carried out in a variety of ways, ranging from Ministerial

Departments, to local authorities, often without a clear distinction between suppliers and enforcement agencies.

Whilst the preparation of suitable legislation and to some extent, the allocation of responsibilities, is taking shape in most countries, resources and experience are often lacking to enforce the standards effectively. Moreover, it is clear that in many countries considerable investment is needed to bring the infrastructure up to standard before reliability of water supply and quality can be assured.

5. MONITORING OF DRINKING WATER QUALITY AND REPORTING

5.1 Monitoring

In EU and other European countries, routine operational monitoring and supervision of water quality, including compliance monitoring, is carried out in a variety of ways; often through a combination of responsibilities at various levels of administration. As already mentioned in relation to institutional mechanisms (see Section 4), there often seems to be no clear distinction between routine monitoring and compliance monitoring or supervision, particularly where responsibilities for provision of supply and compliance with standards overlap. Monitoring of raw water sources is usually the responsibility of government departments, although some monitoring is also done by water suppliers to check the quality of their intakes.

Self-monitoring by water companies and close scrutiny of these activities by the enforcement agency, as practised in England & Wales, Scotland and, increasingly, in the Netherlands, is relatively rare. The function is more typically carried out by government health laboratories, or other government appointed laboratories, whilst water suppliers undertake a minimum of routine operational monitoring.

Often the laboratories of the water suppliers and those of the government health authorities, particularly where they are small and at local level, are not the best equipped or resourced facilities to deal with the considerable technical demands of the full range of water quality analyses, for example the low concentrations of organic contaminants prescribed in the EU Drinking Water Directive (80/778/EEC, replaced by 98/83/EC) or recommended in the WHO Guidelines for Drinking Water Quality (WHO 1993). Traditionally, these laboratories are experienced and equipped mainly for dealing with microbiological analyses, e.g. in France, where the best equipped laboratories are probably those of the major private water companies. These problems have been recognised in some instances; for example in Germany, some laboratories of large water suppliers have been certified by the administrations to carry out analyses on their behalf, but these are only permitted to carry out compliance monitoring of other water suppliers, not their own. In England & Wales, where self-monitoring is practised, the laboratories of the private water companies are generally good and well equipped, and participating in external quality control systems.

Even in EU Member States where water quality standards and monitoring programmes should be well established, some inadequacies in monitoring have been mentioned; for example France and Belgium in relation to small supplies (due to high cost of analyses), Sweden in respect of pesticides and toxic elements; and major monitoring difficulties seem to be encountered in Greece because of technical and financial problems and inadequate human resources. Some other Western European countries also refer to monitoring problems due to inadequate human resources (Andorra, Malta) and insufficient monitoring at the numerous small supplies (Norway).

Most CEE countries seem to encounter considerable difficulties in routine and compliance monitoring, due to insufficient resources, technical and organisational problems and inadequate human resources. Where specified, the population receiving water which is regularly monitored, ranges from 15-84% in different countries. Moreover, understandably, monitoring often comprises a basic set of parameters, focusing on microbiological quality, pH, organoleptic properties and major ions, whilst many of the chemical parameters requiring sophisticated, expensive methods of analysis, such as toxic metals, pesticides, PAH etc., are rarely measured.

There is clearly a need for operational water quality monitoring by water suppliers. However, this, together with the need for compliance monitoring by separate authorities leads to duplication of effort which is expensive and can divert valuable resources. This situation could be avoided by self-monitoring, together with effective controls on the monitoring activities, such as inspection of data, quality control systems and laboratory audits. It would be particularly relevant to make more use of such systems in countries where resources are particularly scarce.

Another issue is the often inadequate monitoring of small and private supplies which are numerous in many countries. However, these are usually spring waters and groundwater wells; the best solution would clearly be improved protection of the source waters and wells, thereby reducing the need for monitoring, if implemented successfully.

5.2 Reporting

Most countries claim to be producing reports on drinking water quality (except Monaco, Slovenia and Turkey) and most claim to make data available to the public (except Andorra, Malta, Monaco, Hungary, Turkey). However, most of the reports seem to be very general summaries, and usually without identification of suppliers. Alternately, reports are often produced by water companies as part of public relations exercises; these usually provide annual average results and are not always complete and unlikely to mention non-compliant results.

The most comprehensive report in the EU, produced annually and allowing comparisons over the years since 1990, is issued by the Drinking Water Inspectorate (e.g. DWI 1998), covering all water companies in England & Wales. Scotland and the Netherlands have also started to produce an annual report in recent years, though less detailed (e.g. The Scottish Office 1998, and Versteegh *et al.* 1997). Some reports are available in France (e.g. Godet *et al.*, 1995), usually covering several years and focusing on certain parameters only. Similarly, the report from Ireland (EPA 1996) covers a three year period and summarises results for certain parameters without giving details of specific supplies (EPA 1996). Other EU countries are beginning to produce reports as required for returning to the European Commission, under the Reporting Directive (e.g. Belgium: Région Wallonne, 1995), but these are not necessarily published, nor available to the public.

The Czech Republic has also been producing detailed annual reports of drinking water quality for some years (e.g. Šamánek and Havlík, 1994), whilst in Switzerland no

comprehensive data are available at national level (BUWAL 1993) though County Laboratories may include very brief summaries of drinking water analyses in their annual reports.

Attempts to gather and collate information on compliance with the EU Directive at EU level are underway, but are fraught with difficulties. Even where reports are produced or data are otherwise available, it is difficult to make precise comparisons of compliance, due to differences in data presentation; these may be presented in terms of percentage of samples analysed, population or volume of water supplied, supply regions, compliance for individual parameters or all parameters measured etc. In addition, a measure of the duration of exposure of consumers to water exceeding a standard would be useful, but is not normally addressed.

Until there is a unified system of monitoring and reporting, it is impossible to make meaningful, precise comparisons of drinking water quality across Europe. Only broad generalisations can be made.

6. PROBLEMS CONCERNING DRINKING WATER SUPPLY AND QUALITY

Despite the inadequacies in reporting (see Section 5), it is possible to make some general conclusions concerning water supply and quality from the questionnaires returned as part of the survey and other information used to back up this project.

Whilst non-continuous supply and microbiological problems clearly pose a potential health risk to consumers and must be addressed immediately, other problems (most chemical parameters) do not pose an immediate risk and can be solved in the long term.

6.1 Water supply

On the whole, supply is maintained on a continuous basis in the EU Member States, with the exception of certain localised, seasonal problems due to draught conditions, and occasional short term interruptions due to maintenance works. Of the other Western European States, Malta reported some problems in urban areas due to power failures, repair works and newly built up areas lacking connections to public water supply. In Central and particularly in Eastern European countries including Turkey, supply is still non-continuous in many parts or frequently interrupted for various reasons (see Table in Appendix A). A few countries suffer inadequate water resources all year round (Moldova) or on a seasonal basis (Serbia, Slovenia), whilst others refer to inadequate or poor state of distribution networks, lack of technical and financial resources, inadequate storage provisions, poor management of water supply and increasing demand.

Although this survey focused on public water supplies and, therefore, not much information has been gathered on private supplies, it seems that there are still large numbers of people in rural areas in EU and other European countries, relying mainly on private supplies (individual households) or very small community supplies receiving little or no treatment and usually inadequate monitoring of water quality.

6.2 Water quality

Concerning water quality, the most frequently reported non-compliance problems relate to microbiological parameters, nitrate, pesticides, iron and manganese. Other areas of concern include nitrite, ammonia, aluminium, lead (from lead pipes), naturally occurring high levels of arsenic and fluoride, industrial contaminants including heavy metals, disinfection by-products (THMs), and *Cryptosporidium*.

In the EU Member States and other Western European countries, the drinking water quality problems are on the whole relatively minor, often mainly concerning small and private supplies where little or no treatment is applied, and particularly frequently relating to non-health based parameters, such as pesticides. However, Greece mentioned significant microbiological problems due to inadequate (discontinuous) disinfection.

An issue which has given increasing cause for concern in the UK is *Cryptosporidium* which is not eliminated by traditional chemical disinfection methods (chlorine); it poses a serious threat to human health and its occurrence could be far more widespread (in surface waters and groundwaters) than has previously been thought (DETR 1998). However, with the exception of the UK, and more recently in France, Germany and the Netherlands, this potential problem has received little attention to date in most European countries including EU Member States; it should be investigated across Europe and dealt with together with other (known) microbiological problems.

Problems can occur due to raw water pollution incidents, insufficient treatment or treatment failures, poor state of the distribution systems, and corroded or inappropriate pipe materials, such as lead pipes. In EU countries, some problems due to the state of the distribution system have been mentioned by Finland, France and the UK, and non-compliance with the lead standard by France and the UK (Northern Ireland; minor problem in England & Wales). However, many problems are directly related to agricultural activities, sometimes industrial and municipal effluents, and inadequate protection of water resources. On the whole, many pollutants are removed during treatment of surface waters since these usually need extensive treatment in any case, whereas contaminated groundwater affects drinking water quality directly, as such water sources usually receive minimal or no treatment. Moreover, groundwaters normally take longer to recover than surface waters, once pollution sources have been reduced or eliminated.

For example, in France, there has been considerable emphasis on the application of high technology water treatment by the private operators of large supplies, whilst groundwater protection seems to have been neglected. Consequently, the large numbers of small community and private supplies which receive minimal or no treatment are adversely affected. There are similar problems in other countries where source protection seems to be inadequate (e.g. Sweden, Belgium, Norway). In Germany many small supplies have been closed down because of non-compliance problems (mainly nitrate and pesticides) and replaced by supplies from larger works, often far removed (Fernversorgungen); concerns have been expressed that this policy will result in neglect of groundwater protection measures.

Similar, but generally more severe problems than in the EU and other Western European countries are encountered in CEE countries. Microbiological problems are often reported, also iron, manganese, nitrate, nitrite, ammonia, pesticides, and toxic metals. Clearly, microbiological problems are inevitably encountered where supplies are interrupted (see Section 6.1.) but they are also widespread for various reasons even where continuous supplies are provided, including inadequate disinfection facilities and poor state of the distribution system. Problems with nitrate and pesticides are mainly related to contamination of water sources due to agricultural activities and inappropriate storage or disposal of old chemicals, combined with inadequate source protection measures, whilst industrial pollutants are also encountered.

As in other European countries, there are many private and small community supplies (see Section 6.1) which receive little or no treatment and minimal or no water quality

monitoring; these are often at risk of contamination from agricultural and other activities (e.g. cesspits near private wells), i.e. microbiological contamination, nitrate and pesticides.

In addition, some problems of naturally occurring, toxic elements, such as arsenic in Hungarian deep well waters have been reported; these wells also have anoxic conditions and high ammonia levels, making treatment more difficult (Licskó, in Licskó and Horth 1995). However, much of the problem has been resolved so that arsenic levels in treated waters now lie mainly below the previous EU standard of $50 \mu\text{g l}^{-1}$ (Directive 80/778/EEC), but significant difficulties will be encountered once the standard of $10 \mu\text{g l}^{-1}$ of the recently adopted EU Drinking Water Directive (98/83/EC of 3 November 1998) is implemented in Hungary.

Beryllium, for which there is no EU or WHO standard, is of concern in the Czech Republic, its presence in source waters is partly due to natural occurrence, and partly from industrial contamination (B Havlík, Scientific Adviser to the Czech Minister of Health, Prague, personal communication).

However, it must be stressed, that problems in many CEE countries are likely to be more severe than those reported, because of inadequate monitoring (see Section 5.1), resulting in considerable gaps in the information, particularly, for example, concerning toxic metals, pesticides, PAH etc. Difficulties were mentioned in all countries, resulting from inadequate infrastructure, and in particular, poor treatment facilities and old, corroded distribution networks, including lead pipes (e.g. Lithuania). For example, a recent survey in Lithuania has shown that an extensive pipe renovation (replacement, relining) programme is needed, including replacement of lead pipes, in order to improve/safeguard the quality of drinking water supplies.

6.3 Action in case of non-compliance

Where non-compliance with water quality standards is encountered, the emphasis is, on the whole, on implementing improvement measures, setting priorities and allocating public funds for treatment and distribution facilities, and implementing source protection measures. Options, such as closure of supplies and withdrawal of licences to supply (Turkey) may be used, as well as prosecution of water suppliers (UK, France, Germany and particularly in many CEE countries). However, it is beyond the scope of this study to assess how much use is made, in practice, of the various options.

7. CRITICAL ASSESSMENT OF THE SITUATION ACROSS EUROPE

On the whole, there are relatively minor problems concerning adequate supply and quality of drinking water across the European Union and other Western European countries, although there are still problems which pose a health risk (microbiological quality) and real difficulties are still experienced in a few countries (e.g. Greece, Malta). In contrast, far more significant problems remain in many CEE countries where public supplies are often restricted (non-continuous, low connection rate), although the availability of water resources is rarely the limiting factor; moreover, drinking water quality is often poor and/or poorly monitored. The problems are mainly due to contamination of raw water sources and inadequate infrastructures.

Detailed comparisons of water quality across European countries are not possible due to inadequate monitoring in many parts and the lack of reports on water quality, as well as the absence of a unified system of reporting. It is clear, however, that the most frequently encountered drinking water quality problems include microbiological contamination, iron and manganese, and nitrate and pesticide concentrations above standards. Other areas of concern include nitrite, ammonia, aluminium, lead (from lead pipes), disinfection by-products (THMs), naturally occurring high levels of arsenic and fluoride, industrial contaminants including heavy metals, and *Cryptosporidium*.

The main reasons for inadequate drinking water quality are: contamination of water sources from agricultural and industrial activities and domestic effluents, inadequate source protection, inappropriate water treatment and distribution systems, including lead pipes.

The organisation of water supply and monitoring of water quality is on the whole fragmented with responsibilities often resting at local level and frequently without clear distinction between responsibilities for supply and compliance monitoring. This can lead to costly duplication of effort (routine monitoring and compliance monitoring) or inadequate monitoring and supervision. Where supplies are monitored, it is sometimes incomplete, focusing on basic water quality parameters (microbiological, organoleptic, pH, major ions), whilst there are inadequate resources for monitoring the parameters requiring sophisticated and expensive methods of analysis. Moreover, large numbers of private (individual household) and small community supplies are insufficiently monitored due to the high costs of monitoring such supplies.

Most CEE countries are gradually aligning their legislation with EU Directives and attempting to prioritise and implement improvement measures where supplies are inadequate (some include the possibility of court action against suppliers). However, there are often shortages of financial resources, a lack of trained personnel and inadequate institutional mechanisms for the supervision of drinking water quality and enforcement of legislation. Whilst it is important that these countries are given the opportunity to learn from experiences in the EU, it is equally important that priorities are clearly defined, i.e. focusing primarily on the provision of adequate, uninterrupted supplies and

microbiological safety, in view of the limited resources available to make the necessary improvements.

Although, for example, the system of compliance monitoring and enforcement in England & Wales has proved effective in raising compliance with drinking water quality standards, the EU Commission has recently challenged the legality (and started court action) in respect of the approach taken by the DWI in cases where water companies breach standards without compromising public health. The approach involves the use of legally binding 'Undertakings', i.e. improvement programmes agreed between DWI and water companies, with clear targets and time limits for achieving these. It may be interesting to note that many EU Member States take similar, though less formalised and certainly less open, approaches to enforcement or they have, in the past, issued legislation permitting temporary exceedence of standards (e.g. France, Italy); the latter clearly in contravention of the 1980 EU Drinking Water Directive 80/778/EEC. A very similar approach to DWI's enforcement practice is taken in the Netherlands where, with the exception of one private operator, water services are directly under public control; compliance controls are also carried out through self-monitoring, and the approach to enforcement action taken by Public Health Inspectors is on a much more informal basis, but equally successful in achieving improved compliance. Ironically, a similar approach, to that currently practised in England & Wales and in the Netherlands, appears to be sanctioned by the recently adopted, revised EU Drinking Water Directive 98/83/EC.

The system in France is not without its problems. France is also facing EU court action, in this case over non-compliance with the nitrate standard. In addition, French consumers have successfully fought court actions and have been awarded compensation payments from water suppliers for breaches of water quality standards. Moreover, France's own public audit office, the Court de Comptes, in a report in 1997 on French water service management, has criticised municipalities, utility companies and the relevant state agencies of a lack of transparency, insufficient competition between private operators, inadequate information for consumers, and a lack of monitoring of delegated public services.

However, when considering compliance with drinking water quality standards, it must be borne in mind that, unlike the WHO Guideline values, some parameters of the Directive are not based on health considerations, notably the limits for pesticides ($0.1 \mu\text{g l}^{-1}$ for individual pesticides, and $0.5 \mu\text{g l}^{-1}$ for total pesticides) which are frequently the subject of exceedence and debate in EU countries. Although most pesticides are highly unlikely to pose a risk to consumers if found in drinking water at considerably higher concentrations, their enforcement has exerted significant pressure on implementation of environmental measures, such as stricter controls on pesticide application and designation of water protection zones. Whilst this approach has undoubtedly led to environmental improvements in the EU region, considerable expense is associated with these measures. In addition, expensive treatment technology frequently has to be employed to remove traces of pesticides from drinking water at great expense to consumers, whilst conferring dubious benefits in terms of health effects. The fairness of this approach in terms of violation of the 'polluter pays' principle has often been criticised.

Such debate is particularly pertinent in countries (e.g. many Eastern European countries) where continuity of supply and microbiological quality are the prime concerns. Considerable care should be exercised in prioritising improvement measures, primarily to secure continuous, safe supplies whilst, in the short term, avoiding undue emphasis and pressure on compliance with chemical parameters which have little health significance.

Dealing with pollution of water sources may in time be affected by the new European Water Framework Directive, but in the short-term, costly treatment options and investment in distribution facilities, as well as putting in place effective controls, are widely needed to provide a safe and uninterrupted drinking water supply across pan-Europe.

This results in pressures to attract investment through privatisation, which in turn re-enforces the need for effective controls to adequately supervise such private operators, i.e. strong legislation and institutional mechanisms backed by staff training and adequate resources to allow effective enforcement of compliance. At the same time, overuse of legislation and resorting to prosecution of water suppliers for breaches of standards can be very costly, ultimately having to be paid for by the consumer, whilst it is likely to provide little or no benefits in terms of public health.

8. CONCLUSIONS

Although this survey of pan-European countries is limited to just over half of the 53 countries targeted with the questionnaire, that is 29 countries which returned the questionnaire, and the replies were to some extent limited due to the necessarily simple questions asked in the questionnaire, a number of conclusions can be drawn, as follows:

- Water services are organised in a wide variety of ways across pan-Europe; they are mostly fragmented, with responsibilities divided among different levels of administration, but with the focus on local provision of water supply.
- Whilst the ultimate responsibility for supervision of water quality lies at national, ministerial level in most countries, much of the responsibility of direct supervision is delegated to lower levels of administration (regional, local/municipal) and there is often no clear distinction between provision of supply and supervision of compliance with legal requirements.
- The EU Drinking Water Directive (80/778/EEC, recently replaced by 98/83/EC) provides the framework for drinking water standards and monitoring requirements in EU Member States; other Western European States have similar requirements in place and most CEE countries are gradually aligning their drinking water legislation with EU requirements, although enforcement of compliance with national legislation is often poor.
- Routine and compliance monitoring are carried out in a variety of ways with responsibilities often shared between water suppliers and local, regional or national authorities, sometimes leading to duplication of effort. Self-monitoring, as practised in England & Wales, Scotland and increasingly in the Netherlands, is rare. More typically, compliance monitoring is carried out by government health laboratories or other government appointed laboratories, whilst water suppliers carry out routine operational monitoring.
- Monitoring of drinking water quality is inadequate in many countries; some EU and other Western European countries refer to inadequate monitoring, particularly of small supplies, due to the high cost of analyses; whilst many CEE countries report considerable difficulties due to insufficient resources, technical and organisational problems, and lack of suitably trained personnel (population receiving water which is regularly monitored ranging from 15-84%). Moreover, monitoring is often restricted to a limited number of basic parameters.
- The publication of reports on drinking water quality is often lacking or inadequate, containing brief summaries only. Even where data are reported, detailed comparisons of water quality cannot be made due to the differences in data presentation (e.g. results in terms of number of samples analysed or percentage exceeding standards, individual parameters or all parameters measured, population supplied, volume of water supplied, etc.).

- Many countries in Europe, particularly in the EU and other Western countries, have high quality drinking water supplies, although relatively minor problems of non-compliance with standards still have to be solved.
- Large numbers of people, mainly in Eastern Europe, do not have access to safe drinking water (low connection rates, discontinuous supply, microbiological contamination).
- In rural areas across Europe (East and West) there are many private supplies (individual households) and small community supplies which receive little or no treatment or monitoring of water quality.
- Detailed comparisons of water quality across Europe cannot be made because of inadequate monitoring and reporting of results; therefore, many potential problems may still be undetected, particularly in CEE countries.
- However, it is clear that the most frequently reported water quality problems include microbiological contamination, nitrate, iron and/or manganese, and pesticides. Other areas of concern include nitrite, ammonia, aluminium, lead (from lead pipes), naturally occurring high levels of arsenic and fluoride, industrial contaminants including heavy metals, disinfection by-products (THMs), and *Cryptosporidium*.
- The main reasons for inadequate supplies (quantity and quality) are lack of financial resources, organisational problems, lack of suitably trained personnel, contamination of raw water sources, inadequate water treatment and poor state of the distribution system.
- Where non-compliance with standards is encountered, the emphasis is, on the whole, on setting priorities and implementing improvement measures, rather than prosecution of water suppliers, although the latter is an option in several countries.
- Whilst non-continuous supply and microbiological problems clearly pose a potential health risk to the public and must be addressed immediately, other problems (most chemical parameters) do not pose an immediate risk and can be solved in the long term.

9. RECOMMENDATIONS

- Whilst giving priority to monitoring the microbiological quality of drinking water, comprehensive monitoring programmes, in line with EU or appropriate national requirements, should be set up where not already in operation. This will best be accomplished by starting with the relatively simple analyses (e.g. ‘indicator parameters’ as set out in Annex I, Part C, or ‘check monitoring as set out in Annex II of the EU Directive 98/83/EC) before moving on to more complex analyses (e.g. ‘chemical parameters’ as set out in Annex I, Part C of the EU Directive 98/83/EC).
- Many countries (mainly CEE) will need to organise appropriate staff training programmes and set up suitably equipped laboratories before the task of comprehensive water quality monitoring can be adequately performed.
- Self-monitoring by water suppliers combined with a sound mechanism for compliance supervision, or other forms of rationalisation of routine and compliance monitoring, should be considered to avoid costly duplication of monitoring.
- Systems for collecting the data and publishing comprehensive reports on water quality should be established in all countries, preferably a unified system across Europe which would allow comparisons within countries and across countries.
- Significant improvements in the infrastructure have to be made in many parts of Europe, mainly in CEE countries, to provide an uninterrupted, safe supply of drinking water to the entire population; priorities will need to be clearly established in order to address this as a matter of urgency.
- In the long term, protection of raw water supplies is an important task to be put in place or maintained, as appropriate, particularly to safeguard the many small rural supplies which receive little or no treatment or monitoring of water quality.

BIBLIOGRAPHY

Andrews, K., Rickard, L. and Dubourg, R. (1999) Prevention and Control of Water Related Disease in Europe - Economic Assessment, WRc/WHO/UKWIR Report, UK Water Industry Ltd, London

BUWAL (1993) Bundesamt für Umwelt, Wald und Landschaft (Ministry of Environment, Forests and Landscape) Situation der Trinkwasserversorgung (The situation regarding public water supply), Schriftenreihe Umwelt No. 212 - Wasserversorgung, Bern, Switzerland (in German).

CEU (1998) Council of the European Union, Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption, *Official Journal*, **L330/32**, 5 December 1998.

CEC (1980) Council of the European Communities, Council Directive 80/778/EEC relating to the quality of water intended for human consumption, *Official Journal*, **L229**, 30 August 1980.

DETR (1998) Cryptosporidium in Water Supplies; Third Report of the Group of Experts (Chairman: Prof. Ian Bouchier CBE) to: Department of the Environment, Transport and the Regions & Department of Health, London.

DWI (1998) Drinking Water Inspectorate, Department of the Environment Transport and the Regions and Welsh Office, Drinking Water 1997, A report by the Chief Inspector, The Stationery Office, London.

EPA (1996) Ireland's Drinking Water - a summary report on its quality in the period: 1993-1995, Environmental Protection Agency, Arcavan, Wexford, Ireland.

Financial Times Newsletters - Global Water Reports, various issues, 1996-1998.

Godet, J.L., Marchand, D., and Tricard, D. (1995) Qualité des Eaux d'Alimentation 1993-1994-1995 (Quality of drinking water 1993-1994-1995), Ministère de l'Emploi et de la Solidarité - Direction Générale de la Santé (Ministry of Employment and Social Affairs - Directorate General for Health), Paris, France (in French).

Harris, R. (editor) Who's Who in European Water 1994/5, Sterling Publications Ltd., London.

Šamánek, J., and Havlík, B. (1994) Czech Drinking Water Quality Report, Project II: 1993, Report No. 369/91, Institute of Public Health (SZU), Prague (in Czech).

Knezevic, T. (no date) Water and Sanitation in Yugoslavia, Federal Institute of Public Health, Environment and Health Department, Belgrade.

Licskó I., and Horth H. (1995) Drinking Water Quality Network (DRINKNET) Workshop on National and International Drinking Water Standards, Budapest 30/31 January, 1995, Proceedings, WRc Medmenham, Marlow, Buckinghamshire, SL7 2HD.

Questionnaires (WHO/EEA/WRc) returned from 28 pan-European countries (information summarised in Appendices A and B).

Région Wallonne (1995) Royaume de Belgique, Ministère de la Région Wallonne (Ministry for the Walloon Region), Service du Contrôle de l'Eau, Eaux distribuées par réseaux en région wallonne en 1995 (Public water supplies in the Walloon region in 1995), Rapport à l'Union Européenne, Belgium (in French).

The Scottish Office (1998) Drinking Water Quality in Scotland 1997, Water Services Unit, Agriculture, Environment and Fisheries Department, The Stationery Office Bookshop, Edinburgh.

Versteegh, J.F.M., van Gaalen, F.W., and Peen, F. (1997) De kwaliteit van het drinkwater in Nederland in 1995 (The quality of drinking water in the Netherlands in 1995), Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (VROM - Ministry of Environment), Handhaving Milieuwetten 1997/114, The Netherlands (in Dutch).

WHO (1999) Draft Protocol on Water and Health to the 1992 Convention and Use of Transboundary Watercourses and International Lakes, United Nations Economic and Social Council, Economic Commission for Europe and World Health Organization's Regional Office for Europe.

WHO (1993) Guidelines for Drinking Water Quality, Second Edition, Volume 1 - Recommendations, World Health Organisation, Geneva.

WHO (1984) Guidelines for Drinking Water Quality, World Health Organisation, Geneva.

APPENDIX A

**TABLE SUMMARISING INFORMATION FOR
29 COUNTRIES WHICH RETURNED THE
QUESTIONNAIRE**

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
EUROPEAN UNION						
1.	Austria	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Federal, ministerial level. 2. Compliance supervision: municipal/local authorities through officially appointed private, State or Federal laboratories. 3. Operational management: local authorities (some delegated to private water companies, or regional associations or co-operatives). 4. Routine monitoring: public and private suppliers. 	<ul style="list-style-type: none"> • Monitoring criteria: EU and national standards. • National standards: i.e. Aldrin, Dieldrin, hexachlorobenzene. • Measures for non-compliance: discontinue supply (if necessary on public health grounds), additional treatment, and/or water protection measures. 	Continuous supply, no problems	Some non-compliance problems: <ul style="list-style-type: none"> • nitrate, • atrazine, • desethylatrazine. Reasons: agricultural activities.	No reports (but first report in preparation). Data available for inspection.
2.	Belgium (Flanders and Walloon)	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Regional Ministry, local authorities and public water companies. 2. Compliance supervision: Regional Ministry. 3. Operational management: as 1. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: EU and regional standards. • Measures for non-compliance: improvements in drinking water quality and/or allocation of public funds to protect water sources. • Small water companies: less monitoring frequency due to organisational and financial considerations, shortage of human resources. 	Continuous supply. In Flanders 95% of population are connected to public supply (remote households not connected due to technical and financial constraints).	Non – compliance: <ul style="list-style-type: none"> • Microbiological, • pH, • iron, manganese, • sodium, potassium, • nitrate, • pesticides (triazines, urons), • aluminium, • THMs. Reasons: agricultural activities, geology, inappropriate treatment and financial constraints.	Regional level (Walloon only). Information provided by municipalities and/or data available to public for inspection.

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
3.	Finland	<ol style="list-style-type: none"> 1. Legal responsibility for supply: municipalities/local authorities. 2. Compliance supervision: as 1. 3. Operational management: as 1. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: WHO Guidelines, EU and national standards. • Measures for non-compliance: improvement measures and/or prosecution of suppliers. 	<p>No problem with continuous supply:</p> <ul style="list-style-type: none"> • 87% population supplied by public water supply systems. • rural areas supplied by private wells. 	<p>Some non - compliance problems:</p> <ul style="list-style-type: none"> • fluoride, • iron, • manganese, • microbiological parameters. <p>Reasons: geological reasons and problems in distribution systems.</p>	<p>National level and water treatment plants.</p> <p>Data available to public.</p>
4.	France	<ol style="list-style-type: none"> 1. Legal responsibility for supply: municipal/local authorities (Mayor). 2. Compliance supervision: Ministry, Departmental Prefect of the Departmental Health Directorates. 3. Operational management: private water companies, municipal councils and syndicates. 4. Routine monitoring: as 3. 	<ul style="list-style-type: none"> • Monitoring criteria: EU/national standards. • Major problem monitoring small supplies due to financial considerations. • Measures for non-compliance: improvement measures, allocation of public funds to construct installations and/or give information to the public. 	<ul style="list-style-type: none"> • Continuous supply. • 60% of population supplied by private water companies. 	<p>Non – compliance:</p> <ul style="list-style-type: none"> • microbiological, • nitrate, • pesticides (atrazine, simazine), • turbidity, • iron, • aluminium, • lead. <p>Reasons: agricultural activities, no protection areas, chlorination or other treatment failures, lead pipes.</p>	<p>National and regional level .</p> <p>Data available to public.</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
5.	Germany	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Municipal, town or district authorities. 2. Compliance supervision: Federal Ministry of Health, individual State health departments and district or local authorities (local Health Officer). 3. Operational management: local/municipal or district authorities, municipal or private water companies. 4. Routine monitoring: as 3. 	<ul style="list-style-type: none"> • Monitoring criteria: EU and national standards. • Measures for non-compliance: improvement measures (treatment, alternative source, raw water protection) and/or prosecution of suppliers. 	Continuous supply, no major problems.	<p>Non - compliance problems:</p> <ul style="list-style-type: none"> • coliforms, • nitrate, • atrazine. <p>Reasons: agricultural activities. Some additional problems for geological reasons.</p>	<p>Federal, State and district or local level.</p> <p>Some data available to the public (mainly summaries of routine monitoring provided by suppliers).</p>
6.	Greece	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry, municipalities. 2. Compliance supervision: Ministry. 3. Operational management: public or municipal corporations, municipalities. 4. Routine monitoring: as 3. 	<ul style="list-style-type: none"> • Monitoring criteria: EU standards. • Monitoring inadequate due to insufficient laboratories (technical, financial, human resource problems). • Measures for non-compliance: drinking water quality improvements, prosecution of suppliers and/or allocation of public funds to construct installations. 	Continuous supply.	<p>Major non - compliance problem:</p> <ul style="list-style-type: none"> • Microbiological (total coliforms, faecal coliforms). <p>Reasons: non-continuous chlorination.</p>	<p>National level.</p> <p>Data available to public through inspection.</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
7.	Sweden	<ul style="list-style-type: none"> • Legal responsibility for supply: Ministerial Departments (legislation), local authorities (supply). • Compliance supervision: local authorities (public and private supplies). • Operational management: local authorities and some regional associations. • Routine monitoring: local authorities (public supplies). 	<ul style="list-style-type: none"> • Monitoring criteria: EU and national standards. • Some monitoring considered inadequate (pesticides, arsenic) • Measures for non-compliance: improvements in drinking water quality. 	Continuous supply.	<p>Non - compliance:</p> <ul style="list-style-type: none"> • iron, • manganese, • fluoride, • radon, • arsenic. <p>Reasons: geological conditions, poor protection of raw waters, eutrophication, and inadequate treatment.</p>	<p>National level (general overviews only).</p> <p>Data available to public for inspection.</p>
8.	The Netherlands	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry of Housing, Physical planning and Environment. 2. Compliance supervision: Environmental Inspectorate (Regional Public Health Inspector) 3. Operational management: Water Companies (publicly owned, non-profit making). 4. Routine monitoring: as 3. 	<ul style="list-style-type: none"> • Monitoring criteria: EU and national standards. • All public supplies monitored. • Measures for non-compliance: improvement measures/programmes. 	Continuous supply; most of the population connected to public supply.	<p>No significant water quality problems, some minor non-compliance problems:</p> <ul style="list-style-type: none"> • iron, • manganese, • pesticides, • nitrate (below EU limit). <p>Reasons:</p> <ul style="list-style-type: none"> • Geological, • Agricultural activities. 	Water quality report produced annually, available free to public. Water companies produce annual reports, but variable content of water quality data.

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
9a.	UK - England & Wales	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry (legislation/regulation), private water companies (public supply), Local Authorities (private supplies). 2. Compliance supervision: Ministry - Drinking Water Inspectorate (Local Authorities: private supplies). 3. Operational management: private water companies (public supplies), Local Authorities (private supplies). 4. Routine monitoring: as 3. 	<ul style="list-style-type: none"> • Monitoring criteria: EU and national standards. • All public and private supplies monitored. • Measures for non-compliance: drinking water quality improvements. 	<p>Continuous supply (minor problems in some areas during dry, hot summers may require some restrictions, e.g. hose pipe bans).</p>	<p>Minor non – compliance problems:</p> <ul style="list-style-type: none"> • lead, • iron, • nitrate, • pesticides (atrazine, simazine), • PAH. <p>Reasons: agricultural activities, sewage effluent, conditions of the distribution system.</p>	<p>National level and private water companies.</p> <p>Data available to public.</p>
9b.	UK - Northern Ireland	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry, Water Services Department. 2. Compliance supervision: Ministry - Drinking Water Inspectorate. 3. Operational management: as 1. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: EU and national standards. • All public and private supplies monitored. • Measures for non-compliance: drinking water quality improvements, allocation of public funds to improve treatment and distribution systems. 	<p>Continuous supply (minor, local problems, short-term, affecting less than 0.3% of population).</p> <p>98% of population connected to public supply.</p>	<p>Minor non – compliance problems:</p> <ul style="list-style-type: none"> • THMs, • iron, • aluminium, • lead, • pesticides, • microbiological. <p>Reasons: agricultural activities, geological conditions, corrosion of the distribution system, treatment, lead pipes.</p>	<p>National level.</p> <p>Data available to public.</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
9c.	UK - Scotland	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Scottish Ministers (Minister for Transport and the Environment). 2. Compliance supervision: Scottish Executive (Water Services Unit). 3. Operational management: Water Authorities (public bodies). 4. Routine monitoring: as 3. 	<ul style="list-style-type: none"> • Monitoring criteria: EU and national standards. • All public and private supplies monitored. • Measures for non-compliance: improvement programmes. 	Continuous supply; 98% of population connected to public supply, rest private supplies.	<p>No serious water quality problems, but major non-compliance problem:</p> <ul style="list-style-type: none"> • THMs <p>Reason: high organic content of raw waters.</p> <p>Other non-compliance problems:</p> <ul style="list-style-type: none"> • microbiology, • iron, • colour, • aluminium, • manganese, • lead. 	Water quality data reported at national and local level; available to public (national report for sale, local free).
OTHER WESTERN EUROPEAN COUNTRIES						
10.	Andorra	<ol style="list-style-type: none"> 1. Responsibility for water supply: local authorities and one private water company. 2. Compliance supervision: Ministry of Public Health and Welfare. 3. Operational management: as 1. 4. Routine monitoring: Ministry, local authorities, and private water company. 	<ul style="list-style-type: none"> • Monitoring criteria: limited set of standards based on EU standards. • Monitoring programmes inadequate due to shortage of human resources. • 73% of population served by water treatment works where routine monitoring is carried out. • Measures for non-compliance: improvements in drinking water quality. 	Continuous supply.	<p>Non - compliance:</p> <ul style="list-style-type: none"> • microbiological parameters. <p>Reasons: agricultural activities, absence of catchment protection, inadequate treatment technology.</p>	<p>Local reports.</p> <p>Data not available to public.</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
11.	Iceland	<ol style="list-style-type: none"> 1. Legal responsibility for supply: municipal/local authorities. 2. Supervision: none. 3. Management: as 1. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: national standards based on WHO Guidelines and EU standards. • Focus on microbiological parameters, chemical parameters limited. • Measures for non-compliance: improvements of drinking water quality. 	No major problems; 94% of population supplied with groundwater; occasional minor regional problems.	<p>No problems of nitrate or pesticide contamination.</p> <p>Non - compliance:</p> <ul style="list-style-type: none"> • total coliforms/faecal coliforms, • viable counts 22 °C. <p>Reasons: Contamination of shallow groundwater from run-off, inadequate protection measures.</p>	<p>National and local level.</p> <p>Reports/data available to public.</p>
12.	Liechtenstein	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry, municipal/local authorities and private co-operatives. 2. Compliance supervision: Ministry/Department for Food Control. 3. Operational management: municipal/local authorities and private co-operatives. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: (Swiss) national standards. • effective monitoring (decentralised) of all supplies. • Measures for non-compliance: improvements of drinking water quality (treatment). 	Continuous supply.	No compliance problems - some microbiological contamination of water sources in alpine settlements due to cattle/geological conditions, solved with filtration or UV treatment.	<p>Regional and local level (summary reports)</p> <p>Reports available to public, detailed data on request.</p>
13.	Malta	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry. 2. Compliance supervision: Health Ministry. 3. Operational management: Water Service Corporation (WSC). 4. Routine monitoring: Health Ministry and the Institute of Water Technology at the WSC. 	<ul style="list-style-type: none"> • Monitoring criteria: limited set of parameters based on WHO Guidelines and EU requirements. • Inadequate monitoring for technical reasons and lack of human resources. • Measures for non-compliance: improvements of drinking water quality. 	Supply not continuous in urban areas (power failure, distribution repair works) and new buildings not connected.	<p>Non - compliance:</p> <ul style="list-style-type: none"> • microbiological, • chloride, • fluoride, • hardness, • nitrate. <p>Reasons: agricultural activities and geological conditions, inadequate treatment.</p>	<p>Department level.</p> <p>Data not available to public.</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
14.	Monaco	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry and private water companies. 2. Compliance supervision: none. 3. Operational management: private water companies. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: WHO Guidelines, EU and national standards. • 100% of population served by 2 water treatment works where routine monitoring is carried out. • Measures for non-compliance: na. 	Continuous supply. Two treatment works supplying 100% of population.	No non - compliance.	No reports. Data not available to public.
15.	Norway	<ol style="list-style-type: none"> 1. Legal responsibility for supply: municipalities and private water suppliers (small supplies). 2. Compliance supervision: local health authorities. 3. Operational management: as 1. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: WHO Guidelines, EU and national standards. • Monitoring at many small water works inadequate, not complying with new regulations. • Measures for non-compliance: drinking water quality improvements and/or allocation of public funds to construct installations. 	Continuous supply.	Non - compliance: <ul style="list-style-type: none"> • total coliforms, • faecal coliforms, • colour, • disinfection by-products, • pH. Reasons: land use, geological/biological conditions. Many small private water works have inadequate treatment (disinfection, colour removal).	Regional level. Data available to public for inspection.

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
16.	Switzerland	<ol style="list-style-type: none"> 1. Legal responsibility for supply: communities (Cantonal Health Administrations or Cantonal Laboratories). 2. Compliance supervision: none. 3. Operational management: communities or groups of communities, enterprises, co-operatives, associations. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: national standards (dual set of target values and health based MACs). • Regular monitoring (100% of supplies/population). • Measures for non compliance: improvement measures (source protection, restriction of agricultural practices, and closure of supplies or mixing waters) or prosecution of suppliers. 	Continuous supply.	<p>No major problems, minor non-compliance problems:</p> <ul style="list-style-type: none"> • microbiological, • nitrate, • chloride, • pesticides (atrazine), • volatile hydrocarbons, • occasionally EDTA. <p>Reasons: agricultural and industrial contamination of source waters.</p>	<p>Regional level (Cantons).</p> <p>Data available to public for inspection.</p>
CENTRAL AND EASTERN EUROPEAN COUNTRIES						
17.	Albania	<ol style="list-style-type: none"> 1. Legal responsibility for supply: shared between State Ministry/ government departments and local/municipal authorities. 2. Compliance supervision: Ministry through district laboratories and local authorities (public supplies). 3. Operational Management: local/municipal authorities. 4. Routine monitoring: as 1, and The Regulatory Agency for Water Supply and Removal of Waste Water, and private users (private supplies). 	<ul style="list-style-type: none"> • Monitoring criteria: WHO Guidelines and EU standards; in practice only basic set of parameters (mainly faecal coliform and taste and odour). • Inadequate drinking water quality monitoring. • Measures for non-compliance: prioritising improvements and allocation of public funds to construct treatment facilities. 	Non-continuous supply during the whole year, affecting 100% of population (interruptions 1-3 times per day, or 1-3 hours per day, in general more frequent in rural areas).	<p>Non compliance:</p> <ul style="list-style-type: none"> • <i>E. Coli</i> • Nitrate <p>Reasons: water interruptions, old/corroded distribution systems, inadequate chlorination equipment (manual dosing), raw water pollution.</p>	<p>National and regional level.</p> <p>Data available to public for inspection.</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
18.	Croatia	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry or other government department. 2. Compliance supervision: as 1. 3. Operational management: as 1. 4. Routine monitoring: Ministry and municipal/local authorities. 	<ul style="list-style-type: none"> • Monitoring criteria: WHO Guidelines, EU and national standards. • Monitoring covers supplies of 70% of population. • Measures for non-compliance: improvements, prosecution of suppliers and/or allocation of public funds to construct installations. 	<p>Non-continuous supply. 70% of population connected to public water supply (connection rate lower in rural areas). Reason: insufficient financial resources.</p>	<p>Major non – compliance problems:</p> <ul style="list-style-type: none"> • microbiological (total and faecal coliforms, faecal streptococci), • nitrate, • nitrite, • ammonium, • iron. <p>Reasons: agricultural activities, geological conditions, industrial and domestic discharges, inadequate treatment.</p>	<p>National level.</p> <p>Data available to public.</p>
19.	Czech Republic	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry and municipal/local authorities. 2. Compliance supervision: local authorities (State Public Health Service) (public supplies only). 3. Operational management: municipalities and private water companies. 4. Routine monitoring: as 3. 	<ul style="list-style-type: none"> • Monitoring criteria: national standards (including WHO GVs). • Monitoring of all public supplies (85% population) - some difficulties for financial reasons. • Measures for non-compliance: improvements and/or allocation of public funds to construct installations. 	<p>Continuous supply.</p>	<p>Non - compliance:</p> <ul style="list-style-type: none"> • total coliforms, • chloroform, • dichlorobenzene, • nitrate. <p>Other issues of concern:</p> <ul style="list-style-type: none"> • beryllium, • <i>Cryptosporidia</i>. <p>Reasons: agricultural activities, industrial and municipal discharges, inappropriate treatment technology, financial.</p>	<p>National level.</p> <p>Data available to public.</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
20.	Estonia	<ol style="list-style-type: none"> 1. Legal responsibility for supply: municipal/local authorities and private water companies. 2. Compliance supervision: Ministry of Social Affairs (National Board for Health Protection) and municipal/local authorities. 3. Operational management: as 1. 4. Routine monitoring: shared between Ministry of Social Affairs (National Board for Health Protection), local authorities, private water companies. 	<ul style="list-style-type: none"> • Monitoring criteria: national standards. • Inadequate monitoring due to lack of financial resources. • Measures for non-compliance: drinking water quality improvements, prosecution of suppliers and/or allocation of public funds to construct installations. 	Continuous supply.	<p>Non -compliance:</p> <ul style="list-style-type: none"> • microbiological, • iron, • manganese, • sulphate, • H₂S, • nitrate, • nitrite, • halogens (chloride, fluoride, iodine) • heavy metals, • organoleptic. <p>Reasons: agricultural activities, geological conditions, inadequate treatment, lack of finance.</p>	<p>National and regional level.</p> <p>Data available to public.</p>
21.	Hungary	<ol style="list-style-type: none"> 1. Legal responsibility for supply: municipalities/local authorities. 2. Compliance supervision: Public Health Service. 3. Operational management: local authorities and private companies. 4. Routine monitoring: water companies. 	<ul style="list-style-type: none"> • Monitoring criteria: national standards. • Problems of inadequate routine monitoring (covering only 15% of population) and limited compliance monitoring. • Measures for non-compliance: improvements of drinking water quality, prioritisation of problems in the National Environmental Health Action Programme. 	Continuous supply.	<p>Non compliance:</p> <ul style="list-style-type: none"> • microbiological, • iron, manganese, • sodium, • calcium (too low), • arsenic, • nitrate, nitrite, • organic micropollutants. <p>Reasons: geological conditions, inadequate source protection, pollution of surface water, inadequate treatment, aftergrowth in distribution system.</p>	<p>National level.</p> <p>Data not available to public.</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
22.	Latvia	<ol style="list-style-type: none"> 1. Legal responsibility for supply: municipal/local authorities. 2. Compliance monitoring: Ministry, local authorities and private water companies. 3. Operational management: as 1. 4. Routine monitoring: as 2. 	<ul style="list-style-type: none"> • Monitoring criteria: WHO Guidelines and national (GOST 2874-82 Drinking Water Standard). • Routine monitoring of all public supplies. • Measures for non-compliance: prioritisation of improvements and/or allocation of public funds to construct installations. 	<p>Non-continuous supply.</p> <p>Reason: interruptions in electricity supply, poor availability of equipment.</p>	<p>Major problems with microbiological quality; Non - compliance:</p> <ul style="list-style-type: none"> • total coliforms. <p>Reasons: interrupted supply, inadequate treatment, poor state of distribution system.</p>	<p>National and regional level.</p> <p>Data available to public.</p>
23.	Lithuania	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry, local authorities. 2. Compliance supervision: as 1. 3. Operational management: local authorities through municipal water companies. 4. Routine monitoring: water companies. 	<ul style="list-style-type: none"> • Monitoring criteria: national standards. • Monitoring difficulties for technical, financial and organisational reasons, (covers 70% of population). • Measures for non-compliance: improvements in drinking water quality and/or prosecution of suppliers. 	<p>Continuous supply.</p>	<p>Non - compliance:</p> <ul style="list-style-type: none"> • microbiological parameters, • nitrate, • iron, • total hardness. <p>Reasons: agricultural activities, geological reasons, and poor treatment equipment and old/corroded distribution system.</p> <p>Also: lead pipes.</p>	<p>National level.</p> <p>Data available to public for inspection..</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
24.	Moldova	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry and local authorities. 2. Compliance supervision: Ministry and other government department. 3. Operational management: as 1. 4. Routine monitoring: as 2. 	<ul style="list-style-type: none"> • Monitoring criteria: former USSR standards. • Inadequate monitoring for technical, organisational, financial reasons, and lack of human resources. • Measures for non-compliance: preparing information for government and local authorities and prioritising improvements. 	<p>Discontinuous supply affecting 75% population, very frequent in small cities, towns and villages and rural areas.</p> <p>Reasons: lack of water, discontinuous electricity, lack of equipment and financial resources.</p>	<p>Non-compliance:</p> <ul style="list-style-type: none"> • nitrate (groundwater) • fluoride (groundwater) • ammonium, • chloride, • sulphate, • iron, • strontium, • organoleptic properties, • H₂S, • turbidity. <p>Reasons: geological conditions and human activities, inadequate water treatment.</p>	<p>No reports produced.</p> <p>Data available to public for inspection.</p>
25.	Romania	<ol style="list-style-type: none"> 1. Legal responsibility for supply: municipal/local authorities. 2. Compliance supervision: Ministry of Health. 3. Operational management: as 1 through autonomous companies. 4. Routine monitoring: water companies. 	<ul style="list-style-type: none"> • Monitoring criteria: national standards (being adjusted to EU requirements). • Inadequate monitoring due to lack of resources. • Measures for non-compliance: prioritising improvement measures, prosecution of suppliers and/or allocation of public funds to construct installations. 	<p>Non-continuous supply</p> <p>Reasons: inadequate sanitation facilities, deficiencies in network system, low storage capacity and financial considerations.</p>	<p>Major raw water pollution and drinking water non-compliance problems:</p> <ul style="list-style-type: none"> • microbiological, • pesticides (organo-chlorine, herbicides), • organic substances, • heavy metals, • ammonia, • free residual chlorine. <p>Reasons: agricultural activities, industrial and domestic discharges, inadequate treatment facilities.</p>	<p>National and regional reports</p> <p>Data available for the public.</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
26.	Serbia (Former Republic of Yugoslavia)	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry. 2. Compliance supervision: as 1. 3. Operational management: as 1. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: EU and national standards. • Monitoring inadequate (covering 35% of population). • Measures for non-compliance: improvements, prosecution of suppliers and/or allocation of public funds to construct installations. 	<p>Non-continuous supply in some areas.</p> <p>Frequent supply interruptions, mainly seasonal, and most frequent in urban areas.</p> <p>Reasons: water shortage, lack of equipment and finance.</p>	<p>Non - compliance:</p> <ul style="list-style-type: none"> • microbiological parameters (total and faecal coliforms), • no chlorine residual, • physico-chemical parameters incl. nitrate, nitrite. <p>Reasons: agricultural activities, industrial discharges, inadequate treatment.</p>	<p>National and regional level.</p> <p>Data available to public.</p>
27.	Slovakia	<ol style="list-style-type: none"> 1. Legal: Ministry of Soil Management (Department of Water Management). 2. Compliance supervision: Hygienic Service. 3. Operational management: state owned water works. 4. Routine monitoring: water works and Hygienic Service. 	<ul style="list-style-type: none"> • Monitoring criteria: national standards (Slovak Standard). • Inadequate monitoring of parameters requiring specialist analyses (heavy metals, organic pollutants). • Measures for non-compliance: improvements of drinking water quality. 	<p>Supply not continuous.</p>	<p>Non - compliance:</p> <ul style="list-style-type: none"> • microbiological (total and faecal coliforms, faecal streptococci, live organisms) • nitrate, • ammonia, • manganese, • iron. <p>Reasons: source water contamination, inadequate treatment technologies, poor quality distribution system.</p>	<p>National level.</p> <p>Data available to public for inspection, (also research reports and publications).</p>

Country		Institutional responsibilities	Monitoring	Drinking water supply	Drinking water quality/problems	Reports
28.	Slovenia	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Municipality/local authorities. 2. Compliance supervision: none. 3. Operational management: as 1. 4. Routine monitoring: as 1. 	<ul style="list-style-type: none"> • Monitoring criteria: national standards based on revised (draft) EU Directive. • Little or no monitoring at small works supplying 16% of population. • Measures for non-compliance aimed at improvement in drinking water quality. 	Supply interruptions affecting 120 000 people, mainly during summer periods, and more frequent in rural areas.	Non - compliance: <ul style="list-style-type: none"> • nitrate, • pesticides (atrazine and other triazines), • microbiological. Reasons: agricultural activities, industrial discharges.	No reports Data available to public through inspection.
29.	Turkey	<ol style="list-style-type: none"> 1. Legal responsibility for supply: Ministry, local authorities and private water companies. 2. Compliance supervision: Ministry. 3. Operational management: as 1. 4. Routine monitoring: National government departments and local authorities. 	<ul style="list-style-type: none"> • Monitoring criteria: WHO Guidelines, EU and national standards. • Measures for non-compliance: drinking water quality improvement measures, and/or prosecution of suppliers, withdrawal of licence to supply and closure of water sources. 	Supply not continuous.	Non compliance: <ul style="list-style-type: none"> • microbiological parameters (total and faecal coliforms, aerobic mesophilic bacteria), • nitrate, nitrite, • organic substances. Reasons: agricultural activities, industrial discharges and geological reasons.	No reports No data available to public.

na: not applicable.

GV: Guideline Value

MAC: Maximum Admissible Concentration

APPENDIX B

SUMMARIES FOR 29 COUNTRIES WHICH RETURNED THE QUESTIONNAIRE

ALBANIA

SUMMARY

Albania has major drinking water supply and quality problems, with interrupted supply affecting 100% of the population, and old, corroded distribution systems and inadequate chlorination equipment giving rise to microbiological contamination. Drinking water quality monitoring is also inadequate, due to lack of financial resources.

INSTITUTIONAL RESPONSIBILITIES

The country is divided into 26 administrative districts plus the capital Tirana.

The Ministry of Municipal Economy has overall responsibility for potable water supplies and wastewater treatment, whilst the district authorities are responsible for their operational administration, and operational management rests with local authorities. The Ministry of Health, through its district centres, has direct responsibility for drinking water quality.

MONITORING OF DRINKING WATER QUALITY

Ministry of Health and other government departments together with the Regulatory Agency for Water Supply and Removal of Waste Water, are responsible for routine monitoring of all public supplies, including raw water sources (surface water and groundwater) and drinking water. Routine monitoring of drinking water quality may also be carried out by local authorities (public supplies) and by private users (private supplies) or by independent laboratories.

Drinking water compliance monitoring requirements are determined by the Ministry of Health and controlled through laboratories based in each district, but may also be carried out by local authorities (public supplies).

The extent of drinking water quality monitoring programmes is based on the size of population supplied, and the assessment is broadly based on WHO guideline values and EU standards. The monitoring frequency is based on the WHO Guidelines, and the type of parameters are broadly based on minimum EU requirements, plus additional parameters upon request from competent authorities. In practice, however, the focus is on microbiological parameters (mainly faecal coliforms) and taste and odour (daily for public supplies, once a year for private supplies) with some additional parameters analysed weekly or annually. The following are not normally analysed: total coliforms, faecal streptococci, metals, pesticides, solvents, THMs, other disinfection by-products, PAHs, fluoride.

Drinking water monitoring is, on the whole, inadequate due to financial difficulties resulting in shortage of equipment and chemicals.

There are considerable difficulties with compliance monitoring; 11 of the Ministry of Health district laboratories are not functioning for a variety of reasons, including lack of equipment and chemicals.

Drinking water quality data obtained from public or private supplies are collected at treatment works, consumer taps and/or intakes from sources. In Albania, there are two major treatment works, one based in the Durres district (Shijak), built in 1940, and one is under construction in Tirana.

When non-compliance occurs, measures are aimed at prioritising improvements and, where necessary, allocation of public funds to construct installations.

Drinking water quality reports are produced at national and regional level; the data are available to the public for inspection.

DRINKING WATER SUPPLY AND QUALITY

Albania has major problems in achieving a continuous water supply because of organisational difficulties, financial considerations, lack of equipment and technical problems (e.g. old distribution systems with high percentage of leakage). Supply is reduced, 1-3 times per day (for 1-3 hours) during the whole year, affecting 100% of the population, but is generally worst in rural areas.

It's also difficult to achieve a high quality of drinking water, due to the poor state of supply systems (corrosion of pipelines), shortage of reliable (automatic) chlorination equipment, and financial resources to provide water works with the necessary disinfection chemicals. This is reflected in non-compliance with parameters such as *E. Coli* (it has been detected at levels between 2-16/100 ml). Recently, automatic equipment for sodium hypochlorite dosing has been installed in several cities, towns and villages with aid from WHO, UNICEF and the German government.

In general, the population is considered to be at risk from water related diseases.

Some monitoring data presented in the questionnaire:

Monitoring data reported for 1996, indicated <5% of 120 000 samples analysed, exceeded the faecal coliforms standard of 0/100 ml.

Results quoted from a review of nitrate pollution, gave 48 (4.3%) of 1118 samples exceeding the standard of 25-50 mg l⁻¹ nitrate; of these 31 (2.8%) were in the range 50-150 mg l⁻¹, and 17 (1.5%) in the range 150-300 mg l⁻¹.

ANDORRA

SUMMARY

Local authorities are responsible for water supply, and in one case, a private water company. The Ministry of Health and Welfare is responsible for compliance supervision. The main drinking water quality problem is microbiological contamination of water supplies, due to agricultural activities and cattle raising, the absence of catchment protection and inappropriate treatment technology. Water legislation and monitoring programmes are considered inadequate.

INSTITUTIONAL RESPONSIBILITIES

Local authorities are responsible for water supply, and in one case, a private water company. The Ministry of Health and Welfare has the responsibility for compliance supervision. There are seven districts in Andorra, with one treatment works in each of five districts, whilst two districts have no treatment works.

MONITORING OF DRINKING WATER QUALITY

The Ministry is responsible for routine monitoring of surface water quality and for routine and compliance monitoring of public and private water supplies. Routine monitoring of drinking water is also carried out by municipal/local authorities and the private water company. Seventy-three percent of the population are served by three water treatment works where routine monitoring is carried out.

For compliance monitoring, sampling frequency is based on the districts; six samples per week are analysed from each district.

Assessment of drinking water quality is based on a limited set of EU standards. However, insufficient human resources have so far prevented a complete monitoring programme to be implemented; metals, pesticides, solvents, THMs, PAH and taste and odour are not analysed. Parameters analysed are microbiological indicators, pathological organisms, nitrate and nitrite, ammonia, pH, turbidity, conductivity.

When non-compliance is detected, priorities are determined and improvement measures implemented.

Drinking water quality data are collected at consumer taps; treatment works; and intakes from source waters. The public cannot access this information, although reports on the quality are produced at local level.

DRINKING WATER SUPPLY AND QUALITY

Andorra has no difficulties in achieving a continuous water supply, but it has problems in achieving high quality drinking water and inadequate monitoring of drinking water. This is due to the absence of legislation covering all aspects of drinking water supply (i.e. catchment protection, treatment and distribution) and the limitation of human resources to develop and execute full monitoring programmes.

The main problem is microbiological contamination of water supplies, due to agricultural activities and cattle raising, the absence of catchment protection and inappropriate treatment technology.

There are no compliance problems with nitrate (standard 50 mg l⁻¹).

AUSTRIA

SUMMARY

Austria is a Federal Republic and relatively new EU Member State, with its drinking water legislation being adjusted to EU requirements. Drinking water supply is organised at municipal/local level, where direct responsibilities for compliance monitoring also lie. Most drinking water (99%) is derived from groundwater sources. There are no problems with continuous supply and only relatively minor non-compliance problems, mainly due to agricultural pollution (nitrate, atrazine, desethylatrazine). Some localised industrial pollutants in raw water are dealt with by targeted treatment technology.

INSTITUTIONAL RESPONSIBILITIES

Austria is a Federal Republic of nine states (Länder), each with its own assembly. Hence responsibilities for water supply are shared between Federal, individual state and local (municipal) level of administration.

There are both government and private institutions responsible for water services and their various responsibilities are prescribed by the Federal Act on Water Affairs which constitutes the basis of all water administration.

Overall responsibility for water services, including legislation and inspection, lies with Federal government services which include the following:

- Authority of Water Affairs - Ministry of Agriculture and Forests (permits for any measures affecting quantity and quality of water resources);
- Authority on Foods - Ministry of Health (regulation and control of drinking water quality);
- Water Quality Surveillance Services (monitoring waste water discharges and river water quality).

As a relatively new member of the EU, Austria is still adapting its water legislation to EU requirements with often stricter standards than Austria's previous national standards, although some stricter, national standards are also in place. Drinking water regulations (Codex) are incorporated into the Food Law, in addition there are specific regulations covering nitrate and pesticides in drinking water.

Whilst overall legal responsibility for water supply is at ministerial level, water supply services are provided by municipalities/local authorities or private undertakings (as decided by municipal or local authorities); there are some 1000 large/medium size plants and about 4000 small waterworks. Some municipalities have combined to provide regional water supply and sewerage services. These Regional water associations or

co-operatives are responsible for construction, management, operation and maintenance of facilities including financial provisions. They are authorised and controlled by the Authority on Water Affairs; authorisation is usually given if it is considered a more efficient provision of services.

MONITORING OF DRINKING WATER QUALITY

Overall responsibility for drinking water quality is with the health departments of each federal state. Public and private suppliers are responsible for routine monitoring of drinking water quality, and to demonstrate to the authorities that the water is safe to drink. Where private supplies relate to only one household, monitoring of the water quality is not required. Compliance monitoring is the responsibility of the municipal/local authorities; sampling and analysis is carried out by officially recognised laboratories (appointed private, state or federal examination institutes). The extent of monitoring is based on the size of population supplied; the volume of water produced; and, in the case of nitrate and pesticides, the likely presence and concentration (as requested by competent authorities).

Assessment of drinking water quality is based on EU standards and additional national standards (i.e. Aldrin, Dieldrin and hexachlorobenzene). The frequency and parameters monitored are as per minimum EU requirements, although additional parameters are measured upon request from competent authorities.

In case of non-compliance, measures taken include prohibiting of distribution (where the authorities consider it necessary due to health risks), improvement of treatment technology, or long-term measures, such as groundwater protection schemes. The affected areas may be defined as “sanitation areas” and actions implemented to reduce the application of substances of concern (i.e. nitrate, pesticides) (Groundwater Standards Regulation). In some highly industrialised areas, there is some pollution of water sources with chemicals, but these are removed through additional treatment, e.g. activated carbon, to achieve compliance with drinking water standards.

Although no drinking water quality reports have been produced to date, the public can access the data which are available for inspection at treatment works. A report is in preparation and due to be published for the first time in the near future.

DRINKING WATER SUPPLY AND QUALITY

Austria has no major problems with water supply. Over 99% of drinking water supply is derived from groundwater; consequently minimal treatment is usually needed and the quality is high, although there are some problems caused by agricultural activities; nitrate, atrazine and desethylatrazine are frequently found at levels of concern in drinking water. Long distance water supply pipe lines are under consideration in some areas where EU limits cannot be met. Some localised problems of raw water contamination with chemicals in heavily industrialised areas are solved with targeted treatment technology.

BELGIUM (FLANDERS AND WALLOON)

SUMMARY

Belgium is an EU Member State divided into three autonomous regions (Flanders, Walloon, Brussels). Water supply is provided and distributed by municipal companies and compliance supervised by the Regional Ministries. There are no problems of continuous supply, but some water quality problems due to agricultural activities, geological conditions, and inadequate treatment. Parameters of concern include microbiological, nitrate, iron, manganese, sodium, potassium, pH, pesticides, THMs, aluminium.

This summary relates to Flanders and Walloon, as no reply to the Questionnaire was received from Brussels.

INSTITUTIONAL RESPONSIBILITIES

Belgium is an EU Member State divided into three autonomous regions (Flanders, Walloon, Brussels). There are nine provinces and 600 municipalities. Water supply is provided and distributed by the municipalities, 90% through six large inter-municipal companies, the other 10% through 200 small municipal companies, all publicly owned (shares held by provinces and regions).

Legal responsibilities and operational management of drinking water supply are shared between regional institutions (ministries or other government departments) and municipal/local authorities, and the water companies. Direct responsibility for supervising compliance rests with the Regional Ministry (public and private supplies) and the water companies (public supplies).

MONITORING OF DRINKING WATER QUALITY

In Flanders the Ministry is responsible for routine monitoring of surface water, groundwater and drinking water (public and private supplies) and compliance monitoring of public and private supplies. The water companies also carry out routine monitoring and compliance monitoring of public supplies. In Walloon routine monitoring of drinking water is carried out by the maniple/local authorities and the water companies; and compliance checks (analysis of routine results) are undertaken by the Regional Ministry (spot checks: Water Department of DERNE, checks in response to complaints: Environmental Police Department at DERNE).

The extent of monitoring is based on the size of population supplied and the volume of water produced; in Walloon the characteristics of the distribution system are also taken into consideration. In Flanders all of the 111 treatment works are monitored regularly; hence 95% of the population receive supplies which are monitored regularly (about 20 000 samples per annum). In Walloon the five main treatment works are monitored

regularly; in addition there are large numbers of groundwater works (minimal treatment) where monitoring is also minimal.

Assessment of drinking water quality is based on EU and regional standards. The frequency and type of parameters monitored are under minimum EU requirements. Some smaller companies are not complying with the legal requirement of monitoring frequency, due to limited financial resources.

When non-compliance occurs, measures include prioritisation of drinking water quality improvements and/or (in Walloon) allocation of public funds for protection of water sources.

Drinking water quality data are collected at treatment works, consumer taps or the distribution network, and intakes from source waters. Drinking water quality reports are produced and published in the Walloon Region, and municipalities have the responsibility to provide information to the public. Although no reports are produced in Flanders, the public can access the data which are available on request.

DRINKING WATER SUPPLY AND QUALITY

There are no problems of continuous supply. In Flanders 95% of the population are connected to the public system, the remaining 5% are remote households not connected because of technical and financial considerations.

There are pollution problems of water resources caused by agricultural activities (i.e. nitrate and pesticides such as Atrazine, Simazine, Diuron, Isoproturon, Chlortoluron) and natural, geological conditions (i.e. sodium, potassium, iron, manganese).

Whereas the pesticides are mostly removed during treatment (activated carbon), the other parameters are found at levels exceeding the standard in drinking water. Other problems include: pH (acidity), THMs, aluminium and short-term non-compliance with free chlorine because of inappropriate treatment, and microbiological quality.

The drinking water compliance problems caused by inadequate treatment are due to financial considerations, particularly in large rural areas with small numbers of people connected to many small supplies.

Examples provided from Walloon:

Total coliforms (standard 0/100 ml, 95% of samples): public supplies (supply zones >5000 population):

Year	No samples	Exceedance (%)	Population affected (no)	Population affected (%)
1993	27 957	2.49	225 000	8.2
1994	29 449	2.20	131 000	4.8
1995	28 886	3.03	179 000	6.5

Faecal coliforms (standard 0/100 ml, 95% of samples): public supplies (supply zones >5000 population):

Year	No samples	Exceedance (%)	Population affected (no)	Population affected (%)
1993	28 185	1.70	130 000	4.8
1994	29 539	1.30	72 000	2.6
1995	29 095	2.07	10 ,000	3.7

Nitrate (standard 50 mg l⁻¹): public supplies (supply zones >5000 population):

Year	No samples	Exceedance (%)	Population affected (no)	Population affected (%)
1993	4 196	0.64	78 000	2.9
1994	11 563	0.30	68 000	2.5
1995	11 260	0.20	42 000	1.5

Arsenic (standard 0.05 mg l⁻¹) and **Fluoride** (standard 1.5 mg l⁻¹): some public supplies: 1993-1995, zero non-compliance (about 500-1800 samples per year).

Pesticides (standard 0.1 µg l⁻¹ individual, 0.5 µg l⁻¹ total): Note: these data are not considered representative, focusing on problem supplies, rather than random sampling.

Year	No samples	Exceedance (%)
1993	651	13.36
1994	1224	7.35
1995	1359	4.27

Belgium (Flanders and Walloon)

CROATIA

SUMMARY

Legal responsibilities and operational management, and compliance supervision of drinking water supply are all at ministerial level. Due to lack of financial resources, only 70% of the population are connected to public water supply; the connection rate is particularly low in rural areas, and treatment is mostly minimal. There are major drinking water quality problems, particularly microbiological quality, but also ammonia, nitrate, nitrite and iron. These are due to pollution of raw water sources from agricultural activities, geological conditions, industrial and domestic effluent discharges, and inadequate treatment.

INSTITUTIONAL RESPONSIBILITIES

Legal responsibilities and operational management of drinking water supply are at ministerial level (Ministry or other government departments). The Ministry also has the responsibility for compliance supervision. Due to a shortage of financial resources, only about 70% of the population are connected to public water supply, the connection rate is particularly low in rural areas. There are 500 treatment works, though 450 of these use chlorination treatment only.

MONITORING OF DRINKING WATER QUALITY

The ministry and municipalities/local authorities are responsible for routine monitoring of public supplies and raw water sources (surface water, groundwater). Compliance monitoring is carried out by the Ministry or other government department (public supplies only).

The extent of monitoring is based on the volume of water produced and the size of population supplied. Systematic monitoring of drinking water quality from public and private supplies is in place. Routine monitoring is carried out at 450 of the 500 treatment works. About 70% of the population receive water which is monitored.

Assessment of drinking water quality is based on WHO Guidelines, EU and national standards. The frequency and type of parameters monitored are under EU requirements plus additional standards.

When non-compliance occurs, measures include prioritisation of drinking water quality improvements, prosecution of suppliers and/or allocation of public funds to construct installations.

Drinking water quality data for public supplies are collected at treatment works, consumers' taps and source water intakes. Reports are produced at national level

(1992-1996), and the public can access the information since it is published and available free.

DRINKING WATER SUPPLY AND QUALITY

Due to lack of financial resources, only 70% of the population are connected to public water supply; the connection rate is particularly low in rural areas.

The main drinking water quality problems of concern relate to microbiological quality, ammonia, nitrate, nitrite and iron. These are due to pollution of raw water sources from agricultural activities, geological conditions, and industrial and domestic effluent discharges.

Other parameters, such as metals, THMs and chlorinated solvents are rarely found at concentrations exceeding the standards, occasionally halogen ions or metals are found slightly above (<10%) the standards in incident situations. Pesticides are not normally found at concentrations above the standards (0.1 $\mu\text{g l}^{-1}$ individual, 0.5 $\mu\text{g l}^{-1}$ total).

Examples provided:

Total coliforms (standard 0/100 ml for public supplies, 10/100 ml for private supplies): 1992-1996, non-compliance ranging from 4.3-5.8% of samples (about 30 000-36 000 per annum) taken from public supplies, and 19-38% non-compliance of samples (about 4800-6700 per annum) taken from private supplies, with no apparent trends.

Faecal coliforms (standard 0/100 ml): 1992-1996, non-compliance ranging from 2.3-3.6% of samples (about 30 000-36 000 per annum) taken from public supplies, and 8-18% non-compliance of samples (about 4800-6700 per annum) taken from private supplies, with no apparent trends.

Faecal streptococci (standard 0/100 ml): 1992-1996, non-compliance ranging from 1.5-3.9% of samples (about 30 000-36 000 per annum) taken from public supplies, and 8.3-16% non-compliance of samples (about 4800-6700 per annum) taken from private supplies, with no apparent trends.

Nitrate (standard 44.29 mg l^{-1} nitrate): 1992-1996 non-compliance ranging from 2.1-3.8% of samples (about 30 000 per annum) taken from public supplies, and 3.4-12% non-compliance of samples (about 4200-5700 per annum) taken from private supplies, with no clear trends.

Arsenic (standard 0.05 mg l^{-1}) and **fluoride** (standard 1.5 mg l^{-1}): In the period 1992-1996 zero exceedences (1100-1300, and 1400-1600 samples per year, respectively).

CZECH REPUBLIC

SUMMARY

The Czech Republic is a Central European country of the former Soviet Block, and a first wave EU accession country; consequently, there is considerable pressure on the Czech Republic to align its water legislation with that of the EU. Water supply is organised by municipal/local authorities, in part delegated to private water companies. Local authorities, through the State Public Health Service, also have responsibility for compliance supervision. The Czech Republic does not have difficulties in achieving a continuous water supply, but there are some water quality problems due to financial reasons, inadequate treatment, and/or low quality of surface water (agricultural activities, domestic and industrial effluents). The parameters most frequently exceeding standards in drinking water are nitrate, chloroform, dichlorobenzene and coliform bacteria.

INSTITUTIONAL RESPONSIBILITIES

The Czech Republic is a Central European country of the former Soviet Block. As a first wave EU accession country, there is considerable pressure on the Czech Republic to align its water legislation with that of the EU. A new comprehensive water law has been under consideration for some time, however, changes may still be required to comply with EU legislation. Although the Water Law and Regulations to implement the law have been drafted long ago, their adoption is being delayed to some extent, as these are awaiting finalising of some EU Directives, e.g. the Water Framework Directive and the Revision of the Drinking Water Directive. It is thought likely that the recently elected government will speed up the completion of the new legislation.

The result of the new legislation will in some cases mean lower water quality standards than those of the former Czech Standards laid down between 1991 and 1994. In practice this may mean that standards are more likely to be achieved.

Legal responsibilities for drinking water supply are shared between the Ministry and other government departments, and municipal/local authorities. Local authorities (State Public Health Service) have direct responsibility for supervising compliance from public sources. Operational management rests with municipal or private water companies; the latter operate on behalf of municipalities which retain majority shareholding.

MONITORING OF DRINKING WATER QUALITY

Water companies are responsible for routine monitoring of surface water, groundwater, and drinking water quality (public supplies). Compliance monitoring is the responsibility of the municipal/local authorities and carried out by the State Public Health Service. There is no legal duty for owners to monitor private supplies, nor is there any compliance monitoring for these.

The extent of monitoring is based on the volume of water produced and the size of the population supplied. Routine monitoring is carried out at all of the 3243 treatment works which serve 85% of the population. It seems that there can be problems in monitoring drinking water, due to financial considerations.

Assessment of drinking water quality is based on national standards which include WHO guideline values (1984). (A revision to include the 1993 WHO Guidelines, and to bring legislation in line with the revised EU Drinking Water Directive has been drafted). The parameters monitored correspond to EU minimum requirements plus additional national parameters.

When non-compliance occurs, priorities are set for improvements in drinking water quality and/or allocation of public funds to construct installations.

Drinking water quality data are collected at treatment works, consumer taps and source water intakes. There are reports, produced annually at national level, on drinking water quality from public water supply systems of selected regions (covering about 50% of the population). The public can access this information since it is published and available free. Data from local supplies are available for inspection.

DRINKING WATER SUPPLY AND QUALITY

The Czech Republic does not have difficulties in achieving a continuous water supply.

There can be problems in achieving high water quality mainly due to financial reasons and/or low quality of surface water. Source water pollution problems are mainly caused by agricultural activities (i.e. nitrate). Other factors, such as industrial and municipal discharges into surface waters, and inappropriate treatment technology, contribute to drinking water quality problems.

The parameters most frequently exceeding standards are as follows: nitrate (>3% of samples), chloroform (3.5% of samples), dichlorobenzene (3% of samples) and coliform bacteria (about 3% of samples).

Other contaminants of concern relate to beryllium and *Cryptosporidia*.

ESTONIA

SUMMARY

Estonia is a newly independent state of the former USSR, and first wave EU accession country under pressure to adopt EU legislation. Water supply is organised by towns and municipalities, with some involvement of private companies. Water quality supervision is the responsibility of the National Board for Health Protection. There are no problems in achieving continuous supply, but major drinking water quality problems, mainly concerning microbiological quality, as well as nitrate, fluoride, and other chemical substances, and organoleptic properties, due to geological conditions, agricultural activities and inadequate treatment, including discontinuous chlorination.

INSTITUTIONAL RESPONSIBILITIES

Following the break-up of the former Soviet Union the independent Republic of Estonia was formed in 1991 and the new Constitution was approved in 1992. The framework for environmental legislation is provided by the Law on Environmental Protection 1990; many Regulations of the former Soviet Union are still in force, provided they do not conflict with the Constitution.

A new Water Law has been prepared with the aim of providing State leadership in all aspects of water usage and protection. It was recognised that many of the former Soviet water quality standards were not achievable; these have been revised to more realistic standards, with the possibility of tightening them as technological progress allows. Drinking water standards are governed by the Drinking Water General Requirements Regulation (EVS 663:1995), but certain relaxation's of standards were granted under another Regulation (No. 8. 15.03.1996) until 1.1.1998.

However, legislation is continuing to be developed and updated using the regulatory approach of the European Union (EU) as a model; the aim is to create the necessary pre-conditions, ultimately leading to harmonisation with EU standards. As a first wave accession country, Estonia is under considerable pressure to align its water legislation with that of the EU.

Legal responsibilities for drinking water supply are shared between different institutions at ministerial and municipal/local level, as well as private water companies. The National Board for Health Protection (Ministry of Social Affairs) has direct responsibility for compliance supervision of public and private supplies, whilst the Inspector for Environment Protection (Ministry of Environment) is responsible for overseeing surface water and groundwater quality.

Water supply is organised by towns and municipalities (assets owned by the State) and some 'private' companies, in which the municipality appears to own the assets. There are few large water service utilities (major cities), most are small scale municipal plants,

though some private companies now run several plants on behalf of municipalities (e.g. Estonian Water Company). There are a total of 23 treatment works which supply 39.8% of the population. The remainder rely on private supplies.

MONITORING OF DRINKING WATER QUALITY

Ministerial departments, municipalities/local authorities and private water companies all carry out routine monitoring of surface water, groundwater and drinking water (public and private supplies). Two independent regulators participate in this and are ultimately responsible for raw water quality (Inspector for Environment Protection, Ministry of Environment) and drinking water quality (National Board for Health Protection, Ministry of Social Affairs). The latter also carries out compliance monitoring of public and private supplies, although municipal/local authorities also take part, as well as the Ministry (public supplies only).

The extent of this monitoring is based on the size of population supplied, though there are some problems due to financial considerations. Routine monitoring is carried out at all of the 23 treatment works which supply 39.8% of population. A total of 15 450 samples are processed per year, of these 10 201 from public supplies, and 5189 from private supplies.

Assessment of drinking water quality is based on national standards. The type of parameters monitored are under national requirements.

When non-compliance occurs, measures include prioritisation of drinking water quality improvements, prosecution of suppliers and/or allocation of public funds to construct installations.

Drinking water quality data for public and private supplies are collected at consumer taps, treatment works and source water intakes (public supplies only). Reports on drinking water quality are produced at national and regional level. The public can access the information as it is published for sale, available free and/or available for inspection.

DRINKING WATER SUPPLY AND QUALITY

There are no problems in achieving continuous supply, but there are major drinking water quality problems, mainly concerning microbiological quality, due to financial considerations and discontinuous chlorination.

In addition, the parameters most frequently giving rise to concern are: iron, nitrate, nitrite, fluoride, iodide, sulphate, manganese, chloride, heavy metals, H₂S, organoleptic properties. The main reasons are geological conditions, agricultural activities and inadequate treatment.

Examples provided:

Total coliforms: In 1995 and 1996 non-compliance was 10.7% and 12.8%, respectively, of samples (19 270 and 17 406 samples each year from public and private supplies), affecting 2.36 and 2.2% (35 549 and 33 149) of the population.

Faecal coliforms: In 1995 and 1996 non-compliance was 1.07% and 1.2%, respectively, of samples (19 270 and 17 406 samples each year from public and private supplies), affecting 0.03% and 0.028% (458 and 419) of the population.

Nitrate (standard 45 mg l⁻¹): In the period 1993-1996 non-compliance was in the range 3-4% of samples (5000-7000 samples per year from public supplies), some of these (0.07-0.8%) in the range 150-300 mg l⁻¹, with non-compliance affecting 0.25-0.28% (3800-4140) of the population.

Fluoride (standard 1.5 mg l⁻¹): In the period 1990-1996 non-compliance was in the range 26-35% of samples (180-400 samples per year from public and private supplies), some of these (0-0.4%) >10 mg l⁻¹, with non-compliance affecting 0.7% (about 11 000) of the population.

There are **no pesticides** found at levels exceeding the standards (0.1 µg l⁻¹ individual, 0.5 µg l⁻¹ total); only traces of Dimethoate, Metalaxyl, Prometryn, Simazine, Phosalone and 2,4-D have been found.

FINLAND

SUMMARY

Finland is an EU Member State; consequently its drinking water legislation has been adjusted to implement the EU Drinking Water Directive. Drinking water supply is the responsibility of municipal authorities which also carry out operational management and compliance monitoring. Eighty-seven percent of the population are connected to public water supply, the remainder have private wells. There are no problems with continuous supply, but some compliance problems due to geological reasons and high organic carbon levels leading to aftergrowth in distribution systems.

INSTITUTIONAL RESPONSIBILITIES

Finland is a republic and EU Member State. There are 12 provincial governments each having an environmental protection office. The National Board of Waters and the Environment, which reports to both the Ministry of Environment and the Ministry of Agriculture and Forestry has 13 district offices. Their duties relate to water usage, management and protection, and include supervision of compliance with water legislation.

Waters in Finland are generally privately owned; there are three Water Courts which issue permits relating to water usage, discharges and water construction projects.

Municipalities have legal responsibility for public water supply and operational management. There are 461 local municipalities, each with boards for local services, including water services. All water supply is under municipality ownership and management. Some small co-operative companies exist where the local communities are shareholders in the water company.

MONITORING OF DRINKING WATER QUALITY

Municipalities/local authorities are responsible for routine monitoring of raw water sources (surface and groundwater) and drinking water. Owners of private wells have to monitor their own water. Compliance monitoring of public and private supplies is carried out by the municipality/local authority.

The extent of monitoring is based on the size of population supplied and the volume of water produced. All public water supplies (works serving 87% of the population) are subject to regular water quality monitoring.

Assessment of drinking water quality is based on EU and national standards, and WHO Guidelines. The frequency (Annex II) and type of parameters (Annex I) monitored is based on minimum EU requirements, although additional parameters are measured upon request from competent authorities.

In case of non-compliance, measures involve prioritisation of drinking water quality improvements and/or allocation of public funds to construct installations.

Drinking water quality data are collected at treatment works, consumer taps and source water intakes. Reports on water quality are produced at national level and by water suppliers. The public can access the data (published for sale or available free or for inspection).

DRINKING WATER SUPPLY AND QUALITY

Finland has no major problems in achieving continuous water supply of drinking water; 87% of the population are served by public supply systems, the remainder, who live mostly in rural areas, have private wells.

In some parts of Finland, high levels of naturally occurring substances can give compliance problems, i.e. fluoride, iron, manganese and total organic carbon. These have mostly been dealt with through improved treatment technologies. High organic carbon contents have, in the past, given rise to high levels of disinfection by-products (THM and others), these too have been tackled through removal of organics prior to disinfection; however, some problems remain in distribution systems, where high levels of assimilable organic carbon can promote bacterial growth. Pesticides are not a problem in Finland.

Examples of non-compliance provided in questionnaire (all 1996 data, public supplies):

Parameter	Standard	No of samples analysed	Percentage exceeding std.	Population affected
Nitrate	25 mg l ⁻¹ (nitrate)	6 477	0.4 (<50 mg l ⁻¹)	11 000 (0.2%)
Fluoride	1.5 mg l ⁻¹	2 086	18.1 (most <4.5)	275 000 (4.8%)
Arsenic	0.01 mg l ⁻¹	112	8.9	35 500 (0.7%)
Chromium	0.05 mg l ⁻¹	-	0.8	-
Copper	1.0 mg l ⁻¹	-	0.8	-
Zinc	3.0 mg l ⁻¹	-	0.2	-
Total coliforms	<1/100 ml	16 210	27.3 (max. 250/100 ml)	-
Faecal coliforms	<1/100 ml	12 223	3 (max. 10/100 ml)	240 000 (4.7%)
Faecal streptococci	<1/20 ml	497	25.8 (max. 29/100 ml)	303 000 (5.9%)

- no data

FRANCE

SUMMARY

Water supply is provided by municipalities, the majority through private companies, though numerous small municipal companies also supply water. Supervision of drinking water quality is at ministerial level, through the 95 departmental health directorates. There are no problems of providing continuous supply, but some compliance problems and inadequate monitoring, particularly at the small supplies. Quality problems include microbiological contamination, nitrate, pesticides, lead, aluminium, iron, turbidity, and are due to agriculture, inadequate source protection and treatment, and lead piping.

INSTITUTIONAL RESPONSIBILITIES

France is an EU Member State, a democratic Republic, administratively divided into 22 Regions, 100 Departments and 36400 Municipalities.

Legal responsibilities for drinking water supply are with the municipalities/local authorities (Mayor); many of these delegate operational management to private water companies which are serving 60% of the population. The remainder are managed directly by municipal councils or jointly by syndicates of several municipalities. There are large numbers of small municipal supplies. Whilst overall responsibility for water quality lies with the Ministry of Employment and Solidarity - Directorate General of Health, compliance supervision is the duty of the Departmental Prefect of the Departmental Health Directorates (DDASS).

Water supplies are derived from groundwater (63%) and surface water (37%). Forty-two million, or 73% of the population, are served by water works supplying >5000 consumers.

MONITORING OF DRINKING WATER

Routine monitoring of public supplies is carried out by the private or municipal water companies (raw and treated water), whilst compliance monitoring is carried out by the DDASS, which also monitors the quality of surface water, groundwater and private supplies.

The extent of monitoring is based on the volume of water produced and the size of population supplied.

Assessment of drinking water quality is based on EU standards and national standards (Decree No.89 relatif aux eaux destinés à la consommation humaine à l'exclusion des eaux minérales naturelles). The frequency and type of parameters monitored are under EU minimum requirements, plus few additional parameters (e.g. turbidity); monitoring of

pesticides depends on their use in the catchment. There are 15 000 treatment works where regular monitoring is carried out; some 300 000 samples are processed per annum (depending on the type of analysis, several parameters are analysed per sample), plus a small number of samples from private supplies. There are major problems in adequate monitoring of drinking water quality of small supplies, due to financial considerations.

When non-compliance occurs, measures include prioritisation of drinking water quality improvements, provision of information to the public and/or allocation of public funds to construct installations.

Drinking water quality data is collected at treatment works, consumer taps (microbiological parameters only), and intakes from source waters; private supplies at the intake and at the point of supply. The public can access this information which is published and available free of charge, and data are available at community level (Mairie). Reports on drinking water quality are produced at national and regional level.

DRINKING WATER SUPPLY AND QUALITY

France no longer has problems in providing continuous water supply. There are, however, some compliance problems and inadequate monitoring, particularly at the small supplies. Quality problems include microbiological contamination (small supplies), nitrate, pesticides (mainly Atrazine, Simazine, Desethylatrazine, Diuron), lead, aluminium, iron, turbidity, and are due to agriculture, inadequate source protection and treatment, and lead piping. Other potential problems include, tin, copper and zinc from domestic plumbing, but data are inadequate to assess the extent.

Examples provided (public supplies from all sources, data refers to supply zones serving >5000 population, which corresponds to 42 million consumers or 73% of the total population):

Total coliforms (standard 0/100 ml, 95% of samples): In the period 1993-1995, non-compliance was in the range 2-2.3% of samples (about 60-63 000 samples per annum).

Faecal coliforms (standard 0/100 ml): In the period 1993-1995, non-compliance was in the range 0.8-1% of samples (about 110-114 000 samples per annum).

Faecal streptococci (standard 0/100 ml): In the period 1993-1995, non-compliance was in the range 0.6-0.8% of samples (about 110-114 000 samples per annum).

Nitrate (standard 50 mg l⁻¹ as nitrate): In the period 1993-1995, non-compliance was in the range 3.4-3.8% of samples (about 39 000 samples per annum), affecting 1.4-1.7 million consumers, i.e. 3.5-5% of the population of 42 million covered by the monitoring.

Pesticides exceeding standard ($0.1 \mu\text{g l}^{-1}$ individual, $0.5 \mu\text{g l}^{-1}$ total), supply zones >5000 population:

Year	Atrazine		Simazine		Desethylatrazine	
	no. zones	population affected	no. zones	population affected	no. zones	population affected
1993	238	7.5 M	53	1.0 M	13	0.16 M
1994	216	6.1 M	27	0.75 M	18	0.20 M
1995	199	5.0 M	29	0.35 M	19	0.21 M

Year	Diuron		Lindane		Other pesticides	
	no. zones	population affected	no. zones	population affected	no. zones	population affected
1993	7	132 000	3	28 000	8	165 000
1994	3	33 000	0	0	5	57 000
1995	4	91 000	1	9 000	6	90 000

Fluoride (standard 1.5 mg l^{-1}): In the period 1993-1995, non-compliance was in the range 1.3-2.1% of samples (about 3300 samples per annum), affecting 0.4 million consumers or 1% of the total population.

Arsenic (standard $50 \mu\text{g l}^{-1}$): In the period 1993-1995, non-compliance was in the range 0.05-0.2% of samples (about 1400-2000 samples per annum), affecting 6000-18 000 consumers or <0.05% of the total population.

GERMANY

SUMMARY

Germany is an EU Member State with a well established, highly decentralised system of water supply and compliance supervision. The responsibility for drinking water supply lies with the municipal, town or district administrations. There are no problems with continuous supply and relatively minor compliance difficulties relating mainly to agricultural pollution of water sources (nitrate, pesticides, microbiological); these problems are particularly widespread in rural areas where there are large numbers of private or small community supplies which receive no treatment.

INSTITUTIONAL RESPONSIBILITIES

Germany is a Federal Republic consisting of 16 individual States (Länder) which have variable administrations, and a high degree of autonomy, including legislative powers. Environmental laws are generally passed at Federal level (as Framework Laws) as are some implementing regulations. Some Federal laws apply throughout Germany (e.g. health related ones relating to drinking water), others have to be transposed by the individual States (in particular water pollution legislation). This makes for rather complex legislation with variable requirements throughout Germany, although quality standards tend to be uniform across the country.

Since the unification of Germany in 1990, the five 'New Länder' (former East Germany) have undergone fundamental changes in their governmental structures and legislation, both of which have gradually been adapted in line with the former West Germany and with EU legislation.

Water supply services are the responsibility of the municipalities, town or district administrations and they may be provided in a number of ways, including:

- Private companies owned by the municipalities (Stadtwerke) (comprising the majority);
- Publicly quoted companies, partly owned by municipalities;
- Associations owned by a number of, usually smaller, municipalities;
- Delegation of duties to a private company, with the municipality retaining overall responsibility, and the assets being returned to the municipality at the end of the contract;

In all cases, capital ownership is wholly or in part with the municipality which also has overall responsibility for the services provided.

MONITORING OF DRINKING WATER QUALITY

Municipalities and private water companies are responsible for routine monitoring of drinking water quality.

Compliance supervision of drinking water quality (public and private) are shared through different institutions at different levels; individual state (health or other government departments), and local (municipalities and local health authorities headed by the local Medical Officer - *Amtsarzt*). Some compliance monitoring is done through officially appointed laboratories, including some water company laboratories, but the latter may not carry out compliance monitoring of their own supplies.

The extent of monitoring is based on the volume of water produced and the size of the population supplied. There are a total of 2584 treatment works, serving about 84% of the population, where routine monitoring is carried out.

Assessment of drinking water quality is based on EU standards and national standards. The frequency and type of parameters monitored are under minimum EU requirements with some additional national parameters; additional parameters are monitored upon request from competent authorities.

Drinking water quality data are collected at treatment works, except for some microbiological monitoring at consumer's taps. Summary reports on the quality are produced at individual state or regional and local level, some of which can be obtained by the public (mainly routine monitoring data).

In the case of non-compliance, measures include prioritising drinking water quality improvements (additional treatment, alternative supplies, and/or source protection measures) and/or prosecution of suppliers.

DRINKING WATER SUPPLY AND QUALITY

Germany has no major problems with water supply and quality, although considerable investment has been needed in recent years to bring the former Eastern German States up to national/EU requirements.

There are still some compliance problems, particularly for nitrate, pesticides (mainly atrazine) and microbiological parameters (coliforms, *E. Coli*). There are considerable problems in some rural areas where there are still many private supplies, often contaminated through agricultural activities. In addition, there are some geological factors contributing to non-compliance problems.

Some monitoring data presented in the questionnaire:

Nitrate exceeding standard of 50 mg l⁻¹:

2.3% of 17 269 samples in 1993;
3.4% of 17 682 samples in 1994; and
3.2% of 10 814 samples in 1995.

Total coliforms exceeding standard of 0/100 ml:

0.63% of 141 008 samples in 1993;
0.66% of 152 319 samples in 1994;
0.73% of 102 325 samples in 1995;

Estimated population exposed to water with **atrazine** exceeding standard of 0.1 µg l⁻¹
(max. 3 µg l⁻¹):

163 000 in 1993;
194 000 in 1994;
167 000 in 1995.

GREECE

SUMMARY

As a member of the EU, the legal framework is clear and well established but implementation and regulation can be poor. The responsibility for water supply is at municipal level, but operation mostly delegated to corporations. The Ministry is responsible for water quality supervision. There are no major problems in providing continuous supply, but there are water quality problems, and monitoring is inadequate. The main problem of concern relates to microbiological quality, because of non-continuous chlorination.

INSTITUTIONAL RESPONSIBILITIES

As a member of the EU, the legal framework is clear and well established but implementation and regulation can be poor.

The institutional framework is complex and decentralised. Greece is divided into 13 regions, 54 prefectures and 6034 municipalities. The Ministry of the Interior is responsible for drinking water quality and issues permits for drinking water supply works and use, except in Athens and Thessaloniki where the Ministry of Environment, Planning and Public Works (MoEPPW) is responsible.

Water is viewed as a public service and the responsibility of municipalities. However, concession and management contracts are provided for in law and have been set up for Athens and Thessaloniki. There are three distinct types of system of local water supply:

1. In Athens and Thessaloniki public government entities (non profit making corporations) own and operate the treatment plants, acting as private enterprises (EYDAP in Athens (water and wastewater), OYTH (water) in Thessaloniki); these account for 45% of the total volume supplied.
2. Regions with more than 10 000 inhabitants are managed by public utility corporations - operating as private enterprises but owned by the municipalities; presently there are 50 of these responsible for water and wastewater services.
3. Municipalities are responsible directly for only 5% of the population served.

MONITORING OF DRINKING WATER QUALITY

Local authorities and public corporations, such as EYDAP in Athens and OYTH in Thessaloniki, are responsible for routine monitoring of drinking water from public supplies. The users have direct responsibilities for routine monitoring of private supplies.

Compliance monitoring of public and private supplies is carried out by the Ministry or other government department.

The extent of monitoring is based on the size of population supplied.

Assessment of drinking water quality is based on EU standards. The frequency and type of parameters monitored are under minimum EU requirements. 185 000 samples are processed per annum. Due to lack of financial and human resources, and technical problems, there are not enough laboratories to carry out a full monitoring programme. However, there are plans for improving the situation and putting a full monitoring programme in place in the near future.

When non-compliance occurs, measures include prioritisation of drinking water improvements, allocation of public funds to construct installations and/or prosecution of suppliers.

Drinking water quality data from public supplies are collected at treatment works, consumer taps and intakes from source waters, the latter also from private supplies. The public can access this information since it is available for inspection. Reports on drinking water quality are produced at national level.

DRINKING WATER SUPPLY AND QUALITY

There are no major problems in providing continuous supply. However, there are water quality problems and monitoring of drinking water quality is inadequate at present. The main problem of concern relates to microbiological quality, because of non-continuous chlorination.

HUNGARY

SUMMARY

Municipalities/local authorities have legal responsibilities for public water supply, sharing the operational management with private companies and the Public Health Service is responsible for compliance supervision of drinking water quality. There is a high public supply connection rate (96-97% of population) and supply is continuous, but there are water quality problems, some due to geological conditions, others because of inadequate source water protection, inadequate treatment, and aftergrowth in the distribution system. Monitoring is considered inadequate.

INSTITUTIONAL RESPONSIBILITIES

As a former USSR country, and a first wave EU accession country, Hungary is under considerable pressure to align its water legislation with that of the EU.

Prior to 1992 water services were provided by the state in the form of 28 large 'council' companies (in effect owned by a group of municipalities) and five state companies. These companies have since been broken up into smaller municipal/local companies and some private companies.

Municipalities/local authorities now have legal responsibilities for public water supply, sharing the operational management with private companies. The Environmental Authority is responsible for monitoring surface water and groundwater quality, and the Public Health Service is responsible for compliance supervision of drinking water quality.

Water supplies are mainly derived from groundwater sources (deep wells and bank filtrate), providing 92% of supplies. There are 755 water treatment works, most of which use only minimal treatment (mainly iron removal). Only a small proportion of the population (3-4%) in rural areas are not served by public water works, these use their own private wells.

MONITORING OF DRINKING WATER QUALITY

The Ministry (Environmental Authority) carries out routine monitoring of surface water and groundwater. The water companies routinely monitor public supplies, including groundwater intakes, and private drinking water supplies. The Public Health Service carries out a limited amount of monitoring for the purpose of compliance supervision (audits) of drinking water quality (public and private supplies). Some compliance monitoring is also carried out by other, accredited laboratories which are audited by the Public Health Service (round robin tests).

The extent of routine monitoring is based on the volume of water produced and the population supplied. Of the 755 treatment works, only 80 receive regular monitoring (the remainder require minimal monitoring as they are groundwater plants using minimal treatment, i.e. mainly iron removal). Only an estimated 15% of the population are served by treatment works where routine monitoring is carried out. An estimated total of 280 000 samples are analysed per annum, of these 260 000 from public supplies and 20 000 from private supplies. Private supplies receive limited monitoring by the Public Health Service.

The assessment of drinking water quality is based on national standards. The frequency is based on the population supplied and the parameters to be analysed, as prescribed in the national regulations. For instance, fluoride is not monitored regularly, and arsenic is only monitored routinely in the affected areas. Depending on the parameters monitored, there are three types of analyses: basic, regular and irregular. The latter, are only carried out in case of complaints or other problems and in specific surveys.

There are problems in monitoring drinking water quality, mainly due to organisational reasons (fragmented organisation of water supply, i.e. large number of small operational companies), technical (badly equipped laboratories, inappropriate for micropollutants), financial problems and uncoordinated assessment of the results (for example to study trends and thereby initiate measures to prevent deterioration). Although the supervisory authority (Public Health Service) has a better organised and better equipped monitoring facility, it can only undertake a limited number of analyses for the purpose of compliance supervision/auditing.

When non-compliance occurs, measures will depend on the situation and level of exceedance, and will aim to prioritise drinking water quality improvements. For example, the National Environmental Health Action Programme contains the prioritisation of drinking water problems.

Public drinking water quality data are collected at consumer taps (also limited monitoring of private supplies), at treatment works, and including source water intakes. The public cannot access the data, although drinking water quality reports are produced at national level (containing only compliance monitoring data).

DRINKING WATER SUPPLY AND QUALITY

There are no major difficulties in providing a continuous water supply.

However, there are considerable difficulties in achieving satisfactory water quality, in part this is due to problems as follows:

- deep well water contamination for natural/geological reasons (high concentrations of arsenic, ammonia, high methane levels, humic substances and high temperature; the latter giving rise to secondary contamination);

- industrial and agricultural pollution affect groundwater and surface water sources (nitrate, faecal pollution, oil, organic micropollutants);
- inadequate protection of vulnerable aquifers (particularly in relation to bank filtrate and shallow groundwater wells);
- inadequate treatment technologies (iron and manganese removal, and surface water treatment);
- aftergrowth in distribution systems leading to poor microbiological quality.

Parameters most frequently found at levels of concern in drinking water are microbiological (total plate counts, faecal bacteria), nitrate, nitrite, ammonia, iron, manganese, sodium, calcium (too low), arsenic, organic micropollutants (hydrocarbons, pesticides, disinfection by-products).

Trichloroethylene, tetrachloroethylene, and cis-dichloroethene are found occasionally.

Other issues of concern are lead leaching from low quality PVC pipes (lead used as stabiliser) and, in some cases, zinc from galvanised pipes and domestic galvanised water storage tanks.

Examples provided:

Total coliforms/faecal coliforms (standard 2/100 ml): From 1992-1996, exceedences ranged from 6.1-10.2% of samples (64 000-88 000 samples per annum) affecting an estimated 2-4% (216 000-432 000) of the population.

Nitrate: Of the private supplies, 60-70% of wells have nitrate concentrations above the limit of 40 mg l⁻¹; in these cases bottled water is provided for babies.

Some small public supplies (34 small village supplies) have nitrate levels exceeding the standard; bank filtered water also often exceeds the standard, dilution usually achieves levels ranging from 40-60 mg l⁻¹; the population affected is estimated at about 0.5% in each case.

Fluoride: An estimated 0.85% (8780 consumers) of the population receive water with fluoride concentrations above the standard of 1.7 mg l⁻¹, and 1.4% (14 170) in the range 1.5-1.7 mg l⁻¹ (data from 1990 survey, evaluation of 1997 survey not complete, but expected to be similar).

Arsenic: Much of the arsenic problem has been solved through treatment, bringing concentrations in drinking water down to <50 µg l⁻¹ (current standard), but compliance problems will be considerable again, once the revised EU Drinking Water Directive is adopted with the revised arsenic standard of 10 µg l⁻¹. Current estimates are as follows: <0.5% of the population receive water with arsenic >50 µg l⁻¹, but as many as 10-12% may be exposed to arsenic concentrations >10 µg l⁻¹.

Pesticides: There are national standards for 17 pesticides based on the WHO Guidelines, i.e. health-based standards, most of which are higher than the EU limit of $0.1 \mu\text{g l}^{-1}$. Monitoring has not been systematic in the past; herbicides have been found most frequently (e.g. 2,4-D and MCPA) but below health-based standards. A comprehensive survey was started in 1997, results are not yet available.

ICELAND

SUMMARY

In Iceland, municipalities/local authorities are wholly responsible for drinking water supply, operational management and compliance supervision. There are no major problems of supply or quality, though microbiological contamination of shallow groundwaters, and consequently relatively high levels of non-compliance with microbiological parameters (total coliforms, faecal coliforms) is relatively high. Monitoring of chemical parameters is limited due to limited financial resources, but surveys of nitrate and pesticides have indicated that there are no problems.

INSTITUTIONAL RESPONSIBILITIES

Municipalities/local authorities are wholly responsible for drinking water supply, operational management and compliance supervision.

MONITORING OF DRINKING WATER QUALITY

Municipal Authorities are responsible for routine monitoring of all public supplies, raw source water (surface and groundwater) and drinking water quality. Samples are taken regularly and sent to the Laboratory of Environment and Food Agency. There is no separate compliance supervision.

The extent of monitoring is based on the size of population supplied. Assessment of drinking water quality is based on national standards, which are based on EU standards and WHO Guidelines, and the parameters monitored are under minimum EU requirements. However, the focus is mainly on microbiological parameters; monitoring of chemical parameters is limited due to financial resources. When non-compliance occurs, measures are aimed at prioritisation of drinking water quality improvements.

Drinking water quality data are collected at consumer taps and intakes from source waters. The public can access this information as it is published and is available free, for inspection and/or upon request. Reports on the quality are produced at national (Laboratory of Environment and Food Agency) and local level (water works).

DRINKING WATER SUPPLY AND QUALITY

There are no major problems of provision of continuous supply, though occasional, minor regional problems can occur.

Most areas are supplied with groundwater (94% of population) and therefore there are no problems in achieving high quality of drinking water. In some towns public water supply

is derived from surface water, which is normally treated by filtration and UV-treatment, but not chlorinated.

The main problems of drinking water quality relate to total coliforms and viable counts at 22 °C. These are mainly due to contamination of shallow groundwater resulting from seasonal weather conditions (rain, run-off) and unprotected areas (see results of analyses below).

Pesticides are not analysed in routine monitoring. However, the largest water works have carried out surveys for metals and organic chemicals, including pesticides. The latter have never been detected in Icelandic drinking water. Nitrate is not considered a problem; 100% samples analysed for nitrate are below 50 mg l⁻¹.

Examples of microbiological analyses of public and private supplies:

Total coliforms and faecal coliforms (standards <1/100 ml) between 1986 and 1996: annual numbers of samples analysed ranging from about 500-1000, percentage exceeding standard ranging from 9-18, with maximum concentrations ranging from 92-920/100 ml (no clear trends).

LATVIA

SUMMARY

Latvia is a former Soviet republic country with water services mainly provided by municipalities/local authorities. As a second wave EU accession country, there is pressure to harmonise with EU legislation. However, Latvia has major problems concerning non-continuous water supply and poor microbiological quality of drinking water.

INSTITUTIONAL RESPONSIBILITIES

Latvia is a former Soviet republic country with water services mainly provided by municipality operation of state owned assets, although some private companies have been set up that operate the assets.

For water management, the former USSR Water Code of 1972 is still in force. The drinking water standards of the former USSR (GOST 2874-82) are still in use, although the WHO guideline values are also used. With Latvia being in the second wave of EU accession countries, there is pressure to harmonise with EU legislation.

Legal responsibilities and operational management for drinking water supply are at municipal/local authority level. Compliance supervision is shared between these and the Ministry of Social Affairs (Department of Health).

MONITORING OF DRINKING WATER QUALITY

The Ministry, municipalities/local authorities and private water companies are responsible for routine monitoring of surface water, groundwater and drinking water quality (public and private supplies), whilst the Ministry and municipalities/local authorities monitor surface water quality. Compliance monitoring of public and private supplies is also carried out by the Ministry, municipalities/local authorities and private water companies.

The extent of monitoring depends on the water source (surface or groundwater) and is based on the size of population supplied. There are four treatment works where routine monitoring is undertaken, which means that 100% of the population are served with monitored water.

Assessment of drinking water quality is based on the WHO Guidelines and national standards (GOST 2874-82 Drinking Water Standard). The latter also prescribes sampling frequency and parameters to be monitored.

When non-compliance occurs, measures include prioritisation of drinking water quality improvements and/or allocation of public funds to construct installations.

Drinking water quality data from public and private supplies are collected at consumer taps and source water intakes. Reports on drinking water quality are produced at national and regional level. The public can access the information which is published or the data available for inspection.

DRINKING WATER SUPPLY AND QUALITY

Latvia has major problems concerning non-continuous water supply. Interruptions occur as a result of interrupted electricity supply and inadequate equipment.

The main problems of drinking water quality concern its microbiological quality; exceedance of the total coliform standard (3/1000 ml) in samples taken from distribution systems was in the range 7-13% in the years 1987-1996 (15 000 to 23 000 samples per annum), with an apparently increasing trend over the years. It was estimated that, in big towns, 90-95% of the population was affected by these exceedences, and 40-50% of the population in small to medium size towns.

Pesticides, such as Lindane, Aldrin, Heptachlor, Metoxichlor, Kelthane and α, β, γ -HCH were investigated and found not to exceed the national standard; this is, however, a standard of $1 \mu\text{g l}^{-1}$, i.e. 10 times higher than the EU standard.

LIECHTENSTEIN

SUMMARY

Legal responsibilities for drinking water supply are shared between national authorities, municipal/local authorities, and private water co-operatives, whilst the Ministry (Department for Food Control) has direct responsibility for compliance supervision. There are no problems of continuous supply which is guaranteed in all communities, nor are there any major water quality problems. Most water sources are of high quality and require no treatment, except in some alpine settlements where filtration or UV-irradiation is used.

INSTITUTIONAL RESPONSIBILITIES

Legal responsibilities for drinking water supply are shared between national authorities, municipal/local authorities, and private water co-operatives (Brunnengenossenschaften); the latter being responsible for the small number of private supplies (individual households, small communities or alpine settlements). All municipal water supplies are linked by the so called 'Wasserverband' (water association) to ensure continuous supply. The Ministry (Department for Food Control) has direct responsibility for compliance supervision.

MONITORING OF DRINKING WATER QUALITY

Routine monitoring of groundwater and drinking water (public and private supplies) is carried out by the municipalities/local authorities and the Ministry (Department for Food Control); the latter is also responsible for compliance monitoring of public supplies. There are no problems with monitoring which is carried out in a decentralised manner.

The Administration of Liechtenstein is closely linked to Switzerland; consequently, assessment of drinking water quality is based on the Swiss drinking water standards (also equivalent to the requirements of the EU Directive 80/778/EEC).

When non-compliance occurs, drinking water quality improvement measures are implemented (treatment).

Drinking water quality data from public supplies are collected at treatment works, consumer taps and intakes from source waters. Summary reports are produced at national (government), regional or local level (community water supply) which are published and available free; more detailed data may be obtained on request.

DRINKING WATER SUPPLY AND QUALITY

In Liechtenstein there are no problems of continuous supply which is guaranteed in all communities, nor are there any major water quality problems.

Most water sources are of high quality and require no treatment, except in some alpine settlements where filtration or UV-irradiation is used; this is necessary because there is some microbiological contamination of waters from cattle pastures combined with specific geological conditions.

LITHUANIA

SUMMARY

A small country of the former USSR and first wave EU accession country, Lithuania is aligning its legislation with EU requirements. Water supply is provided by municipal water companies and supervised by local and national authorities. Continuous supply has been achieved, but major problems are encountered with microbiological quality and nitrate in private supplies, to a lesser extent in public supplies, where iron and hardness are also of concern.

INSTITUTIONAL RESPONSIBILITIES

Following the break-up of the former Soviet Union, the independence of the Republic of Lithuania was declared in 1990. The framework for environmental legislation is provided by the Law on Environmental Protection 1992; but many Regulations of the former Soviet Union are still in force, provided they do not conflict with the new Constitution. Drinking water quality, for example, is still subject to the old Soviet Regulation GOST 2874 (Drinking Water Hygiene Requirements and Quality Control 1984).

However, as a first wave accession country, Lithuania is under pressure to align its legislation to the EU. Consequently, legislation is continuing to be developed and updated using the regulatory approach of the EU as a model; the aim is to create the necessary pre-conditions, ultimately leading to harmonisation with EU standards. The new Lithuanian Water Law (21 October 1997, No.VIII-474) and relevant draft Regulations to implement the Law, are currently being assessed to ascertain whether they adequately transpose EU requirements.

Overall responsibility for water protection and management of water resources lies with the Ministry of the Environment; though much of the management is devolved to the 16 Regional Environmental Protection Departments and County Governors.

Legal responsibilities for drinking water supply and compliance supervision (public and private supplies) are shared between the national (Ministry and other government departments) and municipal/local authorities. Operational management is carried out by the municipalities which, in 1995, became the owners of the formerly state owned water supply assets. To facilitate the change the municipalities formed 'stock companies', with the municipalities holding the entire stock.

MONITORING OF DRINKING WATER QUALITY

The Ministry of the Environment is responsible for routine monitoring of surface water, groundwater and drinking water quality from public supplies; compliance monitoring of public and private water supplies is shared between national and local authorities.

The extent of monitoring is based on the size of population supplied. It is estimated that 70% of the population are served by treatment works where routine monitoring is carried out. There are monitoring difficulties due to technical, financial and organisational constraints.

Assessment of drinking water quality is based on the national standard (old Soviet Regulation GOST 2874) which prescribe the frequency and parameters to be monitored. Pesticides, solvents, THMs, PAH or pathological organisms are not monitored.

When non-compliance occurs, measures include prioritisation of drinking water quality improvements and/or prosecution of suppliers.

Drinking water quality data from public supplies are collected at consumer taps and intakes from source waters (also private supplies). The public can access the information which is available for inspection. Reports on the quality are produced at national level.

DRINKING WATER SUPPLY AND QUALITY

Continuous supply has been established, but there are problems in achieving high quality drinking water. Parameters most frequently found at levels of concern are microbiological parameters, iron and hardness in public supplies, and nitrate and microbiological parameters in private supplies (wells). Water quality problems are due to intensive agriculture, geological conditions, lack of technical equipment and treatment chemicals, non-continuous chlorination, and financial constraints, and the poor state of the distribution system. For example, a recent survey in Lithuania has shown that an extensive pipe renovation (replacement, relining) programme (955 km or 21% of the total length) is needed in order to improve / safeguard the quality of drinking water supplies, including replacement of 29 km of lead pipes in order to comply with the lead parameter.

Examples provided:

Nitrate (standard 50 mg l⁻¹): in 1994, 1995, and 1996, exceedence in public supplies was 0.35%, 1.5%, and 0.1% of samples; and in private supplies, 46.4%, 42%, and 37.5% of samples (6000-8000), respectively. In the private supplies, 11% of the samples in 1995, and 8.1% in 1996, were above 150 mg l⁻¹.

Fluoride (standard 1.5 mg l⁻¹): in public supplies 2.8% (of 542 samples) were above the standard in 1996.

Total coliforms (standard 0.3/100 ml in public supplies, 1/100 ml in private supplies): in 1989-1996, exceedence in public supplies was in the range 7.3-2.9% of samples (20 000-55 000 samples per annum) and in private supplies 43-58% of samples (4000-7000). There seems to be a decreasing trend in the public supplies.

MALTA

SUMMARY

There are five water treatment works serving 70% of the population. Legal responsibility for drinking water supply is at ministerial level, whilst operational management is delegated to the Water Services Corporation (WSC). The Health Ministry has direct responsibility for compliance supervision of public water supplies. There are major difficulties in the provision of continuous supplies, as well as water quality problems and insufficient monitoring.

INSTITUTIONAL RESPONSIBILITIES

Legal responsibility for drinking water supply is at ministerial level (Ministry or other government departments). Operational management is delegated to the Water Services Corporation (WSC), which is headed by a Manager under the direction of a Board of Directors. There are five water treatment works serving 70% of the population. The Health Ministry has direct responsibility for compliance supervision of public supplies.

MONITORING OF DRINKING WATER QUALITY

Routine monitoring is shared between the Health Ministry (groundwater) and the Institute of Water Technology at the WSC (surface, groundwater and public water supplies). Seventy percent of the population are served by five water treatment works where routine monitoring is carried out.

Assessment of drinking water quality is based on WHO Guidelines. The extent of monitoring is based on the volume of water produced and geographical zones, with a minimum of two samples from each locality per week. The sampling frequency is based on EU minimum requirements, although additional sampling is undertaken upon request from the competent authorities (i.e. when microbiological results obtained during normal sampling indicate a problem). The parameters analysed are limited, i.e. microbiological indicators, pathological organisms, salinity, chloride, sodium and taste and odour. There are problems in monitoring drinking water quality for technical reasons and inadequate human resources. Private supplies do not appear to be monitored/supervised, except by the groundwater monitoring programme of the Ministry of Health.

When non-compliance occurs, priorities are set for drinking water quality improvements.

Drinking water quality data are collected at treatment works, consumer taps and intakes from source waters. The public does not have access to the data, although reports are produced at departmental level.

DRINKING WATER SUPPLY AND QUALITY

Malta has major problems in achieving a continuous supply of drinking water. Normally, all urban areas are provided with a continuous supply, except during power failure events and works on the distribution system. Some new building areas still have to use bowsers to fill their wells and water tanks, as they are not yet connected to the distribution system.

There are also problems in achieving high quality drinking water because of financial considerations. It appears that water resources have pollution problems caused by agricultural activities and geological conditions. Chloride, fluoride, nitrate and hardness are frequently found at levels of concern in drinking water; there are also some microbiological problems.

For example:

Nitrate (standard 50 mg l⁻¹): non-compliance in the years 1989-1996 ranged from 24.5-59% of samples analysed (ranging from 47 to 338 samples per annum, public supplies from all sources); overall, percentage non-compliance and concentrations found seem to be decreasing.

Fluoride (standard 1.5 mg l⁻¹): non-compliance in the years 1987-1996 (not analysed in 1991, 92 or 93) ranged from 0-21% of samples analysed (ranging from 44 to 159 samples per annum, public supplies from all sources); no clear trend.

Total coliforms and faecal coliforms (standards 0/100 ml): from about 8500-12 000 samples (public supplies from all sources) analysed per annum in the years 1987-1996 (not analysed in 1988), non-compliance ranged from 1-8% for total coliforms, and 1-3.4% for faecal coliforms.

MOLDOVA

SUMMARY

Moldova has severe problems of discontinuous supply (affecting 75% of the population), contamination of surface water and groundwater sources and poor quality drinking water. The reasons include geological (fluoride), and anthropogenic pollution, inadequate water treatment, lack of water, electricity and financial resources.

INSTITUTIONAL RESPONSIBILITIES

Legal responsibilities and operational management of drinking water supply are shared between ministerial/national authorities and municipal/local authorities.

MONITORING OF DRINKING WATER QUALITY

The Ministry has direct responsibilities for routine/compliance monitoring of public supplies, as well as routine monitoring of groundwaters and surface waters.

The extent of monitoring is based on the size of population supplied. Thirty percent of the population are served by 23 water treatment works where routine monitoring is carried out (20 000 samples per year).

Assessment of drinking water quality and monitoring frequency are based on former USSR standards (e.g. 45 mg l⁻¹ for nitrate and 1.2 mg l⁻¹ for fluoride), and include microbiological analyses, taste and odour, metals, nitrate and pesticides, but not solvents, THMs or other disinfection by-products, nor PAH. However, there are considerable difficulties in performing adequate drinking water quality monitoring, because of technical, organisational, and financial considerations, and lack of human resources.

When non-compliance is detected, government and local authorities are informed and improvement measures prioritised.

Drinking water quality data is collected at treatment works, consumer taps (microbiological indicators) and intakes from source waters. Although there are no reports produced on water quality, the public can access data which is available for inspection.

DRINKING WATER SUPPLY AND QUALITY

Moldova has problems in achieving a continuous water supply of drinking water. There are permanent interruptions in small cities, towns and villages. Discontinuous supply affects 75% of the population and is more frequent in rural areas. The main reasons are

discontinuous electricity, water shortage, financial considerations and inadequate equipment.

Surface water and groundwater sources have severe pollution problems, in part for geological reasons, but also from agricultural and industrial activities and domestic effluents. High levels of fluoride and nitrate affect groundwater sources and are frequently found in drinking water at levels of concern (see below). Other factors such as inadequate availability of treatment technology, equipment and treatment chemicals, including discontinuous chlorination, contribute to poor quality drinking water. In addition to fluoride and nitrate, parameters of concern include ammonia, high mineralisation, turbidity, organoleptic properties, H₂S, iron, strontium, sulphate and chloride.

Nitrate exceeding the standard of 45 mg l⁻¹ nitrate:

Year	No samples	Exceeding standard (%)	Population affected (%)
1993	11 836	33.9	55.0
1994	11 858	38.1	55.7
1995	11 503	42.1	56.6
1996	11 013	36.8	57.4

Fluoride exceeding the standard of 1.2 mg l⁻¹:

Year	No samples	Exceeding standard (%)	Population affected (%)
1993	3 896	12.9	~ 35
1994	4 407	14.2	~ 35
1995	3 859	12	~ 35
1996	3 289	15.3	~ 35

MONACO

SUMMARY

Monaco has two water treatment works, where routine monitoring is carried out, supplying 100% of the population. There are neither problems of providing continuous supply, nor any monitoring difficulties, or water quality problems.

INSTITUTIONAL RESPONSIBILITIES

Legal responsibilities for drinking water supply are shared between the Ministry and private water companies. Operational management is delegated to private water companies. There are two companies supplying 100% of the population.

MONITORING OF DRINKING WATER QUALITY

The Ministry or other government department and private water companies are responsible for routine monitoring of surface water and groundwater sources and public supplies, without any separate compliance monitoring. The extent of monitoring is based on the size of population supplied. One hundred percent of the population are served by two water treatment works where routine monitoring is carried out, with 200 samples processed per annum. There are no monitoring problems.

Assessment of drinking water quality is based on WHO Guidelines, EU and national standards. The frequency and type of parameters monitored are under minimum EU requirements, plus additional, national parameters. It appears that there are no measures planned/needed in case of non-compliance, because there are no exceedences.

Drinking water quality data from public supplies are collected from consumer taps, treatment works and intakes from source waters. No reports on this data are produced and the public cannot access any information on water quality.

DRINKING WATER SUPPLY AND QUALITY

Monaco has neither problems of providing continuous supply, nor any monitoring difficulties or water quality problems.

NORWAY

SUMMARY

Although a non-EU country, drinking water legislation has been adjusted to EU standards. Water supply is the responsibility of municipalities/local authorities which also carry out operational management, although there are some small community co-operatives and numerous private suppliers serving small communities. There are no problems in providing continuous supply, but there are some water quality problems, mainly due to natural geological/biological conditions and land use. Treatment is inadequate at many small private water works, particularly colour removal and disinfection.

INSTITUTIONAL RESPONSIBILITIES

Although Norway has rejected EU membership, its participation in the European Economic Area means that it must conform with EU water quality standards. Recent legislative changes have focused on regulating drinking water quality (1995). All water works have received guidelines based on EU standards.

The Ministry of Social Affairs and Norwegian Board of Health have overall responsibility for drinking water quality. Provision of water services is the responsibility of municipalities/local authorities which also carry out operational management, although there are some small community co-operatives and numerous private suppliers serving small communities. Local health authorities have direct responsibility for compliance control of drinking water quality.

MONITORING OF DRINKING WATER QUALITY

Municipalities are responsible for routine monitoring of drinking water quality from public supplies and including raw water sources (surface water, groundwater). Private water companies undertake routine monitoring of private supplies. Local health authorities carry out compliance monitoring of public and private supplies.

The extent of monitoring is based on the size of population supplied and the volume of water produced. Although routine monitoring takes place at all of the 600 main treatment works (public supplies), many small water works (private supplies) have not implemented the full monitoring programme specified in the national Regulations.

The assessment of drinking water quality is based on WHO Guidelines, EU standards and national standards. The frequency and type of parameters monitored are under minimum EU requirements, plus additional national standards.

When non-compliance occurs, measures include prioritisation of drinking water quality improvements and/or allocation of public funds to construct installations.

Drinking water quality data from public and private supplies are collected at consumer taps, treatment works and intakes from source waters. The public can access this information since it is available for inspection. Reports on the quality of drinking water are produced at regional level.

DRINKING WATER SUPPLY AND QUALITY

There are no problems in providing continuous supply, but there are some water quality problems, concerning microbiological quality (total and faecal coliforms), colour (humic substances giving rise to disinfection by-products), and pH (leading to corrosion of pipes).

Treatment is inadequate at many small private water works, particularly colour removal and disinfection; suppliers do not seem to understand the need for disinfection, instead trying to keep charges as low as possible.

Raw water problems are mainly due to land use and geological/biological conditions.

ROMANIA

SUMMARY

Romania is a second wave EU accession country and actively engaged in adjusting its environmental legislation to EU requirements. Public water supply is organised by municipalities and local authorities through autonomous (some private) companies, with supervision of water quality being the overall responsibility of the Ministry of Health. It has severe problems of drinking water supply (discontinuous supply affecting much of the population) and quality due to water source pollution (agricultural and industrial), inadequate treatment, storage and distribution facilities, shortage of trained personnel, lack of financial resources etc.

INSTITUTIONAL RESPONSIBILITIES

Romania is a former socialist (USSR) state in the second wave of accession to the EU.

Its water legislation, whilst still in a state of flux, is progressively being brought in line with that of the EU. Although it is not a first wave accession country there appears to be a relatively high commitment to this improvement process.

Recent legislation has been implemented on the abstraction, treatment and supply of drinking water (Government Decision 101/1997).

The Ministry of Waters, Forests and Environmental Protection is responsible for:

- developing water management policy and implementing it via the 12 basin branches of its Water Authority;
- the Environmental Protection Agency and its regional offices.

There is no overall national framework for price and service regulation, this being the responsibility of the municipalities.

Municipalities/local authorities are responsible for drinking water supply and its operational management. Water supply and sewerage are fully integrated and organised through autonomous (some private) companies and some regional associations serving several towns. The Ministry of Public Works and Regional Planning is responsible for national policy and strategy of water supply, treatment and sewerage, whilst the Ministry of Health has overall responsibility for supervising drinking water quality.

MONITORING OF DRINKING WATER QUALITY

Routine monitoring of raw waters and drinking water (public and private supplies) is carried out by water companies, whilst compliance monitoring of public and private supplies is carried out by units under the control of the Ministry of Health.

The extent of monitoring is based on the size of the population supplied (compliance monitoring) and the volume of water produced (routine monitoring). Assessment of drinking water quality is based on national standards, which also prescribe sampling frequency and the parameters to be monitored. Parameters monitored regularly in public supplies include microbiological indicators, pathological organisms, pesticides, THMs, taste and odour (private supplies: taste and odour only).

There are problems in monitoring drinking water quality, such as lack of equipment, inadequate co-ordination between laboratory and operational management, and scarcity of well trained personnel, especially for microbiological monitoring.

Where non-compliance is detected, measures include prioritisation of improvements, prosecution of suppliers and/or allocation of public funds to construct installations.

Drinking water quality data are collected at treatment works, consumer taps and intakes from source waters. Drinking water quality reports are produced at national and regional levels. The public can access this information; it is available free of charge or may be inspected.

DRINKING WATER SUPPLY AND QUALITY

Romania has major problems in achieving a continuous water supply of drinking water (see Table below). This is mainly due to urban development without adequate sanitation facilities, deficiencies in network systems, low storage capacity and financial difficulties.

Year	Discontinuous supply (h/day)	Population affected (%)	Localities affected
1985-1989	<8 h/day	35	30% of total urban localities
1990-1995	<8 h/day	50	22% of total urban localities
1993	<8 h/day 8-12 h/day >12 h/day	36.6 10.85 6.3	

Water sources have pollution problems caused by agricultural activities (i.e. organochlorine pesticides, triazines). Such substances are frequently found at levels of concern in drinking water. Industrial and domestic discharges are responsible for high levels of organic substances (COD), algal blooms, heavy metals, ammonia.

Other factors, such as low treatment efficiency, inadequate or non-availability of equipment, lack of adequately trained human resources, hyperchlorination or inadequate chlorination systems, overloaded treatment capacities and financial considerations, contribute to the quality of drinking water. The parameters most frequently giving rise to concern in drinking water are organochlorine pesticides, triazines, organic substances, algae (algal toxins), heavy metals, ammonia, residual chlorine.

Total coliform exceedences in public supplies (standard: 0/100 ml) affected an estimated 15-18% (1.5-2 million) of the population each year from 1991-1995, with no apparent improvement in this time period. Faecal coliform exceedence (standard 0/100 ml) affected an estimated 8.3%, 8.1%, 11.1% and 6.6% in 1991, 1992, 1994 and 1995, respectively.

A survey of organochlorine insecticides and triazine herbicides in source waters and drinking water (public supplies and private wells in rural areas) across Romania during 1988-1996 revealed non-compliance (standard: $0.1 \mu\text{g l}^{-1}$) of between 73%-100% of samples with mean values of $0.82 \mu\text{g l}^{-1}$ - $10 \mu\text{g l}^{-1}$. Surveys of drinking waters alone showed similarly high levels of non-compliance and high concentrations of pesticides. The most frequently detected substances were: α -, β -, and γ -HCH, Aldrin, Dieldrin, Heptachlor, pp-DDE, pp-DDT, Atrazine, Simazine, Propazine.

Nitrate exceeded the standard of 45 mg l^{-1} in 1.26%, 1.58%, 1.7% and 1.64% of samples taken (sample size: 40-50 000 each year) in 1986, 1987, 1988 and 1989, respectively, in each case affecting about 1.1% of the population.

SERBIA (FR YUGOSLAVIA)

SUMMARY

The Ministry appears to be responsible for all aspects of water supply. There are major problems in providing a continuous supply as well as achieving good water quality and adequate monitoring. The main problems are microbiological quality, nitrate and nitrite.

INSTITUTIONAL RESPONSIBILITIES

Legal responsibilities and operational management of drinking water supply are at ministerial level. The Ministry also has direct responsibilities for compliance supervision (public supplies). There are 208 water treatment works.

MONITORING OF DRINKING WATER QUALITY

The ministry carries out routine monitoring of water provided from all public supplies and surface water and groundwater sources. The extent of monitoring is based on the size of the population supplied. However, monitoring may not always be adequate because of financial and technical problems. It is estimated that 35% of the population are supplied from treatment works where routine monitoring is carried out; about 5600 samples are processed monthly from public supplies.

The assessment of drinking water quality is based on EU and national standards. The frequency and type of parameters monitored are under minimum EU requirements plus additional parameters. These include daily examination of microbiological parameters including pathological organisms, and taste and odour, whereas pesticides, solvents, THMs and other disinfection by-products, and PAH analyses are carried out monthly or on rare occasions, and heavy metals are not analysed.

When non-compliance occurs, measures include prioritisation of drinking water quality improvements, prosecution of suppliers and/or allocation of public funds to construct installations.

Drinking water quality data are collected at consumer taps, raw water sources are also monitored. Reports on the quality of drinking water have been produced annually for the past 20 years at national and regional level. The public can access the information since reports are published and available free and data are available for inspection.

DRINKING WATER SUPPLY AND QUALITY

There are major problems in providing a continuous supply. There are areas which do not have a continuous supply. Interruptions of supply are often seasonal and depending on weather conditions, they are most frequent in urban areas. The main reasons for

Serbia (Fr Yugoslavia)

interruptions are water shortage, poor availability of equipment and financial considerations.

There are also major problems concerning drinking water quality. Water sources are contaminated from agricultural activities and industrial discharges. Factors such as financial considerations, poor availability of equipment and chemicals, shortage of human resources, and discontinuous chlorination contribute to poor quality of drinking water, resulting in non-compliance with parameters such as total and faecal coliforms (absence of chlorine residual), and physico-chemical parameters, particularly nitrate and nitrite.

SLOVAKIA

SUMMARY

Legal responsibilities for drinking water supply are at ministerial level whilst operational management is delegated to state owned water supply companies. The Hygienic Service has direct responsibility for compliance supervision. Slovakia has major difficulties in achieving a continuous water supply and in achieving high water quality. This is mainly due to the pollution of water sources, inadequate treatment and poor state of the distribution network. The main cause of concern is the microbiological quality of drinking water.

INSTITUTIONAL RESPONSIBILITIES

Legal responsibilities for drinking water supply are at ministerial level (Ministry of Soil Management, Department of Water Management), whilst the operational management is delegated to state owned water supply companies. Seventy-nine point seven percent of the population are connected to treatment works (a total of 118). The Hygienic Service has direct responsibility for compliance supervision.

MONITORING OF DRINKING WATER QUALITY

The Water Works and Hygienic Service have shared responsibilities for routine monitoring of all surface water, groundwater and drinking water (public and private supplies). The extent of monitoring is based on the volume of water produced and the size of the population supplied. Routine monitoring is carried out at all 118 water treatment works which serve 79.7 % of the population.

Assessment of drinking water quality is based on national standards (Slovak Standard STN 75 7211 - Surveillance of the Quality). The frequency and type of parameters monitored are under minimum EU requirements, although additional parameters are measured upon request from the competent authorities. However, there are problems in monitoring drinking water (i.e. not enough special analyses, such as heavy metals and organic pollutants).

When non-compliance occurs, priorities are set for drinking water quality improvements.

Drinking water quality data from public supplies are collected at treatment works, consumer taps and intakes from source waters. The public can access this information which is available for inspection, as well as through research reports and publications. Reports on the quality are produced at national level.

DRINKING WATER SUPPLY AND QUALITY

Slovakia has major difficulties in achieving a continuous water supply and in achieving high water quality. This is mainly due to the pollution of water sources, inadequate treatment and poor state of the distribution network. The main cause of concern is the microbiological quality of drinking water (faecal streptococci, live organisms, total and faecal coliforms), although other parameters of concern include ammonia, nitrate, manganese and iron.

Pesticides do not present any problems (in the period 1994-1996, 99,9 % of results from 5000 determinations and 21 parameters complied with the Slovak Standard value), nor did any samples exceed the fluoride standard (1.5 mg l^{-1}) or the arsenic standard (0.05 mg l^{-1}).

Examples given (public supplies from all sources):

Total coliforms (standard 0/100 ml):

Year	No of samples	Exceedence (%)	Max. number/ml
1994	5 890	9.25	100
1995	11 510	7.8	120
1996	12 250	7.75	50

Faecal coliforms (standard 0/100 ml):

Year	No of samples	Exceedence (%)	Max. number/ml
1994	2 950	3.9	50
1995	8 250	2.63	90
1996	11 125	2.43	115

Nitrate (standard 50 mg l^{-1} nitrate):

Year	No of samples	Exceedence (%)	Population affected	Population affected (%)
1994	4 890	1.55	115 940	2.86
1995	9 395	1.09	42 830	1.05
1996	10 160	0.71	95 180	2.31

SLOVENIA

SUMMARY

Responsibility for drinking water supply lies with municipal/local authorities which also carry out operational management and monitoring of drinking water quality. For organisational and financial reasons, there are considerable problems of supply, with interruptions affecting about 120 000 population, mainly during the summer, and with higher frequency in rural areas. Major quality problems include microbiological, nitrate and pesticides, due to agricultural and industrial pollution of water sources and inadequate treatment technology. There are many small works (supplying 16% of the population) where little or no drinking water quality monitoring takes place.

INSTITUTIONAL RESPONSIBILITIES

The Ministry of Environmental and Physical Planning has overall responsibility for water supply, although legal responsibilities for drinking water supply are delegated to municipal/local authorities which also carry out operational management.

MONITORING OF DRINKING WATER QUALITY

Municipalities carry out routine monitoring of raw water sources (surface water and groundwater) and drinking water quality. There is no separate compliance supervision.

The extent of monitoring is based on size of the population supplied and volume of water produced. Nine hundred and fifty-nine water treatment works serve 84% of the population; adequate monitoring is carried out only at the larger works (447), little or no monitoring is carried out at the remaining, large number of small works and private wells, due to lack of resources.

Assessment of drinking water quality is based on national standards which are equal to the revised (draft) EU Drinking Water Directive, for example including acrylamide, epichlorohydrin, and bromate; as well as the reduced MACs for arsenic and lead ($10 \mu\text{g l}^{-1}$). The parameters measured and sampling frequency correspond to minimum EU requirements plus additional sampling where considered necessary.

In case of non-compliance, measures focus on prioritisation of drinking water quality improvements.

Drinking water quality data are collected at treatment works, consumer taps and intakes from source waters. Reports are produced at national and regional level, and data are available to the public for inspection.

DRINKING WATER SUPPLY AND QUALITY

Slovenia has problems with continuous water supply. Interruptions affect almost 120 000 people, mainly during the summer periods, and are particularly frequent in rural areas. This is predominantly due to financial and organisational problems.

In addition there is a shortage of human resources and lack of sophisticated treatment technology to ensure high quality drinking water supplies. The main problems relate to microbiological contamination, nitrate and pesticides, resulting from agricultural and industrial pollution of water sources.

Examples provided in the questionnaire:

The standard for pesticides corresponds to EU requirements (0.1 $\mu\text{g l}^{-1}$ individual and 0.5 $\mu\text{g l}^{-1}$ total pesticides). Atrazine and other triazines are found most frequently above these standards, although, in general, levels and number of waterworks affected are considered to be decreasing.

Year	Atrazine concentration range ($\mu\text{g l}^{-1}$)	Water works affected
1996	0.18 – 0.54	few
1997	0.12 – 1.37	2

For nitrate, the following results were reported (standard 50 mg l^{-1} nitrate):

Year	No samples analysed	Percentage exceeding standard (50-150 mg l^{-1})	Population affected	Population affected (%)
1995	13 375	2.4	112 498	6
1996	12 611	1.2	89 928	5

SWITZERLAND

SUMMARY

Switzerland is a Confederation where responsibilities for water supply are divided among Cantonal authorities (implementation of Federal legislation) and communities (provision of water supply and quality monitoring). There are no major problems of adequate supply or quality, though minor problems occur due to agricultural and industrial pollution of water sources (microbiological, nitrate, chloride, pesticides, chlorinated hydrocarbons and occasionally EDTA).

INSTITUTIONAL RESPONSIBILITIES

Switzerland is a Confederation with a high degree of autonomy of the individual 'States' (Cantons). Each Canton has a written constitution and a government and legislative assembly.

The Federal Office for Public Health has overall responsibility for drinking water quality legislation. The Federal Law on Foods and Basic Commodities and Ordinance 1936 (as amended) lay down drinking water quality standards and standards for equipment and methods used in water treatment.

Responsibility for implementation of the legislation lies at Cantonal level where, due to the Federal nature of the country, administrations vary from Canton to Canton; overseeing of drinking water quality normally lies with Cantonal Health Administrations or Cantonal Laboratories.

Communities have the legal responsibility to supply drinking water. Operational management may also be carried out directly by the communities or be delegated to enterprises, co-operatives or associations; increasingly it is also becoming organised jointly by several communities (group supplies). In addition, there are numerous private supplies in rural areas, but this relates to a small fraction of the total population.

MONITORING OF DRINKING WATER QUALITY

Communities are responsible for routine monitoring of surface water, groundwater and drinking water quality (public and private supplies). There is no separate compliance monitoring.

Routine monitoring is carried out at all of the 43 222 water treatment works, i.e. 100% of the population are served with water which is regularly monitored.

Assessment of drinking water quality is based on national standards, although the frequency and parameters to be monitored are determined by the Cantonal authorities.

When non-compliance occurs, decisions may be taken on the basis of prioritisation of water quality improvements and the results of regular monitoring (i.e. protection of sources, restriction of agricultural practices or closing of a supply). Decisions can also include prosecution of suppliers. In some cases, e.g. nitrate problems, waters may be mixed to achieve compliance.

Drinking water quality data are collected at source water intakes, treatment works, consumer taps and private supplies. The public can access the data which are available for inspection. Reports on the quality are produced at regional level (Cantons). In addition, the Swiss Gas and Water Association publishes annual statistics of water supply and quality on behalf of its members (covering 40% of water supply in Switzerland).

DRINKING WATER SUPPLY AND QUALITY

There are no major problems concerning continuous supply, quality monitoring or achieving high quality drinking water. Groundwaters and spring waters provide 82% of water supplies; almost half of such supplies need no treatment at all, whilst the remainder (mainly large suppliers) use disinfection only as a precautionary measure.

However, there are some incidents of non-compliance, mainly with respect to microbiological quality (3975 samples in 1996), and less frequently, chemical parameters (1096 samples in 1996). The chemical substances of concern include mainly nitrate, chloride, pesticides (particularly atrazine), volatile hydrocarbons and, occasionally, EDTA. The microbiological problems affect almost exclusively small supplies where little or no treatment is used.

Contamination of water sources is predominantly due to agricultural and industrial activities.

SWEDEN

SUMMARY

Sweden is a relatively new member of the EU with its water legislation in line with EU requirements. The provision of water supply services is the responsibility of the 290 local authorities, which also carry out routine and compliance monitoring. There are no problems in achieving a continuous supply, but there are problems in achieving high quality water, due to cuts in personnel at water works and inadequate water source protection (groundwater and surface water) as well as geological conditions. The main parameters of concern are: microbiological, radon, fluoride, arsenic, nitrate, iron and manganese, and, potentially, algal toxins.

INSTITUTIONAL RESPONSIBILITIES

Sweden is a relatively new member of the EU with its water legislation in line with EU requirements.

Legal responsibilities for drinking water supply are shared between the Ministry and municipalities/local authorities. The National Food Administration is responsible for setting standards for public and large private supplies, whilst the National Board of Health and Welfare is responsible for small private supplies. The provision of water supply services is the responsibility of the 290 local authorities, which also carry out routine and compliance monitoring. Operational management of water supply is also carried out by local authorities, with the exception of the major urban areas of Stockholm, Goteborg and Malmo, where it is managed by regional associations.

MONITORING OF DRINKING WATER QUALITY

Municipalities are responsible for routine monitoring from all public supplies and including raw water sources (surface water and groundwater), as well as compliance monitoring of public and private supplies. No routine monitoring is carried out at small private wells.

The extent of monitoring public supplies is based on the population supplied, and for private supplies the volume of water supplied. Assessment of drinking water quality is based on EU and national standards which include additional (e.g. radon) or stricter (arsenic 0.01 mg l^{-1} , corresponding to the draft revised EU Directive) standards. The frequency and type of parameters monitored are under minimum EU requirements plus additional national standards (e.g. radon). However, monitoring of certain parameters (e.g. pesticides) may be inadequate due to high costs or other reasons. For example arsenic is not routinely measured although a survey in 1986 indicated high occurrence above the standard, probably affecting mainly private wells.

Routine monitoring is carried out at all of the 4200 treatment works (about 50% public supplies and 50% private/small community supplies), supplying 85-90% of the population. The samples analysed per annum comprise 68 000 from public supplies, and 5400 from private supplies (total 73 400).

Long-term planning decisions due to non-compliance problems involve prioritisation/implementation of improvement measures.

Drinking water quality data are obtained from treatment works, consumer taps, source water intakes, and private supplies (only the larger ones). The public can access the data which are available for inspection. Reports are produced at national level, but these are only general overviews, containing no detailed results.

DRINKING WATER SUPPLY AND QUALITY

There are no problems in achieving a continuous supply, but there are problems in achieving high quality water, due to cuts in personnel at water works and inadequate water source protection (groundwater and surface water) as well as geological conditions.

The parameters most frequently found at levels of concern are:

- microbiology - due to inadequate source protection and treatment;
- iron and manganese - due to geological conditions and inappropriate treatment;
- radon, fluoride (arsenic mainly private wells, inadequate information) - due to geological conditions and inadequate treatment.;
- possible other problems include algal toxins - due to eutrophication and insufficient protection of surface waters.

Pesticides are monitored in occasional surveys. Substances of concern (exceeding drinking water standard (detection limit) in the past were atrazine, desethylatrazine and 2,6-dichlorobenzamide, but these have now been banned. Representative data are not available, but in general, pesticides are no longer thought to be a major problem.

Examples provided:

About 3% of the 4200 water works supply water which does not meet **microbiological standards** (total coliforms, *E. Coli*, total heterotrophes).

In 1995 an estimated 0.4% (35 000) of the population received water containing **nitrate** above the standard of 50 mg l⁻¹ (private wells in the Southern part of the country).

In 1995 an estimated 2.4% (200 000) of the population received water containing **fluoride** (of natural origin) above the standard of 1.3 mg l⁻¹.

In a survey in 1986, 17 of 102 samples, taken from all types of supplies, exceeded the **arsenic** standard of 0.01 mg l⁻¹.

The **radon** standard came into force on 1 July 1997; the recommended limit is 100 Bq l⁻¹, the maximum health based limit is 1000 Bq l⁻¹ (above this level, water is considered unfit for human consumption). There are problems with this parameter, particularly in private wells and small public supplies, see below:

Radon level (Bq l⁻¹)	No of samples	Percentage samples
>1 000	28	3
100-999	366	43
<100	460	54

THE NETHERLANDS

SUMMARY

The Netherlands are part of the European Union. Overall responsibility for water supply lies at Ministerial level whilst publicly owned water companies are providing the water services. Almost the entire population are connected to public water supplies; water quality of public supplies are routinely monitored. There are no difficulties concerning continuous supply, nor major water quality problems.

INSTITUTIONAL RESPONSIBILITIES

The Netherlands are part of the European Union with its national legislation in line with European Directives. Overall responsibility for water supply and quality lies at Ministerial level, primarily the Ministry of Housing, Physical Planning and Environment (VROM). The responsibility for the provision of water services lies with the mainly publicly owned, non-profit making water companies, their stakeholders being local and regional (provincial) government. Traditionally, the supply of drinking water has been organised through a large number of municipal and regional water companies; however, the highly fragmented administrative structure has, in recent years, been subjected to a process of reorganisation and rationalisation aimed at achieving a reduction in the number of water supply companies from 86 to about 15-20. Almost the entire population are connected to public water supplies.

The legal framework is clearly defined and in line with EU requirements. Drinking water legislation contains not only standards for final treated water, but also legally binding standards for raw water intakes.

There are five Regional Inspectorates for the Environment, each with one Public Health Inspector responsible for overseeing that water companies comply with the legal requirements concerning the supply and quality of drinking water. One of the Public Health Inspectors co-ordinates the activities of all Regional Public Health Inspectors with the aim of achieving consistency of approach throughout the country, and liaises with the Ministry.

MONITORING OF DRINKING WATER QUALITY

The water companies carry out routine and compliance monitoring of raw water intakes (groundwater and surface water) and public water supplies (self-monitoring) and submit the results to the Public Health Inspector who is responsible for ensuring that the legal requirements (quantity and quality of supplies) are met.

The extent of monitoring is based on the population served and volume of water supplied. Treated water samples are taken from treatment works and consumers' taps. There are no monitoring problems.

Assessment of drinking water quality is based on national (EU plus some additional) standards. Monitoring frequencies are also based on EU and national requirements.

In case of non-compliance, measures focus on remediation and improvement programmes undertaken by the water companies and supervised by the Public Health Inspector. The emphasis is on discussion and mutual agreement between water company management and Public Health Inspectors. The Public Health Inspector can request improvement measures even if no standards are breached, if there is cause for concern; e.g. a potential risk to public health.

Drinking water quality data are published at national level and available free to the public. Some data may be disseminated by water companies voluntarily in the interest of customer relations, but varies from company to company.

DRINKING WATER SUPPLY AND QUALITY

There are no problems providing a continuous supply; most of the population are connected to public water supply. There are no significant water quality problems, apart from relatively minor breaches of standards; these include mainly iron, manganese, pesticides (in particular the pesticides bentazone, atrazine, bromacil, MCP, and diuron; and AMPA which may be a pesticide degradation product), and nitrate. The latter, however, is found, at certain locations, above 25 mg l⁻¹ but below the EU limit of 50 mg l⁻¹, but still considered to be of concern.

TURKEY

SUMMARY

The responsibilities for water supply in Turkey are shared between national and local authorities, and private water companies. Turkey has major problems of continuous supply, as well as drinking water quality problems due to industrial and agricultural contamination of raw water supplies and for geological reasons.

INSTITUTIONAL RESPONSIBILITIES

Legal responsibilities and operational management of drinking water supply are shared through different institutions at different levels, national (Ministry and other government departments), municipal (municipalities and local authorities) and private water companies. The Ministry has direct responsibility for compliance supervision of public and private supplies.

MONITORING OF DRINKING WATER QUALITY

Ministry and other government departments are responsible for routine monitoring of drinking water quality (surface water, ground water and drinking water, including public and private supplies); public supplies are also monitored by municipal/local authorities. Compliance monitoring is carried out by government departments.

The extent of this monitoring is based on the size of population supplied.

Assessment of drinking water quality is broadly based on WHO Guidelines, EU and national standards. The frequency and type of parameters monitored are based on minimum EU requirements.

In the case of non-compliance, actions include prioritisation of drinking water quality improvement, and/or prosecution of suppliers. During an incident, the licence to supply drinking water may be withdrawn and water sources may be closed.

Drinking water quality data are obtained for raw water intakes, at treatment works, and consumer taps. No reports are produced, no data are available to the public.

DRINKING WATER SUPPLY AND QUALITY

Turkey has major problems with continuous water supply.

Water quality problems include microbiological contamination (total coliforms, faecal coliforms, aerobic mesophilic bacteria) as well as nitrate (standard: 25-45 mg l⁻¹), nitrite, and organic substances (not specified). The problems are due to industrial discharges and agricultural activities, as well as geological reasons.

UK - ENGLAND AND WALES

SUMMARY

England and Wales are part of the UK which is an EU Member State and have a fully privatised water industry. Provision of public supplies is the responsibility of the private water companies which are supervised by an independent regulator (Drinking Water Inspectorate, DETR). Private supplies are the responsibility of Local Authorities. There are no major problems of continuous supply, quality monitoring or drinking water quality, although some compliance problems occur, mainly for lead, pesticides, nitrate, iron and PAH.

INSTITUTIONAL RESPONSIBILITIES

England & Wales has a fully privatised water industry. Legal responsibilities are shared between the Ministry (Department of the Environment, Transport and the Regions (DETR)) (legislation and regulation), the private water companies (supply) and Local Authorities (private supplies). Operational management of public supplies is the responsibility of the private water companies, and Local Authorities are responsible for private supplies. Compliance supervision is carried out by the Drinking Water Inspectorate (DWI), the independent regulator within the Ministry.

The legal and regulatory systems underpinning the provision of water services in England & Wales are clear and robust. Under its obligations of EU Membership, legislation in England & Wales has been brought in line with EU requirements. The legislative base is predominantly provided by the Water Industry Act 1991 and, to a lesser extent, the Water Resources Act 1991 and Environment Act 1995. Environmental water quality is covered by the Water Resources Act 1991 and the Environmental Protection Act 1990 and is regulated by the Environment Agency. Drinking water quality is covered by the 'Water Supply (Water Quality) Regulations 1989' and regulated by the DWI, whilst financial regulation is the duty of the Office of Water Services (OFWAT). Private supplies are subject to the 'Private Water Supplies Regulations 1991' and compliance supervision is the responsibility of local authorities.

MONITORING OF DRINKING WATER QUALITY

Routine monitoring of public supplies (raw surface water and groundwater intakes and final, treated water) is carried out by the water companies, whilst Local Authorities carry out routine monitoring of private supplies. The Environment Agency has overall responsibility for the quality of fresh waters (surface water, groundwater) including monitoring. Compliance monitoring of public supplies is the overall responsibility of the DWI, but this is carried out through self-monitoring by the water companies and inspection of the water companies and auditing of results by DWI. A limited amount of

monitoring may also be carried out by the Local Authorities which are also responsible for compliance monitoring of private supplies.

The extent of monitoring is based on the size of population and the volume of water produced (supply zones). There are no monitoring problems; 99% of the population are served by public supplies (1533 treatment works) where routine monitoring is carried out (3 million tests per annum).

Assessment of drinking water quality is based on EU and national standards. The frequency and type of parameters monitored are under minimum EU requirements, plus additional, national standards.

Long-term decisions based on non-compliance focus on planning and implementing drinking water quality improvement measures (enforced by DWI).

Drinking water quality data are collected at treatment works (operational monitoring) and at consumer taps (legal requirement). Reports on the quality are produced at national level (DWI) and by the water companies. The national report is published annually for sale, water company reports are available to the public free of charge. Water companies also have to make their water quality data available for inspection (public records).

DRINKING WATER SUPPLY AND QUALITY

There are no major problems concerning continuous supply, although there are short term, temporary interruptions due to distribution system maintenance works. In some parts of the country, supply cannot always meet demand during dry, hot summers and water companies may have to urge consumers to conserve water and sometimes it is necessary to impose a hose pipe ban (garden watering) but supplies are always provided.

There are no major problems in achieving consistently high water quality. However, there are some non-compliance problems, most frequently concerning the following:

1. Lead - due to lead pipes (some water company distribution systems, but mainly household pipes) - this is usually addressed through treatment to reduce plumbosolvency, but lead replacement programmes are needed (especially to meet the 10 µg l⁻¹ limit of the revised (not yet adopted) EU Directive).
2. Pesticides - due to agricultural and non-agricultural use; addressed through treatment and ban on atrazine and simazine.
3. Nitrate - due to agriculture and some sewage effluent; addressed through treatment and Code of Good Agricultural Practice.
4. Iron - due to condition of distribution system; addressed through pipe relining or replacement.
5. PAH - due to condition of distribution system; addressed through pipe relining or replacement.

Examples provided (public supplies from all sources):

Total coliforms at treatment works (standard 0/100 ml): In the years 1990-1996 non-compliance ranged from 0.5 to 0.2% (clearly decreasing over the years) of about 200 000 samples per annum.

Total coliforms at service reservoirs (standard 0/100 ml for 95% of samples): In the years 1990-1996 non-compliance ranged from 1.1 to 0.3% (clearly decreasing over the years) of about 260 000 samples per annum.

Total coliforms at consumers taps (standard 0/100 ml for 95% of samples in each supply zone): In the years 1990-1996 non-compliance ranged from 2.0 to 0.7% (clearly decreasing over the years) of about 160 000 samples per annum.

Faecal coliforms at treatment works (standard 0/100 ml): In the years 1990-1996 non-compliance ranged from 0.1 to <0.1% (all <0.1% since 1992) of about 200 000 samples per annum.

Faecal coliforms at service reservoirs (standard 0/100 ml): In the years 1990-1996 non-compliance ranged from 0.2 to <0.1% (decreasing over the years) of about 260 000 samples per annum.

Faecal coliforms at consumers taps (standard 0/100 ml): In the years 1990-1996 non-compliance ranged from 0.2 to <0.1% (decreasing over the years) of about 160 000 samples per annum.

Nitrate (standard 50 mg l⁻¹ as nitrate): In the years 1990-1996 non-compliance ranged from 2.8 to 0.1% (clearly decreasing over the years) of about 40 000 samples per annum.

Pesticides (standard 0.1 µg l⁻¹ individual and 0.5 µg l⁻¹ total): In the years 1990-1996 non-compliance ranged from 3.0 to 0.2% (clearly decreasing over the years) of about 1 million samples per annum. The most frequently found above the standard were triazines (Simazine, Atrazine), urons (Chlorotoluron, Isoproturon, Diuron), and phenoxy acids (MCPA, Mecoprop, 2,4-D).

Lead (standard 50 µg l⁻¹) at consumer's taps: In the years 1990-1996 non-compliance ranged from 2.2-3.4% (no clear trend) of about 40 000-60 000 samples per annum. Using the future standard of 10 µg l⁻¹, exceedence would have been in the range 16.3-23.3%.

Arsenic (standard 50 µg l⁻¹) and **fluoride** (standard 1.5 mg l⁻¹): zero non-compliance in 1995 (3430 and 9634 samples respectively).

No significant exceedences were detected for **trichloroethylene, tetrachloroethylene, carbon tetrachloride or heavy metals** (other than lead).

UK - NORTHERN IRELAND

SUMMARY

Northern Ireland is part of the United Kingdom but with increasing autonomy and separate legal and regulatory frameworks. Responsibilities for water supplies are with the ministry; 98% of the population are connected to public water supplies; water quality of public and private supplies are routinely monitored. There are no major problems of providing continuous supply, nor major water quality problems. Minor problems include THMs, iron, aluminium, pesticides, lead, and microbiological quality.

INSTITUTIONAL RESPONSIBILITIES

Northern Ireland is part of the United Kingdom (EU Member State) but with increasing autonomy and separate legal and regulatory frameworks. Water supply is the responsibility of the Ministry or water services departments which also carry out operational management. There are 81 water treatment works serving 98% of the population; the remainder have private supplies. Supervision of drinking water quality (public and private supplies) is the responsibility of the Drinking Water Inspectorate.

MONITORING OF DRINKING WATER QUALITY

The Ministry or other government departments are responsible for routine monitoring of surface water and groundwater sources, as well as routine and compliance monitoring of public and private water supplies.

The extent of monitoring is based on the size of the population supplied and the volume of water produced. Routine monitoring is carried out at all of the 81 water treatment works; i.e. monitoring covers 98% of the population. Some 107 100 samples from public supplies are processed per annum, and 7000 from private supplies (total 114 100 samples per annum). There are no monitoring problems; a statutory scheme for sampling water received by consumers is in operation.

Assessment of drinking water quality is based on national (EU plus some additional) standards. The frequency and type of parameters monitored are under minimum EU requirements, plus additional, national parameters.

In case of non-compliance, measures include prioritisation of drinking water quality improvements and allocation of public funds to construct or improve installations (ongoing water treatment and distribution system investment programme).

Drinking water quality data from public supplies are collected from consumer taps (most samples, most parameters), treatment works and intakes from source waters, and from

consumers' taps from private supplies. Reports are produced at national level; these are published and available free. Data are also available to the public for inspection.

DRINKING WATER SUPPLY AND QUALITY

There are no problems of providing continuous supply. Minor interruptions occur occasionally due to localised problems (burst mains, repair or maintenance works); such interruptions lasting more than 12 hours affect on average less than 0.3% of the population. Most supplies have stand-by generators in case the public electricity supply should fail. Although there are no water shortages, systems are flexible, allowing, in most cases, switching of supplies to alternative sources, if necessary.

There are no major water quality problems, although some non-compliance with standards does occur. 98.19% of all samples collected from consumers' taps meet the legal requirements, 99.31% meeting the key microbiological standards. The most frequently detected contravention of standards concern THMs (produced from reaction of chlorine with naturally occurring organic substances in raw waters), iron (due to geological conditions, also corrosion of distribution system) and aluminium (due to geological conditions, and from its use in water treatment). Pesticides also exceed the standard at times, most frequently MCPA, Mecoprop, Isoproturon, Simazine, and Atrazine), and so does lead (from lead pipes).

Examples provided:

Total coliforms (standard 0/100 ml): 1.12% of 43 271 samples in 1995, and 0.87% of 34 627 samples in 1996 exceeded the standard.

Faecal coliforms (standard 0/100 ml): 0.21% of 43 271 samples in 1995, and 0.23% of 34 627 samples in 1996 exceeded the standard.

Pesticides (standard 0.1 $\mu\text{g l}^{-1}$ individual, 0.5 $\mu\text{g l}^{-1}$ total): 0.14% of 28 880 determinations in 1995, and 0.08% of 11 079 determinations in 1996 exceeded the standard.

Lead (standard 50 $\mu\text{g l}^{-1}$) exceedences: in 3.15% of 889 samples in 1995, and 2.56% of 625 samples in 1995.

Nitrate (standard 50 mg l^{-1}): zero non-compliance in 1995 (1216 samples), one of 851 samples exceeding standard in 1996 ('one off' exceedence) affecting over 20 000 consumers (or 1%).

Fluoride (standard 1.5 mg l^{-1}) and **arsenic** (standard 0.05 mg l^{-1}): zero non-compliance in 1995/96 (154/106 samples, and 125/108 samples respectively).

UK - SCOTLAND

SUMMARY

Scotland is part of the United Kingdom but with increasing autonomy and separate legal and regulatory frameworks. Overall responsibility for water supply lies at Ministerial level whilst water authorities (public bodies) are providing the water services. Ninety-eight percent of the population are connected to public water supplies; water quality of public and private supplies are routinely monitored. There are no problems concerning continuous supply and, with the exception of high levels of non-compliance with the THM parameter, there are no major water quality problems.

INSTITUTIONAL RESPONSIBILITIES

Scotland is part of the United Kingdom (an EU Member State) but with increasing autonomy and separate legal and regulatory frameworks. Overall responsibility for water supply and quality lies with Scottish Ministers, primarily the Minister for Transport and the Environment. The responsibility for the provision of water services in Scotland was transferred from local authorities to three new public water authorities in 1996. There are 630 water treatment works supplying 98% of the population, the remainder have private supplies.

The legal framework is clear and in line with EU requirements. The legislative base is provided mainly by the following:

- The Water (Scotland) Act 1980;
- The Water Supply (Water Quality) (Scotland) Regulations 1990;
- The Private Water Supplies (Scotland) Regulations 1992; and
- The Surface Waters (Abstraction for Drinking Water) (Classification) (Scotland) Regulations 1996.

The Water Services Unit of the Environment Group at the Scottish Executive oversees compliance with legal requirements.

MONITORING OF DRINKING WATER QUALITY

The Water Authorities are responsible for routine monitoring of raw water sources (groundwater and surface water) and public water supplies, whilst local authorities are responsible for monitoring private supplies. Compliance monitoring for public water supplies is also carried out by the Water Authorities, but supervised by the Water Services Unit of the Scottish Executive which is responsible for ensuring that the legal requirements are met; the Water Services Unit also carries out audits of water treatment works and service reservoirs.

The extent of monitoring is based on the population served and volume of water supplied. Routine monitoring is carried at all of the 560 treatment works which supply 98% of the population. For public supplies, some 178 600 samples are processed per annum. There are no monitoring problems; a statutory scheme for sampling water supplies is in place. For public supplies, samples are taken from raw water intakes, and treated water at treatment works and from consumers' taps; private supplies are sampled at source and from consumers' taps.

Assessment of drinking water quality is based on national (EU plus some additional) standards.

In case of non-compliance, measures focus on remediation and improvement programmes undertaken by the Water Authorities and supervised by the Water Services Unit.

Drinking water quality data are published and available to the public (available free at local level; national report published for sale).

DRINKING WATER SUPPLY AND QUALITY

There are no problems providing a continuous supply; 98% of the population are connected to public water supply, the remainder have private supplies.

With the exception of THMs, there are no major water quality problems, although non-compliance with certain standards does occur (see summary table below).

Examples from Drinking Water Quality in Scotland 1997 - Summary of selected parameters measured in supply zones

Parameter	No. samples	No. non-compliance	% non-compliance
Coliforms	20 275	475	2.34
Faecal coliforms	20 275	163	0.80
Colour	5 366	144	2.68
Turbidity	4 753	22	0.46
pH	10 251	56	0.55
Aluminium	6 426	125	1.95
Iron	6 524	300	4.6
Manganese	4 696	65	1.38
Lead	4 081	56	1.37
THMs	4 668	1428	30.59
All others	91 293	599	0.66
Total	178 608	3433	1.92

Microbiological standards are most frequently exceeded at small treatment works but have not changed significantly since 1995. THMs present considerable compliance problems since water sources in Scotland are mainly from surface waters with a high content of natural organic matter (reacting with chlorine to produce THMs and other chlorination by-products). Other problem parameters include iron, colour, aluminium, manganese and lead.

