



NORTHERN IRELAND DRINKING WATER QUALITY 1998

A Report by the Northern Ireland
Drinking Water Inspectorate



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SUMMARY

This report is the third prepared by the Drinking Water Inspectorate Unit of Environment and Heritage Service, acting in its regulatory role in matters of drinking water quality. It describes the work of the Inspectorate and provides an overview of drinking water quality in Northern Ireland for 1998.

During this reporting period, the drinking water quality results show that out of a total of 108,422 tests carried out by Water Service during 1998, 98.86% met the regulatory standards. This overall water quality figure is similar to the 98.89% compliance figure reported for 1997. The 1998 compliance figure of 99.64% for all microbiological samples shows a small increase in the level of compliance when compared to the 99.50% figure for 1997. The number of physical/chemical reported exceedences shows a small decrease in compliance. The compliance rate for the key microbiological parameters for samples taken at consumers taps was 99.51%; an improvement on the 99.31% compliance figure for 1997. These results show, that overall, the drinking water supplied is of good quality. The comparable figures are given in Figure 1 and Figure 2 below.

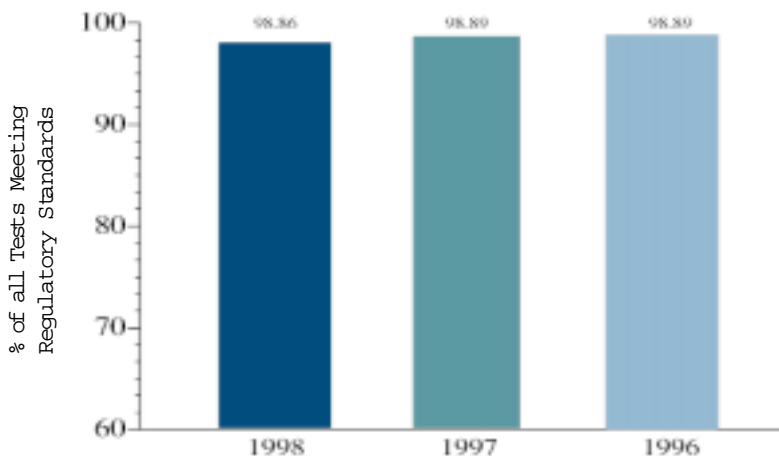


Figure 1: Overall Water Quality

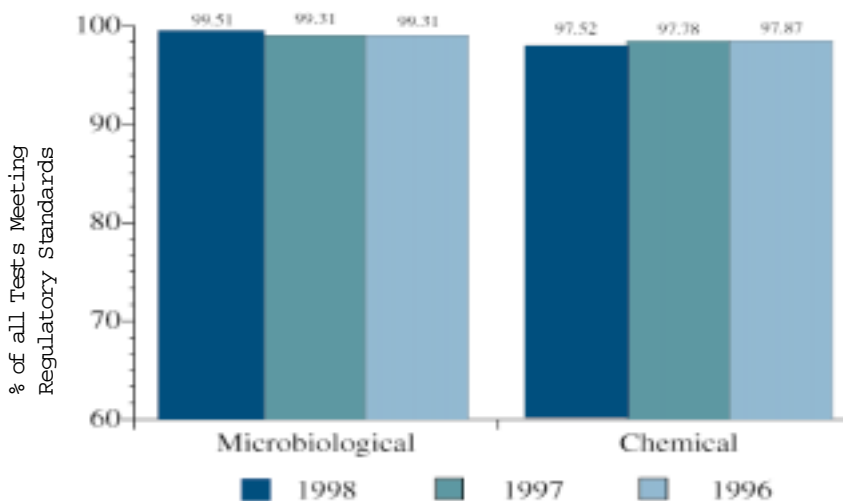
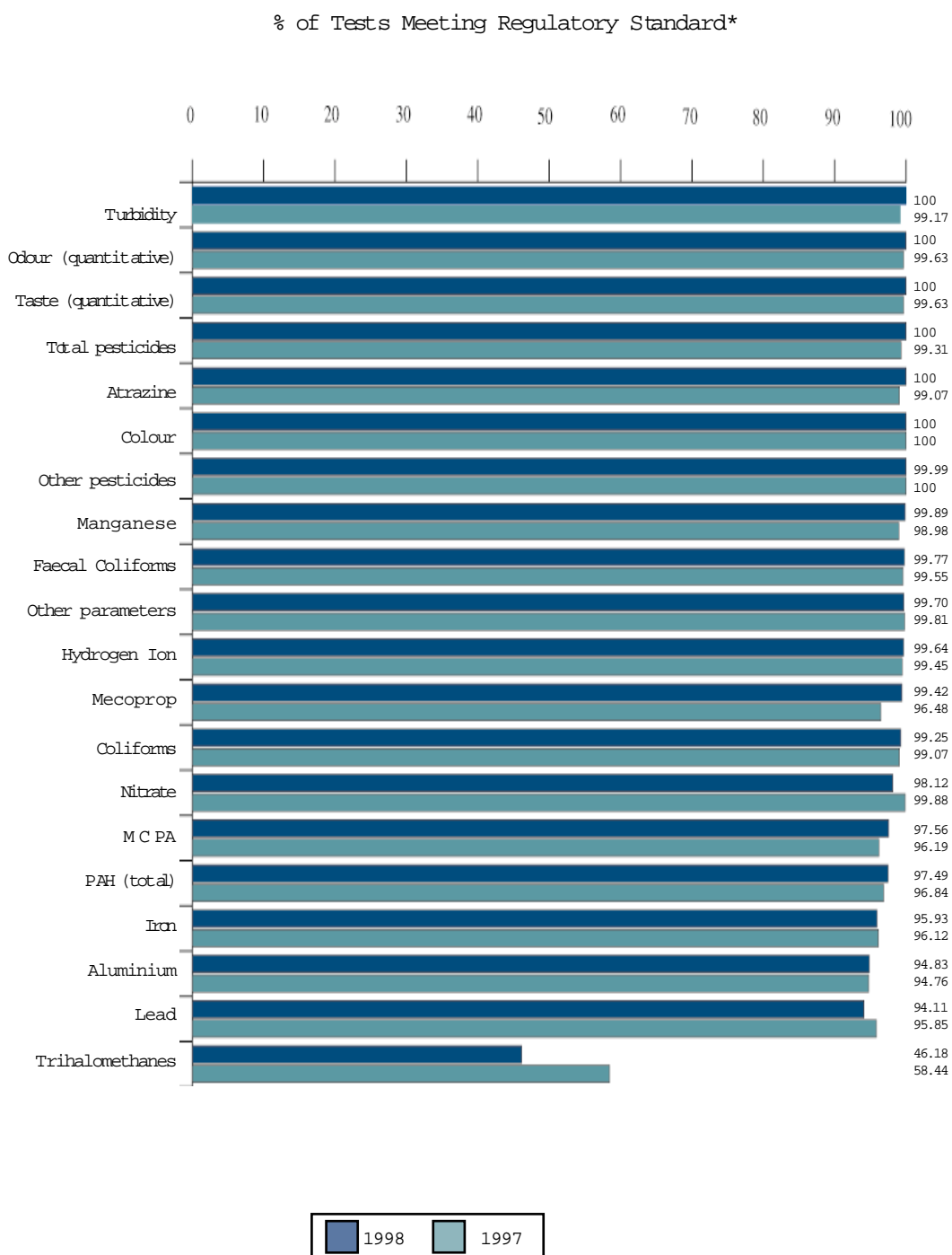


Figure 2: Microbiological and Chemical Quality at Consumers Taps

During 1998, the level of compliance was reported for 106 water supply zones which were routinely monitored for 78 individual parameters. The regulatory requirements were met for 62 of these parameters. A water supply zone can be non-compliant if one parameter fails on a single occasion. Figure 3 shows the percentage of determinations in water supply zones meeting the regulatory standards.

Figure 3: Microbiological and Chemical Quality in Water Supply Zones



* Regulatory standard refers to the Prescribed Concentration or Value (PCV) or Relaxed PCV.

The number of physical/chemical tests not meeting the standards shows a small downward trend, with 2.48% of 39,760 tests failing to meet the required standards. The non-compliances relate largely to trihalomethanes, lead, aluminium and iron.

Many of the non-compliances which were detected arose in circumstances which require the implementation of improvement programmes for water treatment works and distribution systems. Improvements to several water treatment works have been completed or are underway and there are possible early indications that this may be having an effect on the individual aluminium compliance figures, where improvement from 9.88% non-compliance in 1996 to 5.24% in 1997 was reported. The comparable figure for 1998 was 5.17%. The improvements in microbiological quality of water supplies may, at the same time, have resulted in an increased failure rate for trihalomethanes. The compliance rates for trihalomethanes were 46.18% and 58.44% for 1998 and 1997 respectively.

The Water Quality Regulations (Northern Ireland) 1994 set demanding standards for public drinking water quality. During 1998, 1038 contraventions of the standards were reported for samples taken at consumers taps. Contraventions were reported for 16 parameters. Each contravention has been followed up and assessed by the Inspectorate. Depending on the magnitude or duration of the contravention, each has been assessed as being trivial or non-trivial.

Water Service was formally notified of non-trivial contraventions of the following 10 parameters:

Total coliforms, faecal coliforms, trihalomethanes, iron, aluminium, lead, M C PA, PAH (total), hydrogen ion and nitrate.

All contraventions are followed up by Water Service and remedial action is taken where practical and appropriate. When contraventions of the regulatory standards occur, Water Service notifies the Health and Social Services Boards and District Councils on an ongoing basis, under an agreed reporting procedure.

Water Service has a major capital works programme, targeted at water treatment works and the distribution system, which will mitigate the contraventions within the shortest practicable timescale. The last 2 years have seen a commitment to increased investment in water treatment works and refurbished infrastructure. Continued commitment to funding further investment in water treatment and supply infrastructure needs to be maintained to ensure the continuing provision of high quality drinking water and to improve regulatory compliance. The investment programme needs to continue to address improved compliance, in particular, with the trihalomethane, lead, iron and aluminium parameters; further investment in water treatment and water mains rehabilitation; enhanced protection against *Cryptosporidium*; and the additional requirements of the new European Drinking Water Directive.

The Water Quality Regulations (Northern Ireland) 1994 set out sampling and other regulatory requirements to demonstrate the wholesomeness of drinking water supplies. In the 1998 compliance assessment, a sampling shortfall of 1.55% of the required number of determinations was identified for regulatory standard sampling frequencies for water supply zones. The comparable figure reported for 1997 was 0.50%. Where non-trivial deficiencies have been identified, the Inspectorate has formally notified Water Service. Action will be taken by Water Service to remedy the sampling shortfall.

The Inspectorate's other activities and responsibilities, including those relating to the Private Water Supplies Regulations (Northern Ireland) 1994, are presented in this report.

INTRODUCTION

The Drinking Water Inspectorate (the Inspectorate) is a unit within the Environment and Heritage Service, an agency of the Department of the Environment, in Northern Ireland*. The Inspectorate has a responsibility to regulate drinking water quality in Northern Ireland under the Water Quality Regulations (Northern Ireland) 1994 and the Private Water Supplies Regulations (Northern Ireland) 1994. This report details the work of the Inspectorate and reviews drinking water quality in Northern Ireland for 1998. This is the third annual report prepared by the Inspectorate, and, as with the previous reports, it will act as a criterion against which water quality in Northern Ireland will be measured in future years. The Inspectorate continues to progress water quality issues, with a view to improving compliance with regulatory standards.

1.1 The Inspectorate prepared the summary of drinking water quality in Northern Ireland using information provided by Water Service. The information was obtained from Water Service's monitoring programme, carried out as prescribed in the Water Quality Regulations (Northern Ireland) 1994. In accordance with regulation 28, Water Service has published its own report, entitled Drinking Water Quality Report 1998. The Inspectorate's report includes a detailed independent assessment of drinking water quality in Northern Ireland in terms of the standards set out in the Water Quality Regulations (Northern Ireland) 1994.

1.2 In the report, Section 2 describes the regulatory framework within which the Inspectorate operates. Section 3 broadly reviews the Inspectorate's activities regarding drinking water quality, including those defined by the Private Water Supplies Regulations (Northern Ireland) 1994. The technical audit process, carried out to support the Inspectorate's administration of the Water Quality Regulations (Northern Ireland) 1994, is considered in detail in Section 4. Section 5 overviews drinking water quality in Northern Ireland for 1998; comments on the key non-compliances with the standards, including non-trivial water supply zone contraventions; and draws relevant comparisons to water quality in 1997 and 1996. An assessment of standard sampling frequencies for water supply zones, water treatment works and service reservoirs is also included in this section. In Section 6, water quality incidents have been identified, and, in Section 7, a summary of the various classification types of private water supplies in Northern Ireland is provided. Section 8 refers to the Department of the Environment, Transport and the Regions (DETRs) Drinking Water Research Programme on water quality and health, which is steered by the Drinking Water Inspectorate for England and Wales. Finally, the Glossary provides brief explanations of the technical terms and abbreviations used in this report.

* Under government reorganization, Environment and Heritage Service remains as an Agency, as part of the Department of the Environment.

THE REGULATORY FRAMEWORK

Water quality requirements in the United Kingdom fully incorporate the European Directive of 15 July 1980 (80/778/EEC), the Drinking Water Directive¹, relating to the quality of water intended for human consumption.

In Northern Ireland, the primary legislative powers to transpose the Drinking Water Directive are contained in the Water and Sewerage Services (Northern Ireland) Order 1973 No. 70 (N.I. 2) as amended by the Water and Sewerage Services (Amendment) (Northern Ireland) Order 1993 No. 3165 (N.I. 16). The Water Quality Regulations (Northern Ireland) 1994 S.R. No. 221 set the standards for public supplies for drinking (which includes use in food production). The Private Water Supplies Regulations (Northern Ireland) 1994 S.R. No. 237 set standards for private water supplies.

The treatment of raw water referred to in regulation 22 of the Water Quality Regulations (Northern Ireland) 1994 is now contained in the Surface Waters (Abstraction for Drinking Water) (Classification) Regulations (Northern Ireland) 1996 S.R. No. 603.

The key points of the Order and Regulations are:

2.1 The Water and Sewerage Services (Northern Ireland) Order 1973 and the Water and Sewerage Services (Amendment) (Northern Ireland) Order 1993

- 1 place a duty on the Department² when supplying water to premises for domestic or food production purposes, to supply water which is wholesome at the time of supply;
- 1 require the Department³ to keep itself informed about the wholesomeness and sufficiency of private water supplies;

- 1 empower the Department³ to require remedial action to be taken where private supplies are found to be unwholesome or insufficient; and
- 1 provide regulation making powers relating to preserving water quality and setting standards for wholesomeness.

2.2 The Water Quality Regulations (Northern Ireland) 1994

- 1 define wholesomeness by setting standards for 55 parameters and descriptive standards for a further 2;
- 1 set and define a water supply zone as the basic unit for water quality monitoring;
- 1 require the Department² to monitor the quality of its supplies;
- 1 specify detailed sampling requirements for samples taken at taps within water supply zones, at service reservoirs and at water treatment works;
- 1 make provision in certain circumstances whereby, taking account of public health risk, standards may be relaxed where the water is not of the required quality;
- 1 control substances coming into contact with drinking water; and
- 1 require the Department² to publish an annual report and keep public registers of water quality at its Water Service Divisional Headquarters offices.

¹ The new Drinking Water Directive was agreed by the Member States of the European Union in November 1998. Consultation is ongoing and new United Kingdom Regulations and associated guidance will be made.

² Under government reorganization, now the Department for Regional Development.

³ Under government reorganization, now the Department of the Environment.

2.3 The Private Water Supplies Regulations (Northern Ireland) 1994

- 1 define wholesomeness in the same manner and prescribe the same standards as for public supplies (paragraph 2.2 refers);
- 1 require the Department³ to classify private water supplies according to size and use; and
- 1 require the Department³ to monitor private supplies according to the classification category.

2.4 The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations (Northern Ireland) 1996

- 1 set standards for the quality of surface water to be used as sources of public water supply;
- 1 permit waivers for certain parameters where these have a natural origin; and
- 1 require the Department² to classify all its sources of water in accordance with prescribed quality criteria subject to authorized waivers.

² Under government reorganization, now the Department for Regional Development.

³ Under government reorganization, now the Department of the Environment.

References

Copies of individual Regulations may be obtained from Her Majesty's Stationery Office, 16 Arthur Street, BELFAST BT1 4GD.

THE ROLE AND ACTIVITIES OF THE DRINKING WATER INSPECTORATE

Regulatory Role

In Northern Ireland, the administration of the Water Quality Regulations (Northern Ireland) 1994 (the Regulations) and the Private Water Supplies Regulations (Northern Ireland) 1994 is carried out by the Drinking Water Inspectorate Unit of Environment and Heritage Service.

In the case of the Water Quality Regulations (Northern Ireland) 1994, Water Service, an executive agency within the Department for Regional Development, is responsible for implementing the requirements of the Regulations. The Inspectorate has an independent responsibility to assess and regulate compliance against these standards.

In relation to private water supplies, the Drinking Water Inspectorate is responsible for the implementation of the Private Water Supplies Regulations (Northern Ireland) 1994. The Department of Agriculture and Rural Development, and the 26 District Councils also have interests in these private water supplies.

The Water Quality Regulations (Northern Ireland) 1994

3.1 The Inspectorate's duties in implementing its responsibilities under the Regulations are mainly carried out by an ongoing programme of technical audit. The technical audit process is an annual assessment which includes the following core tasks:

- 1 the transfer of information from Water Service on the quality of water at water treatment works, service reservoirs and in water supply zones;
- 1 a compliance assessment of this information against the regulatory standards;
- 1 carrying out an inspection programme which examines the sampling, analytical and reporting procedures; and
- 1 assessing if satisfactory practices and processes are in place for water treatment and distribution.

3.2 Inspection reports, which provide conclusions, opinions and recommendations of the inspection findings, are sent to Water Service.

3.3 Where a regulatory standard has not been met, the compliance assessment process classifies the contraventions as trivial or non-trivial. The non-trivial contraventions are listed and formally notified to Water Service. This formal notification requires a response from Water Service, outlining proposals for remedial action.

The Private Water Supplies Regulations (Northern Ireland) 1994

3.4 The Inspectorate carried out a survey in 1997 to identify the private water supplies falling within the Private Water Supplies Regulations (Northern Ireland) 1994:

- 1 1,190 private water supplies have been identified to date and categorized into one of 10 classes according to size, nature and use of the private water supply, and
- 1 a monitoring programme, based on these classifications, is in place for private water supplies.

Chemicals and Materials

3.5 A scheme for the statutory approval of chemicals used in water treatment and materials which come into contact with drinking water is administered in Northern Ireland by the Inspectorate. The purpose of the scheme is to ensure that use of such products does not cause any adverse effect on water quality. Advice on matters of approval is given by the Committee on Chemicals and Materials of Construction for Use in Public Water Supply and Swimming Pools. The Drinking Water Inspectorate for England and Wales operates the approval process on behalf of its Secretary of State.

3.6 A new Committee was appointed during 1998, consisting of a Chairman and five members who between them, bring a range of expertise spanning engineering, materials science, toxicology and water treatment to the Committee. An independent member represents water consumers' interests.

- 3.7 A list of chemicals and materials, approved by the Secretary of State for England and Wales, is published annually by the Drinking Water Inspectorate for England and Wales. Regulation 24 of the Water Quality Regulations (Northern Ireland) 1994 endorses the use of the substances and products contained in this document and, consequently, it is applicable in Northern Ireland. A cumulative list of products approved under the statutory scheme was last published in December 1999. A copy of this list and the 1999 revision of the guidance note on the approval system and how to make an application for approval, can be obtained from the Department of the Environment, Transport and the Regions website (<http://www.dwi.detr.gov.uk/list/index.htm>).
- 3.8 The Committee also advises on matters of approval for a non-statutory, voluntary approval scheme operated by the Drinking Water Inspectorate for England and Wales, for products which are used for the treatment of swimming pool water or for the production of potable water from seawater or brackish water. A list of substances and products approved for use in swimming pools is published annually by the Institute for Sport and Recreational Management in the magazine *Recreation*. Details of publication dates can be obtained from the Institute (Tel: 01664-65531).

Quality Assurance

- 3.9 The Water Quality Regulations (Northern Ireland) 1994 require water quality to be monitored using analytical systems which are capable of achieving and maintaining compliance with the appropriate quality criteria. These systems must have internal and external analytical quality control schemes in place and are subject to external inspection.
- 3.10 Water Service routinely checks the performance of its laboratories by participating in external quality control schemes. These include the Water Research Centre's Aquacheck scheme. The Inspectorate audits external and internal analytical quality control systems and procedures as part of its inspection programme.
- 3.11 Water Service is also implementing the requirements of the Drinking Water Testing Specification (DWTS). DWTS is an optional national scheme agreed between the Drinking Water Inspectorate for England and Wales, the Northern Ireland Drinking Water Inspectorate, the Scottish Office's Water Services Unit and the United Kingdom Accreditation Service (UKAS), for the accreditation of laboratories carrying out drinking water analyses. The accreditation, among other requirements, will demonstrate compliance with regulation 20 of the Water Quality Regulations (Northern Ireland) 1994 and regulation 19 of the Private Water Supplies Regulations (Northern Ireland) 1994.

Consumer Complaints and Water Quality Incidents

- 3.12 The Inspectorate's policy, on receiving a complaint regarding drinking water quality from a member of the public, is to log the complaint details and to refer the matter to Water Service for follow-up investigation and comment. In some instances, the local Environmental Health Officer may also be involved in the follow-up investigation. In 1998, 22 complaints were received by the Inspectorate.

Where a water quality incident has occurred, Water Service is required to provide the Inspectorate with information in accordance with agreed procedures. During 1998, 5 drinking water quality incidents and 3 events were brought to the attention of the Inspectorate (see Section 6 for further details).

Contact with other Organizations

- 3.13 The Inspectorate has regular contact with the Department of Health, Social Services and Public Safety (DHSSPS), the Environment and Planning Division of the Department of the Environment for Northern Ireland, and the Department of Agriculture and Rural Development. It represents Northern Ireland interests in the development of United Kingdom drinking water regulatory policy through liaison with the Drinking Water Inspectorate for England and Wales, the Water Services and Regulation Division of the Department of the Environment, Transport and the Regions, and the Scottish Office's Water Services Unit. The Inspectorate keeps itself informed of research being carried out by the Water Research Centre (WRC) and other organizations. This includes having representation on the DEIR Water Distribution, Conservation and Quality Research Programme Committee (see Section 8 for details). Contact with Member States of the European Union is made through a European Drinking Water Regulators Forum.
- 3.14 The Inspectorate has regular contact with Environmental Health Officers in the District Councils in connection with both private and public water supplies. Meetings are also held with the Northern Ireland Water Council and the General Consumer Council for Northern Ireland.

- 3.15 Medical advice is obtained from the Chief Medical Officer of the Northern Ireland Department of Health, Social Services and Public Safety. The Inspectorate liaises with the Chief Medical Officer and the Chief Environmental Health Officer (also of the DHSSPS) on relevant health related matters.

DWI Information

- 3.16 To increase awareness of the water quality of private water supplies, the Inspectorate produced a leaflet *Is your PRIVATE Water Supply SAFE?* which was widely circulated to owners through the Department of Agriculture for Northern Ireland*, and the 26 District Councils. During 1998, the Inspectorate presented papers and delivered lectures on a number of occasions to learned societies and public bodies.
- 3.17 Previous Inspectorate publications include *Northern Ireland Drinking Water Quality 1997* and *Northern Ireland Drinking Water Quality 1996*.

* Under government reorganization, now the Department of Agriculture and Rural Development.

THE TECHNICAL AUDIT

The Inspectorate's technical audit assesses compliance with the Water Quality Regulations (Northern Ireland) 1994 and consists of 2 main elements:

- 1 the assessment of Water Service's analytical data on drinking water for compliance against regulatory standards; and
- 1 an ongoing inspection programme which examines Water Service's policies and relevant procedures for sampling, analysis, reporting, water treatment and distribution.

This section details the compliance assessment process and outlines the results of the 1998 Inspection Programme. Section 5 details the results of the compliance assessment and gives an overview of drinking water quality in Northern Ireland.

The Inspectorate acknowledges the cooperation of Water Service staff in facilitating the technical audit process.

General Compliance Assessment

- 4.1 Schedule 2 to the Water Quality Regulations (Northern Ireland) 1994 refers to the number of samples required to be taken for each parameter. In practice, each sample is tested for several parameters and, thus, the text and tables relate to the number of determinations made for each individual parameter rather than to the number of samples taken.
- 4.2 Compliance assessment for 1998 is shown in 2 ways: firstly, the total number of all determinations that fail to meet the regulatory standards; and secondly, water supply zone compliance (see Section 5 for further details).
- 4.3 The number of samples per annum specified in Schedule 2 to the Regulations is the minimum required in the various situations to which the Schedule refers. For 1998, the Inspectorate has looked for full compliance with the required standard sampling frequencies for water supply zones, water treatment works and service reservoirs.

4.4 The term total coliforms refers to the parameter listed in Table C of Schedule 1 to the Water Quality Regulations (Northern Ireland) 1994. It includes all coliform organisms, whether faecal in origin or not. In the following sections, the term coliforms will be used to represent the total coliform parameter. The detection of coliforms in a sample is indicative of potential contamination which must be investigated urgently. The presence of faecal coliforms in the same sample would strongly suggest that the contamination was of faecal origin.

4.5 Six parameters specified in the Regulations have no prescribed concentration or value (PCV) assigned to them. These are:

- 1 total organic carbon;
- 1 colony counts at 22 C;
- 1 colony counts at 37 C;
- 1 residual disinfectant;
- 1 taste (qualitative); and
- 1 odour (qualitative).

Although all have an assigned sampling frequency, the absence of a PCV means that it is not appropriate to include the number of their determinations in the overall total of compliance determinations carried out when assessing compliance with water quality standards. These parameters are included in the standard sampling frequency compliance assessment.

4.6 The parameters alkalinity and total hardness have a PCV assigned to them only for water which is artificially softened (to reduce alkalinity and hardness). The PCV, in this case, is a minimum value which must be exceeded. These 2 parameters have an assigned sampling frequency but, because no softening of water supplied by Water Service takes place, these PCVs effectively do not apply. It is, therefore, not appropriate to include determinations for these 2 parameters when assessing compliance with water quality standards.

4.7 Sampling frequencies are not specified in the Regulations for 6 parameters which have PCVs:

- 1 kjeldahl nitrogen;
- 1 dissolved or emulsified hydrocarbons;
- 1 phenols;
- 1 faecal streptococci;
- 1 sulphite-reducing clostridia; and
- 1 substances extractable in chloroform.

Consequently, there is no regulatory requirement to sample for these parameters.

4.8 The number of individual pesticides monitored by Water Service may vary from year to year. The monitoring strategy is based upon those pesticides understood to be used within catchment areas and which

could reach water sources. During 1998, water samples were analysed for 32 individual pesticides. These included mecoprop and MCPA which are extensively used in agriculture. The monitoring programme also included atrazine and simazine which have been widely used in non-agricultural situations, although their use on non-crop land is no longer approved.

4.9 The total pesticides parameter is defined in the Regulations as the sum of the detected concentrations of individual substances. In practice, the detected concentrations of whatever pesticides are determined in a particular sample are summed and assessed against the prescribed concentration for total pesticides of 0.5 mg/l.

Water Treatment Works

4.10 Regulation 3(7) of the Water Quality Regulations (Northern Ireland) 1994 requires 100% compliance with water quality standards for coliforms and faecal coliforms at water treatment works. For 1998, the Inspectorate has generally regarded the detection of coliforms and faecal coliforms on a single occasion as a trivial contravention of the standards. All other contraventions were considered to be non-trivial and these have been formally notified to Water Service.

Service Reservoirs

4.11 Regulation 3(8) of the Water Quality Regulations (Northern Ireland) 1994 requires 95% of samples taken in the preceding 12 months from a service reservoir to be free from coliforms. For 1998, compliance was assessed on the basis of results of samples taken from each service reservoir in the 12 months of the calendar year. Non-trivial contraventions of the coliform standard for service reservoirs were formally notified to Water Service.

4.12 The detection of 1 or 2 faecal coliforms in 100 ml of sample taken from a service reservoir on a single occasion has been regarded as a trivial contravention of the faecal coliform standard. All other contraventions of this standard were formally notified to Water Service.

Water Supply Zones

4.13 Regulation 3 prescribes concentrations or values for 55 of the 57 parameters as listed in Tables A to E of Schedule 1 to the Water Quality Regulations (Northern Ireland) 1994 and also for trihalomethanes. In general, to be wholesome, water must not contain a parameter in excess of a PCV; total hardness and alkalinity must not be below prescribed values if the water is treated by softening or desalination; and in the case of hydrogen ion (pH), the pH value must be in a range defined by a maximum and minimum prescribed value.

4.14 The Drinking Water Directive and regulation 4 of the Regulations permit standards to be relaxed in certain specified circumstances. The circumstances applying in Northern Ireland stem from the nature and structure of the ground from which the supplies are taken, as the composition of geological strata can affect background levels of substances occurring in water. The Drinking Water Directive and regulation 5 place certain restrictions on the relaxed standards, in particular, that public health shall not be put at risk. Regulation 5 also requires the specification of the extent to which the PCV for any parameter can be contravened. Following consultation with DHSSPS, relaxed standards are permitted in specified water supply zones in Northern Ireland for taste (quantitative), odour (quantitative), colour, aluminium and manganese. The number of water supply zones with permitted relaxations for 1998 are listed below:

Relaxations in Water Supply Zones

Parameter	Number of Water Supply Zones with Relaxations
Colour	93
Manganese	101*
Odour (quantitative)	79
Taste (quantitative)	79
Aluminium	34*

* Amended figure - April 1999 erratum.

4.15 In assessing water quality in water supply zones, the Inspectorate has taken into account the existence of permitted relaxations. Thus, throughout the text and tables of this report, reference to contravention of a PCV means that, where a relaxation is in place, a concentration or value greater than the relaxed standard has occurred. Concentrations or values up to the relaxed concentration or value are not included in the number or percentage of PCV contraventions.

4.16 The regulations prescribe standards for a wide range of parameters, of which only some have a health significance, and their standards are generally set with a wide margin of safety. The other parameters are of aesthetic significance, with standards set well below the level at which water would become unacceptable to consumers and contravention of these standards does not necessarily indicate that the water is unfit to drink.

4.17 Contravention of a PCV, even for only one parameter and in only one sample out of the large number taken from each water supply zone in the course of the year, indicates that the water supplied at the time the sample was taken cannot be regarded as wholesome. That does not mean that the water was harmful to health or unfit for drinking, but it may mean, when considered in the light of other monitoring results, that the water quality needs improvement in order to meet the high standards specified in the Regulations.

4.18 The general rule that any contravention of a PCV constitutes a breach of the Water Quality Regulations (Northern Ireland) 1994 and, thus, causes the water to be regarded as unwholesome does not apply to some parameters specified in regulation 3. Water supply zones have only been regarded as non-compliant if:

- 1 the average concentration for trihalomethanes in any 3 month period exceeded the concentration of 100 mg/l as prescribed in regulation 3(3)(e), (trihalomethanes refers to the sum of the concentrations of trichloromethane, dichlorobromomethane, dibromochloromethane and tribromomethane);

- 1 20% or more sodium determinations carried out in the preceding 36 months exceeded the prescribed concentration of 150 mg/l specified in Table A and regulation 3(5);

- 1 coliforms were detected in 5% or more of the samples taken in the 12 months of the calendar year or, where less than 50 samples were taken in the 12 month period, the assessment was made using the previous 50 samples or the number of samples taken since the implementation of the Regulations (1 October 1994). If in the latter case, total coliforms were detected in 3 or more samples, the water supply zone has been considered non-compliant; and

- 1 in the case of Table D parameters which include benzo 3,4 pyrene, the average concentrations or values during the calendar year 1998 exceeded the prescribed concentrations or values.

4.19 Where a contravention of the regulatory standard has been identified, the number and percentage of individual determinations in excess of the relevant numerical PCV are shown in Table 5.4 in Section 5. A water supply zone is assessed as being non-compliant if just one sample has not met the required standard. The percentage of non-compliant water supply zones for each parameter in contravention of the Regulations is also shown in Table 5.4.

4.20 For 1998, the Inspectorate has generally regarded a contravention of a standard for an individual non-microbiological parameter on a single occasion in a water supply zone as trivial, provided that 10 or more samples have been taken in that zone or, if a smaller number has been taken, provided that there was not a corresponding contravention in the previous calendar year. In other cases, the Inspectorate has taken into account the number of determinations carried out and the number and extent of the contraventions in deciding whether the contraventions were trivial or not. Water Service has been formally notified of all cases where the contraventions were regarded as non-trivial.

4.21 Where 5 or less faecal coliforms in 100 ml have been detected on a single occasion in a water supply zone, the contravention of the standard has been regarded as trivial. Where more than 100 samples have been taken, 2 contraventions of the standard have been regarded as trivial, provided that no more than 2 faecal coliforms in 100 ml were detected in either sample and there was no

contravention of the standard in the previous calendar year. No contravention of the coliform regulatory standard (see paragraph 4.18) was regarded as trivial. All cases where contraventions of the standard for a microbiological parameter were regarded as non-trivial have been formally notified to Water Service.

4.22 In 1998, the inspection programme was based on the following topics:

- 1 detailed audit of a selected water treatment works;
- 1 detailed audit of 2 selected service reservoirs;
- 1 detailed audit of a water quality analytical laboratory; and
- 1 progress on agreed follow-up action as a result of the 1997 Inspection Programme.

4.23 During October and December 1998, and January 1999, the Drinking Water Inspectorate carried out inspections at Killyhevlin Water Treatment Works, Academy House Laboratory, Ballysillan High and Ballykeel Service Reservoirs.

4.24 On completion of the inspection programme, conclusions, opinions and recommendations were reported to Water Service. The recommendations require a written response from Water Service, and an agreed action plan is produced.

4.25 The reports and their conclusions, opinions and recommendations are, of necessity, based on the audit and inspection of a small selection of records, documents and locations. Any statements of satisfaction therefore represent the inspectors' opinions at the time, based on the information available to and inspected by them, and do not constitute a general endorsement of the adequacy of Water Service's procedures and practices. The main findings of these inspections are summarized in paragraphs 4.26 to 4.29.

Killyhevlin Water Treatment Works

4.26 An inspection of Killyhevlin Water Treatment Works was carried out on 5, 7-9 October 1998. The overall objective was to carry out an inspection of the various arrangements and processes at the water treatment works. The treatment process was found, with the exception of 2 parameters in the water

supply zones served exclusively by the works, to comply with regulations 22, 24, and 25, producing drinking water which met the standards specified in the Water Quality Regulations (Northern Ireland) 1994. At the time of the inspection, the water treatment works had been in operation for just over one year.

As a result of the inspection, the Inspectorate made 10 recommendations which were considered necessary to consolidate procedures and help ensure regulatory compliance. The recommendations were conveyed to Water Service for formal response. Water Service has taken action on all of these recommendations.

Academy House Laboratory

4.27 Academy House Laboratory was inspected on 26, 28-30 October 1998. The objective of the inspection process was to assess the following topics:

- 1 sampling programme;
- 1 sample reception and analyses allocation;
- 1 compliance samples;
- 1 analytical quality control procedures;
- 1 public register;
- 1 exceedence procedures; and
- 1 sampling under field conditions.

As a result of the inspection, the Inspectorate concluded that Analytical Quality Control procedures, which ensure the accuracy of the results of testing, met regulatory requirements. A computerized recording system, which provided an audit trail for results (from sampling to the public record), was in place.

Following the inspection, the Inspectorate made 7 recommendations which were considered necessary to consolidate procedures and help ensure regulatory compliance. The recommendations were conveyed to Water Service for formal response. Water Service has taken action on all of these recommendations.

Ballysillan High Service Reservoir

4.28 An inspection of Ballysillan High Service Reservoir was carried out on 2 December 1998. The overall objective was to carry out an inspection of the sampling arrangements and the security of the service reservoir.

As a result of the inspection, the Inspectorate made 4 recommendations which were considered necessary to help ensure regulatory compliance. The recommendations were conveyed to Water Service for formal response. Water Service has taken action on all of these recommendations.

Ballykeel Service Reservoir

4.29 An inspection of Ballykeel Service Reservoir was carried out on 15 January 1999. The overall objective was to carry out an inspection of the sampling arrangements and the security of the service reservoir.

As a result of the inspection, the Inspectorate made 4 recommendations which were considered necessary to help ensure regulatory compliance. The recommendations were conveyed to Water Service for formal response. Water Service has taken action on all of these recommendations; 2 recommendations have been implemented, and the remaining 2 will be addressed under the new reservoir contract scheduled to start in May 2001.

Follow-up to the 1997 Inspection Programme

4.30 Follow-up action resulting from the 1997 inspections of Ballinrees Water Treatment Works and Altnagelvin Laboratory has been completed.

OVERVIEW OF DRINKING WATER QUALITY IN NORTHERN IRELAND IN 1998

Introduction

In 1998, Water Service supplied on average 690 million litres/day of water to 98.5% of Northern Ireland's population of approximately 1.69 million people. These water supplies are mostly derived from surface water (92%), with the remainder being groundwater sources. Water from all these sources is treated and distributed through approximately 22,000 km of watermains. Regulatory compliance monitoring is carried out at 72 water treatment works, 374 service reservoirs and 106 water supply zones. The majority of the service reservoir sampling points correspond to single reservoir sites, although some have more than one reservoir on site.

Water Treatment Works Volume Categories

Water Treatment Works		Volume Distributed from Works (m ³ /d) Categories
Number	Percentage	
27	37.5	<3,000
28	38.9	3,000 - 12,000
17	23.6	>12,000

Service Reservoirs Capacity Categories

Service Reservoirs		Capacity of Reservoirs (m ³) Categories
Number	Percentage	
209	56.2	<2,000
125	33.1	2,000 - 10,000
40	10.7	>10,000

In 1998, there were 106 water supply zones in Northern Ireland which were categorized for monitoring purposes according to the size of the population served. As Water Service upgrades and develops its infrastructure, and rural supply zones are rationalized by developing regional schemes, the number of water supply zones may change from year to year; in 1997, there were 108 water supply zones; in 1996, there were 109 water supply zones.

Water Supply Zone Population Categories

Water Supply Zone		Population Category
Number	Percentage	
25	24%	<5,000
35	33%	5,000 - 20,000
46	43%	20,000 - 50,000

A water supply zone is a designated geographical area with a population of no more than 50,000, supplied with water from one water treatment works or blended water from several works. Samples are routinely collected for analysis as part of the regulatory compliance requirements.

COMPARISON OF WATER QUALITY

5.1 The tables included in this section provide summary information on water quality, and relevant comparisons are made with water quality in 1997 and 1996. When comparing annual compliance information, there may be factors which account wholly, or in part, for a particular difference and this must be considered before drawing any conclusions about possible differences in water quality. These factors include:

- 1 adoption of increased sampling frequencies as a result of contraventions for a particular parameter;
- 1 modifications to the pesticide monitoring strategy in the light of reassessment of pesticide usage within water catchments

- 1 changes in the sampling programme due to the annual review of the delineation of water supply zones; and
- 1 improvements in analytical systems which may have reduced or eliminated the possible contribution to earlier data of results of uncertain accuracy.

Any or all of these factors may result in an observed difference in the number or percentage of determinations showing contravention of the PCV for a particular parameter being largely a consequence of the sampling programme, rather than indicative of any underlying difference in water quality.

5.2 However, comparison between the 3 years, using the number of zones showing non-compliance with the PCV for a particular parameter, is rather less affected by the factors set out in the previous paragraph.

Table 5.1

SUMMARY OF OVERALL WATER QUALITY			
	1998	1997	1996
Water treatment works			
Total number of determinations	19,648	20,224	19,832
- number exceeding PCV	44	60	60
- % exceeding PCV	0.22	0.30	0.30
Service reservoirs			
Total number of determinations	37,972	37,973	38,708
- number exceeding PCV	150	207	245
- % exceeding PCV	0.40	0.55	0.63
Water supply zones			
Total number of determinations	50,802	49,551	48,519
- number exceeding PCV	1,038	930	879
- % exceeding PCV	2.04	1.88	1.81
All samples			
Total number of determinations	108,422	107,748	107,059
- number exceeding PCV	1,232	1,197	1,184
- % exceeding PCV	1.14	1.11	1.11

Overall Water Quality

5.3 The level of compliance is shown in 2 ways. The first, and best overall measure because it takes into account all the results for the calendar year, is the total of all determinations that meet the regulatory standards. During 1998, a total of 108,422 reported determinations were carried out at water treatment works, service reservoirs and consumers taps. Of these determinations, 98.86% complied with the relevant water quality standards. This overall water quality figure shows a small decrease from the 98.89% compliance reported during 1997. This can be attributed to an

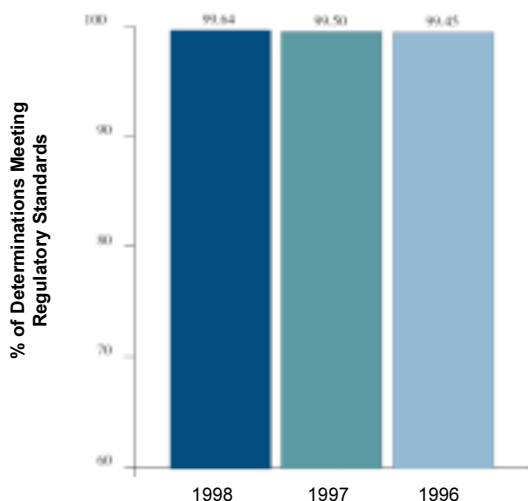
increased number of physical/chemical tests not meeting the regulatory standards. The compliance rate for the key microbiological parameters for samples taken at consumers taps was 99.51%; an improvement on the 99.31% compliance figure for 1997. These results confirm, that overall, the water supplied is of good quality. The second measure which is used to check water quality is water supply zone compliance. A water supply zone is assessed as being non-compliant if just one sample has not met the required standard. Comparable figures with 1997 and 1996 compliance assessments are given in Tables 5.1 to 5.4 and Figures 4 to 16.

5.4 During 1998, the level of compliance was assessed for 106 water supply zones which were routinely monitored for 78 individual determinations. The regulatory requirements were not met for 16 of these parameters: 2 microbiological; and 14 physical/chemical. The percentage of non-compliant zones for each key parameter is shown in Table 5.4.

Where the regulatory standards have been exceeded, agreed procedures exist for the reporting of exceedences to the Health and Social Services Boards.

The compliance figure for all microbiological samples shows a further increase in the level of compliance in 1998; 99.64% of 68,752 determinations meet the required standards. The comparable figures for 1997 and 1996 are given in Figure 4.

Figure 4: Overall Microbiological Quality



The improvements in microbiological quality of water samples may, at the same time, have resulted in an increased failure rate for trihalomethanes. Water Service has taken measures to improve the disinfection of water supplies and it needs to continue to take steps to bring about compliance with the trihalomethane standard. For 1998, as in the 1996 and 1997 reporting periods, trihalomethanes continue to be the parameter with the highest non-compliance rate of the regulatory standard.

During 1998, out of a total of 108,422 determinations carried out at water treatment works, service reservoirs and water supply zones, 1,232 determinations contravened the standards. Depending on the magnitude or duration of the contravention, each has been assessed as being trivial or non-trivial. Formal notifications of non-trivial contraventions were notified to Water Service for the following 10 parameters: total coliforms, faecal coliforms, trihalomethanes, iron, aluminium, lead, MCPA, PAH (total), hydrogen ion and nitrate. Water Service is dealing with contraventions by follow-up action in each individual case and by a major capital works programme targeted at water treatment works and the distribution system.

Microbiological Quality of Water Leaving Water Treatment Works

5.5 Summary results for water treatment works are given in Table 5.2. The results show that in respect of the number of determinations at water treatment works in 1998, 99.71% and 99.84% complied with the regulatory standards for coliforms and faecal coliforms respectively. The number of works not complying with the coliform standard reported an improvement in 1998 (Figure 5 refers). During 1998, faecal coliforms contraventions were detected at 11 water treatment works, of which, 5 were considered non-trivial. The coliform standard was contravened at 21 water treatment works, 10 of those being considered non-trivial.

All non-trivial contraventions of the faecal coliform and coliform standards have been formally notified to Water Service. All contraventions of microbiological standards at water treatment works are followed up

urgently and remedial action is taken by Water Service as a matter of policy.

Figure 5: Number of Water Treatment Works Not Complying with Standards

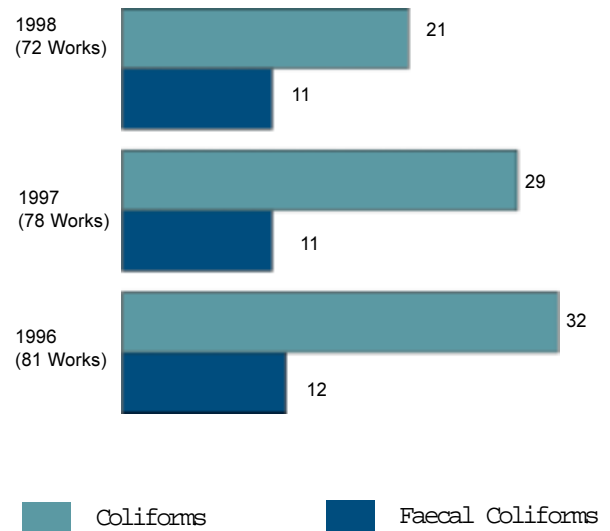


Table 5.2

MICROBIOLOGICAL QUALITY OF WATER LEAVING WATER TREATMENT WORKS			
	1998	1997	1996
Coliforms			
Total number of determinations	9,824	10,112	9,916
- number of determinations containing coliforms	28	48	46
- % containing coliforms	0.29	0.47	0.46
Treatment works with coliforms detected	21	29	32
Faecal Coliforms			
Total number of determinations	9,824	10,112	9,916
- number of determinations containing faecal coliforms	16	12	14
- % containing faecal coliforms	0.16	0.12	0.14
Treatment works with faecal coliforms detected	11	11	12
Number of Water Treatment Works	72	78	81

Microbiological Quality of Water in Service Reservoirs

5.6 Summary results for service reservoirs are given in Table 5.3. These results indicate an improvement in the water quality at service reservoirs compared to that reported for 1997. The number of service reservoirs not complying with the microbiological standards reported an improvement in 1998 (Figure 6 refers). A longer run of data is required before trends can be established.

5.7 Of the 18,986 determinations in samples taken at service reservoirs in 1998, 99.40% were free from coliforms. During this reporting period, coliforms were detected in at least one sample collected at 83 service reservoirs. However, the Regulations are only contravened at a service reservoir if more than 5% of the samples taken during the year contain coliforms. On this basis, 11 service reservoirs contravened the

coliform standard. These non-trivial contraventions have been formally notified to Water Service.

Figure 6: Number of Service Reservoirs Not Complying with Standards

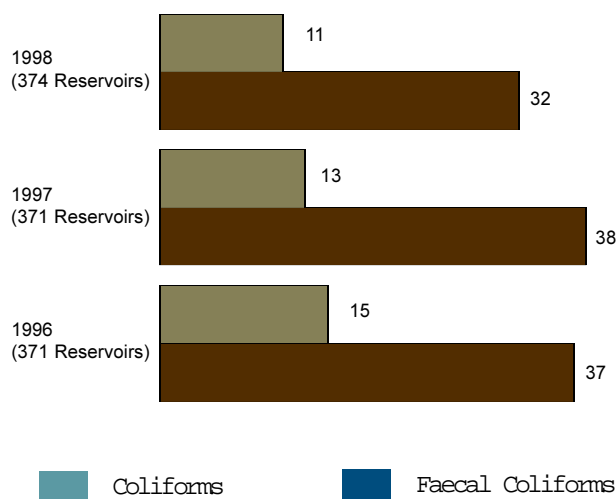


Table 5.3

MICROBIOLOGICAL QUALITY OF WATER IN SERVICE RESERVOIRS			
	1998	1997	1996
Coliforms			
Total number of determinations	18,986	18,987	19,354
- number of determinations containing coliforms	114	164	199
- % containing coliforms	0.60	0.86	1.03
Service reservoirs with coliforms detected in more than 5% of samples	11	13	15
Faecal Coliforms			
Total number of determinations	18,986	18,986	19,354
- number of determinations containing faecal coliforms	36	43	46
- % containing faecal coliforms	0.19	0.23	0.24
Service reservoirs with faecal coliforms detected	32	38	37
Number of Service Reservoirs	374	371	380

5.8 Of the 18,986 determinations carried out for faecal coliforms in samples taken at service reservoirs during 1998, 99.81% met the regulatory requirements. Faecal coliforms were detected in at least one sample at 32 service reservoirs. Contraventions of the faecal coliform standard were considered trivial for 20 of these cases. Non-trivial contraventions of the faecal coliform standard at 12 service reservoirs have been formally notified to Water Service.

5.9 All contraventions of microbiological standards at service reservoirs are followed up urgently and remedial action is taken by Water Service as a matter of policy. Water Service also has an ongoing programme of service reservoir inspection which includes addressing the problem of possible groundwater and/or surface water ingress.

Water Quality in Water Supply Zones

5.10 Table 5.4 gives a summary of water quality for the 18 key parameters which are significant in Northern Ireland. All other parameters, with the exception of pesticides, have been taken together in the penultimate item of the table under the parameter description Other parameters. Only those parameters which have numerical standards are included under this heading (see paragraphs 4.5 and 4.6). Table 5.4 includes comparable figures for 1997 and 1996. It also outlines:

- 1 the total number of reported determinations for parameters having a PCV;
- 1 the number of determinations and the percentage of the total number of determinations which contravened the numerical PCV, or the concentration or value to which the PCV is permitted to be relaxed under regulation 4 (see paragraphs 4.14 and 4.15); and
- 1 percentage compliance of water supply zones, including non-trivial contraventions.

5.11 For some parameters, exceedences of the numerical value for the PCV, recorded when considering individual determinations, need not necessarily constitute a contravention of the Water Quality Regulations (Northern Ireland) 1994 when assessing compliance for water supply zones (see paragraphs 4.18 and 4.19). In Table 5.4, these circumstances apply to coliforms, trihalomethanes and benzo 3,4 pyrene. (Benzo 3,4 pyrene is included under other parameters).

5.12 When considering non-compliant zones, it needs to be remembered that a single marginal contravention of a parameter may have caused the water supply zone to become non-compliant (see paragraph 4.17). Such contraventions have been included with those regarded as trivial in the compliance assessment (see paragraphs 4.20 and 4.21). A fuller discussion, parameter by parameter, is given in paragraphs 5.14 to 5.53.

5.13 Depending on the magnitude or duration of the contravention, the Inspectorate has assessed each one as being trivial or non-trivial for each water supply zone. The results of the non-trivial compliance assessment are summarized in Table 5.4.

Table 5.4: Water Quality in Water Supply Zones 1998

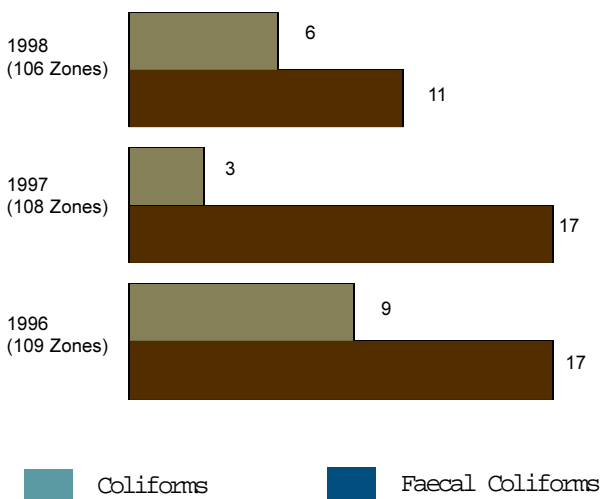
Parameter	Determinations in 1998 Exceeding PCV or Relaxed PCV			Determinations in 1997 Exceeding PCV or Relaxed PCV		Zones 1998		Zones 1997	Zones 1996
	Total No.	No.	%	Total No.	%	% Exceeding PCV or Relaxed PCV	% with Non-Trivial Contraventions	% Exceeding PCV or Relaxed PCV	% Exceeding PCV or Relaxed PCV
Coliforms	5,566	42	0.75	5,604	0.93	5.66	5.66	4.63	8.26
Faecal coliforms	5,566	13	0.23	5,604	0.45	10.38	2.83	15.74	15.59
Colour	829	0	0.00	893	0.00	0.00	0.00	0.00	0.00
Turbidity	966	0	0.00	963	0.83	0.00	0.00	7.41	5.50
Odour (quantitative)	790	0	0.00	818	0.37	0.00	0.00	2.78	0.00
Taste (quantitative)	790	0	0.00	820	0.37	0.00	0.00	2.78	0.00
Hydrogen ion	3,366	12	0.36	3,439	0.55	9.43	1.89	4.63	9.17
Nitrate	746	14	1.88	809	0.12	0.94	0.94	0.93	0.92
Aluminium	1,740	90	5.17	1,812	5.24	21.70	9.43	21.30	33.02
Iron	2,186	89	4.07	2,294	3.88	34.91	16.04	38.89	34.86
Manganese	932	1	0.11	885	1.02	0.94	0.00	5.56	1.83
Lead	730	43	5.89	674	4.15	18.87	8.49	14.81	8.26
PAH (total)	676	17	2.51	727	3.16	8.49	2.83	12.96	15.59
Trihalomethanes	1,243	669	53.82	1,220	41.56	71.70	71.70	65.74	65.14
Total pesticides	426	0	0.00	436	0.69	0.00	0.00	2.78	0.00
Atrazine	450	0	0.00	539	0.93	0.00	0.00	0.93	0.00
MCPA	532	13	2.44	551	3.81	5.66	3.77	7.41	2.75
Mecoprop	517	3	0.58	511	3.52	2.83	0.00	9.26	1.83
Other pesticides	12,404	1	0.01	10,107	0.00	0.94	0.00	0.00	2.75 *
Other parameters	10,347	31	0.30	10,845	0.19	10.38	0.00	7.41	7.34
Total	50,802	1038	2.04	49,551	1.88	No. of Water Supply Zones	106	108	109

* Amended figure - April 1999 erratum.

Microbiological Quality in Water Supply Zones

5.14 Of the 5,566 determinations for faecal coliforms carried out in water supply zones during 1998, 99.77% met the regulatory standards. A total of 11 zones were non-compliant for faecal coliforms in respect of the Regulations (Figure 7 refers). Contraventions in 3 of these water supply zones were regarded as non-trivial.

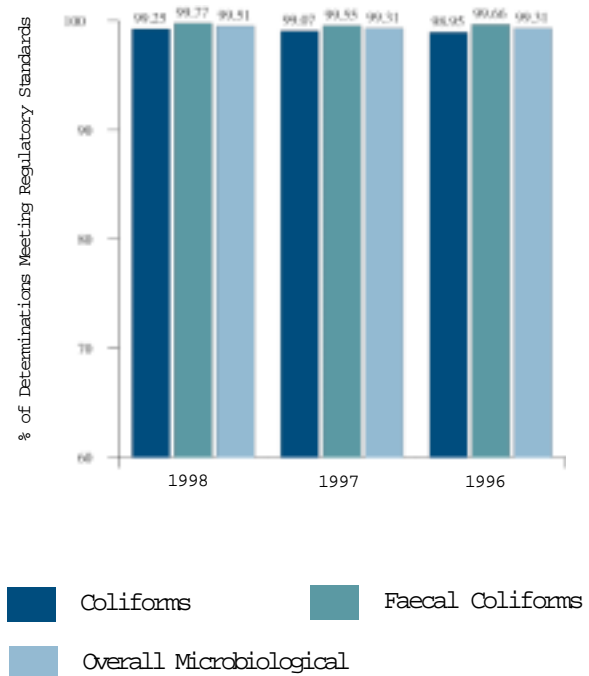
Figure 7: Number of Zones Not Complying with Microbiological Regulatory Standards



For coliform determinations in water supply zones, 99.25% complied with the numerical standard for the PCV in Table C of Schedule 1 to the Water Quality Regulations (Northern Ireland) 1994. During the reporting period, coliforms were detected in at least one sample collected in 28 water supply zones. The Regulations, however, are only contravened in a water supply zone if more than 5% of samples taken contain coliforms (see paragraph 4.18). On this basis, 6 water supply zones contravened the coliform standard. Taking the 2 key microbiological parameters together, the overall compliance rate with the numerical standards for determinations at consumers taps was 99.51% (Figure 8 refers).

The non-trivial contraventions of the faecal coliform standard in 3 water supply zones, and the 6 water supply zones with contraventions of the coliform standard have been formally notified to Water Service.

Figure 8: Microbiological Determinations Meeting Regulatory Standards in Water Supply Zones



5.15 Regulation 11(2) requires that at least 50% of samples taken from water supply zones for monitoring compliance with the key microbiological parameters be taken from randomly selected consumers taps. Water Service collects all samples for microbiological testing from such taps. Contraventions of the standards in samples taken from consumers taps can be caused solely by the condition of the consumer's plumbing. This means that the information in Table 5.4 does not necessarily reflect the microbiological quality of the water supplied. Contraventions of microbiological standards are not necessarily a risk to human health but indicate a potential risk. All microbiological contraventions in water supply zones, as with those at water treatment works and service reservoirs, are followed up urgently and remedial action is initiated by Water Service as a matter of policy.

Trihalomethanes (THM)

5.16 Drinking water in Northern Ireland is predominantly obtained from surface waters, which are likely to contain naturally occurring organic materials. The leaching of this organic content into water supplies is affected by seasonal variations in the climate. Trihalomethanes are by-products of the reaction between chlorine, which is used to disinfect the water and make it microbiologically safe, and these organics.

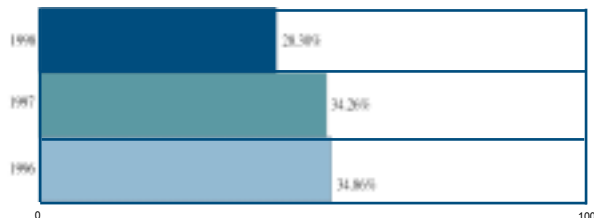
In England and Wales, there are indications that the deterioration in reported compliance for colour and trihalomethanes associated with water supply zones fed from upland peaty catchment sources, may have arisen from the 1995 drought when the peat dried out. This was followed by wetter periods when there was an increased leaching of organics from the peat into the run-off to the reservoirs. In Northern Ireland, climatic variations may have contributed to increasing the organic content of surface run-off

5.17 There is no maximum admissible standard for trihalomethanes in the Drinking Water Directive but the Regulations set a standard for trihalomethanes of 100 mg/l as an average over a 3 month period for the sum of 4 specified trihalomethanes (see paragraph 4.18).

5.18 In 1998, 53.82% of the determinations for trihalomethanes exceeded the numerical 100 microgrammes per litre standard. This is a reported increased failure rate for trihalomethanes. In 1997, 41.56% of determinations exceeded the numerical standard compared to 38.54% in 1996.

5.19 In 1998, the regulatory standard was contravened in 76 (71.70%) water supply zones. Contraventions in all of these zones were assessed as non-trivial and have been formally notified to Water Service. In both 1997 and 1996, the regulatory standard was contravened in 71 water supply zones.

Figure 9: Water Supply Zones Complying with THM Standard



5.20 The improvements reported in the microbiological quality of water supplies (see paragraph 5.4) may, at the same time, have resulted in an increased failure rate for trihalomethanes. Water Service has taken measures to improve the disinfection of water supplies and needs to continue to take steps to bring about compliance with the trihalomethane standard.

5.21 Government guidance encourages that action be taken to reduce trihalomethane concentrations, but only if this can be achieved without prejudicing microbiological quality, which is considered much more important. The World Health Organization has guideline values for trihalomethanes at higher levels than the regulatory standard, and also stresses that primary consideration should be given to ensuring that disinfection is never compromised.

5.22 Water Service's policy is to give priority to the maintenance of microbiological quality in water. Its major water treatment capital works programme is designed to reduce organic material prior to chlorination and, thereby, reduce trihalomethane levels. In the interim, Water Service is assessing the most cost effective methods of implementing recommendations made by the Water Research Centre and others, including a pilot study to assess alternative disinfection regimes to reduce trihalomethanes in supply. Water Service continues to review operational procedures, with the aim of reducing trihalomethane levels in the distribution system.

Lead

5.23 In 1998, an increased number of contraventions of the regulatory lead standard, and of the number of contravening zones when compared to 1997, were recorded in 20 (18.87%) water supply zones. Eleven of these zones were assessed as having trivial contraventions. The non-trivial contraventions of the regulatory standard for lead in 9 zones have been formally notified to Water Service. Continued planned investment is necessary to improve regulatory compliance with the lead standard.

Water Service has undertaken a more detailed investigative programme to identify water supply zones where there is a significant risk that the lead standard may be exceeded. A pilot project designed to minimize the solubility of lead has also been started.

Figure 10: Water Supply Zones Complying with Lead Standard



5.24 In considering contraventions of the lead standard, it is particularly important to bear in mind that the nature and condition of the pipework at sampling locations will greatly influence the results obtained. Water leaving treatment works and in the distribution systems is essentially lead free. If lead is detected at a consumer tap, it is caused by the action of water on existing lead service piping between the water mains and the tap. Whether or not the lead standard is contravened at a particular tap depends on a number of factors, an important one being the plumbosolvency (the tendency for lead to dissolve in water) of the water. Water Service has an ongoing programme of pH adjustment to reduce plumbosolvency (see paragraph 5.44).

5.25 In individual cases where samples have exceeded the regulatory standard for lead, Water Service will take follow-up samples and give the consumer appropriate advice as a matter of policy. Water Service has a general ongoing programme of replacement of its part of lead service pipes, which is carried out during mains rehabilitation. Water Service will also replace, free of charge, any of its pipes which may be made of lead in the supply to a property, but only when a written request is received from a consumer who has replaced the portion of lead service pipe for which the householder is responsible.

Aluminium

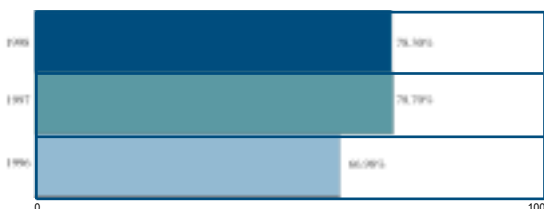
5.26 Aluminium is naturally occurring in many water sources, particularly those derived from upland areas. Aluminium compounds are used as an important part of the processes for the treatment and purification of water, including the removal of harmful organisms. In addition to this primary role, aluminium-based water treatment removes naturally occurring aluminium from water.

5.27 The regulatory standard for aluminium is based on aesthetic considerations because high concentrations in water may cause discoloration. Water supply zones served from the Silent Valley source in the Mourmes have, due to the nature and structure of the ground, naturally occurring aluminium in their water supplies.

There are permitted relaxations of the aluminium standard in these water supply zones (see paragraph 4.14). There are no other relaxations for aluminium in Northern Ireland, irrespective of whether aluminium is present in the raw water source or not, since aluminium-based water treatment is usually in place if required. The compliance assessment takes permitted relaxations into account (see paragraph 4.15).

5.28 In 1998, contraventions of the regulatory standards for aluminium were recorded in 23 (21.70%) water supply zones. Twenty three (21.30%) water supply zones were non-compliant in 1997. In 1998, 13 zones were regarded as having trivial contraventions. The non-trivial contraventions of the aluminium standards in 10 water supply zones have been formally notified to Water Service. These contraventions can result from changes in raw water quality or from fluctuations in the control of the water treatment process.

Figure 11: Water Supply Zones Complying with Aluminium Standards



5.29 As part of a major capital works programme, improvements to several water treatment works have been completed, or are underway, and there are possible early indications that this may be having an effect on the individual aluminium compliance figures, where a significant improvement from 9.88% non-compliance in 1996 to 5.24% in 1997 was reported. The comparable figure for 1998 is 5.17%. Continued planned investment is necessary to further improve regulatory compliance with the aluminium standards.

Iron

5.30 The regulatory standard for iron has been set for aesthetic reasons because levels persistently above the standard can give rise to discoloured water. Contraventions of the regulatory standard for iron were recorded in 37 (34.91%) water supply zones. Contraventions in 20 of these zones were regarded as trivial. The non-trivial contraventions of the iron standard in 17 water supply zones have been formally notified to Water Service.

Figure 12: Water Supply Zones Complying with Iron Standard



5.31 The majority of iron contraventions are considered to be caused by corrosion of older, cast-iron water mains. The presence of excessive iron may make the appearance and taste of the water unacceptable to consumers. Water Service has an ongoing programme of scouring and cleaning of the distribution system to minimize the problem. In addition, there is a continuing planned maintenance programme into the next decade, to reline and replace parts of the distribution system. Continued planned investment is necessary to improve regulatory compliance with the iron standard.

Polycyclic Aromatic Hydrocarbons (PAH)

5.32 PAH can leach into the water supply from the coal tar linings of cast-iron distribution mains. (These linings were used in the past to protect the iron pipes from corrosion.) PAH contraventions will be a localized phenomenon in the distribution system, depending on the pipe lining material and its condition. Contravention of the standard in a water supply zone does not mean that the entire supply in that zone is non-compliant. In 1998, contraventions of the regulatory standard for PAH were recorded in 9 (8.49%) water supply zones. Contraventions in 6 of these zones were regarded as trivial. The remaining 3 water supply zones were assessed as being non-trivial and have been formally notified to Water Service.

Figure 13: Water Supply Zones Complying with PAH Standard



5.33 Remedial action is being taken by Water Service during the continuing planned maintenance programme of relining and replacing parts of the distribution system.

Pesticides

5.34 Pesticides include insecticides, herbicides and fungicides. Government guidelines specify that sampling and analysis should be undertaken for those pesticides used on catchments in significant amounts and those most likely to reach water supplies. Water Service has an ongoing pesticide monitoring programme and currently analyses samples for 32 individual pesticides.

5.35 During 1998, 13,903 determinations for individual pesticides were carried out. Of these, 17 (0.12%) exceeded the very stringent 0.1 mg/l regulatory standard. All of these contraventions were well within the Government Advisory Values given in the Guidance Document, Safeguarding Public Water Supplies.*

The pesticides detected above the regulatory standard were some of those more commonly used: MCPA, mecoprop and glyphosate.

5.36 Contraventions of the regulatory standard for MCPA were reported in 6 water supply zones, 2 of which were assessed as trivial. The non-trivial contraventions of the regulatory standard for MCPA in 4 water supply zones have been formally notified to Water Service.

5.37 Contraventions of the regulatory standard for

mecoprop were reported in 3 water supply zones, all of which were assessed as being trivial.

5.38 Contravention of the regulatory standard for glyphosate was reported in one water supply zone. This contravention was assessed as being trivial.

5.39 The Inspectorate has initiated a review of pesticide usage and control within the water catchment areas.

Nitrate

5.40 The main source of nitrate in surface and ground waters is from agricultural activity on land. Nitrate only occurs at concentrations near the regulatory standard in a few of Water Service's groundwater sources. These sources are usually blended with low nitrate water, derived from other abstractions, before entering supply.

5.41 One water supply zone recorded 14 contraventions of the regulatory standard in 1998. This was attributed to high nitrate levels in one of the ground water sources. This raw water source is within a Nitrate Vulnerable Zone and the requirements of the Action Programme For Nitrate Vulnerable Zones Regulations (Northern Ireland) 1999, aimed at reducing nitrate pollution from agricultural sources, apply.

Figure 14: Water Supply Zones Complying with Nitrate Standard



* Reference - Guidance on Safeguarding the Quality of Public Water Supplies. Department of the Environment, Welsh Office, HMSO, 1989. (ISBN 0 11 752262 7).

5.42 The contraventions were assessed as being non-trivial and have been formally notified to Water Service. It is expected that changes made in operational practices will improve future compliance.

Hydrogen ion (pH)

5.43 The pH is a measure of acidity (or alkalinity) in water. The Regulations prescribe that pH should be between 5.5 and 9.5. Contraventions of the pH regulatory standard were recorded in 10 (9.43%) water supply zones. Contraventions in 8 of these water supply zones were regarded as trivial. The remaining 2 were assessed as being non-trivial and have been formally notified to Water Service.

Figure 15: Water Supply Zones Complying with pH Standard



5.44 In Northern Ireland, many upland waters used for public supply contain acidic organic material derived from peat. The pH of water supplied is adjusted during treatment to control the corrosion of watermains and to reduce the uptake of metals such as lead, copper and zinc from consumers plumbing. Contraventions of the pH standard in treated water can often be related to a problem at the water treatment works. Another, usually temporary cause of contravention of the pH standard, arises from water in contact with the cementitious lining of newly installed water mains in the distribution system.

Manganese

5.45 The regulatory standard for manganese has been set for aesthetic reasons. Manganese occurs naturally in many of Northern Ireland's water sources and, therefore, there are extensive permitted relaxations of the manganese standard in water supply zones (see paragraph 4.14). The compliance assessment takes permitted relaxations into account (see paragraph 4.15).

5.46 In 1998, one contravention of the regulatory standard for manganese was recorded in one water supply zone. This contravention was regarded as trivial.

Figure 16: Water Supply Zones Complying with Manganese Standards



Turbidity

5.47 Turbidity measurements provide an assessment of the fine particles suspended in water. This parameter is often, but not always associated with discoloration, which in turn, can be caused by corrosion within the distribution system. Excessive turbidity can make the appearance of the water unacceptable to consumers. Contraventions of the regulatory standard for turbidity were not recorded in any water supply zones during the 1998 compliance assessment.

Odour (quantitative) and Taste (quantitative)

5.48 Naturally occurring substances which have odour and taste properties are present in many water sources. In the purification of water supplies, the treatment process may remove or introduce odour or taste to the water supply. Odour and taste determinations are carried out using defined analytical procedures to provide quantitative assessment.

5.49 There are permitted relaxations of the odour (quantitative) and taste (quantitative) standards. The compliance assessment takes permitted relaxations into account (see paragraph 4.15).

In 1998, there were no contraventions of the regulatory standards recorded in any water supply zones for either odour (quantitative) or taste (quantitative).

Other Parameters

- 5.50 The penultimate item in Table 5.4 shows that in 1998, 10,347 determinations were made on the wide range of other parameters in the Regulations. Of these, only 3 parameters (oxidizability, nitrite and benzo 3,4 pyrene) contravened the regulatory standard.
- 5.51 The oxidizability parameter provides an indication of changes in water quality and estimates organic content. Total organic carbon measurement also fulfils this function but does not have a PCV assigned to it (see paragraph 4.5). Therefore, the 26 contraventions of the regulatory standard for oxidizability which were reported in 9 water supply zones were considered trivial.
- 5.52 Nitrite concentrations contravened the regulatory standard in 2 water supply zones. Both contraventions were assessed as trivial.
- 5.53 Although benzo 3,4 pyrene contravened the regulatory numerical standard in 3 water supply zones, each on a single occasion, these exceedences did not constitute a breach of the Regulations. A water supply zone is non-compliant in respect of benzo 3,4 pyrene only if the average concentration or value during the calendar year exceeds the PCV (see paragraph 4.18).

Cryptosporidium

- 5.54 Cryptosporidium is a parasitic organism which has been recognized as a cause of gastro-intestinal illness in humans. It is present in the aquatic environment, usually in small numbers, and is found more commonly in surface waters than in groundwater. It is closely associated with livestock and is, therefore, more likely to occur in areas of agricultural activity than in remote upland catchments. Conventional water treatment, operated in accordance with good practice, is normally an effective barrier against Cryptosporidium.

- 5.55 In 1997, the Inspectorate had initiated, with the cooperation of Water Service, a preliminary Cryptosporidium risk assessment which had the aim of checking the implementation of the recommendations of the Second Report of the Group of Experts, Cryptosporidium in Water Supplies*. This work continued throughout 1998 and is ongoing, further taking into consideration the new developments contained in the Third Report of the Group of Experts**. A more detailed Cryptosporidium risk assessment at water treatment works was developed during 1999 and revised monitoring arrangements will be implemented during 2000. Monitoring arrangements will be considered further, in the light of experience gained from the initial monitoring by a liaison group which takes its membership from the Inspectorate, Water Service and the Department of Health, Social Services and Public Safety.

Standard Sampling Frequencies

- 5.56 The Water Quality Regulations (Northern Ireland) 1994 set out sampling requirements which demonstrate the wholesomeness of drinking water supplies. For 1998, the Inspectorate carried out an assessment of the regulatory standard sampling frequencies for water supply zones, water treatment works and service reservoirs.
- 5.57 Only where the annual sampling frequency is for 50 samples or more, has any short fall of the regulatory sampling requirements been considered trivial, and then only to the extent of 2% of the requirement.
- 5.58 Excess samples can be programmed into the sampling programme so that if a sample is not collected for any reason, it does not cause a short fall. The excess samples should not be more than 5-10% of the required number and should not concentrate on any one group of parameters.

* Reference - Badenoch J (1995) Cryptosporidium in Water Supplies - Second Report of the Group of Experts, Department of the Environment, Department of Health, London, UK, HMSO. (ISBN 0 11 753136 7).

** Reference - Bouchier I (1998) Cryptosporidium in Water Supplies - Third Report of the Group of Experts, Department of the Environment, Department of Health, London, UK, HMSO. (ISBN 1 85112 131 5). (<http://www.dwi.detr.gov.uk/crypto/bouc.htm>).

- 5.59 In the 1998 sampling assessment of water treatment works, sampling excesses of more than 10% have been considered non-trivial.
- 5.60 Based on the compliance assessment of the regulatory requirements for sampling and analysis, Water Service has generally met the requirements. The identified deficiencies are described in more detail in paragraphs 5.61-5.66.
- 5.61 During 1998, 50,802 determinations were carried out on samples taken at consumers taps in water supply zones. The Inspectorate identified a short fall of 1,209 determinations. For water supply zones, 1.55% of the regulatory standard sampling requirements were assessed as non-trivial; the comparable figure reported for 1997 was 0.50%.
- 5.62 The compliance assessment of each water supply zone is made on a parameter basis. Fifty two (49.06%) water supply zones recorded a non-trivial sampling contravention for at least one parameter; the comparable figure for 1997 was 30.56%. Thirty nine water supply zones had sampling short falls for more than one parameter in 1998 compared to 30 water supply zones in 1997.
- 5.63 Compliance assessments of regulatory sampling requirements were carried out for water treatment works and service reservoirs.
- 5.64 In 1998, 72 water treatment works sampling points were routinely sampled and analysed. The Inspectorate identified a significant number of water treatment works where there was a short fall or excess of the regulatory standard sampling frequency; 37 water treatment works (51.39%) recorded a non-trivial sampling contravention.
- 5.65 In 1998, samples were taken from 374 service reservoirs. The Inspectorate identified a short fall of the required sampling frequencies in 51 (13.64%) service reservoirs.

- 5.66 Water Service has been formally notified of the non-trivial contraventions of the standard sampling frequencies for water supply zones, service reservoirs and water treatment works. Action will be taken to remedy the sampling short fall.

Compliance with New Standards

- 5.67 A new EC Drinking Water Directive 98/83/EC was published in the Official Journal of the European Communities on 25 December 1998. Most of the new and tighter standards have to be met by the end of 2003. For bromate, lead and trihalomethanes, interim standards have to be met by the end of 2003, and final standards by the end of 2008, 2013 and 2008 respectively.
- 5.68 The new Directive contains 2 types of parameter values. Firstly, there are mandatory standards that have to be met by the specified dates given above. Table 5.5 shows those mandatory standards of the Directive that have changed or are new, together with the current regulatory standards. It does not include those standards that have been dropped altogether or those that have not changed. Secondly, there are non-mandatory indicator values for monitoring purposes. Any exceedence of a value has to be investigated but remedial action only needs to be taken when there is a risk to public health. Table 5.6 shows the new indicator values of the Directive together with the current regulatory standards. Some of these indicator values may be retained as mandatory standards when the new Regulations are made. Parameters that have been dropped altogether are not included in Table 5.6.

Table 5.5: New Mandatory Standards

Parameter	Current Regulatory Standard	New Directive Mandatory Standard	Unit	Comment
Faecal coliforms	0		No/100 ml	Parameter name change
E coli		0	No/100 ml	
Faecal streptococci	0		No/100 ml	Parameter name change
Enterococci		0	No/100 ml	
Acrylamide		0.10	g/l	Control by product specification
Antimony	10	5	g/l	
Arsenic	50	10	g/l	
Benzene		1	g/l	
Benzo 3,4 pyrene	0.01 ^(a)	0.01	g/l	
Boron	2.0 ^(a)	1.0	mg/l	
Bromate		25	g/l	by end 2003
		10	g/l	by end 2008
Copper	3.0	2.0	mg/l	
1,2 dichloroethane		3.0	g/l	
Epichlorhydrin		0.10	g/l	Control by product specification
Lead	50	25 ^(c)	g/l	by end 2003 } monitoring
		10 ^(c)	g/l	by end 2013 } to be decided
Nickel	50	20	g/l	
Nitrite		0.1	mg/l	Ex works
	0.1	0.5	mg/l	Consumers taps
Nitrate/nitrite		Formula ^(d)		
PAH	0.2		g/l	6 substances inc. fluoranthene
		0.1	g/l	4 substances exc. fluoranthene
Tetrachloroethene	10	} 10	g/l	Sum of 2 substances
Trichloroethene	30		g/l	
Trihalomethanes	100 ^(b)	150	g/l	by end 2003 } sum of
		100	g/l	by end 2008 } 4 THM
Vinyl chloride		0.5	g/l	Control by product specification

(a) annual average

(b) three monthly average

(c) weekly average

(d) the formula is $[\text{nitrate}]/50 + [\text{nitrite}]/3 \leq 1$

Table 5.6: New Non-Mandatory Standards

Parameter	Current Regulatory Standard	New Directive Indicator Value	Unit	Comment
Aluminium	200	200	g/l	
Iron	200	200	g/l	
Manganese	50	50	g/l	
Chloride	400 ^(a)	250	mg/l	
Colour	20	Acceptable to consumers and no abnormal change	mg/l Pt/Co	
Odour	3		Dilution No	
Taste	3		Dilution No	
Turbidity	4		FTU	
		1	NTU	Strive for ex works
Coliforms	0 ^(c)	0	No/100 ml	
Conductivity	1500 ^(a)	2500	S/cm at 20°C	
Hydrogen ion	5.5 min 9.5 max	6.5 min 9.5 max		
Sodium	150 ^(b)	200	mg/l	
Oxidizability	5	5	mg oxygen/l	
Sulphate	250	250	mg/l	
Sulphite reducing clostridia	<1		No/20ml	Parameter name change
Clostridium perfringens		0	No/100 ml	Surface Water
Radioactivity:				
Tritium		100	Bq/l	} Monitoring to be decided
Total indicative dose		0.1	mSv/year	

(a) annual average

(b) three yearly average

(c) 95% of results must comply

DRINKING WATER QUALITY INCIDENTS AND COMPLAINTS

6.1 Where a water quality incident or event has occurred, Water Service is required to provide the Inspectorate with information in accordance with agreed procedures. The Inspectorate defines an incident as a situation where there has been a demonstrable deterioration in the quality of drinking water. Where no such deterioration has taken place, the situation is classified as an event. All incidents and events are assessed by the Inspectorate. In 1998, Water Service notified the Inspectorate of 5 water quality incidents and 3 events.

In May 1998, in the Belfast/Down area, an event involving the reporting of some *Cryptosporidium* cases was notified to the Inspectorate. These cases were subsequently considered to be attributable to causes other than the water supply. A summary of the water quality related incidents/events is provided in the table below.

Water Quality Incidents/Events

Date	Location	Nature of Incident/Event	Classification
February 1998	Dunmisk Park, Belfast	Water main breach in the vicinity of a fractured sewer.	Event
March 1998	Hollywood	Replacement of Creighton Green source (which had been out of service) by Church Road source.	Event
March 1998	Killyfole, Enniskillen	Exceedences of pesticide parameter (MCPA) at Killyfole Water Treatment Works.	Incident
June 1998	Lynnhurst Avenue, Bangor	Bacteriological exceedence - Boil notice issued.	Incident
July 1998	Kilmaconnell Road, Coleraine	Back siphonage contamination of public supply from cattle trough.	Incident
August 1998	Ballymartin Village, Co Down	Bacteriological exceedence - Boil notice issued.	Incident
November 1998	Rathlin Island	Bacteriological exceedence - Boil notice issued.	Incident

6.2 In 1998, the Inspectorate received 22 complaints relating to drinking water quality. All complaints were referred to Water Service for follow-up investigation. The main categories of complaint were:

- 1 taste and odour (11 complaints);
- 1 discoloration of water supply (8 complaints);

- 1 presence of sediment (1 complaint);
- 1 presence of aquatic fauna (1 complaint); and
- 1 inadequate water supply (1 complaint).

As a matter of policy, all complaints, events and incidents are followed up urgently and remedial action is initiated by Water Service.

PRIVATE WATER SUPPLIES

7.1 The Private Water Supplies Regulations (Northern Ireland) 1994 apply to private supplies which serve more than one household for purely domestic purposes, or are used in commercial food production, that is, the making, processing, preserving, preparing, or marketing of food or drink (including water) for sale for human consumption. Private water supplies in Northern Ireland are defined as any supplies of water provided otherwise than by the public supplier, Water Service.

7.2 The Inspectorate is responsible for monitoring private water supplies. Before monitoring takes place, all private water supplies must first be identified and classified. The Inspectorate continues to review the private supplies falling within the Private Water Supplies Regulations (Northern Ireland) 1994:

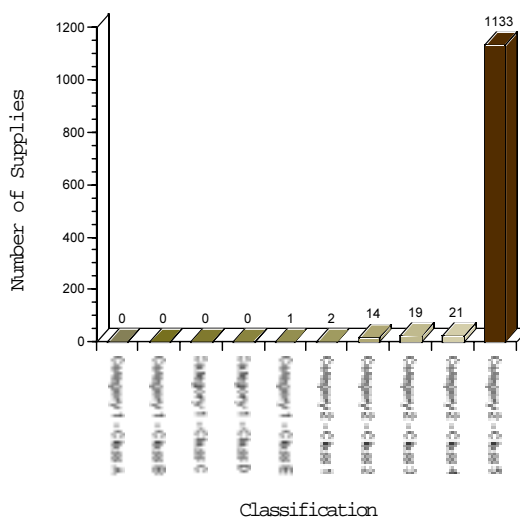
- 1 1,190 private water supplies have been identified to date and categorized into one of 10 classes according to size, nature and use of the private water supply; and
- 1 a sampling and analysis monitoring programme, based on these classifications, has been implemented for private water supplies.

7.3 The monitoring requirements of the Regulations vary according to the size and nature of a private supply. For each supply, these will be based on one of the 10 classes specified in Schedule 1 to the Private Water Supplies Regulations (Northern Ireland) 1994. There are 2 categories of private water supplies:

- 1 **category 1** a supply which is used only for drinking, washing or cooking by people living in properties receiving the supply. Category 1 supplies are placed in classes A to E depending on the number of people supplied or the volume of water used; and
- 1 **category 2** a supply which is used to make food or drink that is sold, or is used in properties with a regularly changing population, for example, hospitals, hotels, caravan sites or schools. Category 2 supplies are placed in classes 1 to 5 depending on the volume of water used.

7.4 In Northern Ireland, the majority of private water supplies are category 2, class 5 (predominantly used by dairy farms). The various private supplies are classed in Figure 17.

Figure 17: Private Water Supplies Classification Categories



7.5 To increase awareness of the water quality of private water supplies, the Inspectorate produced a leaflet *Is your PRIVATE Water Supply SAFE?* which was widely circulated to owners through the Department of Agriculture for Northern Ireland, and the 26 District Councils. The purpose of the leaflet is to alert owners and users of private water supplies to the risks of contamination of their water supplies.

DRINKING WATER RESEARCH

8.1 Most research into drinking water quality and health is funded by the Department of the Environment, Transport and the Regions (DETR) as part of a research programme designed to meet the needs of the United Kingdom Government in formulating policy relating to the quality of public and private water supplies, and in imparting sound scientific input to European and worldwide debate on drinking water issues. The Drinking Water Inspectorate for England and Wales provides the research programme management and administration function for the Water and Land Directorate (WLD) of DETR. The Drinking Water Inspectorate for England and Wales also provides the contract management function for the Water Distribution, Conservation and Quality (WDCQ) research programme. The content of the research programme is determined at the annual meeting of the Research Programme Committee. The objectives of the programme are to assist DETR and the Welsh Office to formulate policy on the quality of water supplies and to make an input to European and international drinking water issues. It also assists the Drinking Water Inspectorate for England and Wales to formulate its approach to the technical audit of water companies. Approximately £900,000 of the £3,300,000 WLD research budget was devoted to the WDCQ programme during 1998.

8.2 The WLD research programme is a component of the DETR Environment Protection Group (EPG) research programme. Details of the EPG programme can be obtained from the Science and Technology Policy Division, DETR, Great Minister House, Horseferry Road, London SW1P 4DR. Details of EPG research requirements for 1999/2000 can be obtained from: Mr K Nulty, DETR, 5/F8 Ashdown House, 123 Victoria Street, London SW1E 6DE.

Information on WDCQ Research

8.3 Specific enquiries about current research and future research requirements should be addressed to Mr M S Smith, DWI, 2/A1 Ashdown House, 123 Victoria Street, London SW1E 6DE.

8.4 Executive summaries of all the reports produced under the WDCQ research programme and previous Department of the Environment drinking water programmes, are posted on the Foundation for Water Research (FWR) website (<http://www.fwr.org>) Copies of research reports can be obtained from the Foundation for Water Research, Allen House, The Listons, Liston Road, Marlow, BUCKS SL7 1FD.

COMPLETED RESEARCH

8.5 Research contracts were funded solely by DETR and copies of reports are available through FWR, unless otherwise indicated.

Private Water Supplies

8.6 Following the successful conclusion of an agreement with the National Sanitation Foundation (NSF) International over the use of copyright material, five test protocols have been published on the Drinking Water Inspectorate for England and Wales website (<http://www.dwi.detr.gov.uk/protocol/index.htm>). The protocols provide a basis for assessing the performance of treatment systems which might be used in private water supplies. A contract has been placed with WRC to review and update the protocols in the light of comments received from users.

8.7 DETR has collaborated with the Environment Agency (EA) and the Welsh Office to provide analytical support for an investigation into the concentrations of sheep-dip compounds, including organo-phosphates, in private water supplies.

Cryptosporidium

Private Water Supplies

8.8 A collaborative study of surrogate measures for the infectivity of *Cryptosporidium* has been funded jointly by DETR and the American Water Works Association Research Foundation (AW WARF). The contractor was Clancy Environmental Consultants Inc. and the participating organisations included the University of Arizona, Thames Water Utilities and the Scottish Parasite Diagnostic Laboratory. Comparisons were made between neonatal mouse infection, inclusion/exclusion of vital dyes and *in vitro*

excystation. The final report is available from: Phalita Hampton, AW WARF, 6666 West Quincy Avenue, Denver, CO 80235, USA.

- 8.9 Alcontrol Laboratories have completed a review of published disinfection studies on *Cryptosporidium*. The contract also included an investigation into how the affinity of antibodies to *Cryptosporidium* is affected by oocyst source, age, concentration and purification procedures. The results were considered at a workshop organized in late 1999 (see 8.23 below).
- 8.10 The Scottish Parasite Diagnostic Laboratory has participated in a collaborative trial organized by the United States Environment Protection Agency, of a novel continuous centrifugation system for separation of protozoan parasites from water.
- 8.11 The Centre for Applied Microbiological Research has investigated the feasibility of establishing an animal infection model for genotype 1 oocysts of *Cryptosporidium*. This genotype is infectious to humans but not animals. The study has looked at the possibility of establishing infection in immuno-compromised mice in order to use this animal for production of supplies of the genotype 1 oocyst.

Endocrine Disrupters

- 8.12 Research in 1997 and 1998 concentrated on development of analytical methods for endocrine disrupters in water and assessment of the potential for polymeric materials to constitute a source of exposure for these substances. The Laboratory of the Government Chemist has supervised a collaborative trial of a method for the analysis of trace levels of oestrone, 17 β oestradiol and ethynyl oestradiol in water sources and drinking water. This trial was funded by DETR, EA and UK Water Industry Research Ltd (UKWIR). The analytical method will be considered by the EA Standing Committee of Analysts for publication in its Methods for Examination of Water and Related Materials series.
- 8.13 WRc has completed a study of the potential for endocrine disrupters to leach into water from polymeric materials, including those

used in the public water supply systems and in water supply systems within consumers premises.

Water Supply within Consumers Premises

- 8.14 Research into policy aspects of the control of water supply systems within consumers premises falls within the scope of the WLD and the DETR Construction Directorate (CD) research programmes. The projects referred to below were either funded from the WDCQ research programme or involved the Drinking Water Inspectorate for England and Wales participation in CD funded research. The results of this research were considered by the DETR Water Regulations Advisory Committee (WRAC), which advised Ministers on the content of regulations which replaced the Water Bylaws.
- 8.15 The Building Services Research and Information Association (BSRIA) has completed an investigation into the effectiveness of chlorine dioxide and electrolytically generated copper/silver ions in the control of legionella. The conclusions of this study will be published by the Health and Safety Executive in the revision of its guidance on the control of legionella in hot and cold water services (Technical Supplement to HS(G)70). The Building Research Establishment has completed reviews on the applications of waterless toilets and low water use showers in water conservation schemes; guidance based on these reports will be published as BRE Construction Notes. WRc has completed 2 studies which were intended to inform the development of guidance to WRAC: A study on the performance specification for float valves in relation to avoiding the need for external warning pipes on water closets; and a study on the specifications for backflow prevention devices. WRc has also carried out a review of the feasibility of using coating and lining techniques to eliminate exposure to lead from household plumbing.

Quality of Water Supplies and Monitoring Arrangements

- 8.16 Creative Research has completed a consumer consultation exercise on behalf of the Drinking Water Inspectorate for England and Wales. The consultation was intended to

ensure that consumers views on drinking water quality issues are taken into account when the level of future water bills is set. The report has been published by the Drinking Water Inspectorate for England and Wales. Consultants CES have prepared a review of the approaches adopted by member states of the European Union when setting standards for health related parameters. WRc has completed a review of the arrangements for monitoring and reporting the quality of drinking water in Europe, including the former Eastern Bloc countries. This review represents the UK contribution to a World Health Organization-United Nations Economic Commission for Europe protocol on water and health in relation to transboundary watercourses and international lakes. WRc has also completed an assessment of the alternatives to chemical disinfection that might be applied in the treatment of drinking water.

- 8.17 The Drinking Water Inspectorate for England and Wales, assisted by conference Secretariat, organized an international workshop on the difficulties in comparing the performance of microbiological methods for examination of bacteria in water. The workshop was intended to assist the development of a protocol which member states of the European Union could use to demonstrate the comparability of national test procedures with the reference procedures specified in the new Drinking Water Directive. The Public Health Laboratory Service is carrying out further development and will produce a protocol in a format suitable for submission to the International Standards Organization for consideration as an ISO method.
- 8.18 The University of Leeds has completed an ecological study of the possible correlation between nitrate concentrations in drinking water and the incidence of childhood diabetes. The study, which considered data from Scotland and a large area of Southern England, failed to identify any correlation. It was concluded that the positive correlation reported in a smaller study in Yorkshire had arisen by chance or because nitrate was a surrogate for another, as yet unidentified, environmental factor.

Materials Testing and Approval

- 8.19 WRc has completed 2 studies on cementitious materials: a review of the toxicology of cement admixtures; and a study of the potential for leaching of toxic metals from ready mixed and site mixed concrete. These reviews will assist the development of a procedure for authorising the civil engineering uses of cementitious materials in contact with drinking water, when the traditional use exemptions, which are currently available under regulation 25(1)(c) (Northern Ireland Regulation 24(b)(iii)) of the Regulations, are removed in April 2000.
- 8.20 WRc has also completed experimental work on leaching test procedures for use in the approval of drinking water treatment membranes. The study compared the French and Dutch test procedures in the testing of ultra-filtration and reverse osmosis systems. The results will be submitted for consideration at a workshop to be organized jointly by the Drinking Water Inspectorate for England and Wales, Kiwa (The Dutch Certification/Testing Body) and NSF International. The workshop will attempt to develop an international consensus on the health-based approval of membrane technologies for drinking water treatment.
- 8.21 The Water Quality Centre (WQC) has completed phase 1 of an assessment of the comparability of European approval testing for polymeric water supply pipes. The results of this study are being considered by the European Commission's Regulatory Group - Construction Products Drinking Water (RG-CPDW). The RG-CPDW is responsible for development of proposals for introducing a harmonized European approval system for water supply products

CURRENT RESEARCH

Cryptosporidium

- 8.22 The West Cumbria epidemiological study was commissioned in late 1994 to investigate the cause of an apparently high background incidence of cryptosporidiosis in an area served by unfiltered water supplies. These supplies will now be upgraded through provision of membrane treatment processes at the water works and the study is being

extended to investigate the impact of this additional treatment on the incidence of cryptosporidiosis. The study will also investigate whether installation of treatment is accompanied by any changes in the sero-prevalence status of the population.

- 8.23 The Drinking Water Inspectorate for England and Wales collaborated with AW WARF to organize a workshop which evaluated the results of research into how reactions at the surface of *Cryptosporidium* oocysts are influenced by the history of the oocyst in terms of its source and the procedures for concentration and purification. This workshop was used to focus the scope of an AW WARF study on the structural physiology of the oocyst surface in relation to its vulnerability in water treatment.

Materials Testing and Approval

- 8.24 WRC is carrying out leaching tests to assess the possible migration of selected cement admixtures from concrete into water supplies.

WQC is carrying out phase 2 of a study on the comparability of European test procedures for polymeric water supply pipes. The study will investigate Dutch proposals for assessing potential to support microbiological growth and the French cytotoxicity test procedure.

Water Supply and Consumers Premises

- 8.25 The Construction Industry Research and Information Association (CIRIA) is managing a DEIR funded review of international standards for re-use of grey water. The review will develop proposals for application in the UK. The proposals will be incorporated in the final report of a CIRIA report: Buildings That Save Water. CIRIA is also managing a DEIR funded review of the application of rainwater infiltration systems. This review will be used to produce authoritative planning guidance to local authorities on sustainable urban drainage systems in the UK.

DEFINITIONS AND GLOSSARY OF TERMS

Aquifers	water-containing underground strata.
Catchment	the area of land that drains into a watercourse.
Coliforms	a group of bacteria which may be faecal or environmental in origin.
Compliance assessment	a comparison made by the Inspectorate, of data provided by Water Service, against regulatory requirements.
Contravention	a breach of the regulatory requirement.
Cryptosporidium	a protozoan parasite.
Cryptosporidiosis	the illness produced by infection with Cryptosporidium.
Determination	a single analytical result for a specific parameter.
Distribution systems	a water supplier's network of mains, pipes, pumping stations and service reservoirs through which treated water is conveyed to consumers.
Drinking Water Directive	European Council Directive 80/778/EEC relating to the quality of water intended for human consumption. (Replaced by Council Directive 98/83/EC in December 1998 - the New Directive).
Event	a situation affecting or threatening to affect drinking water quality.
Exceedence	synonym for contravention (see above).
Faecal coliforms	a sub-group of coliforms, almost exclusively faecal in origin.
GCMS/MS	analytical techniques used - gas chromatography mass spectrometry/mass spectrometry.
Groundwater	water from aquifers or other underground sources.
Incident	an event where there has been a demonstrable deterioration in the quality of drinking water.
Indicator organism	an organism which indicates the presence of contamination and, hence, the possible presence of pathogens.

Inspectorate	the Northern Ireland Drinking Water Inspectorate.
Investment programme	investment in improvement works to water treatment works and distribution systems.
Key parameters	18 parameters chosen for this report to indicate the quality of water in water supply zones.
Leaching	to lose or cause to lose soluble substances by the action of a percolating liquid.
Mains rehabilitation	restoration of watermains pipework to a proper condition.
m ³ /d	cubic metres per day.
mg/l	milligrammes per litre.
ml	millilitres.
ML/d	megalitres per day (one ML/d is equivalent to 1,000 m ³ /d or 220,000 gallon/d).
µg/l	microgrammes per litre.
Oocyst	the resistant form in which <i>Cryptosporidium</i> occurs in the environment, and which is capable of causing infection.
PAH	a group of organic compounds known as polycyclic aromatic hydrocarbons, comprising, for the purposes of the Regulations, 6 substances: fluoranthene, benzo 3,4 fluoranthene, benzo 11,12 perylene, benzo 3,4 pyrene, benzo 1,12 perylene and indeno (1,2,3-cd) pyrene.
Parameter	a parameter is any substance, organism or property listed in Schedule 1 and regulation 3 of the Regulations.
Pathogen	an organism which causes disease.
PCV	see Prescribed concentration or value .
Pesticides	any fungicide, herbicide or insecticide or related product (excluding medicines) used for the control of pests or diseases.
Plumbosolvency	the tendency for lead to dissolve in water.

Public registers	the information made available to the public as required by regulations 26 and 27.
Prescribed concentration or value	the numerical value assigned to water quality standards (PCV), defining the maximum or minimum legal concentration or value of a parameter. In certain circumstances, under regulation 4 of the Regulations, certain standards may be permitted to be relaxed to a specific amount. See Relaxation .
Private supplies	any supplies of water provided otherwise than by the public supplier, Water Service.
Protozoan	single celled animal.
Regulations	The Water Quality Regulations (Northern Ireland) 1994 S.R. No. 221 ISBN 0 337 9122 1 or, in the case of private water supplies, The Private Water Supplies Regulations (Northern Ireland) 1994 S.R. No. 237 ISBN 0 337 91237 8.
Relaxation	a relaxation of the standards according to regulations 4 and 5 by reason of the composition of geological strata from which the supplies are taken.
Service reservoir	a water tower ,tank or other reservoir used for the storage of treated water within the distribution system.
Surface water	water from rivers, impounding reservoirs or other surface water sources.
Technical audit	the means of checking that Water Service is complying with its statutory obligations.
Trihalomethanes (THM)	a group of organic substances comprising, for the purposes of the Regulations, 4 substances: trichloromethane, (also known as chloroform), dichlorobromomethane, dibromochloromethane and tribromomethane.
Time of supply	the moment when water passes from the water supplier s pipework into a consumer s pipework.
Toxicology	the study of the health effects of substances.
Treated water	water treated for use for domestic purposes as defined in the Regulations.
W ater supply zone	the basic unit of supply for establishing sampling frequencies, compliance with standards and information to be made publicly available.
W aiver	authorized relaxation.

Wholesomeness

a concept of water quality which is defined by reference to standards and other requirements set out in the Regulations.

W R c

Water Research Centre (1989) plc and/or, as the context may require, its predecessor body.



Our aim is to protect and conserve the natural and built environment and to promote its appreciation for the benefit of present and future generations.

Environment & Heritage Service
Drinking Water Inspectorate
Calvert House, 23 Castle Place
BELFAST BT1 1FY
Tel (028) 9025 4750 - Fax (028) 9025 4865
Website <http://www.nics.gov.uk/ehs/>

Environment & Heritage Service
Natural Heritage
Commonwealth House, 35 Castle Street
BELFAST BT1 1GH
Tel (028) 9025 1477 - Fax (028) 9054 6660
Website <http://www.nics.gov.uk/ehs/>

Environment & Heritage Service
Built Heritage
5-33 Hill Street
BELFAST BT1 2LA
Tel (028) 9023 5000 - Fax (028) 9054 3111
Website <http://www.nics.gov.uk/ehs/>