



Northern Ireland Drinking Water Quality 2002

*A Report by the Northern Ireland
Drinking Water Inspectorate*



An Agency within the Department of the
Environment
www.doeni.gov.uk



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Summary

This report is the seventh 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 2002.

During this reporting period, the drinking water quality results show that out of a total of 104,644 tests carried out by Water Service in 2002, 99.11% met the regulatory standards. This overall water quality figure is the percentage compliance rate for all samples and all parameters collected from water supply zones (consumers' taps), service reservoirs and water treatment works. The overall compliance figure has remained at around 99% in Northern Ireland since 1996, and has marginally improved by 0.05% to 99.11% in 2002 from the 99.06% reported for 2001.

While it is encouraging that there is an indication that overall quality in 2002 is improving due to increased compliance for certain chemical parameters, there is however, a reduction reported in overall microbiological compliance. The compliance rate at consumers' taps for the important microbiological parameters has shown a reduction from 99.69% in 2001, to 99.54% in 2002. For service reservoirs, a similar reduction of 99.66 % in 2001, to 99.51% in 2002 is reported. Compliance rates at water treatment works have been maintained at 99.88% (99.87% in 2001).

The microbiological compliance rate of 99.54% for drinking water at consumers' taps remains good. However, the overall water quality figure for consumers' taps, which also includes physical/chemical tests, is 98.56% due to the continued poorer performance rates for certain chemical parameters. As with previous reporting years, these are notably: trihalomethanes (THMs), iron, aluminium and lead.

Comparable compliance figures for previous years are given in Figures 1-3 below.

Figure 1: Overall Water Quality Compliance with Regulatory Standards

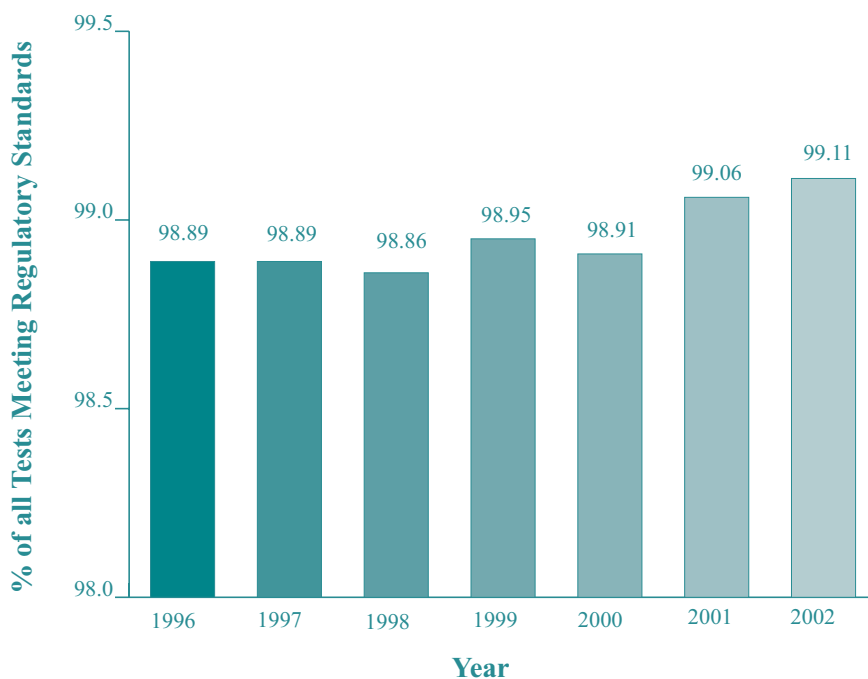
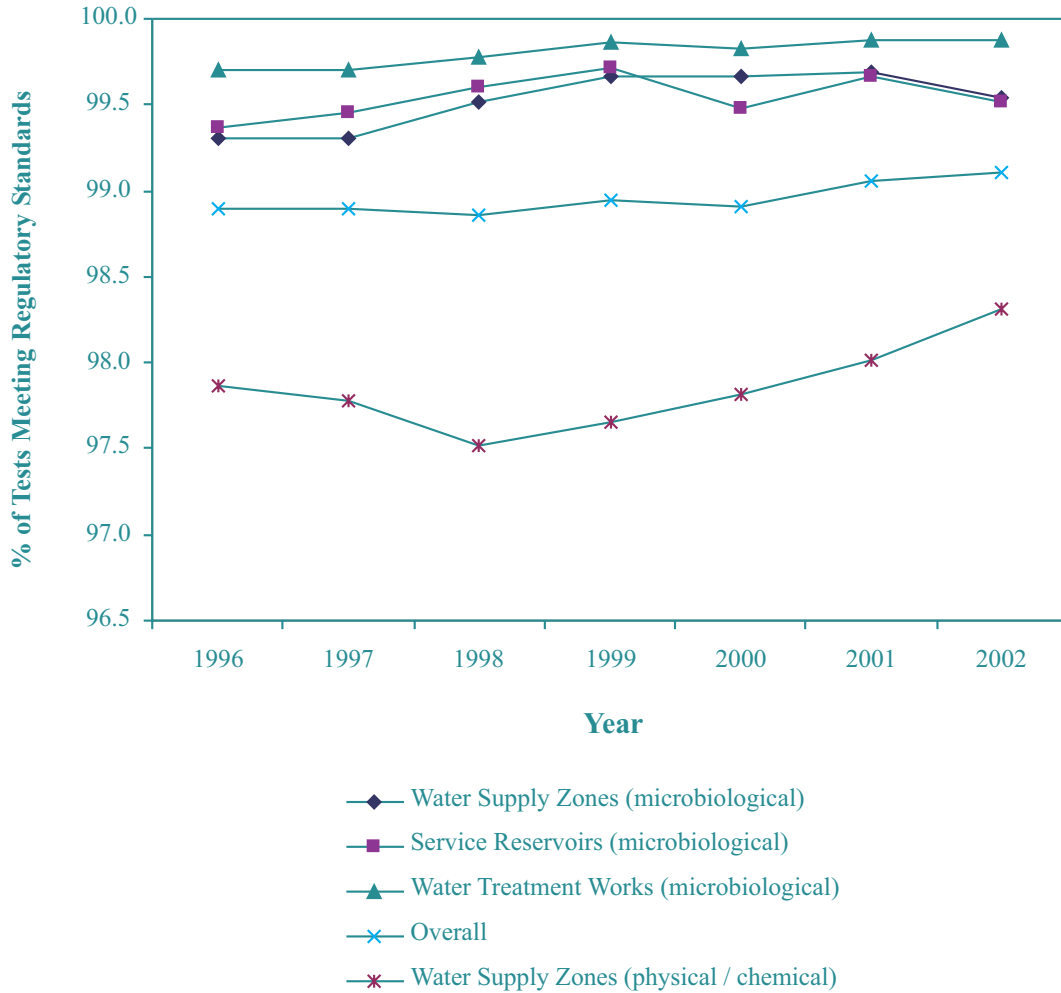
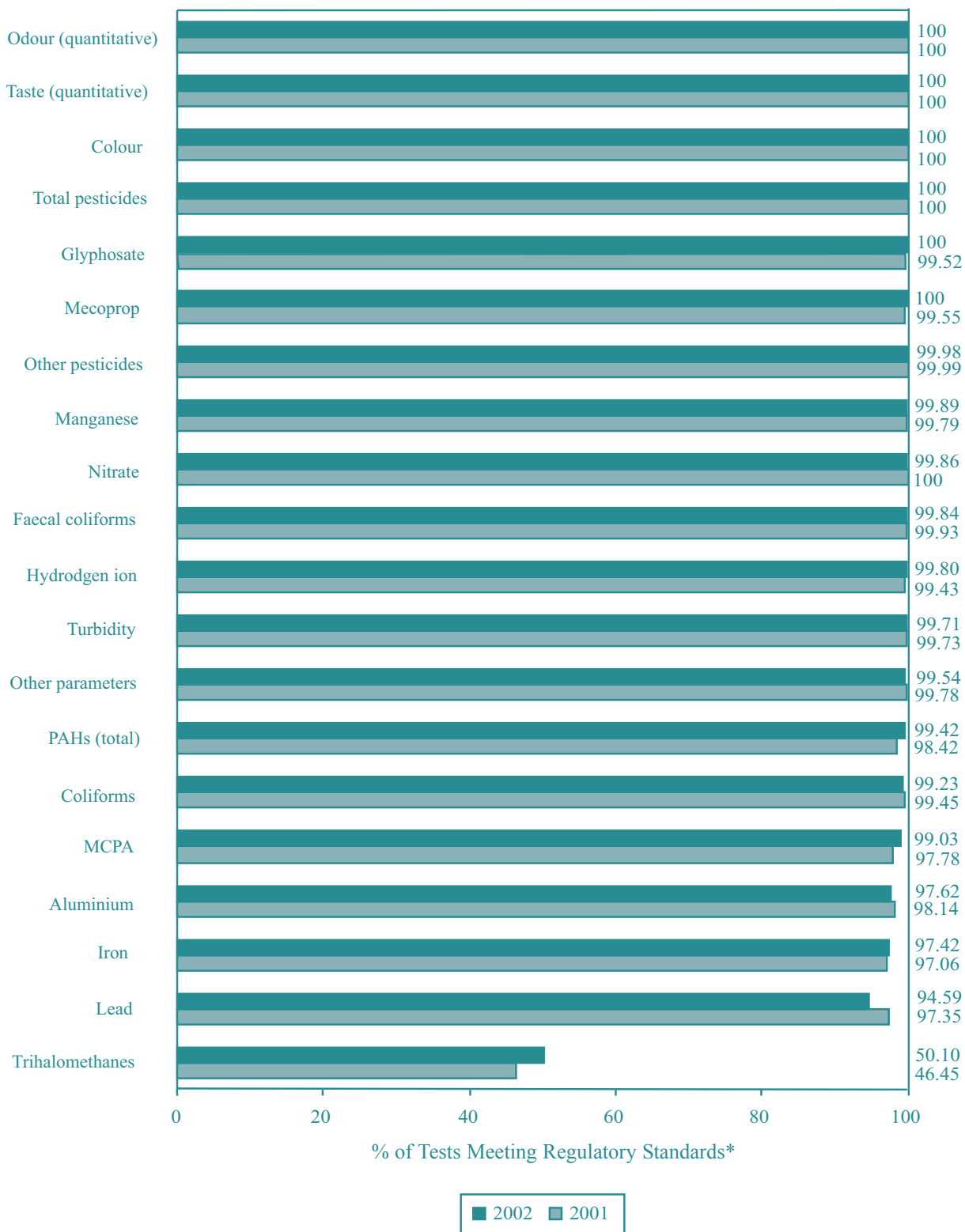


Figure 2: Compliance Summary Results



During 2002, the level of compliance was reported for 101 water supply zones which were routinely monitored for 88 individual parameters. The regulatory requirements were met for 72 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.

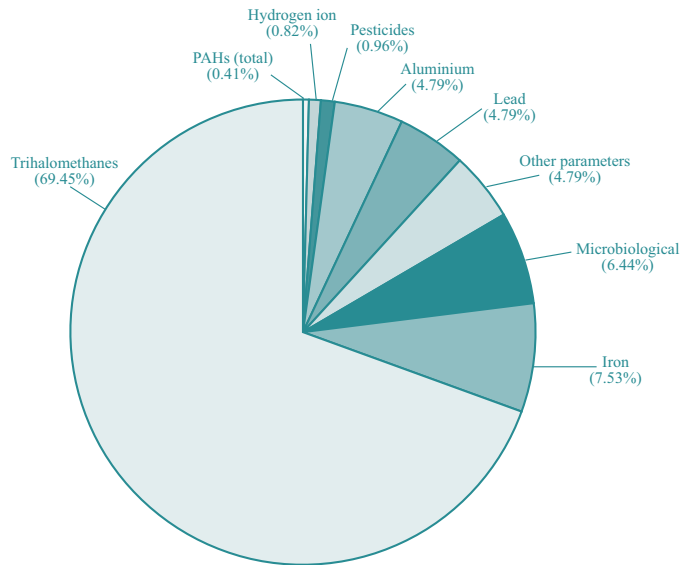
Figure 3: % Compliance for Microbiological & Chemical Quality in Water Supply Zones



*Regulatory Standards refers to the Prescribed Concentration or Values (PCVs) or Relaxed PCVs.

The overall number of physical/chemical tests not meeting the standards shows an improvement, with 1.69% (683) of 40,510 tests failing to meet the required standards in 2002; the comparable figure for 2001 was 2.0%. Figure 4 below shows those parameters, both microbiological and physical/chemical, for which compliance with the regulatory standards was not achieved in 2002. Each is shown as a percentage of the 730 individual contraventions in water supply zones. These continue to relate largely to THMs, lead, iron, aluminium and coliforms.

Figure 4: Contraventions of Standards in Water Supply Zones in 2002



The number of zones contravening the trihalomethane standard in 2002 is 72.28%; this is higher than last year's non-compliance rate of 68.63%. Every effort must continue to be made to control the formation of THMs, while at the same time ensuring that disinfection, and, hence, microbiological quality is never compromised. It is disappointing that during 2002, a reduction in overall microbiological compliance is reported from 99.72% in 2001 to 99.61%.

During 2002 there has been an increase in the number of zones not complying with the regulatory standard for lead; 19 (18.81%) zones failed to comply in 2002 compared to 14 (13.73%) zones in 2001. While Water Service continues to undertake investigative programmes to minimize the solubility of lead, and ortho-phosphate treatment is introduced, every effort must be made to reduce the levels of lead in drinking water to meet the regulatory requirements.

For aluminium, the number of tests that fail to meet the standards has increased from 1.86% in 2001 to 2.38% in 2002, and the number of zones failing to meet the regulatory standards has also increased from 10.78% in 2001 to 11.88% in 2002. While there has been an improving trend for aluminium compliance reported over previous years as investment and improvements to water treatment processes have been implemented, there has, however been a reduction in the compliance rate by 0.52% for the number of tests complying with the regulatory standards for 2002, when compared to last year. It is important that Water Service optimizes operational control of the water treatment processes and that its programme of work to improve water treatment, which is necessary to achieve regulatory compliance, will progress as quickly as possible.

There has been a decrease in the number of water supply zones failing to comply with the iron standard during 2002. A total of 31 (30.69%) zones failed to comply with the iron standard when compared with 38 (37.25%) zones in 2001. While there has been an improvement in compliance reported, the figures reflect that programmes of work are necessary to rehabilitate the distribution system and improve drinking water quality.

Of the 50,688 samples taken at consumers' taps in 2002, the standards laid down in the Water Quality Regulations (Northern Ireland) 1994 were contravened on 730 occasions. Depending on the magnitude or duration of the contravention, the Inspectorate has assessed each contravention as being trivial or non-trivial. Formal notifications for non-trivial contraventions were sent to Water Service for the following parameters:

Trihalomethanes, lead, iron, aluminium, total coliforms, faecal coliforms, turbidity, ammonium, hydrogen ion (pH), MCPA, and nitrate.

All contraventions are followed up by Water Service and remedial action taken where practical and appropriate. When contraventions of the regulatory standards occur, Water Service notifies the Health and Social Services Boards and district councils under an agreed reporting procedure. Only some of the parameters are of health significance, and their standards are generally set with a wide margin of safety. The other parameters are of aesthetic significance, with standards generally set well below the level at which water would become unacceptable to consumers.

In line with the rest of the United Kingdom, a major activity during 2002 was the continuing implementation of arrangements for monitoring Cryptosporidium. The arrangements were established for public health protection and incorporate a formal notification level of one or more oocysts per 10 litres and an alert level of 0.1 oocysts per 10 litres. Of the 1,528 samples collected in the monitoring programme for 2002, no samples were reported to have contained oocysts above the alert level.

The Water Quality Regulations (Northern Ireland) 1994 set out sampling and other regulatory requirements to demonstrate the wholesomeness of drinking water supplies. The compliance assessment process requires Water Service to provide the Inspectorate with specific information requirements; it is imperative that the necessary validated information reporting systems are in place to meet these needs, by the stipulated timescales. In relation to sampling, the Inspectorate expects Water Service to have a target of full compliance with the regulatory standard sampling frequencies. For 2002, there was a significant overall sampling shortfall of 3.3%. The Inspectorate expects Water Service to have a robust sampling programme in place to comply with regulatory requirements.

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

Forward Look

To further protect public health in Northern Ireland, formidable challenges lie ahead in the provision of high quality drinking water. To mitigate contraventions of the Regulations, investment programmes require secured finance to deliver the improvements necessary, and the resources applied to maximum effect, to enable Water Service to comply with both current and imminent new regulatory standards. The large programme of work invested in drinking water infrastructure in England and Wales in recent years illustrates this, with overall compliance there now reported at 99.87%. Comparable compliance rates in Northern Ireland have remained at around 99% since the Regulations were introduced in 1994. In Northern Ireland, the planned investment programmes require: modification of existing treatment; additional treatment; new treatment works; and renovation of distribution systems. The most significant programmes are those needed to achieve compliance with specific parameters, notably: THMs, iron, lead and aluminium. The work on improving water treatment to provide effective barriers against Cryptosporidium continues to be important for the protection of public health.

Preparing for the New Regulations

New Water Quality Regulations, 'The Water Supply (Water Quality) Regulations (Northern Ireland) 2002' come fully into force on 25 December 2003. These new Regulations set out new and revised standards for a number of parameters, for the protection of public health. Most of the standards in the new Regulations remain the same as those in the current Regulations but there are some new requirements such as new and tighter standards, revised information requirements and new investigative and remedial actions to be taken where the drinking water quality standards are not met.

Regarding the new standards and compliance, the monitoring that has been carried out indicates that compliance with the interim lead standard of 25 µg/l will be a significant issue for Water Service. In 2002, 5.41% of samples failed the current standard of 50 µg/l, whereas 9.27% would fail the new interim standard of 25 µg/l which has to be met by the end of 2003, and 18.55% would fail the new final standard of 10 µg/l which has to be met by 2013. This indicates the need for effective plumbosolvency measures to be implemented. Non-compliance with the THMs, aluminium and iron standards continues to remain significant issues for Water Service. Improvement programmes for these particular water quality issues are essential and should be implemented in the fastest possible timescales to enable Water Service to meet the requirements of the new Regulations and further protect public health through the provision of high quality drinking water.

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 2002. This is the seventh annual report prepared by the Inspectorate, and, as with the previous reports, it has reported water quality annually in Northern Ireland since the introduction of the current regulations in 1994. In line with the rest of the United Kingdom, new drinking water quality regulations come into operation in Northern Ireland on 25 December 2003. This report provides criterion against which water quality in Northern Ireland can be measured. The Inspectorate continues to progress water quality issues, with a view to improving compliance with both the current and proposed new regulatory standards.

- 1.1** The Inspectorate prepared the summary and assessment of drinking water quality in Northern Ireland from 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 (the 'Regulations'). Water Service has published its own report, entitled 'Drinking Water Quality Report 2002', in accordance with regulation 28. 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 Regulations.

- 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 Regulations, is considered in detail in Section 4. Section 5 overviews public drinking water quality in Northern Ireland for 2002, comments on the key non-compliances with the standards, including non-trivial water supply zone contraventions, and draws relevant comparisons to water quality in previous years. 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 private water supplies monitoring programme in Northern Ireland is provided. Section 7 also includes an overview of water quality for private water supplies for the period 1999 to 2002. Section 8 refers to the Department of the Environment, Food and Rural Affairs (DEFRA's) Drinking Water Research Programme on water quality and health, which is steered by the Drinking Water Inspectorate for England and Wales. Finally, as an aid to understanding the technical terms and abbreviations used in this report, a quality standards table and glossary of terms is provided.

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 Directive'¹, 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

- 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;
- require the Department³ to keep itself informed about the wholesomeness and sufficiency of private water supplies;
- empower the Department³ to require

remedial action to be taken where private supplies are found to be unwholesome or insufficient; and

- provide regulation making powers relating to preserving water quality and setting standards for wholesomeness.

2.2 The Water Quality Regulations (Northern Ireland) 1994

- define wholesomeness by setting standards for 55 parameters and descriptive standards for a further two;
- set and define a water supply zone as the basic unit for water quality monitoring;
- require the Department² to monitor the quality of its supplies;
- specify detailed sampling requirements for samples taken at taps within water supply zones, at service reservoirs and at water treatment works;
- 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;
- control substances coming into contact with drinking water; and
- require the Department² to publish an annual report and keep public registers of water quality at its Water Service Divisional Headquarters' offices.

¹ A new Drinking Water Directive (98/83/EC) was agreed by the Member States of the European Union in November 1998.

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

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

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

The water quality objectives contained in these regulations are now governed by the requirements of the Water (Northern Ireland) Order 1999 No. 662 (N.I.6)⁴

2.5 Future Drinking Water Quality Regulatory Framework

A new Directive (98/83/EC)⁵ on Water Intended for Human Consumption was adopted as European Law in November 1998. New Regulations are required to transpose the requirements of the Directive. In Northern Ireland, the existing Water Quality Regulations (Northern Ireland) 1994 have been replaced by the Water Supply (Water Quality) Regulations (Northern Ireland) 2002. These new Regulations will come fully into effect on 25 December 2003. Copies can be obtained from the HMSO web site: <http://www.northernireland-legislation.hmso.gov.uk/sr/sr2002/20020331.htm>

New Regulations on private water supplies will also be required to implement the new EC Drinking Water Directive.

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

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

⁴ Copies of Northern Ireland legislation can be obtained from the HMSO web site: <http://www.hmso.gov.uk/legislation/northernireland/nisr/yeargroups/1990-1999>

⁵ Copies of the Directive can be obtained from the web site: http://europa.eu.int/eur-lex/pri/en/oj/dat/1998/l_330/l_33019981205en00320054.pdf

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 (DARD) 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:

- the transfer of information from Water Service on the quality of water at water treatment works, service reservoirs and in water supply zones;
- a compliance assessment of this information against the regulatory standards;
- an inspection programme which examines the sampling, analytical and reporting procedures; and

- an assessment to establish if satisfactory practices and processes are in place for water treatment and distribution.

3.2 The technical audit inspection reports, which provide conclusions, opinions and recommendations of the inspection findings, are issued to Water Service.

3.3 Where a regulatory standard has not been met, the compliance assessment process classifies the contravention as trivial or non-trivial. All 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 In 1997, the Inspectorate began an annual survey to identify and categorize the private water supplies falling within the Private Water Supplies Regulations (Northern Ireland) 1994:

- for 2002, 1,247 private water supplies have been identified and categorized into one of ten classes according to size, nature and use of the private water supply; and
- a monitoring programme for private water supplies, based on these classifications, is in place.

Future Drinking Water Legislation

3.5 The Inspectorate provides technical advice on drinking water quality to the Department's Environmental Policy Division in particular, on matters associated with the new regulatory framework currently being implemented to meet legislative requirements of the new Drinking Water Directive (98/83/EC).

Products and Processes in the Provision of Water Supplies

- 3.6** A scheme for the statutory approval of substances, products and processes used in the provision of public water supplies is administered in Northern Ireland by the Inspectorate. The purpose of the scheme is to ensure that chemicals and construction materials do not cause any adverse effect on drinking water quality. The Drinking Water Inspectorate for England and Wales operates the approval process on behalf of its Secretary of State.
- 3.7** The Committee on Products and Processes for Use in Public Water Supplies advises on approval issues. This Committee is an advisory, non-departmental public body with expertise in engineering, materials science, toxicology and water treatment. A lay member represents water consumers' interests.
- 3.8** 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. The list of all the currently approved products that may be used in the public water supply can be accessed on the Drinking Water Inspectorate for England and Wales web site: <http://www.dwi.gov.uk/cpp/index.htm>

Impact of European Standards

- 3.9** The Secretary of State's list includes those chemicals that are the subject of a European standard and have been published by BSI in its BS:EN series. Specific products made from chemicals that conform to a BS:EN are not listed. These products may be used without the approval of Government Authorities, providing that

the national conditions of use are observed. The national conditions of use are also included in the list of approved products.

- 3.10** In respect of construction products used in contact with drinking water, the DG Enterprise Regulatory Group - Construction Products Drinking Water, is developing the European Acceptance Scheme for drinking water construction products. This will lead to the establishment of harmonized arrangements for testing and certification of construction products that are used in contact with drinking water. In the meantime, the Committee will continue to consider equivalent test results obtained from approval bodies in other countries. Applicants, however, will need to submit copies of test protocols and test results; test certificates alone will not be accepted.
- 3.11** Information on the approval systems in EU and EFTA countries is available in a report commissioned by the Drinking Water Inspectorate for England and Wales, entitled 'European Approval Systems - Effects of Materials on Water Quality', 2nd Edition (ISBN 1 898920 427). The report is available from WRc Publications Ltd. Tel: 01793 865138.

Designated Laboratories

- 3.12** During 2002, the Committee reviewed the appointments of its test laboratories. LGC (Teddington) Ltd was not reappointed. The Water Quality Centre was reappointed and new appointments were made in respect of WRc-NSF, ITS Testing & Certification Ltd and Law Laboratories Ltd. These four laboratories are now designated by the Drinking Water Inspectorate for England and Wales and by the Water Regulations Advisory Scheme to carry out testing of products used in contact with drinking water.

Regulatory Issues in 2002

Change in National Condition of use for Polyacrylamide Flocculants

3.13 The Drinking Water Inspectorate for England and Wales Regulation 25¹ Letter 2/2002 gave notice of the intention to impose a stricter purity requirement for the free acrylamide monomer content of polyacrylamide flocculants for water treatment. A notification has been made to the European Commission under provisions of the Directive 98/34/EC on the notification of new technical requirements. It is anticipated that the requirement, which will reduce the concentration of acrylamide monomer from 0.025% in the product to 0.020%, will come into force on 25 December 2003.

Quality Assurance

- 3.14** The Regulations 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 these are subject to external inspection.
- 3.15** Water Service routinely checks the performance of its laboratories through participation in external quality control schemes; these include the Water Research Centre's Aquacheck scheme.
- 3.16** Water Service has achieved the requirements of the Drinking Water Testing Specification (DWTS) in one laboratory. DWTS is an optional national scheme agreed between the Drinking Water Inspectorate for England and Wales, the Northern Ireland Drinking Water Inspectorate, the Scottish Executive's Water

Services Unit and the United Kingdom Accreditation Service (UKAS), for the accreditation of laboratories carrying out drinking water analyses. UKAS accreditation has been achieved in the other three water quality laboratories. 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.

3.17 Water Service has established a *Cryptosporidium* Analytical Unit at Altnagelvin Laboratory which is approved by the Drinking Water Inspectorate for England and Wales

Consumer Complaints and Water Quality Incidents

- 3.18** The Inspectorate's policy, on receiving a complaint on 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. The Inspectorate will inform the complainant when Water Service has been notified. In some instances, the local Environmental Health Officer may also be involved in the follow-up investigation. In 2002, the Inspectorate received 37 complaints.
- 3.19** Where a water quality incident has occurred, Water Service is required to provide the Inspectorate with information, in accordance with agreed procedures. During 2002, five drinking water quality incidents and two events were brought to the attention of the Inspectorate (see Section 6 for further details).

¹ Copies of Regulation 25 Letter 2/2002 can be obtained from the Drinking Water Inspectorate for England and Wales web site: <http://www.dwi.gov.uk/cpp/reg25/0202.htm>

Contact with other Organizations

3.20 The Inspectorate has regular contact with the Department of Health, Social Services and Public Safety (DHSSPS), the Environmental Policy Division of the Department of the Environment, 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, Food and Rural Affairs (DEFRA) and the Scottish Executive's Drinking Water Quality 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 DEFRA 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.

3.21 The Inspectorate has regular contact with Environmental Health Officers in the district councils in connection with both public and private water supplies. Contact is also maintained with the General Consumer Council for Northern Ireland.

3.22 Meetings are also held with the Northern Ireland Water Council, which is a statutory advisory council appointed to advise the DRD, DoE, DARD and Department of Culture, Arts and Leisure, on the promotion of conservation of water measures and the cleanliness of water in waterways and underground strata.

3.23 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. The Inspectorate communicates

with the Communicable Disease Surveillance Centre (Northern Ireland) (CDSC) and has contact with the Food Standards Agency.

DWI Information

3.24 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 and Rural Development, and the 26 district councils.

3.25 During 2002, the Inspectorate presented papers and delivered lectures on a number of occasions to learned societies and public bodies.

3.26 The Inspectorate has published drinking water quality reports annually since 1996. Copies of the reports published from 1998, together with general consumer information are available on the Northern Ireland Drinking Water Inspectorate web site: <http://www.ehsni.gov.uk/environment/drinkWater/links.shtml>

3.27 'Guidance for the Monitoring of *Cryptosporidium* in Treated Water Supplies in Northern Ireland' (First Edition - May 2002 and updated on February 2003), is available on the web site: <http://www.ehsni.gov.uk/environment/drinkWater/links.shtml>

3.28 The Drinking Water Inspectorate has a web site which contains information on: Public Water Supplies; Private Water Supplies; Current Issues; Consumer Information; Regulations and Research; Contacts; and Links. This information is available on the web site: <http://www.ehsni.gov.uk/environment/drinkWater/drinkWater/links.shtml>

The Technical Audit

The Inspectorate's technical audit assesses compliance with the Regulations, and consists of two main elements:

- the assessment of Water Service's analytical data on drinking water for compliance against regulatory standards; and
- 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 2002 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 co-operation of Water Service staff in facilitating the technical audit process.

General Compliance Assessment

- 4.1** Schedule 2 to the Regulations 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 2002 is shown in two 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 that required in the various situations to which the Schedule refers. For 2002, 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 Regulations. 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:

- total organic carbon;
- colony counts at 22°C;
- colony counts at 37°C;
- residual disinfectant;
- taste (qualitative); and
- 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, however, included in the standard sampling frequency compliance assessment.

4.6 The parameters alkalinity and total hardness have a PCV assigned to them but this only applies 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 two 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 two parameters when assessing compliance with water quality standards.

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

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

There is, therefore, 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 2002, water samples were analysed for 43 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 of 0.5 µg/l for total pesticides.

Assessment of Water Quality

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 2002, 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 2002, 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 at service reservoirs were formally notified to Water Service.

4.12 The detection of one or two 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 coliforms 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 Water Quality Regulations (Northern Ireland) 1994 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 2002 are listed below.

Table 4.1: Relaxations in Water Supply Zones

Parameter	Number of Water Supply Zones with Relaxations
Colour	88
Manganese	97
Odour (quantitative)	79
Taste (quantitative)	79
Aluminium	34

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:

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

- 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; and
- in the case of Table D parameters which include benzo 3,4 pyrene, the average concentrations or values during the calendar year 2002 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 5.10, 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 5.10.

4.20 For 2002, 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 ten 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 For 2002, the Inspectorate assessed nitrite contraventions for triviality taking into consideration nitrite and nitrate prescribed values as formulated in the new Drinking Water Directive. Water supply zones were assessed as trivial if the nitrite value was <0.5 mg/l and if the calculated value was < or = 1. The formula is:

$$\frac{\text{Nitrate (mg/l)}}{50} + \frac{\text{Nitrite (mg/l)}}{3} < \text{or} = 1$$

- 4.22** For 2002, the Inspectorate assessed total polycyclic aromatic hydrocarbons (PAHs) contraventions for triviality taking into consideration the new Drinking Water Directive's requirements. Water supply zones were assessed as trivial if the new standard, which is based on the sum of the following four substances: benzo 1.12 perylene, benzo 11.12 fluoranthene, indeno (1,2,3-cd) pyrene and benzo 3.4 fluoranthene, was \leq to 0.1 $\mu\text{g/l}$.
- 4.23** Taking into consideration the tighter lead standards in the new Drinking Water Directive, the Inspectorate has, for 2002, considered all exceedences of the 50 $\mu\text{g/l}$ standard as non-trivial contraventions.
- 4.24** When assessing triviality for pesticides in 2002, contraventions from previous years were taken into consideration. Where an individual pesticide has been detected in two consecutive years, the contravention will be considered non-trivial. Where more than one individual pesticide has contravened 0.1 $\mu\text{g/l}$ in samples taken from the same source, in the same year, the contraventions will all be considered non-trivial.
- 4.25** For oxidizability, the non-compliances will be considered trivial as the oxidizability parameter is taken into account with the total organic carbon parameter which does not have a PCV assigned to it.
- 4.26** Where five 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, two contraventions of the standard have been regarded as trivial, provided that no more than two faecal coliforms in 100 ml were detected in either sample and there was no contravention of the standard in the previous calendar year. Contraventions of the coliform regulatory standard were regarded as non-trivial because compliance is assessed on a 95 percentile basis. All cases where contraventions of the standard for a microbiological parameter were regarded as non-trivial have been formally notified to Water Service.

The 2002 Inspection Programme

2002 Inspection Programme

4.27 The 2002 Inspection Programme was based on the following topics:

- evaluation of strategies to meet new regulatory requirements;
- ongoing review of *Cryptosporidium* risk assessment and monitoring practices; and
- progress on agreed follow-up action including non-trivial parameter contraventions, previous inspections and post incident analysis.

4.28 On completion of the inspection programme, conclusions, opinions and recommendations were reported to the respective authorities. 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.

Cryptosporidium Risk Assessment and Monitoring

4.29 As part of the ongoing inspection programme, the Inspectorate, in co-operation with Water Service, continues to review the *Cryptosporidium* risk assessments at all water treatment works. The overall objective is to use the results of the risk assessments to develop the annual *Cryptosporidium* sampling programme.

4.30 Water Service, through a *Cryptosporidium* Action Group, continued to progress the Implementation of the Recommendations of the *Cryptosporidium* in Water Supplies Reports^{*/**} during 2002.

Dunore Point Water Treatment Works

4.31 Following an outbreak of cryptosporidiosis in April 2001 in water supply areas served by Dunore Point Water Treatment Works, an 'Action Plan' was produced to implement the recommendations of the inquiry team. Water Service has been actively progressing the recommendations, which include changes to infrastructure, operation of works procedures and other related issues.

4.32 Progress on Agreed Follow-Up Action Resulting From Previous Inspections

All follow-up action from previous inspections has now been completed.

2003 Inspection Programme

4.33 During 2003, the following Water Service sites were included in the Inspection Programme:

- Detailed audit of Derg Water Treatment Works;
- Detailed audit of Dunfane and Dundrum Service Reservoirs; and
- Assessment of sampling arrangements at Marlborough House Laboratory.

* 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)

Overview of Drinking Water Quality in Northern Ireland in 2002

Introduction

Water Service produces 740 million litres/day of water to 98.5% of Northern Ireland's population for approximately 1.69 million people. These water supplies are mostly derived from surface water (94%), with the remainder being groundwater sources. Water from all these sources is treated and distributed through nearly 25,000 km of watermains. Regulatory compliance monitoring in 2002 was carried out at 58 water treatment works, 360 service reservoirs and in 101 water supply zones (Tables 5.1 - 5.3 refer). The majority of the service reservoir sampling points correspond to single reservoir sites, although some have more than one reservoir on site.

In 2002, there were 101 water supply zones in Northern Ireland which were categorized for monitoring purposes depending on 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.

Table 5.1: Water Treatment Works Volume Categories

Water Treatment Works		Volume Distributed from Works (m ³ /d) Categories
Number	Percentage	
28	48.28	<3,000
17	29.31	3,000 - 12,000
13	22.41	>12,000

Table 5.2: Service Reservoirs Capacity Categories

Service Reservoirs		Capacity of Reservoirs (m ³) Categories
Number	Percentage	
259	71.94	<2000
82	22.78	2,000 - 10,000
19	5.28	>10,000

Table 5.3: Water Supply Zone Population Categories

Water Supply Zone		Population Category
Number	Percentage	
23	22.77	<5,000
35	34.65	5,000 - 20,000
43	42.57	20,000 - 50,000

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 previous years. When comparing annual compliance information, there may be factors which account wholly, or in part, for a particular difference and these must be considered before drawing any conclusions about possible differences in water quality. These factors include:

- revised sampling frequencies to reflect the upgrading of data on the Laboratory Information Management System for water supply zones and water treatment works;
- adoption of increased sampling frequencies as a result of contraventions for a particular parameter;
- modifications to the pesticide monitoring strategy in light of the reassessment of pesticide usage within the water catchments (see paragraph 4.8);
- changes in the sampling programme due to the annual review of the delineation of water supply zones; and
- improvements in analytical systems which may have reduced or eliminated the possible contribution to earlier data of results of uncertain accuracy.

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

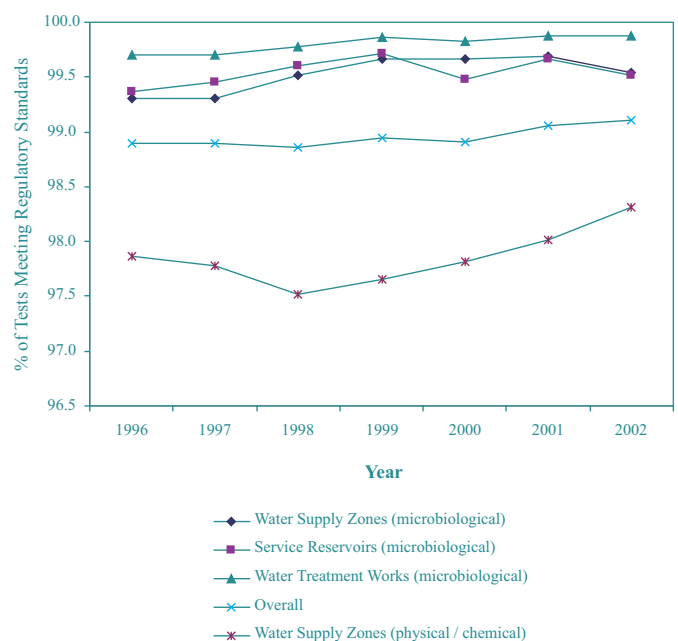
5.3 However, using the number of zones showing non-compliance with the PCV for a particular parameter, comparison between the seven years is rather less affected by the factors set out in the previous paragraph.

Overall Water Quality in 2002

5.4 The level of compliance is shown in two 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 2002, a total of 104,644 reported determinations were carried out at water treatment works, service reservoirs and consumers' taps (Table 5.4 refers). Of these determinations, 99.11% complied with the relevant water quality standards.

5.5 Figure 5 below shows compliance summary results over the last seven years, and while overall the trends indicate a marginal improvement in the percentage of all determinations meeting the regulatory standards, compliance for the physical/chemical parameters remains considerably poorer than for microbiological compliance.

Figure 5: Compliance Summary Results,



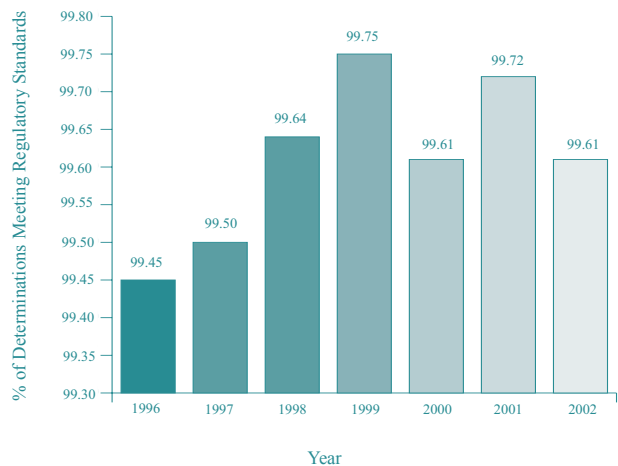
5.6 The table below provides a summary of overall water quality.

Table 5.4: Summary of Overall Water Quality

	2002	2001	2000	1999	1998
Water Treatment Works					
Total number of determinations	17,298	18,052	18,522	19,360	19,648
- number exceeding PCV	21	24	32	28	44
- % exceeding PCV	0.12	0.13	0.17	0.14	0.22
Service Reservoirs					
Total number of determinations	36,658	36,414	37,314	38,044	37,972
- number exceeding PCV	181	123	193	109	150
- % exceeding PCV	0.49	0.34	0.52	0.29	0.40
Water Supply Zones					
Total number of determinations	50,688	53,970	54,406	53,826	50,802
- number exceeding PCV	730	874	979	1,033	1,038
- % exceeding PCV	1.44	1.62	1.80	1.92	2.04
All samples					
Total number of determinations	104,644	108,436	110,242	111,230	108,422
- number exceeding PCV	932	1,021	1,204	1,170	1,232
- % exceeding PCV	0.89	0.94	1.09	1.05	1.14

5.7 While it is encouraging that there is an indication (as shown in Table 5.4) that overall quality is improving, there is, however, as Figure 6 shows, a deterioration in overall microbiological compliance from 99.72% in 2001, to 99.61% for 2002. For 2002, microbiological quality has been maintained at water leaving treatment works but has deteriorated at both service reservoirs and water supply zones, resulting in a decrease in overall microbiological compliance.

Figure 6: Overall Microbiological Compliance



5.8 The graphs below show compliance with the standards specified in the Water Quality Regulations (Northern Ireland) 1994, over the last seven years. Figure 7 shows that the overall compliance figure has remained at around 99% in Northern Ireland since 1996, and has marginally improved by 0.05% to 99.11% in 2002, from the 99.06% reported for 2001. The graph presented in Figure 8 shows that the number of contraventions has decreased particularly over the last two years; this is due to increased compliance for certain chemical parameters.

Figure 7: Overall Compliance with Regulatory Standards

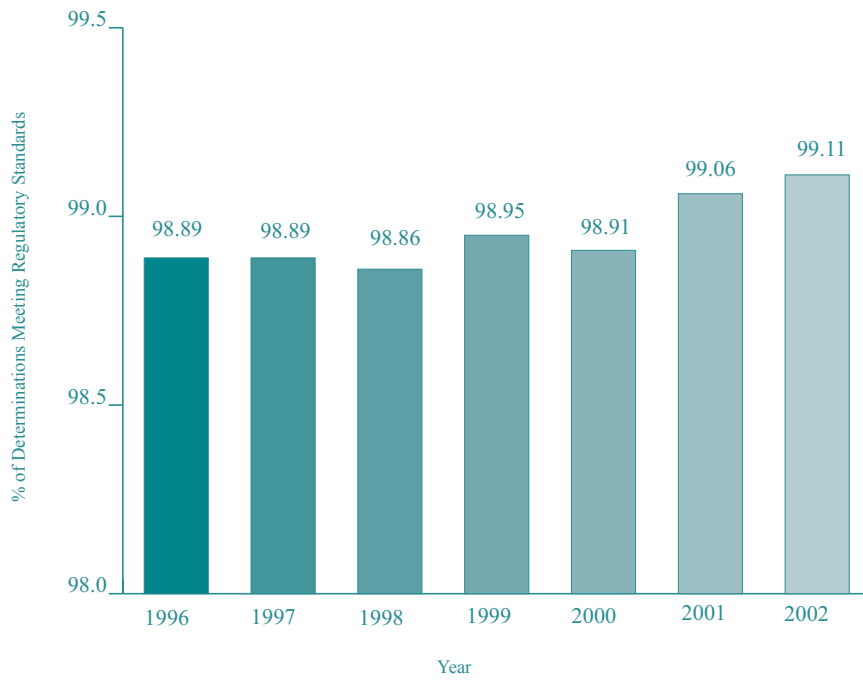
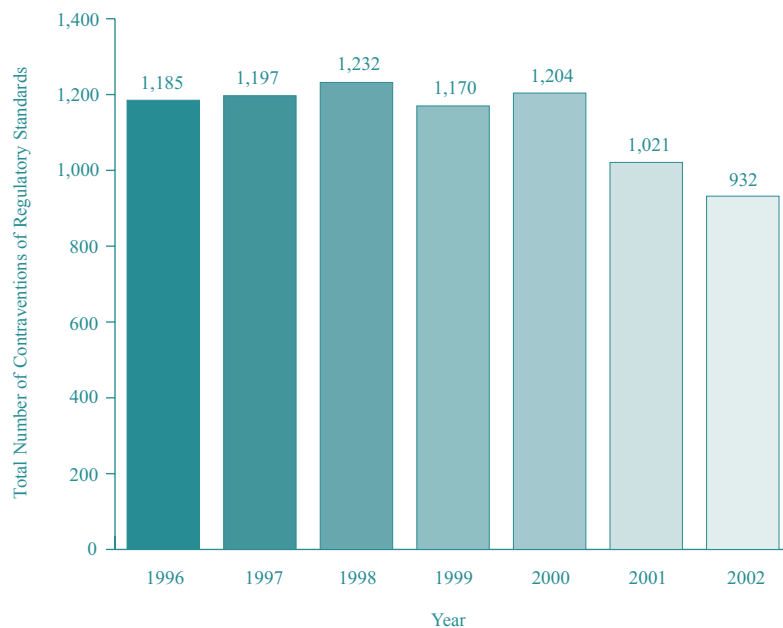


Figure 8: Total Number of Contraventions of Numerical Standards



5.9 Overall, the microbiological quality for drinking water at consumers' taps remains good with 99.54% compliance reported for 2002. However, the overall water quality figure for consumers' taps, which also includes physical/chemical tests, is reduced to 98.56% due to the continued poorer performance rates for certain physical/chemical parameters, notably: THMs, iron, aluminium and lead

5.10 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.

Compliance summary results together with comparable figures with previous compliance assessments on an individual parameter basis are given in Table 5.10 and Figures 20 to 25.

5.11 Where the regulatory standards have not been met, depending on the magnitude or duration of the contravention, the Inspectorate has assessed each contravention as being trivial or non-trivial. A summary of the 2002 non-trivial microbiological contraventions for water treatment works, service reservoirs and water supply zones, together with previous year's assessments is presented in Tables 5.5 - 5.7 and 5.11. All non-trivial contraventions are formally notified to Water Service for immediate investigation, and where practical and appropriate, remedial action is taken.

5.12 When contraventions of the regulatory standards occur, Water Service notifies the Health and Social Services Boards and district councils under an agreed reporting procedure.

Non-Trivial Microbiological Contraventions Summary Assessments, 2002-1998

Table 5.5: Non-Trivial Microbiological Contraventions at Water Treatment Works

	No. of Water Treatment Works (WTWs)	No. of WTWs with Non-Trivial Faecal Coliform Contraventions	No. of WTWs with Non-Trivial Total Coliform Contraventions	% of WTWs with Non-Trivial Faecal Coliform Contraventions	% of WTWs with Non-Trivial Total Coliform Contraventions
2002	58	3	3	5.17	5.17
2001	63	1	5	1.59	7.94
2000	63	4	7	6.35	11.11
1999	70	4	8	5.71	11.43
1998	72	5	10	6.94	13.89

Table 5.6: Non-Trivial Microbiological Contraventions at Service Reservoirs

	No. of Service Reservoirs (SR)	No. of SR with Non-Trivial Faecal Coliform Contraventions	No. of SR with Non-Trivial Total Coliform Contraventions	% of SR with Non-Trivial Faecal Coliform Contraventions	% of SR with Non-Trivial Total Coliform Contraventions
2002	360	11	19	3.06	5.28
2001	362	1	10	0.28	2.76
2000	372	18	18	4.84	4.84
1999	373	14	4	3.75	1.07
1998	374	12	11	3.21	2.94

Table 5.7: Non-Trivial Microbiological Contraventions at Water Supply Zones

	No. of Water Supply Zones (WSZ)	No. of WSZ with Non-Trivial Faecal Coliform Contraventions	No. of WSZ with Non-Trivial Total Coliform Contraventions	% of WSZ with Non-Trivial Faecal Coliform Contraventions	% of WSZ with Non-Trivial Total Coliform Contraventions
2002	101	6	2	5.94	1.98
2001	102	2	0	1.96	0.00
2000	103	3	1	2.91	0.97
1999	104	1	3	0.96	2.88
1998	106	3	6	2.83	5.66

Microbiological Quality of Water Leaving Water Treatment Works

5.13 The summary tables below indicate that the overall microbiological quality at water treatment works has been maintained for 2002, with a compliance rate of 99.88%. The results show, that in relation to the number of determinations at water treatment works in 2002, 99.83% and 99.93% complied with the regulatory standards for coliforms and faecal coliforms respectively.

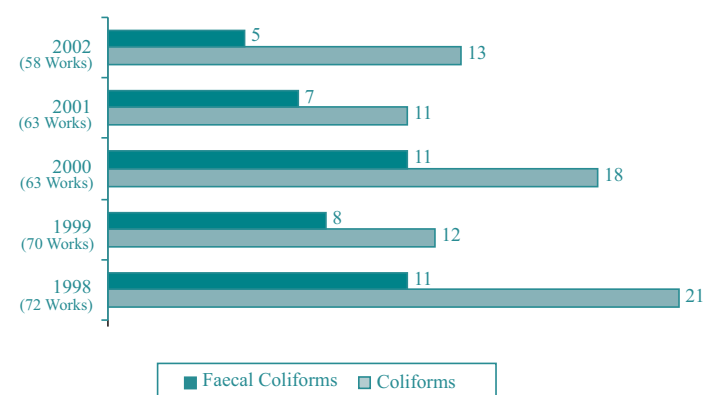
Table 5.8: Microbiological Quality of Water Leaving Water Treatment Works

	2002	2001	2000	1999	1998
Coliforms					
Total number of determinations	8,649	9,026	9,261	9,680	9,824
- number of determinations containing coliforms	15	15	21	18	28
- % containing coliforms	0.17	0.17	0.23	0.19	0.29
Number of treatment works with coliforms detected	13	11	18	12	21
Faecal Coliforms					
Total number of determinations	8,649	9,026	9,261	9,680	9,824
- number of determinations containing faecal coliforms	6	9	11	10	16
- % containing faecal coliforms	0.07	0.10	0.12	0.10	0.16
Number of treatment works with faecal coliforms detected	5	7	11	8	11
Number of Water Treatment Works	58	63	63	70	72

5.14 Figure 9 shows the number of works not complying with the coliform standards. A total of 58 treatment works were sampled: faecal coliforms were found at five (8.6%) of these; of which three were considered non-trivial contraventions. Total coliforms were found in 13 (22.4%) treatment works; three were considered to be non-trivial.

5.15 Total and faecal coliforms are not usually considered harmful to health but they may indicate that more dangerous organisms could be present. Coliform bacteria are easy to detect and their presence in water leaving a water treatment works can indicate that the effectiveness of the treatment or disinfection processes have been compromised. All contraventions of the microbiological standards at water treatment works are followed up urgently, and remedial action taken by Water Service.

Figure 9: Number of Water Treatment Works Not Complying with the Standards



Microbiological Quality of Water in Service Reservoirs

5.16 Summary results for service reservoirs are given in the table below. These indicate that overall the microbiological quality of service reservoirs shows a reduction in compliance for 2002. The results show that in relation to 18,329 samples taken from service reservoirs, 99.51% complied with the standards; for 2001 the comparable compliance rate was 99.66%.

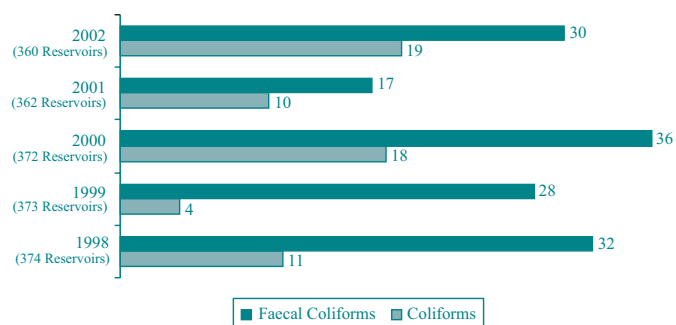
Table 5.9: Microbiological Quality of Water in Service Reservoirs

	2002	2001	2000	1999	1998
Coliforms					
Total number of determinations	18,329	18,207	18,657	19,022	18,986
- number of determinations containing coliforms	147	106	147	79	114
- % containing coliforms	0.80	0.58	0.79	0.42	0.60
Number of service reservoirs with coliforms detected in more than 5% of samples	19	10	18	4	11
Faecal Coliforms					
Total number of determinations	18,329	18,207	18,657	19,022	18,986
- number of determinations containing faecal coliforms	34	17	46	30	36
- % containing faecal coliforms	0.19	0.09	0.25	0.16	0.19
Number of service reservoirs with faecal coliforms detected	30	17	36	28	32
Number of Service Reservoirs	360	362	372	373	374

5.17 Figure 10 shows the number of service reservoirs not complying with the coliform standards. A total of 360 service reservoirs were sampled: faecal coliforms were found at 30 (8.3%) of these; 11 were considered non-trivial contraventions. Total coliforms were found in 66 (18.3%) service reservoirs; 19 were considered to be non-trivial.

5.18 Where the microbiological standards have not been met, Water Service takes investigative action. An ongoing programme of service reservoir inspection, which includes addressing the problem of possible groundwater and/or surface water ingress, is undertaken by Water Service

Figure 10: Number of Service Reservoirs Not Complying with the Standards



Water Quality in Water Supply Zones

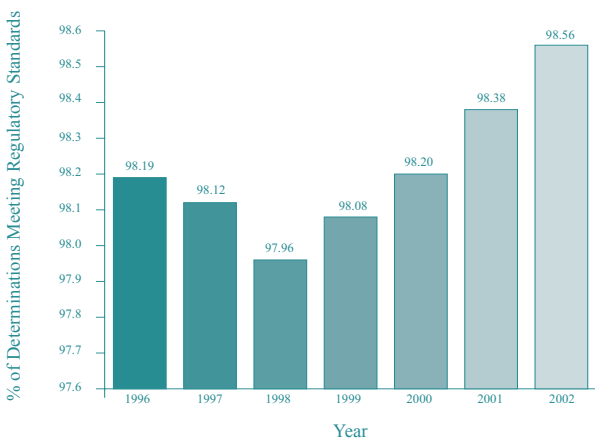
5.19 The Table below shows Water Service's performance in 2002, with data for 2001 and 2000 for comparison. The table provides a summary of water quality for the key parameters which are significant in the supply of public drinking water in Northern Ireland. All other parameters which are included in the compliance monitoring programme, with the exception of pesticides, are presented in the parameter description 'Other parameters'.

Table 5.10: Water Quality in Water Supply Zones

Parameter	Determinations in 2002			Determinations in 2001		Zones in 2002	Zones in 2001	Zones in 2000
	Total No.	Exceeding PCV or Relaxed PCV		Total No.	% Exceeding PCV or Relaxed PCV			
		No.	%			% Exceeding PCV or Relaxed PCV	% Exceeding PCV or Relaxed PCV	% Exceeding PCV or Relaxed PCV
Coliforms	5,089	39	0.77	6,019	0.55	1.98	0.00	0.97
Faecal coliforms	5,089	8	0.16	6,019	0.07	7.92	3.92	9.71
Colour	851	0	0.00	879	0.00	0.00	0.00	0.97
Turbidity	1,051	3	0.29	1,105	0.27	2.97	2.94	2.91
Odour (quantitative)	2,798	0	0.00	782	0.00	0.00	0.00	0.00
Taste (quantitative)	2,783	0	0.00	782	0.00	0.00	0.00	0.00
Hydrogen ion	2,934	6	0.20	3,328	0.57	2.97	7.84	2.91
Nitrate	729	1	0.14	742	0.00	0.99	0.00	0.00
Aluminium	1,472	35	2.38	1,617	1.86	11.88	10.78	19.42
Iron	2,129	55	2.58	2,411	2.94	30.69	37.25	34.95
Manganese	922	1	0.11	940	0.21	0.99	0.98	0.00
Lead	647	35	5.41	905	2.65	18.81	13.73	14.56
PAHs (total)	513	3	0.58	571	1.58	1.98	7.84	9.71
Trihalomethanes	1,016	507	49.90	1,197	53.55	72.28	68.63	64.08
Total pesticides	366	0	0.00	392	0.00	0.00	0.00	0.00
Glyphosate	366	0	0.00	419	0.48	0.00	1.96	0.00
MCPA	411	4	0.97	450	2.22	2.97	4.90	3.88
Mecoprop	389	0	0.00	441	0.45	0.00	1.96	0.97
Other pesticides	14,631	3	0.02	14,832	0.01	2.97	1.96	0.00
Other parameters	6,502	30	0.46	10,139	0.22	13.86	6.86	9.71
Total	50,688	730	1.44	53,970	1.62	No. of Water Supply Zones 101	102	103

5.20 During 2002, the level of compliance was reported for 101 water supply zones which were routinely monitored for 88 individual parameters, 72 of which met the regulatory requirements. The graph below shows the overall compliance with water quality standards in water supply zones over the last seven years.

Figure 11: Overall Compliance with Standards in Water Supply Zones



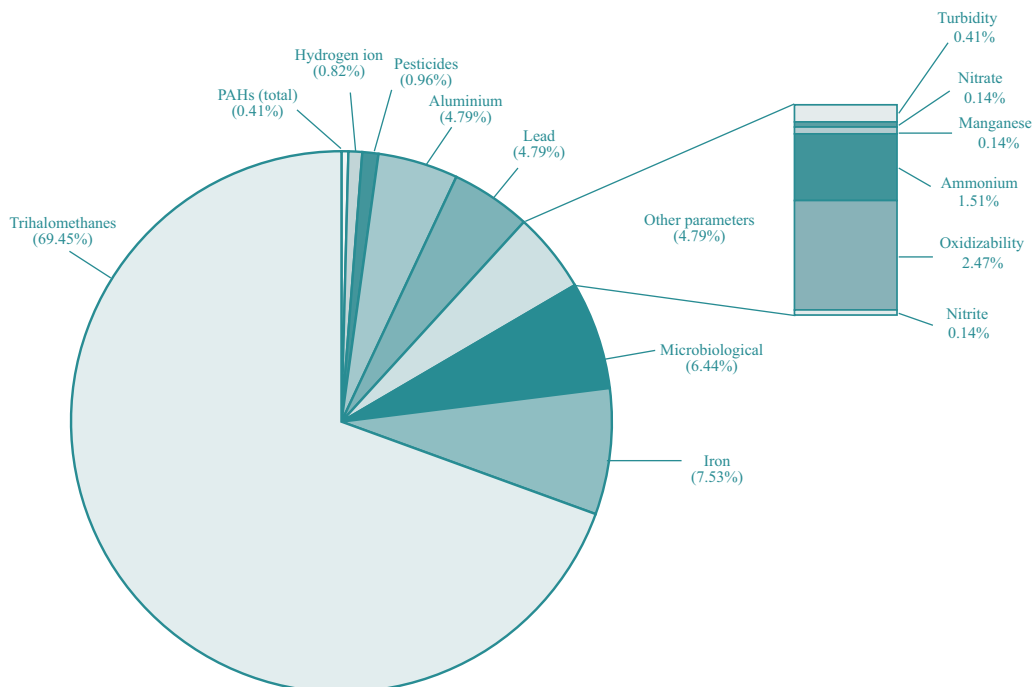
5.21 The 'compliance figures' in Figure 11 have been derived by taking the total number of tests in zones and the number of occasions on which one or more samples have not met the relevant numerical standard.

5.22 Since 1996, there has been a reduction in the number of test results from zones which failed to comply with the relevant standards. In 2002, of the 50,688 tests carried out, 730 (1.44%) failed to comply compared to 1.81% of tests failing to comply in 1996.

5.23 Figure 12 below shows those parameters, both microbiological and physical/chemical, for which compliance with the regulatory standards was not achieved in 2002. Each parameter is shown as a percentage of the 730 individual contraventions in water supply zones. These continue to relate largely to THMs, lead, iron, aluminium and coliforms.

For further information on a specific parameter, please refer to the Quality Standards Table on page 57 of this report.

Figure 12: Contraventions of Standards in Water Supply Zones



5.24 Looking at the percentage zonal compliance of water quality, trends over the last seven years are presented for selected parameters in the graphs below. The parameters have been arranged in groups for presentational purposes only and these groupings do not have any scientific or regulatory significance. The groups are categorized as follows:

- **'Microbiological' parameters:** total and faecal coliforms;
- **'Metals' parameters:** metals such as iron, aluminium and lead which may be present;
- **'Organic' parameters:** parameters such as THMs, PAHs and pesticides;
- **'Aesthetic' parameters:** parameters which may affect the appearance, taste or odour of the water; and
- **'Ionic' parameters:** pH, nitrate and nitrite.

Figure 13: 'Microbiological' Parameters

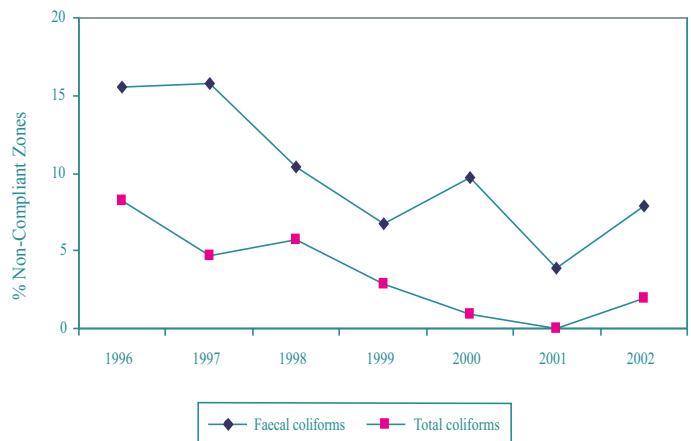


Figure 14: 'Metals' Parameters

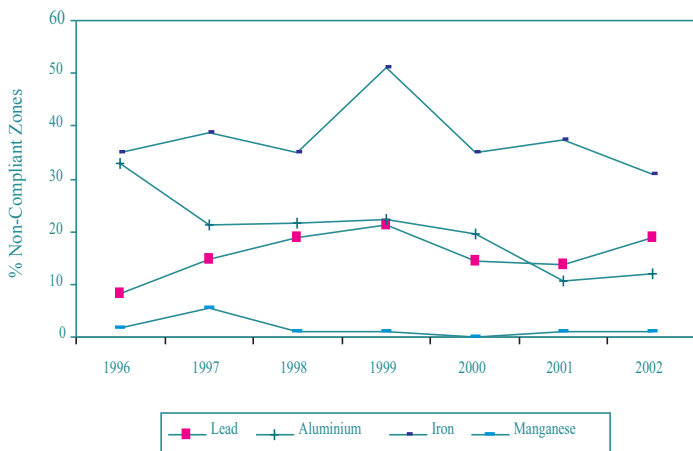


Figure 15: 'Organic' Parameters

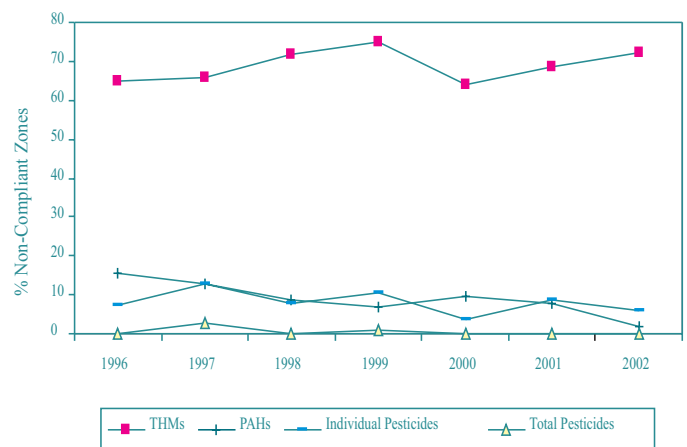


Figure 16: 'Aesthetic' Parameters

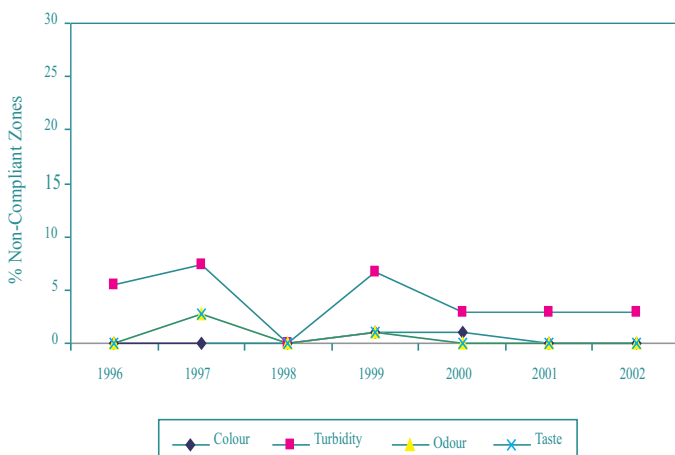
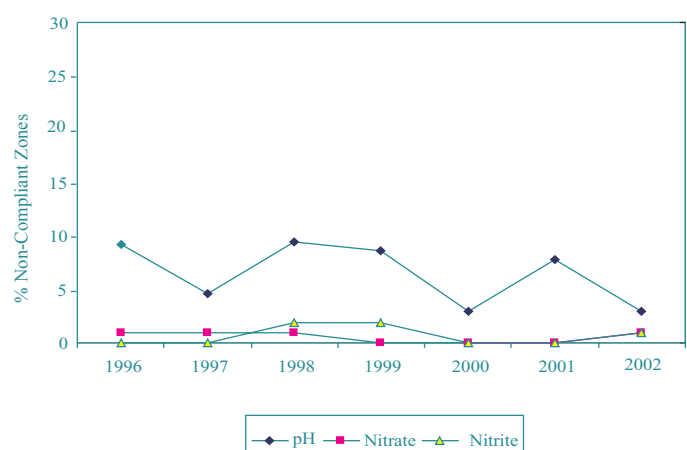


Figure 17: 'Ionic' Parameters



Non-Compliant Zones

5.25 A zone may be non-compliant; because a single result has not met the standard. The Inspectorate assesses each contravention; some are regarded to be trivial and do not indicate a serious water quality problem and can be remedied through prompt investigative action. In other cases, the contravention may be considered non-trivial and Water Service may be required to take appropriate action as part of an improvement programme. The table below shows the parameters for which water supply zones in 2002 and 2001 were assessed as having non-trivial contraventions.

Table 5.11: Non-Trivial Contraventions in Water Supply Zones

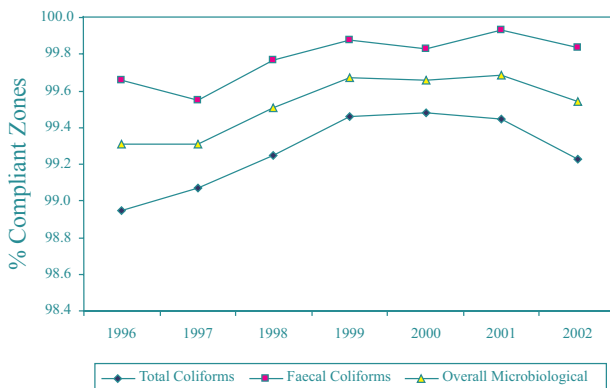
Parameter	2002 Water Supply Zones with Non-Trivial Contraventions		2001 Water Supply Zones with Non-Trivial Contraventions	
	No.	%	No.	%
Trihalomethanes	73	72.28	70	68.63
Lead	19	18.81	14	13.73
Iron	11	10.89	15	14.71
Aluminium	6	5.94	5	4.90
Faecal coliforms	6	5.94	2	1.96
Turbidity	2	1.98	1	0.98
Ammonium	2	1.98	1	0.98
Total coliforms	2	1.98	0	0.00
Hydrogen ion	1	0.99	5	4.90
MCPA	1	0.99	4	3.92
Nitrate	1	0.99	0	0.00
Mecoprop	0	0.00	2	1.96
Manganese	0	0.00	1	0.98
Number of Water Supply Zones	101		102	

5.26 Water Service has a planned improvement programme to upgrade both the water treatment and water distribution systems to remedy these contraventions.

Microbiological Quality in Water Supply Zones

5.27 The number of zones not meeting the coliform standards showed an increase since last year. Of the 5,089 samples taken from 101 zones in 2002, 0.46% failed to meet the microbiological standards, compared to 0.31% in 2001. Figure 18 below shows that for faecal coliforms, 99.84% met the regulatory standards and for total coliforms 99.23% of tests complied with the regulatory standards. The comparable figures for 2001 were 99.93% and 99.45% respectively.

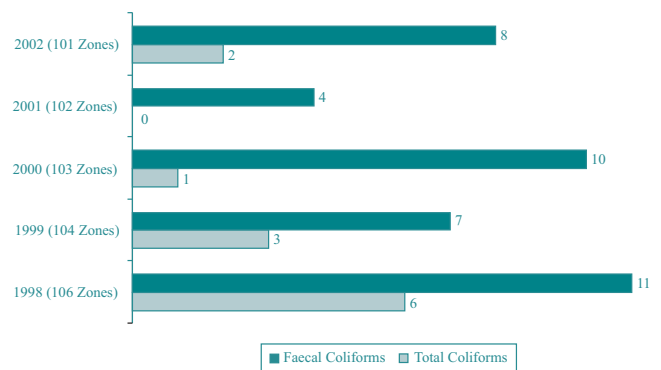
Figure 18: Microbiological Determinations Meeting Regulatory Standards* in Water Supply Zones



* For coliforms, this assessment is against the numerical standard.

5.28 Figure 19 shows that eight zones did not meet the regulatory standards for faecal coliforms. Contraventions in six of these water supply zones were regarded as non-trivial. Total coliforms were detected in at least one sample collected during the year in 27 water supply zones. The regulations are only contravened in a water supply zone if more than 5% of samples contain coliforms. On this basis two zones failed to meet the regulatory coliform standard.

Figure 19: Number of Zones Not Complying with Microbiological standards



5.29 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 5.10 need not necessarily reflect the microbiological quality of the water supplied. All microbiological contraventions in water supply zones are followed up and remedial action initiated where necessary by Water Service.

Physical/Chemical Quality in Water Supply Zones

Trihalomethanes (THMs)

5.30 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. Trihalomethanes are by-products of the reaction between chlorine, which is used to disinfect the water and make it microbiologically safe, and these naturally occurring organic materials. Water treatment is necessary to remove the organic material prior to disinfection to reduce the level of THMs.

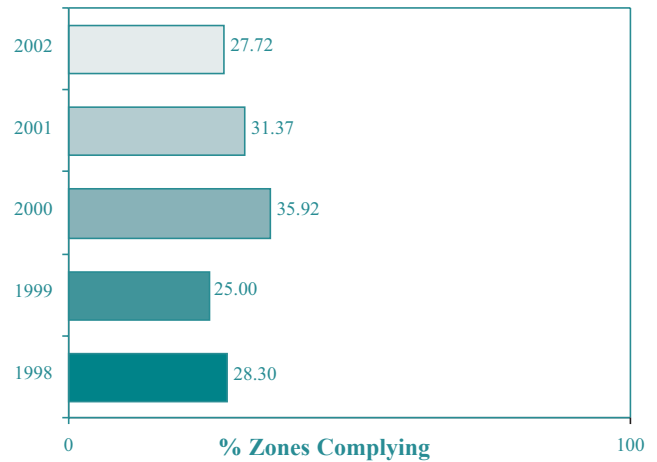
5.31 The current Regulations set a standard of 100 µg/l for THMs as an average over a three-month period for the sum of four specified substances.

5.32 In 2002, the number of determinations exceeding the numerical standard for THMs (100 µg/l) remains high at 49.90%. Of the samples taken from 101 water supply zones in 2002, 73 (72.28%) zones were non-compliant with the regulatory standard. THMs, as in previous years, remains the parameter with the lowest reported compliance rate.

5.33 The New Drinking Water Directive has set an interim standard for THMs of 150 µg/l to be met by 25 December 2003. The Water Supply (Water Quality) Regulations (Northern Ireland) 2002 has set a numerical standard of 100 µg/l to be met by 25 December 2003.

The Inspectorate notes that for 2002, the compliance rate for THMs if assessed against the 150 µg/l standard would be; 57.09% of tests, and 42.58% of zones would comply. The comparable figures for 2001 would be 87.13%, and 49.02%.

Figure 20: Water Supply Zones Complying with THMs Standard



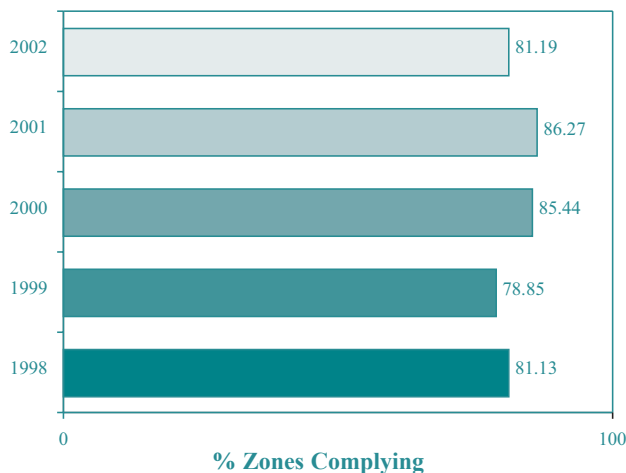
5.34 While Water Service continues to implement measures to mitigate non-compliance with the regulatory standards, every effort must continue to be made to control the formation of THMs, while ensuring at the same time that disinfection, and, hence, microbiological quality is never compromised.

5.35 Water Service has a major water treatment capital works programme which is designed to reduce organic material prior to chlorination and, thereby, reduce THMs levels. Water Service is also assessing the potential for the wider use of monochloramine as an alternative disinfectant. In the interim, Water Service continues to review operational procedures, with the aim of reducing THMs levels in the distribution system, while maintaining microbiological quality. Improved compliance is expected as improvements to water treatment works and distribution systems are completed.

Lead

5.36 Of the 647 samples collected in 2002, there was an increased number which failed to meet the lead standard. For 2002, 35 (5.41%) tests failed to comply; the comparable figure for 2001 was 24 (2.65%). There has also been an increase in the number of zones not complying with the regulatory standard for lead during 2002. Nineteen (18.81%) zones failed to comply in 2002 compared to 14 (13.73%) zones in 2001. Contraventions in all 19 zones were assessed as non-trivial.

Figure 21: Water Supply Zones Complying with Lead Standard



5.37 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 may 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's tap, it is caused by the action of water on existing lead service piping between the watermains and the tap. Occasionally, the use of lead solder can cause problems. Whether or not the lead standard is contravened at a particular tap depends on a number of factors, an important one being the plumbosolvency of the water (the tendency for lead to dissolve in water).

Water Service has an ongoing programme of pH adjustment to reduce plumbosolvency.

5.38 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.

5.39 While Water Service continues to undertake investigative programmes to minimize the solubility of lead, and ortho-phosphate treatment is introduced throughout Northern Ireland water supplies, every effort must be made to reduce the levels of lead in drinking water to meet the regulatory requirements.

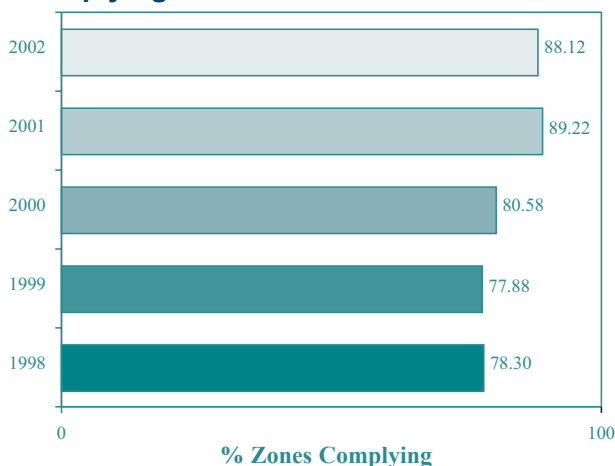
5.40 The new Drinking Water Directive has set tighter lead standards. The new regulatory requirements are set as an interim lead standard of 25 µg/l to be met by 25 December 2003, and a final standard of 10 µg/l to be met by 25 December 2013.

The Inspectorate notes that for 2002, the compliance rate for lead, if assessed against the new interim standard of 25 µg/l, would mean that out of 647 samples collected, 60 (9.27%) would fail to comply. If assessment was made against the final standard of 10 µg/l, 120 (18.55%) of samples collected would fail to comply.

Aluminium

- 5.41** Aluminium is naturally occurring in many water sources, particularly those derived from upland areas. Aluminium compounds are also used as an important part of the processes in 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.
- 5.42** 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 Mourne 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. The compliance assessment takes permitted relaxations into account.
- 5.43** For aluminium, the number of zones failing to meet the regulatory standards has increased from 10.78% in 2001 to 11.88% in 2002, and the number of tests that fail to meet the standards has increased from 1.86% in 2001 to 2.38% in 2002. While there has been an improving trend for aluminium compliance since 1996 as investment and improvement to water treatment processes have been implemented, there has been a reduction in the compliance rate by 0.52% for 2002, when compared to last year.

Figure 22: Water Supply Zones Complying with Aluminium Standards



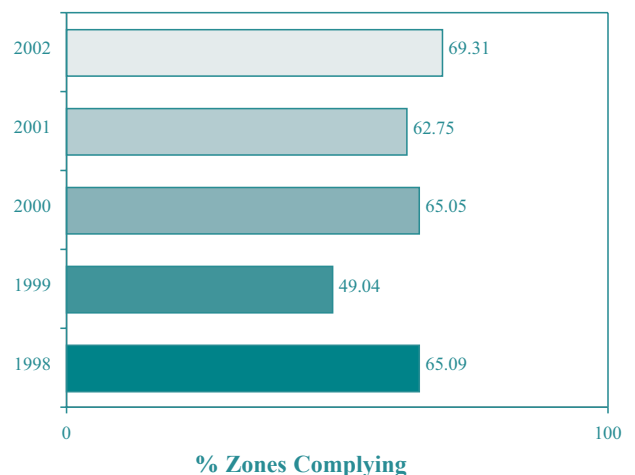
5.44 Of the 12 zones not complying with the regulatory standards in 2002, six zones were assessed as having non-trivial contraventions.

5.45 As part of a major capital works programme, improvements to several water treatment works have been completed or are underway. In certain areas, there are indications that this has improved the individual aluminium compliance figures. In other situations, however, compliance monitoring identifies areas where a targeted continued planned investment programme is necessary to further improve regulatory compliance with the aluminium standards.

Iron

5.46 There has been an increase in the number of water supply zones complying with the iron standard during 2002. A total of 31 (30.69%) zones failed to comply with the iron standard when compared with 38 (37.25%) zones in 2001. Of these 31 zones, 11 zones were assessed as having non-trivial contraventions in 2002.

Figure 23: Water Supply Zones Complying with Iron Standard



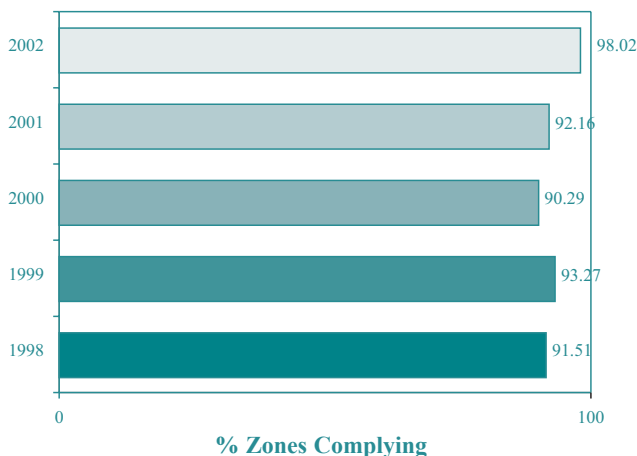
5.47 While there has been an improvement in compliance reported, the figures reflect that programmes of work are necessary to rehabilitate the distribution system and improve drinking water quality.

5.48 The regulatory standard for iron has been set for aesthetic reasons because levels persistently above the standard can give rise to discoloured water. There is no health risk from the reported exceedences of the iron standard, but the presence of excessive iron may make the appearance and taste of the water unacceptable to consumers. The majority of iron contraventions are caused by corrosion of older, cast-iron watermains. Water Service has an ongoing Water Mains Rehabilitation Programme in which detailed water supply zone studies are carried out to determine the nature and extent of water quality problems associated within the distribution system.

Polycyclic Aromatic Hydrocarbons (PAHs)

5.49 PAHs can leach into the water from the coal tar linings of cast-iron distribution mains. These linings were used in the past to protect the iron pipes from corrosion. PAHs contraventions will be a localised phenomenon in the distribution system dependent 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 2002, contraventions of the regulatory standard for PAHs were recorded in two (1.98%) water supply zones, both of which were regarded as trivial.

Figure 24: Water Supply Zones Complying with PAHs Standard



5.50 Although the reported PAHs exceedences mean the water cannot be regarded as wholesome according to the definition in

regulation 3, they are not regarded by the Inspectorate as being of immediate concern because the requirements of the new Drinking Water Directive were met. Water Service's planned maintenance programme of relining and replacing parts of the distribution system will, although, primarily targeted at iron exceedences, continue to improve PAHs compliance.

Pesticides

5.51 Pesticides include insecticides, herbicides, fungicides and algicides. 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 during 2002, of the 43 individual pesticides monitored, two pesticides (MCPA and asulam) were detected above the regulatory standard of 0.1 µg/l.

5.52 Of the 15,797 determinations carried out for individual pesticides in 2002, there were seven (0.04%) occasions when the regulatory standard was not met. This is a significant reduction on last year when 16 (0.10%) contraventions were reported. Of the seven contraventions reported in 2002, four were for MCPA. These occurred in three water supply zones, one of which was considered non-trivial. The other three contraventions were for asulam and these occurred in three zones. In every instance, the contraventions corresponded to exposures far smaller than those known to be harmful or likely to affect health.

5.53 Pesticides are used in Northern Ireland for a range of purposes and can find their way into watercourses from a variety of sources, mainly from agricultural usage or weed control; these include MCPA, mecoprop, atrazine, glyphosate and asulam. Table 5.12 shows the pesticides that have been detected above the regulatory standard over the last five years. Water Service is currently engaged in preparing a series of catchment management plans which will look at pesticide usage and control.

Table 5.12: Number of Individual Pesticide Exceedences in Water Supply Zones

Pesticide Name	2002	2001	2000	1999	1998
MCPA	4	10	8	9	13
Asulam	3			2	
Mecoprop		2	1	1	3
Glyphosate		2		3	1
Atrazine				1	
Simazine		1			
Pentachlorophenol		1			
Total Number of Exceedences	7	16	9	16	17

5.54 Meetings of an interdepartmental liaison group, comprising Department of Agriculture and Rural Development, Environment and Heritage Service and Water Service, provide the forum for discussion of pesticide usage and catchment control, including evaluation of the possibility of reducing the impact of pesticides in raw water sources from which drinking water is derived.

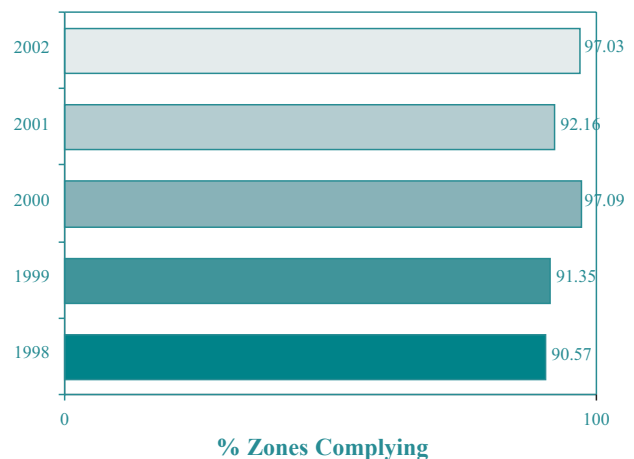
Hydrogen ion (pH)

5.55 The pH is a measure of acidity (or alkalinity) in water. The Regulations prescribe that pH should be between a minimum value of 5.5 and a maximum value of 9.5.

5.56 Of the 2,934 samples taken for pH during 2002, the regulatory standards were not met on six (0.20%) occasions in three (2.97%) water supply zones. As Figure 25 shows, this is a significant improvement on the 7.84% of zones which failed to comply with the standards in 2001.

5.57 In 2002, one water supply zone contravened both the minimum and maximum pH value and was assessed as non-trivial.

Figure 25: Water Supply Zones Complying with pH Standards



5.58 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.

Nitrate

5.59 The main source of nitrate in surface and groundwaters 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. For 2002, the nitrate standard was not met on one occasion and was considered trivial.

Manganese

- 5.60** 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. The compliance assessment takes these permitted relaxations into account.
- 5.61** Of the 922 samples taken in 2002, the manganese standard was not met on one occasion and was considered trivial.

Turbidity

- 5.62** 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.
- 5.63** Contraventions of the regulatory standard for turbidity were recorded in three (2.97%) water supply zones, two of which were assessed as non-trivial.

Other Parameters

- 5.64** The penultimate item (other parameters) in Table 5.10 shows that in 2002, of the 6,502 samples taken, 30 (0.46%) failed to comply with the regulatory standards for the following three parameters: oxidizability; ammonium; and nitrite.
- 5.65** The oxidizability parameter provides an indication of changes in water quality and estimates organic content. Of the 184 samples taken for oxidizability, 18 did not comply with the regulatory standard. Eight water supply zones failed to comply, all of which were assessed as trivial contraventions.

- 5.66** Ammonium concentrations contravened the regulatory standard on 11 occasions in six water supply zones; two zones were assessed as being non-trivial contraventions of the regulatory standard.
- 5.67** Ammonium can be present in water naturally or due to certain water disinfection processes. Enhanced operational control of the water treatment process and use of the required quality assured analytical methods used to detect ammonium should improve compliance.
- 5.68** One nitrite contravention of the regulatory standard was reported in one water supply zone during 2002 and was assessed as trivial.

Cryptosporidium

- 5.69** *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.
- 5.70** In line with practices in the rest of the United Kingdom, monitoring for *Cryptosporidium* is carried out in Northern Ireland. These arrangements were established for public health protection and incorporate a formal notification level of one or more oocysts per 10 litres and an alert level of 0.1 oocysts per 10 litres.
- 5.71** Monitoring is carried out in accordance with the document 'Guidance for the Monitoring of *Cryptosporidium* in Treated Water Supplies in Northern Ireland' (May 2002 and updated in February 2003) which is available on the web site: <http://www.ehsni.gov.uk/environment/drinkwater/links.shtml>.

5.72 The guidance identifies factors that contribute towards the assessment of 'significant risk' such as: the quality of the source water; the catchment; water source type; the type of treatment provided; and history of any drinking water related cryptosporidiosis outbreaks.

5.73 An annual risk assessment was carried out, and during 2002, out of 58 water treatment works assessed, five sites were included in a continuous monitoring programme for the detection of *Cryptosporidium* oocysts.

5.74 These sites abstract water mainly from surface water sources where treatment includes one or more of the following processes: disinfection; slow sand; rapid gravity; and ultra-fine filtration.

5.75 The table below shows summary results for the detection of *Cryptosporidium* since continuous monitoring programmes were implemented in 2000. Of the 1,528 samples collected in the monitoring programme for 2002, only very low numbers of oocysts were detected. All of the detections were in the range 0.01 - 0.10 oocysts per 10 litres.

No samples were found to have contained oocysts above the alert level (0.1 oocysts per 10 litres) or the formal notification level (1 oocyst per 10 litres).

5.76 The results show that for the sites selected for continuous monitoring in 2002, drinking water was not a major source of exposure of the population to *Cryptosporidium* oocysts. However, *Cryptosporidium* remains a water quality issue of concern and it is imperative that enhanced protection measures continue to be implemented by Water Service.

5.77 Modern, well-operated conventional treatment processes, operating under normal circumstances, will minimize the risk of *Cryptosporidium* getting into water supplies and, therefore, offer protection against cryptosporidiosis. Water Service's programme of investment in drinking water infrastructure has *Cryptosporidium* removal as one of its key objectives, and as the programme advances, it will progressively reduce the potential risk from *Cryptosporidium* in the drinking water supply.

Table 5.13: *Cryptosporidium* Monitoring, 2002-2000

	2002	2001	2000
Number of sites sampled	5	5	3
Number of samples collected	1,528	1,317	407
Number of samples with oocysts detected	94	193	82
% of samples with oocysts detected	6.2	14.7	20.2
Number of sites with oocysts detected in one or more samples	5	4	3
% of sites with oocysts detected in one or more samples	100	80	100
% of detections that were <0.1 oocysts/10 litres	100	97.04	99.02
Number of samples >1 oocysts/10 litres	0	0	0
Number of sites with >1 oocysts/10 litres	0	0	0
Highest concentration of oocysts/10 litres detected	0.09	0.62	0.40
Number of Water Treatment Works	58	63	63

Standard Sampling Frequencies

- 5.78** The Water Quality Regulations (Northern Ireland) 1994 set out sampling requirements, which demonstrate the wholesomeness of drinking water supplies. For 2002, the Inspectorate carried out an assessment of the regulatory standard sampling frequencies for water supply zones, water treatment works and service reservoirs.
- 5.79** Only where the annual sampling frequency is for 50 samples or more, has any shortfall of the regulatory sampling requirements been considered trivial, and then only to the extent of 2% of the requirement.
- 5.80** 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 shortfall. The excess samples should not be more than 5-10% of the required number and should not concentrate on any one group of parameters.
- 5.81** For 2002, there continued to be a significant overall sampling shortfall of 3.3%, the comparable figure for 2001 was 3.2%. The Inspectorate expects that Water Service have a robust sampling programme in place to comply with regulatory requirements.
- 5.82** The compliance assessment is made on a parameter basis for each of the sampling location types: water supply zones (consumers' taps); water treatment works; and service reservoirs. Where Water Service has not met the sampling requirements during 2002, the deficiencies for each of the sampling location types are as follows:

Water Supply Zones

- Of 50,688 determinations carried out on samples taken at consumers' taps there was a shortfall of 3,105 (6.13%) of the standard sampling requirements; the comparable figure for 2001 was 1.57%;
- 6.08% of the regulatory standard sampling requirements for water supply zones were assessed as non-trivial; the comparable figure reported for 2001 was 1.55%; and
- Of the 101 water supply zones monitored, 87 (86.14%) had a non-trivial sampling shortfall for at least one parameter; the comparable figure reported for 2001 was 65.69%.

Water Treatment Works

- 58 water treatment works were routinely sampled during 2002. Of these, 20 (34.48%) had a shortfall of the required regulatory standard sampling frequency; the comparable figure reported for 2001 was 47.62%; and
- 7 water treatment works (12.07%) recorded a non-trivial sampling contravention; the comparable figure for 2001 was 26.98%.

Service Reservoirs

- 360 service reservoirs were routinely sampled during 2002. Of these, 43 (11.94%) had a shortfall of the regulatory standard sampling frequencies; the comparable figure reported for 2001 was 48.07%; and
- 8 service reservoirs (2.22%) recorded a non-trivial sampling contravention; the comparable figure for 2001 was 23.76%.

-
- 5.83** A new Laboratory Information Management System (LIMS) came into operation during 2001. The Inspectorate expected improved compliance rates with regard to the regulatory sampling requirements during 2002 due to the introduction of enhanced sample management.
- 5.84** In 2002 there was a significant improvement reflected in the sampling compliance information provided by Water Service for water treatment works and service reservoirs. This can, in part, be attributed to improved reporting mechanisms which more accurately take into account when service reservoirs or water treatment works are not in use. The Inspectorate, however, has expressed its concern to Water Service about the significant shortfall for the water supply zones sampling requirements.
- 5.85** The Inspectorate expects Water Service to have a target of full compliance with the regulatory standard sampling frequencies.

Compliance with New Drinking Water Quality Standards

- 5.86** The 1998 EC Directive on the quality of water intended for human consumption (98/83/EC) introduced new regulatory requirements for monitoring, and sets out new or revised standards for a number of parameters. 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.
- 5.87** The standards in the EC Directive largely reflect the current World Health Organization Guidelines for drinking water quality.
- 5.88** The requirements of the Directive in relation to public water supplies in Northern Ireland were transposed into national law by the Water Supply (Water Quality) Regulations (Northern Ireland) 2002.

parameters. The Inspectorate requested Water Service to take samples for the new parametric values. This monitoring is required to ascertain if remedial work will be required to meet the new standards proposed in the new Regulations.

- 5.90** Monitoring commenced in 2002 for three of the new parameters: benzene; bromate; and 1,2 dichloroethane. It should be noted that because sampling was not undertaken at the new monitoring frequencies specified in the Directive, the results shown in Tables 5.14 and 5.15 cannot be interpreted at this stage in terms of percentage compliance. Monitoring for the new parameters is continuing through 2003.
- 5.91** Water Service will also be required to monitor against tighter standards for nine parameters and a more relaxed standard for one parameter, which are included in the current Water Quality Regulations (Northern Ireland) 1994. The existing standards remain in force until 25 December 2003.

Results of Monitoring in 2002

- 5.89** The new Regulations require Water Service to monitor against standards for five new

Table 5.14: New Mandatory Parameters

Parameter	Total Number of Determinations in 2002	New Standards to Apply on 25-12-2003	Number of Determinations not Meeting Standard
Benzene	389	1.0 µg/l	0
Bromate	131	10.0 µg/l	0
1,2 dichloroethane	380	3.0 µg/l	0
Enterococci*	-	0/100ml	-
Clostridium perfringens*	-	0/100ml	-

*Data not available from Water Service for the reporting period 2002.

5.92 The table below presents an assessment of the samples collected under the current Regulations against the new standards.

5.93 The new standard for PAHs relates to the sum of four substances rather than the sum of six substances as specified in the 1994 Regulations.

5.94 The new Regulations also introduce a tighter standard for THMs, with a maximum concentration of 100 µg/l rather than a three monthly rolling mean. The following formula has also been introduced for nitrate and nitrite:

$$\frac{\text{Nitrate (mg/l)}}{50} + \frac{\text{Nitrite (mg/l)}}{3} < \text{or} = 1$$

5.95 The monitoring that has been carried out indicates that compliance with the interim lead standard of 25 µg/l will be a significant issue for Water Service. In 2002, 5.41% of samples failed the current standard of 50 µg/l whereas 9.27% would fail the interim standard of 25 µg/l and 18.55% would fail the final standard of 10 µg/l. This indicates the need for effective plumbosolvency measures to be implemented.

5.96 Compliance with the THMs, aluminium and iron standards continue to remain an issue for Water Service. Improvement programmes for these particular water quality issues are essential and should be implemented in the fastest possible timescales to enable Water Service to meet the requirements of the new Regulations and further protect public health through the provision of high quality drinking water.

Table 5.15: Revised Parameter Values

	Total Number of Determinations in 2002	Current Standard	Number of Determinations Not Meeting Current Standard	Revised Standard	Number of Determinations Not Meeting Revised Standard
Antimony	93	10.0 µg/l	0	5.0 µg/l	0
Arsenic	93	50.0 µg/l	0	10.0 µg/l	0
Boron	93	2.0 mg/l	0	1.0 mg/l	0
Copper	374	3.0 mg/l	0	2.0 mg/l	1
Lead	647	50.0 µg/l	35	25.0 µg/l ¹ 10.0 µg/l ²	60 120
Nickel	93	50.0 µg/l	0	20.0 µg/l	0
Nitrite (at consumers' taps)	726	0.1 mg/l	1	0.5 mg/l	0
PAHs	513	0.2 µg/l	3	0.1 µg/l	0
Tetrachloroethene	365	10.0 µg/l	0	10.0 µg/l	0
Trichloroethene	365	30.0 µg/l	0		

¹ From 25 December 2003

² From 25 December 2013

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 giving rise to a significant potential risk to the health of consumers, or a significant adverse, aesthetic water quality change. Where no such deterioration has taken place, the situation is classified as an event. All incidents and events are assessed by the Inspectorate. In 2002, Water Service notified the Inspectorate of five water quality incidents and two events.

A summary of the water quality related incidents/events is provided in the table below.

Table 6.1: Water Quality Incidents/Events

Date	Location	Nature of Incident/Event	Classification
February 2002	Gortahurk Road, Desertmartin	Burst water main - 'Boil Notice' issued	Incident
April 2002	Artigarvin	Broken sewage pipe - precautionary 'Boil Notice' issued	Event
July 2002	Premier Drive, Belfast	Bacteriological exceedence - 'Boil Notice' issued	Incident
August 2002	Ballymartin Village	Bacteriological exceedence - 'Boil Notice' issued	Incident
October 2002	Carrick/ Newtownabbey Area	Taste and odour problems following changeover in water supply	Event
October 2002	Dungiven	Bacteriological exceedence - 'Boil Notice' issued	Incident
October 2002	Derrylin	Bacteriological exceedence - 'Boil Notice' issued	Incident

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

Drinking Water Complaints

6.3 In 2002, the Inspectorate received 37 complaints relating to drinking water quality. All complaints were referred to Water Service, district councils or health authorities, as appropriate, for follow-up investigation. The main categories of complaint were:

- discoloration (9 complaints);
- taste (9 complaints);
- discoloration and sediment (5 complaints);
- taste and odour (4 complaints)
- discoloration and taste (3 complaints);
- discoloration and odour (2 complaints);
- sediment (2 complaints);
- potential contamination (2 complaints); and
- odour (1 complaint).

Private Water Supplies

Private Water Supplies Monitoring Programme

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: 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.

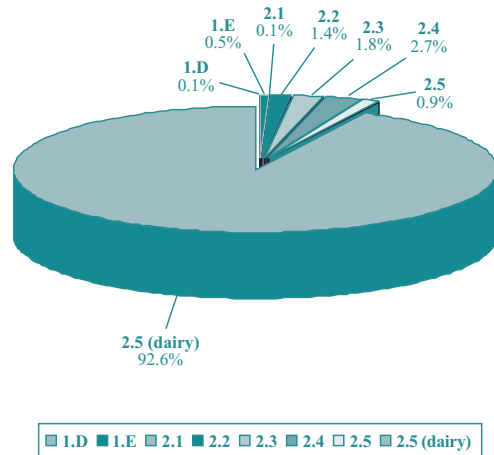
7.2 The Inspectorate is responsible for monitoring private water supplies that are identified under the Private Water Supplies Regulations (Northern Ireland) 1994.

7.3 The Regulations set monitoring requirements based on the size and nature of the private supply, taking into account the volume or the number of people using the supply. Private water supplies are split into two categories:

- **category 1** - a supply that is used only for drinking, washing or cooking by people living in properties receiving the supply: water used solely for domestic purposes. Category 1 supplies are placed in classes A to E depending on the number of people supplied, or the volume of water used; and
- **category 2** - a supply that 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.

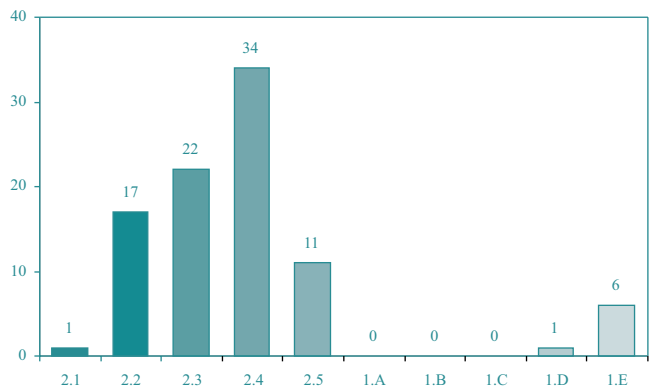
7.4 This section lists the number of water supplies identified under the Private Water Supplies Regulations. For 2002, the figure below shows that 1,247 private water supplies were identified and categorised into seven classifications.

Figure 26: Private Water Supplies - 2002 Classification Categories Including Dairy Farms



7.5 In Northern Ireland the majority of private water supplies fall within category 2, class 5 relating primarily to dairy farms, which accounts for approximately 93% of all private water supplies tested. The figure below shows, for the remaining 7% of private water supplies, the number of supplies in each of the other categories.

Figure 27: Private Water Supplies - 2002 Classification Categories Excluding Dairy Farms



- 7.6** A sampling and analysis programme determines water quality against the standards. The frequency of the sampling and the type of parameters tested are based on the nature of the supply. Dairy farms are sampled only for microbiological parameters and these account for 14.70% of all determinations carried out in 2002. All other classified private water supplies are sampled and analysed for microbiological and physical/chemical parameters.
- 7.7** The sampling of private water supplies, excluding dairy farms, is carried out on behalf of the Inspectorate by the Environmental Health Departments of the relevant district councils. The Inspectorate has a contract in place for the analysis of samples, which specifies that all analysis must be carried out by a laboratory using, at least, UKAS accredited methods.
- 7.8** A separate sampling, analysis and reporting programme of dairy farms is carried out on the Inspectorate's behalf by the Quality Assurance Division of the Department of Agriculture and Rural Development (DARD). The DARD laboratory at Newforge, which has UKAS accreditation, undertakes the analysis. The Quality Assurance Division of DARD takes responsibility for investigating and acting upon contraventions of the regulatory standards for these private water supplies.
- 7.9** The Inspectorate acknowledges the co-operation of staff from both the Quality Assurance Division and Newforge Laboratory of DARD, and from the relevant district council Environmental Health Departments, in carrying out their activities in relation to the Private Water Supplies Regulations.

Overview of Water Quality for 2002

- 7.10** Since June 1999, the Inspectorate has been carrying out a sampling and analysis programme as specified within the Private Water Supplies Regulations (Northern Ireland) 1994. The following tables and

figures provide a summary of information comparing compliance over previous years.

- 7.11** 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:
- changes in the sampling programme due to annual review of the identification and classification of private water supplies; and
 - improvements in analytical and reporting systems which may have reduced or eliminated the possible contribution to earlier data reporting of results of uncertain accuracy.
- 7.12** Table 7.1 provides an overview of the quality of water in private water supplies. The results show that out of a total of 10,859 tests carried out in 2002, 92.94% met the regulatory standards. The regulatory requirements were not met on 767 occasions. The comparable figure for 2001 was 97.19%.

Table 7.1: Overall Water Quality in Private Water Supplies

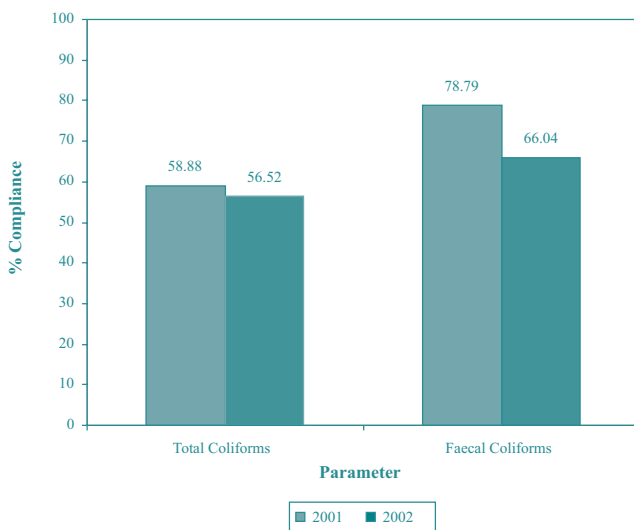
Parameters	Determinations in 2002			Determinations in 2001			Determinations in 2000		
	Total No.	Exceeding PCV		Total No.	Exceeding PCV		Total No.	Exceeding PCV	
		No.	%		No.	%		No.	%
Total coliforms	1,214	360	29.65	621 ¹	99	15.9	403 ²	54	13.4
Faecal coliforms	1,214	280	23.06	621 ¹	49	7.9	402 ²	22	5.5
Iron	145	28	19.31	135	26	19.3	119	20	16.8
Manganese	145	25	17.24	134	22	16.4	120	14	11.7
Trihalomethanes	144	16	11.11	135	16	11.9	119	15	12.6
Oxidizability	92	5	5.43	82	2	2.4	70	4	5.7
Taste (quantitative)	118	6	5.08	107	2	1.9	77	1	1.3
Sodium	93	4	4.30	82	5	6.1	70	1	1.4
Odour (quantitative)	138	5	3.62	128	5	3.9	116	8	6.9
Aluminium	145	5	3.45	135	5	3.7	119	5	4.2
Turbidity	177	5	2.82	154	6	3.9	140	8	5.7
Ammonium	146	4	2.74	135	5	3.7	121	3	2.5
Conductivity	216	5	2.31	198	2	1.0	187	1	0.5
Sulphate	93	2	2.15	82	1	1.2	70	2	2.9
Colour	156	3	1.92	135	4	3.0	120	6	5.0
Nitrate	176	2	1.14	153	1	0.7	140	0	0.0
Calcium	93	1	1.08	82	1	1.2	70	1	1.4
Magnesium	93	1	1.08	82	1	1.2	70	2	2.9
Nitrite	146	1	0.68	135	2	1.5	119	1	0.8
Temperature	330	1	0.30	311	2	0.6	332	5	1.5
Hydrogen ion	216	0	0.00	198	1	0.5	187	1	0.5
Total pesticides	69	0	0.00	73	3	4.1	70	2	2.9
Individual pesticides	2,898	3	0.10	3,139	5	0.2	3,011	12	0.4
Other parameters	2,602	5	0.19	2,389	0	0.0	2,080	5	0.2
Total	10,859	767	7.06	9,446	265	2.81	8,332	193	2.32

¹ For 2001, due to the foot and mouth outbreak, there was a shortfall in the number of samples collected from dairy farms for microbiological analysis.

² When interpreting coliform data, it should be noted that dairy farms were not included in the results reported for 2000.

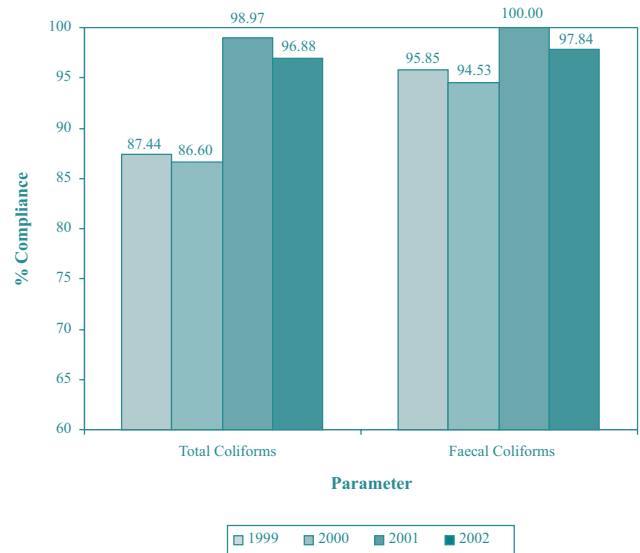
7.13 Out of the 1,247 private water supplies sampled, 1,155 were dairy farms where compliance was based on microbiological parameters only. The chart below shows that in 2002, 56.52% of samples collected at dairy farms met the regulatory standard for total coliforms, and 66.04% compliance was reported for faecal coliforms.

Figure 28: Summary of Microbiological Quality in Dairy Farms



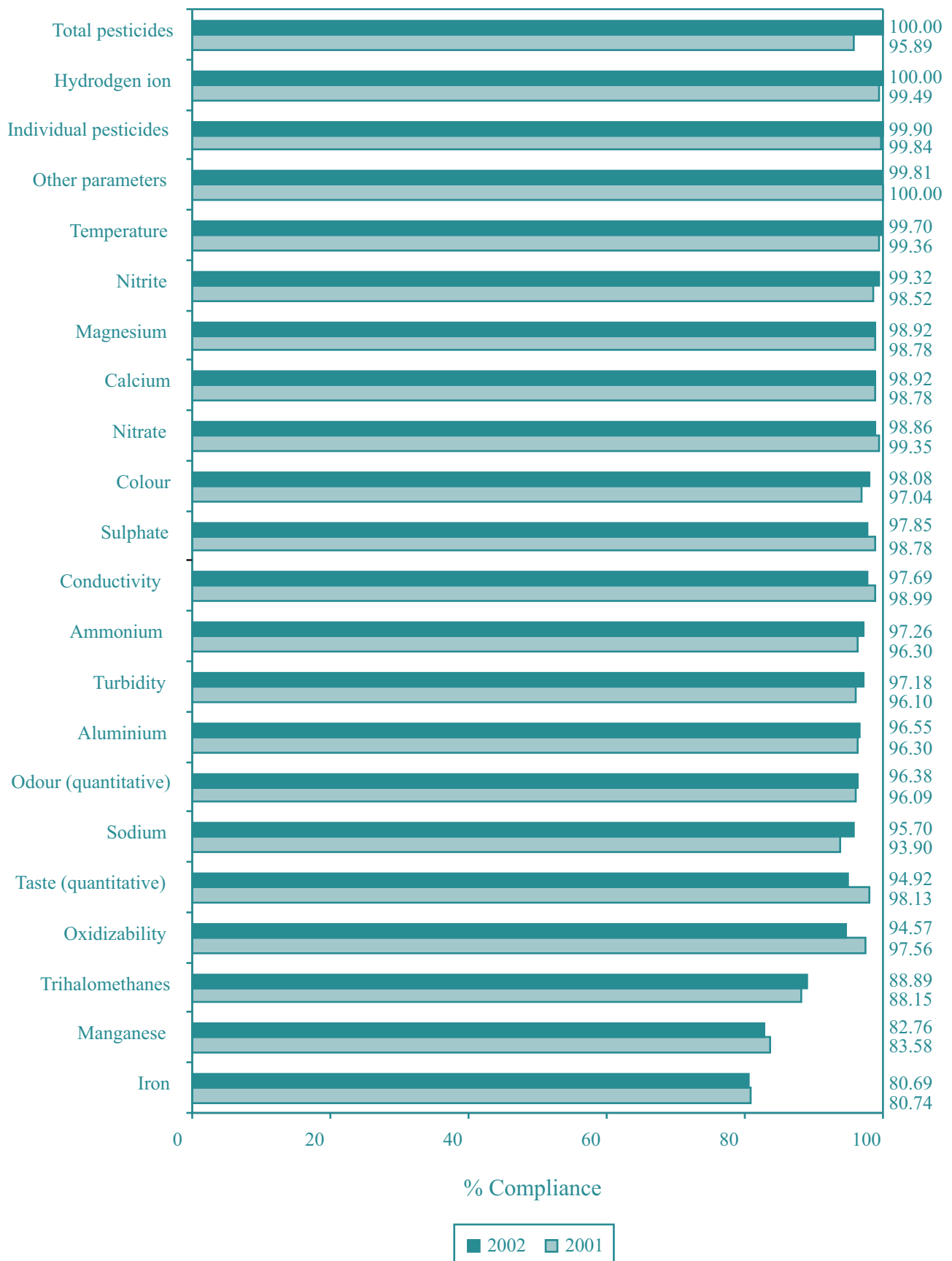
7.14 Figure 29 shows the percentage compliance for private water supplies other than dairy farms. For 2002, the microbiological quality is reported as 96.88% compliance for total coliforms and 97.84% compliance for faecal coliforms.

Figure 29: Summary of Microbiological Quality in Private Water Supplies (Excluding Dairy Farms)



7.15 Contraventions of the physical/chemical parameters have been reported over a range of parameters. As with previous years, these non-compliances continue to relate largely to iron (19.31%), manganese (17.24%), and THMs (11.11%) as shown in Figure 30.

Figure 30: % Compliance for Physical/Chemical Quality in Private Water Supplies



7.16 An ongoing pesticide monitoring programme is undertaken for private water supplies that fall within the 2.1 and 2.2 classifications. During 2002, 42 individual pesticides were monitored. Of these, two individual pesticides (MPCA and mecoprop) exceeded the regulatory standard. Table 7.2 lists the pesticides which have exceeded the regulatory standards since monitoring began.

Table 7.2: Number of Individual Pesticide Exceedences in Private Water Supply Zones

Pesticide Name	2002	2001	2000	1999
MCPA	2	2	6	
Mecoprop	1	1	2	
Diuron		1	1	
2,4-D		1		
Atrazine			1	1
2,4 -Dichlorophenol			1	
Isoproturon			1	
Chlorotoluron				1
Total Number of Exceedences	3	5	12	2

7.17 Contraventions of the regulatory standards are notified by the Inspectorate to the relevant district council's Environmental Health Department, the owner/occupier of the supply and DARD. All contraventions are investigated by the Inspectorate, in conjunction with the appropriate Environmental Health Department, and actions taken depending on the nature and level of the failure.

Provision of Information

7.18 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 and Rural Development, and the 26 district councils. The purpose of the leaflet is to alert owners and users of private water supplies to the potential risks of contamination of their water supplies.

Future Private Water Supplies Regulatory Framework

7.19 Private water supplies are currently governed by the Private Water Supplies Regulations (Northern Ireland) 1994 which transpose the 1980 European Drinking Water Directive (80/779/EEC). The new Drinking Water Directive (98/83/EC) requires new regulations for private water supplies to be made. The Department of the Environment will be consulting on new draft regulations.

Groundwater Monitoring

7.20 Environment and Heritage Service is responsible for the management and protection of groundwater sources. Under the Water (Northern Ireland) Order 1999, the Water Management Unit (a functional unit within EHS) continues to implement a groundwater monitoring programme for a range of representative sampling locations. Of interest to the Inspectorate are those samples collected from private water supplies from a single well/single household, which are used for domestic purposes and, which do not have a regulatory sampling requirement under the Private Water Supplies Regulations (Northern Ireland) 1994. The Water Management Unit liaises with the Inspectorate where the regulatory standards have not been met in these supplies.

* This leaflet is available on the web site: http://www/ehsni.gov.uk/environment/drinkWater/private_water.shtml

Drinking Water Research

8.1 Most research into drinking water quality and health is funded by the Department of the Environment, Food and Rural Affairs (DEFRA) 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 manages the Water Directorate's (WD) Water Distribution, Conservation and Quality (WDCQ) research programme. The WD research programme is a component of the DEFRA Environment Protection Group (EPG) research programme. The content of the research programme is determined annually by the Research Programme Committee.

Information on WDCQ Research

- 8.2** Enquiries should be addressed to: DWI Enquiries, 2/A2 Ashdown House, 123 Victoria Street, London SW1E 6DE.
- 8.3** Executive summaries of the WDCQ research reports and earlier Department of the Environment and DETR drinking water research reports are posted on the Foundation for Water Research web site: www.fwr.org with details of how to obtain copies of research reports.
- 8.4** General enquiries about the EPG programme should be directed to: Ken Nulty, DEFRA, Zone 4/C2, Ashdown House, 123 Victoria Street, London SW1E 6DE.
- 8.5** As part of the Departmental evaluation of its use of science, each Directorate is producing its Science Strategy. The strategy for WDCQ has been posted on the DEFRA web site: www.defra.gov.uk

Completed Research Projects

Area of Research	Project Summary	Contractor
<i>Cryptosporidium</i>	<p>West Cumbria Epidemiological Study</p> <p>This study was commissioned in 1995 and investigated whether installation of filtration in an unfiltered supply affected the reported incidence of cryptosporidiosis. The study also assessed whether installation of filtration caused a change in the sero-prevalence status of the population. The results showed a significant decrease in the level of cryptosporidiosis after installation of filtration, even after allowing for the effect of foot and mouth disease on cattle numbers in the catchment. The sero-prevalence data did not reveal a significant difference in sero-prevalence, or relative intensity of antibody responses, between the different areas.</p>	West Cumbria Health Authority

Area of Research	Project Summary	Contractor
	<p>Enhanced Surveillance of <i>Cryptosporidium</i> in the UK</p> <p>This study commenced in 2000 and investigated the epidemiology of sporadic cryptosporidiosis in two regions of the UK during the implementation of the <i>Cryptosporidium</i> regulations. The factors strongly associated with illness were reported as: travel outside the UK; contact with infected persons; and physical contact with cattle. The results did not show drinking water to be an important risk factor for cryptosporidiosis.</p>	PHLS
Water Supply within Consumers' Premises	<p>Review of Benefits and Disbenefits of Drinking Water Storage within Premises</p> <p>Storage within premises is a UK tradition. In most of Europe all taps within premises are supplied at mains pressure. This project reviewed operational, cost, and water quality aspects of maintaining a requirement for storage. It recommended that for new or renovated water systems all supplies to the cold water taps in domestic premises should be supplied directly at mains pressure from the water company distribution network.</p>	Binnie, Black & Veatch
	<p>Assessment of the Effect of In-House Treatment Devices on the Quality of Public Water Supplies</p> <p>The project investigated the effect of running a range of jug filters beyond the cartridge's recommended life, and the effect of the use of filters on dissolution of metals in a range of kettles and cooking utensils. It found no evidence of adverse effects on microbial water quality even when tested under conditions simulating abuse. Kettles with nickel-plated elements initially released significant concentrations of nickel, more so when the water had been jug-filtered. The amount dissolved decreased with prolonged kettle use, but concentrations in the boiled water still exceeded the regulatory standard with some kettles after a month's use, irrespective of whether the water had been jug-filtered.</p>	WRC-NSF
Materials Testing and Approval	<p>Exposure to Chloropropanol Isomers via Polyamines.</p> <p>LGC has developed a direct GCMS technique for the analysis of chloropropanol isomers in an ethyl acetate extract. The limits of detection are 0.02 µg/l for 1,3-DCP and 2,3-DCP. The study was not able to provide exposure data to chloropropanol isomers via drinking water because no waterworks were found to be using polyamine flocculants during the study period.</p>	LGC (Teddington)

Area of Research	Project Summary	Contractor
	<p>Reliability of Test Methods for Metallic Products</p> <p>An inter-laboratory study involving three laboratories assessed the performance of the 2001 revision to BS 7766 "Assessment of the potential for metallic materials to affect adversely the quality of water intended for human consumption". The results showed that, despite making a number of changes to the test protocol, no significant improvement in the inter-laboratory performance has been achieved.</p>	WRc-NSF
Oestrogens	<p>Consolidation of Two Analytical Methods</p> <p>This project consolidated two similar methods for the routine analysis of three oestrogens in drinking water using gas chromatography and mass spectrometry. The potential use of an alternative method using liquid chromatography and mass spectrometry was also investigated.</p>	Laboratory of the Government Chemist
Research Planning	<p>Organisation of Research Conference</p> <p>The objective of the Conference was to identify the medium to long-term questions that might impact on research needs. The Conference identified a number of issues that have been incorporated in the WDCQ Science Strategy. (See information on WDCQ research above.)</p>	WTi

Current Research

Area of Research	Brief Detail	Contractor
<i>Cryptosporidium</i>	<p>Molecular Finger-Printing of <i>Cryptosporidium</i> Oocysts Isolated During Regulatory Monitoring</p> <p>This project aims to develop methods for the extraction of DNA from oocysts detected in regulatory monitoring for <i>Cryptosporidium</i> so that it can then be used for speciation of the isolates. The ability to speciate oocysts will be a valuable aid to understanding the sources and transmission of <i>Cryptosporidium</i> and in the investigation of cases of disease.</p>	Scottish Parasite Diagnostic Laboratory
	<p>Investigation of <i>Cryptosporidium</i> Clinical Isolates and Analysis with Epidemiological Data</p> <p>This study seeks to improve the discrimination of gene probe based molecular fingerprinting system, which had been developed under an earlier contract with SCIEH. Collection of human and animal isolates has been completed and investigation of potential sub-typing techniques is underway.</p>	Scottish Centre for Infection and Environmental Health and PHLS

Area of Research	Brief Detail	Contractor
	<p>Effectiveness of UV Treatment for <i>Cryptosporidium</i> in Drinking Water</p> <p>Inter-laboratory trials are being organised to test the robustness of published cell culture techniques. A treatment study on the effectiveness of UV against <i>Cryptosporidium</i> has been conducted and a workshop on the requirements for UV equipment and design of trials for demonstrating inactivation of pathogens was held in March 2002.</p>	UK Water Industry Research Ltd
Other Health Risks and Monitoring	<p>Enumeration of <i>Giardia</i> in Drinking Water</p> <p>This study is investigating the feasibility of concurrently detecting and identifying <i>Giardia</i> cysts during regulatory monitoring for <i>Cryptosporidium</i>.</p>	Severn Trent Laboratories
	<p>Further Studies on the Incidence of Mycobacterium Avium Complex (MAC) and Helicobacter Organisms in Water Supplies</p> <p>This study is investigating whether biofilms in water supply systems, including household systems, might provide a source of exposure to MAC organisms or <i>Helicobacter pylori</i>. Culture methods have been developed for both bacteria and survey work is underway.</p>	PHLS
	<p>A Study of Sources of Drinking Water and Crohn's Disease</p> <p>It has been suggested that Crohn's disease could be associated with exposure to <i>Mycobacterium avium var paratuberculosis</i> (MAP) and that exposure to MAP might occur via drinking water. Although research reported in Northern Ireland Drinking Water Quality 2001 failed to detect MAP in water supplies, this case-control epidemiological study based around newly diagnosed cases of Crohn's disease examines whether there is any demonstrable link with sources of drinking water.</p>	University of East Anglia
	<p>Support for Review of WHO Guidelines for Drinking Water</p> <p>The contractor has provided reports on the proposal for reviews of current WHO guideline values for drinking water. Reports have also been provided on the toxicity of silver, nickel and asbestos.</p>	Faber Maunsell (formerly Metcalfe and Eddy)

Area of Research	Brief Detail	Contractor
Materials Testing and Approval	<p>Provision of Expert Advice for European Research and Standardisation Activities</p> <p>Support has been provided in the development of the regulatory approach to a European system for positive lists for polymeric drinking water construction products. During 2002 this has included the use of conversion factors to relate test conditions to consumer exposure conditions and the reduced assessment approach for low-risk uses of construction products.</p>	WRc-NSF
	<p>Development of Test Methods for the European Acceptance Scheme</p> <p>Test methods have been developed for ability to support microbial growth using ATP measurements (2) cytotoxic using suppression of RNA synthesis (3) screening for unsuspected organic contaminants using GCMS general survey. In addition, the affects of high concentrations of disinfectants on construction products were studied and a report on the potential application of genotoxicity testing was prepared.</p>	WRc-NSF and The Water Quality Centre
Water Treatment	<p>Monitoring the Integrity of Low-Pressure Membrane Processes for Drinking Water Treatment</p> <p>This joint Defra/American Water Works Association Research Foundation project examines existing and innovative methods for monitoring membrane integrity in low-pressure systems. Following a literature review, full-scale testing of existing and innovative monitoring techniques is in hand at six membrane plants in the US and Europe.</p>	Carollo Engineers

Current Local Research

Area of Research	Brief Detail	Contractor
Radon	<p>Radon in Drinking Water Supplies</p> <p>Environment and Heritage Service (Industrial Pollution and Radiochemical Inspectorate and Drinking Water Inspectorate) has contracted a study with the National Radiological Protection Board (NRPB), on the measurement of radon in a selected number of public and private water supplies in Northern Ireland.</p>	NRPB and Queen's University, Belfast

Definitions and Glossary of Terms

These definitions will assist the understanding of the Report, where technical terms have been used. These definitions apply to current Regulations.

Quality Standards Table

Substance	Description	Standard
MICROBIOLOGICAL PARAMETERS		Amount Allowed
Faecal coliforms	Faecal coliforms are present in the gut of all warm-blooded animals. Their presence in water supplies indicates a need to take immediate action to remove the source of faecal pollution. These organisms are controlled through the disinfection of water.	0 per 100 ml
Total coliforms	The coliform group of organisms is widely distributed in the environment, for example, through human and animal activity and through vegetable matter. Their presence in water supplies indicates a need to investigate the source of contamination. Coliform numbers are controlled through the disinfection of water.	0 per 100 ml
CHEMICAL PARAMETERS		
Alkalinity	The concentration of this parameter is an indication of the natural hardness and pH of the water.	No standard
Aluminium	Occurs naturally in some drinking water sources. This aluminium is removed during the water treatment processes (coagulation and filtration). Aluminium sulphate can be used as a water treatment chemical to remove cloudiness, colour and organisms.	200 µg/l
Ammonium	Ammonium salts are naturally present in trace amounts in most drinking water sources. They are decomposed during disinfection.	0.5 mg/l
Antimony	Antimony is not normally present in drinking water sources. Trace concentrations in drinking water can be derived from brass fittings and from solders.	10 µg/l
Arsenic	Naturally present at trace levels in a very few groundwater sources. Arsenic, when present, is removed by specialist water treatment processes.	50 µg/l
Barium	Occurs naturally in trace concentrations in some water sources.	1000 µg/l
Boron	Boron in water sources comes from the residues of detergent formulations that are present in treated sewage effluents.	2000 µg/l

Substance	Description	Standard
CHEMICAL PARAMETERS		Amount Allowed
Cadmium	Cadmium may be present at trace levels in a very few groundwater sources. When present, it is removed by specialist water treatment processes.	5 µg/l
Calcium	Occurs naturally in all water sources, and, along with magnesium, is responsible for the hardness of water, which causes scale in kettles and hot water systems.	250 mg/l
Chloride	In association with sodium, chloride occurs naturally as a very dilute salt in all water sources and is not removed during water treatment.	400 mg/l
Chlorine	Chlorine gas is used as a disinfectant in water treatment. It destroys bacteria derived from animal wastes and sewage effluents.	No standard
Chromium	Not normally present in drinking water sources.	50 µg/l
Colour	Colour occurs naturally in water from upland sources. Colour is removed during the water treatment processes (coagulation and filtration).	20 mg/l Pt/Co Scale
Conductivity	Conductivity is a measure of the amount of natural inorganic substances dissolved in source water. It is used to assist treatment control.	1500 µS/cm
Copper	Traces of copper occur naturally in many water sources and significant concentrations may occur at consumers' taps as a consequence of copper pipes.	3000 µg/l
Cyanide	Cyanide is not normally present in drinking water sources.	50 µg/l
Fluoride	Traces of fluoride occur naturally in many water sources, particularly, in groundwater.	1500 µg/l
Iron	Present naturally in many water sources, iron is removed during water treatment. Iron in water supplies may also be derived from corrosion of iron mains. Iron compounds are used in water treatment to remove cloudiness.	200 µg/l
Lead	Not normally present in water sources but may be present at consumers' taps if lead pipes are present.	50 µg/l
Magnesium	Occurs naturally in all water sources, and, along with calcium, is responsible for the hardness of water, which causes scale in kettles and hot water systems.	50 mg/l
Manganese	Present naturally in many water sources and is removed during water treatment.	50 µg/l
Mercury	Mercury is not normally present in drinking water sources.	1 µg/l
Nickel	Not normally found in drinking water sources. Traces found in drinking water may emanate from protective coatings on taps and fittings.	50 µg/l

Substance	Description	Standard
CHEMICAL PARAMETERS		Amount Allowed
Nitrate	Present naturally in all source waters, although higher concentrations can be caused by use of fertilisers. Where necessary, nitrate levels are reduced during water treatment (ion exchange or blending with low nitrate water).	50 mg/l
Nitrite	Traces of nitrite are produced when chlorine and ammonia are used in the disinfection process. Levels are minimized through careful operation of the disinfection process.	0.1 mg/l
Oxidizability	The oxidizability of water provides a measure of its organic content. This is an alternative measure of total organic carbon.	5 mg/l
Pesticides	Water sources may contain traces of pesticide residues as a result of agricultural and non-agricultural uses of pesticides on crops, and for weed control.	0.1 µg/l
pH (Hydrogen ion)	pH value, or hydrogen ion concentration, gives an indication of the degree of acidity of the water. pH7 is neutral; values below 7 indicate acidic characteristics and values greater than 7 indicate alkaline characteristics. A low pH value may result in pipe corrosion. An alkali may be added before supply so that corrosion is minimized.	5.5 - 9.5
Phosphorus	Traces of phosphorus salts occur naturally in many water sources and high concentrations are associated with treated sewage effluents and agricultural fertilisers. Phosphates are also used in water treatment as a health protection measure to reduce lead content that may come from consumers' pipes.	2200 µg/l
Polycyclic Aromatic Hydrocarbons (PAHs) Benzo 3, 4 pyrene (a PAH)	Polycyclic aromatic hydrocarbons are present in coal tar linings, which were used to protect water mains before 1970. Traces of PAHs may be present in tap water if the original coal tar lining is still present.	0.2 µg/l 10 ng/l
Potassium	This occurs naturally in all water sources and is not removed during water treatment.	12 mg/l
Qualitative odour and taste	Odour and taste occur naturally in water, particularly, in surface water sources during the summer. The organics causing the odour and taste are removed during the water treatment processes (e.g. activated carbon or ozone).	No standard
Quantitative odour and taste	A formal method is undertaken in the laboratory to measure odour and taste in water. Individual tests are carried out, and any imperfections are removed during the treatment process as described above.	Dilution No. of 3 at 25°C
Selenium	Selenium is not normally present in drinking water sources.	10 µg/l
Silver	This is not normally present in drinking water sources. Silver may be used as a disinfectant for small private supplies.	10 µg/l

Substance	Description	Standard
CHEMICAL PARAMETERS		Amount Allowed
Sodium	In association with chloride, sodium occurs naturally as a very dilute salt in all water sources and is not removed during water treatment.	150 mg/l
Sulphate	This occurs naturally in all source waters and is not removed during water treatment.	250 mg/l
Surfactants	Surfactants in water sources come from the residues of detergent formulations that are present in treated sewage effluents. They are removed during treatment.	200 µg/l
Temperature	The temperature of surface waters varies according to the season. Groundwater has a much smaller variation in temperature range.	25°C
Tetrachloroethene Tetrachloromethane Trichloroethene	These solvents can be present at low concentrations in groundwater under industrial areas. Where necessary, specialist treatment is used to protect public health by removing solvents from drinking water.	10 µg/l 3 µg/l 30 µg/l
Total hardness	This represents the concentration of both naturally occurring calcium and magnesium in the source water. Hard water can cause scale formation in kettles and hot water systems.	No standard
Total organic carbon (TOC)	TOC represents the total amount of organic matter present in the water.	No significant increase
Trihalomethanes (THMs)	THMs are formed during the disinfection process by reaction between chlorine and mainly naturally occurring organic substances. Treatment processes are controlled to minimize their production.	100 µg/l
Turbidity	All source waters are naturally cloudy on occasions. Turbidity is a quantitative measure of cloudiness, and levels are controlled by treatment processes.	4 Formazin Turbidity Units
Zinc	Significant concentrations of zinc in water are only found in premises served by galvanized iron service pipes. Traces of zinc may emanate from solders.	5000 µg/l

Definitions and Glossary of Terms

Aesthetic	associated with the senses of taste, smell and sight.
Aquifers	underground strata containing water.
Catchment	the area of land that drains into a watercourse.
Chloramination	an alternative form of disinfectant, based on chlorine and ammonia, which provides a longer lasting residual in the distribution system compared to free chlorine.
Coliforms	a group of bacteria which may be faecal or environmental in origin.
Compliance assessment	a comparison made by the Inspectorate of data (gathered by Water Service) against standards and other regulatory requirements.
Contravention	a breach of the regulatory requirement.
Crohn's Disease	Crohn's disease is an inflammation of the bowel.
Cryptosporidiosis	the illness produced by infection with <i>Cryptosporidium</i> .
<i>Cryptosporidium</i>	a protozoan parasite.
DEFRA	Department of the Environment, Food and Rural Affairs.
Determination	a single analytical result for a specific parameter.
Distribution systems	Water Service'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'.)
Epidemiology	a process of studying the distribution of cases of disease within a population in relation to exposure to possible sources of the infection, with a view to establishing the actual source of the infection.
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.
Filtration	the separation of suspended particulate matter from a fluid.

GCMS/MS	analytical techniques used - gas chromatography mass spectrometry/mass spectrometry.
<i>Giardia</i>	a protozoan parasite.
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	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.
Microbiological	associated with the study of microbes.
m³/d	cubic metres per day.
mg/l	milligrammes per litre.
ml	millilitre.
MI/d	megalitres per day (one MI/d is equivalent to 1,000 m ³ /d or 220,000 gallon/d).
Mycobacterium Avium Complex (MAC)	a group of bacteria responsible for pulmonary and non-pulmonary infections, particularly, in the immunocompromised.
Mycobacterium Avium Paratuberculosis (MAP)	species of the MAC group of organisms that causes Johne's disease in cattle.
New Regulations	the Water Supply (Water Quality) Regulations (Northern Ireland) 2002 S.R. No.331 ISBN 0-337-94388-5.
ng/l	nanogramme per litre.

Oocyst	the resistant form in which <i>Cryptosporidium</i> occurs in the environment, and which is capable of causing infection.
PAHs	a group of organic compounds known as polycyclic aromatic hydrocarbons, comprising, for the purposes of the Regulations, six 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.
pH value	a measure of the acidity or basicity related to the concentration of the hydrogen ion.
Plumbosolvency	the tendency for lead to dissolve in water.
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.
Public registers	the information made available to the public as required by regulations 26 and 27.
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.
Remedial action	action taken to improve a situation.

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.
Time of supply	the moment when water passes from Water Service'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.
Trihalomethanes (THMs)	a group of organic substances comprising, for the purposes of the Regulations, four substances: trichloromethane, (also known as chloroform), dichlorobromomethane, dibromochloromethane and tribromomethane.
µg/l	microgrammes per litre.
UKAS	The sole national accreditation body recognised by government to assess, against internationally agreed standards, organizations that provide certification, testing, inspection and calibration services.
Waiver	authorised relaxation.
Water supply zone	the basic unit of supply for establishing sampling frequencies, compliance with standards and information to be made publicly available.
Web site	location of information on the Internet. The Inspectorate's web site is: http://www.ehsni.gov.uk/environment/drinkWater/drinkWater.shtml
Wholesomeness	a concept of water quality which is defined by reference to standards and other requirements set out in the Regulations.
WRc	Water Research Centre (1989) plc and/or, as the context may require, its predecessor body.

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present and future generations.*

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