



Northern Ireland Drinking Water Quality 2003

*A Report by the Northern Ireland
Drinking Water Inspectorate*





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Contents

	Page Nos
Summary	1
1 Introduction	7
2 The Regulatory Framework	8
3 The Role and Activities of the Drinking Water Inspectorate	10
4 The Technical Audit	15
5 Overview of Drinking Water Quality in Northern Ireland in 2003	23
6 New Regulations and Associated Programmes of Work	44
7 Drinking Water Quality Incidents and Complaints	47
8 Private Water Supplies	48
9 Drinking Water Research	54
10 Definitions and Glossary of Terms	59

Summary

This report is the eighth 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 2003. New Regulations came into operation in December 2003 and future reports will be made against the new regulatory framework.

As this is the last report to be produced in association with the 1994 Regulations, it is encouraging to note that overall compliance has improved from 98.89% in 1996, to 99.31% in 2003. 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. Out of a total of 98,922 tests carried out by Water Service in 2003, 99.31% met the regulatory standards due to improved compliance for certain chemical parameters as new and upgraded water treatment facilities became operational. However, within this improving overall picture, there remain some aspects of water quality, notably: trihalomethanes (THMs), lead, iron, and aluminium, which require substantial improvement works to mitigate contraventions of the regulatory standards. The Inspectorate welcomes Water Service's commitment to deliver improvement measures within the required timescales ensuring that the protection of public health continues to remain a high priority in its operational business.

It is noted that in 2003 there is an improvement in overall microbiological compliance to 99.76% from the 99.61% reported in 2002. The compliance rate at consumers' taps for the important microbiological parameters has shown an improvement from 99.54% in 2002, to 99.61% in 2003. For service reservoirs, an improvement from 99.51% in 2002, to 99.74% in 2003 is reported. Compliance rates at water treatment works have been maintained at 99.87% (99.88% in 2002). Within these overall statistics, there were occasions where increased numbers of faecal coliforms were reported during 2003. The Inspectorate welcomes the implementation of the new investigation and reporting procedures which have been introduced by the new Regulations and will assist in the proactive prevention of regulatory non-compliance.

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

Figure 1: Overall Water Quality Compliance with Regulatory Standards

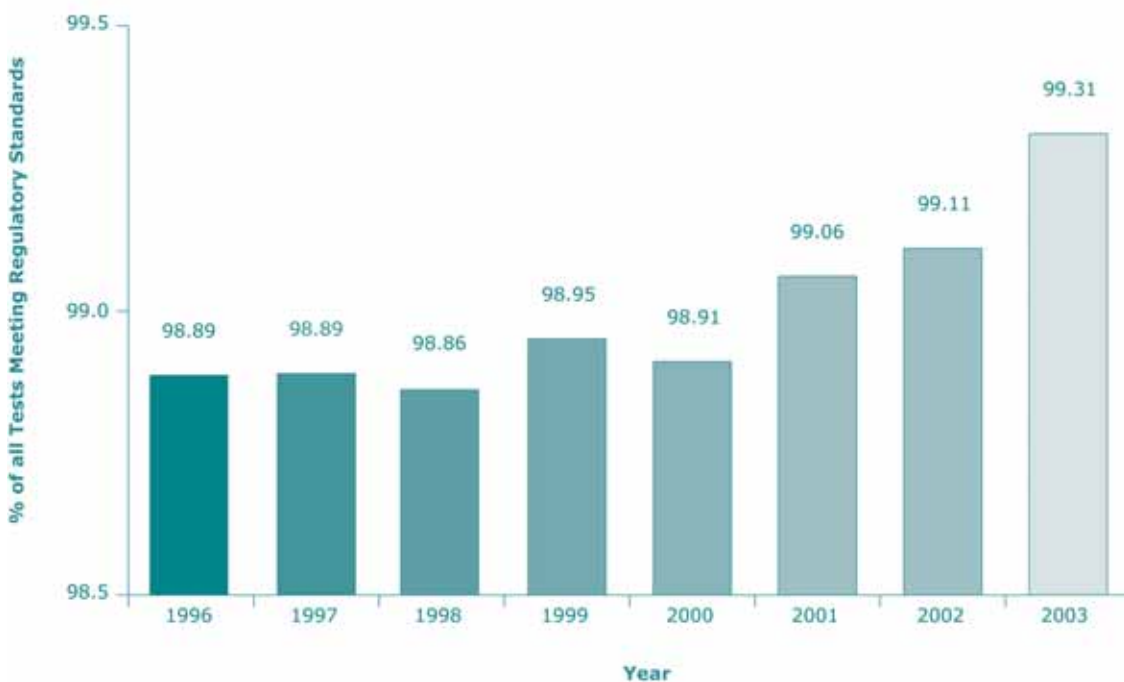


Figure 2: Compliance Summary Results

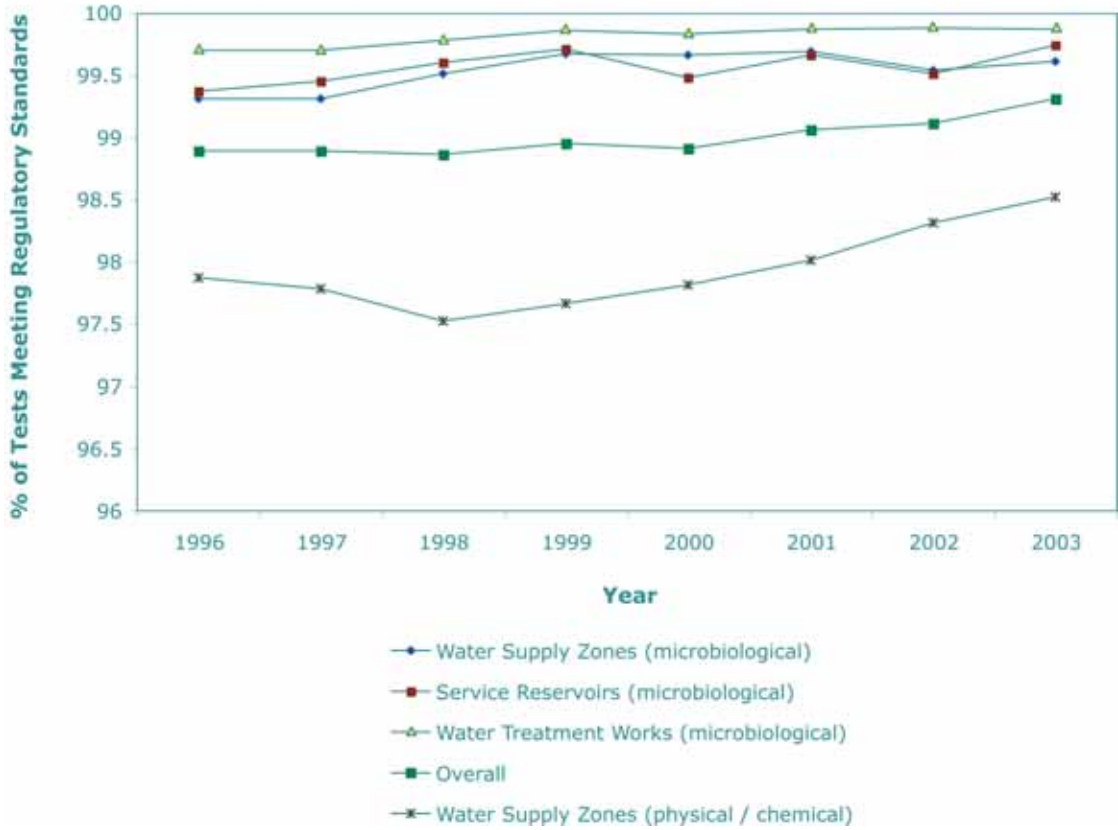
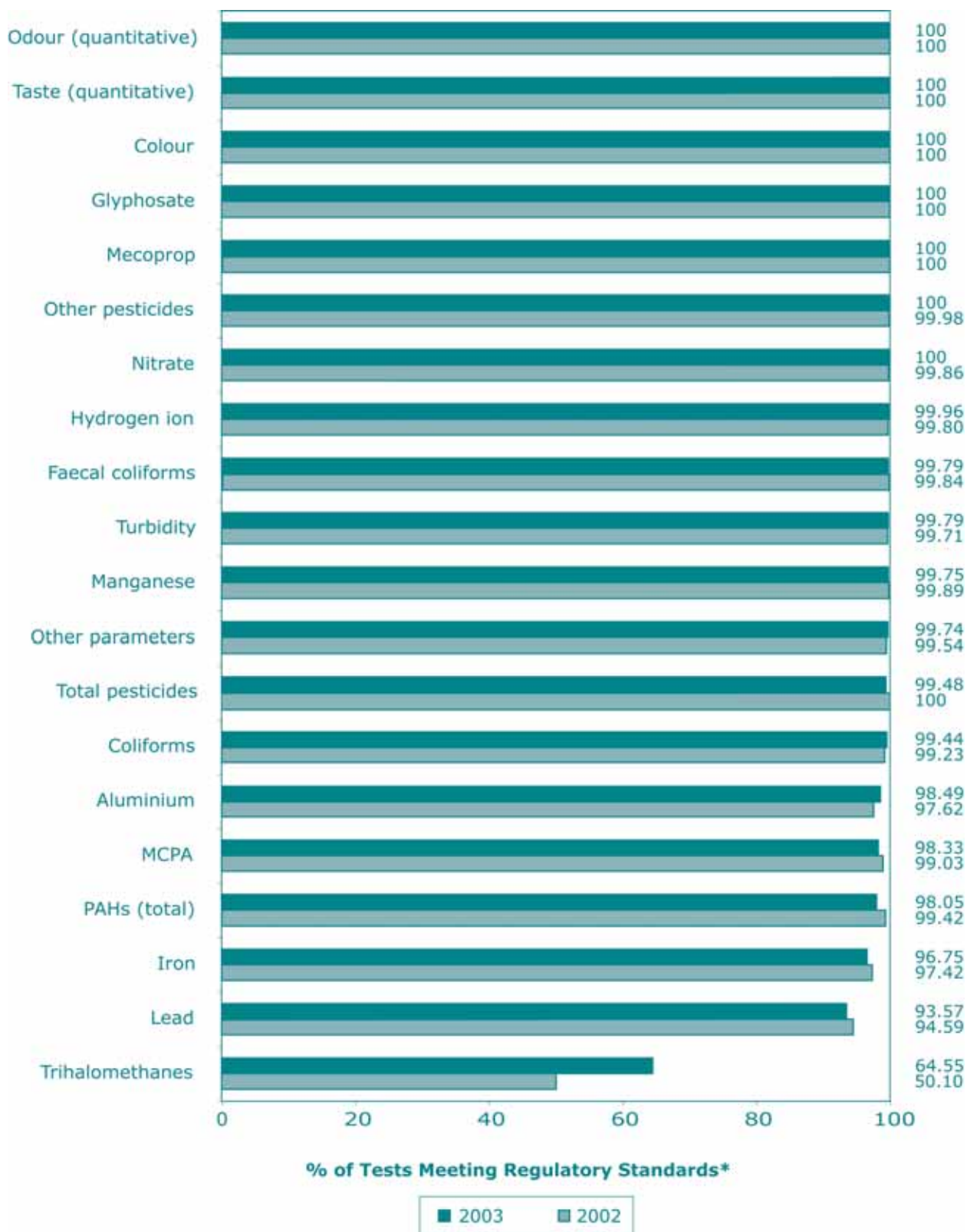


Figure 2 above shows that the microbiological compliance rate of 99.61% for drinking water at consumers' taps remains good. However, the overall water quality figure for consumers' taps, which also includes physical/chemical tests, is 98.75% due to the continued poorer performance rates for certain chemical parameters, notably: THMs, iron, aluminium and lead.

During 2003, the level of compliance was reported for 97 water supply zones which were routinely monitored for 88 individual parameters. The regulatory requirements were met for 75 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. The overall number of physical/chemical tests not meeting the standards shows a significant improvement, with 531 (1.48%) of 35,894 tests failing to meet the required standards in 2003; the comparable figure for 2002 was 683 (1.69%).

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



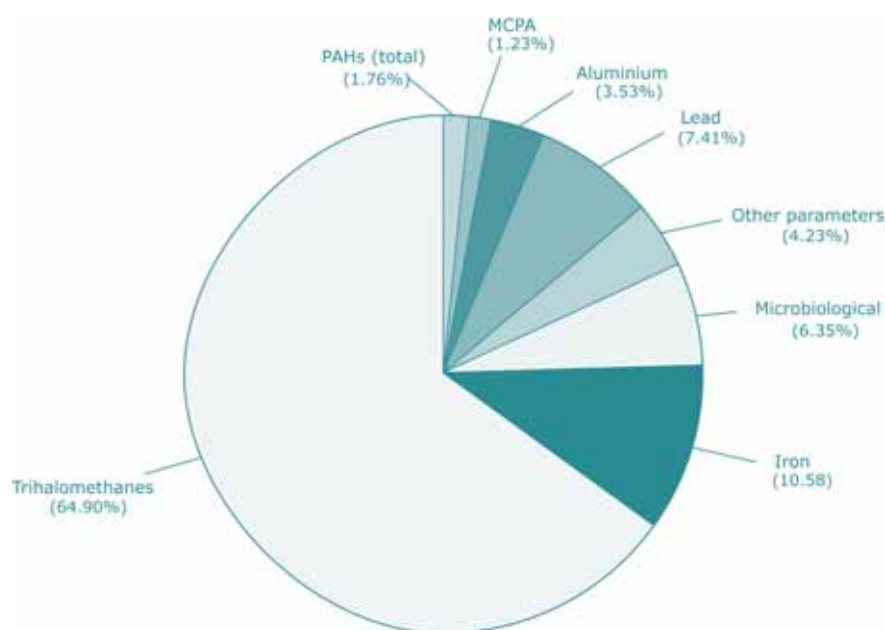
*Regulatory Standards refer to the Prescribed Concentrations or Values (PCVs) or Relaxed PCVs.

Of the 45,206 samples taken at consumers' taps in 2003, the standards laid down in the Water Quality Regulations (Northern Ireland) 1994 were contravened on 567 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, faecal coliforms, ammonium, hydrogen ion (pH), MCPA, total pesticides and total polycyclic aromatic hydrocarbons.

Figure 4 below shows those parameters, both microbiological and physical/chemical, for which compliance with the regulatory standards was not achieved in 2003. Each is shown as a percentage of the 567 individual contraventions in water supply zones.

Figure 4: Contraventions of Standards in Water Supply Zones in 2003



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.

The percentage number of tests contravening the THMs standard in 2003 is 35.45%; this is a significant improvement on last year's non-compliance rate of 49.90%. Every effort must continue to be made to control the formation of THMs through improved operational practices and the introduction of new or enhanced water treatment processes.

During 2003, there has been an increase in the percentage number of tests not complying with the regulatory standard for lead; 6.43% of tests failed to comply in 2003 compared to 5.41% in 2002. While Water Service continues to undertake investigative programmes to minimize the solubility of lead, and orthophosphate treatment is introduced, every effort must be made to reduce the levels of lead in drinking water to meet the regulatory requirements.

There has been an increase in the percentage number of tests failing to comply with the iron standard during 2003; 3.25% of tests failed to meet the iron standard when compared with 2.58% in 2002. The figures reflect that programmes of work are necessary to rehabilitate the distribution system and improve drinking water quality.

For aluminium, the percentage number of tests that fail to meet the standards has improved from 2.38% in 2002, to 1.51% in 2003. While there has been an overall improvement in aluminium compliance reported over previous years, as investment and enhancements of water treatment processes have been implemented, it is important that Water Service optimizes operational control of existing treatment works until all the new and upgraded water treatment works projects are completed.

During 2003, arrangements continued to be implemented for the monitoring of 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 1,502 samples collected in the compliance monitoring programme for 2003, no samples were reported to have contained oocysts above the alert reporting 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; it is imperative that the necessary validated 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 robust sampling programme in place and that a target of full compliance with the regulatory standard sampling frequencies is achieved. For 2003, there is a significant improvement in compliance with the overall sampling requirements, with a sampling shortfall of 0.7% reported compared to 3.3% in 2002.

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.

Looking Towards The New Regulations

While overall compliance for 2003 is 99.31%, it remains significantly behind the 99.88% reported for 2003 in England and Wales; a figure which has been achieved because of the large programmes of work invested by the water companies in drinking water infrastructure in recent years. In Northern Ireland, formidable challenges lie ahead for Water Service, while undergoing organizational change, to deliver the required programmes of work necessary to improve compliance: modification of existing treatment; additional treatment; new treatment works; and renovation of distribution systems. The most significant programmes are those needed to mitigate contraventions of the regulations for specific parameters, notably: THMs, iron, lead and aluminium. The work on improving water treatment to provide effective barriers against Cryptosporidium continues to be part of the ongoing vigilance necessary for the protection of public health.

New Water Quality Regulations, 'The Water Supply (Water Quality) Regulations (Northern Ireland) 2002', which set out new and revised standards for a number of parameters came fully into force on 25 December 2003. Most of the standards in the new Regulations remain the same as those in the 1994 Regulations but there are some additional 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 2003, 6.43% of samples failed the current standard of 50 µg/l, whereas 14.09% would fail the new interim standard of 25 µg/l which had to be met by the end of 2003, and 25.11% would fail the new final standard of 10 µg/l which has to be met by 2013. While there has been slippage in the implementation of Water Service's lead strategy, orthophosphate treatment has now been installed at 34 sites across Northern Ireland and an improvement in compliance with the new 25 µg/l standard is expected as this programme takes effect.

Non-compliance with the trihalomethane and aluminium standards remains a significant issue for Water Service and this is being addressed through the delivery of a programme of work in accordance with terms and conditions which have been introduced through an 'authorisation process' which is part of the new Regulations. Longer timescales for improvement works which are required to address the necessary water mains rehabilitation projects to mitigate iron contraventions are being progressed.

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 2003. This is the eighth annual report prepared by the Inspectorate, and, as with the previous reports, it reports on water quality in Northern Ireland following the introduction of the current Regulations in 1994. New drinking water quality regulations came into operation in Northern Ireland on 25 December 2003, and future reports will be made against the new regulatory framework. The Inspectorate continues to progress water quality issues, with a view to improving compliance with the 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, an executive agency within the Department for Regional Development, responsible for the provision of public water supplies. The information was obtained from Water Service's monitoring programme, carried out as prescribed in the Water Quality Regulations (Northern Ireland) 1994 (the 'Regulations'). In accordance with regulation 28, Water Service has published its own report, entitled 'Drinking Water Quality Report 2003'. 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 2003, 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. Section 6 provides an introduction to the new Regulations and the associated programmes of work. In Section 7, water quality incidents have been identified, and in Section 8, a summary of the private water supplies monitoring programme in Northern Ireland is provided. This is followed in Section 9 by 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', 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 Department,² 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 (DRD).

³ Under government reorganization, now the Department of the Environment (DoE).

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 came fully into effect on 25 December 2003. Copies can be obtained from The Stationery Office (TSO) website:

<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 (DRD).

³ Under government reorganization, now the Department of the Environment (DoE).

⁴ Copies of Northern Ireland legislation can be obtained from the TSO website:
http://www.northernireland-legislation.hmso.gov.uk/legislation/northernireland/ni_legislation.htm

⁵ Copies of the Directive can be obtained from the website:
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 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.

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

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 2003, 1,535 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 Group, in particular, on matters associated with the new regulatory framework currently being implemented to meet the 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, chemical analysis, water treatment and consumer relations. Details of the current membership of the Committee and its activities are posted on the Drinking Water Inspectorate for England and Wales website: www.dwi.gov.uk/cpp/index.htm

Annual List of Approved Products

- 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 website: <http://www.dwi.gov.uk/cpp/index.htm>. By the end of 2003 following an audit of approved products, 144 products on the list had been audited and 35 formerly approved products had been removed from the 2003 List of Approved Products. Some products had been removed from the list because they were no longer available; in other cases, approval had been revoked because the

product had failed the audit tests or because the approval holder had failed to comply with a condition of approval. Full details of products removed from the 2003 List of Approved Products are contained in Appendices 2 and 3 of that document.

Impact of the 2002 Regulations

- 3.9** From 1 January 2004, regulations 24 and 25 of the 1994 Regulations were replaced by regulations 30 and 31 in the 2002 Regulations. The principal changes in the new Regulations are:
- precedence is given to European Standards and European Technical Approvals;
 - no provision for unapproved use at Water Service's discretion;
 - no provision for traditional use exemptions from approval; and
 - introduction for the purposes of testing and research must be authorised by the Government Authorities.

Guidance on this is available from the Drinking Water Inspectorate for England and Wales website: <http://www.dwi.gov.uk/regs/pdf/Interim2003.pdf>

European Developments in Construction Products and Treatment Chemicals

- 3.10** The majority of chemicals and filter materials for drinking water treatment are now the subject of European Standards. The 2003 List of Approved Products contains a full listing of standards published by BSI in its BS:EN series in Appendices 1.6. and 1.7. The European standards for testing the effects of organic products and materials on water intended for human consumption are listed in Appendix 1.8.
- 3.11** During 2003, the UK made a notification under Directive 98/34/EC of the new technical requirements concerning the use of hydrogen peroxide containing silver

compounds. The Drinking Water Inspectorate for England and Wales Information Letter 6/2003 contains the relevant details, and is posted on the website: www.dwi.gov.uk/cpp/reg25/current.shtm

3.12 The Drinking Water Inspectorate for England and Wales provides the UK's regulatory representation on the European Commission's Regulatory Group - Construction Products Drinking Water. This Group is developing the European Acceptance Scheme (EAS) for drinking water construction products. The EAS will provide harmonized reporting arrangements for the testing and acceptance of drinking water construction products throughout the European Union. Progress with the EAS and a copy of the interim report are posted on the DG Enterprise website: http://europa.eu.int/comm/enterprise/library/enterprise-europe/issue10/articles/en/enterprise12_en.htm

3.13 The EAS will eventually replace the UK's national approval requirements. In 2003, the Drinking Water Inspectorate for England and Wales organized a number of initiatives preparing for the transition from national to European requirements for testing and certification. These included:

- participation in meetings to disseminate information about the EAS and its implications in the UK (details of current activities are given on the website) www.dwi.gov.uk/cpp/seminar.shtm;
- promotion of the certification and testing infrastructure. In 2003, BuildCert was appointed as a notified body for the purposes of EAS;
- research to assess the impact of European test requirements for the UK water industry and its suppliers (see Section 9 of this report); and

- in preparation for the EAS, the Water Regulatory Advisory Scheme (WRAS) and the Committee have started to use jointly designated test laboratories.

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 Drinking Water Quality Unit and the United Kingdom Accreditation Service (UKAS), for the accreditation of laboratories carrying out drinking water analyses. UKAS accreditation has been achieved in all other water quality laboratories. Accreditation, among other requirements, will demonstrate compliance with regulation 20 of the Water Quality Regulations (Northern Ireland) 1994.

3.17 Water Service has established a *Cryptosporidium* Analytical Unit at Altnagelvin Laboratory which is approved for UK wide analytical work 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 2003, the Inspectorate received 28 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 2003, four drinking water quality incidents and one event were brought to the attention of the Inspectorate (see Section 7 for further details).

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 Group of the Department of the Environment (DoE), and the Department of Agriculture and Rural Development (DARD). 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 9 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 have been held with the Northern Ireland Water Council, which is a statutory advisory council appointed to advise the Department for Regional Development, 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. Copies of the leaflet are available on the Northern Ireland Drinking Water Inspectorate website: http://www.ehsni.gov.uk/environment/drinkWater/private_water.shtml

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- 3.25** During 2003, 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 website: <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 website: <http://www.ehsni.gov.uk/environment/drinkWater/links.shtml>
- 3.28** The Drinking Water Inspectorate has a website which contains information on: Public Water Supplies; Private Water Supplies; Current Issues; Consumer Information; Regulations and Research; Contacts; and Links and can be accessed at: <http://www.ehsni.gov.uk/environment/drinkWater/drinkWater/links.shtml>

The Technical Audit

This part of the report provides an overview of the Inspectorate's technical audit process which 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 2003 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 2003 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 2003, 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 2003, 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 2003, 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 from a service reservoir in the preceding 12 months to be free from coliforms. For 2003, compliance was assessed on the basis of results of samples taken from each service reservoir in the 12 months of the calendar year.

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 coliform standard. All other contraventions of this standard were formally notified to Water Service.

Water Supply Zones

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

4.14 The Drinking Water Directive and regulation 4 of the 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 2003 are listed below.

Table 4: Relaxations in Water Supply Zones

Parameter	Number of Water Supply Zones with Relaxations
Manganese	93
Colour	85
Odour (quantitative)	77
Taste (quantitative)	77
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 2003 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 2003, 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 2003, 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 $\leq 0.1 \mu\text{g/l}$.

- 4.22** Taking into consideration the tighter lead standards in the new Drinking Water Directive, the Inspectorate has, for 2003, considered all exceedences of the $50 \mu\text{g/l}$ standard as non-trivial contraventions.
- 4.23** When assessing triviality for pesticides in 2003, 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.

4.24 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.

4.25 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 total coliform regulatory standard have been regarded as non-trivial where compliance with the 95 percentile standard is not achieved.

The 2003 Inspection Programme

2003 Inspection Programme

4.26 The Inspectorate carries out an annual inspection programme to check if Water Service complies with its regulatory obligations. The audit process also allows the Inspectorate to observe whether current good practice is being followed. For 2003, the inspection programme was based on the following topics:

- detailed audit of Derg Water Treatment Works;
- detailed audit of two service reservoirs (Drumfane and Dundrum);
- audit of Craigavon Water Quality Laboratory;
- evaluation and implementation 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.

4.27 On completion of the inspection programme, conclusions, recommendations and suggestions were reported to Water Service. The reports and their conclusions, recommendations and suggestions 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.

Derg Water Treatment Works

4.28 An inspection of Derg Water Treatment works was carried out on 1 and 2 September 2003. The overall objective was to ensure compliance with regulatory duties and current codes of practice relating to the operation of water treatment works. As a result of the inspection, the Inspectorate made 15 recommendations and four suggestions to consolidate operating practices. All of the recommendations and suggestions have been actioned by Water Service.

Drumfane Service Reservoir

4.29 An inspection of Drumfane Service Reservoir was carried out on 22 July 2003. As a result of the inspection, the Inspectorate made two recommendations and three suggestions to help ensure regulatory compliance. Water Service has taken action on both recommendations, given commitments to progress two of the suggestions and has provided comment to the Inspectorate on the third suggestion.

Dundrum Service Reservoir

4.30 An Inspection of Dundrum Service Reservoir was carried out on 1 August 2003. As a result of the inspection, the Inspectorate made one recommendation and two suggestions to help ensure regulatory compliance. Water Service has taken action on the recommendation and has given commitments to progress the two suggestions contained in the report.

Craigavon Water Quality Laboratory

4.31 Craigavon Water Quality Laboratory was inspected on 16 and 17 September 2003. The objective of the inspection was to ensure regulatory compliance with the regulatory duties and current codes of

practice relating to the sampling arrangements at Craigavon Laboratory. As a result of the inspection, the Inspectorate made 25 recommendations and three suggestions which were conveyed to Water Service for formal response. The Inspectorate has received correspondence from Water Service indicating that work is ongoing to action the recommendations and suggestions.

Strategies to Meet New Regulatory Requirements

4.32 The Inspectorate continued to monitor the progress of Water Service's strategy to meet the new and revised standards in the new Regulations which came into force on 25 December 2003. For the Inspectorate, this particular activity has involved:

- the establishment of new reporting and investigation procedures where regulatory standards have been exceeded;
- the process of applying, granting and monitoring 'authorised departures', in association with infrastructure improvement programmes; and
- monitoring Water Service's implementation of a lead treatment programme.

Cryptosporidium Risk Assessment and Monitoring

4.33 As part of the ongoing inspection programme, the Inspectorate, continues to monitor 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.

For 2003, of the 54 sites assessed, continuous monitoring was required at five sites; the remaining sites were sampled by a process of spring and autumn survey.

4.34 Water Service, through a *Cryptosporidium* Action Group, continued to progress the Implementation of the Recommendations of the *Cryptosporidium* in Water Supplies Reports^{*/**} during 2003.

Dunore Point Water Treatment Works

4.35 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 continues to progress the recommendations, which include changes to infrastructure, operation of works procedures and other related issues.

Follow-Up Action

4.36 The Inspectorate continues to progress agreed follow-up action, including non-trivial parameter contraventions and other water quality related issues.

2004 Inspection Programme

4.37 During 2004, the following Water Service sites were included in the inspection programme:

- audit of Killylane Water Treatment Works;
- audit of Ballymageogh and Kingarow Service Reservoirs; and
- procedures audit at Fofanny Water Treatment Works.

* Reference - Badenoch J (1995) *Cryptosporidium in Water Supplies - Second Report of the Group of Experts*, Department of the Environment, Department of Health, London, UK, TSO. (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, TSO. (ISBN 1 85112 131 5)

Benchmarking

- 4.38** A system of benchmarking was first introduced in 2002, when an inspector from the Northern Ireland Drinking Water Inspectorate accompanied a team of inspectors from the Drinking Water Inspectorate for England and Wales on a visit to two water treatment works in England. This process continues and now includes a member from the Scottish Executive Inspectorate team.
- 4.39** The main objective of the exercise was to compare the approaches of the respective organizations to the technical audit inspection process and to develop a consistent approach to auditing. This will ensure that best practice approach is adopted.

Overview of Drinking Water Quality in Northern Ireland in 2003

This part of the report provides an overview of water quality and details the following:

- Water Quality Monitoring;
- Non-Trivial Contraventions;
- Microbiological Quality;
- Physical/Chemical Quality;
- *Cryptosporidium* Monitoring; and
- Standard Sampling Frequencies.

Water Quality Monitoring

5.1 Water Service provides 676 million litres/day of water to 99% of Northern Ireland's population: approximately 1.71 million people. These water supplies are mostly derived from surface water (91%), with the remainder being groundwater sources. Water from all these sources is treated and distributed through nearly 25,700 km of watermains. Regulatory compliance monitoring in 2003 was carried out at 54 water treatment works, 361 service reservoirs and in 97 water supply zones (Tables 5.1- 5.3 refer). The majority of service reservoir sampling points correspond to single reservoir sites, although some have more than one reservoir on site. Water supply zones are categorized for monitoring purposes depending on the size of the population served.

Table 5.1: Water Treatment Works Volume Categories

Water Treatment Works		Volume Distributed from Works (m ³ /d) Categories
Number	Percentage	
16	29.63	<3,000
20	37.04	3,000 - 12,000
18	33.33	>12,000

Table 5.2: Service Reservoirs Capacity Categories

Service Reservoirs		Capacity of Reservoirs (m ³) Categories
Number	Percentage	
254	70.36	<2000
83	22.99	2,000 - 10,000
24	6.65	>10,000

Table 5.3: Water Supply Zone Population Categories

Water Supply Zones		Population Categories
Number	Percentage	
20	20.62	<5,000
34	35.05	5,000 - 20,000
43	44.33	20,001 - 50,000

Comparison of Water Quality

5.2 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 for water supply zones and water treatment works, on the Laboratory Information Management System;
- 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 of results of uncertain accuracy to earlier data.

5.3 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.

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

Overall Water Quality in 2003

5.5 The level of compliance is shown in two ways:

- (i) an assessment of the total number of all determinations carried out at water treatment works, service reservoirs and water supply zones (consumers' taps); and
- (ii) water supply zone compliance.

5.6 The first assessment measure takes into account all the results for the calendar year; this is the total of all determinations that meet the regulatory standards. During 2003, a total of 98,922 reported determinations were carried out (Table 5.4 refers). Of these determinations, 99.31% complied with the relevant water quality standards.

5.7 Figure 5 shows compliance summary results for the last eight years, and while, overall, the trends indicate an improvement in the percentage of all determinations meeting the regulatory standards, compliance for the physical/chemical parameters, notably: THMs, iron, lead and aluminium, remains considerably poorer than for microbiological compliance.

5.8 It is encouraging to note (as shown in Table 5.4) that overall compliance, which reflects both microbiological and physical/chemical quality, has improved from 98.89% in 1996, to 99.31% in 2003. This improvement is due to improved compliance for certain chemical parameters as new and upgraded water treatment facilities become operational.

Figure 5: Compliance Summary Results

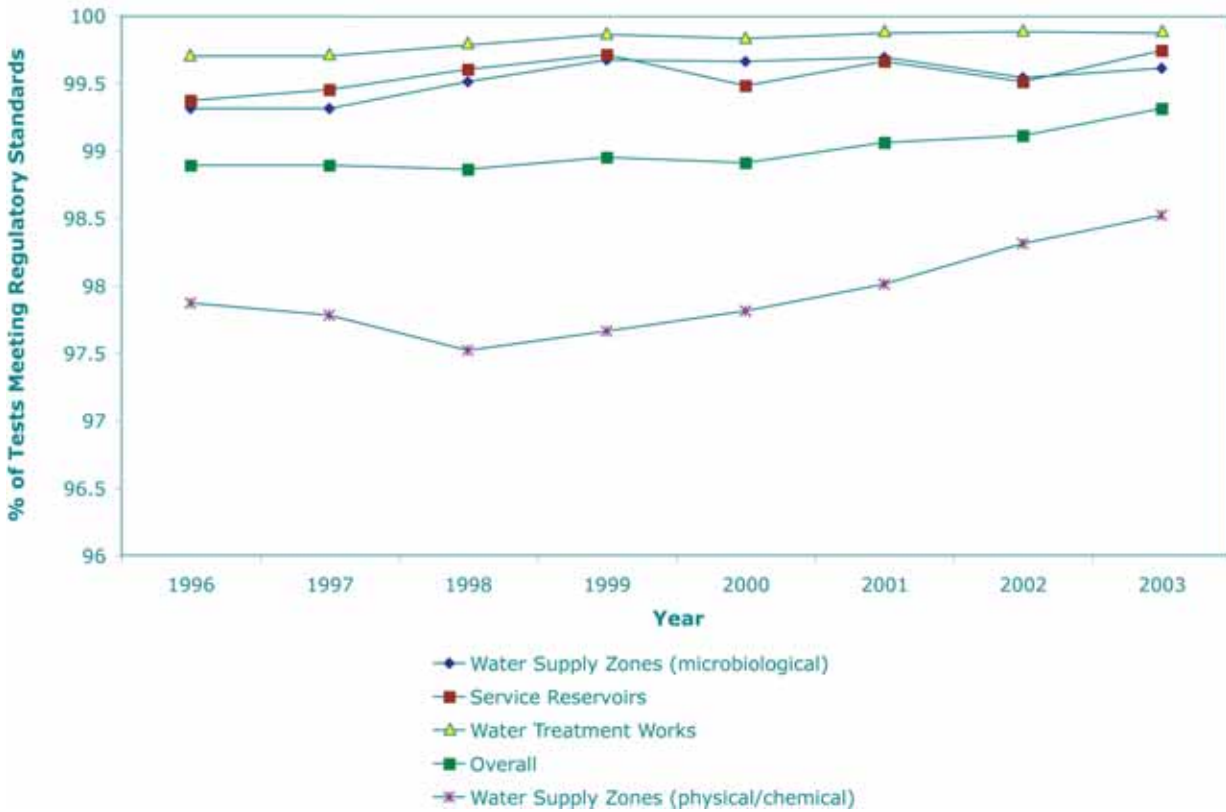
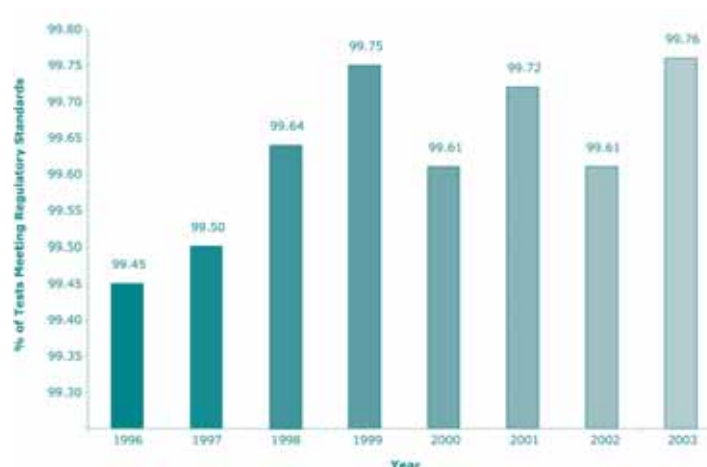


Table 5.4: Summary of Overall Water Quality

	2003	2002	2001	2000	1999
Water Treatment Works					
Total number of determinations	17,106	17,298	18,052	18,522	19,360
- number exceeding PCV	23	21	24	32	28
- % exceeding PCV	0.13	0.12	0.13	0.17	0.14
Service Reservoirs					
Total number of determinations	36,610	36,658	36,414	37,314	38,044
- number exceeding PCV	94	181	123	193	109
- % exceeding PCV	0.26	0.49	0.34	0.52	0.29
Water Supply Zones					
Total number of determinations	45,206	50,688	53,970	54,406	53,826
- number exceeding PCV	567	730	874	979	1,033
- % exceeding PCV	1.25	1.44	1.62	1.80	1.92
All samples					
Total number of determinations	98,922	104,644	108,436	110,242	111,230
- number exceeding PCV	684	932	1,021	1,204	1,170
- % exceeding PCV	0.69	0.89	0.94	1.09	1.05

5.9 In 2003, there is an improvement in overall microbiological compliance to 99.76% compared with the 99.61% reported for 2002. The compliance rate at consumers' taps for the important microbiological parameters has shown an improvement from 99.54% in 2002, to 99.61% in 2003. For service reservoirs, an improvement from 99.51 % in 2002, to 99.74% in 2003 is reported. Compliance rates at water treatment works have been maintained at 99.87% (99.88% in 2002). Within these overall statistics, there were occasions where increased numbers of faecal coliforms were reported during 2003. The Inspectorate welcomes the implementation of the new investigation and reporting procedures which have been introduced, which will assist in the proactive prevention of regulatory non-compliance.

Figure 6: Overall Microbiological Compliance



5.10 The graphs below show compliance with the regulatory standards for the last eight years. Figure 7 shows that overall compliance has improved to 99.31% in 2003 and the graph presented in Figure 8 shows that the number of contraventions has decreased since 1996, particularly so, over the last three years. This improvement is due to increased compliance for certain chemical parameters.

Figure 7: Overall Compliance with Regulatory Standards

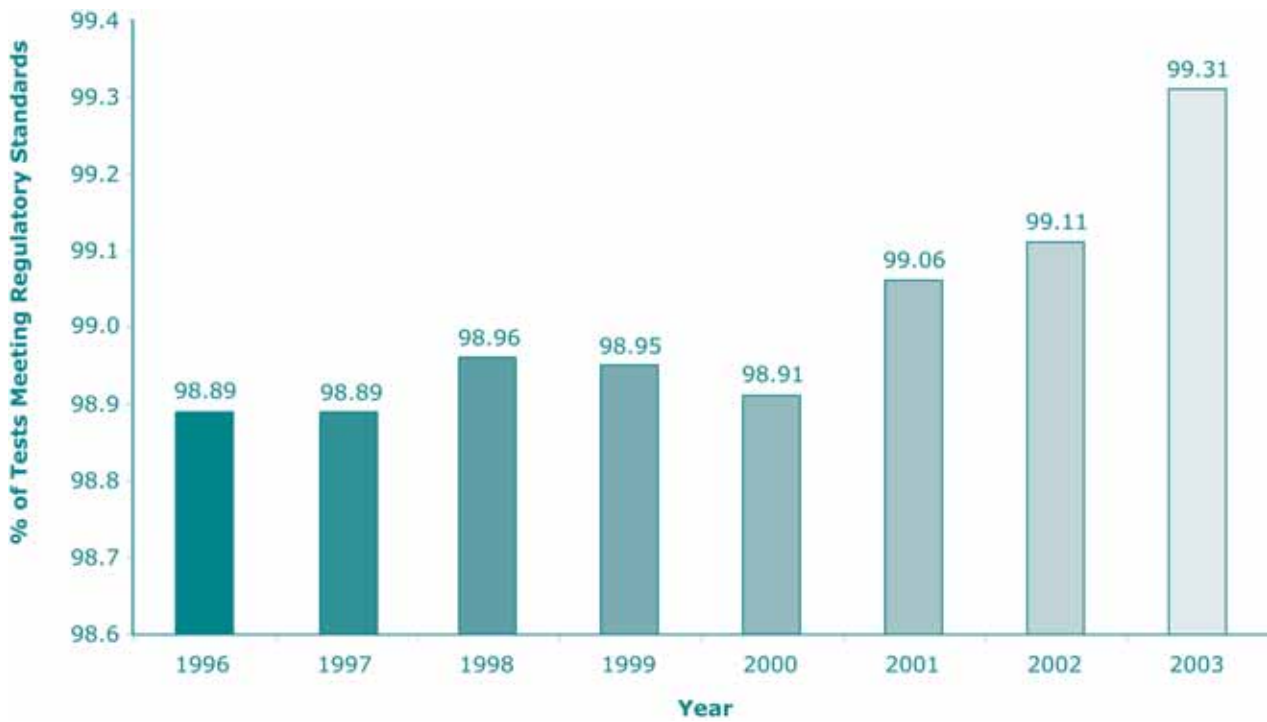
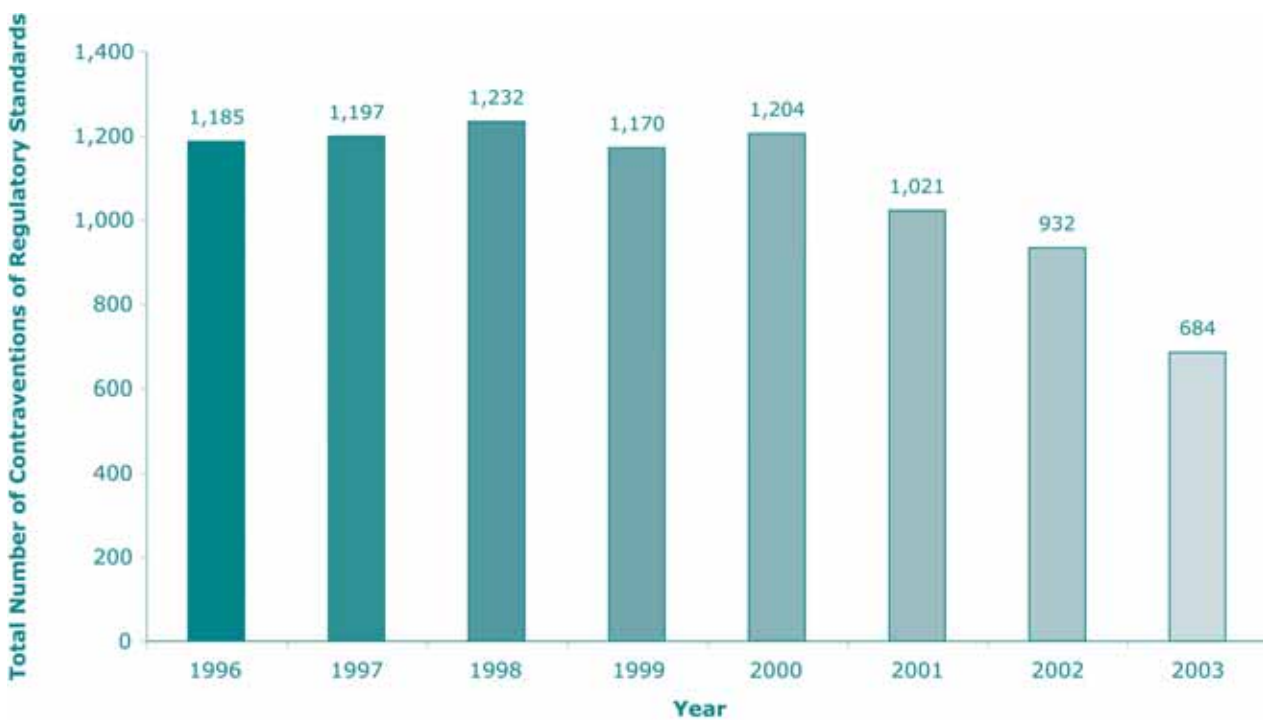


Figure 8: Total Number of Contraventions of Numerical Standards



5.11 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.

5.12 Later on in this section, starting at paragraph 5.21, summary assessments are presented for water supply zones in an overall compliance summary table (Table 5.10), together with individual parameter assessments, which are given in Figures 20 to 25.

Non-Trivial Contraventions

5.13 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 2003 non-trivial microbiological contraventions for water treatment works, service reservoirs and water supply zones, together with previous years' 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.

5.14 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

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	% of WTWs with Non-Trivial Faecal Coliform Contraventions	No. of WTWs with Non-Trivial Total Coliform Contraventions	% of WTWs with Non-Trivial Total Coliform Contraventions
2003	54	3	5.56	5	9.26
2002	58	3	5.17	3	5.17
2001	63	1	1.59	5	7.94
2000	63	4	6.35	7	11.11
1999	70	4	5.71	8	11.43

Table 5.6: Non-Trivial Microbiological Contraventions at Service Reservoirs

	No. of Service Reservoirs (SRs)	No. of SRs with Non-Trivial Faecal Coliform Contraventions	% of SRs with Non-Trivial Faecal Coliform Contraventions	No. of SRs with Non-Trivial Total Coliform Contraventions	% of SRs with Non-Trivial Total Coliform Contraventions
2003	361	19	5.26	0	0.00
2002	360	11	3.06	19	5.28
2001	362	1	0.28	10	2.76
2000	372	18	4.84	18	4.84
1999	373	14	3.75	4	1.07

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

	No. of Water Supply Zones (WSZs)	No. of WSZs with Non-Trivial Faecal Coliform Contraventions	% of WSZs with Non-Trivial Faecal Coliform Contraventions	No. of WSZs with Non-Trivial Total Coliform Contraventions	% of WSZs with Non-Trivial Total Coliform Contraventions
2003	97	4	4.12	0	0.00
2002	101	6	5.94	2	1.98
2001	102	2	1.96	0	0.00
2000	103	3	2.91	1	0.97
1999	104	1	0.96	3	2.88

Microbiological Quality of Water Leaving Water Treatment Works

5.15 Overall microbiological quality at water treatment works has been maintained for 2003, with a compliance rate of 99.87%. The results in the summary table below show, that in relation to the number of determinations at water treatment works in 2003, 99.84% and 99.89% complied with the regulatory standards for coliforms and faecal coliforms, respectively.

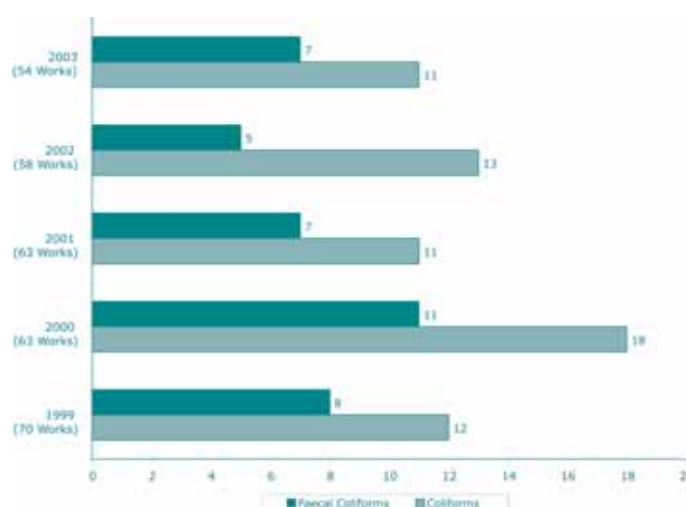
Table 5.8: Microbiological Quality of Water Leaving Water Treatment Works

	2003	2002	2001	2000	1999
Coliforms					
Total number of determinations	8,553	8,649	9,026	9,261	9,680
- number of determinations containing coliforms	14	15	15	21	18
- % containing coliforms	0.16	0.17	0.17	0.23	0.19
Number of treatment works with coliforms detected	11	13	11	18	12
Faecal Coliforms					
Total number of determinations	8,553	8,649	9,026	9,261	9,680
- number of determinations containing faecal coliforms	9	6	9	11	10
- % containing faecal coliforms	0.11	0.07	0.10	0.12	0.10
Number of treatment works with faecal coliforms detected	7	5	7	11	8
Number of Water Treatment Works	54	58	63	63	70

5.16 Figure 9 shows the number of works not complying with the coliform standards. A total of 54 treatment works were sampled: faecal coliforms were found at seven (12.96%) of these works; of which, three were considered non-trivial contraventions. Total coliforms were found in 11 (20.37%) treatment works; five were considered to be non-trivial.

5.17 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.

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



Microbiological Quality of Water in Service Reservoirs

5.18 Overall microbiological quality at service reservoirs has shown an improvement from 99.51% in 2002, to 99.74% in 2003. The results in the table below show that there was a significant improvement in the number of service reservoirs which complied with the total coliform standard.

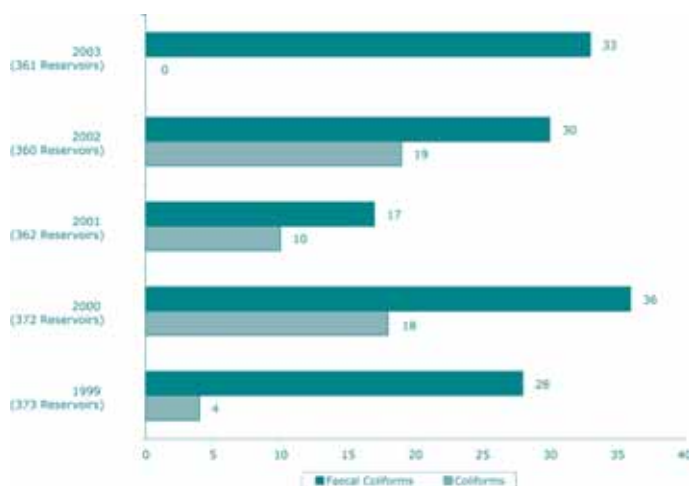
Table 5.9: Microbiological Quality of Water in Service Reservoirs

	2003	2002	2001	2000	1999
Coliforms					
Total number of determinations	18,305	18,329	18,207	18,657	19,022
- number of determinations containing coliforms	59	147	106	147	79
- % containing coliforms	0.32	0.80	0.58	0.79	0.42
Number of service reservoirs with coliforms detected in more than 5% of samples	0	19	10	18	4
Faecal Coliforms					
Total number of determinations	18,305	18,329	18,207	18,657	19,022
- number of determinations containing faecal coliforms	35	34	17	46	30
- % containing faecal coliforms	0.19	0.19	0.09	0.25	0.16
Number of service reservoirs with faecal coliforms detected	33	30	17	36	28
Number of Service Reservoirs	361	360	362	372	373

5.19 Figure 10 shows the number of service reservoirs not complying with the coliform standards. A total of 361 service reservoirs were sampled: faecal coliforms were found at 33 (9.14%) of these; 19 of which were considered non-trivial contraventions. Total coliforms were found in 53 (14.68%) service reservoirs; all complied with the 95 %ile regulatory standard and were considered to be trivial.

5.20 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

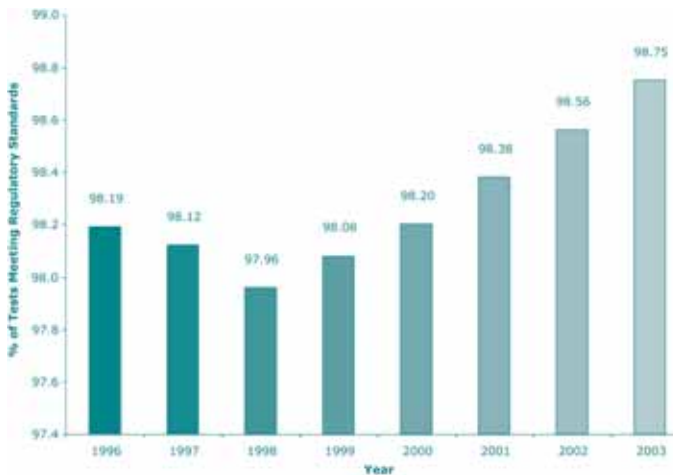
5.21 The Table below shows Water Service's performance in 2003, with data for 2002 and 2001 for comparison. The table provides a summary of water quality for the key parameters which are significant in the supply of public drinking water in Northern Ireland. All other parameters which are included in 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 2003			Determinations in 2002		Zones in 2003	Zones in 2002	Zones in 2001
	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	4,656	26	0.56	5,089	0.77	0.00	1.98	0.00
Faecal coliforms	4,656	10	0.21	5,089	0.16	10.31	7.92	3.92
Colour	764	0	0.00	851	0.00	0.00	0.00	0.00
Turbidity	973	2	0.21	1,051	0.29	2.06	2.97	2.94
Odour (quantitative)	642	0	0.00	2,798	0.00	0.00	0.00	0.00
Taste (quantitative)	643	0	0.00	2,783	0.00	0.00	0.00	0.00
Hydrogen ion	2,601	1	0.04	2,934	0.20	1.03	2.97	7.84
Nitrate	662	0	0.00	729	0.14	0.00	0.99	0.00
Aluminium	1,325	20	1.51	1,472	2.38	13.40	11.88	10.78
Iron	1,847	60	3.25	2,129	2.58	34.02	30.69	37.25
Manganese	811	2	0.25	922	0.11	2.06	0.99	0.98
Lead	653	42	6.43	647	5.41	20.62	18.81	13.73
PAHs (total)	514	10	1.95	513	0.58	7.22	1.98	7.84
Trihalomethanes	1,038	368	35.45	1,016	49.90	52.58	72.28	68.63
Total pesticides	383	2	0.52	366	0.00	2.06	0.00	0.00
Glyphosate	391	0	0.00	366	0.00	0.00	0.00	1.96
MCPA	418	7	1.67	411	0.97	6.19	2.97	4.90
Mecoprop	392	0	0.00	389	0.00	0.00	0.00	1.96
Other pesticides	15,334	0	0.00	14,631	0.02	0.00	2.97	1.96
Other parameters	6,503	17	0.26	6,502	0.46	8.25	13.86	6.86
Total	45,206	567	1.25	50,688	1.44	No. of Water Supply Zones		
						97	101	102

5.22 During 2003, the level of compliance was reported for 97 water supply zones which were routinely monitored for 88 individual parameters, 75 of which, met the regulatory requirements. The graph below shows the overall compliance with water quality standards in water supply zones for the last eight years.

Figure 11: Overall Compliance with Standards in Water Supply Zones



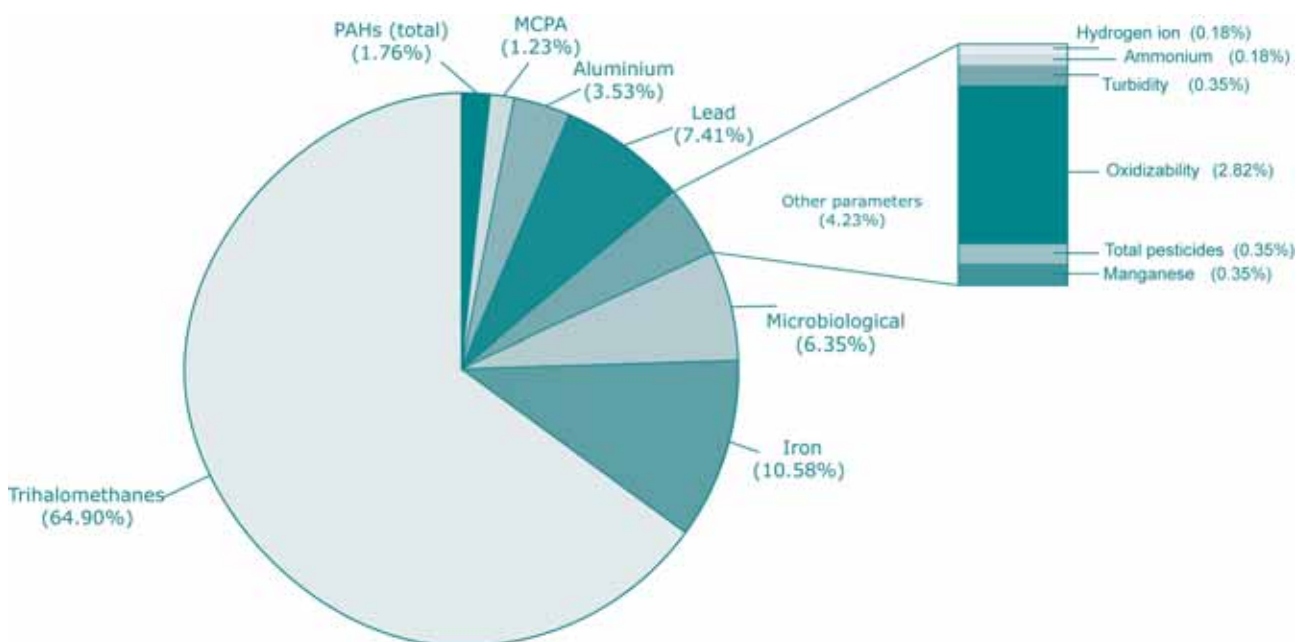
5.23 The 'compliance figures' in Figure 11 have been derived by taking the total number of tests in zones and the number of occasions on which one or more samples have not met the relevant numerical standard.

5.24 Since 1996, there has been a reduction in the number of test results from zones which failed to comply with the relevant standards. In 2003, of the 45,206 tests carried out, 567 (1.25%) failed to comply compared to 1.81% of tests failing to comply in 1996.

5.25 Figure 12 below shows those parameters, both microbiological and physical/chemical, for which compliance with the regulatory standards was not achieved in 2003. Each parameter is shown as a percentage of the 567 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 59 of this report.

Figure 12: Contraventions of Standards in Water Supply Zones



5.26 Looking at the percentage zonal non-compliance of water quality, trends over the previous 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

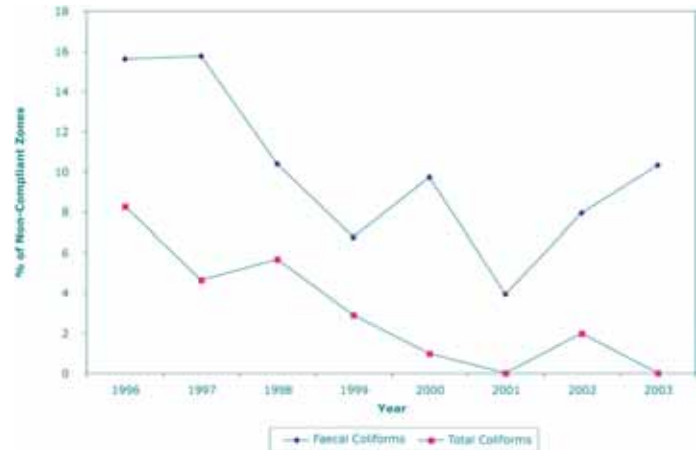


Figure 14: 'Metals' Parameters

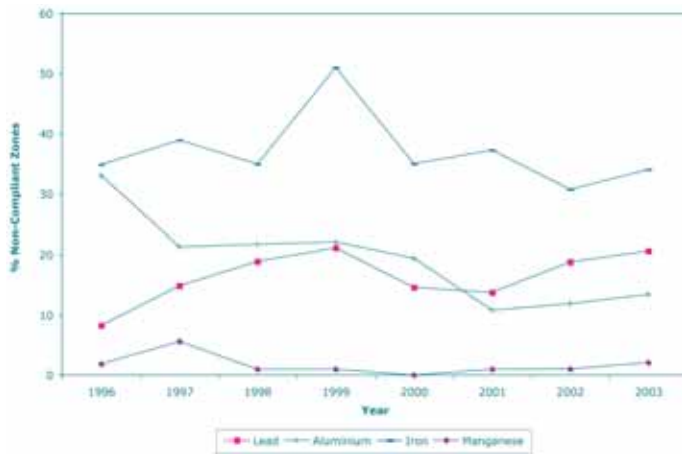


Figure 15: 'Organic' Parameters

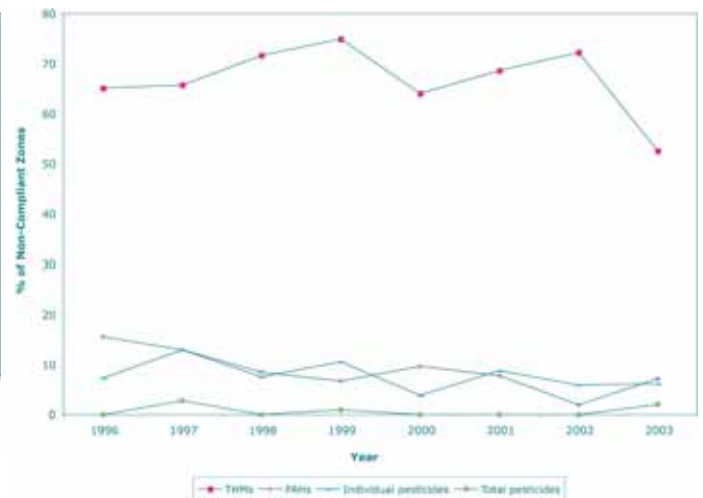


Figure 16: 'Aesthetic' Parameters

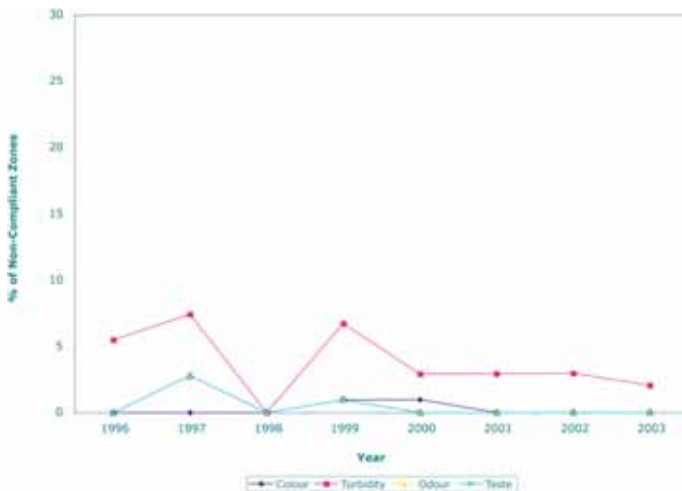
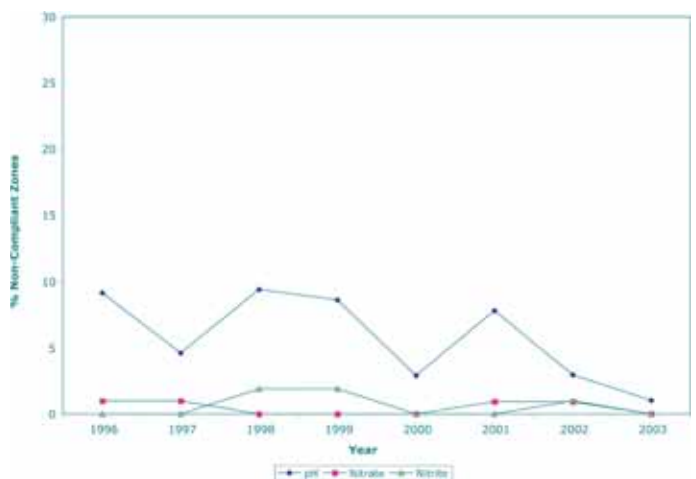


Figure 17: 'Ionic' Parameters



5.27 A zone may be non-compliant because a single result has not met the standard. The Inspectorate assesses each contravention; some are regarded as trivial because they 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 2003, 2002 and 2001 were assessed as having non-trivial contraventions.

Table 5.11: Non-Trivial Contraventions in Water Supply Zones

Parameter	2003		2002		2001	
	Non-Trivial Contraventions		Non-Trivial Contraventions		Non-Trivial Contraventions	
	No.	%	No.	%	No.	%
Trihalomethanes	51	52.58	73	72.28	70	68.63
Lead	20	20.62	19	18.81	14	13.73
Iron	14	14.43	11	10.89	15	14.71
Aluminium	5	5.15	6	5.94	5	4.90
Faecal coliforms	4	4.12	6	5.94	2	1.96
MCPA	2	2.06	1	0.99	4	3.92
Ammonium	1	1.03	2	1.98	1	0.98
Hydrogen ion	1	1.03	1	0.99	5	4.90
Total coliforms	0	0.00	2	1.98	0	0.00
Turbidity	0	0.00	2	1.98	1	0.98
Nitrate	0	0.00	1	0.99	0	0.00
Mecoprop	0	0.00	0	0.00	2	1.96
Manganese	0	0.00	0	0.00	1	0.98
Number of Water Supply Zones	97		101		102	

5.28 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

5.29 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 are followed up and remedial action initiated, where necessary, by Water Service.

5.30 Of the 4,656 samples taken from consumers' taps in 97 water supply zones in 2003, 99.61% complied with the microbiological standards. While this overall compliance rate shows an improvement from the 99.54% reported for 2002, there is an increased number of tests failing to meet the faecal coliform standard: 99.79% in 2003 compared to 99.84% in 2002, as shown in Figure 18 below.

5.31 Figure 19 shows that of the ten water supply zones that did not comply with the regulatory standards for faecal coliforms, contraventions in four of these zones were regarded as non-trivial. Total coliforms were detected in at least one sample collected during the year in 20 water supply zones. The regulations are only contravened in a water supply zone if more than 5% of samples contain coliforms. On this basis, all zones met the regulatory standard.

Figure 19: Number of Water Supply Zones Not Complying with Microbiological Standards

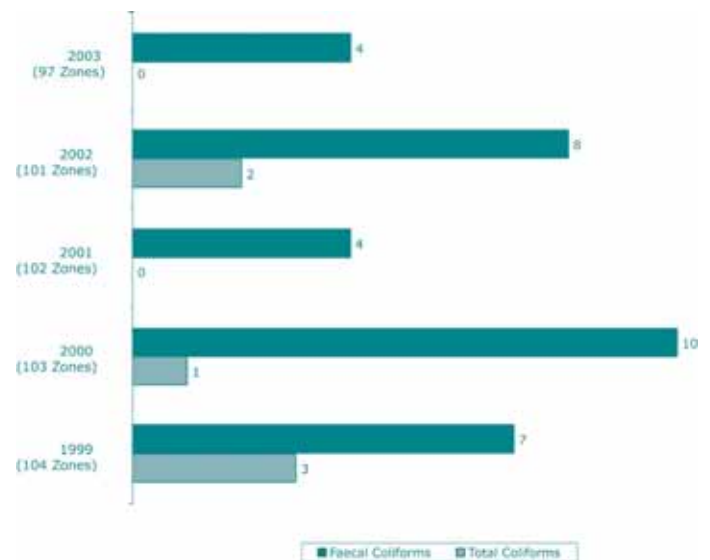


Figure 18: Microbiological Determinations Meeting Regulatory Standards* in Water Supply Zones



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

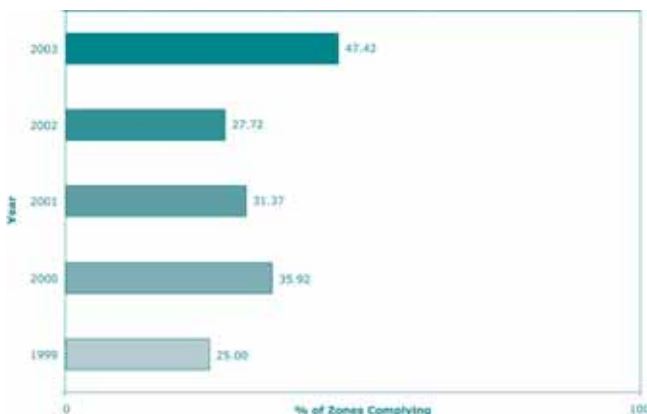
Physical/Chemical Quality in Water Supply Zones

Trihalomethanes (THMs)

5.32 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. THMs 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.

5.33 The current Regulations set a THMs standard of 100 µg/l as an average over a three-month period for the sum of four specified substances. The number of determinations exceeding the numerical standard for THMs, while remaining high, shows an improvement from 49.90% in 2002, to 35.45% in 2003. Of the samples taken from 97 water supply zones in 2003, 51 (52.58%) zones were non-compliant with the regulatory standard compared to 73 (72.28%) zones in 2002. This improvement during 2003 is mainly attributed to a combination of improved operational practices, and the introduction of ozone treatment at Dunore Water Treatment Works.

Figure 20: Water Supply Zones Complying with THMs Standard



5.34 THMs, as in previous years remain the parameter with the lowest reported compliance rate. While Water Service continues to implement measures to mitigate non-compliance, 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. In the interim, Water Service expects to improve compliance through a combination of improved operational practices and, where practicable, the introduction of monochloramine and ozone as alternative disinfectants.

Lead

5.36 Of the 653 samples collected in 2003, there was an increased number of samples failing to meet the 50 µg/l standard for lead; 42 (6.43%) compared to 35 (5.41%) in 2002. These contraventions occurred in 20 (20.62%) zones all of which 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 water mains 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). Towards the end of 2003, Water Service commenced orthophosphate treatment of water supplies, which aims to reduce lead levels in drinking water supplies across Northern Ireland.

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 water mains rehabilitation. Water Service will also replace, free of charge, any of its pipes which may be made of lead in the supply to a property, but only when a written request is received from a consumer who has replaced the portion of lead service pipe for which the householder is responsible.

Aluminium

5.39 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.

5.40 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's 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.

5.41 For aluminium, the number of tests failing to meet the regulatory standards has improved from 2.38% in 2002, to 1.51% in 2003, although the percentage number of zones that fail to meet the standards has risen from 11.88% in 2002, to 13.40% in 2003. Of the 13 zones not complying with the aluminium standard in 2003, five were assessed as having non-trivial contraventions. While there has been an overall improvement for aluminium compliance reported over previous years as investment and enhancements of water treatment processes have been implemented, it is important that Water Service optimizes operational control of existing treatment works until all the new and upgraded water treatment works projects are completed.

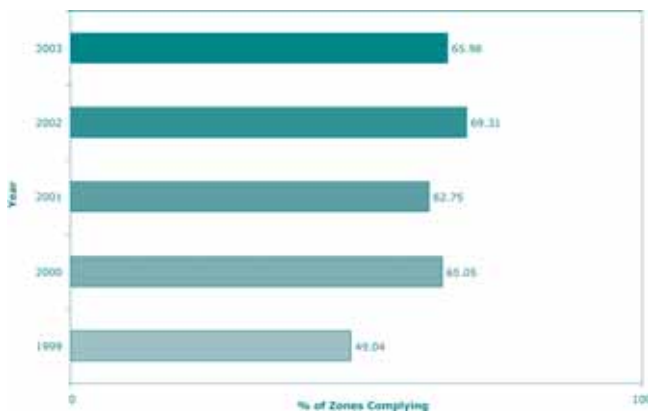
Figure 22: Water Supply Zones Complying with Aluminium Standards



Iron

5.42 There has been an increase in the number of water supply zones not complying with the iron standard during 2003. A total of 33 (34.02%) zones failed to comply with the iron standard when compared with 31 (30.69%) zones in 2002. Of the 33 zones not complying with the iron standard, 14 were assessed as having non-trivial contraventions.

Figure 23: Water Supply Zones Complying with Iron Standard



5.43 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 water mains. 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 with the distribution system.

Polycyclic Aromatic Hydrocarbons (PAHs)

5.44 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 localized 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 2003, an increase in the number of contraventions of the regulatory standard for PAHs was recorded: 1.95% of samples and 7.22% of zones failed to comply compared to 0.58% of samples and 1.98% of zones in 2002. Of the seven zone contraventions in 2003, one zone was assessed as non-trivial.

Figure 24: Water Supply Zones Complying with PAHs Standard



5.45 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 compliance for PAHs.

Pesticides

5.46 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 2003, of the 43 individual pesticides monitored, only MCPA was detected above the regulatory standard (0.1 µg/l). In addition to the individual pesticide contraventions, the total pesticide standard (0.5 µg/l) was not met on two occasions, both of which were considered

to be non-trivial. In every instance, the contraventions corresponded to exposures far smaller than those known to be harmful or likely to affect health.

5.47 Of the 16,535 determinations carried out for individual pesticides in 2003, there were seven (0.04%) occasions when the regulatory standard for MCPA was not met. These contraventions occurred in six water supply zones, two of which, were considered non-trivial. The non-trivial contraventions were attributed to forestry work in the area and Water Service is liaising with the Forestry Commission to prevent recurrence of these failures.

5.48 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 previous 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	2003	2002	2001	2000	1999
MCPA	7	4	10	8	9
Asulam		3			2
Mecoprop			2	1	1
Glyphosate			2		3
Atrazine					1
Simazine			1		
Pentachlorophenol			1		
Total Number of Exceedences	7	7	16	9	16

Hydrogen ion (pH)

5.49 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. Of the 2,601 samples taken for pH during 2003, the maximum regulatory standard was not met on one (0.04%) occasion in one (1.03%) water supply zone due to operational reasons at the supplying water treatment works. This contravention was assessed as being non-trivial.

Figure 25: Water Supply Zones Complying with pH Standards



Manganese

5.50 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.

5.51 Of the 811 samples taken in 2003, the manganese standard was not met on two occasions in two water supply zones; both were considered trivial.

Turbidity

- 5.52** 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.
- 5.53** Contraventions of the regulatory standard for turbidity were recorded in two (2.06%) water supply zones, and both were considered trivial.

Other Parameters

- 5.54** The penultimate item, 'other parameters' in Table 5.10 shows that in 2003, of the 6,503 samples taken, 17 (0.26%) failed to comply with the regulatory standards for the following two parameters: oxidizability and ammonium.
- 5.55** The oxidizability parameter provides an indication of changes in water quality, and estimates organic content. Of the 222 samples taken for oxidizability, 16 did not comply with the regulatory standard. Seven water supply zones failed to comply, all of which, were assessed to be trivial contraventions.
- 5.56** A non-trivial contravention of the regulatory standard for ammonium occurred on one occasion in 2003 due to operational reasons at the water treatment works.

Cryptosporidium Monitoring

- 5.57** *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.

- 5.58** 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.

- 5.59** 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 website: <http://www.ehsni.gov.uk/environment/drinkWater/links.shtml>

- 5.60** 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.

- 5.61** An annual risk assessment was carried out during 2003, and of the 54 water treatment works assessed, five sites were included in a continuous monitoring programme for the detection of *Cryptosporidium* oocysts.

- 5.62** 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.

- 5.63** Table 5.13 shows summary results for the detection of *Cryptosporidium* since continuous monitoring programmes were implemented in 2000. Of the 1,502 samples collected in the monitoring programme for 2003, 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).

5.64 The results show that for the sites selected for continuous monitoring in 2003, drinking water was not a major source of exposure to *Cryptosporidium* oocysts for Northern Ireland's population. However, *Cryptosporidium* remains a water quality issue of concern and it is imperative that enhanced protection measures continue to be implemented by Water Service.

5.65 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

	2003	2002	2001	2000
Number of sites sampled	5	5	5	3
Number of samples collected	1,502	1,528	1,317	407
Number of samples with oocysts detected	79	94	193	82
% of samples with oocysts detected	5.3	6.2	14.7	20.2
Number of sites with oocysts detected in one or more samples	5	5	4	3
% of sites with oocysts detected in one or more samples	100	100	80	100
% of detections that were <0.1 oocysts/10 litres	100	100	97.04	99.02
Number of samples >1 oocysts/10 litres	0	0	0	0
Number of sites with >1 oocysts/10 litres	0	0	0	0
Highest concentration of oocysts/10 litres detected	0.09	0.09	0.62	0.40
Number of Water Treatment Works	54	58	63	63

Standard Sampling Frequencies

5.66 The Water Quality Regulations (Northern Ireland) 1994 set out sampling requirements which demonstrate the wholesomeness of drinking water supplies. For 2003, the Inspectorate carried out an assessment of the regulatory standard sampling frequencies for water supply zones, water treatment works and service reservoirs.

5.67 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.

5.68 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.

5.69 For 2003, there is a significant improvement in compliance with the overall sampling requirements with a sampling shortfall reported of 0.7% compared to 3.3% in 2002. While this improvement is welcomed, the Inspectorate expects Water Service to have a target of full compliance with the regulatory standard sampling frequencies.

New Regulations and Associated Programmes of Work

New Drinking Water Quality Standards

- 6.1** The 1998 EC Directive on the quality of water intended for human consumption (98/83/EC) introduces new regulatory requirements for monitoring, and sets out new or revised standards for a number of parameters. Most of the new and tighter standards had to be met by the end of 2003. For bromate, lead and trihalomethanes, interim standards had to be met by the end of 2003, and final standards to be met by the end of 2008, 2013 and 2008, respectively.
- 6.2** The standards in the EC Directive largely reflect the current World Health Organization Guidelines for drinking water quality.
- 6.3** 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.

Programmes of Work

- 6.4** Water Service has agreed to programmes of work to ensure that water supplies will meet the new regulatory standards. It is essential that these work programmes, which are essential to achieve regulatory compliance, should be implemented in the fastest possible timescales. The Inspectorate is currently monitoring progress with the implementation of the work programmes to address, in particular, non-compliance with the THMs, aluminium, lead and iron standards.

Authorised Departures

- 6.5** Under the new Regulations, Water Service may apply to the Department of the Environment for authorisation to supply water that is not wholesome, if it has reason to believe that the water is failing, or is likely to fail, a prescribed standard. A condition of each authorisation is that Water Service

must take steps to improve the supply by specific dates. Such remedial work should be completed within a three-year period, although a further authorisation may be granted. Any authorisation, however, can only be granted if the health authorities are satisfied that it does not constitute a potential danger to human health.

- 6.6** Regulation 37 of the 2002 Regulations permitted Water Service to apply for authorisations where it had reason to believe that water would not satisfy the requirements of the new Regulations. Fifty-five completed applications relating to THMs and/or aluminium were received by the due date; 54 water supply zones were granted authorisations. Details of the authorisations have been published locally by Water Service.

Monitoring for the New Drinking Water Quality Standards

- 6.7** The new Regulations require Water Service to monitor against standards for five new parameters (Table 6.1 refers). In advance of the new Regulations, the Inspectorate requested Water Service to take samples during 2003 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.

Results of Monitoring in 2003

- 6.8** Monitoring commenced in 2003 for: benzene; bromate; 1,2 dichloroethane; nitrite ex-water treatment works; enterococci; and *Clostridium perfringens*. In 2003, as Table 6.1 shows, the overall number of samples failing to meet the new standards is small. Very few contraventions are anticipated in 2004.

Table 6.1: New Mandatory Parameters

Parameter	Total Number of Determinations in 2003	New Standards to Apply on 25-12-2003	Number of Determinations Not Meeting Standard
Benzene	384	1.0 µg/l	1
Bromate	384	10.0 µg/l	0
1,2 Dichloroethane	384	3.0 µg/l	0
Nitrite (ex WTWs with chloramination)	110	0.1 mg/l	0
Enterococci	372	0/100ml	1
<i>Clostridium perfringens</i>	352	0/100ml	7

6.9 Water Service is also required to monitor against tighter standards for nine parameters and a more relaxed standard for one parameter which were included in the Water Quality Regulations (Northern Ireland) 1994.

6.10 Table 6.2 below presents an assessment of the samples collected under the current Regulations against the new standards.

Table 6.2: Revised Parameter Values

Parameter	Total Number of Determinations in 2003	Current Standard	Number of Determinations Not Meeting Current Standard	Revised Standard	Number of Determinations Not Meeting Revised Standard
Antimony	96	10.0 µg/l	0	5.0 µg/l	0
Arsenic	96	50.0 µg/l	0	10.0 µg/l	0
Boron	95	2.0 mg/l	0	1.0 mg/l	0
Copper	370	3.0 mg/l	0	2.0 mg/l	1
Lead	653	50.0 µg/l	42	25.0 µg/l ¹ 10.0 µg/l ²	92 164
Nickel	96	50.0 µg/l	0	20.0 µg/l	0
Nitrite (at consumers' taps)	663	0.1 mg/l	0	0.5 mg/l	0
PAHs	514	0.2 µg/l	10	0.1 µg/l	1
Tetrachloroethene	383	10.0 µg/l	0	10.0 µg/l	0
Trichloroethene	383	30.0 µg/l	0		

¹ From 25 December 2003

² From 25 December 2013

6.11 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. Of the 514 samples collected in 2003, only one sample would be non-compliant with the new PAHs standard.

6.12 In the new Regulations, the following formula has also been introduced for nitrate and nitrite:

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

6.13 From the monitoring that has been carried out in 2003, all samples taken at consumers' taps, and at the two water treatment works (Derg and Clay Lake) which have chloramination as a treatment process, would comply with the new standards.

6.14 Compliance with the interim lead standard of 25 µg/l will be a significant issue for Water Service. In 2003, 6.43% of samples failed the current standard of 50 µg/l; 14.09% would fail the interim standard of 25 µg/l, and 25.11% would not comply with the final standard of 10 µg/l. This indicates the need for effective plumbosolvency measures to be implemented.

6.15 The New Drinking Water Directive (the 'Directive') has set an interim standard of 150 µg/l for THMs, to be met by 25 December 2003, with a final standard of 100 µg/l to be met by 2008. In keeping with the rest of the United Kingdom, the new Regulations to implement the new Directive requirements, have set a numerical standard of 100 µg/l to be met by 25 December 2003.

6.16 For 2003, the following THMs assessments can be reported:

- 64.55% of tests, and 47.42% of zones comply with the current regulatory standard of a three-monthly rolling average value not exceeding 100 µg/l;
- 72.45% of tests, and 63.92% of zones would comply with the Directive standard of 150 µg/l; and
- 64.55% of tests, and 38.14% of zones would comply with the new regulatory standard of 100 µg/l.

6.17 Through a process of "Authorisation Departure" (paragraph 6.5 refers), Water Service is committed to delivering substantial improvement works to mitigate the THM contraventions.

Drinking Water Quality Incidents and Complaints

7.1 Where a water quality incident or event has occurred, Water Service is required to provide the Inspectorate with information, in accordance with agreed procedures.

7.2 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 2003, Water Service notified the Inspectorate of four water quality incidents and one event. A summary of these water quality related incidents/events is provided in the table below.

Table 7.1: Water Quality Incidents/Events

Date	Location	Nature of Incident/Event	Classification
July 2003	Ballydunmaul Road, Randalstown	Burst pipe - 'Boil Notice' issued.	Incident
July 2003	Eagry and Craigpark Service Reservoirs	Bacteriological exceedences - 'Boil Notice' issued.	Incident
September 2003	Craigs Road, Ballymena	Contaminated tap - 'Boil Notice' issued.	Event
September 2003	Caulfield Villas, Moneymore	Burst Main - 'Boil Notice' issued.	Incident
October 2003	Conagher Road, Dervock	Pipe replacement - 'Boil Notice' issued.	Incident

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

Drinking Water Complaints

7.4 In 2003, the Inspectorate received 28 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 and sediment (6 complaints);
- discoloration (8 complaints);
- presence of aquatic fauna (4 complaints);
- taste and odour (2 complaints);
- potential contamination (2 complaints);
- taste (2 complaints);
- discoloration, taste and odour (3 complaints); and
- sediment (1 complaint).

Private Water Supplies

Private Water Supplies Monitoring Programme

8.1 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.

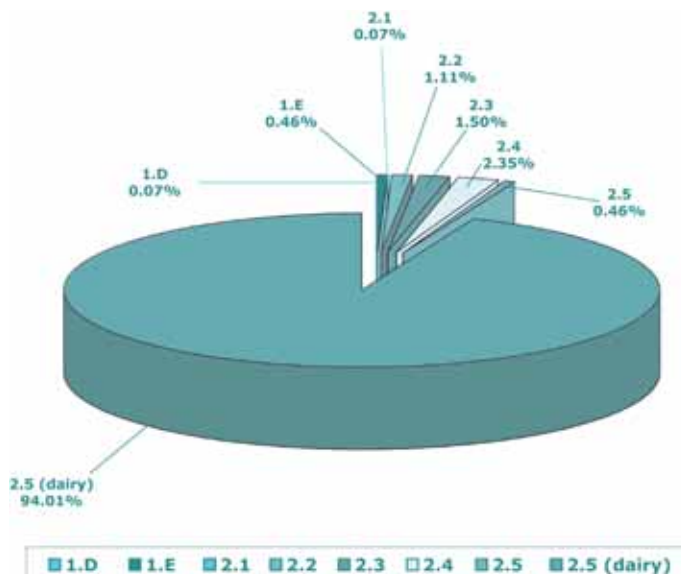
8.2 The Inspectorate is responsible for monitoring private water supplies that are identified under the Private Water Supplies Regulations (Northern Ireland) 1994.

8.3 The Regulations set monitoring requirements based on the size and nature of the private supply, taking into account the volume of water used 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.

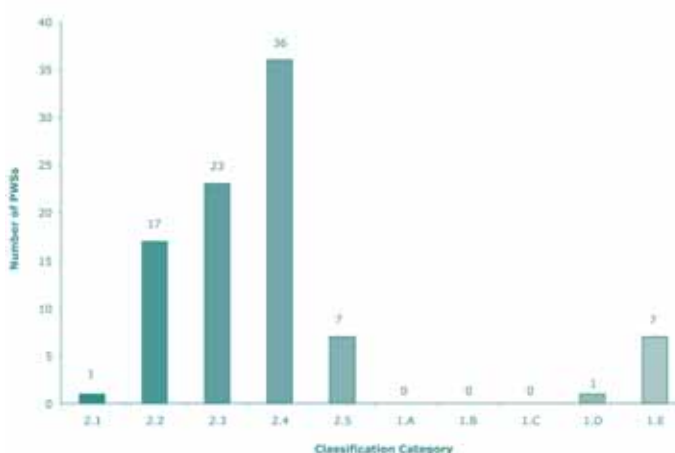
8.4 For 2003, the number of private water supplies (PWSs) identified under the regulations was 1,535; these have been categorized into seven classifications as shown in Figure 26.

Figure 26: Private Water Supplies - 2003 Classification Categories Including Dairy Farms



8.5 In Northern Ireland, the majority of private water supplies fall within category 2, class 5 relating primarily to dairy farms, which accounts for approximately 94% of all private water supplies tested. The figure below shows the number of supplies in each of the other categories for the remaining 6% of private water supplies.

Figure 27: Private Water Supplies - 2003 Classification Categories Excluding Dairy Farms



- 8.6** 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 13.61% of all determinations carried out in 2003. All other classified private water supplies are sampled and analysed for microbiological and physical/chemical parameters.
- 8.7** 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.
- 8.8** 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.
- 8.9** 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 2003

- 8.10** 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.
- 8.11** 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 of results of uncertain accuracy to earlier data reporting.
- 8.12** Table 8.1 provides an overview of the quality of water in private water supplies. The results show that out of a total of 12,431 tests carried out in 2003, 96.17% met the regulatory standards. The regulatory requirements were not met on 476 occasions. This shows an increase in the rate of compliance for 2003, compared to 92.94% for 2002.

Table 8.1: Overall Water Quality in Private Water Supplies

Parameters	Determinations in 2003			Determinations in 2002			Determinations in 2001		
	Total No.	Exceeding PCV		Total No.	Exceeding PCV		Total No.	Exceeding PCV	
		No.	%		No.	%		No.	%
Total coliforms	1,301	192	14.76	1,214	360	29.65	621 ¹	99	15.94
Faecal coliforms	1,302	141	10.83	1,214	280	23.06	621 ¹	49	7.89
Iron	179	26	14.53	145	28	19.31	135	26	19.26
Manganese	112	50	44.64	145	25	17.24	134	22	16.42
Trihalomethanes	172	16	9.30	144	16	11.11	135	16	11.85
Oxidizability	121	3	2.48	92	5	5.43	82	2	2.44
Taste (quantitative)	141	1	0.71	118	6	5.08	107	2	1.87
Sodium	121	6	4.96	93	4	4.30	82	5	6.10
Odour (quantitative)	175	2	1.14	138	5	3.62	128	5	3.91
Aluminium	179	4	2.23	145	5	3.45	135	5	3.70
Turbidity	202	7	3.47	177	5	2.82	154	6	3.90
Ammonium	179	2	1.12	146	4	2.74	135	5	3.70
Conductivity	247	1	0.40	216	5	2.31	198	2	1.01
Sulphate	121	2	1.65	93	2	2.15	82	1	1.22
Colour	179	1	0.56	156	3	1.92	135	4	2.96
Nitrate	202	3	1.49	176	2	1.14	153	1	0.65
Calcium	121	1	0.83	93	1	1.08	82	1	1.22
Magnesium	121	1	0.83	93	1	1.08	82	1	1.22
Nitrite	181	2	1.10	146	1	0.68	135	2	1.48
Temperature	311	5	1.61	330	1	0.30	311	2	0.64
Hydrogen ion	247	0	0.00	216	0	0.00	198	1	0.51
Total pesticides	74	0	0.00	69	0	0.00	73	3	4.11
Individual pesticides	3,108	5	0.16	2,898	3	0.10	3,139	5	0.16
Other parameters	3,335	5	0.15	2,602	5	0.19	2,389	0	0.00
Total	12,431	476	3.83	10,859	767	7.06	9,446	265	2.81

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.

8.13 Out of the 1,535 private water supplies sampled, 1,443 were dairy farms where compliance was based on microbiological parameters only. Figure 28 shows that in 2003, 80.26% of samples collected at dairy farms met the regulatory standard for total coliforms, and 85.22% compliance was reported for faecal coliforms.

8.14 Figure 29 shows the percentage compliance for private water supplies other than dairy farms. For 2003, the microbiological quality was reported as 94.51% compliance for total coliforms and 96.49% compliance for faecal coliforms.

Figure 28: Summary of Microbiological Quality in Dairy Farms

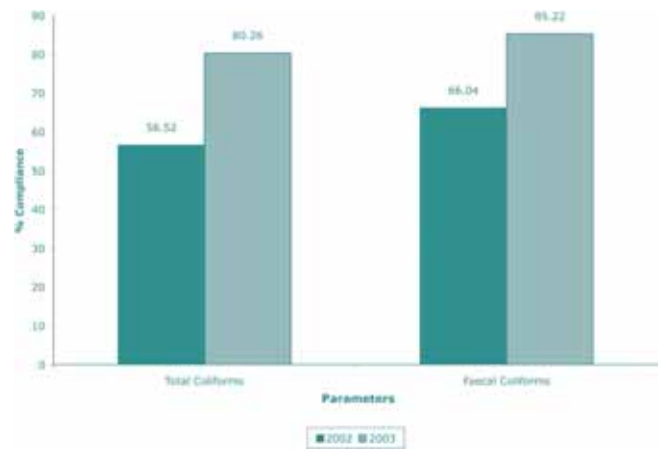
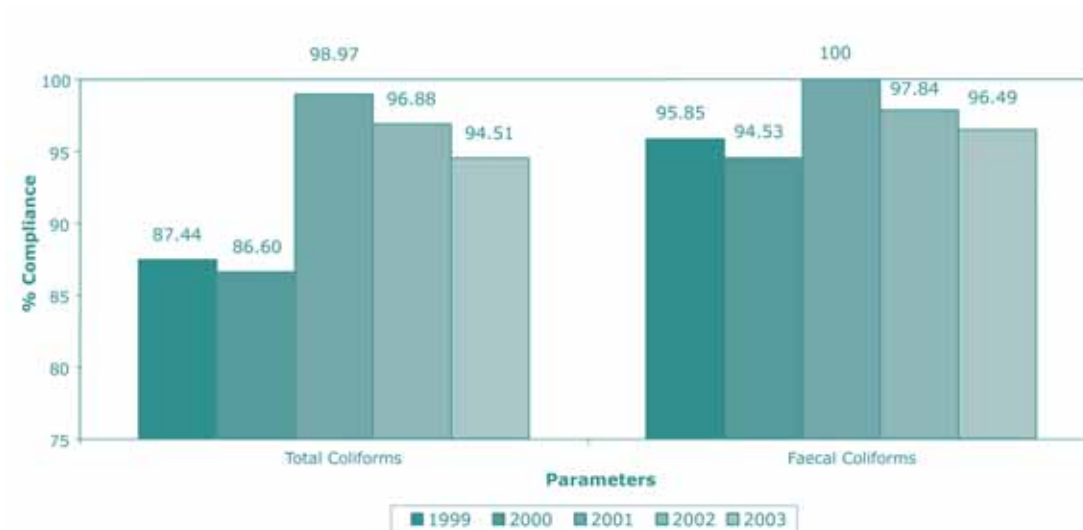
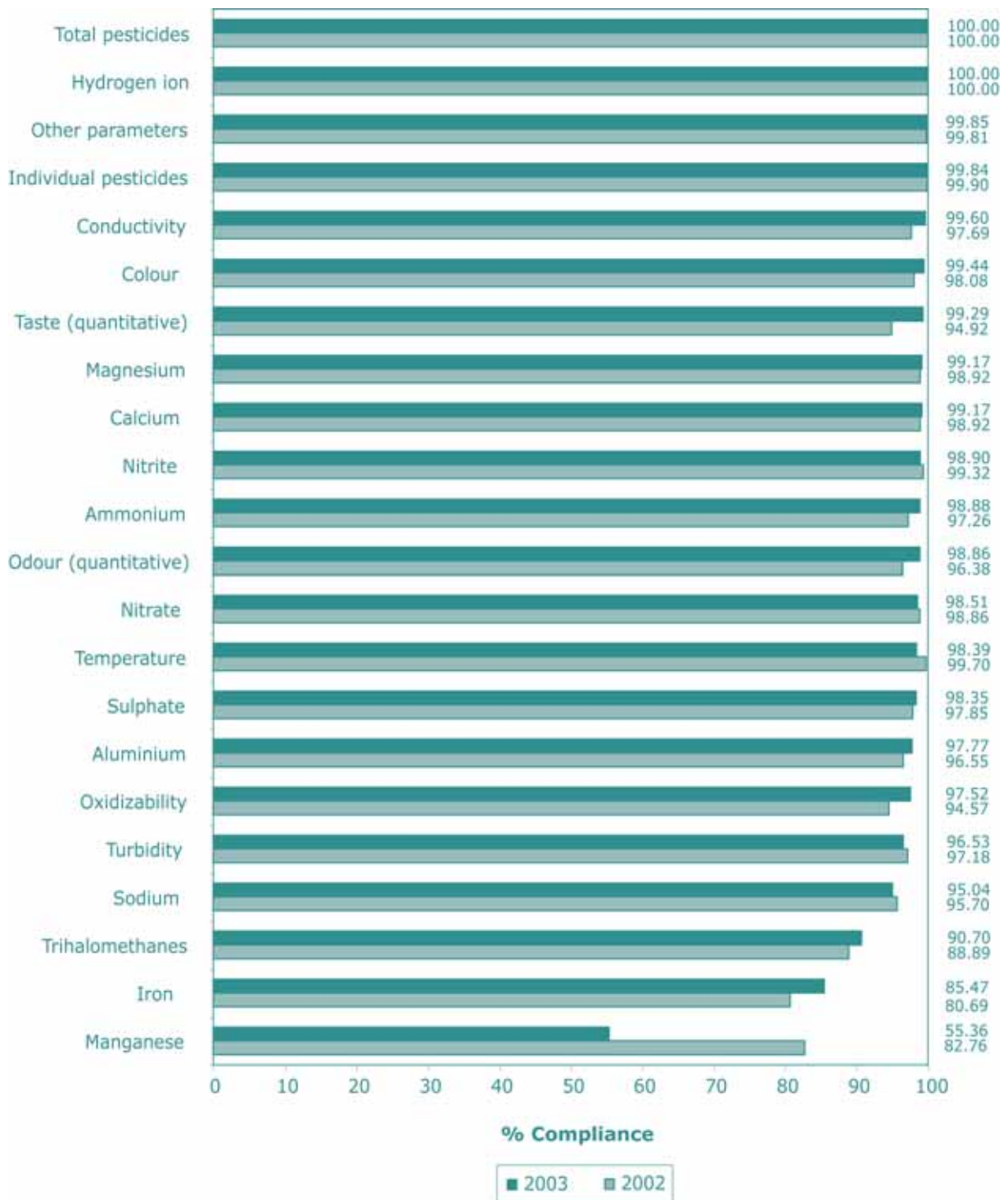


Figure 29: Summary of Microbiological Quality in Private Water Supplies (Excluding Dairy Farms)



8.15 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 manganese (44.64%), iron (14.53%), and THMs (9.30%) as shown in Figure 30.

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



8.16 An ongoing pesticide monitoring programme is undertaken for private water supplies that fall within the 2.1 and 2.2 classifications. During 2003, 42 individual pesticides were monitored. Of these, three individual pesticides (asulam, MPCA and mecoprop) were detected at levels above the regulatory standard. Table 8.2 lists the pesticides which have exceeded the regulatory standards since monitoring began.

Table 8.2: Number of Individual Pesticide Exceedences in Private Water Supplies

Pesticide Name	2003	2002	2001	2000	1999
Asulam	3				
MCPA	1	2	2	6	
Mecoprop	1	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	5	3	5	12	2

8.17 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, where required 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

8.18 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

8.19 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

8.20 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 at these supplies.

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

Drinking Water Research

9.1 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 Directorates (WD)'s 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

9.2 Enquiries should be addressed to: DWI Enquiries, 2/A2 Ashdown House, 123 Victoria Street, London SW1E 6DE or by e-mail to: dwi.enquiries@defra.gsi.gov.uk

9.3 Executive summaries of WDCQ, Department of the Environment, and Department of Environment, Transport and the Regions (DETR) drinking water research reports are posted on the Foundation for Water Research (FWR) website: www.fwr.org with details of how to obtain copies of research reports. The FWR website also provides access to a number of reports concerning components of the European Commission's Framework Programmes that are relevant to WD interests.

9.4 General enquiries about the EPG programme should be directed to: Ken Nulty, DEFRA, Zone 4/C2, Ashdown House, 123 Victoria Street, London SW1E 6DE.

9.5 As part of the Departmental evaluation of its use of science, each Directorate is producing its Science Strategy. These are posted on the DEFRA website and the WD document can be found at the following web address: www.defra.gov.uk/Science/S_IS/Strategy_03_06/Directorate_PDF/WD.pdf

Research Completed in 2003

Area of Research	Project Summary	Contractor
<i>Cryptosporidium</i>	<p>Molecular Fingerprinting of <i>Cryptosporidium</i> Oocysts Isolated During Regulatory Monitoring</p> <p>This project developed methods for the extraction of DNA from oocysts detected in regulatory monitoring for <i>Cryptosporidium</i> to permit speciation of the isolates. The results confirmed that PCR methods can be used to speciate the small numbers of oocysts on regulatory sample slides.</p>	Scottish Parasite Diagnostic Laboratory
	<p>International Workshop on Genetic Fingerprinting for Monitoring of <i>Cryptosporidium</i> in the Environment</p> <p>This workshop was organized in collaboration with the American Water Works Association Research Foundation (AWWARF) and UK Water Industry Research Ltd. The proceedings have been published by FWR.</p>	AWWARF

Area of Research	Project Summary	Contractor
Other Health Risks and Monitoring	<p>Enumeration of <i>Giardia</i> in Drinking Water</p> <p>This study considered the feasibility of concurrently detecting and identifying <i>Giardia</i> cysts during regulatory monitoring for <i>Cryptosporidium</i>. The results showed relatively poor recovery of <i>Giardia</i> cysts in treated water, compared with data obtained in the laboratory. This was attributed to chlorine damage of the structural integrity of cell surface epitopes.</p>	Severn Trent Laboratories
Water Supply Within Consumers' Premises	<p>Quality of Drinking Water in Public Buildings</p> <p>This study produced an estimate of the numbers of different types of public buildings that will fall within the 'public buildings' classification of the 1998 Drinking Water Directive. The study included a comprehensive survey of plumbing systems in buildings sampled and analysis of drinking water quality. An overall high level of compliance, comparable to water company compliance monitoring, was reported.</p> <p>Demonstration of Optimization of Plumbosolvency Treatment and Control Measures</p> <p>The study assessed water company arrangements and plans for monitoring plumbosolvency treatment and control at treatment works and in distribution. Numbers of sampling locations of each type for each treatment scheme, frequency of monitoring, parameters monitored in addition to lead, and arrangements for monitoring the concentration of orthophosphate dose were reported. Recommendations were made on monitoring strategies, and statistical methods for assessing lead monitoring data were summarized.</p>	WRc-NSF Ltd
Materials Testing and Approval	<p>Audit of Organizations Appointed to Certify Activities of Lining Contractors</p> <p>The performance of the two Assessment Organizations designated by the Inspectorate for lining contractors was assessed. Both organizations were found to have produced and implemented procedures and instructions for the assessment and accreditation process, but it was recommended that a further review of their comprehensiveness and application be carried out.</p>	Corporate Risk Associates Ltd

Area of Research	Project Summary	Contractor
Materials Testing and Approval	<p>Development of Test Methods for the European Acceptance Scheme</p> <p>Reports have now been published on the following topics: assessment of microbial growth support potential; screening for unsuspected organic contaminants using GCMS general survey; review of high level disinfection practices; and assessment of the effect of high levels of disinfectants. Publication of a further report on cytotoxicity using suppression of RNA synthesis is anticipated in 2004. Details of the reports are available on the Cordis website: www.dbs.cordis.lu</p>	WRc-NSF Ltd and The Water Quality Centre

Current Research

Area of Research	Brief Detail	Contractor
<i>Cryptosporidium</i>	<p>Investigation of <i>Cryptosporidium</i> Clinical Isolates and Analysis with Epidemiological Data</p> <p>This study seeks to improve the discrimination of a gene probe-based molecular fingerprinting system. Five subtyping methods are being studied. The most suitable will be used to investigate the prevalence and distribution of subtypes in the 320 human and animal isolates. Analysis of subtype data with case control data to calculate odds ratios to identify risk factors for infection will be completed in December 2004.</p>	Scottish Centre for Infection and Environmental Health and PHLS
	<p>Effectiveness of UV Treatment for <i>Cryptosporidium</i> in Drinking Water</p> <p>Inter-laboratory trials to test the robustness of published cell culture techniques and preliminary treatment studies on the effectiveness of UV against <i>Cryptosporidium</i> have been completed. Only one of the two cell culture assays being considered is showing reproducible performance. A second treatment study, which will investigate turbidity interference, is to be carried out in 2004.</p>	UK Water Industry Research Ltd
	<p>Establishing the Relationship Between Farm Re-stocking and <i>Cryptosporidia</i></p> <p>This study concerns the effects of re-stocking with livestock after the Foot and Mouth epidemic on the subtypes of <i>Cryptosporidia</i> in farmed and wild animals and the environment. The study investigates how potentially new genotype patterns appear in human infection cases.</p>	CREH

Area of Research	Brief Detail	Contractor
Other Health Risks and Monitoring	<p>Further Studies on the Incidence of <i>Mycobacterium Avium Complex (MAC)</i> and <i>Helicobacter</i> Organisms in Water Supplies</p>	Health Protection Agency
	<p>This study has investigated whether <i>Mycobacterium</i> spp. and <i>Helicobacter</i> can survive within water distribution systems and colonize biofilms and deposits from water mains and domestic plumbing. Although <i>Mycobacteria</i> were present in a high proportion of samples, <i>Mycobacterium avium</i> subsp. <i>paratuberculosis</i> was absent and the low occurrence of <i>Mycobacterium avium</i> Complex and <i>H. pylori</i> was not considered to be a major public health concern. In fact, <i>H. pylori</i> was detected by PCR, a technique that may detect dead organisms. A culture method for <i>H. pylori</i> is currently being investigated.</p>	
	<p>A Study of Sources of Drinking Water and Crohn's Disease</p>	University of East Anglia
	<p>This case-control epidemiological study is examining whether there is any demonstrable link with sources of drinking water and newly diagnosed cases of Crohn's disease. Ethics approval has been received at all five sites in the study, recruitment of cases is underway and recruitment of controls is being developed. Work is underway on a geographical information system (GIS) based on cattle density in catchments and population supplied by treatment works.</p>	
	<p>Investigation of Possible Relationships Between Chlorination By-products and Adverse Pregnancy Outcomes</p>	Imperial College, London
	<p>A number of US studies have reported a tentative association between Trihalomethane (THM) levels in drinking water and adverse pregnancy outcomes. This study provides a retrospective analysis of some 10 years of monitoring data for THM in water supply zones in England, Scotland and Wales. These data are being compared with data from National Registries on birth outcomes.</p>	
	<p>Characterization of Waterborne <i>Aeromonas</i> Species for Their Virulence Potential</p>	AWWARF
	<p>This project is jointly funded with AWWARF and involves collaborative work with three other research organizations. Thirty-five <i>Aeromonas</i> isolates have been obtained from a collection derived from both clinical and water samples and have been sub-cultured. A further three <i>Aeromonas</i> isolates have been obtained from a sampling survey of water treatment works. All isolates have been assayed for haemolytic and cytotoxic activity. Further biochemical and virulence testing is planned.</p>	

Area of Research	Brief Detail	Contractor
Materials Testing and Approval	<p>Provision of Expert Advice for European Research and Standardization 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 2003, work has concentrated on the detail of setting up and operating the positive list procedures.</p>	WRc-NSF Ltd
	<p>Information Base to Support Water Efficiency Labelling</p> <p>The initial stage of data collection and analysis for the selected WCs, showers, baths, taps, washing machines and dishwashers has been completed. This will determine the need for development of any further test methodologies and performance information. The output of the initial stage will be reported by updated Policy Briefs and Briefing Notes on the UKEPIC website and will inform further policy development.</p>	AEA Technology
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. During 2003, full scale testing of existing and innovative monitoring techniques has been undertaken at six membrane plants; four in the United States, and two in Europe. The test programme included microbial challenge tests and the final report was published in early 2004.</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 usually 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 decompose 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.	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. pH 7 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 in place.	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.
Biofilm	naturally occurring growth of micro-organisms on surfaces inside water mains.
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.
Coagulation	the process of aggregating colloidal and fine particulate matter into a settleable material.
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.

Epoxy resin lining	a rehabilitation process in which a cleaned section of iron water is sprayed with a mixture of epoxy resin and hardener to produce a thin but strong coating of material on the inside of the main.
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 water mains 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).

<i>Mycobacterium Avium Complex (MAC)</i>	a group of bacteria responsible for pulmonary and non-pulmonary infections, particularly, in the immunocompromised.
<i>Mycobacterium Avium Paratuberculosis (MAP)</i>	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 parasites	a single celled organism that can only survive by infecting a host.
Public registers	the information made available by Water Service 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.
Springs	groundwater appearing at the surface at the outcrop of the junction of an impermeable stratum.
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.
TSO	The Stationery Office whose predecessor body was HMSO.
µg/l	microgrammes per litre.
UKAS	The sole national accreditation body recognized 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.
Website	location of information on the Internet. The Inspectorate's website 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.
WHO	World Health Organization.
WRc	Water Research Centre (1989) plc and/or, as the context may require, its predecessor body.

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