



# NORTHERN IRELAND DRINKING WATER QUALITY 2001

*A Report by the Northern Ireland  
Drinking Water Inspectorate*



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## SUMMARY

*This report is the sixth 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 2001.*

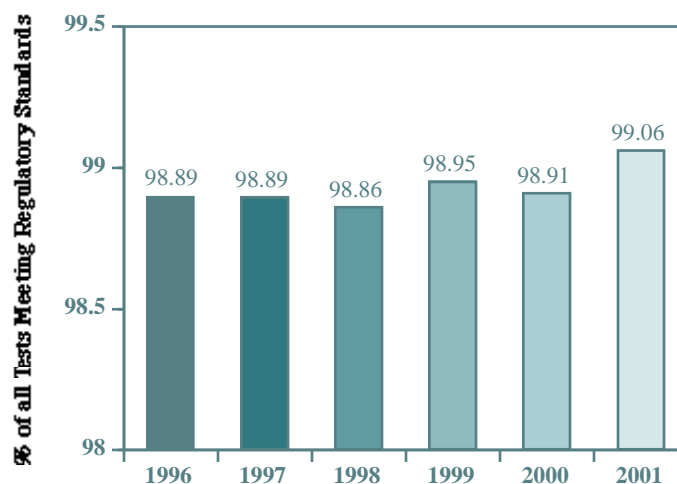
*During this reporting period, the drinking water quality results show that out of a total of 108,436 tests carried out by Water Service in 2001, 99.06% met the regulatory standards. This overall water quality figure is the percentage compliance rate for all samples and all parameters collected from water supply zones (consumers' taps), service reservoirs and water treatment works. The overall compliance figure has remained at around 99% in Northern Ireland since 1996, and has now improved by 0.15% from the 98.91% reported for 2000.*

*During 2001, the compliance rate at consumers' taps for the important microbiological parameters has been maintained at 99.69% (99.66% in 2000); these figures demonstrate the good microbiological quality of tap water in Northern Ireland. Compliance rates at water treatment works have been maintained at 99.87% (99.83% in 2000). An increase in the number of microbiological compliances has been reported for service reservoirs (99.66% in 2001, 99.48% in 2000), and it is this that has contributed to an improvement in the overall microbiological compliance rate from 99.61% in 2000, to 99.72% in 2001.*

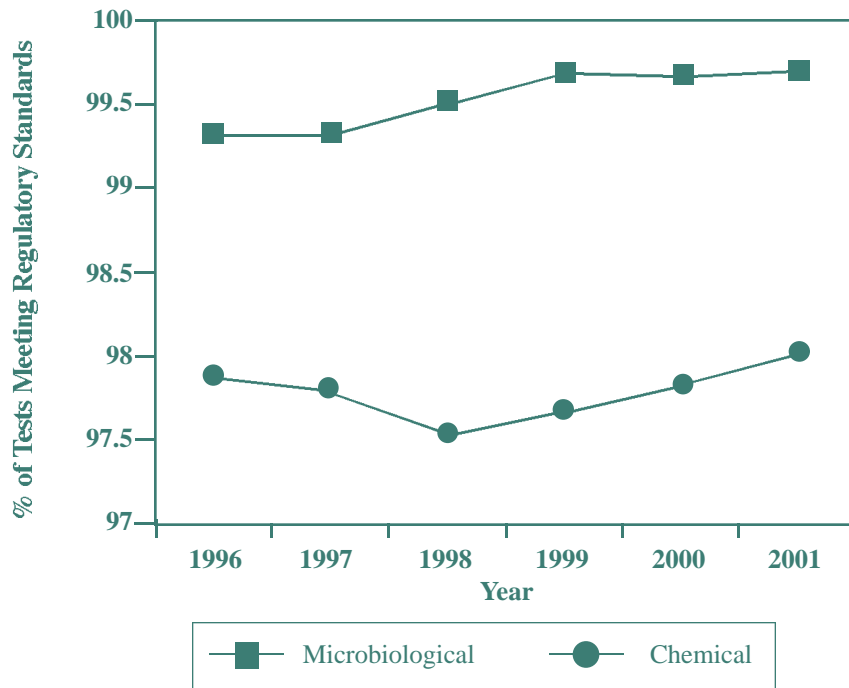
*Although the microbiological compliance rate of 99.69% for drinking water at consumers' taps is good, the overall water quality figure for consumers' taps, which also includes physical/chemical tests, is reduced to 98.38% due to the continued poorer performance rates for certain chemical parameters. As with previous reporting years, these are notably: trihalomethanes (THMs), iron, aluminium and lead.*

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

**Figure 1: Overall Water Quality**

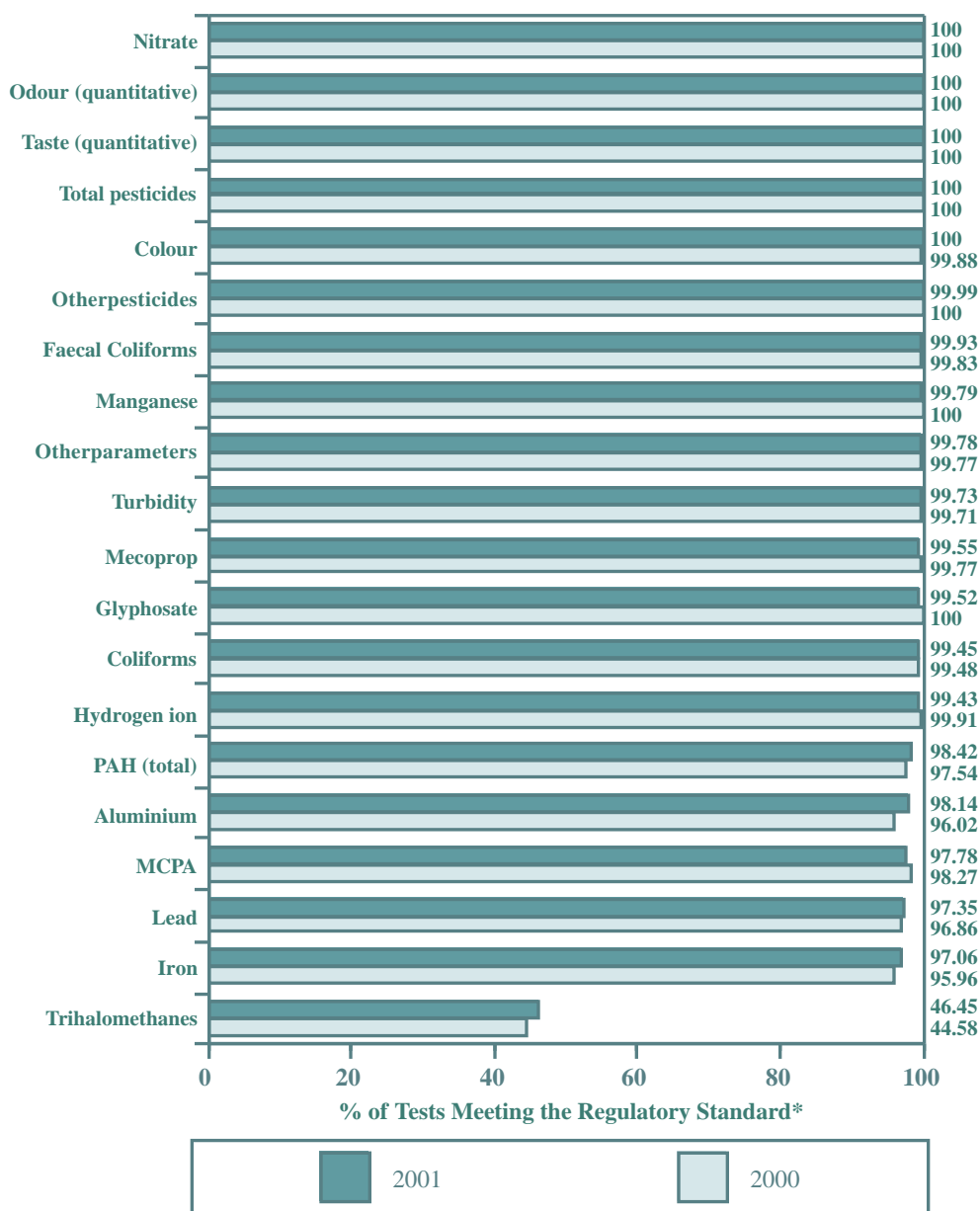


**Figure 2: Microbiological and Chemical Quality at Consumers' Taps**



*During 2001, the level of compliance was reported for 102 water supply zones which were routinely monitored for 86 individual parameters. The regulatory requirements were met for 68 of these parameters. A water supply zone can be non-compliant if one parameter fails on a single occasion. Figure 3 shows the percentage of determinations in water supply zones meeting the regulatory standards.*

Figure 3: Microbiological & Chemical Quality in Water Supply Zones

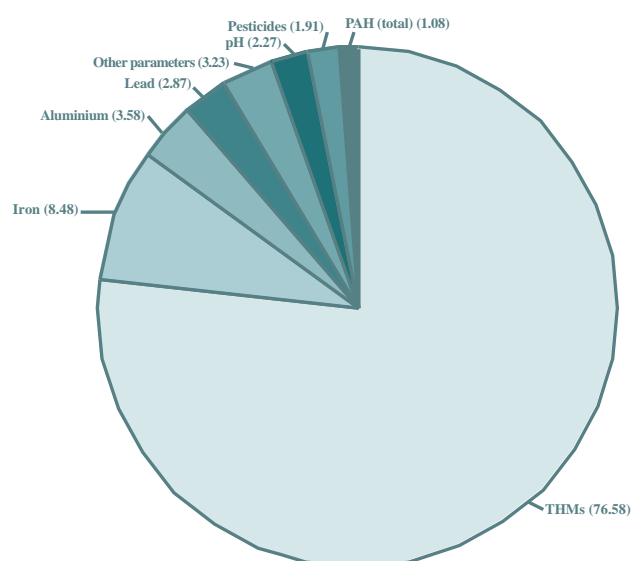


\* Regulatory Standard refers to the Prescribed Concentration or Value (PCV) or Relaxed PCV.

The overall number of physical/chemical tests not meeting the standards shows a further improvement, with 2.00% (837) of 41,932 tests failing to meet the required standards in 2001; the comparable figure for 2000 was 2.19%.

As with previous reporting years, the non-compliances continue to relate largely to trihalomethanes, iron, aluminium and lead (Figure 4 refers). Of the 837 physical/chemical non-compliances reported, 76.58% (641) relate to THMs.

**Figure 4: Water Supply Zones  
Parameter Contraventions as a % of Total Physical/Chemical  
Contraventions**



While microbiological quality of water supplies has been maintained in 2001, it may, at the same time, have contributed to the continuing high failure rate for trihalomethanes. As a percentage of all tests meeting the regulatory standards, the compliance rates for trihalomethanes have remained low at 46.45% in 2001 (44.58% in 2000). Every effort must continue to be made to control the formation of THMs. The World Health Organization has stated that in controlling trihalomethanes, primary consideration should be given to ensuring that disinfection, and, hence, microbiological quality, is never compromised.

Many of the water quality non-compliances which were detected arose in circumstances which require the implementation of improvement programmes for water treatment works and distribution systems. Improvements to several water treatment works have been completed or are underway, and in certain areas, there are indications that this continued to improve the individual aluminium compliance figures. In other situations, however, compliance monitoring continues to identify areas where a targeted improvement programme is necessary to achieve aluminium compliance. In 2001, lead and iron showed improved rates of compliance at 97.35% and 97.06% respectively; the comparable figures reported for 2000 were 96.86% and 95.96%. Targeted work programmes continue to be required to improve lead and iron compliance. With regard to the lead parameter, the Inspectorate notes Water Service's commitment to continue to introduce treatment at prioritized locations to assist in meeting future regulatory standards for lead by the required dates.

*The Water Quality Regulations (Northern Ireland) 1994 set demanding standards for public drinking water quality. During 2001, 874 contraventions of the standards were reported for samples taken at consumers' taps. Contraventions were reported for 18 parameters, and each contravention has been followed up and assessed by the Inspectorate. Depending on the magnitude or duration of the contravention, each has been assessed as being trivial or non-trivial.*

*Formal notifications for non-trivial contraventions were notified to Water Service for the following 12 parameters:*

*Total coliforms, faecal coliforms, trihalomethanes, iron, lead, aluminium, hydrogen ion (pH), MCPA, mecoprop, manganese, turbidity and ammonium.*

*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 on an ongoing basis, 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 Inspectorate welcomes Water Service's commitment to its capital works programme, targeted at water treatment works and the distribution system, which is necessary to mitigate the contraventions within the shortest possible timescale. The last five years have seen a commitment to increased investment in water treatment works and refurbished infrastructure. Continued commitment to funding further investment in water treatment and supply infrastructure needs to be maintained, and the resources applied to greatest effect to ensure the provision of high quality drinking water, with improved regulatory compliance. The investment programme needs to continue to address: the substantial improvements required in compliance, in particular, with the trihalomethane, iron, aluminium and lead parameters; further investment in quality driven water treatment and water mains rehabilitation; enhanced protection against Cryptosporidium; and the additional requirements of the new European Drinking Water Directive.*

*In line with the rest of the United Kingdom, a major activity during 2001 was the continuing implementation of arrangements for monitoring Cryptosporidium. The arrangements were established for public health protection and incorporate a formal notification level of one or more oocysts per 10 litres and an alert level of 0.1 oocysts per 10 litres. This monitoring programme was ongoing throughout the year and an assessment of this monitoring is provided in Section 5 of this report.*

*The Water Quality Regulations (Northern Ireland) 1994 set out sampling and other regulatory requirements to demonstrate the wholesomeness of drinking water supplies. The Inspectorate commends Water Service on maintaining regulatory sampling programmes, as far as was practicable, during the difficult foot and mouth events which occurred during the reporting year. In the 2001 Compliance Assessment, a sampling shortfall of 1.55% of the required number of determinations was identified for regulatory standard sampling frequencies for water supply zones; the comparable figure reported for 2000 was 1.04%.*

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

## **Forward Look**

*To further protect public health in Northern Ireland, formidable challenges lie ahead in the provision of high quality drinking water. Investment programmes require secured finance to deliver the improvements necessary to comply with the regulatory standards. The large programme of work invested in drinking water infrastructure in England and Wales in recent years, illustrates this, with overall compliance now reported at 99.86%. Comparable compliance rates in Northern Ireland have remained at around 99% since the Regulations were introduced in 1994. The planned investment programmes require modification of existing treatment, additional treatment, new treatment works and renovation of distribution systems. The most significant programmes are those needed to achieve compliance with specific parameters, notably: THMs, iron, lead and aluminum. The work on improving water treatment to provide effective barriers against Cryptosporidium continues to be important for the protection of public health.*

*The strategies to improve these particular water quality issues are all important stages which must be accomplished if Northern Ireland is to achieve comparable compliance with the rest of the United Kingdom.*

*The Inspectorate acknowledges Water Service's commitment to planned improvements and welcomes its recently published 'Water Service Resource Strategy 2002-2030'\* which clearly identifies drinking water quality as a key strand of the strategy.*

\* Water Resource Strategy 2002-2030 is available from Water Service on website <http://www.watemi.gov.uk>

# 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 2001. This is the sixth annual report prepared by the Inspectorate, and, as with the previous reports, it will act as a criterion against which water quality in Northern Ireland will be measured in future years. The Inspectorate continues to progress water quality issues, with a view to improving compliance with regulatory standards.

- 1.1** The Inspectorate prepared the summary and assessment of drinking water quality in Northern Ireland from information provided by Water Service. The information was obtained from Water Service's monitoring programme, carried out as prescribed in the Water Quality Regulations (Northern Ireland) 1994 (the 'Regulations'). Water Service has published its own report, entitled 'Drinking Water Quality Report 2001', in accordance with regulation 28. The Inspectorate's report includes a detailed independent assessment of drinking water quality in Northern Ireland in terms of the standards set out in the Regulations.
- 1.2** In the report, Section 2 describes the regulatory framework within which the Inspectorate operates. Section 3 broadly reviews the Inspectorate's activities regarding drinking water quality, including those defined by the Private Water Supplies Regulations (Northern Ireland) 1994. The technical audit process, carried out to support the Inspectorate's administration of the Regulations, is considered in detail in Section 4. Section 5 overviews public drinking water quality in Northern Ireland for 2001, comments on the key non-compliances with the standards, including non-trivial water supply zone contraventions, and draws relevant comparisons to water quality in previous years. An assessment of standard sampling frequencies for water supply zones, water treatment works and service reservoirs is also included in this section. In Section 6, water quality incidents have been identified, and, in Section 7, a summary of the private water supplies monitoring programme in Northern Ireland is provided. Section 7 also includes an overview of water quality for private water supplies for the period 1999 to 2001. Section 8 refers to the Department of the Environment, Food and Rural Affairs (DEFRA's) Drinking Water Research Programme on water quality and health, which is steered by the Drinking Water Inspectorate for England and Wales. Finally, as an aid to understanding the technical terms and abbreviations used in this report, a quality standards table and glossary of terms is provided.



# THE REGULATORY FRAMEWORK

Water quality requirements in the United Kingdom fully incorporate the European Directive of 15 July 1980 (80/778/EEC), the ‘Drinking Water Directive’<sup>1</sup>, 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<sup>2</sup> when supplying water to premises for domestic or food production purposes, to supply water which is wholesome at the time of supply;
- require the Department<sup>3</sup> to keep itself informed about the wholesomeness and sufficiency of private water supplies;

- empower the Department<sup>3</sup> 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 Department<sup>2</sup> 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 Department<sup>2</sup> to publish an annual report and keep public registers of water quality at its Water Service Divisional Headquarters’ offices.

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

<sup>2</sup> Under government reorganization, now the Department for Regional Development.

<sup>3</sup> Under government reorganization, now the Department of the Environment.

### 2.3 The Private Water Supplies Regulations (Northern Ireland) 1994

- define wholesomeness in the same manner and prescribe the same standards as for public supplies (paragraph 2.2 refers);
- require the Department<sup>3</sup> to classify private water supplies according to size and use; and
- require the Department<sup>3</sup> 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 Department<sup>2</sup> to classify all its sources of water in accordance with prescribed quality criteria subject to authorized 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).<sup>4</sup>

### 2.5 Future Drinking Water Quality Regulatory Framework

A new Directive (98/83/EC)<sup>5</sup> 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<sup>4</sup>. These new Regulations will come fully into effect on 25 December 2003.

<sup>2</sup> Under government reorganization, now the Department for Regional Development.

<sup>3</sup> Under government reorganization, now the Department of the Environment.

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

<sup>5</sup> Copies of the Directive can be obtained from: [http://europa.eu.int/index\\_en.htm](http://europa.eu.int/index_en.htm)

# 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** Inspection reports, which provide conclusions, opinions and recommendations of the inspection findings, are issued to Water Service.

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

## The Private Water Supplies Regulations (Northern Ireland) 1994

**3.4** In 1997, the Inspectorate began an annual survey to identify the private water supplies falling within the Private Water Supplies Regulations (Northern Ireland) 1994:

- for 2001, 1,050 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 to the Department's Environmental Policy Division on drinking water quality, in particular, on matters associated with the new regulatory framework currently being

implemented to meet legislative requirements of the new Drinking Water Directive (98/83/EC).

## Products and Processes in the Provision of Water Supplies

- 3.6** A scheme for the statutory approval of substances, products and processes used in the provision of public water supplies is administered in Northern Ireland by the Inspectorate. The purpose of the scheme is to ensure that chemicals and construction materials do not cause any adverse effect on water quality. The Drinking Water Inspectorate for England and Wales operates the approval process on behalf of its Secretary of State.
- 3.7** The Committee on Products and Processes for Use in Public Water Supplies advises on approval issues. This Committee is an advisory, non-departmental public body with expertise in engineering, materials science, toxicology and water treatment. A lay member represents water consumers' interests.
- 3.8** A list of chemicals and materials, approved by the Secretary of State for England and Wales, is published annually by the Drinking Water Inspectorate for England and Wales. Regulation 24 of the Water Quality Regulations (Northern Ireland) 1994 endorses the use of the substances and products contained in this document and, consequently, it is applicable in Northern Ireland. The list of all the currently approved products that may be used in public water supply can be accessed on the Drinking Water Inspectorate for England and Wales website:  
<http://www.dwi.gov.uk/cpp/index.htm>

## Impact of European Standards

- 3.9** The removal of technical barriers to trade is a major aim of the European Union's single

market programme. Harmonized standards are being developed by the European Standards Institution (CEN) under European legislation. One objective of these standards is to remove technical barriers to trade resulting from national testing and checking requirements. As a consequence of the publication of European Standards (BS EN) for drinking water treatment chemicals, products that conform to a BS EN may be used without the approval of Government authorities, providing the national conditions of use are observed.

- 3.10** In respect of construction products used in contact with drinking water, the DG Enterprise Regulatory Group – Construction Products Drinking Water, is developing the European Acceptance Scheme for drinking water construction products. This will lead to the establishment of harmonized arrangements for testing and certification of construction products that are used in contact with drinking water. In the interim, the Committee will continue to consider equivalent test results obtained from approval bodies in other countries. Applicants, however, will need to submit copies of test protocols and test results; test certificates alone will not be accepted.
- 3.11** Information on the approval systems in EU and EFTA countries is available in a report commissioned by the Drinking Water Inspectorate for England and Wales, entitled 'European Approval Systems – Effects of Materials on Water Quality', 2nd Edition (ISBN 1 898920 427). The report is available from WRc Publications Ltd. Tel: 01793 865138.
- 3.12** During 2001, LGC (Teddington) Ltd and the Water Quality Centre, Reading, continued their roles as designated laboratories for analysis associated with applications for approval.

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## Quality Assurance

- 3.13** 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 are subject to external inspection.
- 3.14** 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. The Inspectorate audits external and internal analytical quality control systems and procedures as part of its inspection programme.
- 3.15** Water Service is also implementing the requirements of the Drinking Water Testing Specification (DWTS). DWTS is an optional national scheme agreed between the Drinking Water Inspectorate for England and Wales, the Northern Ireland Drinking Water Inspectorate, the Scottish Executive's Water Services Unit and the United Kingdom Accreditation Service (UKAS), for the accreditation of laboratories carrying out drinking water analyses. The accreditation, among other requirements, will demonstrate compliance with regulation 20 of the Water Quality Regulations (Northern Ireland) 1994 and regulation 19 of the Private Water Supplies Regulations (Northern Ireland) 1994.

## Consumer Complaints and Water Quality Incidents

- 3.16** 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 2001, the Inspectorate received 22 complaints.
- 3.17** Where a water quality incident has occurred, Water Service is required to provide the Inspectorate with information, in accordance with agreed procedures. During 2001, six drinking water quality incidents and one event were brought to the attention of the Inspectorate (see Section 6 for further details).

## Contact with other Organizations

- 3.18** The Inspectorate has regular contact with the Department of Health, Social Services and Public Safety (DHSSPS), the Environmental Policy Division of the Department of the Environment, and the Department of Agriculture and Rural Development. It represents Northern Ireland interests in the development of United Kingdom drinking water regulatory policy through liaison with the Drinking Water Inspectorate for England and Wales, the Water Services and Regulation Division of the Department of the Environment, Food and Rural Affairs (DEFRA) and the Scottish Executive's Drinking Water Quality Unit. The Inspectorate keeps itself informed of research being carried out by the Water Research Centre (WRc) and other organizations. This includes having representation on the DEFRA Water Distribution, Conservation and Quality Research Programme Committee (see Section 8 for details). Contact with Member States of the European Union is made through a European Drinking Water Regulators' Forum.
- 3.19** The Inspectorate has regular contact with Environmental Health Officers in the district councils in connection with both private and

public water supplies. Contact is also maintained with the General Consumer Council for Northern Ireland.

**3.20** Meetings are also held with the Northern Ireland Water Council, which is a Statutory Advisory Council appointed to advise the 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.

**3.21** 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.

**3.22** The Inspectorate has been in contact with researchers at the Department of Food Science, Queen's University of Belfast and has given advice on a project looking at paratuberculosis in water.

## **DWI Information**

**3.23** To increase awareness of the water quality of private water supplies, the Inspectorate produced a leaflet 'Is Your PRIVATE Water Supply SAFE?', which was widely circulated to owners through the Department of Agriculture and Rural Development, and the 26 district councils.

**3.24** During 2001, the Inspectorate presented papers and delivered lectures on a number of occasions to learned societies and public bodies.

**3.25** Previous Inspectorate Annual Report publications include:

- 'Northern Ireland Drinking Water Quality 2000';
- 'Northern Ireland Drinking Water Quality 1999';
- 'Northern Ireland Drinking Water Quality 1998';
- 'Northern Ireland Drinking Water Quality 1997'; and
- 'Northern Ireland Drinking Water Quality 1996'.

**3.26** The 2001, 2000, 1999 and 1998 Northern Ireland Drinking Water Quality reports, together with general information about the Northern Ireland Drinking Water Inspectorate, are available on the 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), is available on the website: <http://www.ehsni.gov.uk/environment/drinkWater/links.shtml>

# THE TECHNICAL AUDIT

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

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

This section details the compliance assessment process and outlines the results of the 2001 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 2001 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 2001, 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 included in the standard sampling frequency compliance assessment.

- 4.6** The parameters alkalinity and total hardness have a PCV assigned to them only for water which is artificially softened (to reduce alkalinity and hardness). The PCV, in this case, is a minimum value which must be exceeded. These two parameters have an assigned sampling frequency but, because no softening of water supplied by Water Service takes place, these PCVs effectively

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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 2001, water samples were analysed for 40 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 2001, the Inspectorate has generally regarded the detection of coliforms and faecal coliforms on a single occasion as a trivial contravention of the standards. All other contraventions were considered to be non-trivial and these have been formally notified to Water Service.

## Service Reservoirs

**4.11** Regulation 3(8) of the Water Quality Regulations (Northern Ireland) 1994 requires 95% of samples taken in the preceding 12 months from a service reservoir to be free from coliforms. For 2001, compliance was assessed on the basis of results of samples taken from each service reservoir in the 12 months of the calendar year. Non-trivial contraventions of the coliform standard at service reservoirs were formally notified to Water Service.

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

## Water Supply Zones

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

softening or desalination; and in the case of hydrogen ion (pH), the pH value must be in a range defined by a maximum and minimum prescribed value.

**4.14** The Drinking Water Directive and regulation 4 of the Water Quality Regulations (Northern Ireland) 1994 permit standards to be relaxed in certain specified circumstances. The circumstances applying in Northern Ireland stem from the nature and structure of the ground from which the supplies are taken, as the composition of geological strata can affect background levels of substances occurring in water. The Drinking Water Directive and regulation 5 place certain restrictions on the relaxed standards, in particular, that public health shall not be put at risk. Regulation 5 also requires the specification of the extent to which the PCV for any parameter can be contravened. Following consultation with DHSSPS, relaxed standards are permitted in specified water supply zones in Northern Ireland for taste (quantitative), odour (quantitative), colour, aluminium and manganese. The number of water supply zones with permitted relaxations for 2001 are listed below.

## Relaxations in Water Supply Zones

Parameter	Number of Water Supply Zones with Relaxations
Colour	89
Manganese	98
Odour (quantitative)	79
Taste (quantitative)	79
Aluminium	34

- 4.15** In assessing water quality in water supply zones, the Inspectorate has taken into account the existence of permitted relaxations. Thus, throughout the text and tables of this report, reference to contravention of a PCV means that, where a relaxation is in place, a concentration or value greater than the relaxed standard has occurred. Concentrations or values up to the relaxed concentration or value are not included in the number or percentage of PCV contraventions.
- 4.16** The Regulations prescribe standards for a wide range of parameters, of which only some have a health significance, and their standards are generally set with a wide margin of safety. The other parameters are of aesthetic significance, with standards set well below the level at which water would become unacceptable to consumers, and contravention of these standards does not necessarily indicate that the water is unfit to drink.
- 4.17** Contravention of a PCV, even for only one parameter and in only one sample out of the large number taken from each water supply zone in the course of the year, indicates that the water supplied at the time the sample was taken cannot be regarded as wholesome. That does not mean that the water was harmful to health or unfit for drinking, but it may mean, when considered in the light of other monitoring results, that the water quality needs improvement in order to meet the high standards specified in the Regulations.
- 4.18** The general rule that any contravention of a PCV constitutes a breach of the Water Quality Regulations (Northern Ireland) 1994 and, thus, causes the water to be regarded as unwholesome, does not apply to some parameters specified in regulation 3. Water supply zones have only been regarded as non-compliant if:
- the average concentration for trihalomethanes in any three-month period has exceeded the concentration of 100 µg/l as prescribed in regulation 3(3)(e), (*'trihalomethanes' refers to the sum of the concentrations of trichloromethane, dichlorobromomethane, dibromochloromethane and tribromomethane*);
  - 20% or more sodium determinations carried out in the preceding 36 months exceeded the prescribed concentration of 150 mg/l specified in Table A and regulation 3(5);
  - coliforms were detected in 5% or more of the samples taken in the 12 months of the calendar year or, where less than 50 samples were taken in the 12 month period, the assessment was made using the previous 50 samples; and
  - in the case of Table D parameters which include benzo 3,4 pyrene, the average concentrations or values during the calendar year 2001 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 5.7 in Section 5. A water supply zone is assessed as being non-compliant if just one sample has not met the required standard. The percentage of non-compliant water supply zones for each parameter in contravention of the Regulations is also shown in Table 5.7.
- 4.20** For 2001, 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 2001, the Inspectorate assessed nitrite contraventions for triviality taking into consideration nitrite and nitrate prescribed values as formulated in the new Drinking Water Directive. Water supply zones were assessed as trivial if the nitrite value was <0.5 mg/l and if the calculated value was < or = 1. The formula is:

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

- 4.22** For 2001, the Inspectorate assessed total polycyclic aromatic hydrocarbons 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 < or = to 0.1 µg/l.

- 4.23** Taking into consideration the tighter lead standards in the new Drinking Water Directive, the Inspectorate has, for 2001, considered all exceedences of the 50 µg/l standard as non-trivial contraventions.

- 4.24** When assessing triviality for pesticides in 2001, 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 0.1µg/l in samples taken from the same source, in the same year, the contraventions will all be considered non-trivial.

- 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 coliform regulatory standard were regarded as non-trivial because compliance is assessed on a 95 percentile basis. All cases where contraventions of the standard for a microbiological parameter were regarded as non-trivial have been formally notified to Water Service.



# THE 2001 INSPECTION PROGRAMME

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## 2001 Inspection Programme

**4.26** The 2001 Inspection Programme was based on the following topics:

- detailed audit of a water quality laboratory for *Cryptosporidium* analysis and reporting;
- ongoing review of *Cryptosporidium* risk assessment and monitoring practices;
- audit of a selected analytical water quality laboratory; and
- progress on agreed follow-up action as a result of the 2000 and 2001 Inspection Programmes.

**4.27** During March and April 2001, inspections were carried out on behalf of the Inspectorate, at Altnagelvin, Westland House and Marlborough House Laboratories (Water Service laboratories used to monitor public water supplies) and at Newforge Laboratory (a Department of Agriculture and Rural Development laboratory utilized by the Inspectorate to monitor private water supplies on dairy farms).

**4.28** On completion of the inspection programme, conclusions, opinions and recommendations were reported to the respective authorities and are being followed up.

**4.29** The reports and their conclusions, opinions and recommendations are, of necessity, based on the audit and inspection of a small selection of records, documents and locations. Any statements of satisfaction therefore represent the inspectors' opinions at the time, based on the information available to and inspected by them, and do not constitute a general endorsement of the adequacy of Water Service's procedures and practices. The main findings of these inspections are summarized in paragraphs 4.30 to 4.39.

## Altnagelvin Laboratory

**4.30** An initial joint assessment of Altnagelvin Laboratory was carried out by the Northern Ireland Inspectorate and the Drinking Water Inspectorate for England and Wales. This was followed up by a detailed inspection undertaken by the Drinking Water Inspectorate (E&W) during March 2001. The overall objective was to carry out a further assessment of the monitoring methods in place for *Cryptosporidium* analysis, for accreditation purposes. The following topics were included in the assessment:

- sample protocols;
- laboratory analysis;
- analytical quality control procedures;
- reporting procedures; and
- procedures and analysis audit trail.

As a result of the inspection of the protocols and the analytical procedures, the Inspectorate supports the approval for *Cryptosporidium* analysis, given to Altnagelvin Laboratory by the Drinking Water Inspectorate for England and Wales.

## Westland House Laboratory

**4.31** The United Kingdom Accreditation Service (UKAS) carried out an inspection of Westland House Laboratory during April 2001. The overall objective was to carry out an inspection to assess if the requirements of the Drinking Water Testing Specification (paragraph 3.15 refers) were being met.

## Marlborough House Laboratory

**4.32** During 2001, the Marlborough House Water Testing Laboratory was inspected by UKAS. The laboratory attained the necessary standards and was awarded accreditation.

## Newforge Laboratory

- 4.33** The United Kingdom Accreditation Service carried out an inspection of Newforge Laboratory during 2001. The overall objective of the inspection was to assess if the requirements of the Drinking Water Testing Specification were being met.

As a result of the inspection of the analytical quality control procedures, the Inspectorate supports the approval given by UKAS.

## *Cryptosporidium* Risk Assessment and Monitoring

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

- 4.35** Following the introduction of Draft Protocols for the Monitoring of *Cryptosporidium* in Treated Water Supplies in Northern Ireland, in December 1999, the administrative arrangements were reviewed by the Inspectorate through the Drinking Water Liaison Group which takes representation from the Inspectorate, Water Service and the health authorities. A revised document, 'Guidance for the Monitoring of *Cryptosporidium* in Treated Water Supplies in Northern Ireland' (May 2002) was issued by the Inspectorate and is available on the website:

<http://www.ehsni.gov.uk/environment/drinkWater/links.shtml>

The document will be kept under review by the Inspectorate. It will take into consideration further recommendations which may arise from the findings of the current Group of Experts on *Cryptosporidium*, which reports to DEFRA.

## Dunore Point Water Treatment Works

- 4.36** Following the outbreak of cryptosporidiosis in April 2001 in water supply areas served by Dunore Point Water Treatment Works, the Inspectorate was involved in a detailed post incident analysis review. The inquiry team had membership from Queen's University Belfast, the Inspectorate and Water Service. This review focused on investigations which aimed to identify measures which could be taken to endeavour to prevent recurrence of contamination at this and other water treatment works. Following the investigation, an 'Action Plan' was produced to implement the recommendations of the inquiry team. Water Service has been actively progressing the recommendations, which include changes to infrastructure, operation of works procedures and other related issues.

- 4.37** The 'Outbreak Control Team' which was established at the time of the incident to report on the outbreak of cryptosporidiosis, has published its findings. The respective Departments will follow up on the recommendations contained in the Outbreak Control Team report.

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## Follow-up to the 2000 Inspection Programme

**4.38** Follow-up action resulting from the 2000 Inspection Programme is outlined below:

- Lisnabreeny Service Reservoir - completed;
- Lough Island Reavy Water Treatment Works - ongoing;
- *Cryptosporidium* Risk Assessment Review - ongoing; and
- Progress on the Implementation of the Recommendations of the *Cryptosporidium* in Water Supplies Reports<sup>\*/\*\*</sup> - ongoing.

## Follow-up to the 2001 Inspection Programme

**4.39** Follow-up action resulting from the 2001 Inspection Programme is outlined below:

- Dunore Point Water Treatment Works – progress on the implementation of the recommendations of the post incident report – ongoing.

\* Reference - Badenoch J(1995) *Cryptosporidium* in Water Supplies - Second Report of the Group of Experts, Department of the Environment, Department of Health, London, UK, HMSO. (ISBN0 11 753136 7)

\*\* Reference - Bouchier I(1998) *Cryptosporidium* in Water Supplies - Third Report of the Group of Experts, Department of the Environment, Department of Health, London, UK, HMSO. (ISBN1 85112 131 5)



# OVERVIEW OF DRINKING WATER QUALITY IN NORTHERN IRELAND IN 2001

## Introduction

Water Service produces 740 million litres/day of water to 98.5% of Northern Ireland's population for approximately 1.69 million people. These water supplies are mostly derived from surface water (94%), with the remainder being groundwater sources. Water from all these sources is treated and distributed through nearly 25,000 km of watermains. Regulatory compliance monitoring in 2001 was carried out at 63 water treatment works, 362 service reservoirs and in 102 water supply zones (Tables 5.1-5.3 refer). The majority of the service reservoir sampling points correspond to single reservoir sites, although some have more than one reservoir on site.

In 2001, there were 102 water supply zones in Northern Ireland which were categorized for monitoring purposes depending on the size of the population served. As Water Service upgrades and develops its infrastructure, and rural supply zones are rationalized by developing regional schemes, the number of water supply zones may change from year to year.

**Table 5.1: Water Treatment Works Volume Categories**

Water Treatment Works		Volume Distributed from Works (m <sup>3</sup> /d) Categories
Number	Percentage	
22	34.92	<3,000
25	39.68	3,000-12,000
16	25.40	>12,000

**Table 5.2: Service Reservoir Capacity Categories**

Service Reservoir		Capacity of Reservoirs (m <sup>3</sup> ) Categories
Number	Percentage	
198	54.70	<2,000
124	34.25	2,000-10,000
40	11.05	>10,000

**Table 5.3: Water Supply Zone Population Categories**

Water Supply Zone		Population Category
Number	Percentage	
22	21.57	<5,000
32	31.37	5,000-20,000
48	47.06	20,000-50,000

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

## COMPARISON OF WATER QUALITY

**5.1** The tables included in this section (Tables 5.4-5.8 refer) 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:

- adoption of increased sampling frequencies as a result of contraventions for a particular parameter;
- modifications to the pesticide monitoring strategy in the light of reassessment of pesticide usage within the water catchments (see paragraph 4.8);
- changes in the sampling programme due to the annual review of the delineation of water supply zones; and

- improvements in analytical systems which may have reduced or eliminated the possible contribution to earlier data of results of uncertain accuracy.

In 2001, the number of determinations carried out for individual pesticides has increased by over 2,200 on the number carried out in 1998. This should be taken into consideration when making direct comparisons for pesticides and overall physical/chemical quality between the respective years.

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 indicative of any underlying difference in water quality.

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

**Table 5.4: Summary of Overall Water Quality**

	2001	2000	1999	1998	1997
<b>Water Treatment Works</b>					
Total number of determinations	18,052	18,522	19,360	19,648	20,224
- number exceeding PCV	24	32	28	44	60
- % exceeding PCV	0.13	0.17	0.14	0.22	0.30
<b>Service Reservoirs</b>					
Total number of determinations	36,414	37,314	38,044	37,972	37,973
- number exceeding PCV	123	193	109	150	207
- % exceeding PCV	0.34	0.52	0.29	0.40	0.55
<b>Water Supply Zones</b>					
Total number of determinations	53,970	54,406	53,826	50,802	49,551
- number exceeding PCV	874	979	1,033	1,038	930
- % exceeding PCV	1.62	1.80	1.92	2.04	1.88
<b>All Samples</b>					
Total number of determinations	108,436	110,242	111,230	108,422	107,748
- number exceeding PCV	1,021	1,204	1,170	1,232	1,197
- % exceeding PCV	0.94	1.09	1.05	1.14	1.11

## Overall Water Quality

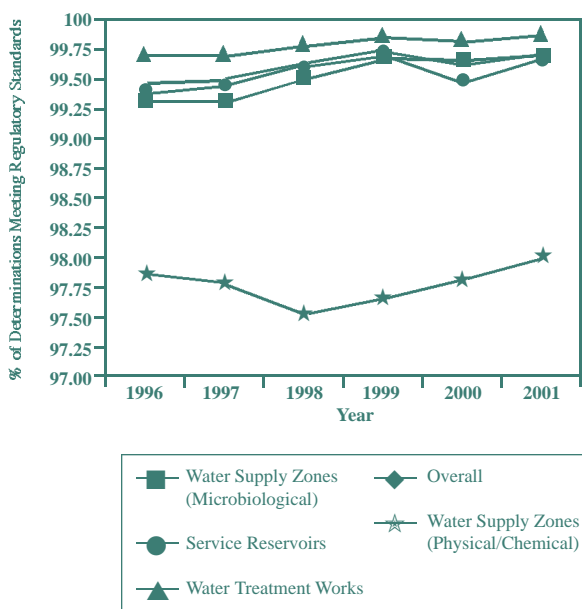
**5.3** The level of compliance is shown in two ways. The first, and best overall measure, because it takes into account all the results for the calendar year, is the total of all determinations that meet the regulatory standards. During 2001, a total of 108,436 reported determinations were carried out at water treatment works, service reservoirs and consumers' taps (Table 5.4 refers). Of these determinations, 99.06% complied with the relevant water quality standards. These results confirm that, overall, the water supplied is of good quality. This overall water quality figure shows a further increase in the compliance rate for

2001 when compared to the compliance figure of 98.91% reported for 2000, and, in addition, the overall microbiological compliance rate has increased to 99.72% from the 99.61% compliance figure reported for 2000 (Figure 5 refers). An increase, in the number of microbiological compliances has been reported for service reservoirs (99.66% in 2001, 99.48% in 2000). This improved compliance rate for service reservoirs has contributed to an improvement in the overall microbiological compliance rate. The compliance rate for the key microbiological parameters for samples taken at consumers' taps was maintained at 99.69%; the comparable figure for 2000 was 99.66%.

While the overall number of physical/chemical reported exceedences shows an improvement for 2001, with a compliance figure of 98.00% when compared to the 97.81% figure for 2000, there continues to be poorer performance rates for certain chemical parameters. As with previous reporting years, these are notably: trihalomethanes, lead, iron and aluminium.

**5.4** The second measure which is used to check water quality is water supply zone compliance. A water supply zone is assessed as being non-compliant if just one sample has not met the required standard. Compliance summary results are provided in Figure 5. In addition, comparable figures with previous compliance assessments on an individual parameter basis are given in Tables 5.4 to 5.8 and Figures 7 to 18.

**Figure 5: % Compliance Summary Results 1996-2001**



**5.5** During 2001, the level of compliance was assessed for 102 water supply zones which were routinely monitored for 86 individual determinations. The regulatory requirements were not met for 18 of these parameters (two microbiological and

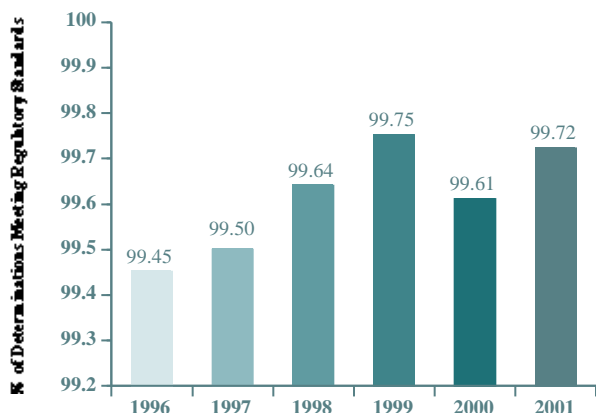
16 physical/chemical). As with previous reports, the non-compliances continue to relate largely to trihalomethanes, iron, aluminium and lead. The percentage of non-compliant zones for the following key parameters is shown in Table 5.7.

- Coliforms
- Faecal Coliforms
- Colour
- Turbidity
- Odour (quantitative)
- Taste (quantitative)
- Hydrogen ion
- Nitrate
- Aluminium
- Iron
- Manganese
- Lead
- PAH (total)
- Trihalomethanes
- Total pesticides
- Glyphosate
- MCPA
- Mecoprop
- Other pesticides

**5.6** Where the regulatory standards have been exceeded, agreed reporting procedures exist between Water Service, Health and Social Services Boards and the Inspectorate.

**5.7** The compliance figure for all microbiological samples shows an increase in the level of compliance in 2001; 99.72% of 66,504 determinations meet the required standards, when compared to the 99.61% reported for 2000. The comparable figures for previous years are given in Figure 6. During 2001, the compliance rate at consumers' taps for the important microbiological parameters has been maintained at 99.69% (99.66% in 2000). Compliance rates at water treatment works have been maintained at 99.87% (99.83% in 2000) for overall microbiological quality. An increase in the number of compliances has been reported for service reservoirs (99.66% in 2001, 99.48% in 2000), and it is this improvement that has increased the overall microbiological compliance by 0.11% between 2001 and 2000.

**Figure 6: Overall Microbiological Quality**



**5.8** While overall microbiological quality of water has been improved for 2001, it may, at the same time, have contributed to the continuing high failure rate for trihalomethanes. For 2001, as in the previous five years, trihalomethanes continue to be the parameter with the highest non-compliance rate of the regulatory standard. Water Service has taken measures to improve the disinfection of water supplies and every effort must continue to be made to control the formation of THMs and to also take the necessary steps to bring about compliance with the trihalomethane standard. It is paramount that in doing so, the microbiological quality of drinking water should not be compromised.

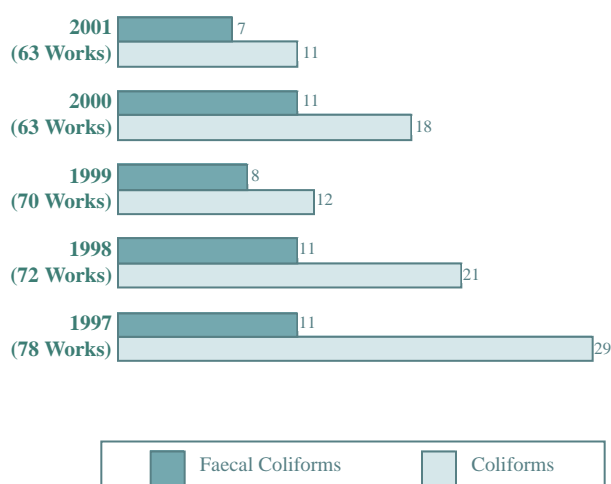
**5.9** During 2001, out of a total of 108,436 determinations carried out at water treatment works, service reservoirs and in water supply zones, 1,021 determinations contravened the standards. Depending on the magnitude or duration of the contravention, each has been assessed as being trivial or non-trivial. Formal notifications for non-trivial contraventions were notified to Water Service for the following twelve parameters: coliforms, faecal coliforms, trihalomethanes, iron, lead, aluminium, pH, MCPA, mecoprop, manganese, turbidity and ammonium. Water Service is dealing with contraventions by follow-up action in each individual case and by a major capital works programme, targeted at water treatment works and the distribution system.

## Microbiological Quality of Water Leaving Water Treatment Works

**5.10** Summary results for water treatment works are given in Tables 5.4 and 5.5. These indicate that the overall microbiological quality has been maintained for 2001 with a compliance rate of 99.87%. The results show, that in relation to the number of determinations at water treatment works in 2001, 99.83% and 99.90% complied with the regulatory standards for coliforms and faecal coliforms respectively. The number of works not complying with the coliform standard reported a decrease from 18 in 2000 to 11 in 2001 (Figure 7 refers). During 2001, contraventions for faecal coliforms were detected at seven water treatment works, of which, one was considered non-trivial. The coliform standard was contravened at 11 water treatment works, five of those being considered non-trivial.

All non-trivial contraventions of the faecal coliform and coliform standards have been formally notified to Water Service. All contraventions of microbiological standards at water treatment works are followed up urgently, and remedial action taken by Water Service as a matter of policy.

**Figure 7: Number of Water Treatment Works not Complying with Standards**



**Table 5.5: Microbiological Quality of Water Leaving Water Treatment Works**

	2001	2000	1999	1998	1997
<b>Coliforms</b>					
Total number of determinations	9,026	9,261	9,680	9,824	10,112
- number of determinations containing coliforms	15	21	18	28	48
- % containing coliforms	0.17	0.23	0.19	0.29	0.47
Number of treatment works with coliforms detected	11	18	12	21	29
<b>Faecal Coliforms</b>					
Total number of determinations	9,026	9,261	9,680	9,824	10,112
- number of determinations containing faecal coliforms	9	11	10	16	12
- % containing faecal coliforms	0.10	0.12	0.10	0.16	0.12
Number of treatment works with faecal coliforms detected	7	11	8	11	11
<b>Number of Water Treatment Works</b>	<b>63</b>	<b>63</b>	<b>70</b>	<b>72</b>	<b>78</b>

## Microbiological Quality of Water in Service Reservoirs

5.11 Summary results for service reservoirs are given in Tables 5.4 and 5.6. These results indicate a significant improvement in the water quality at service reservoirs compared to that reported for 2000, with an increase in the number of microbiological compliances from 99.48% in 2000, to 99.66% in 2001. The number of service reservoirs complying with the microbiological standards also reported an increase in 2001 (Figure 8 refers).

Figure 8: Number of Service Reservoirs not Complying with Standards

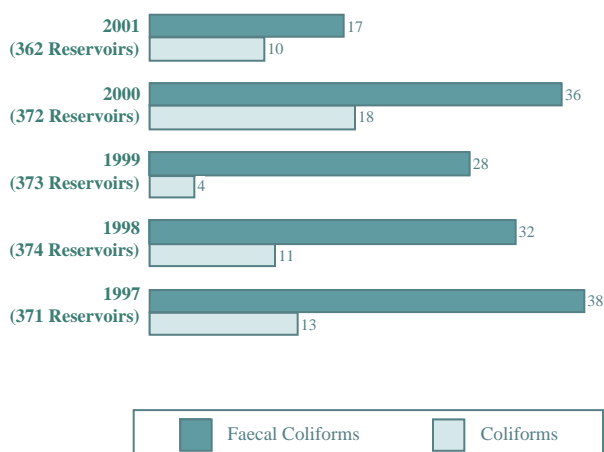


Table 5.6: Microbiological Quality of Water in Service Reservoirs

	2001	2000	1999	1998	1997
<b>Coliforms</b>					
Total number of determinations	18,207	18,657	19,022	18,986	18,987
- number of determinations containing coliforms	106	147	79	114	164
- % containing coliforms	0.58	0.79	0.42	0.60	0.86
Number of service reservoirs with coliforms detected in more than 5% of samples	10	18	4	11	13
<b>Faecal Coliforms</b>					
Total number of determinations	18,207	18,657	19,022	18,986	18,986
- number of determinations containing faecal coliforms	17	46	30	36	43
- % containing faecal coliforms	0.09	0.25	0.16	0.19	0.23
Number of service reservoirs with faecal coliforms detected	17	36	28	32	38
<b>Number of Service Reservoirs</b>	<b>362</b>	<b>372</b>	<b>373</b>	<b>374</b>	<b>371</b>

**5.12** Of the 18,207 determinations in samples taken at service reservoirs in 2001, 99.42% were free from coliforms. Coliforms were detected in at least one sample collected during the year at 68 service reservoirs. However, the Regulations are only contravened at a service reservoir if more than 5% of the samples taken during the year contain coliforms. On this basis, ten service reservoirs contravened the coliform standard (Figure 8 refers); these contraventions have been considered non-trivial and have been formally notified to Water Service.

**5.13** Of the 18,207 determinations carried out for faecal coliforms in samples taken at service reservoirs during 2001, 99.91% met the regulatory requirements. Faecal coliforms were detected in at least one sample at 17 service reservoirs. Contraventions of the faecal coliform standard were considered trivial for 16 of these service reservoirs. Non-trivial contraventions of the faecal coliform standard at one service reservoir has been formally notified to Water Service.

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

## Water Quality in Water Supply Zones

**5.15** Table 5.7 gives 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, with the exception of pesticides, have been taken together in the penultimate item of the table under the parameter description 'Other parameters'. Only those parameters which have numerical standards are included under this heading (see paragraphs 4.5 and 4.6). Table 5.7 includes comparable figures for 2000 and 1999. It also outlines:

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

**5.16** For some parameters, exceedences of the numerical value for the PCV, recorded when considering individual determinations, need not necessarily constitute a contravention of the Water Quality Regulations (Northern Ireland) 1994 when assessing compliance for water supply zones (see paragraphs 4.18 and 4.19). In Table 5.7, these circumstances apply to coliforms, trihalomethanes and benzo 3,4 pyrene. (Benzo 3,4 pyrene is included under other parameters.)

**5.17** When considering non-compliant zones, it needs to be remembered that a single marginal contravention for a parameter may have caused the water supply zone to become non-compliant (see paragraph 4.17). Such contraventions have been included with those regarded as trivial in the compliance assessment (see paragraphs 4.20 to 4.24). Depending on the magnitude or duration of the contravention, the Inspectorate has assessed each one as being trivial or non-trivial for each water supply zone. A fuller discussion, parameter by parameter, is given in paragraphs 5.19 to 5.66.

**5.18** A summary of water quality in water supply zones is presented in Table 5.7.

**Table 5.7: Water Quality in Water Supply Zones, 2001**

Parameter	Determinations in 2001			Determinations in 2000		Zones in 2001	Zones in 2000	Zones in 1999
	Total No.	Exceeding PCV or Relaxed PCV		Total No.	% Exceeding PCV or Relaxed PCV	% Exceeding PCV or Relaxed PCV	% Exceeding PCV or Relaxed PCV	% Exceeding PCV or Relaxed PCV
		No.	%					
Coliforms	6,019	33	0.55	5,809	0.52	0.00	0.97	2.88
Faecal coliforms	6,019	4	0.07	5,809	0.17	3.92	9.71	6.73
Colour	879	0	0.00	840	0.12	0.00	0.97	0.96
Turbidity	1,105	3	0.27	1,024	0.29	2.94	2.91	6.73
Odour (quantitative)	782	0	0.00	776	0.00	0.00	0.00	0.96
Taste (quantitative)	782	0	0.00	776	0.00	0.00	0.00	0.96
Hydrogen ion	3,328	19	0.57	3,374	0.09	7.84	2.91	8.65
Nitrate	742	0	0.00	732	0.00	0.00	0.00	0.00
Aluminium	1,617	30	1.86	1,582	3.98	10.78	19.42	22.12
Iron	2,411	71	2.94	2,326	4.04	37.25	34.95	50.96
Manganese	940	2	0.21	935	0.00	0.98	0.00	0.96
Lead	905	24	2.65	827	3.14	13.73	14.56	21.15
PAH (total)	571	9	1.58	570	2.46	7.84	9.71	6.73
Trihalomethanes	1,197	641	53.55	1,265	55.42	68.63	64.08	75.00
Total pesticides	392	0	0.00	413	0.00	0.00	0.00	0.96
Glyphosate	419	2	0.48	437	0.00	1.96	0.00	2.88
MCPA	450	10	2.22	463	1.73	4.90	3.88	4.81
Mecoprop	441	2	0.45	443	0.23	1.96	0.97	0.96
Other pesticides	14,832	2	0.01	15,254	0.00	1.96	0.00	4.81
Other parameters	10,139	22	0.22	10,751	0.23	6.86	9.71	10.58
<b>TOTAL</b>	<b>53,970</b>	<b>874</b>	<b>1.62</b>	<b>54,406</b>	<b>1.80</b>	<b>No. of Water Supply Zones</b>		
						<b>102</b>	<b>103</b>	<b>104</b>

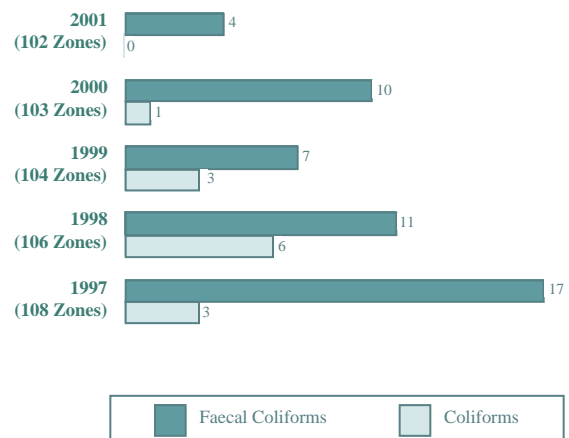
## Microbiological Quality in Water Supply Zones

**5.19** Of the 6,019 determinations for faecal coliforms carried out in water supply zones during 2001, 99.93% met the regulatory standards. A total of four zones were non-compliant for faecal coliforms in respect of the Regulations (Figure 9 refers). Contraventions in two of these water supply zones were regarded as non-trivial and have been formally notified to Water Service.

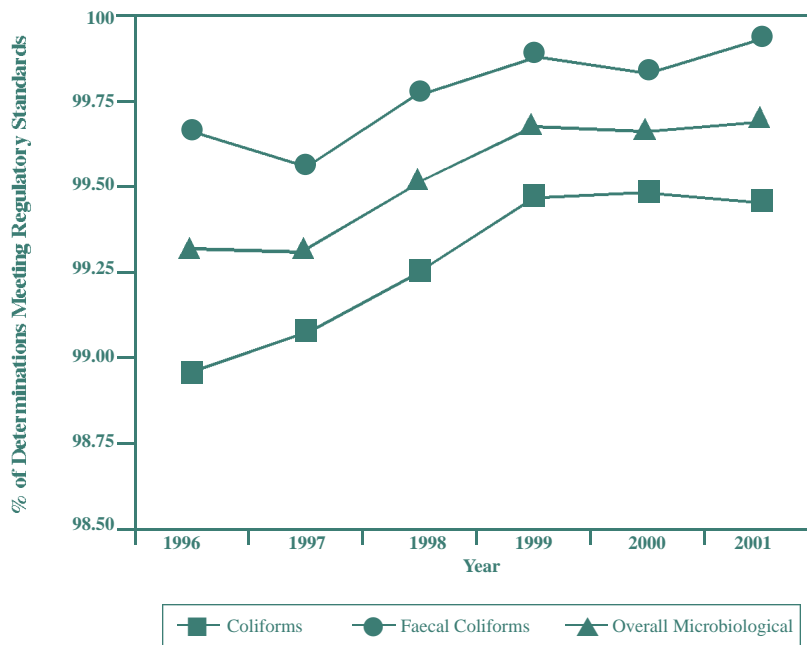
For coliform determinations in water supply zones, 99.45% (Figure 10 refers) complied with the numerical standard for the PCV in Table C of Schedule 1 to the Water Quality Regulations (Northern Ireland) 1994. Coliforms were detected in at least one sample collected during the year in 25 water supply zones. However, the Regulations are only contravened in a water supply zone if more than 5% of samples taken contain coliforms (see paragraph 4.18). On this basis, all of the water supply zones met the regulatory coliform standard. Taking the two key microbiological parameters together, the

overall compliance rate with the numerical standards for determinations at consumers' taps reported for 2001 was 99.69% (Figure 10 refers); comparable to the 99.66% figure reported for 2000.

**Figure 9: Number of Zones not Complying with Microbiological Regulatory Standards**



**Figure 10: Microbiological Determinations Meeting Regulatory Standards\* in Water Supply Zones**



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

**5.20** 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 5.7 need not necessarily reflect the

microbiological quality of the water supplied. Contraventions of microbiological standards are not necessarily a risk to human health, but indicate a potential risk. All microbiological contraventions in water supply zones, as with those at water treatment works and service reservoirs, are followed up urgently, and remedial action initiated by Water Service as a matter of policy.



# PHYSICAL/CHEMICAL QUALITY IN WATER SUPPLY ZONES

## Trihalomethanes (THMs)

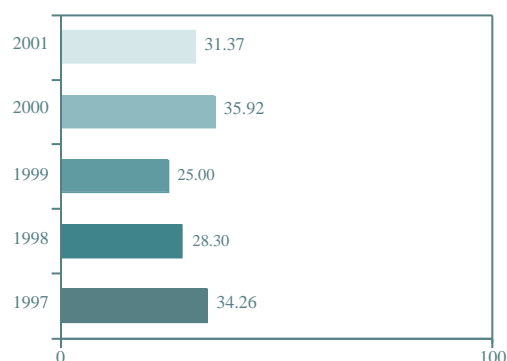
**5.21** Drinking water in Northern Ireland is predominantly obtained from surface waters, which are likely to contain naturally occurring organic materials. The leaching of this organic content into water supplies is affected by seasonal variations in the climate. Trihalomethanes are by-products of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

**5.22** There is no maximum admissible standard for trihalomethanes in the current Drinking Water Directive but the Regulations set a standard of 100 µg/l for trihalomethanes as an average over a three-month period for the sum of four specified trihalomethanes (see paragraph 4.18).

**5.23** In 2001, the number of determinations exceeding the numerical standard for trihalomethanes (100 microgrammes per litre) remains high at 53.55%, with 68.63% of water supply zones non-compliant with the regulatory standard and every effort must continue to be made to control the formation of THMs. Trihalomethanes, as in previous years, remains the parameter with the lowest reported compliance rate (Table 5.7 refers). The new Drinking Water Directive, which comes into force at the end of 2003, sets an interim standard for trihalomethanes of 150 µg/l (see paragraph 5.89). In the interim, trihalomethane compliance will continue to be reported against the current regulatory standard, but it can be noted that the 2001 compliance rate for trihalomethanes against the 150 µg/l standard would be 87.13%, with 49.02% of water supply zones complying with the standard.

**5.24** In 2001, the regulatory standard was contravened in 70 (68.63%) water supply zones (Figure 11 refers). Contraventions in all of these zones were assessed as non-trivial and formally notified to Water Service.

**Figure 11: Water Supply Zones Complying with THM Standard**



**5.25** While good overall microbiological quality has been improved for 2001, it may, at the same time, have contributed to the continuing high failure rate for trihalomethanes. Water Service has taken measures to improve the disinfection of water supplies and every effort must continue to be made to control the formation of THMs.

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

**5.27** Water Service's policy is to give priority to the maintenance of microbiological quality in water. Its major water treatment capital works programme is designed to reduce organic material prior to chlorination and, thereby, reduce trihalomethane levels. Water Service is also assessing the potential for wider use of monochloramine as an alternative disinfectant. In the interim, Water Service continues to review operational procedures, with the aim of reducing trihalomethane levels in the distribution system, while maintaining microbiological quality. Improved compliance is expected as improvements to water treatment works and distribution systems are completed.

## Lead

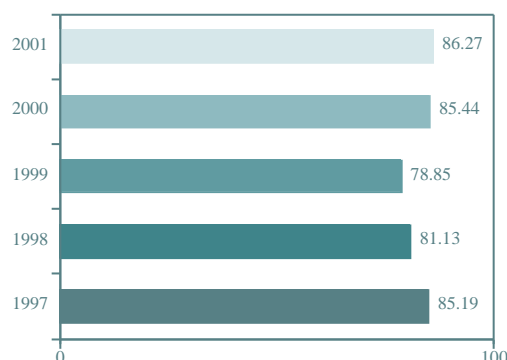
**5.28** In 2001, the regulatory standard for lead was contravened in 14 (13.73%) water supply zones. In light of the tighter lead standards in the new Drinking Water Directive, all 14 zones were assessed as having non-trivial contraventions of the regulatory standard for lead and these have been formally notified to Water Service.

**5.29** Continued targeted planned investment is necessary to improve regulatory compliance with the lead standard.

**5.30** Water Service has undertaken a more detailed investigative programme to identify water supply zones where there is a significant risk that the lead standard may be exceeded. In addition, Water Service is identifying water supply zones where there is a significant risk that future, more stringent lead standards may be exceeded. A pilot project, designed to minimize the solubility of lead, has been implemented using phosphate dosing in one water supply zone to enable optimum operating conditions to be determined. Water Service proposes that the majority of the supplies in Northern Ireland will be treated with

phosphate to minimize lead in the water supply and to achieve compliance with the existing 50 µg/l standard and the new interim standard of 25 µg/l.

**Figure 12: Water Supply Zones Complying with Lead Standard**



**5.31** In considering contraventions of the lead standard, it is particularly important to bear in mind that the nature and condition of the pipework at sampling locations may greatly influence the results obtained. Water leaving treatment works and in the distribution systems is essentially lead free. If lead is detected at a consumer's tap, it is caused by the action of water on existing lead service piping between the watermains and the tap. Occasionally, the use of lead solder can cause problems. Whether or not the lead standard is contravened at a particular tap depends on a number of factors, an important one being the plumbosolvency (the tendency for lead to dissolve in water) of the water. Water Service has an ongoing programme of pH adjustment to reduce plumbosolvency (see paragraph 5.53).

**5.32** In individual cases where samples have exceeded the regulatory standard for lead, Water Service will take follow-up samples and give the consumer appropriate advice as a matter of policy. Water Service has a general ongoing programme of replacement

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

## Aluminium

**5.33** Aluminium is naturally occurring in many water sources, particularly those derived from upland areas. Aluminium compounds are used as an important part of the processes 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.

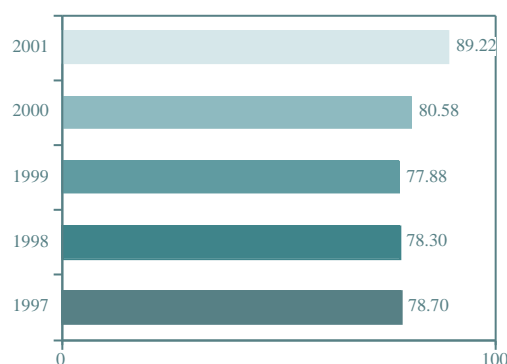
**5.34** The regulatory standard for aluminium is based on aesthetic considerations because high concentrations in water may cause discoloration. Water supply zones served from the Silent Valley source in the Mournes have, due to the nature and structure of the ground, naturally occurring aluminium in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

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

**5.35** In 2001, there was an increase in compliance to 98.14% from 96.02% in 2000. Contraventions of the regulatory standards for aluminium were recorded in 11 (10.78%) water supply zones in 2001; 20 water supply

zones were non-compliant in 2000. In 2001, six zones were assessed as having trivial contraventions. The non-trivial contraventions of the aluminium standards in five water supply zones have been formally notified to Water Service. These contraventions can result from changes in raw water quality or from fluctuations in the control of the water treatment process.

**Figure 13: Water Supply Zones Complying with Aluminium Standards**

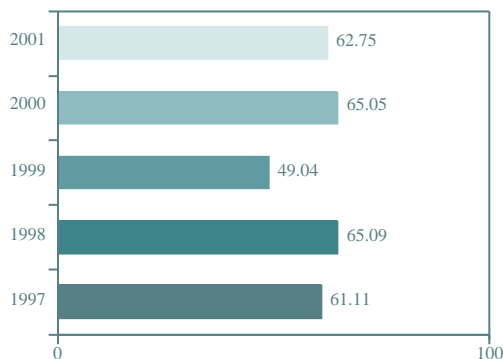


**5.36** As part of a major capital works programme, improvements to several water treatment works have been completed or are underway. In certain areas, there are indications that this has improved the individual aluminium compliance figures. 90.12% tests in 78.70% water supply zones in 1996 met the regulatory standards; in 2001, the comparable figures were 98.14% of tests in 89.22% water supply zones. In other situations however, compliance monitoring identifies areas where a targeted continued planned investment programme is necessary to further improve regulatory compliance with the aluminium standards.

## Iron

**5.37** The regulatory standard for iron has been set for aesthetic reasons because levels persistently above the standard can give rise to discoloured water. In 2001, there was an increase in compliance from 95.96% in 2000 to 97.06%. Contraventions of the regulatory standard for iron were recorded in 38 (37.25%) water supply zones in 2001. Contraventions in 24 of these zones were assessed as being trivial. The non-trivial contraventions of the iron standard in 14 water supply zones have been formally notified to Water Service.

**Figure 14: Water Supply Zones Complying with Iron Standard**



**5.38** 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 considered to be caused by corrosion of older, cast-iron watermains. Water Service has an ongoing programme of scouring and cleaning of the distribution system to minimize the problem. In addition, there is a continuing planned maintenance programme into the next decade, to reline and replace parts of the distribution system. Continued targeted planned investment is necessary to improve regulatory compliance with the iron standard.

## Polycyclic Aromatic Hydrocarbons (PAH)

**5.39** PAH 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. PAH 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 2001, contraventions of the regulatory standard for PAH were recorded in eight (7.84%) water supply zones. Contraventions in all of these zones were regarded as trivial because the 2001 Compliance Assessment evaluated PAH for triviality taking into consideration the new Drinking Water Directive requirements (see paragraph 4.22).

**Figure 15: Water Supply Zones Complying with PAH Standard**



**5.40** Although the reported PAH exceedences mean the water cannot be regarded as wholesome according to the definition in regulation 3, they are not regarded by the Inspectorate as being of immediate concern because the requirements of the new Drinking Water Directive were met. Water Service's planned maintenance programme of relining and replacing parts of the distribution system will, although primarily targeted at iron exceedences, continue to improve PAH compliance.

## Pesticides

**5.41** 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 2001, 40 individual pesticides were monitored.

**5.42** During 2001, 16,142 determinations were carried out for individual pesticides. Of these, 16 (0.10%) exceeded the very stringent 0.1 µg/l regulatory standard.

In every instance, the contraventions corresponded to exposures far smaller than those known to be harmful or likely to affect health. For 15 of the contraventions, the levels detected were all well within the Government Advisory Values given in the Guidance Document, 'Safeguarding Public Water Supplies'\*; the remaining contravention was within the World Health Organization Guideline.\*\*

**5.43** During 2001, ten contraventions of the regulatory standard for MCPA were reported in five water supply zones. Contraventions for one water supply zone were assessed as trivial; four water supply zones were assessed as having non-trivial contraventions and these have been formally notified to Water Service.

**5.44** Two contraventions of the regulatory standard for mecoprop were reported in two water supply zones in 2001. Both were assessed as being non-trivial and these have been formally notified to Water Service.

**5.45** Two contraventions of the regulatory standard for glyphosate were reported in two water supply zones. Both contraventions were assessed as trivial.

**5.46** One pentachlorophenol and one simazine contravention of the regulatory standard were reported in 2001. Both contraventions were assessed as trivial.

**5.47** 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. The pesticides that have been detected above the regulatory standard, were some of those more commonly used: MCPA, mecoprop, atrazine, glyphosate and asulam (Table 5.8 refers).

**Table 5.8: Number of Individual Pesticide Exceedences in Water Supply Zones, 2001-1997**

Pesticide Name	2001	2000	1999	1998	1997
MCPA	10	8	9	13	21
Mecoprop	2	1	1	3	18
Atrazine			1		5
Glyphosate	2		3	1	
Asulam			2 <sup>1</sup>		
Simazine	1				
Pentachlorophenol	1				
Total No. of Exceedences	16	9	16	17	44

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

\*\* 'Guidelines for Drinking Water Quality', Volume 1, Second Edition. WHO 1993. (ISBN 92 4 154460 0).

<sup>1</sup> Amended figure – December 2000 erratum

**5.48** Meetings of the current interdepartmental liaison group, comprising Department of Agriculture and Rural Development, Environment and Heritage Service and Water Service, provide the forum for discussion of pesticide usage and catchment control, including evaluation of the possibility of reducing the impact of pesticides in raw water sources from which drinking water is derived. The Inspectorate has provided information to the group.

### Nitrate

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

**Figure 16: Water Supply Zones Complying with Nitrate Standard**



**5.50** The Inspectorate notes that changes made in operational practice have improved compliance and there have been no contraventions of the regulatory standard reported for nitrate since 1998.

**Figure 17: Water Supply Zones Complying with pH Standard**



### Hydrogen ion (pH)

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

**5.52** Contraventions of the maximum pH regulatory standard were recorded in eight (7.84%) water supply zones. One of these water supply zones also contravened the minimum pH regulatory standard. Contraventions in five water supply zones were regarded as non-trivial and have been formally notified to Water Service.

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

**Figure 18: Water Supplying Zones Complying with Manganese Standards**



## Manganese

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

**5.55** In 2001, there were two contraventions of the regulatory standard for manganese recorded in one water supply zone. These contraventions were considered non-trivial and have been formally notified to Water Service.

## Turbidity

**5.56** 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.

**5.57** Contraventions of the regulatory standard for turbidity were recorded in three (2.94%) water supply zones during the 2001 compliance assessment. Contraventions in

two of these water supply zones were regarded as trivial; one water supply zone was assessed as non-trivial and has been formally notified to Water Service.

## Odour (quantitative) and Taste (quantitative)

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

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

In 2001, there were no contraventions of the regulatory standards recorded for odour (quantitative) or taste (quantitative) in any water supply zones.

## Colour

**5.60** The regulatory standard for colour is based on aesthetic considerations; water should be clear and bright. Water may become coloured due to the nature and structure of the ground. In some circumstances, water may also become coloured as it comes into contact with old iron mains.

**5.61** There are extensive permitted relaxations of the colour standard where the colour is due to the nature and structure of the ground. The compliance assessment takes permitted relaxations into account (see paragraph 4.15). In 2001, there were no contraventions of the regulatory standards for colour.

## Other Parameters

- 5.62** The penultimate item (other parameters) in Table 5.7 shows that in 2001, 10,139 determinations were made on the wide range of other parameters in the Regulations. Of these, only three parameters, (oxidizability, ammonium and mercury) contravened the regulatory standard.
- 5.63** The oxidizability parameter provides an indication of changes in water quality and estimates organic content. Total organic carbon measurement also fulfils this function but does not have a PCV assigned to it (see paragraph 4.5). Therefore, the eight contraventions of the regulatory standard for oxidizability which were reported in five water supply zones were considered trivial.
- 5.64** Ammonium concentrations contravened the regulatory standard on nine occasions in one water supply zone; this contravention was assessed as non-trivial and formally notified to Water Service.
- 5.65** Ammonium can be present in water naturally or due to certain water disinfection processes. Enhanced operational control of the water treatment process should improve compliance. The analytical method used to detect ammonium is under investigation by Water Service.
- 5.66** One mercury contravention of the regulatory standard was reported in one water supply zone during 2001. This contravention was not repeated on resampling and was assessed as trivial.

## *Cryptosporidium*

- 5.67** *Cryptosporidium* is a parasitic organism which has been recognized as a cause of

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

- 5.68** During 2001, the Inspectorate, with the co-operation of Water Service, continued to review the *Cryptosporidium* risk assessments at all water treatment works. This work is ongoing and enables *Cryptosporidium* sampling programmes to be developed. The establishment of risk assessment procedures, and therefore, a list of sites potentially at risk, allow targeted preventative measures to be established and implemented.
- 5.69** In May 2002, the Inspectorate issued a revised document, 'Guidance for the Monitoring of *Cryptosporidium* in Treated Water Supplies in Northern Ireland'\* which includes details on:
- risk assessment guidance;
  - sampling frequencies;
  - new sampling and analytical testing methods;
  - liaison between Water Service and the health authorities;
  - outbreak control guidance; and
  - reporting procedures.

\* Document available on the Drinking Water Inspectorate's website: <http://www.ehsni.gov.uk/environment/drinkWater/links.shtml>

## Continuous Monitoring Programme

**5.70** In line with the rest of the United Kingdom, a major activity during 2001 was the continuing implementation of arrangements for monitoring *Cryptosporidium*. The arrangements were established for public health protection and incorporate a formal notification level of one or more oocysts per 10 litres and an alert level of 0.1 oocysts per 10 litres.

**5.71** Initially, continuous monitoring commenced at one site in February 2000. The sampling programme was extended during 2000 following two *Cryptosporidium* incidents to cover a further two sites.

**5.72** Following the annual risk assessment, at the beginning of 2001, out of 63 water treatment works, 4 sites were included in a continuous monitoring programme. As a result of the *Cryptosporidium* incident in April 2001 (paragraph 4.36 refers), a fifth site was added to the sampling programme.

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

**5.74** The results of the continuous monitoring programme are reported for 2000 and 2001.

### **2000 *Cryptosporidium* Summary Results**

- Three sites were monitored and 407 samples were analysed during 2000;
- oocysts were found in 20.15% of samples;
- oocysts were detected at all three sites monitored;
- no level above 1 oocyst per 10 litres was found in any of the samples;

- 0.98% of samples recorded a level above 0.1 oocyst per 10 litres; these occurred at two sites; and
- the highest concentration recorded was 0.40 oocysts per 10 litres.

### **2001 *Cryptosporidium* Summary Results**

- Five sites were monitored and 978 samples were analysed during 2000;
- oocysts were found in 16.87% of samples;
- oocysts were detected in four of the five sites monitored;
- no level above 1 oocyst per 10 litres was found in any of the samples;
- 3.78% of samples recorded a level above 0.1 oocyst per 10 litres; these occurred at three sites; and
- the highest concentration recorded was 0.62 oocysts per 10 litres.

The results obtained from the continuous monitoring programme continue to provide information on the levels of *Cryptosporidium* oocysts in water supplies.

**5.75** *Cryptosporidium* remains a water quality issue of concern and it is imperative that enhanced protection measures continue to be considered by Water Service.

**5.76** 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 any remaining potential risk from *Cryptosporidium* in the drinking water supply.

## Standard Sampling Frequencies

- 5.77** The Water Quality Regulations (Northern Ireland) 1994 set out sampling requirements which demonstrate the wholesomeness of drinking water supplies. For 2001, the Inspectorate carried out an assessment of the regulatory standard sampling frequencies for water supply zones, water treatment works and service reservoirs.
- 5.78** 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.
- 5.79** 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.
- 5.80** Based on the compliance assessment of the regulatory requirements for sampling and analysis, Water Service has generally met the requirements. Deficiencies where the requirements have not been met are identified and further information for each sampling location type is given in paragraphs 5.81-5.88.
- 5.81** During 2001, 53,970 determinations were carried out on samples taken at consumers' taps in water supply zones. The Inspectorate identified a shortfall of 835 determinations; 1.55% of the regulatory standard sampling requirements for water supply zones were assessed as non-trivial. The comparable figure reported for 2000 was 1.03%.
- 5.82** The compliance assessment of each water supply zone is made on a parameter basis; 67 (65.69%) water supply zones recorded a non-trivial sampling contravention for at least one parameter; the comparable figure for 2000 was 69.90%. Fifty seven water supply zones had sampling shortfalls for more than one parameter in 2001; 52 water supply zones in 2000.
- 5.83** Compliance assessments of regulatory sampling requirements were carried out for water treatment works and service reservoirs.
- 5.84** In 2001, sampling points at 63 water treatment works were routinely sampled and analysed. The Inspectorate identified 30 (47.62%) water treatment works where there was a shortfall of the regulatory standard sampling frequency; 17 water treatment works (26.98%) recorded a non-trivial sampling contravention.
- 5.85** In 2001, samples were taken from 362 service reservoirs. The Inspectorate identified a shortfall of the required sampling frequencies in 174 (48.07%) service reservoirs; 86 (23.76%) service reservoirs had non-trivial sampling frequency contraventions.
- 5.86** Water Service has been formally notified of the non-trivial contraventions of the standard sampling frequencies for water supply zones, service reservoirs and water treatment works. Action will be taken to remedy the sampling shortfall.
- 5.87** The Inspectorate notes the rate of non-compliances reported for the standard sampling frequencies and is aware of the difficulties experienced with the sample programme management facilities of the Laboratory Information Management System (LIMS) in operation during 2001. The Inspectorate, therefore, anticipates improved compliance rates for sampling frequencies during 2002 when the new LIMS becomes operational.
- 5.88** The Inspectorate recognizes that some rural sources: service reservoirs and rural zones may have been within areas of restricted access due to the foot and mouth outbreak which occurred during 2001.

## Compliance with New Drinking Water Quality Standards

**5.89** A new European Drinking Water Directive (98/83/EC) was published in the Official Journal of the European Communities on 25 December 1998. This sets out new and revised standards for a number of parameters which have been incorporated in the new Water Supply (Water Quality) Regulations (Northern Ireland) 2002. Most of the new and tighter standards have to be met by the end of 2003. For bromate, lead and trihalomethanes, interim standards have to be met by the end of 2003, and final standards by the end of 2008, 2013 and 2008 respectively.

**5.90** The new Drinking Water Directive contains two types of parameter values. Firstly, there are mandatory standards that have to be met by the specified dates given above. Secondly, there are non-mandatory indicator values for monitoring purposes. These

parameters have been listed previously in the 'Northern Ireland Drinking Water Quality 2000 Report'. Any exceedence of a value has to be investigated, but remedial action only needs to be taken when there is a risk to public health.

**5.91** The new Regulations require Water Service to monitor against new prospective standards for six new parameters. These parameters are listed in Table 5.9 below. This monitoring is required to ascertain if remedial work will be required to meet the new standards proposed in the new Regulations.

**5.92** Water Service will also be required to monitor against prospective tighter standards for nine parameters that are included in the current Water Quality Regulations (Northern Ireland) 1994. These are listed in Table 5.10. The existing standards remain in force until 25 December 2003.

**Table 5.9: New Mandatory Standards**

Parameter	New Standards to Apply on 25.12.2003	Comments
Benzene	1.0 µg/l	
Bromate	10.0 µg/l	
1,2 dichloroethane	3.0 µg/l	
Enterococci	0/100 ml	
Clostridium perfringens	0/100 ml	Indicator parameter
Nitrite	0.1 mg/l	New standard applies at water treatment works

\* This report is available on the website: <http://www.ehsni.gov.uk/environment/drinkWater/links.shtml>

**Table 5.10: Parameters with New Mandatory Standards**

Parameter	Existing Standards Within the 1994 Regulations	New Standards to Apply on 25.12.2003	Comments
Antimony	10.0 µg/l	5.0 µg/l	
Arsenic	50.0 µg/l	10.0 µg/l	
Boron	2.0 mg/l	1.0 mg/l	
Copper	3.0 mg/l	2.0 mg/l	
Lead	50.0 µg/l	25.0 µg/l	Final standard of 10 µg/l will apply on 25.12.2013
Nickel	50.0 µg/l	20.0 µg/l	
Polycyclic aromatic hydrocarbons (PAH)	0.2 µg/l	0.1 µg/l	New standard excludes fluoranthene and benzo 3,4-pyrene
Tetrachloroethene	10.0 µg/l	10.0 µg/l	New standard applies to the sum of the two substances
Trichloroethene	30.0µg/l		

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

# DRINKING WATER QUALITY INCIDENTS AND COMPLAINTS

## Drinking Water Quality Incidents

6.1 Where a water quality incident or event has occurred, Water Service is required to provide the Inspectorate with information, in accordance with agreed procedures. The Inspectorate defines an incident as a situation where there has been a demonstrable deterioration in the quality of drinking water giving rise to a significant potential risk to the health of consumers, or a significant adverse, aesthetic water quality change. Where no such deterioration has taken place, the situation is classified as an event. All incidents and events are assessed by the Inspectorate. In 2001, Water Service notified the Inspectorate of six water quality incidents and one event.

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

**Table 6.1: Water Quality Incidents/Events**

Date	Location	Nature of Incident/Event	Classification
February 2001	Drumhubbert Road, Stewartstown	Taste & odour problems following commissioning of new watermain.	Event
April 2001	Dunore Point	<i>Cryptosporidium</i> outbreak.	Incident
August 2001	Lisnagirr Road, Omagh	Bacteriological exceedence – ‘Boil Notice’ issued.	Incident
August 2001	Ballymulligan Road, Magherafelt	Bacteriological exceedence – ‘Boil Notice’ issued.	Incident
October 2001	Ballymulligan Road, Magherafelt	Bacteriological exceedence – ‘Boil Notice’ issued.	Incident
November 2001	Mallusk Village, Newtownabbey	Burst sewer ingressed into a split service pipe – ‘Boil Notice’ issued.	Incident
December 2001	Ballyclare Road, Templepatrick	Bacteriological exceedence – ‘Boil Notice’ issued.	Incident

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

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## Drinking Water Complaints

**6.3** In 2001, the Inspectorate received 22 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:

### Public Water Supply

- discoloration (8 complaints);
- potential contamination (3 complaints);
- discoloration and sediment (2 complaints);
- discoloration, taste and odour (1 complaint);
- taste and odour (1 complaint);
- discoloration and taste (1 complaint);
- taste, odour and sediment (1 complaint);
- odour (1 complaint);
- taste (1 complaint); and
- presence of aquatic fauna (1 complaint).

### Private Water Supply

- microbiological contamination (1 complaint).

### Bottled Water\*

- taste and odour (1 complaint).

\* *Bottled water is not the responsibility of the Drinking Water Inspectorate. Local district councils have responsibility for bottled waters under The Natural Mineral Water Spring Water and Bottled Water Regulations (Northern Ireland) 1999. A copy of these Regulations may be obtained from Her Majesty's Stationery Office, 16 Arthur Street, BELFAST BT1 4GD.*

# PRIVATE WATER SUPPLIES

## Private Water Supplies Monitoring Programme

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

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

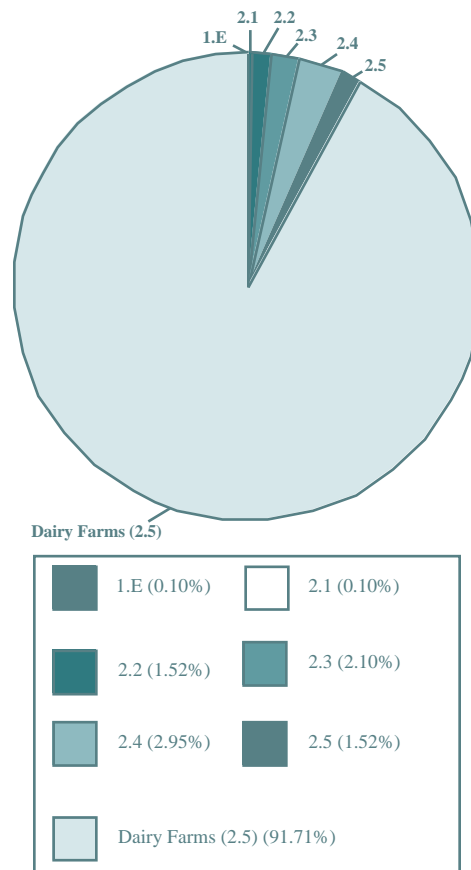
**7.3** The Regulations set monitoring requirements based on the size and nature of the private supply, taking into account the volume or the number of people using the supply. Private water supplies are split into two categories:

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

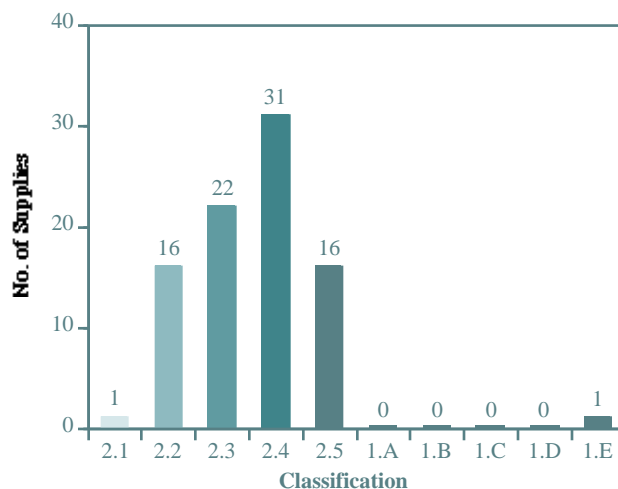
**7.4** This section lists the number of water supplies identified under the Private Water

Supplies Regulations. For 2001, 1,050 private water supplies were identified and categorized into six classifications (Figures 19 and 20 refer).

**Figure 19: Private Water Supplies – 2001 Classification Categories Including Dairy Farms**



**Figure 20: Private Water Supplies – 2001 Classification Categories Excluding Dairy Farms**



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- 7.5** In Northern Ireland the majority of private water supplies fall within category 2, class 5 relating primarily to dairy farms, which accounts for approximately 92% of all private water supplies tested (Figure 19 refers).
- 7.6** A sampling and analysis programme determines water quality against the standards. The frequency of the sampling and the type of parameters tested are based on the nature of the supply. Dairy farms are sampled only for microbiological analysis and these account for 4.89% of all determinations carried out in 2001. All other classified private water supplies are sampled and analysed for microbiological and physical/chemical determinations.
- 7.7** The sampling of private water supplies excluding dairy farms is carried out on behalf of the Inspectorate by the Environmental Health Departments of the relevant district councils. The Inspectorate has in place a contract for sample analyses, which specifies that any laboratory undertaking such work must have UKAS accreditation.
- 7.8** A separate sampling, analysis and reporting programme of dairy farms is carried out on the Inspectorate's behalf by the Quality Assurance Division of the Department of Agriculture and Rural Development (DARD). The DARD laboratory at Newforge, which has UKAS accreditation, undertakes the analysis. The Department of Agriculture and Rural Development takes responsibility for investigating and acting upon contraventions of the regulatory standards for these private water supplies.
- 7.9** The Inspectorate acknowledges the co-operation of staff from both the Quality Assurance Division and Newforge Laboratory of DARD and from the relevant district council Environmental Health Departments, in carrying out their activities in relation to the Private Water Supplies Regulations.

### **Overview of Water Quality for 2001**

- 7.10** Since June 1999, the Inspectorate has been carrying out a sampling and analysis programme as specified within the Private Water Supplies Regulations (Northern Ireland) 1994. The tables and figures included in this section provide summary information on private water supplies for the period 1999 to 2001 (Tables 7.1, 7.2 and Figures 21 and 22 refer).

**Table 7.1: Water Quality in Private Water Supplies 1999-2001**

Parameters	Determinations in 2001			Determinations in 2000**			Determinations in 1999**		
	Total No.	Exceeding PCV		Total No.	Exceeding PCV		Total No.	Exceeding PCV	
		No.	%		No.	%		No.	%
Total Coliforms*	621	99	15.94	403	54	13.40	215	27	12.56
Faecal Coliforms*	621	49	7.89	402	22	5.47	217	9	4.15
Iron	135	26	19.26	119	20	16.81	64	11	17.19
Manganese	134	22	16.42	120	14	11.67	64	11	17.19
Trihalomethanes	135	16	11.85	119	15	12.61	58	7	12.07
Sodium	82	5	6.10	70	1	1.43	38	0	0.00
Odour (quantitative)	128	5	3.91	116	8	6.90	61	0	0.00
Turbidity	154	6	3.90	140	8	5.71	73	1	1.37
Ammonium	135	5	3.70	121	3	2.48	64	0	0.00
Aluminium	135	5	3.70	119	5	4.20	64	1	1.56
Colour	135	4	2.96	120	6	5.00	64	1	1.56
Oxidizability	82	2	2.44	70	4	5.71	38	1	2.63
Taste (quantitative)	107	2	1.87	77	1	1.30	40	0	0.00
Nitrite	135	2	1.48	119	1	0.84	63	3	4.76
Calcium	82	1	1.22	70	1	1.43	38	0	0.00
Sulphate	82	1	1.22	70	2	2.86	38	1	2.63
Magnesium	82	1	1.22	70	2	2.86	38	0	0.00
Conductivity	198	2	1.01	187	1	0.53	104	0	0.00
Nitrate	153	1	0.65	140	0	0.00	77	2	2.60
Temperature	311	2	0.64	332	5	1.51	192	2	1.04
Hydrogen ion	198	1	0.51	187	1	0.53	104	1	0.96
Total pesticides	73	3	4.11	70	2	2.86	33	1	3.03
Individual pesticides	3,139	5	0.16	3,011	12	0.40	1,419	2	0.14
Other parameters	2,389	0	0.00	2,080	5	0.24	1,160	3	0.26
<b>TOTAL</b>	<b>9,446</b>	<b>265</b>	<b>2.81</b>	<b>8,332</b>	<b>193</b>	<b>2.32</b>	<b>4,326</b>	<b>84</b>	<b>1.94</b>

\* When interpreting coliform data, it should be noted that it is only for 2001 that the results include dairy farms.

\*\* The data included for 1999 and 2000 has been amended from that given in the 1999 and 2000 water quality reports.

**Note:** Results for 1999 are only available for the period June to December.

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

- changes in the sampling programme due to annual review of the identification and classification of private water supplies; and
- improvements in analytical and reporting systems which may have reduced or eliminated the possible contribution to earlier data reporting of results of uncertain accuracy.

**7.12** During 2001, 1,050 private water supplies were sampled for a wide range of parameters. Of the 1,050 supplies, 963 were dairy farms and these are monitored only for compliance with the microbiological regulatory standards (Figure 21 refers). The remaining 87 private water supplies were monitored for microbiological and physical/chemical compliance (Figure 22 refers).

**7.13** The private water supplies' results show that out of a total of 9,446 tests carried out in 2001, 97.19% met the regulatory standards. The regulatory requirements were not met on 265 occasions.

**7.14** Contraventions were reported for two microbiological parameters and 24 physical/chemical parameters (Table 7.1 refers).

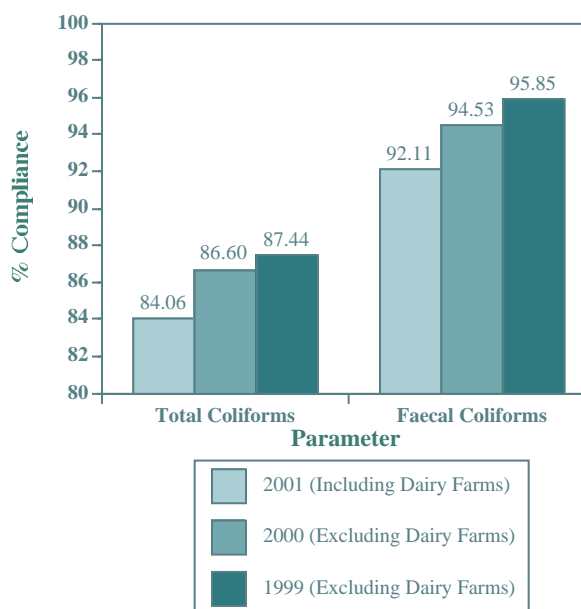
**7.15** Contraventions of the regulatory standards are notified by the Inspectorate to the relevant district council's Environmental Health Department, the owner/occupier of the supply and DARD. All contraventions are investigated by the Inspectorate, mainly in conjunction with the appropriate

Environmental Health Department, and actions taken depending on the nature and level of the failure.

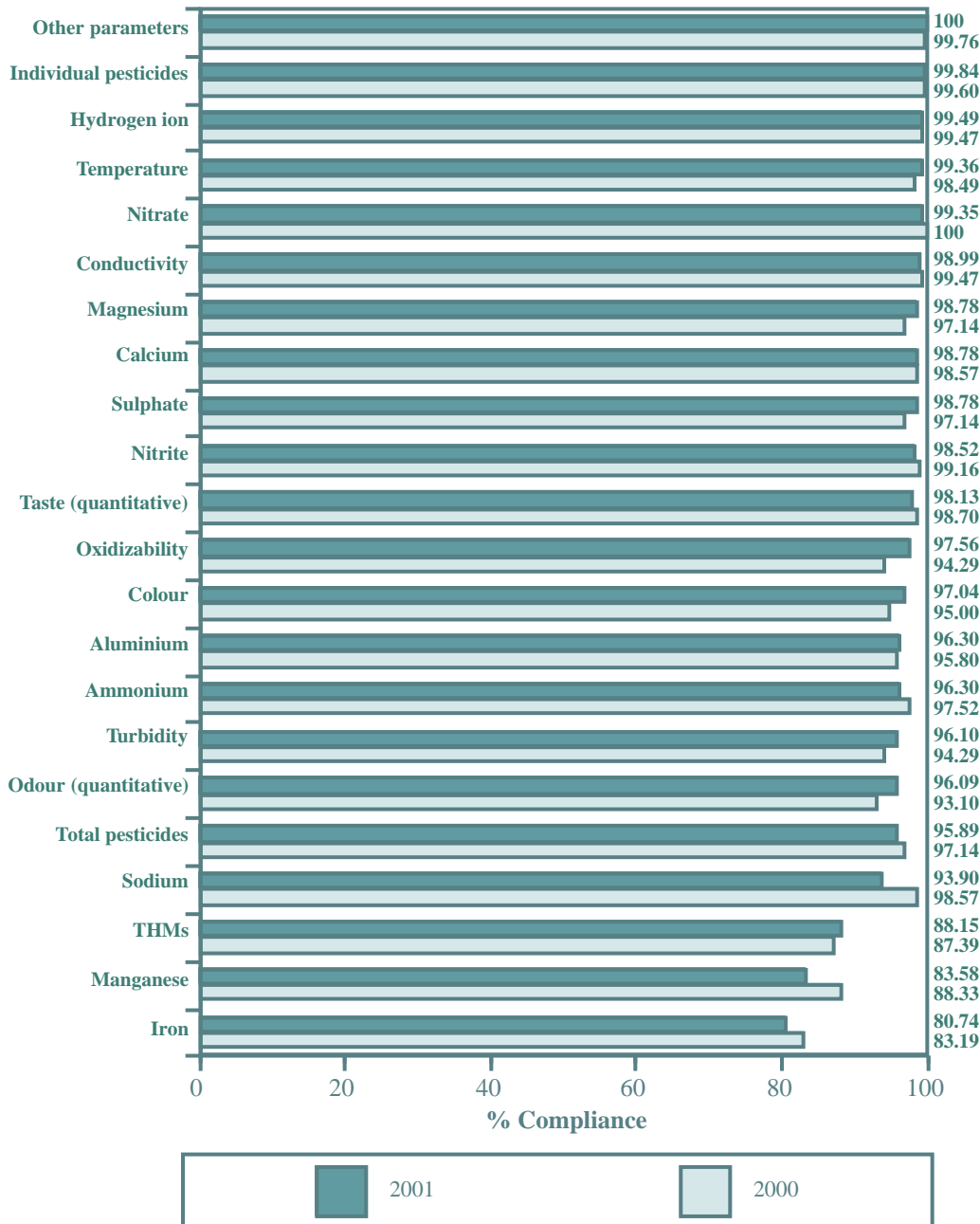
## Microbiological Quality of Private Water Supplies

**7.16** Figure 21 presents summary compliance data for the key microbiological parameters. When making comparisons between the years, it is important to take into consideration in any interpretation of the microbiological data that dairy farms have been included for the first time in the current reporting year assessment. The compliance figure for 2001 for all microbiological samples is 88.08% (84.06% for total coliforms and 92.11% for faecal coliforms). This overall compliance rate will be the baseline against which future microbiological quality will be monitored.

**Figure 21: Summary of Microbiological Quality in Private Water Supplies**



**Figure 22: Physical/Chemical Quality in Private Water Supplies**



**7.17** Contraventions of the physical/chemical parameters have been reported over a range of parameters. These non-compliances relate largely to iron (19.26%), manganese (16.42%), and THMs (11.85%).

**7.18** An ongoing pesticide-monitoring programme is undertaken for private water supplies. During 2001, 43 individual pesticides were monitored. Of these, four individual pesticides exceeded the regulatory standard. Table 7.2 lists the pesticides which have exceeded the regulatory standards since monitoring began.

**Table 7.2 Number of Individual Pesticide Exceedences in Private Water Supplies, 2001-1999**

Pesticide Name	2001	2000	1999
MCPA	2	6	0
MCPP	1	2	0
Diuron	1	1	0
2, 4-D	1	0	0
Atrazine	0	1	1
2, 4-Dichlorophenol	0	1	0
Isoproturon	0	1	0
Chlortoluron	0	0	1
<b>Total number</b>	<b>5</b>	<b>12</b>	<b>2</b>

### Provision of Information

**7.19** To increase awareness of the water quality of private water supplies, the Inspectorate produced a leaflet 'Is Your PRIVATE Water Supply SAFE?\*', which was widely circulated to owners through the Department of Agriculture and Rural Development, and the 26 district councils. The purpose of the leaflet is to alert owners and users of private water supplies to the potential risks of contamination of their water supplies.

### Future Private Water Supplies Regulatory Framework

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

### Groundwater Monitoring

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

\* This leaflet is available on the website: [http://www.ehsni.gov.uk/environment/drinkWater/private\\_water.shtml](http://www.ehsni.gov.uk/environment/drinkWater/private_water.shtml)

# DRINKING WATER RESEARCH

**8.1** Most research into drinking water quality and health is funded by the Department of the Environment, Food and Rural Affairs (DEFRA) as part of a research programme designed to meet the needs of the United Kingdom Government in formulating policy relating to the quality of public and private water supplies, and in imparting sound scientific input to European and worldwide debate on drinking water issues. The Drinking Water Inspectorate for England and Wales provides the research programme management and administration function for the Water Directorate (WD) of DEFRA. The Drinking Water Inspectorate for England and Wales also provides the contract management function for the Water Distribution, Conservation and Quality (WDCQ) research programme. The content of the research programme is determined annually by the Research Programme Committee. The objectives of the programme are to assist DEFRA and the Welsh Assembly Government to formulate policy on the quality and regulation of water supplies and to make an input to European and international drinking water issues. The WD research programme is a component of the DEFRA Environment Protection Group (EPG) research programme.

## Information on WDCQ Research

- 8.2** Enquiries should be addressed to DWI Enquiries, 2/A2 Ashdown House, 123 Victoria Street, London SW1E 6DE.
- 8.3** Executive summaries of the WDCQ research reports and earlier Department of the Environment and DETR drinking water research reports are posted on the Foundation for Water Research web site: [www.fwr.org](http://www.fwr.org). This web site also contains details of how to obtain copies of research reports.
- 8.4** General enquiries about the EPG programme should be directed to: Ken Nulty,

DEFRA, Zone 4/C2, Ashdown House, 123 Victoria Street, London SW1E 6DE.

## COMPLETED RESEARCH PROJECTS

### *Cryptosporidium*

#### **8.5 National Reference Collection of *Cryptosporidium* Oocysts**

A molecular fingerprinting system has been developed using gene probes to characterize the surfaces of oocysts. Genotype data has been generated for almost 5,000 human isolates and some 40 *Cryptosporidium* genotypes have been identified. This system has potential for application in tracing sources of outbreaks and sporadic infections, and is currently being applied to samples collected during epidemiological investigations. **Project contractor** - Scottish Centre for Infection and Environmental Health, and the Public Health Laboratory Service (PHLS).

### Other Health Risks and Monitoring

#### **8.6 Future Regulatory Parameters**

This project identified parameters which are not currently included in the UK Drinking Water Regulations and which might be the subject of future regulation. The report reviewed international sources of information and made proposals for a number of chemical and microbiological parameters where further information on occurrence and distribution might be warranted. **Project contractor** - Metcalf & Eddy (formerly, Warren Associates) and CREH.

#### **8.7 Fate of Mycobacterium Avium Complex in Drinking Water Treatment and Distribution Systems**

This report covers a study into the prevalence of *M. avium* complex (MAC) and *M. avium* var paratuberculosis (MAP) in potable water in England. Methods were developed to culture MAC and MAP from drinking water and used to investigate the

occurrence from various points in six water treatment and distribution systems in England, chosen to represent a range of sources and treatment conditions. The failure to detect MAP in any sample provides some assurance that public water supplies in England are not commonly contaminated with large numbers of MAP. **Project contractor** – PHLS.

### **8.8 The Incidence of *Cryptosporidium* in Private Water Supplies**

Seven private water supplies within the UK were intensively sampled for a range of micro-organisms including *Cryptosporidium*, *Giardia*, *Camylobacter* and *E coli* O157 over two six week periods in 2000. The results, issued in 2001, showed that sites which have proper sanitary surveys and a well protected water supply, have no microbiological problems. Sites in rural areas where there is no control over source water quality and water treatment is absent, will have periods of high microbiological contamination, which may not be detected by low frequency monitoring. This project was funded jointly with the Scottish Executive and the Northern Ireland Drinking Water Inspectorate. **Project contractor** – CREH.

## **Materials Testing and Approval**

### **8.9 Technical Support for CEN Workshop Agreement on Membranes for Drinking Water Treatment**

The workshop activity is complete and the report is now being processed as a CEN standard "Water Treatment Membranes - Influence of Materials on Water Intended for Human Consumption - test method". Materials approval test procedures based on this method are now being used in the UK and France. **Project contractor** – BSI and WRc.

### **8.10 Preliminary Study on the Reproducibility of BS7766: 2001**

The draft BS7766: 2001 updates "Assessment of the Potential for Metallic Materials to Affect Adversely the Quality of Water Intended for Human Consumption: BS 7766: 1994". The study was commissioned to provide the input to the specification of a larger inter-laboratory study on the reproducibility of the final version of the revised standard. (See current research.) **Project contractor** - ITS Testing & Certification Ltd.

## **CURRENT RESEARCH PROJECTS**

### **Water Supply Within Consumers' Premises**

#### **8.11 Review of International Standards for Re-use of Grey Water**

Construction Industry Research and Information Association (CIRIA) has now published the final reports: "Rainwater and Greywater use in Buildings – Best Practice Guidance" and "Rainwater and Greywater use in Buildings – Decision-Making for Water Conservation". **Project contractor** – CIRIA.

#### **8.12 Water Supply (Water Fittings) Regulations – Updating of Regulators' Specifications**

The specifications developed under the former water byelaws have been updated. It is proposed to disseminate the new specifications by posting them on the Water Regulations Advisory Scheme's website. **Project contractor** – WRc.

### ***Cryptosporidium***

#### **8.13 West Cumbria Epidemiological Study**

This ongoing study was commissioned in 1995. It is now investigating whether upgrading of water treatment processes has an impact on the reported levels for

incidence of cryptosporidiosis. The study is also investigating whether installation of treatment is accompanied by any changes in the sero-prevalence status of the population.

**Project contractor** – West Cumbria Health Authority.

#### **8.14 Effectiveness of UV Treatment for *Cryptosporidium* in Drinking Water**

DEFRA is participating in an international collaboration that is evaluating the application of *Cryptosporidium* cell culture as a surrogate indicator of potential for human infection. The research will assess also the effectiveness of UV under worst-case conditions of source water quality.

**Project contractor** – UK Water Industry Research Ltd.

#### **8.15 Enhanced Surveillance of *Cryptosporidium* in the UK**

This study commenced in 2000 and is due to report at the end of 2002. It is investigating the epidemiology of sporadic cryptosporidiosis in two regions of the UK during the implementation of the new regulations. It involves a case control study and a sero-epidemiological study of infection rates. Funded jointly with United Utilities.

**Project contractor** – PHLS.

### **Materials Testing and Approval**

#### **8.16 Exposure to Chloropropanol Isomers via Polyamines**

An analytical method is being developed to permit an assessment of the exposure of consumers to chloropropanol isomers arising from the use of polyamine flocculants in drinking water treatment. The study will also assess exposure to chloropropanol isomers at selected water treatment works.

**Project contractor** – LGC (Teddington).

#### **8.17 Reliability of Test Methods for Metallic Products**

An inter-laboratory study involving three UK laboratories will assess the robustness and

reproducibility of the 2001 revision to BS7766: "Assessment of the Potential for Metallic Materials to Affect Adversely the Quality of Water Intended for Human Consumption". **Project contractor** - WRC-NSF.

#### **8.18 Provision of Expert Advice for European Research and Standardization Activities**

This study supports DEFRA's regulatory input to the European Acceptance Scheme (EAS) for drinking water construction products, and research is under way to develop a Positive List system for the approval of products under the EAS.

**Project contractor** - WRC-NSF.

#### **8.19 Development of Test Methods for the European Acceptance Scheme**

DEFRA is supporting UK involvement in an EU Framework V project that is developing tests for cytotoxic effects, the potential to support microbial growth, and screening for unsuspected contaminants leaching from drinking water construction products.

**Project contractor** – WRC-NSF and the Water Quality Centre.

### **Other Health Risks and Monitoring**

#### **8.20 Performance Testing of Analytical Method for Oestrogen Steroids**

Inter-laboratory trials are under way and, subject to acceptable performance, the method will be published by the Environment Agency in the Standing Committee of Analysts' series of publications. **Project contractor** - LGC (Teddington).

#### **8.21 Monitoring the Integrity of Low-Pressure Membrane Processes for Drinking Water Treatment**

DEFRA is collaborating with American Water Works Association Research Foundation (AWWARF) to evaluate the application of innovative monitoring techniques. Literature reviews have been completed and field

studies are under way at water treatment plants in the United States. **Project contractor** - AWWARF.

#### **8.22 Support for Review of WHO Guidelines for Drinking Water**

The contractor has continued to provide toxicological advice on issues arising from WHO review meetings. **Project contractor** - Metcalf & Eddy.

### **Water Supply Within Consumers' Premises**

#### **8.23 Review of Benefits and Disbenefits of Drinking Water Storage Within Premises**

The UK has a traditional requirement for provision of storage within premises. In mainland Europe, the practice has been to supply all taps within premises with a supply at mains pressure. This project will review the consequences for cost and water quality, and operational aspects of continuing to maintain a requirement for storage. **Project contractor** - Binnie, Black & Veatch.

#### **8.24 Assessment of the Effect of In-house Treatment Devices on the Quality of Public Water Supplies**

Filtration systems are frequently used by consumers to improve the aesthetic quality of water. This study will examine whether jug-type filters cause any deterioration in the quality of the water supplied by water companies. **Project contractor** - WRc-NSF.

## **CURRENT LOCAL RESEARCH PROJECTS**

### **Radon in Drinking Water**

#### **8.25 Radon in Private and Public Water Supplies**

Environment and Heritage Service (Industrial Pollution and Radiochemical Inspectorate (IPRI) and Drinking Water Inspectorate) has contracted a study with the National Radiological Protection Board (NRPB), on the measurement of radon in private water supplies in Northern Ireland. **Project contractor** – NRPB and Queen's University, Belfast.

### **Paratuberculosis in Drinking Water**

#### **8.26 Persistence of *Mycobacterium Avium* Complex in Drinking Water Treatment and Distribution Systems**

The project aimed to determine whether the *Mycobacterium avium* could survive the disinfection element of the standard water treatment process. The project investigated the bactericidal effect of chlorine on *Mycobacterium avium var paratuberculosis* (MAP) in drinking water supplies. The work developed a method for the detection of the organism in water. Research highlighted the need for further research into the survival of MAP during water treatment. Project co-ordinated by DARD/DWI and the work was undertaken at the Department of Food Science, Queen's University, Belfast. The project was extended to establish the potential extent of the occurrence of MAP in untreated water sources in Northern Ireland.

# 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. For changes to be introduced under the new Regulations, see paragraphs 5.89 to 5.92.

## Quality Standards Table

Substance	Description	Standard
<b>MICROBIOLOGICAL PARAMETERS</b>		<b>Amount Allowed</b>
<b>Faecal coliforms</b>	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 100ml
<b>Total coliforms</b>	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
<b>CHEMICAL PARAMETERS</b>		
<b>Alkalinity</b>	The concentration of this parameter is an indication of the natural hardness and pH of the water.	No standard
<b>Aluminium</b>	Occurs naturally in some drinking water sources. This aluminium is removed during the water treatment processes (coagulation and filtration). Aluminium sulphate can be used as a water treatment chemical to remove cloudiness, colour and organisms.	200 µg/l
<b>Ammonium</b>	Ammonium salts are naturally present in trace amounts in most drinking water sources. They are decomposed during disinfection.	0.5 mg/l
<b>Antimony</b>	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
<b>Arsenic</b>	Naturally present at trace levels in a very few groundwater sources. Arsenic, when present, is removed by specialist water treatment processes.	50 µg/l
<b>Barium</b>	Occurs naturally in trace concentrations in some water sources.	1000 µg/l
<b>Boron</b>	Boron in water sources comes from the residues of detergent formulations that are present in treated sewage effluents.	2000 µg/l

Substance	Description	Standard
<b>CHEMICAL PARAMETERS</b>		<b>Amount Allowed</b>
<b>Cadmium</b>	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
<b>Calcium</b>	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
<b>Chloride</b>	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
<b>Chlorine</b>	Chlorine gas is used as a disinfectant in water treatment. It destroys bacteria derived from animal wastes and sewage effluents.	No standard
<b>Chromium</b>	Not normally present in drinking water sources.	50 µg/l
<b>Colour</b>	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
<b>Conductivity</b>	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
<b>Copper</b>	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
<b>Cyanide</b>	Cyanide is not normally present in drinking water sources.	50 µg/l
<b>Fluoride</b>	Traces of fluoride occur naturally in many water sources, particularly, in ground water.	1500 µg/l
<b>Iron</b>	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
<b>Lead</b>	Not normally present in water sources but may be present at consumers' taps if lead pipes are present.	50 µg/l
<b>Magnesium</b>	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
<b>Manganese</b>	Present naturally in many water sources and is removed during water treatment.	50 µg/l
<b>Mercury</b>	Mercury is not normally present in drinking water sources.	1 µg/l
<b>Nickel</b>	Not normally found in drinking water sources. Traces found in drinking water may emanate from protective coatings on taps and fittings.	50 µg/l

Substance	Description	Standard
<b>CHEMICAL PARAMETERS</b>		<b>Amount Allowed</b>
<b>Nitrate</b>	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
<b>Nitrite</b>	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
<b>Oxidizability</b>	The oxidizability of water provides a measure of its organic content. This is an alternative measure of total organic carbon.	5 mg/l
<b>Pesticides</b>	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
<b>pH (Hydrogen ion)</b>	pH value, or hydrogen ion concentration, gives an indication of the degree of acidity of the water. pH7 is neutral; values below 7 indicate acidic characteristics and values greater than 7 indicate basic 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
<b>Phosphorus</b>	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
<b>Polycyclic aromatic hydrocarbons (PAH) Benzo 3, 4 pyrene (a PAH)</b>	Polycyclic aromatic hydrocarbons are present in coal tar linings, which were used to protect water mains before 1970. Traces of PAHs may be present in tap water if the original coal tar lining is still present.	0.2 µg/l 10 ng/l
<b>Potassium</b>	This occurs naturally in all water sources and is not removed during water treatment.	12 mg/l
<b>Qualitative odour and taste</b>	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
<b>Quantitative odour and taste</b>	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
<b>Selenium</b>	Selenium is not normally present in drinking water sources.	10 µg/l
<b>Silver</b>	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
<b>CHEMICAL PARAMETERS</b>		<b>Amount Allowed</b>
<b>Sodium</b>	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
<b>Sulphate</b>	This occurs naturally in all source waters and is not removed during water treatment.	250 mg/l
<b>Surfactants</b>	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
<b>Temperature</b>	The temperature of surface waters varies according to the season. Groundwater has a much smaller variation in temperature range.	25°C
<b>Tetrachloroethene</b> <b>Tetrachloromethane</b> <b>Trichloroethene</b>	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
<b>Total hardness</b>	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
<b>Total organic carbon (TOC)</b>	TOC represents the total amount of organic matter present in the water.	No significant increase
<b>Trihalomethanes (THMs)</b>	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
<b>Turbidity</b>	All source waters are naturally cloudy occasionally. Turbidity is a quantitative measure of cloudiness, and levels are controlled by treatment processes.	4 Formazin Turbidity Units
<b>Zinc</b>	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

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<b>Aesthetic</b>	associated with the senses of taste, smell and sight.
<b>Aquifers</b>	water-containing underground strata.
<b>Catchment</b>	the area of land that drains into a watercourse.
<b>Chloramination</b>	an alternative form of disinfectant, based on chlorine and ammonia, which provides a longer lasting residual in the distribution system compared to free chlorine.
<b>Coliforms</b>	a group of bacteria which may be faecal or environmental in origin.
<b>Compliance assessment</b>	a comparison made by the Inspectorate of data (gathered by Water Service) against standards and other regulatory requirements.
<b>Contravention</b>	a breach of the regulatory requirement.
<b>Crohn's Disease</b>	Crohn's disease is an inflammation of the bowel.
<b>Cryptosporidiosis</b>	the illness produced by infection with <i>Cryptosporidium</i> .
<b><i>Cryptosporidium</i></b>	a protozoan parasite.
<b>DEFRA</b>	Department of the Environment, Food and Rural Affairs.
<b>Determination</b>	a single analytical result for a specific parameter.
<b>Distribution systems</b>	Water Service's network of mains, pipes, pumping stations and service reservoirs through which treated water is conveyed to consumers.
<b>Drinking Water Directive</b>	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".)
<b>Epidemiology</b>	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.
<b>Event</b>	a situation affecting or threatening to affect drinking water quality.
<b>Exceedence</b>	synonym for contravention (see above).

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<b>Faecal coliforms</b>	a sub-group of coliforms, almost exclusively faecal in origin.
<b>Filtration</b>	the separation of suspended particulate matter from a fluid.
<b>GCMS/MS</b>	analytical techniques used - gas chromatography mass spectrometry/mass spectrometry.
<b>Groundwater</b>	water from aquifers or other underground sources.
<b>Incident</b>	an event where there has been a demonstrable deterioration in the quality of drinking water.
<b>Indicator organism</b>	an organism which indicates the presence of contamination and, hence, the possible presence of pathogens.
<b>Inspectorate</b>	the Northern Ireland Drinking Water Inspectorate.
<b>Inspectorate's Website</b>	location of information on the Internet. The Inspectorate's website is: <a href="http://www.ehsni.gov.uk/environment/drinkWater/drinkWater.shtml">http://www.ehsni.gov.uk/environment/drinkWater/drinkWater.shtml</a>
<b>Investment programme</b>	investment in improvement works to water treatment works and distribution systems.
<b>Key parameters</b>	parameters chosen for this report to indicate the quality of water in water supply zones.
<b>Leaching</b>	to lose or cause to lose soluble substances by the action of a percolating liquid.
<b>Mains rehabilitation</b>	restoration of watermains pipework to a proper condition.
<b>Microbiological</b>	associated with the study of microbes.
<b>m<sup>3</sup>/d</b>	cubic metres per day.
<b>mg/l</b>	milligrammes per litre.
<b>ml</b>	millilitre.
<b>MI/d</b>	megalitres per day (one MI/d is equivalent to 1,000 m <sup>3</sup> /d or 220,000 gallon/d).
<b><i>Mycobacterium Avium Complex (MAC)</i></b>	a group of bacteria responsible for pulmonary and non-pulmonary infections, particularly, in the immunocompromised.

<b><i>Mycobacterium Avium Paratuberculosis (MAP)</i></b>	species of the MAC group of organisms that causes Johne's disease in cattle.
<b>ng/l</b>	nanogramme per litre.
<b>Oocyst</b>	the resistant form in which <i>Cryptosporidium</i> occurs in the environment, and which is capable of causing infection.
<b>PAH</b>	a group of organic compounds known as polycyclic aromatic hydrocarbons, comprising, for the purposes of the Regulations, 6 substances: fluoranthene, benzo 3,4 fluoranthene, benzo 11,12 perylene, benzo 3,4 pyrene, benzo 1,12 perylene and indeno (1,2,3-cd) pyrene.
<b>Parameter</b>	a parameter is any substance, organism or property listed in Schedule 1 and regulation 3 of the Regulations.
<b>Pathogen</b>	an organism which causes disease.
<b>PCV</b>	see 'Prescribed concentration or value'.
<b>Pesticides</b>	any fungicide, herbicide or insecticide or related product (excluding medicines) used for the control of pests or diseases.
<b>pH value</b>	a measure of the acidity or basicity related to the concentration of the hydrogen ion.
<b>Plumbosolvency</b>	the tendency for lead to dissolve in water.
<b>Prescribed concentration or value</b>	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'.
<b>Private supplies</b>	any supplies of water provided otherwise than by the public supplier, Water Service.
<b>Protozoan</b>	single celled animal.
<b>Public registers</b>	the information made available to the public as required by regulations 26 and 27.
<b>Regulations</b>	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.

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<b>Relaxation</b>	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.
<b>Service reservoir</b>	a water tower, tank or other reservoir used for the storage of treated water within the distribution system.
<b>Surface water</b>	water from rivers, impounding reservoirs or other surface water sources.
<b>Technical audit</b>	the means of checking that Water Service is complying with its statutory obligations.
<b>Time of supply</b>	the moment when water passes from the Water Service's pipework into a consumer's pipework.
<b>Toxicology</b>	the study of the health effects of substances.
<b>Treated water</b>	water treated for use for domestic purposes as defined in the Regulations.
<b>Trihalomethanes (THMs)</b>	a group of organic substances comprising, for the purposes of the Regulations, 4 substances: trichloromethane, (also known as chloroform), dichlorobromomethane, dibromochloromethane and tribromomethane.
<b>µg/l</b>	microgrammes per litre.
<b>Waiver</b>	authorized relaxation.
<b>Water supply zone</b>	the basic unit of supply for establishing sampling frequencies, compliance with standards and information to be made publicly available.
<b>Wholesomeness</b>	a concept of water quality which is defined by reference to standards and other requirements set out in the Regulations.
<b>WRc</b>	Water Research Centre (1989) plc and/or, as the context may require, its predecessor body.

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Published by  
Environment and Heritage Service  
Printed by Central Print Unit