



NORTHERN IRELAND DRINKING WATER QUALITY 1999

*A Report by the Northern Ireland
Drinking Water Inspectorate*



An Agency within the
Department of the
Environment



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SUMMARY

This report is the fourth 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 1999.

During this reporting period, the drinking water quality results show that out of a total of 111,230 tests carried out by Water Service during 1999, 98.95% met the regulatory standards. This overall water quality figure shows a small improvement when compared to the 98.86% compliance figure for 1998. The overall microbiological compliance rate has improved to 99.75% from the 99.64% compliance figure reported for 1998. While the overall number of physical/chemical reported exceedences shows a small improvement in compliance for 1999, with a compliance figure of 97.66% when compared to the 97.52% figure for 1998, the year on year variation is too small for trends to be established. The compliance rate for the key microbiological parameters for samples taken at consumers' taps was 99.67%; an improvement on the 99.51% compliance figure for 1998. These results show, that overall, the drinking water supplied is of good quality. The comparable figures are given in Figure 1 and Figure 2 below.

Figure 1: Overall Water Quality

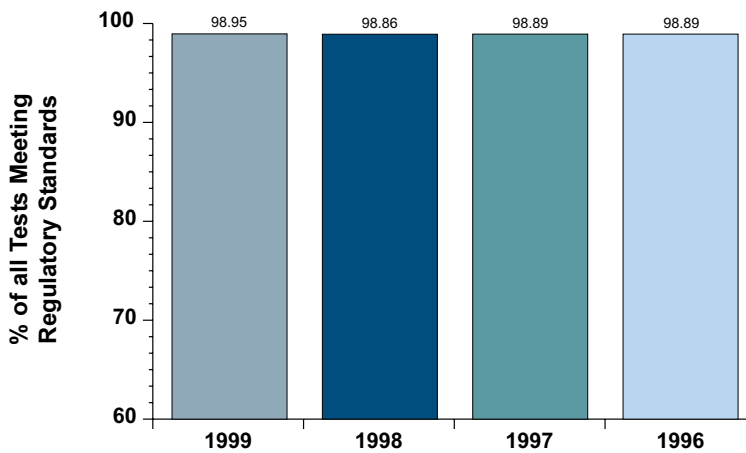
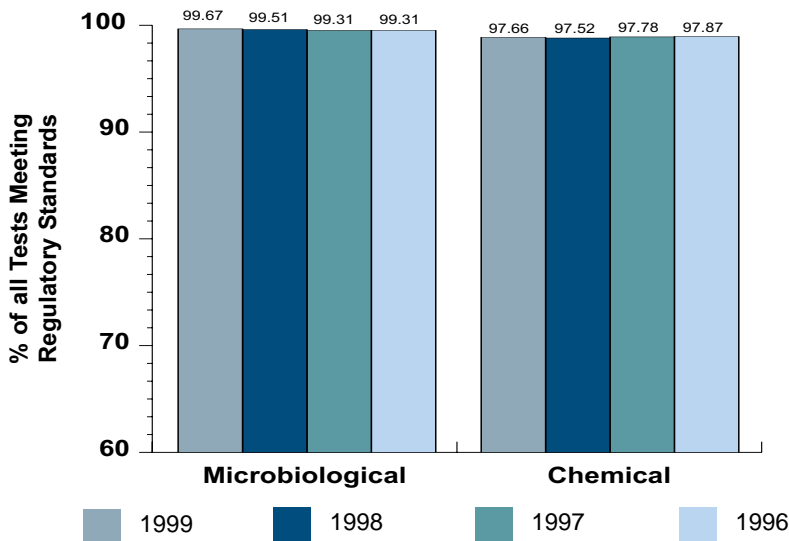
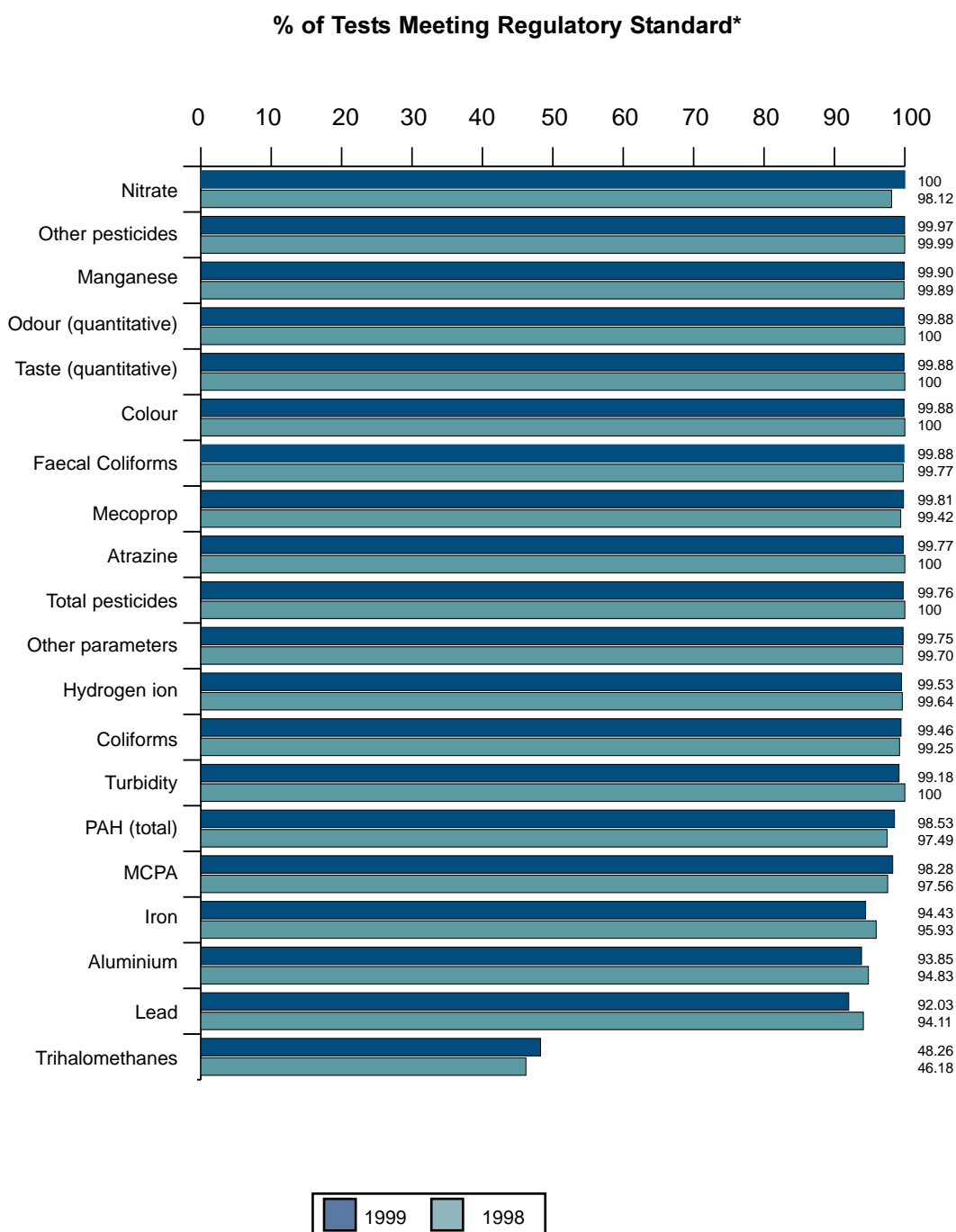


Figure 2: Microbiological and Chemical Quality at Consumers' Taps



During 1999, the level of compliance was reported for 104 water supply zones which were routinely monitored for 86 individual parameters. The regulatory requirements were met for 64 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 number of physical/chemical tests not meeting the standards shows a small improvement, with 2.34% of 43,288 tests failing to meet the required standards. The Inspectorate notes the inclusion of over 2,500 additional individual pesticide determinations into the pesticide monitoring programme for 1999, when making comparisons with the 1998 physical/chemical compliance information.

As with previous reporting years, the non-compliances continue to relate largely to trihalomethanes, lead, aluminium and iron. While an improvement in microbiological quality of water supplies has been reported for 1999, it may, at the same time, have contributed to the continuing high failure rate for trihalomethanes. The non-compliance rates for trihalomethanes have increased to 51.74% in 1999, from 38.54% in 1996. The World Health Organisation 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 has improved the individual aluminium compliance figures. In other situations, however, compliance monitoring identifies areas where a targeted improvement programme is still required to achieve aluminium compliance. For 1999, lead and iron showed increased rates of non-compliance at 7.97% and 5.57% respectively; the comparable figures reported for 1998 were 5.89% and 4.07%. Targeted work programmes are also required to improve lead and iron compliance. With regard to the lead parameter, the Inspectorate notes Water Service's commitment to introduce treatment at prioritised 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 1999, 1033 contraventions of the standards were reported for samples taken at consumers' taps. Contraventions were reported for 22 parameters. Each contravention has been followed up and assessed by the Inspectorate. Depending on the magnitude or duration of the contravention, each has been assessed as being trivial or non-trivial.

Formal notifications for non-trivial contraventions were notified to Water Service for the following 10 parameters:

Total coliforms, faecal coliforms, trihalomethanes, iron, aluminium, lead, hydrogen ion, MCPA, total pesticides, and turbidity.

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 set generally well below the level at which water would become unacceptable to consumers.

Water Service has a major capital works programme, targeted at water treatment works and the distribution system, which will mitigate the contraventions within the shortest possible timescale. The last three 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 applied with maximum efficiency to ensure the continuing provision of high quality drinking water, and to improve regulatory compliance. The investment programme needs to continue to address the substantial improvements required in compliance, in particular; with the trihalomethane, lead, iron and aluminum 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.

The Water Quality Regulations (Northern Ireland) 1994 set out sampling and other regulatory requirements to demonstrate the wholesomeness of drinking water supplies. In the 1999 compliance assessment, a sampling shortfall of 1.33% of the required number of determinations was identified for regulatory standard sampling frequencies for water supply zones. The comparable figure reported for 1998 was 1.58%. Where non-trivial deficiencies have been identified, the Inspectorate has formally notified Water Service; action will be taken by Water Service to remedy the sampling shortfall.

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

INTRODUCTION

The Drinking Water Inspectorate (the 'Inspectorate') is a unit within the Environment and Heritage Service, an agency of the Department of the Environment, in Northern Ireland. The Inspectorate has a responsibility to regulate drinking water quality in Northern Ireland under the Water Quality Regulations (Northern Ireland) 1994 and the Private Water Supplies Regulations (Northern Ireland) 1994. This report details the work of the Inspectorate and reviews drinking water quality in Northern Ireland for 1999. This is the fourth 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 1999', 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 drinking water quality in Northern Ireland for 1999, 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 various classification types of private water supplies in Northern Ireland is provided. Section 8 refers to the Department of the Environment, Transport and the Regions Drinking Water Research Programme on water quality and health, which is steered by the Drinking Water Inspectorate for England and Wales. Finally, the Glossary provides brief explanations of the technical terms and abbreviations used in this report.

THE REGULATORY FRAMEWORK

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

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

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

The key points of the Order and Regulations are:

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

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

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

2.2 The Water Quality Regulations (Northern Ireland) 1994

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

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

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

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

2.3 The Private Water Supplies Regulations (Northern Ireland) 1994

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

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

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

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

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

References

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

THE ROLE AND ACTIVITIES OF THE DRINKING WATER INSPECTORATE

Regulatory Role

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

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

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

The Water Quality Regulations (Northern Ireland) 1994

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

- 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
- assesses if satisfactory practices and processes are in place for water treatment and distribution.

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

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

The Private Water Supplies Regulations (Northern Ireland) 1994

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

- 1,182 private water supplies have been identified to date and categorized into one of 10 classes according to size, nature and use of the private water supply, and
- a monitoring programme, for private water supplies based on these classifications, is in place.

Chemicals and Materials

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

3.6 The Committee comprises a Chairman and five members, who between them, bring a range of expertise spanning engineering, materials science, toxicology and water treatment to the Committee. An independent member represents water consumers' interests. The Drinking Water Inspectorate for England and Wales also provides technical and administrative support to the Committee, which was reconstituted as an advisory non-departmental public body in May 1998.

3.7 A list of chemicals and materials, approved by the Secretary of State for England and Wales, is published annually by the Drinking Water Inspectorate for England and Wales. Regulation 24 of the Water Quality Regulations (Northern Ireland) 1994 endorses the use of the substances and products contained in this document and consequently, it is applicable in Northern Ireland. A cumulative list of products approved under the statutory scheme was last published in December 1999. The list of the approved products and the decisions taken at each meeting of the Committee can be accessed on Department of the Environment, Transport and the Regions' website at (<http://www.dwi.detr.gov.uk/regs/soslist>).

Quality Assurance

3.8 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.

3.9 Water Service routinely checks the performance of its laboratories by participating in external quality control schemes. These include the Water Research Centre's Aquacheck scheme. The Inspectorate audits external and internal analytical quality control systems and procedures as part of its inspection programme.

3.10 Water Service is also implementing the requirements of the Drinking Water Testing Specification (DWTS). DWTS is an optional national scheme agreed between the Drinking Water Inspectorate for England and Wales, the Northern Ireland Drinking Water Inspectorate, the Scottish Office's Water Services Unit and the United Kingdom Accreditation Service (UKAS), for the accreditation of laboratories carrying out drinking water analyses. The accreditation, among other requirements, will demonstrate compliance with regulation 20 of the Water Quality Regulations (Northern Ireland) 1994 and regulation 19 of the Private Water Supplies Regulations (Northern Ireland) 1994.

Consumer Complaints and Water Quality Incidents

3.11 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 1999, 49 complaints were received by the Inspectorate.

Where a water quality incident has occurred, Water Service is required to provide the Inspectorate with information, in accordance with agreed procedures. During 1999, 7 drinking water quality incidents and 2 events were brought to the attention of the Inspectorate (see Section 6 for further details).

Contact with other Organisations

3.12 The Inspectorate has regular contact with the Department of Health, Social Services and Public Safety (DHSSPS), the Environment and Planning Division of the Department of the Environment for Northern Ireland, and the Department of Agriculture and Rural Development. It represents Northern Ireland interests in the development of United Kingdom drinking water regulatory policy through liaison with the Drinking Water Inspectorate for England and Wales, the Water Services and Regulation Division of the Department of the Environment, Transport and the Regions (DETR) and the Scottish Office's Water Services Unit. The Inspectorate keeps itself informed of research being carried out by the Water Research Centre (WRc) and other organisations. This includes having representation on the DETR 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.

- 3.13** 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.
- 3.14** 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.
- 3.15** Medical advice is obtained from the Chief Medical Officer of the Northern Ireland Department of Health, Social Services and Public Safety. The Inspectorate liaises with the Chief Medical Officer and the Chief Environmental Health Officer (also of the DHSSPS) on relevant health related matters.
- 3.16** The Inspectorate has been in contact with researchers at the Department of Food Science, Queens University of Belfast and has given advice on a project looking at paratuberculosis in water.

DWI Information

- 3.17** To increase awareness of the water quality of private water supplies, the Inspectorate produced a leaflet *Is your PRIVATE Water Supply SAFE?*, which was widely circulated to owners through the Department of Agriculture for Northern Ireland*, and the 26 District Councils. During 1999, the Inspectorate presented papers and delivered lectures on a number of occasions to learned societies and public bodies.
- 3.18** Previous Inspectorate Annual Report publications include:
- Northern Ireland Drinking Water Quality 1998;
 - Northern Ireland Drinking Water Quality 1997; and
 - Northern Ireland Drinking Water Quality 1996.
- 3.19** The 1999 and 1998 Northern Ireland Drinking Water Quality reports, together with general information about the Northern Ireland Drinking Water Inspectorate, is available on the website: <http://www.ehsni.gov.uk>.

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

THE TECHNICAL AUDIT

The Inspectorate's technical audit assesses compliance with the Regulations and consists of 2 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 1999 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 1999 is shown in 2 ways: firstly, the total number of all determinations that fail to meet the regulatory standards; and secondly, water supply zone compliance (see Section 5 for further details).
- 4.3** The number of samples per annum specified in Schedule 2 to the Regulations is that required in the various situations to which the Schedule refers. For 1999, 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 2 parameters have an assigned sampling frequency but, because no softening of water supplied by Water Service takes place, these PCVs effectively do not apply. It is, therefore, not appropriate to include determinations for these 2 parameters when assessing compliance with water quality standards.

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

- 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.

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- 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, and for 1999, 8 additional individual pesticides were included in the monitoring programme. These were as follows; bentazone, chlorpropham, chlorpyralid, dichlorophen, diuron, fenpropimorph, flutriafol and tecnazene. During 1999, 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 for total pesticides of 0.5 µg/l.

ASSESSMENT OF WATER QUALITY

Water Treatment Works

4.10 Regulation 3(7) of the Water Quality Regulations (Northern Ireland) 1999 requires 100% compliance with water quality standards for coliforms and faecal coliforms at water treatment works. For 1999, 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 1999, compliance was assessed on the basis of results of samples taken from each service reservoir in the 12 months of the calendar year. Non-trivial contraventions of the coliform standard for service reservoirs were formally notified to Water Service.

4.12 The detection of 1 or 2 faecal coliforms in 100 ml of sample taken from a service reservoir on a single occasion has been regarded as a trivial contravention of the faecal 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 1999 are listed below.

Relaxations in Water Supply Zones

Parameter	Number of Water Supply Zones with Relaxations
Colour	91
Manganese	99
Odour (quantitative)	80
Taste (quantitative)	80
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 3 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 will be 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 1999 exceeded the prescribed concentrations or values.

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

4.20 For 1999, the Inspectorate has generally regarded a contravention of a standard for an individual non-microbiological parameter on a single occasion in a water supply zone as trivial, provided that 10 or more samples have been taken in that zone or, if a smaller number has been taken, provided that there was not a corresponding contravention in the previous calendar year. In other cases, the Inspectorate has taken into account the number of determinations carried out and the number and extent of the contraventions in deciding whether the contraventions were trivial or not. Water Service has been formally notified of all cases where the contraventions were regarded as non-trivial.

4.21 For 1999, the Inspectorate assessed nitrite contraventions of the regulatory standard 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 as follows:-

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

4.22 For 1999, the Inspectorate assessed total polycyclic aromatic hydrocarbons contraventions of the regulatory standards for triviality taking into consideration the New Drinking Water Directive requirements. Water supply zones were assessed as trivial if the new standard, which is based on the sum of the following 4 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 Where 5 or less faecal coliforms in 100 ml have been detected on a single occasion in a water supply zone, the contravention of the standard has been regarded as trivial. Where more than 100 samples have been taken, 2 contraventions of the standard have been regarded as trivial, provided that no more than 2 faecal coliforms in 100 ml were detected in either sample and there was no contravention of the standard in the previous calendar year. 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 1999 AND 2000 INSPECTION PROGRAMMES

1999 Inspection Programme

4.24 In 1999, the Inspection Programme was based on the following topics:

- detailed audit of a selected water treatment works;
- detailed audit of 2 selected service reservoirs;
- detailed audit of a water quality analytical laboratory;
- review of *Cryptosporidium* risk and monitoring at water treatment works; and
- progress on agreed follow-up action as a result of the 1998 Inspection Programme.

4.25 During August 1999 and March 2000, the Drinking Water Inspectorate carried out inspections at Forked Bridge Water Treatment Works, Marlborough House Laboratory, Ladyhill and Teebane West Service Reservoirs.

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

4.27 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 summarised in paragraphs 4.28 to 4.31.

Forked Bridge Water Treatment Works

4.28 An inspection of Forked Bridge Water Treatment Works was carried out on 14 and 19 October 1999. The overall objective was to carry out an inspection of the various arrangements and processes at the water treatment works. Based on the assessment of 1998 information, the treatment process was found, with the exception of 1 parameter in the water supply zones served by the works, to comply with regulations 22, 24, and 25, producing drinking water which met the standards specified in the Water Quality Regulations (Northern Ireland) 1994.

As a result of the inspection, the Inspectorate made 6 recommendations which were considered necessary to consolidate procedures and help ensure regulatory compliance. The recommendations were conveyed to Water Service for formal response. Water Service is considering these recommendations.

Marlborough House Laboratory

4.29 Marlborough House Laboratory was inspected on 3, 4 November 1999, 29 February 2000 and 3 March 2000. The objective of the inspection process was to assess the following topics:

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

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

The Inspectorate made 4 recommendations which were considered necessary to consolidate procedures and help ensure regulatory compliance. The recommendations were conveyed to Water Service for formal response. Water Service is considering these recommendations.

Ladyhill Service Reservoir

4.30 An inspection of Ladyhill Service Reservoir was carried out on 17 September 1999. The overall objective was to carry out an inspection of the sampling arrangements and the security of the service reservoir.

As a result of the inspection, the Inspectorate made 1 recommendation which was considered necessary to help ensure regulatory compliance. The recommendation was conveyed to Water Service for formal response. Water Service has taken action on this recommendation which will be addressed under the reservoir security contract scheduled to be completed in 2001.

Teebane West Service Reservoir

4.31 An inspection of Teebane West Service Reservoir was carried out on 24 August 1999. The overall objective was to carry out an inspection of the sampling arrangements and the security of the service reservoir.

As a result of the inspection, the Inspectorate made 2 recommendations which were considered necessary to help ensure regulatory compliance. The recommendations were conveyed to Water Service for formal response. Water Service has taken action on one recommendation, the requirements of the second will be addressed during Autumn 2000 as part of a Water Service-wide contract to address the problem of potential ingress of surface water.

2000 Inspection Programme

4.32 The 2000 Inspection Programme, which includes the following topics has commenced.

- detailed audit of the continuous monitoring process for *Cryptosporidium* at a selected site, including an audit at a water quality laboratory;
- detailed audit of a selected water treatment plant;
- review of *Cryptosporidium* risk assessment and monitoring practices;
- monitor general progress on the recommendations of the Group of Experts contained in the Second* and Third** Reports, "*Cryptosporidium* in Water Supplies"; and
- progress on agreed follow-up action as a result of the 1999 Inspection Programme.

4.33 During May and June 2000, the Drinking Water Inspectorate carried out inspections at Lisnabreeny Service Reservoir, Westland House Laboratory and Lough Island Reavy Water Treatment Works.

4.34 On completion of the inspections, conclusions, opinions and recommendations were reported to Water Service. The recommendations require a written response from Water Service, and an agreed action plan is produced. The main findings of these inspections are summarised in paragraphs 4.35 to 4.36.

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

** Reference - Bouchier I (1998) *Cryptosporidium in Water Supplies - Third Report of the Group of Experts*, Department of the Environment, Department of Health, London, UK, HMSO. (ISBN 1 85112 131 5).

Lisnabreeny Service Reservoir

4.35 An inspection of the continuous monitoring for *Cryptosporidium* at Lisnabreeny Service Reservoir was carried out on 10 May 2000. An inspection of the laboratory procedures for *Cryptosporidium* was also undertaken at Westland House Laboratory.

The objective of the inspection process was to assess the various arrangements and procedures for *Cryptosporidium* sampling, transportation, analysis and reporting.

As a result of the Inspection, The Inspectorate made 10 recommendations considered necessary to consolidate procedures. The recommendations were conveyed to Water Service for formal response. Water Service has agreed to take action on all of the recommendations

Lough Island Reavy Water Treatment Works

4.36 An inspection of Lough Island Reavy Water Treatment works was carried out on 2 August 2000. The overall objective was to check the efficiency of a new ultra fine mechanical filtration process which had been

recently installed at the treatment works for the control of *Cryptosporidium* oocysts.

As a result of the inspection, the Inspectorate made nine recommendations to consolidate operating practices. The recommendations were conveyed to Water Service for formal response. Water Service is currently considering these recommendations.

Follow-up to the 1998 Inspection Programme

4.37 Follow-up action resulting from the 1998 inspection programme is as follows:

- Ballysillan High Level Service Reservoir completed.
- Ballykeel Service Reservoir ongoing;
- Academy House Laboratory ongoing; and
- Killyhevlin Water Treatment Works ongoing.

Action has been taken on all but a few recommendations which require a longer timescale to complete.

OVERVIEW OF DRINKING WATER QUALITY IN NORTHERN IRELAND IN 1999

Introduction

In 1999, Water Service supplied on average 680 million litres/day of water to 98.5% of Northern Ireland's population of approximately 1.69 million people. These water supplies are mostly derived from surface water (92%), with the remainder being groundwater sources. Water from all these sources is treated and distributed through 22,250 km of watermains. Regulatory compliance monitoring is carried out at 70 water treatment works, 373 service reservoirs and 104 water supply zones. The majority of the service reservoir sampling points correspond to single reservoir sites, although some have more than one reservoir on site.

In 1999, there were 104 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 rationalised by developing regional schemes, the number of water supply zones may change from year to year; in 1998, there were 106 water supply zones; in 1997, there were 108 water supply zones.

Water Treatment Works Volume Categories

Water Treatment Works		Volume Distributed from Works (m ³ /d) Categories
Number	Percentage	
27	38.6	<3,000
27	38.6	3,000 - 12,000
16	22.9	>12,000

Service Reservoirs Capacity Categories

Service Reservoirs		Capacity of Reservoirs (m ³) Categories
Number	Percentage	
208	55.8	<2000
125	33.5	2,000 - 10,000
40	10.7	>10,000

Water Supply Zone Population Categories

Water Supply Zone		Population Category
Number	Percentage	
24	23.1	<5,000
32	30.8	5,000 - 20,000
48	46.2	20,000 - 50,000

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

COMPARISON OF WATER QUALITY

5.1 The tables included in this section provide summary information on water quality, and relevant comparisons are made with water quality in 1998, 1997 and 1996. When comparing annual compliance information, there may be factors which account wholly, or in part, for a particular difference and this must be considered before drawing any conclusions about possible differences in water quality. These factors include:

- adoption of increased sampling frequencies as a result of contraventions for a particular parameter;
- modifications to the pesticide monitoring strategy in the light of re-assessment 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.

For 1999, the number of individual pesticides being monitored has increased by over 2,500 on the number monitored in 1998. This should be taken into consideration when making direct comparisons for pesticides and overall physical/chemical quality between the 2 years.

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

5.2 However, comparison between the 4 years, using the number of zones showing non-compliance with the PCV for a particular parameter, is rather less affected by the factors set out in the previous paragraph.

Table 5.1

SUMMARY OF OVERALL WATER QUALITY				
	1999	1998	1997	1996
Water treatment works				
Total number of determinations	19,360	19,648	20,224	19,832
- number exceeding PCV	28	44	60	60
- % exceeding PCV	0.14	0.22	0.30	0.30
Service reservoirs				
Total number of determinations	38,044	37,972	37,973	38,708
- number of exceeding PCV	109	150	207	245
- % exceeding PCV	0.29	0.40	0.55	0.63
Water supply zones				
Total number of determinations	53,826	50,802	49,551	48,519
- number exceeding PCV	1,033	1,038	930	879
- % exceeding PCV	1.92	2.48	1.88	1.81
All samples				
Total number of determinations	111,230	108,422	107,748	107,059
- number exceeding PCV	1,170	1,232	1,197	1,184
- % exceeding PCV	1.05	1.14	1.11	1.11

Overall Water Quality

5.3 The level of compliance is shown in 2 ways. The first, and best overall measure, because it takes into account all the results for the calendar year, is the total of all determinations that meet the regulatory standards. During 1999, a total of 111,230 reported determinations were carried out at water treatment works, service reservoirs and consumers' taps. Of these determinations, 98.95% 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 small increase in the compliance rate for 1999, from the

compliance figure of 98.86% reported during 1998, and, in addition the overall microbiological compliance rate improved to 99.75% from the 99.64% compliance figure reported for 1998. The compliance rate for the key microbiological parameters for samples taken at consumers' taps was 99.67%; which also demonstrates an improvement on the 99.51% compliance for 1998.

While the overall number of physical/chemical reported exceedences shows a small improvement for 1999, with a compliance figure of 97.66% when compared to the 97.52% figure for 1998, there has

been however some deterioration in compliance for certain chemical parameters; lead, iron and aluminium are significant in this respect. Trihalomethanes continue to have a high level of non-compliance.

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. Comparable figures with 1998, 1997 and 1996 compliance assessments are given in Tables 5.1 to 5.4 and Figures 4 to 16.

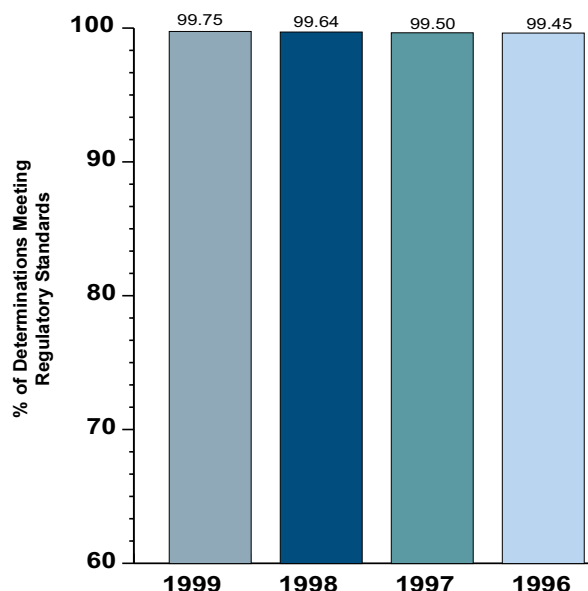
5.5 During 1999, the level of compliance was assessed for 104 water supply zones which were routinely monitored for 86 individual determinations. The regulatory requirements were not met for 22 of these parameters (2 microbiological and 20 physical/chemical). As with previous reports the non-compliances continue to relate largely to trihalomethanes, lead, aluminium and iron. The percentage of non-compliant zones for the following 19 key parameters is shown in Table 5.4.

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

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

5.7 The compliance figure for all microbiological samples shows a further increase in the level of compliance in 1999; 99.75% of 68,614 determinations meet the required standards, when compared to the 99.64% reported for 1998. The comparable figures for 1998, 1997 and 1996 are given in Figure 4. All the microbiological results reported for 1999, show improved compliance rates for water supply zones, water treatment works and service reservoirs, as well as an improvement in overall microbiological quality.

Figure 4: Overall Microbiological Quality



5.8 While an improvement in microbiological quality of water supplies has been reported for 1999, it may, at the same time, have contributed to in the continuing high failure rate for trihalomethanes. For 1999, as in the 1996, 1997 and 1998 reports, 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 but it needs to continue to take steps to bring about compliance with the trihalomethane standard.

5.9 During 1999, out of a total of 111,230 determinations carried out at water treatment works, service reservoirs and water supply zones, 1,170 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 10 parameters: total coliforms, faecal coliforms, trihalomethanes, iron, aluminium, lead, hydrogen ion, MCPA, total pesticides, and turbidity. 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 Table 5.2. These indicate an improvement on the results reported for 1998. The results show that, in respect of the number of determinations at water treatment works in 1999, 99.81% 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 an improvement in 1999 and continue an improving trend (Figure 5 refers). During 1999, contraventions for faecal coliforms were detected at 8 water treatment works, of which, 4 were considered non-trivial. The coliform standard was contravened at 12 water treatment works, 8 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 5: Number of Water Treatment Works not Complying with Standards

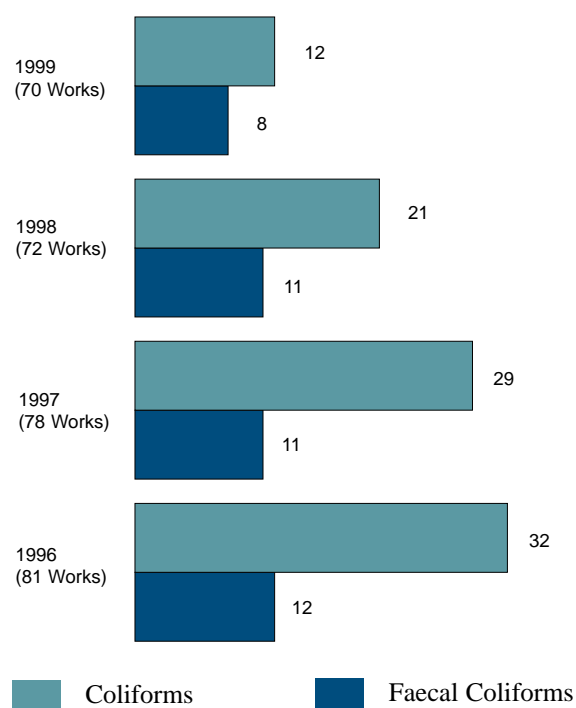


Table 5.2

MICROBIOLOGICAL QUALITY OF WATER LEAVING WATER TREATMENT WORKS				
	1999	1998	1997	1996
Coliforms				
Total number of determinations	9,680	9,824	10,112	9,916
- number of determinations containing coliforms	18	28	48	46
- % containing coliforms	0.19	0.29	0.47	0.46
Treatment works with coliforms detected	12	21	29	32
Faecal Coliforms				
Total number of determinations	9,680	9,824	10,112	9,916
- number of determinations containing faecal coliforms	10	16	12	14
- % containing faecal coliforms	0.10	0.16	0.12	0.14
Treatment works with faecal coliforms detected	8	11	11	12
Number of Water Treatment Works	70	72	78	81

Microbiological Quality of Water in Service Reservoirs

5.11 Summary results for service reservoirs are given in Table 5.3. These results indicate a further improvement in the water quality at service reservoirs compared to that reported for 1998. The number of service reservoirs not complying with the microbiological standards also reported an improvement in 1999 (Figure 6 refers).

5.12 Of the 19,022 determinations in samples taken at service reservoirs in 1999, 99.58% were free from coliforms. Coliforms were detected in at least one sample collected during the year at 63 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, 4 service reservoirs contravened the coliform standard; these contraventions have been considered non-trivial and have been formally notified to Water Service.

Figure 6: Number of Service Reservoirs not Complying with Standards

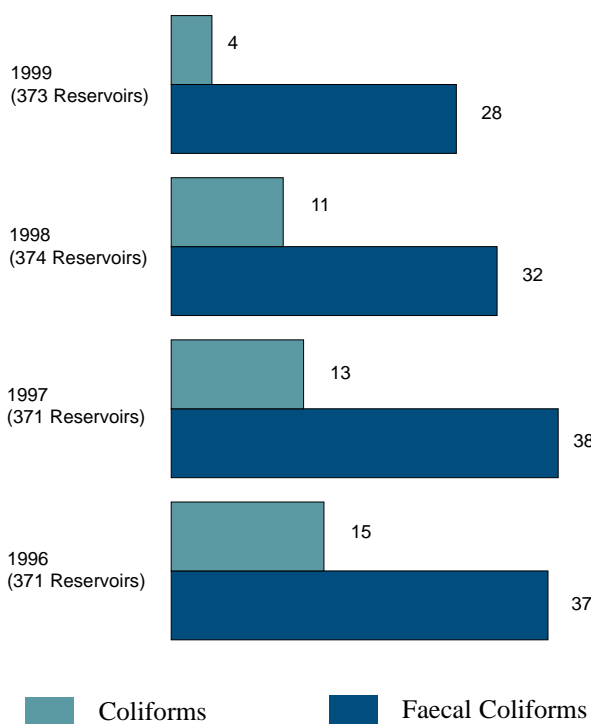


Table 5.3

MICROBIOLOGICAL QUALITY OF WATER IN SERVICE RESERVOIRS				
	1999	1998	1997	1996
Coliforms				
Total number of determinations	19,022	18,986	18,987	19,354
- number of determinations containing coliforms	79	114	164	199
- % containing coliforms	0.42	0.60	0.86	1.03
Service reservoirs with coliforms detected in more than 5% of samples	4	11	13	15
Faecal Coliforms				
Total number of determinations	19,022	18,986	18,986	19,354
- number of determinations containing faecal coliforms	30	36	43	46
- % containing faecal coliforms	0.16	0.19	0.23	0.24
Service reservoirs with faecal coliforms detected	28	32	38	37
Number of Service Reservoirs	373	374	371	380

5.13 Of the 19,022 determinations carried out for faecal coliforms in samples taken at service reservoirs during 1999, 99.84% met the regulatory requirements. Faecal coliforms were detected in at least one sample at 28 service reservoirs. Contraventions of the faecal coliform standard were considered trivial for 14 of these service reservoirs. Non-trivial contraventions of the faecal coliform standard at 14 service reservoirs have 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 5.4 gives a summary of water quality for the 19 key parameters which are significant in Northern Ireland. All other parameters, with the exception of pesticides, have been taken together in the penultimate item of the table under the parameter description 'Other parameters'. Only those parameters which have numerical standards are included under this heading (see paragraphs 4.5 and 4.6). Table 5.4 includes comparable figures for 1998 and 1997. It also outlines:

- the total number of reported determinations for parameters having 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 including non-trivial contraventions.

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 5.4, 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 4.23). A fuller discussion, parameter by parameter, is given in paragraphs 5.19 to 5.67.

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

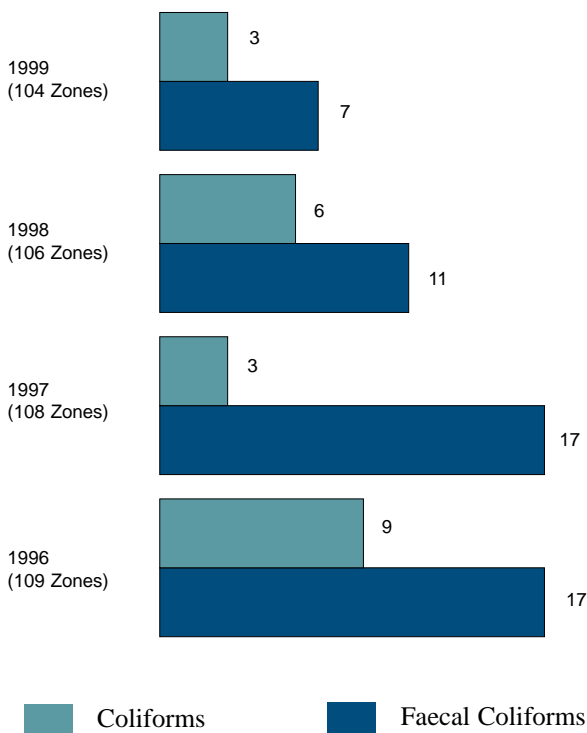
Table 5.4: Water Quality in Water Supply Zones 1999

Parameter	Determinations in 1999 Exceeding PCV or Relaxed PCV			Determinations in 1998 Exceeding PCV or Relaxed PCV		Zones 1999	Zones 1998	Zones 1997
	Total No.	No.	%	Total No.	%	% Exceeding PCV or Relaxed PCV	% Exceeding PCV or Relaxed PCV	% Exceeding PCV or Relaxed PCV
Coliforms	5,605	30	0.54	5,566	0.75	2.88	5.66	4.63
Faecal coliforms	5,605	7	0.12	5,566	0.23	6.73	10.38	15.74
Colour	856	1	0.12	829	0.00	0.96	0.00	0.00
Turbidity	974	8	0.82	966	0.00	6.73	0.00	7.41
Odour (quantitative)	802	1	0.12	790	0.00	0.96	0.00	2.78
Taste (quantitative)	800	1	0.13	790	0.00	0.96	0.00	2.78
Hydrogen ion	3,430	16	0.47	3,366	0.36	8.65	9.43	4.63
Nitrate	777	0	0.00	746	1.88	0.00	0.94	0.93
Aluminium	1,658	102	6.15	1,740	5.17	22.12	21.70	21.30
Iron	2,371	132	5.57	2,186	4.07	50.96	34.91	38.89
Manganese	957	1	0.10	932	0.11	0.96	0.94	5.56
Lead	878	70	7.97	730	5.89	21.15	18.87	14.81
PAH (total)	679	10	1.47	676	2.51	6.73	8.49	12.96
Trihalomethanes	1,181	611	51.74	1,243	53.82	75.00	71.70	65.74
Total pesticides	417	1	0.24	426	0.00	0.96	0.00	2.78
Atrazine	437	1	0.23	450	0.00	0.96	0.00	0.93
MCPA	523	9	1.72	532	2.44	4.81	5.66	7.41
Mecoprop	515	1	0.19	517	0.58	0.96	2.83	9.26
Other pesticides	14,961	5	0.03	12,404	0.01	4.81	0.94	0.00
Other parameters	10,400	26	0.25	10,347	0.30	10.58	10.38	7.41
Total	53,826	1,033	1.92	50,802	2.04	No. of Water Supply Zones		108
						104	106	

Microbiological Quality in Water Supply Zones

5.19 Of the 5,605 determinations for faecal coliforms carried out in water supply zones during 1999, 99.88% met the regulatory standards. A total of 7 zones were non-compliant for faecal coliforms in respect of the Regulations (Figure 7 refers). Contraventions in 1 of these water supply zones were regarded as non-trivial.

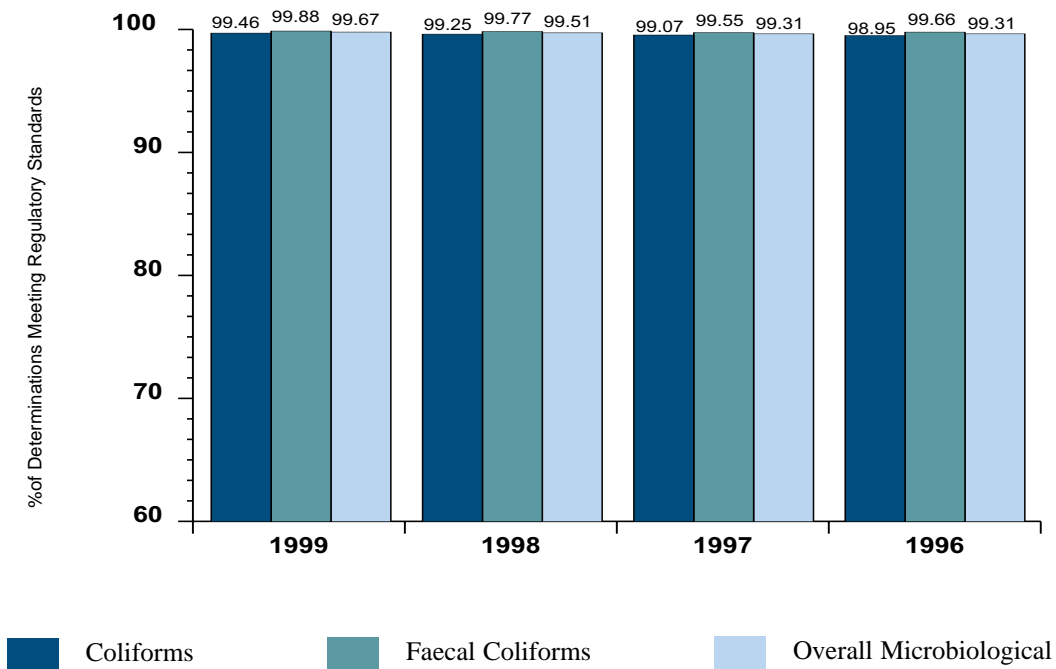
Figure 7: Number of Zones not Complying with Microbiological Regulatory Standards



For coliform determinations in water supply zones, 99.46% 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 22 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, 3 water supply zones contravened the coliform standard. Taking the 2 key microbiological parameters together, the overall compliance rate with the numerical standards for determinations at consumers' taps reported for 1999 was 99.67% (Figure 8 refers); a further improvement on the comparable figure of 99.51% reported for 1998.

The non-trivial contraventions of the faecal coliform standard in 1 water supply zone, and the 3 water supply zones with contraventions of the coliform standard have been formally notified to Water Service.

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



5.20 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 5.4 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 (THM)

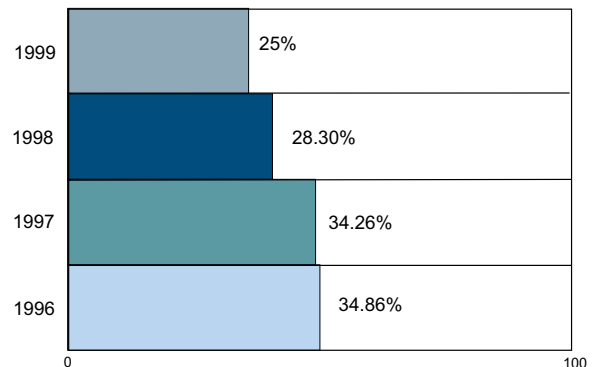
5.21 Drinking water in Northern Ireland is predominantly obtained from surface waters which are likely to contain naturally occurring organic materials. The leaching of this organic content into water supplies is affected by seasonal variations in the climate. Trihalomethanes are by-products of the reaction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

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

5.23 In 1999, the number of determinations exceeding the numerical standard for trihalomethanes (100 microgrammes per litre) remains high at 51.74%. As in 1998, 1997 and 1996, trihalomethanes continue to be the parameter with the highest non-compliance rate of the regulatory standard where 53.82%, 41.56% and 38.54% failure rates were reported respectively. The revised EC Drinking Water Directive, which comes into force at the end of 2003, sets an interim standard for trihalomethanes of 150 µg/l (see paragraph 5.85 and Table 5.5). Trihalomethane compliance will continue to be reported against the current regulatory standard, but it can be noted that the 1999 compliance rate for trihalomethanes against the 150 µg/l standard would be 83.32%.

5.24 In 1999 the regulatory standard was contravened in 78 (75.00%) water supply zones. Contraventions in all of these zones were assessed as non-trivial and formally notified to Water Service. Between 1996 and 1999 the number of water supply zones contravening the regulatory standard increased from 71 (65.14%) water supply zones in 1996 to 78 (75.00%) in 1999.

Figure 9: Water Supply Zones Complying with THM Standard



5.25 The improvements reported in the microbiological quality of water supplies (see paragraph 5.7), 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 but needs to continue to take steps to bring about compliance with the trihalomethane standard.

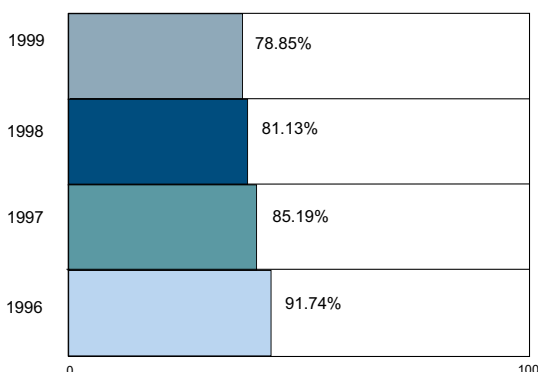
5.26 Government guidance encourages that action be taken to reduce trihalomethane concentrations, but only if this can be achieved without prejudicing microbiological quality, which is considered much more important. The World Health Organisation has guideline values for trihalomethanes at higher levels 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.

Lead

- 5.28** In 1999, an increased number of contraventions of the regulatory lead standard, and of the number of zones when compared to 1998, were recorded in 22 (21.15%) water supply zones. Ten of these zones were assessed as having trivial contraventions. The non-trivial contraventions of the regulatory standard for lead in 12 zones 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 minimise the solubility of lead has been implemented using phosphate dosing in one water supply zone to enable optimum operating conditions to be determined.

Figure 10: 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 will greatly influence the results obtained. Water leaving treatment works and in the distribution systems is essentially lead free. If lead is detected at a consumer's tap, it is caused by the action of water on existing lead service piping between the watermains and the tap. Whether or not the lead standard is contravened at a particular tap depends on a number of factors, an important one being the plumbosolvency (the tendency for lead to dissolve in water) of the water. Water Service has an ongoing programme of pH adjustment to reduce plumbosolvency (see paragraph 5.55).

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

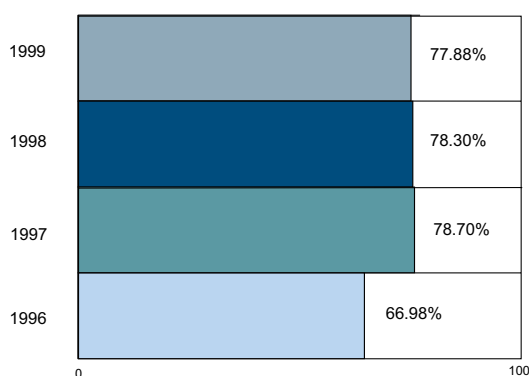
5.33 Aluminium is naturally occurring in many water sources, particularly those derived from upland areas. Aluminium compounds are used as an important part of the processes for the treatment and purification of water, including the removal of harmful organisms. In addition to this primary role, aluminium-based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

5.34 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 1999, the number of determinations exceeding the aluminum standards showed an increase in the number of non-compliances from 5.17% in 1998, to 6.15% in 1999. Contraventions of the regulatory standards for aluminium were recorded in 23 (22.12%) water supply zones in 1999; 23 water supply zones were non-compliant 1998. In 1999, 10 zones were assessed as having trivial contraventions. The non-trivial contraventions of the aluminium standards in 13 water supply zones have been formally notified to Water Service. These contraventions can result from changes in raw water quality or from fluctuations in the control of the water treatment process.

Figure 11: Water Supply Zones Complying with Aluminium Standards

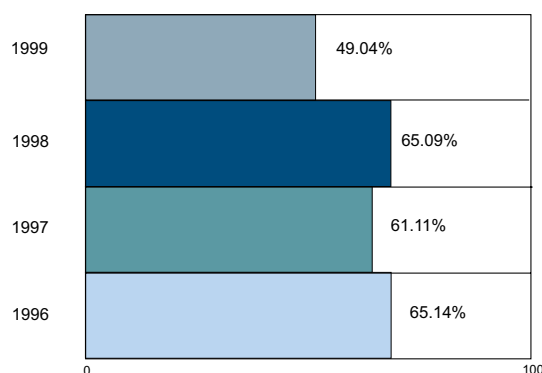


5.36 As part of a major capital works programme, improvements to several water treatment works have been completed or are underway. In certain areas, there are indications that this has improved the individual aluminium compliance figures. In other situations, however, compliance monitoring identifies 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 1999, the number of determinations exceeding the iron standard showed an increase in the number of non-compliances from 4.07 in 1998 to 5.57% in 1999. Contraventions of the regulatory standard for iron were recorded in 53 (50.96%) water supply zones in 1999; this is an increase in the compliance rate of 34.91% reported for 1998. Contraventions in 25 of these zones were assessed as being trivial. The non-trivial contraventions of the iron standard in 28 water supply zones have been formally notified to Water Service.

Figure 12: Water Supply Zones Complying with Iron Standard

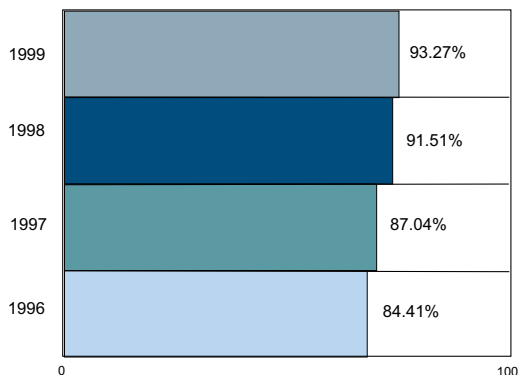


5.38 There is no health risk from the reported exceedences of the iron standard, but the presence of excessive iron may make the appearance and taste of the water unacceptable to consumers. The majority of iron contraventions are considered to be caused by corrosion of older, cast-iron watermains. Water Service has an ongoing programme of scouring and cleaning of the distribution system to minimise 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 localised phenomenon in the distribution system dependent on the pipe lining material and its condition; contravention of the standard in a water supply zone does not mean that the entire supply in that zone is non-compliant. In 1999, contraventions of the regulatory standard for PAH were recorded in 7 (6.73%) water supply zones. Contraventions in all of these zones were regarded as trivial, as the 1999 compliance assessment evaluated PAH's for triviality, taking into consideration the new Drinking Water Directive requirements (see paragraph 4.22).

Figure 13: 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 which incorporated 8 additional individual pesticides into the 1999 programme (see paragraph 4.8). Forty individual pesticides were monitored in 1999.

5.42 During 1999, 16,436 determinations for individual pesticides were carried out. Of these, 15 (0.09%) 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 12 of the 15 contraventions, the levels detected were all well within the Government Advisory Values given in the Guidance Document, *Safeguarding Public Water Supplies*.^{*} For a further 2 of the 15 contraventions (for the pesticide asulam), the levels recorded for the two water supply zones were not a significant risk to health, based on the currently available information provided by the National Centre for Environmental Toxicology. The World Health Organisation has not derived a drinking water guideline for asulam.

For the remaining one contravention which reported a level of MCPA on one occasion greater than the Government Advisory Value, the concentration detected was lower than the guideline derived by the World Health Organisation.

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

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

5.43 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 use in agriculture or weed control.

5.44 Contraventions of the regulatory standard for MCPA were reported in 5 water supply zones, 1 of which was assessed as trivial. The non-trivial contraventions of the regulatory standard for MCPA in 4 water supply zones have been formally notified to Water Service.

5.45 One contravention of the regulatory standard for mecoprop was reported in 1 water supply zone, which was assessed as being trivial.

5.46 Contravention of the regulatory standard for glyphosate was reported for 3 water supply zones; all of these were assessed as being trivial.

5.47 Contravention of the regulatory standard for asulam was reported for 2 water supply zones, both of which were assessed as being trivial.

5.48 Contravention of the regulatory standard for total pesticides was reported for one water supply zone, this contravention was assessed as being non-trivial and formally notified to Water Service. The total pesticide regulatory standard was contravened due to the level of MCPA detected.

5.49 The current inter departmental liaison group comprising Department of Agriculture and Rural Development, Environment and Heritage Service and Water Service is a forum which discusses pesticide usage and catchment control, including evaluating the possibility of reducing the impact of pesticides in raw water sources from which drinking water is derived. The Inspectorate has provided input to the group.

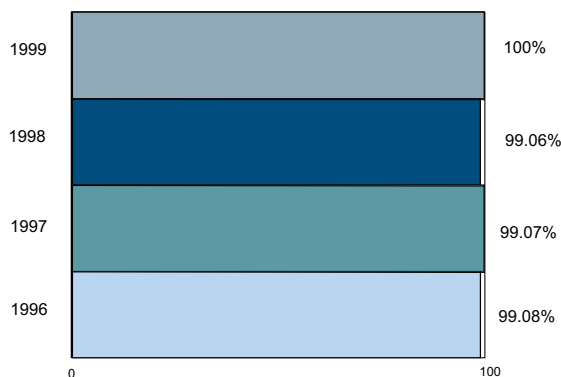
Nitrate

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

entering supply.

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

Figure 14: Water Supply Zones Complying with Nitrate Standard



5.52 The Inspectorate notes that changes made in operational practice have improved compliance and there were no contraventions of the regulatory standard reported for nitrate in 1999.

Hydrogen ion (pH)

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

5.54 Contraventions of the pH regulatory standard were recorded in 9 (8.65%) water supply zones. Contraventions in 4 of these water supply zones were regarded as trivial. The remaining 5 were assessed as being non-trivial. Of the 5 non-trivial contraventions, 4 water supply zones contravened the maximum pH value of 9.5 and 1 water supply zone contravened the minimum pH value of 5.5. All non-trivial contraventions have been formally notified to Water Service.

Figure 15: Water Supply Zones Complying with pH Standard

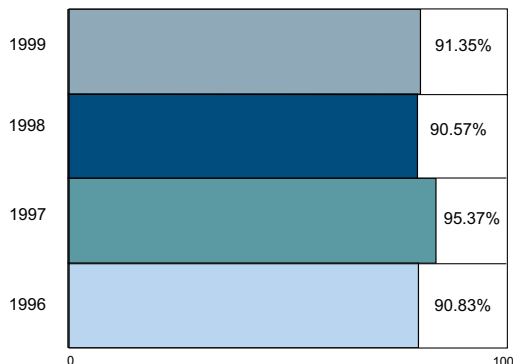
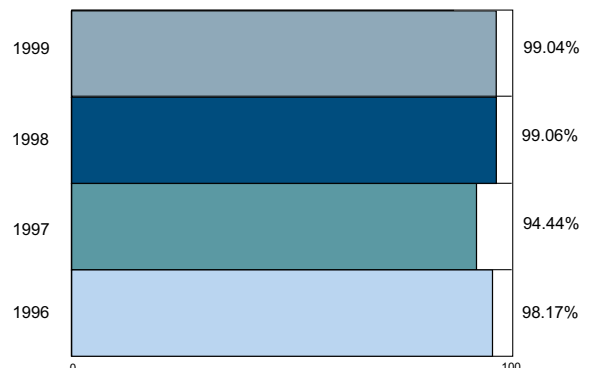


Figure 16: Water Supply Zones Complying with Manganese Standards



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

Manganese

5.56 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).

5.57 In 1999, one contravention of the regulatory standard for manganese was recorded in one water supply zone. This contravention was regarded as trivial.

Turbidity

5.58 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.

5.59 Contraventions of the regulatory standard for turbidity were recorded in 7 (6.73%) water supply zones during the 1999 compliance assessment. Six water supply zones were assessed as being trivial, one water supply zone was assessed as non-trivial and has been formally notified to Water Service.

Odour (quantitative) and Taste (quantitative)

5.60 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.

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

In 1999, there was one contravention of the regulatory standards recorded in one water supply zone for both odour (quantitative) and taste (quantitative); these contraventions were considered trivial.

Colour

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

5.63 There are 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 1999, one contravention of the regulatory standard for colour was recorded and assessed as trivial.

Other Parameters

5.64 The penultimate item (other parameters) in Table 5.4 shows that in 1999, 10,400 determinations were made on the wide range of other parameters in the Regulations. Of these, only 3 parameters, (oxidizability, nitrite and ammonium) contravened the regulatory standard.

5.65 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 23 contraventions of the regulatory standard for oxidizability which were reported in 9 water supply zones were considered trivial.

5.66 Nitrite concentrations contravened the regulatory standard in 2 water supply zones. Both contraventions were assessed as trivial. Compliance assessment evaluated nitrite for triviality in 1999 taking into consideration the new Drinking Water Directive requirements (see paragraph 4.21).

5.67 Ammonium concentrations contravened the regulatory standard in 1 water supply zone, this contravention was assessed as trivial.

Cryptosporidium

5.68 *Cryptosporidium* is a parasitic organism which has been recognised 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*.

5.69 In 1997, the Inspectorate had initiated, with the co-operation of Water Service, a preliminary *Cryptosporidium* risk assessment which had the aim of checking the implementation of the recommendations of the Second Report of the Group of Experts, *Cryptosporidium in Water Supplies**. This work has continued throughout 1999 and is ongoing, further taking into consideration the new developments contained in the Third Report of the Group of Experts**. A more detailed *Cryptosporidium* risk assessment at water treatment works has been developed during 1999 and 2000.

5.70 Following the implementation of new regulatory requirements controlling *Cryptosporidium* in water supplies in England and Wales, and a Draft Direction of *Cryptosporidium* in Scotland, Draft Protocols for the Monitoring of *Cryptosporidium* in Treated Water Supplies in Northern Ireland - Administrative Arrangements were introduced. These protocols consolidated

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

** Reference - Bouchier I (1998) *Cryptosporidium in Water Supplies - Third Report of the Group of Experts*, Department of the Environment, Department of Health, London, UK, HMSO. (ISBN 1 85112 131 5).

risk assessment arrangements and put in place a new methodology for *Cryptosporidium* monitoring. The procedures cover:

- risk assessment guidance;
- sampling frequencies;
- new sampling and analytical testing methods;
- liaison between Water Service and the health authorities; and
- outbreak control guidance.

5.71 The new monitoring arrangements were introduced in 2000 (in line with the rest of the UK) and continuous monitoring for *Cryptosporidium* commenced at one site in February 2000. Monitoring arrangements will be considered further, in the light of experience gained from the initial monitoring, by a liaison group which takes its membership from the Inspectorate, Water Service and the Department of Health, Social Services and Public Safety.

Standard Sampling Frequencies

5.72 The Water Quality Regulations (Northern Ireland) 1994 set out sampling requirements which demonstrate the wholesomeness of drinking water supplies. For 1999, the Inspectorate carried out an assessment of the regulatory standard sampling frequencies for water supply zones, water treatment works and service reservoirs.

5.73 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.

5.74 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.

5.75 In the 1999 sampling assessment of water treatment works, sampling excesses of more than 10% have been considered non-trivial.

5.76 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 5.77-5.81.

5.77 During 1999, 53,826 determinations were carried out on samples taken at consumers' taps in water supply zones. The Inspectorate identified a shortfall of 717 determinations; 1.33% of the regulatory standard sampling requirements for water supply zones were assessed as non-trivial. The comparable figure reported for 1998 was 1.58%.

5.78 The compliance assessment of each water supply zone is made on a parameter basis; 77 (74%) water supply zones recorded a non-trivial sampling contravention for at least one parameter; the comparable figure for 1998 was 49.06%. Seventy one water supply zones had sampling shortfalls for more than one parameter in 1999; 39 water supply zones in 1998.

5.79 Compliance assessments of regulatory sampling requirements were carried out for water treatment works and service reservoirs.

5.80 In 1999, 70 water treatment works sampling points were routinely sampled and analysed. The Inspectorate identified 30 water treatment works where there was a shortfall of the regulatory standard sampling frequency; 19 water treatment works (27.14%) recorded a non-trivial sampling contravention; the comparable figure for non-trivial contraventions for 1998 was 51.39%.

5.81 In 1998, samples were taken from 373 service reservoirs. The Inspectorate identified a shortfall in 87 (23.32%) service reservoirs of the required sampling frequencies; 51 service reservoirs were identified with a shortfall in 1998.

5.82 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.

Compliance with New Standards

5.83 A new EC Drinking Water Directive 98/83/EC was published in the Official Journal of the European Communities on 25 December 1998. Most of the new and tighter standards have to be met by the end of 2003. For bromate, lead and trihalomethanes, interim standards have to be met by the end of 2003, and final standards by the end of 2008, 2013 and 2008 respectively.

5.84 The new Directive contains 2 types of parameter values. Firstly, there are mandatory standards that have to be met by the specified dates given above. Table 5.5 shows those mandatory standards of the Directive that have changed or are new, together with the current regulatory standards. It does not include those standards that have been dropped altogether or those that have not changed. Secondly, there are non-mandatory indicator values for monitoring purposes. Any exceedence of a value has to be investigated but remedial action only needs to be taken when there is a risk to public health. Table 5.6 shows the new indicator values of the Directive together with the current regulatory standards. Some of these indicator values may be retained as mandatory standards when the new Regulations are made. It does not include those parameters that have been dropped altogether.

Table 5.5: New Mandatory Standards

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

(a) annual average

(b) three monthly average

(c) weekly average

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

Table 5.6: New Non-Mandatory Standards

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

- (a) annual average
- (b) three yearly average
- (c) 95% of results must comply

DRINKING WATER QUALITY INCIDENTS AND COMPLAINTS

6.1 Where a water quality incident or event has occurred, Water Service is required to provide the Inspectorate with information, in accordance with agreed procedures. The Inspectorate defines an incident as a situation where there has been a demonstrable deterioration in the quality of drinking water giving rise to a significant potential risk to the health of consumers or a significant consumer perceived adverse 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 1999, Water Service notified the Inspectorate of 7 water quality incidents and 2 events.

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

Water Quality Incidents/Events

Date	Location	Nature of Incident/Event	Classification
April 1999	Altnahinch Supply	Nutrient spreading within the reservoir catchment.	Incident
April 1999	Killea Reservoir	Precautionary Boil Notice issued.	Event
June 1999	Dublin Road, Antrim	Bacteriological exceedence - Boil Notice issued.	Event
June 1999	Gorteen Service Reservoir	Bacteriological exceedence at Belleek Water Treatment Works - Boil Notice issued.	Incident
July 1999	Corlea Service Reservoir	Bacteriological exceedence - Boil Notice issued.	Incident
August 1999	Lenamore Springs	Bacteriological exceedence due to chlorinator breakdown - Boil Notice issued.	Incident
September 1999	Largnacarron Supply	Bacteriological exceedence due to chlorinator breakdown - Boil Notice issued.	Incident
September 1999	Brishey	Bacteriological exceedence - Boil Notice issued.	Incident
October 1999	Churchill Service Reservoir	Bacteriological exceedence - Boil Notice issued.	Incident

6.2 In 1999, the Inspectorate received 49 complaints relating to drinking water quality. All complaints were referred to Water Service, District Councils or Health Authorities as appropriate, for follow-up investigation. The main categories of complaint were:

- discoloration (33 complaints);
- taste and odour (10 complaints);
- presence of sediment (3 complaints);
- presence of aquatic fauna (1 complaint);
- lead (1 complaint); and
- copper (1 complaint).

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

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

- In 1999, 1,182 private water supplies have been identified and categorized into one of 10 classes according to size, nature and use of the private water supply; and
- a sampling and analysis monitoring programme for private water supplies

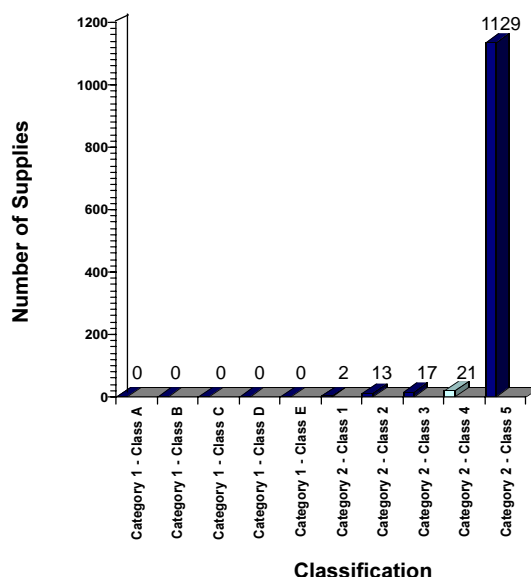
based on these classifications has been implemented.

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

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

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

Figure 17: Private Water Supplies Classification Categories



Overview of Water Quality

- 7.5** In 1999, the Inspectorate implemented a sampling and analysis programme starting in June 1999. Environmental Health Officers collect the samples and the Inspectorate has in place a contract for sample analyses. The majority of the private water supplies are used by dairy farms and a separate sampling analysis and reporting programme is undertaken by the Department of Agriculture and Rural Development, on behalf of the Inspectorate.
- 7.6** Since the commencement of the sampling contract on 1 June 1999 up until 31 December 1999, 75 private water supplies have been sampled on 225 sampling occasions for a wide range of parameters. The regulatory requirements were not met for 56 of these sampling occasions, for a limited number of parameters, these are listed below.

Contraventions of the Regulatory Standards for Private Water Supplies

Parameter		Number of Contraventions
• Total Coliforms	-	27
• Faecal Coliforms	-	9
• Manganese	-	11
• Iron	-	9
• Trihalomethanes	-	7
• Nitrate	-	4
• Individual pesticides	-	3
• Lead	-	1
• Aluminium	-	1
• Nitrite	-	1

Ground Water Monitoring

- 7.7** The Environment and Heritage Service (EHS) are responsible for the management and protection of ground water sources. Under the Water Act (Northern Ireland 1972, the Water Quality Unit (a functional unit within EHS) implemented a ground water monitoring programme in 2000, for a range of representative sampling locations. Of interest to the Drinking Water 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 Supply Regulations (Northern Ireland) 1994. For these supplies, the Water Quality Unit liaises with the Inspectorate, and where the regulatory standards have not been met, the Inspectorate notifies the appropriate private water supply owners.

Provision of Information

- 7.8** Procedures are in place whereby the Inspectorate notifies all results to the owners of the private water supplies and to the relevant Environmental Health Departments within the District Councils.
- 7.9** 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 risks of contamination of their water supplies.

DRINKING WATER RESEARCH

8.1 Most research into drinking water quality and health is funded by the Department of the Environment, Transport and the Regions (DETR) as part of a research programme designed to meet the needs of the United Kingdom Government in formulating policy relating to the quality of public and private water supplies, and in imparting sound scientific input to European and worldwide debate on drinking water issues. The Drinking Water Inspectorate for England and Wales provides the research programme management and administration function for the Water and Land Directorate (WLD) of DETR. The Drinking Water Inspectorate for England and Wales also provides the contract management function for the Water Distribution, Conservation and Quality (WDCQ) research programme. The content of the research programme is determined at the annual meeting of the Research Programme Committee. The objectives of the programme are to assist DETR and the Welsh Office to formulate policy on the quality of water supplies and to make an input to European and international drinking water issues. It also assists the Drinking Water Inspectorate for England and Wales to formulate its approach to the technical audit of water companies. Approximately £800,000 of the £3,600,000 WLD research budget was devoted to the WDCQ programme during 1999.

8.2 The WLD research programme is a component of the DETR Environment Protection Group (EPG) research programme. General enquiries about the EPG programme should be directed to: Berty Bouton, DETR, Zone 5/F8, Ashdown House, 123 Victoria Street, London SW1E 6DE.

Information on WDCQ Research

8.3 Specific enquires about current research and future research requirements should be addressed to Mark Smith, Drinking Water Inspectorate for England and Wales, 2/A1 Ashdown House, 123 Victoria Street, London SW1E 6DE.

8.4 Executive summaries of reports produced under the WDCQ research programme and previous DETR drinking water programmes, are posted on the Foundation for Water

Research (FWR) website (<http://www.fwr.org>). The website also contains details of how to obtain copies of research reports.

COMPLETED RESEARCH

Cryptosporidium

8.5 Alcontrol has completed a review of how the source of the organism and the cleaning and concentration procedures used influence the surface properties of commercial preparations of oocysts. This research was instigated because of inconsistencies of approach in the published reports of disinfection studies on *Cryptosporidium*. The report on this research has been incorporated into the report of a workshop "Towards a Standardised Experimental Design for Viability and Inactivation Studies". The workshop, which was organised by Water Training International, involved collaboration with the American Water Works Association Research Foundation (AWWARF) and the Water Services Association of Australia. The workshop represented the Drinking Water Inspectorate for England and Wales contribution towards an AWWARF research project concerning the structure of the surface of *Cryptosporidium* oocysts and possible novel approaches to inactivation. The workshop produced a consensus on the detailed design of disinfection studies for *Cryptosporidium* and the Drinking Water Inspectorate for England and Wales intends to require adherence to the principles of the report in future research contracts. The workshop report can be downloaded from the Drinking Water Inspectorate for England and Wales at <http://www.dwi.detr.gov.uk/pubs/index.htm>.

Other Health Risks and Monitoring

8.6 WRc has completed a feasibility study on assessing the exposure of pregnant women to disinfection by-products (DBP) in relation to the exposure of the general population. This study investigated the possibility of identifying whether pregnant women receive greater exposure to non-drinking water sources of DBP, eg, inhalation during showering or in swimming pools. The study concluded that there was a very great variability between individuals in terms of frequency and duration of bathing.

Furthermore, inhalation and dermal absorption could be significant routes of exposure for the volatile DBP.

- 8.7** The study was a response to recent American reports on the relationship between exposure to DBP and adverse pregnancy outcomes. The Drinking Water Inspectorate for England and Wales has received advice from the Department of Health's Committee on Toxicity (COT) that there is insufficient evidence in those reports to conclude that the presence of DBP in tap water increases the risk of adverse pregnancy outcomes. The COT did, however recommend that further studies be made into the claimed association. The Government-funded Small Area Health Statistics Unit (SAHSU) is carrying out those studies. DETR may sponsor further research, depending on the outcome of the SAHSU study.
- 8.8** The Public Health Laboratory Service (PHLS) has completed the production of a protocol, which is intended to allow the UK to demonstrate whether national methods are equivalent to the method specified in the new Drinking Water Directive, should be brought to the attention of the International Standards Organisation with a view to achieving an internationally recognised protocol. The protocol is available on the Drinking Water Inspectorate for England and Wales website via <http://www.dwi.detr.gov.uk/regs/infolett/2000/info500.htm>.

Materials Testing and Approval

- 8.9** WRc has completed a study on the leaching of components of cement admixtures from ready-mixed and site-mixed concrete. The data has assisted the development of a control system for admixtures used in concrete for water retaining structures. New arrangements for authorising the civil engineering uses of cementitious materials in contact with drinking water came into force in April 2000.
- 8.10** WRc has also completed the business plan for a CEN Workshop Agreement (CWA) on research into leaching test procedures for use in the approval of drinking water treatment membranes. A related contract was awarded to the British Standard Institution to provide the secretarial support for the CWA. The CWA process is a new

CEN product that has been piloted in the IT and telecommunications sectors. It aims to provide a means of achieving consensus in areas of rapidly emerging technology where the normal standards committee structure may not be effective. Agreement on the CWA was reached in December 1999 and further details are available on the CEN Web site <http://www.cenorm.be/standardization/>.

- 8.11** The Water Quality Centre (WQC) has completed phase 2 of an assessment of the comparability of European approval testing for polymeric water supply pipes. The results of this study were presented to the European Commission's Regulatory Group - Construction Products Drinking Water (RG-CPDW). The RG-CPDW is responsible for development of proposals for introducing a harmonised European approval system for water supply products.
- 8.12** LGC (Teddington) has completed three studies relating to review of approval of products for use in contact with drinking water. These include: a re-appraisal of the levels of leaching of lead from PVC-U water supply pipes containing organo-lead stabilisers; a review of alternatives to organo-lead stabilisers in the production of PVC-U pipes; and a review of possible approaches to implementing an audit on the production of approved products. The Committee has announced that it intends to recommend prohibition of the use of organo-lead stabilisers in PVC-U water supply pipes and is consulting manufacturers over the timescale for re-formulation.

Current Research

Cryptosporidium

- 8.13** The Centre for Research and Environmental Health Analytical Ltd has been awarded two contracts relating to the monitoring of *Cryptosporidium* oocyst concentrations in water supplies. One contract calls for monitoring a selection of treated waters using the regulatory monitoring methodology specified in the Drinking Water Inspectorate for England and Wales guidance on The Water Supply (Water Quality) (Amendment) Regulations 1999. The objective of the study is to carry out continuous, or high frequency, monitoring of turbidity, particle size and

selected microbiological parameters and to investigate possible correlations with oocyst concentrations. A related contract on private water supplies is intended to assess the risk from *Cryptosporidium* in larger private supplies where there is potential for widespread exposure arising from consumption by transient populations, eg, uses in holiday camps, or use in food production. A proportion of this contract is being managed by the Drinking Water Inspectorate for Northern Ireland.

8.14 DETR is collaborating in a contract placed by the Scottish Executive to develop a genetic typing system for *Cryptosporidium*. The contract was awarded to a consortium led by the Scottish Institute for Infection and Environmental Health and involves also the Scottish Parasite Diagnostic Laboratory, Glasgow University and the PHLS.

8.15 The West Cumbria Epidemiological Study was commissioned in 1995 to investigate the cause of an apparently high background incidence of cryptosporidiosis in an area served by private water supplies and disinfected but unfiltered public supplies. The public supplies will now be upgraded through provision of membrane treatment processes at the water works. The study has been extended to investigate whether the enhanced treatment has any impact on the reported levels for incidence of cryptosporidiosis. The study will also investigate whether installation of treatment is accompanied by any changes in the sero-prevalence status of the population.

Other Health Risks and Monitoring

8.16 The PHLS is carrying out a study on removal and inactivation of mycobacteria in water treatment and distribution systems. The study objectives include development of culture techniques that can be applied to risk assessment studies on species of mycobacteria, including *Mycobacterium paratuberculosis*.

8.17 The Drinking Water Inspectorate for England and Wales is collaborating with AWWARF in research into the development of tools for

monitoring the integrity of low-pressure membrane processes for drinking water treatment. A call for proposals on this topic was issued in March 2000.

Materials Testing and Approval

8.18 WQC is carrying out phase 2 of a study on the potential for endocrine disruptors to leach from approved water supply products. This study will attempt to characterise the worst case situations that might develop within domestic water supply systems following commissioning of new distribution and storage systems. WQC is also carrying out research into the test method for leaching of metals from granular activated carbon (GAC) filter media that has been published in the European standard for GAC. The UK is obliged to withdraw conflicting standards when European standards are published. The results of the WQC research will provide information on the implications of adopting European procedures.

8.19 A contract has been placed with Covance Laboratories to carry out mutagenicity testing on 3-monochloro-propane-1, 2-diol, a by-product produced during the manufacture of polyamines. The results of this study will be used by the Committee on Chemicals and Materials for Use in Public Water Supply and Swimming Pools in its review of approval of polyamine flocculants.

Water Supply Within Consumer's Premises

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

DEFINITIONS AND GLOSSARY OF TERMS

Aquifers	water-containing underground strata.
Catchment	the area of land that drains into a watercourse.
Coliforms	a group of bacteria which may be faecal or environmental in origin.
Compliance assessment	a comparison made by the Inspectorate of data gathered by Water Service against standards and other regulatory requirements.
Contravention	a breach of the regulatory requirement.
<i>Cryptosporidium</i>	a protozoan parasite.
Cryptosporidiosis	the illness produced by infection with <i>Cryptosporidium</i> .
Determination	a single analytical result for a specific parameter.
Distribution systems	a water supplier's network of mains, pipes, pumping stations and service reservoirs through which treated water is conveyed to consumers.
Drinking Water Directive	European Council Directive 80/778/EEC relating to the quality of water intended for human consumption. (Replaced by Council Directive 98/83/EC in December 1998 - the "New Directive").
Event	a situation affecting or threatening to affect drinking water quality.
Exceedence	synonym for contravention (see above).
Faecal coliforms	a sub-group of coliforms, almost exclusively faecal in origin.
GCMS/MS	analytical techniques used - gas chromatography mass spectrometry/mass spectrometry.
Groundwater	water from aquifers or other underground sources.
Incident	an event where there has been a demonstrable deterioration in the quality of drinking water.
Indicator organism	an organism which indicates the presence of contamination and, hence, the possible presence of pathogens.
Inspectorate	the Northern Ireland Drinking Water Inspectorate.
Inspectorate website	location of information on the Internet - The Inspectorate website is http://www.ehsni.gov.uk .
Investment programme	investment in improvement works to water treatment works and distribution systems.
Key parameters	19 parameters chosen for this report to indicate the quality of water in water supply zones.

Leaching	to lose or cause to lose soluble substances by the action of a percolating liquid.
Mains rehabilitation	restoration of watermains pipework to a proper condition.
m³/d	cubic metre per day.
mg/l	milligrammes per litre.
ml	millilitres.
MI/d	megalitres per day (one MI/d is equivalent to 1,000 m ³ /d or 220,000 gallon/d).
µg/l	microgrammes per litre.
Oocyst	the resistant form in which <i>Cryptosporidium</i> occurs in the environment, and which is capable of causing infection.
PAH	a group of organic compounds known as polycyclic aromatic hydrocarbons, comprising, for the purposes of the Regulations, 6 substances: fluoranthene, benzo 3,4 fluoranthene, benzo 11,12 perylene, benzo 3,4 pyrene, benzo 1,12 perylene and indeno (1,2,3-cd) pyrene.
Parameter	a parameter is any substance, organism or property listed in Schedule 1 and regulation 3 of the Regulations.
Pathogen	an organism which causes disease.
PCV	see 'Prescribed concentration or value'.
Pesticides	any fungicide, herbicide or insecticide or related product (excluding medicines) used for the control of pests or diseases.
pH value	a measure of the acidity or basicity related to the concentration of the hydrogen ion.
Plumbosolvency	the tendency for lead to dissolve in water.
Public registers	the information made available to the public as required by regulations 26 and 27.
Prescribed concentration or value	the numerical value assigned to water quality standards (PCV), defining the maximum or minimum legal concentration or value of a parameter. In certain circumstances, under regulation 4 of the Regulations, certain standards may be permitted to be relaxed to a specific amount. See 'Relaxation'.
Private supplies	any supplies of water provided otherwise than by the public supplier, Water Service.
Protozoan	single celled animal.

Regulations	The Water Quality Regulations (Northern Ireland) 1994 S.R. No. 221 ISBN 0 337 9122 1 or, in the case of private water supplies, The Private Water Supplies Regulations (Northern Ireland) 1994 S.R. No. 237 ISBN 0 337 91237 8.
Relaxation	a relaxation of the standards according to regulations 4 and 5 by reason of the composition of geological strata from which the supplies are taken.
Service reservoir	a water tower, tank or other reservoir used for the storage of treated water within the distribution system.
Surface water	water from rivers, impounding reservoirs or other surface water sources.
Technical audit	the means of checking that Water Service is complying with its statutory obligations.
Trihalomethanes (THM)	a group of organic substances comprising, for the purposes of the Regulations, 4 substances: trichloromethane, (also known as chloroform), dichlorobromomethane, dibromochloromethane and tribromomethane.
Time of supply	the moment when water passes from the water supplier's pipework into a consumer's pipework.
Toxicology	the study of the health effects of substances.
Treated water	water treated for use for domestic purposes as defined in the Regulations.
Water supply zone	the basic unit of supply for establishing sampling frequencies, compliance with standards and information to be made publicly available.
Waiver	authorised relaxation.
Wholesomeness	a concept of water quality which is defined by reference to standards and other requirements set out in the Regulations.
WRc	Water Research Centre (1989) plc and/or, as the context may require, its predecessor body.



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Printed and Published by
Environment and Heritage Service
Desk Top Publishing Unit